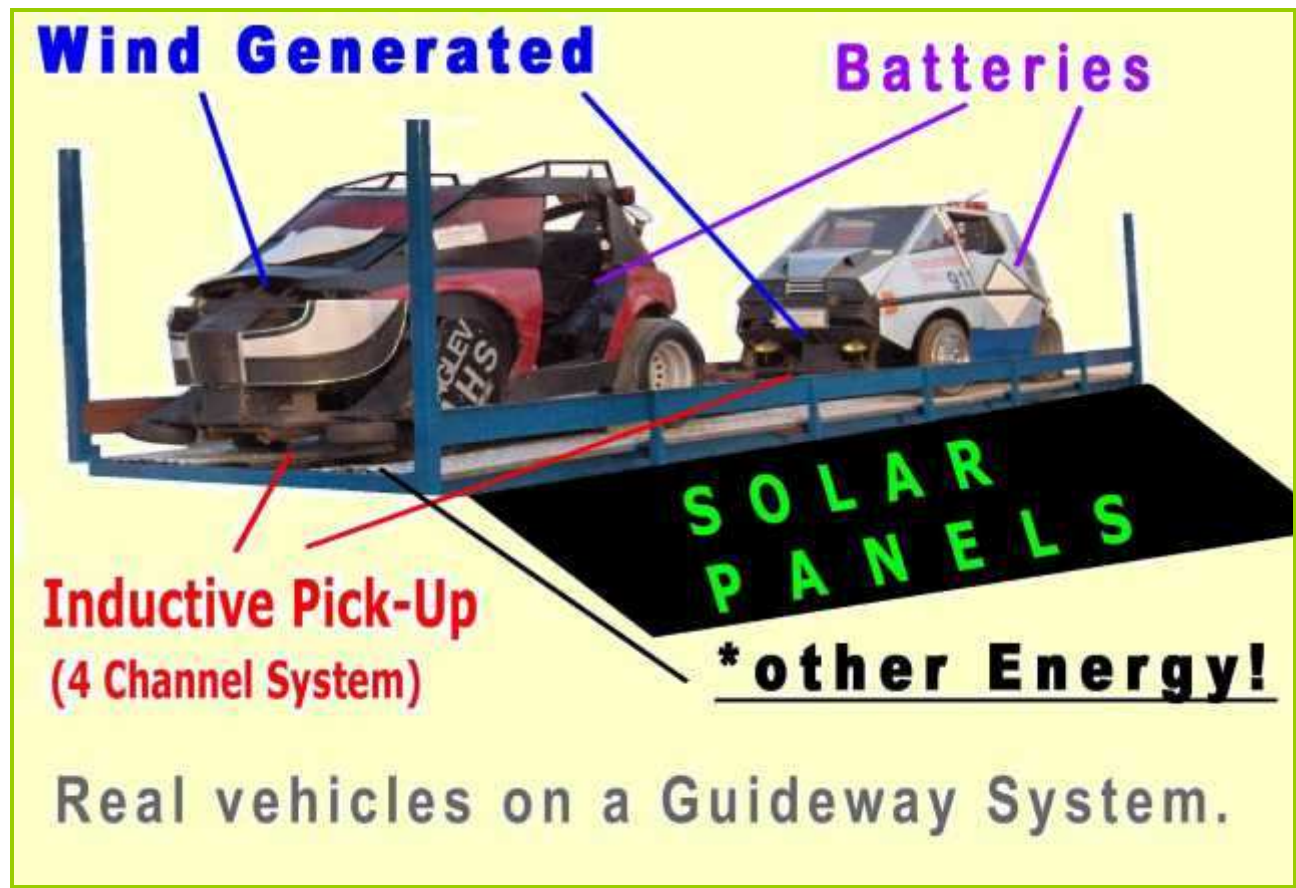




Racing to build **DUAL-MODE VEHICLES**





The Author and Technology Developers attempt to demonstrate Dual-Mode Transportation to an unknowledgeable public. This system is far beyond primitive gasoline cars as of 2010. Allowing vehicles to be more productive (than being dormant 23 hours out of a day), will revolutionize modern society.

Vehicles using a Guide-way System will let people travel without the need to drive long distance (Auto-Pilot), so they can do other things in their own private and affordable vehicle. On a Guide-way System, traveling 3,000 miles can be done in 15 hours or less!

Read on and ENJOY!

Burlington City Dual-Mode

Global Financial Impact Assessment (2009 – 2011)

The Burlington City Dual-Mode Inc. Project will be presented before the U.S. Congress during a hearing process as an International Landmark for Dual-Mode Automation and a plan to rebuild American economies. Burlington City Dual-Mode Inc. will be displayed for **Government Officials, Institutional Investors, US Cities, States, and Countries** seeking solutions to **Alternative Transportation Solutions**. The **Guideway System (and its Renewable Energy System)** is the critical key factor in the development of this project.



Heavy Lines- potential Guideway Corridors
Heavy Squares- Dual-Mode Station and Annexes
 [see attached map for Guide-way Configurations]

Projected Financial Revenues

Marketing revenues
 Tourism, Landmark, R&D

Government Initiatives
 TOD, Transit Village, Space, etc.

Corporate Alliances
 Dept. of Defense, USDOT, FTA

Institutional Investors
 TBA

Countries
 Global Impact (TBA)

Renewable Energy Investments
 Solar, Windmill, Biomass

Public / Private Partnerships
 TBA

Projected Financial Values for Burlington City Dual-Mode Inc.

\$2.2 Billion in assessed value (with initial developmental targets for Burlington Island)

\$150+ Million annually in revenues by 2013*

***this requires the targeted goals for reaching key Government Officials to assess Burlington City Dual-Mode Inc. and designate it as the official USA standard.**

This document was prepared by experts in the field of **Dual-Mode**, who have diverse knowledge of alternative transportation systems being studied globally. This forecast is based on information presented by Universities, Governments and Transportation Administrations.

Copyright 2009© by New Venture Associates II for DLF GLOBAL



“Regardless of what anyone believes, Dual-Mode is being planned for implementation to develop a Country!”

statement by DLF GLOBAL 2015

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM



by Francis D. Reynolds

Commentary

by Public Internet Domain

A Dual-Mode Vehicle poses a serious change to “traditional transportation.” A sharp individual who reads this book will realize that flying an Airplane will eventually make no sense within a 3,000 mile radius. In other words, flying within the continental U.S.A. will become absolutely useless. With that being said, there is no hope for Trains and gasoline powered Automobiles.

Contrary to what some people may rationalize in their mind, a Dual-Mode Vehicle is actually less expensive to purchase and operate than an ordinary automobile. A Dual-Mode Vehicle only requires a good Computer System, none of the other “JUNK” associated with industrial age gasoline cars!

This book is very informative reading, although revisions had to be inserted by a company directly involved in developing and manufacturing real Dual-Mode Vehicles and Guideway Systems.

All inserted comments are via Public Internet Domain and are featured in a PID COMMENT lined format.

PID COMMENT

A dualmode system will get a high percentage of cars off the streets and highways, not by discouraging car use but by providing a very fast high-capacity alternate path for the cars to travel on. This new path will not only let people use their cars; it will get them to where they want to go faster and safer. It will greatly reduce pollution, and will not use fossil fuel. And the guideways, in conjunction with the existing streets and highways, will still provide the door-to-door service that we now enjoy—or would enjoy if the traffic weren't so heavy.

by Dave Petrie

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

“REV”

C o n t e n t s

TITLE PAGE

DEDICATION

ACKNOWLEDGMENTS

FOREWORD (PID page 19)

INTRODUCTION

Chapter

1. DON'T TAKE AWAY MY CAR (PID page 21)

THE CONCEPT (PID page 22, 23, 24)

THE BASICS (PID page 26, 27)

SKEPTICISM (PID page 28)

CARS ARE GOOD (PID page 29, 30, 31, 32)

IT WILL BE DONE (PID page 33, 34)

2. QUOTATIONS ABOUT DUALMODE TRANSPORTATION

(PID page 38)

3. WHY WE ARE WHERE WE ARE

TRANSPORTATION PATHWAYS

MECHANIZATION and TECHNOLOGY (PID page 40)

TRANSPORTATION ON TRACK

RAILROADS vs. AUTOMOBILES

OTHER DISADVANTAGES OF TRAINS

NOSTALGIA

STEAM ON THE FARMS AND STREETS

THE AUTOMOBILE: TODAY AND TOMORROW

(PID page 46)

PATCHES AREN'T WORKING (PID page 49)

4. DUAL-MODE vs. SINGLE-MODE TRANSPORTATION

DEFINITIONS

PALLETS AND TRUE DUALMODE CARS

WHAT WILL THE GUIDEWAY SYSTEM LOOK LIKE?

(PID page 53)

WHAT WILL THE DUALMODE CARS LOOK LIKE?

(PID page 54)

5. DUALMODE HISTORY

THE 1974 DUALMODE NATIONAL CONFERENCE

LATER

THE NATIONAL AUTOMATED HIGHWAY SYSTEM

THE DEVELOPMENT OF IDEAS

THE AUTHOR'S INVOLVEMENT IN DUALMODE

SERENDIPITY

THE TIME IS RIPE

OBSCURITY

INDEPENDENT INVENTORS (PID page 64)

6. ON THE STREETS (PID page 66)

STREET-MODE BATTERIES

HYDROGEN AS A FUEL

FUEL CELLS

ENVIRONMENTALLY CLEAN INTERNAL COMBUSTION

WHICH STREET POWER? (PID page 72)

7. ON THE GUIDEWAYS

TRAVELING ON THE GUIDEWAYS (PID page 74)

OVERHEAD GUIDEWAYS (PID page 75, 76)

WHEELS ON THE GUIDEWAYS

BUILD MODERATE-SIZE GUIDEWAYS (PID page 79)

TYPES OF VEHICLES (PID page 80)

THE GUIDEWAY SYSTEM MUST BE EXTENSIVE
(PID page 81)

GUIDEWAY SPEED (PID page 83, 85)

THE REVOLUTIONARY DUALMODE SYSTEM, “REV”

STRINGS OF CARS ON THE GUIDEWAYS

NOISE

CURVES

HILLS

THE GUIDEWAY COMPUTER SYSTEM (PID page 89, 91, 92)

8. TRANSIT AND OTHER VEHICLES

DUALMODE BUSES

GUIDEWAY-ONLY BUSES

SUBSIDIES AND WELFARE

PERSONAL RAPID TRANSIT (PID page 94)

DUALMODE RENTAL CARS

DUALMODE TAXIS

GUIDEWAY FREIGHT (PID page 98, 100)

9. MAGNETIC LEVITATION AND PROPULSION

LEVITATION ISN'T JUST A MAGIC TRICK

HOW MAGLEV WORKS (PID page 102)

ENERGY REQUIRED FOR SUPPORT

INDUCTIVE MAGLEV

SUPERCONDUCTING MAGLEV (PID page 104)

PERMANENT-MAGNET MAGLEV

OFFICIAL EVALUATION OF MAGLEV

POWERING THE CARS ON THE GUIDEWAYS (PID pg 107, 108)

LINEAR SYNCHRONOUS MOTORS

NO BRAKES ON THE GUIDEWAYS

POWER SAVING

DISCLAIMER (PID page 112)

10. THE CAPACITY OF THE GUIDEWAYS

A COMMON FALLACY

CONTINUOUS FLOW (PID page 114)

GUIDEWAY CAPACITY VERSUS HIGHWAY CAPACITY

GUIDEWAY CAPACITY COMPARED TO BUSES AND TRAINS

**DUALMODE GUIDEWAYS COMPARED TO JETS
GUIDEWAY SYSTEM EXPANSION**

11. GETTING ONTO AND OFF OF THE GUIDEWAYS

VEHICLE IDENTIFICATION (PID page 119)

“DRIVER TO SYSTEM”

RETRACTING THE “LANDING GEAR”

ENTRY RAMPS (PID page 121)

ACCELERATION AND DECELERATION

VELOCITY CONTROL FOR MERGE POSITIONING

EXIT RAMPS (PID page 124)

12. GUIDANCE AND SWITCHING

THE WAY IT IS DONE IN TRAINS AND AUTOMOBILES

(PID page 125)

THE GUIDEWAY GUIDANCE AND SWITCHING SYSTEM

(PID page 127, 129)

13. AUTOMATIC PARKING

THE SOLUTION

THE DETAILS (PID page 131, 133)

14. DUALMODE SYSTEM SAFETY

HUMAN DRIVERS ARE ACCIDENTS WAITING TO HAPPEN

LIMITING SPEED IN STREET MODE?

“DRIVERS” CAN’T CAUSE ACCIDENTS ON THE GUIDEWAYS

(PID page 135)

ROAD-RAGE CRIMES WON’T OCCUR

FEAR OF THE NEW AND UNKNOWN

POWER OUTAGES

LOCAL GUIDEWAY SHUTDOWNS (PID page 137)

NAVIGATION AND MERGING

MAGNETIC LEVITATION IS SAFE

RADIATION

COMPUTER RELIABILITY

DUALMODE SAFETY COMPARED TO RAILROADS

WEATHER

NATURAL DISASTERS

SAFETY BY ELIMINATION (PID page 145)

15. POWER AND THE ENVIRONMENT

CONSERVATION (PID page 147)

GLOBAL WARMING (PID page 149)

POWER AND ENERGY (PID page 151)

PETROLEUM DEPLETION

PEAK OIL PRODUCTION

COAL

ENERGY FOR THE GUIDEWAYS

BIOFUELS

POWER FROM THE WIND

SOLAR POWER

NUCLEAR POWER

OTHER NONSOLAR ENERGIES

HYDROELECTRIC POWER

THE BIG SAD PICTURE (PID page 160)

16. URBAN SPRAWL: THE SUBURBS (PID page 161)

URBAN SPRAWL IS GOOD

DENSITY IS THE ROOT OF THE PROBLEM (PID page 163, 165)

17. THE ECONOMICS OF OUR DUALMODE SYSTEM

WHAT WILL IT COST? (PID page 168)

USE FACTOR

DUALMODE CAR COST (PID page 170, 171)

TRILLION-DOLLAR BARGAINS (PID page 172)

DISCLAIMER

18. “IT WILL NEVER BE BUILT”

THE PESSIMISTS (PID page 173, 175, 177, 181)

IT WILL BE DONE (PID page 184)

19. THE WAY TO A DUALMODE SYSTEM (PID page 185)

APPLICABLE TECHNOLOGY

THE PROBLEM IS...

THE WORK IS YET TO COME

TO GO FAR WE NEED A CZAR

THE TRANSITION PERIOD

THE POLITICS

LABOR

HOW SOON?

20. THE DUALMODE SYSTEM WILL BE DIFFICULT TO SELL

(PID page 192)

NOT INVENTED HERE (PID page 193)

HUGE PROJECTS PRESENT HUGE PROBLEMS

THE MEDIA AND DUALMODE

PROMOTING REVOLUTIONARY INNOVATIONS

DUALMODE DOESN'T FIT THE ESTABLISHMENT

(PID page 197)

SUMMARY

21. HELP NEEDED

“SOMEONE SHOULD DO SOMETHING”

POLITICIANS AND BUSINESSES

DUALMODE TRANSPORTATION PLANNING
THE UNITED STATES DEPARTMENT OF TRANSPORTATION
TO FELLOW TECHNICALLY INCLINED PEOPLE
ACTIVISTS ARE NEEDED
HOW TO SPREAD THE WORD

THIS BOOK IS NOT COPYRIGHTED

22. CONCLUSIONS

MANY BIRDS WITH ONE STONE
DUALMODE WILL FIX IT
THE END AND THE BEGINNING

APPENDIX

FLYING-AUTOMOBILE DUALMODE SYSTEMS (PID page 208)
DECELERATION CONTROL

BIBLIOGRAPHY

ABOUT THE AUTHOR

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

This book is dedicated to

Marianne Reynolds

My Loving Wife

**Marianne made my work on dual-mode transportation possible
by her support, encouragement, suggestions, and
by freeing my time for these efforts.**

Acknowledgments

I am indebted to many people for ideas, technical assistance, transportation-industry information, and help of other kinds in the writing of this book. I give particular thanks to following: Dr. Edward Anderson, Jerome Baer, Captain Paul Bowers, Peter Bowers, Dan Bray, Ronald Case, Dr. Tracy Clark, Dr. Hal B.H. Cooper Jr., Erik Driessens, Dick Eagle, Dr. Christine Economides, Bill and Kathy Flanigan, Ian Ford, Wayne Gillett, Kim Goltermann, Dr. Richard Guadagno, Kirston Henderson, Palle Jensen, Ron Laitsch Dr. Josh Levin, Dr. John Hopkins, Robert Jenny, Professor Robert Joppa, Del Kahan, Steve Kuan, Ware Lantz, James Longbottom, Van Metre Lund, Bruce McHenry, Daryl Oster, Leroy Perkins, Dave Petrie, Sue Plahn, Greg Reynolds, William Roeseler, Jerry Roane, Mara Saltz, Dick Scherer, Dr. J. B. Schneider, Dale Shellhorn, William Sherertz, Robert Style, William Turnbull, Dr. Richard Thornton, Walter Velona, Richard Wallace, Robert Weltzien, and Tad Winiecki.

Dick Scherer not only served on my dualmode development team but proofread this book. (If you find any mistakes in it, blame Dick.)

I especially thank Professor Jerry B. Schneider, the creator and host of the Innovative Transportation Technology website in which you are reading this book. Jerry and this website are of tremendous help to all of us working in the dualmode transportation field.

Many of the other dualmode transportation system inventors worldwide are acknowledged by name above. Their contributions to my knowledge and therefore to this book have been in numerous forms, including their websites, technical papers, presentations at transportation conferences, online debates, and personal correspondence and conversations.

In addition, I am indebted to the American Institute of Aeronautics and Astronautics (AIAA), the Society of Automotive Engineers (SAE), the Intelligent Transportation Society of America, FISITA World Automotive Congress, Transportation 2000 Conference (Oregon Office of Energy), New Visions in Transportation (Aspen, CO), IEEE Intelligent Systems Journal, The Futurist magazine, the Georgia Section of The Institute of Transportation Engineers, the University of Minnesota, Portland State University, The Economist, The Eastside Journal, The Seattle Times, KING TV, and EV World (electric vehicles) magazine for previous opportunities to learn and to present dualmode technical papers, articles and essays.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Foreword

by **Jerry Schneider**
Professor Emeritus, Urban Planning and Civil Engineering,
University of Washington,
Seattle, Washington

This book is a rare treat. Francis Reynolds has offered us a bold vision of a future national-scale transportation concept (with global implications) that deserves wide dissemination and discussion. That our urban and intercity transportation systems are in serious difficulty is apparent to us all. **But it is also apparent that no solutions are being put forth either by industry, academia, think tanks or public officials that offer any substantial prospect for relief.** Most simply complain bitterly about our ruinous congestion, safety and air quality problems and are especially worried about our high level of vulnerability to likely reductions in the availability of oil in the future. Few have attempted to even think about how these problems might be overcome let alone invent a reasonable and comprehensive approach to dealing with them.

Most recently, attention has been focused on the reauthorization of the federal transportation program. The major stakeholders have identified their funding needs for building and maintaining highways and transit systems during this period and they are staggering. The bill has also been burdened with a very large number of "earmarks" for many projects that have little to do with transportation. Yet, the needs are great. For example, the American Association of State Highway and Transportation Officials has recently produced a report entitled "**The Bottom Line**". It concludes that an average of \$92 billion per year will be needed to maintain the current physical condition and performance of the highway system over the next 20 years and that \$126 billion per year will be needed to improve the system. Further, they estimate that \$19 billion is needed annually to maintain the nation's transit systems, while another \$44 billion is the annual estimated need for transit system improvements. The total annual bill - \$281 billion! And, they don't even deal with our air, rail and water transportation facilities and services where the infrastructure needs are also huge.

Could it be that just patching-up and extending the current systems is not a prudent or sensible course of action? Is there a better way that some of these funds could be invested that would provide for increased levels of mobility without perpetuating and

intensifying the negative effects that current systems inflict on us, our cities and countrysides? Now that **the Interstate System has reached its 50 birthday**, isn't it time to think seriously about a system that will initially supplement but eventually replace it? Francis Reynolds thinks so and has outlined a metropolitan-wide and intercity transportation concept that offers a vision that is far superior to the growing maintenance bill that is generated by an aging Interstate System. He offers a positive approach that promises some relief from the ruinous congestion, negative environmental impacts, risky oil dependency and global warming prospects that are currently so worrisome.

In the 1960's and 1970's our federal government sponsored studies with titles like **“Toward a National Urban Growth Policy”** that looked at future population projections and attempted to identify ways to accommodate growth that would both maintain and enhance the livability of our cities. Another report entitled **Tomorrow's Transportation was published in 1968 by the Lyndon Johnson administration** that identified future urban transportation needs and technologies and urged that they be developed and made operational for use about now. A transportation system concept that is quite similar to that outlined in this book was also included in the **Tomorrow's Transportation** report to the Congress.

Since that time there has not been any serious work done to examine ways that our auto-dominated system could be significantly improved to be much more compatible with the high levels of mobility our society and economy needs. This book offers an opportunity to revive this past work by providing a reasoned concept that offers some hope for an improved future level of mobility, with more positive and many fewer negative attributes.

It has been my pleasure to watch this imaginative futures-creation process undergo a vigorous debate on the Internet and evolve into its present form. **Futurist Jim Dator** has said, **“Any useful statement about the future should seem ridiculous”**. But, I, and others have found that this vision is both useful and not at all ridiculous. What is ridiculous is the current effort to extend the current system and its financing mechanisms, largely unchanged, far into the future. Reynolds describes an path to the future that is part evolutionary and part revolutionary by defining a transition path that retains the most useful attributes of the private auto while reducing its many negative impacts.

Reynolds does not argue that his concept is the only feasible and desirable path to a more productive future transportation system. He recognizes that other alternative visions will also be put forth. All will need to be evaluated and compared in a highly visible manner with substantial participation from the many stakeholders that will necessarily be involved in and impacted by the evolution of the current system. **Not only would the U.S. benefit from such an effort but other countries like China and India might also be able to evolve their transportation infrastructure in ways that are less threatening to the global environment and economy.**

Still, according to the U.S. Census Bureau, the U.S. Population Forecast (Middle Series) is expected to increase from 300 million in 2006 to 394 million in 2050, an increase of some 94 million. One thing that we know for sure is that the provision of transportation infrastructure strongly influences when and where this urban growth will occur. This book provides a transportation scenario that can be widely used in future discussions of an appropriate national growth strategy and should help to stimulate them to be conducted with the sense of urgency that they deserve.

PID



Urgent Enough?

I wonder if this scenario was an urgent enough reason to start to take a good look at other alternative solutions! If you separate Tractor Trailers from Automobiles, the Freight Industry will make better time delivering goods! The Guideway System needs to remain strictly for vehicles under 4,000 pounds total weight.

A “Less Than Load” or LTL, is a perfect solution to getting rid of wasteful distribution costs associated with dispatching freight. A Guideway System can do a much better job at a fraction of the cost.

PID

Introduction

This book is a comprehensive disclosure and discussion of “dualmode transportation,” a concept that is largely unknown. It is urgent that this concept be introduced to all areas of society since such a system will largely solve a number of critical worldwide transportation traffic, energy, and environmental problems.

The system to be proposed here is simple in concept, yet complex in the details and in its use of modern state-of-the-art technologies. Like our highways, railroads and airlines, it will be much too huge and too far ranging for any single company, or single local or regional government to build it alone. It must be a unified national and international project: a global transportation revolution.

This revolution will affect all of us in the United States and other developed countries in many ways. It will have as much favorable impact upon humanity as the railroads, the highways, the airplane, the computer, and the Internet have. There will be scoffers, but this is neither science fiction nor humbug. The author promises that those who read this book will close it with quite changed opinions concerning our worldwide transportation and related problems and their solution.

This is intended to be a non-technical book for lay readers as well as a semi-technical book for those with scientific or engineering knowledge and interests. Non-technical readers are urged to skip over any chapters or paragraphs that do not interest them, and to continue on rather than putting the book aside. Conversely, those who will seek more technical details will find ample references. Explanations that seem simple and obvious to some will be helpful to other readers. Knowing that he can’t please all of the people all of the time, the author hopes that he can interest most of you most of the time. His objective, however, goes far beyond pleasing and entertaining—this is a most timely, serious, and urgent subject.

The book is arranged online without page numbers. There is a separate computer file and URL for each chapter. As seen below, at the end of each chapter is a link to the next chapter and also a link to the Table of Contents, which contains links to all of the chapters.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 1

"Don't Take Away My Car!"

(If you haven't read the [Introduction](#), it is recommended that you read it first.)

Most of us will never voluntarily give up our private cars; they are too useful and convenient—too wonderful. Fortunately we won't have to give them up. Our transportation and related environmental and energy problems aren't caused by the **concept** of privately owned vehicles; the problems stem from the **nature** of our present automobiles and highways. The real problem is that we are still using 19th and early-20th-century transportation systems. These old methods for getting from here to there haven't been able to keep up with expanding populations, or with modern technology and lifestyles. More trains, Greyhound™ buses, jets, and transit vehicles won't solve our problems. In most cases we already have as much public transportation as people are willing to use.

PID COMMENT



Automobiles are getting us nowhere.

During the supposed “9/11 Disasters,” the only thing moving were Bicycles and Pedestrians. The Automobiles people so much relied on to evacuate NYC were totally worthless.

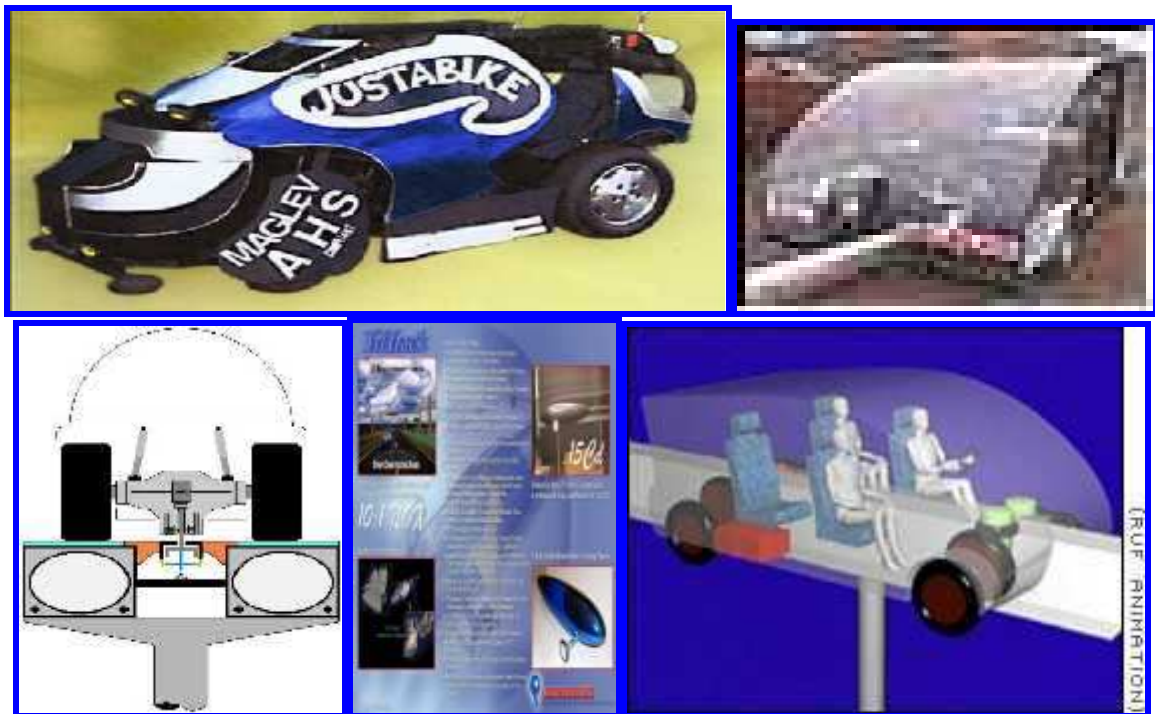
PID COMMENT

But there is an answer: It is called **dualmode transportation**. This revolutionary concept, which is being studied and developed by a growing number of experts, can lead to the solution of our traffic and related environmental problems, even when there are many more private cars than we have now. The author will use as an example, and strongly recommend, a dualmode system with selected features that he considers optimum. He chooses to call it, **THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM**, or “**REV**” for short.

THE CONCEPT

We will use privately owned environmentally clean “**dualmode cars**” that will be driven in the normal manner on the streets and will also travel automatically on a nationwide “**dualmode guideway**” network. The following chapters will explain why only a dualmode system (also written “**dual mode**,” can solve most of the transportation and related problems, not only in the United States but also in the rest of the world.

PID COMMENT



Dual-Mode Entrepreneurs are abundant!

The opportunity to bring forth a revolutionary transportation system is too lucrative to ignore! The best solution will be affordable, and resemble today's vehicles with looks and appeal for Consumers.

PID COMMENT

Constant-high-speed dualmode guideways (perhaps 60mph) will be built in and around cities. Most of us will drive from home to the nearest guideway and use that system for the major part of our daily commutes, effortlessly, rapidly, safely, quietly, and without pollution.

PID COMMENT



A 100 foot section of Guideway System Layouts

A Guideway System is not imaginary technology. People who say they would never ride a Guideway must not use Trains, Elevators, Escalators, Roller-Coasters, Cable Cars, Ski Lifts or Monorails. If you run your car through an Automatic Carwash, that is also guided. A Guideway System has a safer safety record than human drivers ever could!

PID COMMENT

Still-higher-speed guideways (perhaps 200mph) will connect all cities across the nation. At that speed we would be able to take our personal cars from San Francisco to Los Angeles in two hours. One or more persons could “drive” from Boston in the evening, get to New Orleans in less than eight hours, and the “driver” could sleep the whole way. On trips of up to a thousand miles, instead of driving to the airport and then flying, we can stay in our cars and take the guideways. We will arrive sooner than we would have by jet, without all of the time-consuming and frustrating details of flying. And we will have our own car to use at our destination instead of a rental.

PID COMMENT



A single Guideway Lane replaces many highway lanes!

A single Guideway System replaces an enormous amount of freeway lanes. The biggest hurdle is in people’s own mind, because they cannot understand or rationalize this idea. An yet, those same people drive Cars and use Computers, and don’t understand them either!

PID COMMENT

In buses, trains and airplanes we are forced to be close to crying babies, to people we wouldn't choose to travel with, people who must talk when we would prefer quiet, people who occupy all the seats and leave us standing, people who may smell bad, may be drunk or high on drugs, or who have to vomit. Then there are the fellow travelers that have contagious diseases, or who plan to mug or rape us—some will carry guns and might use them. Our dualmode transportation system will provide comfort, personal safety and privacy, just as our automobiles now do.

The guideways of our twenty-first-century system will also carry rental cars, taxis, buses, delivery trucks, and freight. As we will see in Chapter 8, The capacity of the system will be enormous: At 60mph a single city-guideway lane would handle as many cars as **ten** highway lanes, and a single 200mph guideway lane between cities would carry the traffic of **thirty-three** highway lanes! With that great capacity the constant need to add more highway lanes will be a thing of the past.

THE BASICS

When they are on the streets our dualmode cars will be driven normally. On the guideways, in order to get more people and things from here to there in a hurry in a single lane, the cars will travel fast and extremely close together. Human drivers could not drive safely under such seemingly scary conditions; the "driving" on the guideways will be done by an automatic computer-controlled system. Highway traffic will be greatly reduced. Downtown street traffic and street parking will also be reduced, by a neat trick to be explained in Chapter 11.

Gasoline and diesel engines require fuel (that we are rapidly running out of) and these engines aren't kind to the environment. We must get rid of them. Our dualmode cars, without internal-combustion engines, may look a lot like our present automobiles, except under the hood. Each will have a dashboard, steering wheel, brakes, and the usual pedals, levers, switches, and instruments—for street use—but none of these things will be used when the cars are traveling on the guideways.

Human drivers cause the great majority of all vehicle accidents. In the coming dualmode-transportation age drivers will still cause some accidents on the streets and on the partially deserted highways; but human-caused guideway accidents will be impossible because the manual controls will be automatically disabled when the cars are on the guideways. Nothing the person sitting in the driver's seat (or any other seat) can do could cause an accident. (See [Chapter 14. SAFETY](#))

This new transportation system will be a unique combination of a number of great inventions, both old and recent; it will require no major new inventions of its own. Developments in computers, electronics, power generation, energy storage, and electric motors in the last several decades have made an excellent dualmode system practicable. Vital features of the dualmode system proposed here are the use of “**magnetic levitation (maglev)**” and “**linear synchronous motors**” on the guideways. These unusual motors will electrically propel all of the cars at exactly the same speed, permitting them to safely travel very fast and extremely close together, thereby providing the enormous system capacity previously mentioned.



Dynamics of a Linear Synchronous Motor

A Magnetic Levitation Train uses linear motors. This technology was around for over 100 years (since 1902), but it took 80 years to convince Investors, the Government and the Public of its viability. Foolish skepticism is why people are paying \$3.00 dollars a gallon for gasoline.

PID COMMENT



TRUST???

I don't think I can TRUST a bunch of distracted cellphone talking, drunk driving, cigarette smoking, tired, drug (legal or otherwise), beard shaving, make-up applying automobile drivers!

PID COMMENT

SKEPTICISM

Yes, these are big promises. One problem in promoting dualmode transportation will be that it promises to do so many good things for us that cautious people may tend to question its credibility (those from Missouri in particular). After reading one of my early articles on this concept a friend asked, "This is just a story, isn't it?" No, Steve, it is not just a story; it is a serious proposal and a prediction. Dualmode **does** seem to be too good to be true, but in fact it will be as close to a universal cure as we are apt to find in any field. "Nothing is too wonderful to be true."—Michael Faraday.

However, there is no free lunch. It will be most difficult to get such a transportation system. Because of its futuristic nature, its national and international scope, and the major effects it will have on many aspects of society, labor, industry, and government, many people will oppose it. And it is true that the details will require a lot of further research, analysis, development, and testing.

The United States doesn't currently generate enough electricity to power the national dualmode transportation system in addition to our present electric loads; but

during the period in which the dualmode system is being designed and built we will also be expanding electrical generation to provide the required additional power—green power. This will be covered in detail in [Chapter 15](#).

PID COMMENT



SKEPTIC or BELIEVER?

It really does not matter at this point. By this time you should already be realizing that gasoline is a complete waste of time and money! If you have not come to that conclusion, keep reading, and paying ridiculous gas prices!

PID COMMENT

The important thing to note here is that present automobiles, and most other vehicles, are very rapidly depleting earth's fossil fuels—which have become seriously “endangered species.” Burning fuel in turn endangers and pollutes our environment in several nasty ways. But electricity, which dualmode will use in both modes, can be and eventually will be completely "green" and renewable. Internal combustion engines will run on only a few types of fuel, all of them in short supply; but we can make electricity from any source of energy. Most of these “renewable” sources will come from the sun, which will last much longer than humanity will.

At this point some of you are surely thinking that we could never afford dualmode. Fortunately it will pay for itself, as we will see in [Chapter 17](#).

There are doubtless important questions that have not yet been adequately addressed, but unanswered questions should not be allowed to kill this most promising system at the outset. As [Charles Kettering, former Engineering Vice President of](#)

General Motors, once wrote, "**We see what might be wrong with a new idea, not what is right.**" Another quote also comes to mind: "**We must not dismiss any novel idea with the cocksure statement that it can't be done. We have already proved that science and hard work can lick what appear to be insurmountable difficulties.**" — **William E. Boeing**. However, the dualmode system won't present serious technical difficulties—the difficulties will be mostly in the sociological and political arenas.

People love their automobiles. But as higher and higher percentages of our growing population acquire these wonderful and versatile machines, traffic enters gridlock, concrete competes with homes, businesses, and crops for acreage, earth's oil reserves disappear, the air becomes harder to see through and to breathe, acid-rain kills more trees, and the globe becomes dangerously warmer and the weather wilder. These multiple problems have become so severe that many people are now dead-set against automobiles. (The victims of accidents and pollution are not "dead set"; they are just dead.) All in all there are a large number of vital reasons why we must and therefore will have a dualmode transportation system.

CARS ARE GOOD

Some groups have been saying for years that cars are bad. As we will see, that "ain't necessarily so," but it will take some time to undo the bad image that our present automobile-and-highways system has earned.

PID COMMENT



Irrelevant to what you believe, this is REAL!

Skeptic or not, this is what you are paying for gasoline! What you are going to find out is that gasoline is a complete waste of money, and that automobiles are engineered based on extremely poor physics principles.

PID COMMENT



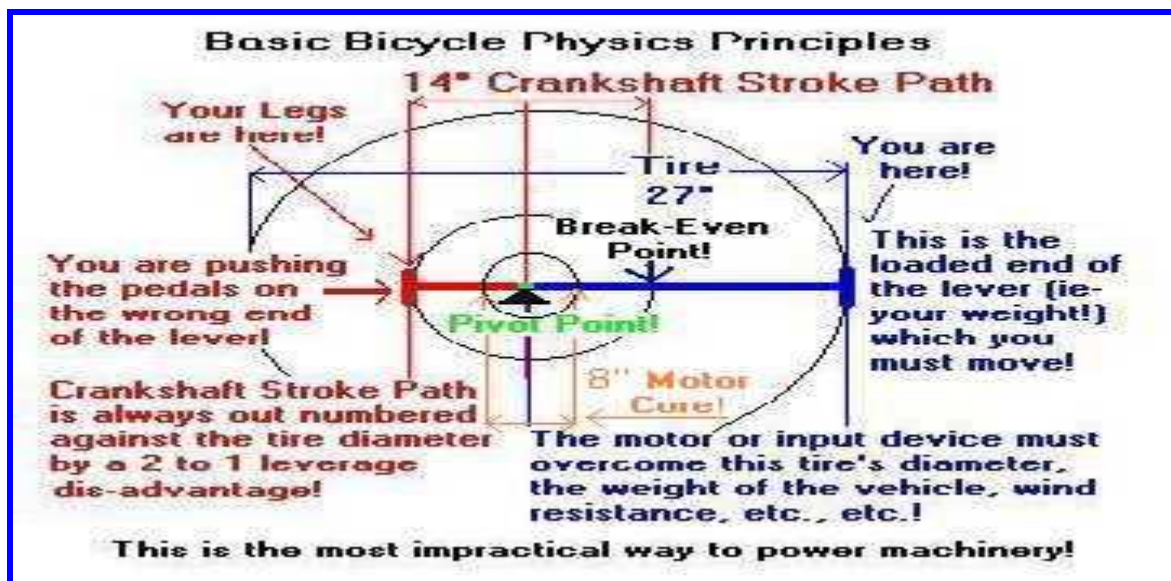
The Japanese and many others are trying to implement a Dual-Mode concept. Their failure or difficulty in implementing the Dual-Mode System stems from the fact that promoters and inventors are using those worthless gasoline vehicles. That is the first and most major mistake. The Automobile Industry failed to create vehicle STANDARDS like every other industry. The Bicycle, Computer, Machine, Tool and most other industries have STANDARDS. A 1" inch measurement is 1" inch everywhere in the world, no matter whether it is U.S. or Metric.

A 27" Schwinn wheel will fit on a Raleigh, Huffy, Sears, Columbia, Cannondale, etc,. You cannot take a Volvo 14" Tire and Rim and put it on a Ford vehicle, or any other. The over complexity of automobile components is pointless, and the Consumer becomes the "sucker" for these tin and plastic vehicles.

Americans already drive well over two trillion passenger miles between cities every year, and traffic is escalating rapidly. Between 1970 and 1996 the mileage driven yearly by Americans increased four times faster than the population, twice as fast as the number of licensed drivers, and eighteen times faster than new roads were being built. (Federal Highway Administration Data.) These frightening facts don't make cars bad however. On the contrary, cars must be very good otherwise they wouldn't be so popular and wouldn't be driven so much.

In an attempt to solve traffic congestion problems, politicians, transportation planners, and citizens of the United States and other developed countries routinely propose additional rapid-transit systems. These, as we have seen, have done and can do little to reduce the problems. Some people support transit proposals in order to get **other** people off the highways so they themselves can drive more easily. I suspect that many transit and environmental advocates drive to where ever they do their advocating rather than take the bus.

PID COMMENT



Industry got it BACKWARDS!

You will find out after studying basic elementary physics, that Industries are not following proper physics principles. Automobiles waste more energy than they produce, therefore, energy efficiency must be the goal. You cannot use renewable energies on wasteful internal combustion engines!

PID COMMENT

The system proposed here will let them drive without feeling guilty.

Yes, cars per se are very good, but in today's world we must have a new kind of car used in a new way in order to solve the problems that have been caused by the overwhelming popularity of the private vehicle.

IT WILL BE DONE

This book does not present dualmode transportation as a suggestion; it is presented as the actual future of transportation. This bold attitude stems from the solid convictions of the author and many other people who have studied dualmode systems.

The Dualmode Transportation System will be built simply because it has so much going for it. It will be built and it will solve most of our transportation problems and reduce many environmental problems. It will be built because we have to have it—there is no other adequate overall solution.

With these assurances some readers who are easily convinced and who have no interest in the details may say, "That will be nice," and stop reading this book. But those who are curious to know more about the guideways, dualmode cars, their control and operation, how the system will affect society, the environmental and energy aspects, the costs, the politics, and when we will build it, have the author's permission to continue reading.

[Next: CHAPTER 2](#)

Quotations About Dualmode Transportation

PID COMMENT



Magnetic Levitation Trains don't need wheels!



Magnetic Levitation Cars??

ABSOLUTELY!

Mag-Lev Trains move so fast, they don't even need wheels! Why should we have wheels on automobiles? It will be too impossible to invest billions of dollars trying to enlighten the Consumer. A logical step beyond Electric Motors and Gasoline Engines are Computer Generated Systems.

This obvious step will be impossible for people to believe, despite the fact that this is how Mag-Lev Trains operate. Today's automobiles are filled with useless "Junk Technology," designed to sock you in the wallet. Truly advanced vehicles will have very few moving mechanical parts under the hood of the vehicle.

PID COMMENT

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 2

Quotations about Dualmode Transportation

“I share your enthusiasm about maglev dualmode concepts. I know of no other that would use maglev for suspension and propulsion of vehicles that are very much like the ones we now drive. Your loop idea that allows for shutting down segments of the guideway is unique in my experience. This is a great time to put the dualmode concept before the general public, as I think there is great interest in finding a solution that (unlike light rail transit) will provide some substantial benefits for the dollars spent.”—**Dr. Jerry Schneider, Professor Emeritus, Urban Planning and Civil Engineering, University of Washington.**

“The dualmode system is very interesting. Your proposal certainly appears to meet many of the Federal Highway Administration’s overall strategic goals, particularly mobility and safety. It would appear to serve the economic efficiency goals as well. We must continue to search for new and innovative solutions. I encourage you to submit an unsolicited research proposal to FHWA.”—Letter to Francis Reynolds from **Gary Maring, Acting Associate Administrator for Policy, Federal Highway Admin., US Department of Transportation.**

“Dualmode transportation is technologically practical, economically feasible, and desperately needed.”—**Donald Bailey, Boeing Engineering.**

“The question asks itself, why hasn’t the concept been investigated before now? It is to me such an obvious solution.”—**Arthur Hoal, Civil Engineer, South African Railways.**

“Building a dualmode system is the right thing to do.”—**Robert Style, political consultant.**

“You have an intriguing idea. I think you hit the problem of poor use of public transportation right on the head.”—**Carl Knowlen, University of Washington Engineering Research Scientist.**

“Dualmode will be to Transportation what the Internet is to Communication: We had the telegraph, telephone, radio, television, fax, and finally the Internet. We have

bicycles, trains, cars, buses, airplanes, and eventually we will have dualmode.”—**Ronald Case, Case Financial Services.**

“You have done a phenomenal job defining a scheme which reflects meaningful vision. You have given consideration to all aspects of the approach and have a masterful workable system. I drove the 91 freeway to Riverside a couple weeks ago, and visualized the dualmode guideway parallel to the freeway and the Santa Ana riverbed, blocks of vehicles smoothly zipping along at very high speed and destined to arrive at Riverside in a matter of minutes.”—**Del Kahan, Electrical systems consultant.**

“The inclusion of unmanned maglev cargo containers on the dualmode guideways will make the system quite lucrative. There is nothing even close to that in existence. **The system will not only pay for itself but will make big money because of the combined people and freight usage.**” —**Dick Scherer, systems analyst.**

“The dualmode transportation system sounds fascinating!”—**Tom Fitzsimmons, Director, Washington State Department of Ecology.**

In a private meeting with the author: words to the effect that dualmode has many advantages, including speed, safety, efficiency, capacity, and environmental advantages over the private-car intelligent transportation system which has been under development.—**Fred Mannering, Professor of transportation engineering, and Dept. of Civil Engineering Chair, University of Washington.**

“It is true that the automobile’s tremendous success is owing to its door-to-door, no-wait, no-transfer service; and if it’s true that the structure of the modern metropolis is incompatible with large vehicle transit systems like trains, trolley, or even 50-passenger buses, then it must be that workable transit systems in low density sections of the metropolis will be those using vehicles that are like the automobile. I suggest that the ideal transit system will serve its passengers from door-to-door with no transfers and very little waiting — and that it will fit the small number of persons having the same origin, the same destination, and the same schedule. **Only such a system can compare with the car on its own grounds.**”—**Melvin Webber, Ph.D., Chairman of Transportation Studies, University of California, Berkeley.**

“Dualmode transportation will let us keep our cars and all the benefits that come along. It will however eliminate most of the problems we have with our cars. As a physically disadvantaged person I would never give up my car!”—**Erik Driessens, The Netherlands**

“In my opinion dualmode puts the Automatic Highway System to shame. This is a much greater benefit for a much larger group. A dualmode system that doesn’t rely on petroleum or natural gas will help solve many fast-approaching environmental

catastrophes. There is no realistic effort on providing for the real future of transportation. We are always taking care of today's immediate needs by adding more roads, widening roads, adding more traffic signals, and then suggesting transit, rail, biking, walking, etc. But people don't want to use shared transportation facilities; there is no guarantee of usage and not much support from the people. Consider me an aggressive supporter [of dualmode]. I believe that it will be very successful.”—**Keary B. Lord, Affiliate Director of the Georgia Section, Institute of Transportation Engineers and Senior Traffic Engineering Assistant, Geraghty & Miller, Atlanta, Georgia.**

“My assignment is to look at future automotive transportation system opportunities. I believe there are potentially unlimited advantages with dualmode systems.”—Ernest Tong, Senior Technical Specialist, Ford Motor Company, February 17, 2001.

Next: **CHAPTER 3**
Why We Are Where We Are



TOTAL TRAFFIC CHAOS!!

How did we get here? Everyone is to blame, your Government Officials, Skeptics, Critics, non-Activists, and anyone who wants to get around using the current transportation infrastructure.

People must factor in the growing population of motor vehicle traffic that is rising annually. These numbers will never go down, and will rise faster than highway capacity can be built!

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 3

Why We Are Where We Are

TRANSPORTATION PATHWAYS

Let us start back at the beginnings of human transportation. We walked. Later we domesticated horses and other beasts of burden. Both walking and travel by horse trampled down the vegetation and produced paths. Then we put chariots, wagons, buggies, carriages, and coaches behind our horses, and the paths grew wider. When we became impatient and wanted to travel faster, we smoothed and straightened the paths out and widened them some more so we could pass each other. We called these super paths roads. After the wagon wheels made deep ruts we found that it helped to put gravel on our roads. In towns and cities where there was lots of traffic we began to surface the streets with cobblestones or bricks. This made them wear-resistant and helped eliminate the mud.

The Roman Appian Way was carefully built up of many different layers of gravel, mortar, and stone. The Romans used crude mortar made with lime, or used bitumen tar from shallow-pit petroleum deposits. In the early eighteenth century John McAdam designed and built somewhat similar heavy-duty roads. We now misspell his name and call roads made in this way “macadam.”

Oil was found in Pennsylvania in 1859, and asphalt surfacing of streets and roads was developed. The first portland-cement concrete pavement was made in Scotland in 1865. When paving machines were developed the cost of building better streets and roads decreased, and these smoother surfaces were cherished by the large percentage of the population using bicycles.

MECHANIZATION and TECHNOLOGY

The discovery of petroleum made possible wide use of internal-combustion engines, which were invented at about the same time. These events led to the development of the automobile, which demanded more and better roads and highways. The roads got dirty both before and after the automobile arrived, but the dirt changed from an unpleasant byproduct of horses to black oil streaks.

All of the basic types of mechanized transportation came along at very close to the same time in history. The Wright brothers, who had a **bicycle** manufacturing shop in Dayton, saw their first **automobile** in 1896. But they traveled to Kitty Hawk North

Carolina by **train** and **steamboat** to test their **airplane**. Glenn Curtiss, the Wright's chief aeronautical competitor, was originally a **motorcycle** pioneer. The "Transportation Revolution" immediately followed the Industrial Revolution, which made it possible. Now we have the Electronics Revolution, which makes the Dualmode Revolution possible.

PID COMMENT



BICYCLES made Planes, Trains and Automobiles possible!

All those foolish "SKEPTICS" are now "Passengers" who desperately rely on these technological innovations!



A bicycle during the 19th Century

Planes, Trains and Automobiles were built on physics principles beginning with the 1600's. It is time to use some common sense. Those fore fathers had very little knowledge during these eras, and if our transportation is built on poor physics principles, it is time to change!

PID COMMENT

TRANSPORTATION ON TRACK

As early as 1550 crude wooden tracks were laid in order to reduce the number of men required to push coal and ore wagons in mines. When passenger and freight trains came along they were horse-drawn until the invention of the steam locomotive.

However most of the freight was carried by canal-barges, which were also drawn by horses. This “horsepower” was on the banks of the canal, pulling towlines attached to the barges. Canals were extensive in Europe and in the Eastern United States during the later half of the 18th and the early part of the 19th century.

Digging canals and building locks took more labor than building roads, but in those days canals had an advantage. It takes very little force to move boats slowly, while the friction of crude wheeled vehicles is great at all speeds, especially with heavy loads on poor roads. The canal boats had to travel slowly anyway; barge speeds were limited to three and a half or four miles per hour, to reduce bank damage from waves generated by the barges.

As steam railroads proliferated, the canal traffic gradually declined. The trains were so fast by comparison that it became possible to ship fresh fruits and vegetables. (Which raises a philosophical question: Why do we “ship” things by rail and car, yet we put “cargo” on ships?)

Steam engines were invented before the internal combustion engine, and wood and coal to heat steam boilers were available before gasoline and diesel oil were; therefore it is not surprising that we had steam locomotives and trains before we had automobiles, trucks, and buses. (We will talk about steam cars later.)

George Stephenson’s “Locomotion” was one of the first “iron horses.” It pulled both freight and passengers on the Stockton and Darlington Railway in England in 1825. Boiler explosions, a deadly early problem, decreased with improved methods and materials. As the designers gained experience, the later fire-breathing dragons set fewer fires in the countryside, became more reliable, got larger and more powerful, ran faster, and began to look like steam locomotives. Rails, first made of wood, changed to cast iron, to wrought iron, and finally to steel.

Railroads in the United States developed at about the same time as those in Europe. Horse-powered “tram” railways were hauling granite in Massachusetts in the early 19th century. John Stevens built the first locomotive in the U.S. in 1825. The Baltimore and Ohio started carrying passengers five years later. The “last spike,” which connected the Union Pacific and Central Pacific railroads and thereby connected the

Pacific and Atlantic oceans by rail, was driven at a point on the Utah prairies in 1869. The big expansion of American railroading occurred in the second half of the 19th and first quarter of the 20th centuries.

Riding the early railroads had its challenges. Open cars provided no protection from the sun, wind, rain, or cold. Passenger's hair and clothes were sometimes set afire by sparks from the locomotive, and riders had to endure the often-choking smoke. Accidents due to exploding locomotives and de-railings were quite common.

In the early days of the Trans-Siberian Railway, during the winter the passengers had to get off the train and cross frozen Lake Baikal by horse-drawn sleigh, then get on another train to continue their journey. In warmer weather the rail cars and their passengers were carried across the lake on barges.

RAILROADS vs. AUTOMOBILES

With the advent of the motorcar and better roads, the railroads had competition. But initially, long trips by automobile were adventures requiring courage. The roads were still scarce and rough, flat tires and blowouts were very common, the early automobile engines wouldn't always start, and breakdowns of various kinds, including brake failures, were frequent.

Gasoline (which had to be poured into the car from a can) was hard to find, and so was repair service. Drivers (men-only of course) learned to be do-it-yourself auto mechanics. People took camping tents and their own food on long trips, because hotels and restaurants were rare and motels (motor hotels) hadn't been invented yet. Bare "auto cabins," close to an outhouse, appeared a decade or two before the motels did.

But the day came, probably in the mid 1930s, when it was as safe and easy to make most long trips by car as by train. From then on automobile mileage soared and passenger-train business declined. Mass production made automobiles better and much cheaper. The price of a new model T Ford got down to \$200 dollars or less. New and better streets, roads, and highways were built rapidly as the demand increased.

The trains lost business not because they were slower, less comfortable, or more expensive to use; but because personal car trips required much less advance planning, provided convenient door to door transportation, and complete privacy. "The freedom of the open road" was a common saying. A trip by car was only one trip, while a trip by train was three or more trips: the trip to the train station, the train ride, and the trip from the final station to the final destination. For those who don't drive, three-step time-consuming trips are still with us, whether we travel by transit bus, GreyhoundTM or airplane. Our coming dualmode trips will all be single-step, just as present automobile trips are.

OTHER DISADVANTAGES OF TRAINS

The basic concept of connecting a “train” (a string of railroad cars) together physically was very useful in its day, since it was much cheaper to provide **one** team of horses or **one** locomotive to pull a large number of passenger or freight cars. But the concept of trains also has some major disadvantages. It takes time to “make up” a train (connect all the cars and locomotive together in the desired order). The entire train has to stop at every station to let passengers off and new ones on. This requirement wastes time for all the “through” passengers and greatly reduces the average speed on multi-stop trips. This disadvantage also applies to bus travel, and to intermediate-stop airline flights.

Freight trains have related problems: A train can easily “drop” the last car without stopping; but if a loaded freight car destined for San Francisco is in the middle, the train would have to be uncoupled in a San Francisco marshalling yard to drop off that car and then the train re-coupled before it could continue on. Marshalling is a slow process. Likewise, a car added to the end of the train at an intermediate city will block the dropping of other cars at cities farther on. To minimize these costly and time-consuming maneuvers, the trains are of course made up as logically as possible at earlier stops; but the need for periodic marshalling of connected trains cannot be eliminated. Unconnected independently powered vehicles on guideways will not suffer these limitations. They may be traveling together but they will be completely independent of each other, and able to go their own ways at any junction.

As we will see in chapter 8, the capacity of trains is very low compared to what we will have with dualmode guideways. For this and other reasons to be discussed, reviving the railroads can’t solve today’s transportation problems. Trains per se are passe.

NOSTALGIA

If we feel nostalgia for railroads, perhaps we can ease the pain of their gradual demise by thinking about a few other wonderful inventions that played vital roles in earlier transportation, but which are now gone. On the water we had birch-bark canoes, canal boats and barges, and transoceanic sailing ships (Departing ships still “sail.” even if they carry no sails). With horses we had saddles, wooden-wheeled wagons, carriages, buggies, buggy-whips, and the stagecoach. And with horseless carriages we had chain-drive hard-tired trucks, acetylene headlights, hand-cranked engines, mechanical brakes that might or might not stop the car, magneto ignition, manual choke and spark advance, solid-rubber tires, and later bias-ply tires with inner tubes. We had cloth-covered biplanes, reciprocating engines with hand-swung props, and transoceanic flying boats. (It strikes the author that young readers may have never heard of some of those wonderful old things, but he saw them all in the 1920s, 30s, and 40s.)

Note that all of these obsolete things served mankind well, and were essential during their tour of duty. They have only moved from the present into the museums because better things have been invented to replace them. The needs for their functions still remain, but these needs grew and changed, and were met by more modern systems and devices. Now our present (but already ancient) transportation systems in turn can no longer do the job. Many things have changed for the better in the past and it is now time for another big change for the better: another transportation revolution.

Passenger trains were essential to this country before we had cars and good roads; but in 1971 the Government took over the passenger railways because they were going bankrupt. The nationalized system is called “Amtrak.” The total ridership has continued to decrease, and the subsidization by the taxpayers has steadily increased. In 1996 Amtrak announced that it would have to close four more major routes. At that time they had a \$200 million budget deficit. In 1999 an Associated Press news headline announced, “Amtrak hopes high-speed train will drive up its profits.” What profits? They really meant, “reduce its losses.” Among other things the article below that headline said, “Amtrak has not turned a profit since it was founded in 1971. The General Accounting Office reported that the railroad lost an average of \$47 per passenger in fiscal 1997.” Also in 1997, “Congress provided a \$2.2 billion cash infusion.” That was in addition to Amtrak’s annual subsidy. This data is rather dated, but it has only gotten worse since.

As the year 2000 rolled around Amtrak announced the opening of a new line between Fort Worth and Oklahoma City. The article stated, “A round-trip ticket is \$48,” and it went on to say that was \$408 per ticket less than the actual cost of the service. “Taxpayers will make up the difference.” Heaven help us. Oh yes, it was also stated that trip will take about 40 minutes **longer** than it took in the 1950s on the privately owned and profitable Santa Fe Railroad.

There is an isolated exception to Amtrak’s losing money, however. A recent article described a private-venture system that uses Amtrak rails to carry private automobiles and their passengers up and down the East Coast on special train cars. It gets them there much faster than they could drive on the jammed highways, and it makes a profit. **It works because it is a form of dualmode transportation.**

STEAM ON THE FARMS AND STREETS

The steam engine arrived a little before the internal combustion engine. The very earliest attempts at self-powered or “auto-mobile” vehicles were steam-powered. In 1769 a Frenchman named Nicolas Cugnot made a successful slow heavy steam-powered tricycle tractor. In 1805 an American, Oliver Evans, designed and built a monster amphibious steam vehicle, the “Orukter Amphibolos.” It was somewhere between a huge success and a complete disaster, depending upon which account one reads.

Starting about 1850, many farm horses were replaced by “steam traction engines.” These locomotive-like horse-less workhorses were in turn gradually replaced by gasoline and diesel-powered tractors fifty to seventy five years later.

Not only did steam locomotives replace horses for pulling trains between cities, but smaller steam locomotives also replaced horses to pull streetcars within the cities. These small engines, which often pulled trains of ten or more streetcars, were enclosed in streetcar-like bodies and designed to be especially quiet, so as not to scare the horses pulling wagons and buggies. These streetcar locomotives started replacing streetcar horses about 1850. By 1900 electric streetcars had, in turn, replaced the streetcar locomotives. The electric streetcars were quieter, cleaner, safer, and more efficient. And since each car was self-powered it could be used independently; trains of cars with their less-frequent schedules were no longer necessary.

Considerable effort was also put into the development of steam-powered automobiles. Several brands, including the famous “Stanley Steamer,” enjoyed some popularity in the 1920s. They were fast and quiet, but one didn’t just turn the key and go. Even with their “flash boilers”, “getting steam up” took far more time than modern drivers would tolerate.

But the steam car had a certain mystique and some loyal followers. There were even some valid engineering arguments in its favor. Steam engines are self-starting, and they develop high torque at any engine speed (permitting a simpler transmission). As late as 1968 Bill Lear, of Lear-Jet airplane fame, undertook to build a modern steam car in mass production. After about four years and fifteen-million-dollars the Lear Steamer efforts were dropped.

No matter how interesting steam may be, we know that oil and water (steam) don’t mix: oil (and gasoline) being lighter, always come out on top—in transportation history as well as in a bucket. Ah, but electricity is still lighter than gasoline, so now **it** is going to come out on top—in a manner of speaking.

THE AUTOMOBILE: TODAY AND TOMORROW

Up until about 1970 the automobile was wonderful. After WW II most families could own a car, there were good roads to take us anyplace we wanted to go, the traffic wasn’t bad in most places at most times, parking was no problem, gasoline was plentiful, and pollution was a little-used word.

Cars are essential to modern life. They give us freedom, recreational opportunities, flexible vacations; and more importantly they get us to our jobs, the doctor, and the supermarket. But with greater affluence and higher populations we now have many more cars—and problems. Exhaust fumes are a major source of atmospheric pollution and global-warming, we have nearly depleted the world’s oil deposits, the highway injury and

death toll is serious, and the increasing numbers of highway lanes we need are taking too much land.

Traffic jams are keeping us from getting where we need to go in reasonable time—tending to negate the basic reason for having automobiles in the first place. We have an overpopulation of automobiles because we have an overpopulation of people.

PID COMMENT



The Highway Fiasco is not easy to ignore!

People who have lost Homes and Businesses will see the need and reality Dual-Mode Transportation represents. If Dual-Mode was immediately available now, all those people who lost Homes and Businesses would definitely not waste time being a foolish skeptic, but analyze this technology, and become an effective advocate to demand its implementation.

PID COMMENT

Our automobile-overpopulation problems apply to our present types of cars and present types of roadbeds; fortunately these problems are **not** inherent in the basic concept of personal-vehicle transportation. We do not need to throw out the good in order to get rid of the bad. The thing that will solve those problems yet let us have private cars is the dualmode car and guideway system. And the use of dualmode buses and trucks on the same guideway system will also let us solve the problems caused by overpopulations of transit and commercial vehicles.

Our transportation planners and people with environmental concerns have been proposing more public transportation. But the systems they are proposing to expand have been around for a century or more, and their ridership has dropped to a small fraction of what it was 75 years ago when we had few automobiles. These systems, which were the right answers then, are the wrong answers now. Most of these dinosaurs nearly died a natural death fifty or more years ago because of declining ridership. But even if the public would use them en masse again, these old systems couldn't provide enough capacity for a major reduction in the transportation load now carried by private cars. Chapter 9 will provide proof of that statement. But in the meantime here is a related example.

In the Pacific-Northwest, Lake Washington separates Seattle from "The Eastside" cities. Sixty-plus years ago there were no bridges across the lake and the few people who lived in small towns on the Eastside traveled to Seattle by ferries. Now these towns, such as Bellevue, are bustling cities. There are two multi-lane bridges across Lake Washington, and the ferries have been gone for 60 years. But the bridges will no longer carry the increasing traffic—so there were serious (?) plans to bring the ferries back, "to relieve the traffic on the bridges." An article in the Seattle Times disclosed four planned ferry routes across the lake. State analysts predicted that the four routes would carry a total of 2,000 cars a day." Good. What that article failed to mention, for obvious reasons, is that the Lake Washington bridges now carry over **two hundred and fifty thousand cars a day**. (1998 Washington State Department of Transportation data.) The proposed ferry traffic would be less than one percent of the total. Could a one-percent reduction in bridge traffic even be noticed?

The Lake Washington ferries (like the San Francisco-Bay ferries) went out of business because they were inadequate even then. That is why the bridges were built. State analysts say the reactivated Lake Washington ferry trip would take 25 minutes (plus waiting, loading, and unloading time). Cars using the bridges can make the trip in five minutes if the traffic is light. (An hour if traffic is jammed up.) Our coming dualmode guideway cars will make the trip over the bridges, from Seattle to Bellevue or Kirkland, in two minutes, all of the time.

The author does not wish to imply that Washington-State transportation planners are worse than others in ignoring facts. Transportation people in general are desperate since they are unable to make our problems go away with existing transportation systems. They probably feel they have to make some kind of promises, to do something, even though they should know the situation is hopeless with current systems. If more transit, for instance, would solve the problems, supply and demand would have provided more transit and done the job long before this. Dualmode will be good news for these desperate people—if we can get them to listen, leave the twentieth-century, and join the twenty-first.

PATCHES AREN'T WORKING

Passenger railroads are largely obsolete because they are inflexible and don't provide door-to-door service. Neither do local transit systems or intercity buses.

Highways are largely obsolete because their dependence upon human drivers limits their capacity, performance, and safety. And highway vehicles use petroleum, which will soon be gone. We can't solve our many transportation problems by patching, adding to, and subtracting from the various existing systems. The truth of that statement is evident through analysis, as well as through observing our many recent and expensive failed efforts to solve these problems with these obsolete solutions. Transportation and environmental problems, worldwide, continue to get worse rather than better. We must build a system using the latest technologies, for our current and future civilization. A revolutionary change is inevitable and essential.

We must broaden our thinking by looking at the big picture. Automotive engineers must start looking beyond automobiles as we now know them. Highway engineers must join hands with railroad engineers and with electrical/electronic engineers and computer scientists. It is now evident that a revolutionary integrated system can use the best features of several of our existing systems yet can eliminate the things in each that now restrict their usefulness, deplete our fuel resources, and pollute our world. This book will describe the coming efforts, including examination of the problems that will make its implementation a fascinating but frustrating challenge. These problems won't be technical nearly as much as they will be political and sociological.

Next: [**CHAPTER 4**](#)

Dualmode vs. Single-Mode Transportation



You cannot implement “Large Scale Revolutionary Concepts!”

To strategically implement a large scale revolutionary concept, you have to shake the very foundation of what people are taught to believe! It has to be personal. As for the automobile and the “Status Quo,” those who realize they are just wasting their hard earned dollars are the ones that will become aware of the new Dual-Mode Vehicle revolution.

People will have to become educated on advanced technology in some capacity, ignorance can become very expensive. How many times have you gotten stuck with a \$2,000.00 dollar automotive repair bill? Do you think having a lack of knowledge is helpful in negotiating a better deal? NO!

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 4

Dualmode vs. Single-Mode Transportation

DEFINITIONS

Automobiles, trucks, trains, buses, and streetcars are all “single-mode” systems. That is, these vehicles operate on streets and highways or on rails; none of them travel on both roads and rails.

Most trips these days are made door to door in a single vehicle. That is the most convenient and time-efficient way to travel, and that is the way most of us will still travel in the future. But a few of us now drive a private car to a park-and-ride lot, and then ride a transit bus. And on longer trips we may use park and ride, transit to the airport (or train depot), then jet to another city, then take a shuttle bus, and then a rental car or taxi to our final destination. We may use five or more different single-mode vehicles in a single long trip. The associated walking, waiting, and the transferring of people and luggage from vehicle to vehicle, often in the rain and in unsafe places, is obviously costly in terms of dollars, time, stress, and danger. But in the future only **one** vehicle will be required for any trip if that one vehicle is dualmode.

“Multi-modal transport” is not the same thing. It means the use of several different vehicles in different modes in one long trip, such as we have just described. Dualmode transportation, all in the same vehicle, will not require changing from one vehicle to another. These multi-modal vs. dualmode comparisons apply to carrying freight as well as people.

Major efforts are now being made to get more people to leave their cars at home in order to reduce street and highway traffic congestion, to save fuel, and to reduce air pollution and the rate of global warming. This approach, as we have repeatedly seen, works very poorly because most people want to drive. And transit that uses the streets and highways cannot provide significantly faster transportation until a high percentage of traffic is removed from those streets and highways. And transit can’t pick up and deliver very many of its passengers close to their doors. Yes, walking is good exercise, but we much prefer to choose where, when, and how far we walk, and in what weather; and we prefer not to have to carry loads such as luggage, kids, or groceries, or ride in wheelchairs under unfavorable conditions.

(The following paragraph was in plain clothes until a fellow dualmode-system proponent previewed it. He said, “That ought to be underlined, because it is the guts of dualmode.” You are right, Dave, this is the crux of the whole concept.)

A dualmode system will get a high percentage of cars off the streets and highways, not by discouraging car use but by providing a very fast high-capacity alternate path for the cars to travel on. This new path will not only let people use their cars; it will get them to where they want to go faster and safer. It will greatly reduce pollution, and will not use fossil fuel. And the guideways, in conjunction with the existing streets and highways, will still provide the door-to-door service that we now enjoy—or would enjoy if the traffic weren’t so heavy.

PALLETS AND TRUE-DUALMODE CARS

A “**true dualmode car**” is defined as a vehicle equipped to be driven on the streets and highways as well as equipped to run directly on the guideways. Existing automobiles won't be able to ride directly on the guideways, but an ordinary automobile on a “**pallet**” will be able to travel on the guideways. Different pallets for the dualmode system will be designed to meet all of the requirements of guideway travel as well as carry a car, boat, or some other cargo. A comparable case would be a trailer carrying something on the highways that cannot run on the highways directly, such as a boat. The details of the pallets will depend upon the details of the guideway system and upon the details of the cars or other cargo the pallets will carry on the guideways. Pallets will be used in the early years of the dualmode system to carry conventional cars, because at first only a few guideways will be available. In that early period the highways will still be used extensively, and few people will yet have dualmode cars.

In the early form of dualmode mentioned in the previous chapter, the automobiles and their drivers and passengers are loaded and carried on trains. In this case the “pallets” are big and carry many vehicles at once: They are whole railroad freight cars. Another dualmode system of this kind is the one for carrying automobiles on trains in the English-Channel Tunnel. It can carry 800 cars per minute on a single lane of track. Palletted dualmode systems have also been proposed where the “guideways” would be dedicated freeway lanes, and the “pallets” would be special trucks designed to carry a number of automobiles and their passengers. One proposal for such a system goes by the name of “CarBus.”

Ferries for carrying cars over water are another form of dualmode system, one where the pallets are boats and the guideways are provided by nature and extend in all directions. Yet another example of dualmode is the airplane, which uses a taxi, takeoff,

and landing mode in addition to a flight mode. Amphibians are triple-mode vehicles. But our subject here is land transportation.

Compared to true dualmode, or to single-vehicle pallets, all multi-vehicle pallet systems suffer from degraded independence and safety for the passengers, and from time delays due to loading and unloading the multi-car pallets. So palletized dualmode systems using highways or railroads are temporary expedients with limited advantages. Therefore let us return to the discussion of the high-tech 21st-century National Dualmode Transportation System.

As the guideway system expands, more and more people will purchase true-dualmode cars and fewer pallets will be needed. But some pallets will continue to be employed for older automobiles and for such things as hauling boats and other trailer loads. The rental of pallets, from companies like auto-rental agencies, is proposed rather than having pallets as an integral part of the guideway system.

The use of true-dualmode cars will reduce pollution, be more energy efficient, and more convenient than using pallets. A pallets-only dualmode guideway system without true-dualmode cars would have much lower net guideway capacity because when the automobiles left the guideways and their pallets the vacated pallets would have to be routed empty on the guideways to locations where entering cars need pallets. Unlike a “deadheading” empty transit bus, which still needs a driver, a deadheading empty pallet will be routed automatically, but deadheading it will still consume energy and will cost as much guideway capacity as an occupied pallet or dualmode car will. This won’t be a problem in the transition period, however: The routing of empty pallets while the number of true dualmode cars is still limited will not stress the capacity of the guideways, because the system use factor will be low during that initial period.

WHAT WILL THE GUIDEWAY SYSTEM LOOK LIKE?

The only kind of national dualmode system that can provide very high-capacity and low-travel-times with a minimum number of guideway lanes is one that will keep the guideway traffic running at full speed all of the time. There cannot be any stopping on the guideways except in an emergency. Dense guideway traffic will travel at the same constant high speed as light traffic, never slowing down as highways do.



Guideways existed long before highways!
**Until recently, the benefits and need for Guideway Capacity
has not been understood.**

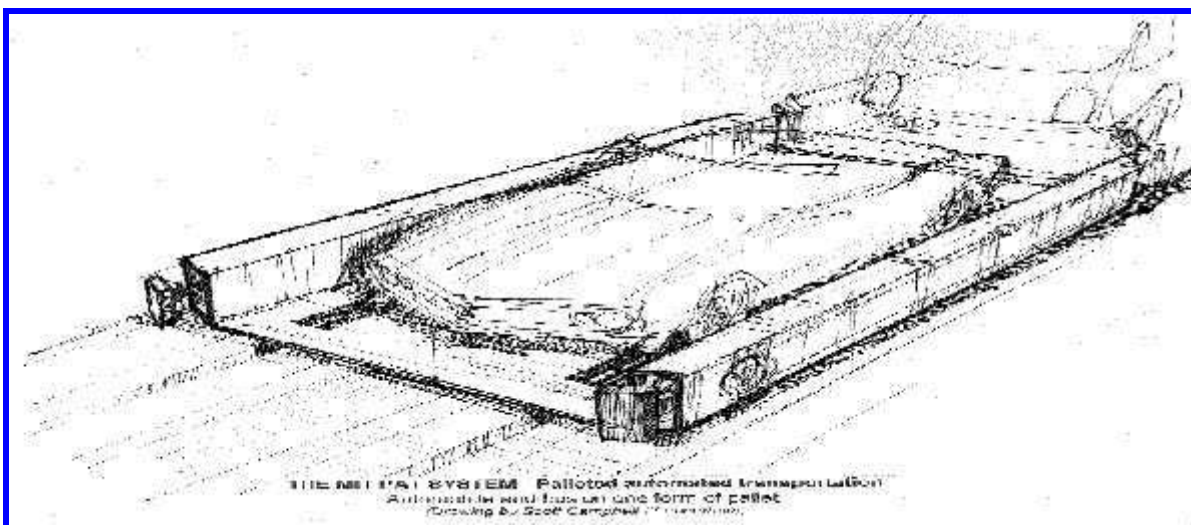
And the cars must also be able to travel close together in order to provide the needed high system capacity. In the firm conviction of the author the best way to accomplish all of this is through the use of linear synchronous motors combined with maglev built into the guideways (explained in [Chapter 9](#)). Since the guideways will be constant speed, all of the acceleration and deceleration of entering and exiting cars will be done on entry and exit ramps (see [Chapter 11](#)). This is the way our highways work, but is quite different from, and much faster than, the way railroads work. The guideways will probably look somewhat more like railroad tracks than like highways, but the similarity will be visual only. In function the guideway system will be comparable to the way our **highway** system would run if the human drivers could and would drive optimally.

Like train tracks and freeways, most of the guideways will be at roughly ground level, and on bridges and in tunnels. Overpasses or underpasses are required at all guideway interchanges, turnarounds, and at crossings with streets, highways, train tracks, and other guideways. In dense urban areas we will probably put our guideways underground or elevate them. Subways and the “elevateds” have been used in some major cities for over a century. Elevated guideways will also make sense in many open stretches where they could be placed above the median between opposite traveling freeway lanes, thereby eliminating the need for acquiring more land. Some guideways will probably be built along abandoned or active rail rights-of-way. Guideways through agricultural fields could be elevated so that crops could be grown beneath them, just as power lines are.

WHAT WILL THE DUALMODE CARS LOOK LIKE?

The cars to ride pallets on the first guideways will be conventional automobiles. The true dualmode cars a little later could also look like current automobiles externally, but there will be major advantages to shaping them more like blunt-ended railway cars, so as to minimize the air resistance or “drag” when running them very close together on the guideways.

PID COMMENT



PALLETS???

Pallets are not a practical solution to carry unnecessarily heavy automobiles. By the time you waste energy and resources building pallets, you could have already built actual Dual-Mode Vehicles! High gasoline prices will force people to get rid of their wasteful automobiles!

PID COMMENT

(See [Chapter 7](#), under STRINGS OF CARS ON THE GUIDEWAYS.) In the past fifty years most cars have been more or less “streamlined” in order to improve their mileage at high speeds on the highways. But on the guideways, with closely spaced strings of cars, the opposite will be true: **Cars that have blunt ends that match the blunt ends of the cars in front of them and behind them will be the most efficient, and therefore require the least energy and make possible the lowest guideway use fees. You wouldn’t like the looks of blunt ended cars? Going back a century, most cars had blunt ends, because they didn’t travel fast enough that the resultant higher aerodynamic drag made much difference.**

What happened when streamlined cars started coming out? Initially they were unpopular because they didn't look like the cars we knew, but we got used to them. Now blunt ended cars are common again (vans, SUVs, Jeeps, and Hummers).

When dualmode cars are parked or driving on the streets little if any of the features that allow them to run on the guideways will show since they will be retracted. Inside of the dualmode cars we will see much of the usual array of pedals, steering wheel, levers, and knobs, because these will all still be needed for driving in the street mode. But the instrument panel will be moderately different. Without a gasoline engine we will no longer need a gas gage, oil pressure warning light, etc. But we will have some new instruments to keep track of such things as the charge level in the battery that will provide power in the street mode.

And we will have a computer monitor and keyboard as well as a microphone and speaker to keep in touch with the guideway system. Oh, and we will have a built-in telephone, personal computer, and a TV set, because we will have lots of time for work and pleasure while we are on the guideways and have no driving chores.

Next: [CHAPTER 5](#)
[Dualmode History](#)

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 5

Dualmode History

THE 1974 DUALMODE NATIONAL CONFERENCE

A few creative thinkers envisioned manually driving on the streets and automatically traveling on guideways in the same vehicle much earlier, but let's start this history with a ["Dualmode Transportation National Conference"](#) which was sponsored by the Transportation Research Board, and held at Washington D.C. in 1974. Participants in that early dualmode conference included the U.S. Department of Transportation, the Commission on Socio-technical Systems, National Research Council, National Academy of Sciences, Urban Mass Transportation Administration, and many universities, corporations and state organizations. Sixty-two talks and papers were presented at that conference, including several from IBM and General Motors.

Sampling a few quotes from that conference: In a paper on the Safety of Dualmode Vehicles, Weinstock and Rossettos of the U.S. Department of Transportation wrote, "Head-on collisions would be impossible. Human error (or vehicle operation by drivers under the influence of drugs or alcohol) is eliminated. The computer can anticipate events that are miles ahead of the vehicle and take corrective action in a controlled and programmable fashion, thus eliminating surprises and near misses."

A participating university professor wrote in part, "Dualmode automated systems possess the important advantage that the passenger can remain in one vehicle from origin to destination just as in an automobile. "Dual mode not only preserves the feeling of ownership thought by many to be extremely important, but also permits one to carry one's own things in one's automobile without suffering the inconvenience of transferring them from one vehicle to another."

In a Summary of the Conference, Chairman Eugene Canty of General Motors reported: "Dual Mode systems appear to be sufficiently attractive to warrant further technological development. For urban-wide applications, a Dual Mode system which includes both buses and personal vehicles is more effective than one consisting of either type exclusively." The majority of participants at that 1974 meeting supported dualmode and urged that such systems be designed and built.

LATER

A lot of things have changed since that conference was held. For one thing the words “Global Warming” were not to be found in those proceedings. This current major concern of the world had not yet reared its ugly head; the rate at which humans were releasing carbon dioxide into the atmosphere was very much less than it is now. According to one paper in the conference, there were “118 million cars in the US in 1974.” In 2006, as this book is written, there are over 250 million cars. In the year 2000 two and two thirds trillion vehicle-miles were traveled on US highways. (From U.S. Department of Transportation website)

This huge increase in the number of cars and the miles traveled not only accelerates deterioration of the environment and expedites the depletion of the world’s petroleum; it explains why our traffic-congestion problems are much more urgent now than they were in 1974. One of the conference papers said, “Transit accounts for five percent of urban travel.” It has dropped to around two and a half percent now. The popularity of cars continues to grow in spite of the efforts to get people to use transit. Again according to U.S. DOT data, there was less than a quarter as many trolley buses in 1996 as there were in 1960. (Some transit systems may even have been operating without subsidies back then.) The passenger railroads had gone bankrupt just prior to that 1974 conference (The government took them over and named them “AMTRAK” in 1971).

But even though the consensus at that meeting was that dualmode was good, over thirty years later we still don’t have it. If this concept is so good, what happened to prevent its development? Unfortunately, three decades isn’t long in terms of getting anything done at the national level, and a study of the papers presented then provides additional answers. The transportation crises weren’t great enough and the dualmode concepts proposed at that time were not advanced enough—1974 was too early.

Computer technologies were very primitive then, and this fact would have precluded any system nearly as good as what we can build today. In that meeting there was considerable discussion of computer-controlled automatic systems for the guideway mode, but only vehicles with wheels were considered. Magnetic levitation, the most logical contender for dualmode vehicle support, wasn’t mentioned anywhere in that conference. And Linear-Synchronous-Motor propulsion, a vital feature for guideway safety, high capacity, and energy efficiency wasn’t mentioned either. LSMs were much less developed and little known then.

That 1974 conference was a good one, but unfortunately it has been largely forgotten. There is now a vital need for an updated National Dualmode Conference. This time the favorable conclusions will not be forgotten. The need for this system has grown tremendously since 1974.

There is much current effort in maglev and linear-synchronous motor technology, much effort toward improving computers, much effort toward making better batteries and better fuel cells, and much effort to develop affordable clean sustainable electric power systems; but there is as yet practically no effort at the government level to logically combine all of these good things and develop desperately needed dualmode transportation.

THE NATIONAL AUTOMATED HIGHWAY SYSTEM CONSORTIUM

The NAHSC, which consisted of Bechtel Corp., Delco, Caltrans, Carnegie Mellon, GM, Lockheed Martin, Parsons Brinkerhoff, PATH, and Raytheon, proposed a type of dualmode system using personal cars wherein the cars would be driven normally on city streets, but they would be under the control of sensors and computers while on specially-equipped highways. This system was tested briefly in San Diego, California. Eighty percent of the funding was U.S. Department of Transportation money. Their approach, using modified existing highway lanes, appears to make sense at first glance; but for the following reasons it turned out to be penny-wise but pound-foolish.

NAHSC obviously understood that any successful system must retain private cars, the system must be automated at high speeds, and that high capacity is obtained by combining high speed with close vehicle spacing. But, in the opinion of the author, NAHSC was not proposing to go far enough, and their approach had serious basic disadvantages. Their system would still deplete our rapidly vanishing oil reserves, still pollute the atmosphere, still require ever more highway lanes, still consume millions of pounds of rubber, and it would still be subject to chain-reaction accidents from electronic-system failures, blowouts, mechanical failures, and engine failures in individual vehicles at high speeds. These and other limitations of the NAHSC system caused the USDOT to withdraw funding from it in early 1998.

Dualmode of the type discussed in this book promises to solve all of the problems left unsolved by the NAHSC system. Dualmode cars with synchronous-linear-motor propulsion could also safely travel much closer together than NAHSC cars could with their separate engines and proximity-sensor velocity control on each automobile. NAHSC estimated thirteen-foot clearance between cars compared with our estimate of one-foot between cars. Running the vehicles much closer together not only increases the capacity of the system in vehicles per hour but it greatly reduces the aerodynamic drag and thereby reduces the power required.

DIFFERENCES BETWEEN AUTOMATED HIGHWAY SYSTEMS AND DUALMODE TRANSPORTATION SYSTEMS

FACTOR	AUTOMATED HIGHWAYS	DUALMODE GUIDEWAYS
Time to complete	Ten years minimum?	Twenty years?
Cost of "Guideways"	High	Much higher
Cost of Vehicles	Moderate	Moderate
Speed	60 mph	200 mph
Minimum Headway	4.0 meters	0.3 meters
Capacity per lane	11,300 cars per hour	66,000 cars per hour
Safety	Better than highways	Far better
Power Source	Fossil fuel	Electricity
Environmental	Would generate CO2	Green vehicles
(Automated Highways entries base upon United States NAHSC data)		

THE DEVELOPMENT OF IDEAS

Many ideas look rosy initially, but analysis beyond the first flash of inspiration often discloses major faults or fallacies. Once in a great while a super idea comes along. Dualmode transportation is clearly a super idea. The more its details are developed the more evident its merits become. The fact that a sizable number of people have independently invented dualmode is further indication that it is an idea whose time has come. It is a safe bet that a few of you who are reading this book had also conceived of the dualmode idea.

George Stephenson and a few others saw that steam would replace horses in pulling trains, and that railroads would replace not only horse-drawn passenger and freight trains but also replace the painfully slow horse-drawn canal boats. The general population lacked that vision. Henry Ford saw that the automobile would largely replace the railroads. Now some of us see that dualmode guideways will largely replace highways, reduce domestic air travel, get us there faster and safer, and make our private cars more useful. And we see that we will have all of this with major environmental and energy advantages as well.

Dualmode will require no new science. It can progress from vision to fact with current technologies. Magnetic levitation has been around for a hundred years and crude computers for fifty years; but a really good dualmode system could not have been designed and built much earlier than this because the development of maglev, linear synchronous motors, and computers, weren't advanced enough for it. However, even if the technology levels required had been available earlier, dualmode would not have been

built then because our traffic and environmental problems hadn't yet escalated to the crisis stage. But now we have the crises, and the technologies, and dualmode is going to happen—eventually. We will address the question, “Why not now?” in later chapters.

THE AUTHOR'S INVOLVEMENT IN DUALMODE TRANSPORTATION

Late in his career as an engineering manager with the Boeing Company he was responsible for some of the development of the “Morgantown People Mover” an automatic **single-mode** transit system. That work led him to visualize and submit an invention disclosure on a **dualmode** transportation concept to the Boeing Company in 1980. Boeing did not pursue the idea further, and neither did the author, until sixteen years later.

Reynolds' 1980 disclosure is titled, “Dual Mode Electric Ground Transportation System.” It proposed “A worldwide automated transportation system for individuals, businesses, and governments.” It employed “electric-powered cars which can operate both from on-board batteries and from electrified roadways.” It would “provide automatic steering and automatic constant velocity for all cars on the electrified roadway.” The disclosure also proposed the operation of electric trucks and buses on the automatic roadways.

After retiring from Boeing, among a number of other activities, Reynolds wrote a book on inventing. In 1996 he was writing a second book titled: “Nutopia,” meaning a new Utopia. In the 500 years since Thomas More wrote the book Utopia things have changed, to say the least. What might have seemed like a perfect society back then certainly wouldn't be considered a perfect society today. (Be patient; this relates to dualmode transportation, we promise.)

In planning for the book Nutopia, he thought about the status quo in each aspect of our modern society, and analyzed what was wrong with them. Then he fabricated an ideal or optimum (in his opinions) state of affairs for each aspect of the imaginary super-country of Nutopia. But that book hasn't yet been finished and published, because he became enamored with the **transportation system** in Nutopia, and went to work studying it full time.

In writing about Nutopia's transportation system the author first looked at our real-world traffic jams, fossil-fuel depletion, atmospheric pollution, highway deaths, and the ever-wider ribbons of concrete overcrowded with frantic ants; and he reached a conclusion: “There has to be a better way—a **much** better way.”

Guess what? That “much better” transportation system for Nutopia turned out to be an updated version of the dualmode system he had proposed to Boeing sixteen years earlier. Nutopia's transportation system was not only perfect for Nutopia; it is just what we need in the real world.

Now, 26 years after the Boeing disclosure, with the great advances in maglev, synchronous linear motors, solid-state electric power conversion, and incredibly fast computers with enormous memory, these early dualmode visions are readily achievable. In 1980 they would have been difficult and the resulting system much less satisfactory.

“HiLoMag” was the acronym the author initially gave to his conceptual dualmode system. It stood for High and Low speed Maglev transportation. He now proposes the name, **THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM** or “**REV.**” That is the system described in this book. In concept it has changed little from his original thinking over a quarter century ago, but the details use the latest technologies. Surely the actual system to be designed and built won’t be exactly like the one described here, but please design and built a **better** one, not a poorer one than this.

SERENDIPITY

Almost every good invention is a response to a need, and often some quirk of fate leads the inventor to the answer indirectly. In this case “Nutopia” needed a transportation system that was better than any system in existence. Looking beyond that subterfuge, **we** are the ones who need a better transportation system; the fictional Nutopia was just a serendipitous tool that inserted itself into the creative process.

The author was also involved in another valuable example of serendipity: In 1949 he and fellow-engineer Leroy Perkins invented and developed a critical component of a digital control system for a radio-controlled **model boat**, strictly as a hobby. That model, with its unique control system, won a world’s championship in Europe in 1960.

But that is neither the end nor the most significant part of the story. Perkins and Reynolds sold the patent rights to that “toy-boat” digital decoder and memory to The Boeing Company, and it was used as a key part of the guidance system for the BOMARC national air-defense missile. One never knows where a unique idea may end up.

THE TIME IS RIPE

When a need for something develops, usually a number of creative minds will independently start working to fill that need. In the case of our need to solve major transportation problems, dozens of people have come forth with ideas. It was not surprising to find that many of them have independently arrived at the following conclusions: Our future ground transportation system must retain private vehicles of some kind. It should be dual mode. It should use electric-power or other “clean” energy in both modes. It must be automatically controlled, guided, and navigated at high speed. And the cars should travel not only fast but also close together in order to produce a high-capacity system. Since many thinking people have come to the same conclusions independently, these conclusions are probably correct.

Henry Ford wrote in 1909, “I invented nothing new, I simply assembled into a car the discoveries of other men, behind whom there were centuries of work. “Had I worked fifty, or ten, or even five years before, I would have failed. “So it is with every new thing. “Progress happens when all the factors are ready, and then it is inevitable.” Change Henry’s word “car” to the word “dualmode” and that quotation fits the present situation perfectly. The last two factors needed to make it possible were the development of synchronous-linear-motor maglev technology and recent developments in computer technology. Henry was right: Dualmode is now “inevitable.” Ford was one of many inventors of the automobile, just as there are now many inventors of the coming dualmode transportation system.

OBSCURITY

Is dualmode obvious? To some yes, but not to most people—not initially, because the concept is revolutionary. It will be a “giant leap for mankind.” Science-fiction author Arthur C. Clarke, like Jules Verne, sometimes “invented” things in his stories that later came to pass. Clarke’s Third Law states: “Any sufficiently advanced technology is indistinguishable from magic.”

Transportation presents a “can’t-see-the-forest-for-the-trees” situation. When we look at existing transportation systems and their shortcomings one at a time our vision is apt to be limited. A car is a car, and a train is a train “and never the twain shall meet.” (Two twains on the same twack go whack when they meet.) Clarke’s “magic” in the case of dualmode is the remarkable advantages of a non-obvious combination of now-quite-separate railroad and automobile concepts.

If we restrict ourselves to conventional thinking it is insane to think of people traveling 200mph in private cars. It is crazy to suggest running high-speed cars so close together that they practically touch. Only a lunatic would seriously claim a single lane of transportation could replace thirty-three lanes of highway. One who would say that private cars could get there faster than jet airplanes on trips of up to a thousand miles is demented. It would take a person a few cards short of a deck to think that we can use still more cars, travel faster, and yet save fossil fuel and reduce smog and global warming. I will accept for myself any or all of the above synonyms for “mentally challenged.” Try acting crazy sometime—it is fun. (It keeps me from going crazy.) Based upon existing ground transportation systems and traditional thinking the above claims are impossible to meet, but by combining selected features of old systems and using new technologies we will produce magic.

Again, the author is neither the only nor the first inventor of dualmode transportation systems. Many are volunteering their time and energy (and jeopardizing their credibility with some people) because they feel a responsibility to their fellow man to see that the very promising dualmode concept gets a fair trial. This concept is just too

good to be allowed to fall through the cracks. But we have discovered that conveying this vision, knowledge, and conviction to the people who will have to act upon it is extremely difficult.

INDEPENDENT INVENTORS

It is sometimes said that the day of the private independent inventor is long gone; we no longer see the likes of Watt, Edison, Bell, etc. Most of the important new developments are so high-tech they can only come out of research labs in universities or large corporations. The earlier inventions were simple enough that one person or a small team working in a modest laboratory and shop could design, develop and test the product, and even manufacture and sell it. But the inventors are still creating, whether in their garages or in huge corporations. More patents than ever are being issued. Many private inventors are working on dualmode because it is a fascinating challenge, and because “somebody has to do it” and almost no government or private organizations or corporations **are** doing it.

The author and many of the other dualmode inventors have placed the “intellectual property rights” to their work in the public domain (meaning that patents are not being applied for). The situation is sort of like “freeware” on the Internet, the work they have done is free to the world. Dualmode is all yours—ours. Do something with it. **Please.** This senior citizen won’t be around when the system is up and running; but he will die happy if he lives to see that we are moving toward a national and international dualmode system.

Next: [CHAPTER 6](#)

On the Streets



Are you really satisfied with automobiles?

The overall quality of the vehicle you buy has drastically diminished. The current automobile is rolled up in thin metal and plastic. Consumers are so blind-sided by all the bells and whistles, they overlook structural stability.

This has a whole lot to do with surviving an actual collision!

The typical Automotive Industry boondoggle cannot continue!

The Automotive Industry will be a noose around the neck of revolutionary change! When a vehicle no longer needs “Junk Technology” under the hood, there is no need for an industrial age manufacturing industry. When it comes to Dual-Mode Vehicles, the automobile industry is obsolete! Vehicles must no longer break down, and are based on “Content,” so their continuous operation is mandatory.

A person who says they are really satisfied with the cost of mobility does not understand the overall economic equation. Factor in the reality if your income is \$25,000.00 dollars a year, and you have two children. Jobs are not guaranteed, and neither is your paycheck. When you have very little income coming in, the cost of mobility becomes crucial!

Many Americans today (July 2007) whine about \$3.00 dollar a gallon gasoline prices, but very few will recall that it costs \$7.00 dollars a gallon in many other countries!

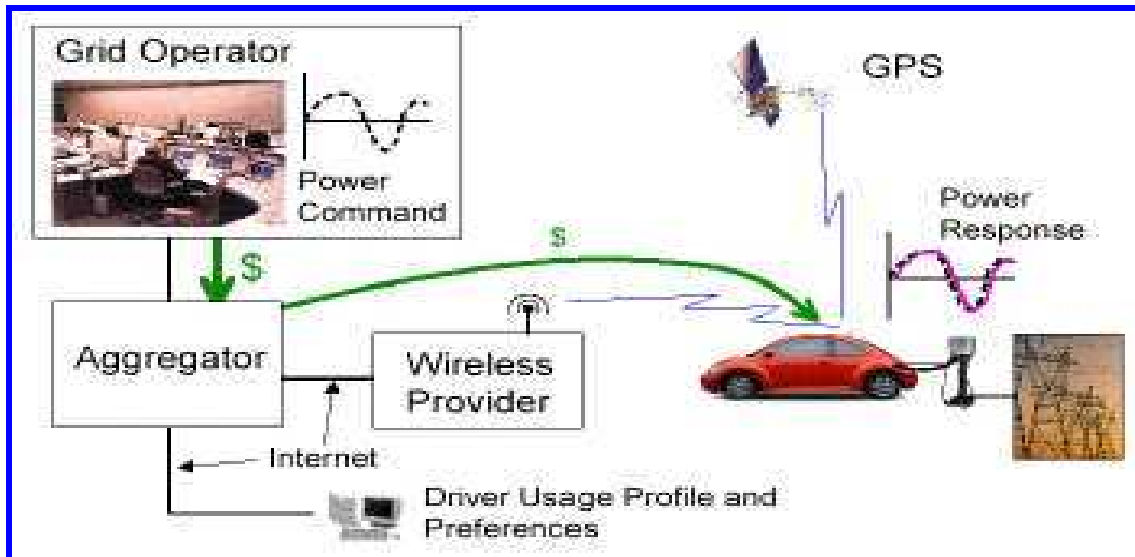
Chapter 6

On the Streets

In the early years the guideway network won't yet be complete and not everyone will have true dualmode cars, so we will still need to use the old highways. With pallets we can run conventional cars on the first of the new guideways. And if there is any fuel left we will continue to use internal-combustion-engine automobiles for a while longer for another reason: Unless there are some breakthroughs, battery-powered, fuel cell, or other environmentally clean cars will have inadequate range and performance for highway use.

However, batteries or fuel cells will be quite adequate for the short distances to be traveled in street mode when the guideway system is complete. True dualmode cars with internal-combustion engines could be built and sold during the transition period. This would be optional to renting pallets for use with conventional automobiles. As the guideway system nears completion we will gradually go almost exclusively to true dualmode cars using sustainable "green" energy on the streets. On the guideways dualmode cars will use electricity from the power-grid; but it would be prohibitively expensive to equip all streets and back roads with trolley wires to provide grid power to the cars in street mode. After the transition period, for street-mode the cars must carry some form of portable energy other than gasoline, diesel oil, or any other carbon-containing fuel. Most of the time (and miles) the cars will be running on the guideways and using grid power, so fortunately they won't need to carry a very large amount of portable energy.

PID COMMENT



Putting Vehicles “On-Line!”

Once again, we go back to taking enormous steps toward getting
Consumers up to speed!

Although there is some so called Plug-In Hybrid Electric Vehicles out there,
until you increase efficiency, these vehicles are complete garbage.
You need to address the existing waste associated with Electric Motors
and Gasoline Engines!

PID COMMENT

Not many environmentally undesirable conventional cars will continue to be used after the guideways are available, because the guideway mode will be much faster, safer, and less stressful than the highways. And as we will very soon be down to the dregs of the world's petroleum reserves, gasoline and its substitutes will be priced so high that few will be able to afford them. So in addition to the many other advantages of the guideways, they will be cheaper to use than the highways.

STREET-MODE BATTERIES

Going way back, in the first two decades of the 20th century, battery-electric cars were fairly popular, especially with women. Some “little old ladies” liked them because electric cars were clean, quiet, and didn't have to be hand cranked to get them started. (Electric starters weren't standard equipment in most regular automobiles until about 1928.) How do I know that? I was there. My Dad's first car, a Model T Ford, required

cranking. The second one, an Erskine (a small Studebaker) purchased in 1929, had an electric starter, a remarkable invention at the time. But just in case the starter failed, it also had a crank.

Most present storage batteries are heavy, expensive, and have limited capacity and limited life. They are only moderately better than the ones the little old ladies used a century ago. There is a lot of research going on to develop better types of batteries, but the technical problems are difficult and progress has been slow. Some recent developments show great promise, however.

Toshiba recently announced a major breakthrough in rechargeable lithium-ion batteries. A great increase in capacity is claimed as well as a charging time of only one minute, and a battery life of a thousand charge/discharge cycles. Lithium-polymer cells are a closely related and equally promising recent development. Lithium is the lightest of all of the metallic elements: It is half as heavy as water and twenty one times lighter than lead. That fact allows lithium battery cells to be many times lighter than “lead-acid” battery cells (the type used in cars) of comparable ampere-hour capacity.

But “ampere hours” aren’t the only thing we need: We need power, not just current, and power is current times voltage. The voltage of a battery is determined by multiplying the number of cells it contains by the voltage per cell. Lead acid batteries provide 2.0 volts per cell. Lithium is not only the lightest metal it is also the most active metal electrically. As a result, lithium cells put out a generous 3.0 volts each. Present 12-volt car batteries have six lead cells, but a 12-volt lithium battery needs only four cells. That fact allows lithium batteries to be even lighter, and also to be more reliable (since there would be fewer cells to fail).

Because of environmental and fuel-depletion pressures there are current efforts to bring back battery-electric cars. But so far they are not good enough in a very vital respect; they can’t carry enough energy between battery charges to begin to compete with engine-powered cars. Fifty pounds of gasoline can deliver about ten times as much energy as fifty-pound lead-acid batteries. If the current lithium-battery developments continue to show their great promise the gasoline-to-battery advantage will be reduced markedly, but gasoline will likely still win out in “energy-density” contests. The author knows of no full-size battery-electric cars currently on the market, mostly because their range and performance would be too limited for use on modern highways. But for the street mode of a dualmode system, even the standard lead-acid type of battery would be adequate, since neither high speeds nor long range is required on the streets. So batteries (probably lithium) will likely power our dualmode cars in their manually driven mode, but we should consider other portable energy candidates as well.

HYDROGEN AS A FUEL

An appealing feature of hydrogen is that it is the only practical fuel that contains no carbon; therefore burning it or otherwise using it can't generate carbon monoxide or carbon dioxide, that evil global-warming gas. When pure hydrogen is used in internal-combustion engines the exhaust gas contains nothing but nitrogen-rich air, steam, and maybe a little NOX (oxides of nitrogen). If we use hydrogen in fuel cells for generating power to run electric motors, we avoid the NOX as well. Therefore hydrogen, like an electric battery, can be used as an environmentally clean **portable** energy supply.

But the earth has almost no natural hydrogen gas; we have to make the elemental gas from some hydrogen compound by one of a number of different methods. We can electrolytically decompose H_2O , but that is an inefficient process, and electricity itself will be in short supply. There are microorganisms that will break down water, but only on a minuscule scale so far.

However, research on decomposing water directly by solar radiation and using photocatalysts is showing considerable promise. According to an article in the May 2006 SCIENTIFIC AMERICAN, research teams at Pennsylvania State University and at University of Texas have been making titanium dioxide nanotubes that have 12 percent efficiency in releasing hydrogen using ultraviolet radiation. Penn State has added carbon to the titanium nanotubes and broadened their response into the visible spectrum, doubling the hydrogen making efficiency. This development sounds well worth watching.

Currently almost all of the hydrogen that we use is made from oil or natural gas. That is doubly wasteful from an energy standpoint since both oil and gas are already in short supply, and the processes for making hydrogen from them are inefficient. If we **must** use fossil fuels to make hydrogen we should use coal, since its depletion is considerably further off.

The problem in making hydrogen from fossil fuels is not only the accelerated depletion of these fuels, but there are no developed economical ways of making it in quantity without also dumping huge amounts of carbon-dioxide gas into the atmosphere. Because of the low efficiency of the conversion processes, for the same amount of useful energy over twice as much CO_2 is generated and twice as much fuel is used in making hydrogen from fossil fuels as is generated by burning the fuel directly in existing automobiles.

There are some undeveloped proposals for “sequestering” the carbon dioxide generated at fuel processing and power plants, but until we can economically do that and find suitable places to put the CO_2 , we would only be shifting the generation and release

of the undesired carbon dioxide from the highways to the processing plants.

Hydrogen is the lightest element and gas. That fact presents another major disadvantage of hydrogen as a fuel. It is the weight of a quantity of fuel that determines the energy it contains, not its volume. It would take an enormous tank to carry an adequate supply of hydrogen gas at atmospheric temperature and pressure. We currently have two marginal solutions to that problem: We can hold the hydrogen at very high pressures in an expensive, strong, heavy, and potentially dangerous tank; or we can liquefy the hydrogen and store it in an expensive large super-insulated thermos bottle (Dewar vessel). Excellent insulation is required to keep the liquid hydrogen from boiling away at an excessive rate. (It boils at 253 degrees below zero centigrade, or 420 degrees below zero Fahrenheit). These hydrogen-carrying methods can't begin to approach the energy-to-weight ratio of gasoline in a tank at atmospheric pressure and ambient temperature; and both methods introduce more significant safety issues than gasoline tanks do. There is a safer method for storing hydrogen that could possibly become practical. Some "hydride" compounds, such as sodium-boro-hydride, will release hydrogen upon demand. Daimler Chrysler has done work in this area.

But currently there is no really satisfactory method of storing an adequate amount of hydrogen in a vehicle for **highway** use. However, the much lower range and performance requirements for the street mode does make hydrogen a viable portable energy source for **dualmode** cars, **if** we can get an affordable green source of hydrogen.

But "energy source" is a poor choice of words in connection with hydrogen. Coal, petroleum, natural gas, the sun, etc. are true energy sources, because we have them available. But we should not look upon either hydrogen or electricity as sources of energy, because we don't have them naturally—we have to make them from some true source of energy. Hydrogen can be used as a "carrier" of energy, along with electricity, steam, springs, elevated weights, flywheels, and storage batteries. But none of these are sources of energy because all of them require that we put energy into them before we can take it out.

We must not believe all of the grand claims being made by those promoting hydrogen power. For instance: I have seen the claim that we have unlimited hydrogen fuel in the water of the oceans. That is fraudulently false, since it currently takes much more energy to decompose water to hydrogen and oxygen than we can get back in using that hydrogen in a fuel cell or in a hydrogen-powered internal combustion engine. Water can be seen not as hydrogen, but only as raw material from which to make hydrogen. There is no free lunch. When we develop controlled nuclear fusion the price of "lunch" may go way down, and "oceans of fuel" would then be less of a stretch.

FUEL CELLS (*FOOL CELLS*)

Fuel cells are comparable to storage batteries, except that instead of seemingly “storing” electricity by means of internally reversible chemical reactions, fuel cells generate electricity through the oxidization of hydrogen gas. Fuel cells, which are not reversible, must have hydrogen fuel delivered to them. Like internal combustion engines they use oxygen from the air, but they don’t “burn” the fuel in the usual combustion sense. And since hydrogen contains no carbon, the exhaust from fuel-cell reactions contains no carbon dioxide, just water.

Cars powered by fuel cells have electric motors for propulsion, just as battery-electric cars do. Most environmentalists like fuel cells because they **supposedly** eliminate pollution and save fossil fuels. (“Supposedly” is emphasized because as we discussed, the only currently affordable way to get hydrogen in quantity is to make it from fossil fuels; but then we still have the problem of the carbon dioxide generated at the hydrogen plant.) And because of the inefficient processes, that will be over twice as much CO₂ as we get when we use the fossil fuel directly in cars. We would make more CO₂ because we use up more fossil fuel. Seen in these ways, hydrogen and fuel cells are currently a lose-lose proposition.

There are also “reforming” fuel cells that run on alcohol or methane gas (the chief ingredient of natural gas) instead of hydrogen. But these two fuels contain carbon; so reforming cells would again produce carbon dioxide that would be released along the highways. That would still be a loser.

ENVIRONMENTALLY CLEAN INTERNAL COMBUSTION

Instead of using fuel cells, street-mode cars could burn hydrogen fuel in internal combustion engines similar to the engines that now power our automobiles. It should be emphasized that internal combustion engines per se aren’t the bad guys; it is the hydrocarbon fuels we use in them that cause most of the environmental problems. But again, we don’t have the hydrogen. And if we did, carrying enough of it in the vehicles would be a problem.

WHICH STREET-MODE POWER?

None of these low-pollution power systems could provide the range or performance of present automobiles because the “energy densities” of all of these alternate power sources are much lower than that of gasoline. Therefore none of them would be widely accepted for highway use. But any of the alternate power systems discussed above would be adequate for the street-mode of a dualmode system since there the cars will not have to travel either far or fast, and “passing power” isn’t needed on the streets.

We might choose to pass laws that would require car manufacturers to limit the street-mode speed of dualmode cars. This would reduce accidents and save lives of drivers, passengers, and pedestrians as well as save energy. Such laws would doubtless be unpopular with many but they would not be violated, because the cars themselves would be set to obey the speed limit. Greater pressure on the accelerator pedal would have no effect.

Service stations could carry hydrogen and/or charge batteries. Batteries could also be charged at home, at public parking spaces, at parking lots and garages, and while traveling on the electric guideways. We could also charge the batteries by simply parking the cars over buried electric battery-charger coils instead of using charger cords and plugs.

It has also been suggested that the cars could be designed so a discharged battery could be removed and replaced with a recharged one at a station in less time than it now takes to pump a tank of gas.

There will be competition among rechargeable batteries, fuel cells, hydrogen engines and perhaps other portable energy systems. Early cars may use one system, and later cars use another. And different manufacturers may build and sell cars with different street-mode power systems. Experience and further developments will improve all of these systems. But based upon what we know today, the author predicts that lithium batteries will prevail over other means for powering our dualmode cars in street mode.

Next: [CHAPTER 7](#) On the Guideways



PEOPLE FORGET TOO SOON!

**The problem with people is they forget the past too soon!
Highway congestion is a daily problem, and billions of dollars are wasted
from automobiles idling in traffic.**

**Economies will have to go bankrupt so that people finally wake up and
realize that they cannot go on with the same old scenario.**

Change is inevitable! Ten years from 2007, you won't be able to drive!

**The Citizens and Governments must understand that you cannot solve a
crisis while you are in the middle of a crisis. The Federal Government has
been able to forecast for many years the coming collapse of the U.S.
Highway System.**

Chapter 7

On the Guideways

TRAVELING ON THE GUIDEWAYS

If we need to take the kids to school or go shopping a couple miles away, we will stay on the ordinary streets and our dualmode cars will operate just as we are used to cars operating, except for their quiet pollution-free power plants. If we have to go more than a few miles we will probably switch modes and use the guideways to save time, money, and avoid frustration.

There will never be any speeding tickets issued on the guideways, because everyone will be traveling at the same high speed all of the time. On the guideways the ride will be smooth and quiet except for the rush of air outside and perhaps a slight electric hum. There will be no passing or being passed, and the speed will be constant regardless of how heavy the traffic may become.

Once on the guideways the “driver” can take a nap, read, or watch television, because no driving duties will be required again until the car leaves the guideway system. Workaholics can work at their computers while traveling, including e-mail and the Internet. And persons who now recklessly eat, shave, put on makeup, or talk on cell phones while driving, will still be able to do these things on the guideways, but without delaying traffic or endangering lives.

The clearance between cars may be only a foot or less, but fear not, as we will see in **Chapter 8** the cars won’t bump; the system will keep them spaced perfectly. On the guideway the cars will be like boxes traveling on a high-speed conveyor belt, their relative positions and the clearance between them will never change.

Things can travel safely very close together at high speeds **if** they are all forced to travel at exactly the same speed. You and I are both riding on a planet that is spinning and traveling through space at thousands of miles per hour, yet we can safely shake hands or hug, because we are synchronized with each other at the same speed and on the same path.

Likewise, nothing can go wrong with a car on a maglev guideway to cause an accident. Nothing in the car is being used in the guideway mode except the permanent magnets underneath that guide it, support it, and keep its speed exact. “What if the magnets should suddenly fail?” That is about like asking, “What if the coffee I am drinking suddenly froze solid?” I am not going to worry about that, because it just can’t happen. It never has and never will.

PID COMMENT



Debunking what is obvious!

In order to get a point across to the average person, all the myths of what they perceive have to be discredited. A Guideway System has a safety record that surpasses the most skilled drivers in the world. A Guideway System in its simplest form is nothing more than a Roller-coaster without the sudden twists and turns.

An automobile that can just freely ram into oncoming traffic and burst into flames is the most dangerous form of transportation, giving the driver a false perception of safety.

PID COMMENT

On the guideways the street-mode motor is off and all of the normally moving parts in the car are stopped. The street-mode tires are not even touching the ground.

Since nothing is running in the car, nothing is wearing out and nothing can go wrong.

If the power to the guideways should suddenly fail the cars will gently de-levitate, the wheels will again provide support, and the cars will coast to a safe stop while continuing to hold the same spacing (to be explained in [Chapter 9](#)). Sleeping travelers will probably be awakened by the sound of the wheels starting to spin, but even if the “driver” doesn’t awaken immediately there would be no problem because the vehicle will still be “on autopilot.”

Should power fail on one section of the guideway, or if a section is shut down for maintenance, that section will be instantly and automatically isolated from the system, and its traffic will be routed to a detour ([Chapter 14](#), under Local Guideway Shutdowns).

OVERHEAD GUIDEWAYS

A system where the cars ride on top of the guideways (comparable to highways and railroads) is likely; but the reverse configuration, where the cars hang below elevated guideways, would have some interesting advantages as well as disadvantages. Although these two guideway systems would look quite different from each other, technically and functionally they would be very similar. In a suspension guideway system the cars would hang from arms connected to fittings running inside of overhead channels. The street-mode wheels would never contact anything, even in the event of a power failure, as long as the cars were in guideway mode.

PID COMMENT



[An Overhead Guideway System](#)

Overhead Guideway Systems have been around for over 40 years. This system is part of a hospital campus in Germany.

PID COMMENT

In either this suspended configuration, or in a normal elevated-highway-like configuration, in some areas the ground below the guideways could be left natural. In farming or range country, crops could be grown or animals pastured below active guideways, much as crops are now grown below electric power lines and wind turbines. All overhead guideways would be built high enough that the cars would be above the heads of people, animals, or vehicles passing beneath. This would eliminate the cost of safety fences and save animal and human lives.

Suspension guideways or elevated guideways would reduce snow and debris problems. In areas of heavy snow the guideway supports would be made higher so the system would operate above deep snow without the need for snow plows or snow sheds.

Passengers could leave suspended vehicles that are to be stalled for some time, by stepping from the car doors to a walkway paralleling the guideway. But these people would be leaving their cars and their belongings up in the air, literally and figuratively. To solve that problem we might lower the cars **and** their occupants to the ground by an automatic winch system and let them drive off in street mode. (I agree with you; those possible solutions are not very appealing.)

PID COMMENT



Similarities are essential!

The Dual-Mode Vehicle must be similar to what the public is already familiar with. Extremely radical ideas are more adventurous than what most people can bare, no matter how good it is, looks or feels.

The Dual-Mode Vehicles featured today look just like automobiles, minus the obvious tailpipe sticking out the back. The SKYWHEELS® Dual-Mode Vehicle has “bicycle” cranks, which is a telltale sign that it is not a motor vehicle.

PID COMMENT

In a suspended-car system the cars could have suspension arms with magnet or roller assemblies extending about a foot above the car tops. But if these appendages were rigidly mounted there, many people would object to their appearance while in street mode, they would cause additional wind resistance, and they might require higher home garage ceilings.

Overhead assemblies on the cars might be retracted into a fairing on the car roof or elsewhere, but a simple practical and attractive configuration is not obvious. Another approach would be to detach the cars from the overhead assemblies and leave the suspension assemblies hanging from the guideways to be routed around to where they are needed by other cars. These would be suspended pallets, with all of the disadvantages of regular pallets.

Perhaps the greatest objections to a suspended-car guideway system would come from the emotions of some potential users. A number of people who ride airplanes with little concern would object to riding in a car suspended above the ground. Such people likely refuse to ride funiculars, ski chair lifts, or to go up in hot air balloons. But most people soon accept useful new things once these are shown to be reasonably safe. However, all factors considered, my personal vote is against cars suspended below the guideways. Supporting the dualmode cars on top of the guideways seems to have many more advantages and fewer disadvantages.

WHEELS ON THE GUIDEWAYS

I strongly favor magnetic-levitation (maglev) cars and guideways (to be discussed in the next chapter), but alternatively we could support the dualmode cars and other vehicles in guideway mode on wheels of some kind. There are two main wheel-type choices: The simplest and cheapest would be to use the same wheels and pneumatic tires on both the streets and the guideways. But “simplest and cheapest” isn’t necessarily wisest. One US Astronaut in space is reported to have said to his partners, “Doesn’t it give you a good feeling to know that this space vehicle was built by the lowest bidder?” Can we build pneumatic tires that would be adequately safe and last long enough for automatic high-speed guideway use? I am skeptical.

The other wheels choice would be to use pneumatic-tired wheels in the street mode and provide a separate set of wheels on each vehicle to ride rail-type guideways. A

number of ways of doing this have been proposed. One way would be to put the four rail wheels on the same axles as the four street wheels, a bit like dual tires on trucks. But the rail wheels would be smaller than the street-wheel tires so that the rail wheels wouldn't touch the ground in street mode. On the guideways the larger pneumatic tires would freely extend down below the tops of moderately high rails.

We wouldn't use the noisy rapid-wearing derailment-prone flanged wheels the railroads use, however. If rail-type dualmode guideways were used they would need a different guidance and switching system ([Chapter 12](#)) that would allow the use of quieter, smoother riding, and much safer flangeless rail wheels. But compared to maglev, using any type of wheels on the guideways would stink. Don't use them—**please**.

BUILD MODERATE-SIZE GUIDEWAYS

Naturally we should not waste money, but the old “Penny-wise but pound-foolish” saying holds much wisdom applicable to a dualmode system. The cost of the national automatic guideway network is going to be enormous, and that fact will tempt many of the planners to try to save a few billion by degrading the performance, capacity, convenience, speed, and/or safety of the system. We must be very cautious in evaluating such cost-cutting proposals.

For instance we could build cheaper guideways if they were lighter and accepted only small vehicles. But it is unlikely that we would be able to get a high enough percentage of the population to buy only small light dualmode cars. Therefore small guideways would be less used, highways would still be crowded, the remaining fossil fuel would still be going up in smoke, and global warming would still be escalating. Also the small light guideways couldn't accept moderate freight vehicles or medium-size transit buses. The total income from a small cheapie guideways would likely be so low that the system would require subsidies or go bankrupt. Wrong way to go. The prime objective of The National Dualmode Transportation System should be to satisfy the majority of the travelers and accommodate most of the express cargo.



GUIDEWAYS are real!

We have exhausted a lot of energy getting this point across, because of the wide range of skepticism that has to be addressed. Morgantown has to be the oldest Guideway System in the U.S.A., which was a foundation for studying Guidyway Technologies. Roller-coasters have been around for over a hundred years, although they seem to be forgotten when it comes to proving the feasibility of a Dual-Mode Transportation System. What is there to prove? The only thing lacking was the existence of a revolutionary Dual-Mode Vehicle!

PID COMMENT

Or we might “save billions of dollars” by building a lower-speed national guideway system. But a slower system would have less capacity in vehicles per hour. It wouldn’t have speed advantages over the cars, buses and trucks on the highways, the railroads, or short airline flights. People won’t pay guideway use fees unless there are significant advantages for them to do so. If the system couldn’t attract a high percentage of its potential customers it wouldn’t solve the problems it was designed to solve, and it would lose money. Likewise, the lower capacity of a slow system would require more guideway lanes, and “saving money” by reducing speed could actually end up costing more.

Unwise attempts to save in the system design and construction could cause the transportation revolution to fail, with nothing to show for the great upheaval, cost, and time loss. Worse, people would have “learned their lesson,” and it would be next to impossible to get their support to rebuild the system. **We have to do it right the first time.**

TYPES OF VEHICLES

Most of the guideway traffic will consist of passenger cars of various types and sizes, just as highway traffic now does. Dualmode cars may be as different from each other as our present automobiles are. And these cars may look a lot like what we now have, be painted our favorite colors, and be made by our favorite companies.

Very small cars have had limited popularity in affluent countries, partly because they are less safe in highway traffic than larger heavier cars. But on the guideways small (even single- or two-passenger) cars will be as safe as large cars, will cost less to buy and operate on both the streets and guideways, and will have a number of environmental advantages. It is hoped that practical small cars become more popular in our dualmode-transportation future. Delivery trucks and school buses will of course be dualmode. There will be two or three different dualmode transit services, and a unique driverless freight system, all to be described in the next chapter.

PID COMMENT



Small and more durable!

A Dual-Mode Vehicle has to be more durable than the traditional automobile, especially if it is smaller than normal. Once again, we must dispose of the perceived perceptions of the Consumer. Overcoming these hurdles is costly to Entrepreneurs breaking into the innovative transportation market. The Dual-Mode Vehicle must also be more affordable than an automobile, and deliver better mobility solutions!

PID COMMENT

Even if internal-combustion engines are used in most of our dualmode vehicles initially, the rate of fossil fuel depletion will be greatly reduced and there will be less pollution, since these automobiles will be traveling on the guideways with their engines

shut off a high percentage of the time. Later, when the guideway system is complete, most of the vehicles will be environmentally clean in both modes.

THE GUIDEWAYS MUST BE EXTENSIVE (and will be expensive)

If the national government should fail to initiate a dualmode system it would be difficult for individual states, counties, or cities to build independent dualmode systems because the small populations served by them couldn't afford the design and development costs. Guideways restricted to a local area wouldn't carry many dualmode cars because not many people could afford special cars built without the major cost advantages of mass production; and people in such areas would need cars that could travel the highways in other areas. Therefore an isolated dualmode system would end up carrying palletted vehicles almost exclusively.

We must have a **Universal Dualmode Guideway System**. It will extend not only from the Atlantic to the Pacific, and from Maine to Florida, but eventually into Canada, Alaska, and Mexico. In fact, when South America develops further the Pan-American Guideways will cross the Panama Canal on the Bridge of the Americas so that we can ride in our own cars at high speed from Alaska to Buenos Aires.

PID COMMENT



The International Highway of Peace Project is underway in some capacity in many places around the world. The Dual-Mode Vehicle must be **UNIVERSAL**! It must be able to drive on a Guideway System in any country of the world, just like an

ordinary automobile. Tunnel boring machines and grand scale projects will escalate with the introduction of a viable Dual-Mode Vehicle!

PID COMMENT

The European dualmode system will of course use the Channel Tunnel to connect the guideways from Scotland to Italy. With Gibraltar-to-Tangier Morocco and Germany-to-Sweden undersea tunnels the guideways could be linked from Hammerfest Norway to Capetown South Africa. How about London to Beijing, and on under the Sea of Japan to Tokyo? Am I serious? Moderately so, but don't expect all of this in the near future.

It is essential that the eventual [INTERNATIONAL DUALMODE TRANSPORTATION SYSTEM](#) be standardized so that any dualmode car from any country can travel the guideways anyplace else in the world, just as our automobiles can now travel in any country. Weights and measures have been standardized worldwide (if the US ever really goes metric), and television, the Internet, and phone systems are standardized. We must also have international **transportation** standards in this shrinking world.

GUIDEWAY SPEED

Most of the people in the forefront of dualmode system development agree that the guideways must be high-speed in order to meet demands for increasingly rapid transportation, and to provide high system capacity with a single guideway lane in each direction. This single-lane system will minimize infrastructure costs, minimize the changes to existing infrastructure, and minimize additional rights-of-way required for the guideway system.

We could build a **very** high-speed system using maglev guideways ([Chapter 9](#)); but the higher the speed, the greater the radii required for turns, the longer the guideway entry acceleration and exit deceleration ramps need to be, the greater the noise, and the greater the energy and power needed. The power for higher speeds is of particular concern because the power required to overcome wind resistance (aerodynamic drag) increases as the **cube** of the velocity. This means that to go twice as fast we require **eight** times as much power. And 200mph guideways would require $(200/60)^3$ or **37 times** as much power as the 60mph guideways. But at the higher speed we would be using that power for a much shorter time, so we won't need 37 times as much **energy**. The energy required for the 200 mph trip will be $(200/60)^2$ or 11.1 times as much as for the 60mph trip. That is still an enormous penalty to pay for higher speed, and it doesn't seem fair, but that is the way it is. Those who advocate lower highway speed limits to reduce the rate of fossil-fuel depletion have a strong argument. And unless we somehow develop an essentially unlimited sustainable source of cheap energy, speed selection will be a major consideration in the design of The National Dualmode Transportation System.



There is a way of greatly reducing the aerodynamic drag and the power required at high speeds, however. Airliners usually fly at very high altitudes because the air is a lot thinner up there, and that markedly reduces the drag. We could gain that great advantage on our dualmode guideways also, by putting them in tunnel-like tubes and pumping most of the air out of the tubes. The more we approach a complete vacuum in the tubes the lower the energy and power required to propel the cars, but the greater the power required to keep the tubes evacuated. Evacuated tubes would be more costly than open guideways for a number of reasons. For instance we would have to pressurize the cars, just as we pressurize jet airplanes. But at some point in the future evacuated tube guideways will be a practicable solution for long trips. Daryl Oster, and his Evacuated-Tube Technology Inc. is a current leader in evacuated-tube transportation.

The disadvantages of high speed are greater in cities and suburbs, and its advantages are greater between cities—so the author proposes two different fixed guideway speeds. Many factors will be weighed in making the final decisions but this book will assume that the **guideways in and around cities will run at 60-mph (100 km/h, and the intercity guideways will run at 200-mph (325-km/h).**

A word to calm the fears of some may be in order here. Two hundred miles per hour in our present human-driven automobiles traveling very close together would be out of the question, but the guideways will be quite a different matter. The automatic synchronization of the cars will make it impossible for them to crash into each other. Progress requires revisions in people's thinking: In the horse-and-buggy era how many would have thought that we would be traveling safely at sixty miles an hour before long?

Neither my wife nor I experienced any feelings of concern when we rode a commuter "Bullet Train" in Japan at 120 miles per hour. In 2000 Erik Driessens, a Netherlands dualmode colleague and friend, rode a "Transrapid" **maglev** train in northern Germany. He wrote, "The ride was for 15 or 20 minutes and covered over 80 km. Their top speed was 403 km/h (250-mph) and the ride was very smooth and silent." Erik loved it and felt completely at ease. Why not? We routinely travel twice that fast in jets.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM- or "REV"

Across the United States there may be one northern and one southern 200-mph east-west guideway, and a large number of north-south and diagonal guideways between cities. All of these guideways will be connected into a readily accessible network largely paralleling our highways. The local 60-mph guideway grids throughout the country will connect with the 200-mph guideway network at frequent points. When the system is fully implemented there will be guideways at one speed or the other paralleling most highways and many streets throughout the nation. We will drive in street mode to and from our homes and on very short trips, travel on the 60-mph guideways for the major part of commutes, and be routed to the 200-mph guideways for longer trips.

The local 60-mph guideways will be the most useful for solving our urban traffic problems, so it is likely that many 60-mph networks will be built and used in and around the major cities for several years before the interconnecting 200-mph guideways are finished. The guideway networks of both speeds will expand gradually over the years, just as our street and highway systems have expanded.



HIGHWAY PROJECTS consume enormous amounts of LAND!

That can include your Home, Business or Farm!

On long stretches the guideways will be two-way, like our highways are, in order to conserve real estate. Conversely, **one-way** guideway grids in cities will greatly reduce the miles of guideway and the land needed, with only a very slight increase in average travel time. One-way guideway grids will be much less frustrating than unfamiliar one-way streets are, because computers will be doing all of the navigating.

All guideways must be effectively endless. One can picture the cars piling up in a huge continuing 60 or 200-mph crash if a guideway came to an abrupt end. A two-way-traffic guideway that does terminate must have a turnaround loop at the “end of the line” so cars approaching it will be looped back if they don’t exit the guideway there. (See [Chapter 14](#)).

Since the guideways will be able to carry an enormous amount of traffic ([Chapter 9](#)), one guideway lane should be plenty for many years; but eventually on the most dense traffic routes a second guideway lane will be needed.

When it approaches a large city the 200-mph traffic will fan out from a single guideway into a number of 60-mph guideways, much as manually driven cars fan out and merge in our highway system. Inter-guideway acceleration ramps will take the cars from sixty to two hundred miles per hour, and deceleration ramps will be used to reenter local 60-mph guideways.

Like train tracks and highways, the guideways will be at ground level, elevated, in tunnels, and on bridges. Overpasses or underpasses will be required at all guideway interchanges, and at crossings with streets, highways, and train tracks. In existing dense urban areas we will usually have to elevate the guideways or put them underground, just as we do trains and subways through cities.

Slightly elevated guideways will probably be built in highway median strips, thereby reducing the need for acquiring more land. In addition to paralleling highways, some guideways will probably be built along abandoned or active rail rights-of-way, and others may be built in power-line and pipeline rights-of-way.

Park-and-ride lots will disappear when we have dualmode, but additional parking space will be needed at final destinations. Factories, malls, and sports stadiums require lots of parking. In these areas, and at homes and in suburban areas where the cost of land is moderate, the cars will leave the guideways and be parked manually by their drivers. But in urban areas many businesses, sporting facilities, and other organizations will provide multi-story **automatic** parking directly from the guideways. This system, which will greatly reduce both urban street traffic and street parking, is explained in [Chapter 13](#).

STRINGS OF CARS ON THE GUIDEWAYS

The guideway-system computers will attempt to establish strings (lines or queues) by merging entering cars adjacent to cars already on the guideways. Compactly stringing the cars will maximize the useable capacity of the guideways. And forming long continuous queues of cars will save a lot of power by greatly reducing the wind resistance per car. In layman's terms, the leading car has to push open a path in the air, which the following cars can more easily slide through. The NAHSC estimated thirty-percent reduction in drag with cars traveling 13 feet apart. With cars only one foot apart, the drag reduction could well be fifty-percent or more. The system computer will attempt to position entering cars either at the end of a "solid" string of cars or at the front of a solid string. This will maintain the low drag advantage of close headways, as well as largely eliminate capacity-robbing gaps too short for a car.

On the **highways** increasing the space between cars increases the safety. The saying, "Don't follow too closely" is good advice for fallible human drivers. But on the **guideways** the reverse will be true. The closer together two objects are traveling at the same speed, the less threat they are to each other. Guideway cars running close together will be unable to bump each other hard if the speed of one of them should start to change,

because there won't be enough room between them to permit the development of a significant velocity differential or "bumping speed."

But actually, as we will see in [Chapter 9](#), the speed of one of them **couldn't** change. Railroad cars that are coupled together are "synchronized" by the couplings, and can't crash into each other. The **guideway** cars will be synchronized by magnetic couplings instead of steel couplings, but the forces will be just as real and ample.

NOISE

Trains are noisy at any speed because in addition to their very noisy locomotives they use screeching flanged-steel wheels on steel rails with imperfect "Click, Click, Click" joints. Automobiles are noisy because of their internal combustion engines and their tire treads. Airplanes are noisy because of their jet engines, or IC engines and propellers. Running on **maglev** guideways the dualmode cars will be quieter than trains, automobiles, or airplanes, because their street-mode motors will be shut off and no wheels or tires will be touching the guideway.

But **any** type of vehicle will generate considerable rushing-wind noise if it travels fast enough. At 200 miles per hour between cities a maglev car on the guideways will make more noise than it will when traveling on the 60mph city guideways. However, overall the dualmode system will significantly reduce average noise levels throughout the nation since it will reduce automobile, train, and airplane traffic. People living close to railroads, airports, and on airline flight-paths will be especially grateful for the guideways.

CURVES

In some places the two-hundred-mph guideways will not parallel the highways since some of the curves on existing highways are too sharp for 200-mph speeds. Curves on railroads are gentle, so some of our high-speed guideways are expected to find homes in railroad rights-of-way.

In curves the guideways will be tilted ("banked" as airplane pilots say, or "super-elevated" as highway and railway engineers say). The bank angle will be just the right amount so that no side forces will be imposed upon the vehicles or the passengers. On the 60-mph guideways the radius of the turns will be comparable to those of turns on our highways. On the 200-mph guideways the radius of the turns must be much larger in order to preserve passenger comfort. Unfortunately centrifugal force varies as velocity squared, so adding a little more speed requires a lot more turning radius. Jet airliners must also make large gently banked turns for passenger comfort, but they have the freedom of three-dimensional space in which to set their personal courses.

If my arithmetic is correct, the radius of a turn on a 200mph guideway needs to be 4,628 ft. if the bank angle is limited to 30° (the angle airline pilots try not to exceed in

order to avoid frightening their more timid passengers). The G-factor in this case is 1.15: A 100-lb passenger would feel like she weighed 115 pounds in the turn. This G-force is obviously very low, but that is how it comes out when we restrict the bank angle to 30°, and push the passengers straight into their seats and not toward the side of the car. The bank angle has proven to be the factor that concerns timid passengers much more than the G-force does. Roller-coaster fans love the feel of tipping, including clear over, as long as they are firmly pushed down into their seats. Could everyone learn to peacefully accept more than 30° in turns? This would allow sharper turns and would reduce the amount and cost of real estate for the 200mph guideways.

(You were warned that this would be a semi-technical book; but if these last few paragraphs have not been your literature of choice, don't read them.)

HILLS

Maglev cars could be designed to climb as steeply as automobiles and trucks can; but the maximum guideway grades will probably be comparable to maximum highway grades since the guideways will usually parallel the highways. Maximum railroad grades are less, since steel wheels on steel rails don't provide enough traction for steep grades. The linear motors in the guideways would have to be more expensive and consume more power if they had to climb excessive grades, so let's keep the maximum grades moderate.

On the Synchronous guideways the cars won't slow down when climbing hills; the traffic will always run at full speed at all points in the system except in the entry and exit ramps. ([Chapters 9](#) and [11](#))

When going **down** hills the linear synchronous motors will operate as AC generators (alternators), providing "regenerative braking" to keep the cars from speeding up. Automobile brakes waste energy, turning it into heat; but the regenerative braking will save a lot of normally-wasted energy by converting it back into guideway electricity. Descending cars will thus indirectly help other cars, and increase the efficiency of the system.

Hybrid automobiles, with a small gasoline engine a large battery and an electric motor-generator, save energy in several ways, an important one of which is by pumping energy back into the battery when they are going downhill. Hybrid diesel-electric locomotives for railroads are also gaining in popularity. Instead of wasting energy in friction brakes or electric resistors when the trains are decelerating or going downhill, the electric motor-generators of hybrid locomotives help to recharge electric batteries and thereby improve their overall efficiency. The National Dualmode Transportation System, using linear synchronous motors, will do the same thing: save and reuse much of the potential energy being expended when going down hills, instead of wasting it by

converting it to heat. This is only one of a number of ways in which our coming dualmode system will conserve energy.

THE GUIDEWAY COMPUTER SYSTEM

Computers will completely control all aspects of guideway travel; but unlike our personal computers we will not see the guideway computers and will be little aware of their actions. Things will just happen automatically, as they do in so many other marvels in our modern world. There will be one top computer in the system (**It won't be "Hal"**). Reporting to this electronic CEO there will be supervisory and worker computers. These will have specific duties such as electronically processing cars wishing to enter the guideways, accelerating them to guideway speed and merging them with the traffic, navigating them to where they want to go, delivering them back to the streets at the end of their guideway journeys, and automatically billing the travelers for their use of the guideways. (Someone has to pay for all of those computers.)

Our highway system has many "computers" too, the brains of us drivers. But when we are driving little communication is possible with nearby drivers, or with the rest of the highway system. On the guideways constant communication between the computers will result in a much more efficient, faster and safer system.

PID COMMENT



A typical Computer Control Room

To the average person---BORING...BORING...BORING!! They would get more thrills out of watching paint dry!

PID COMMENT

If you are worrying about possible computer failures, remember that human-brain "computer" mistakes and stupidity are the chief cause of accidents; but computers are

much better than human brains in many ways, that is why we use them. There are also a number of computers in the modern automobiles we drive. We trust many more computers in the jets we ride and in the air-traffic-control system. The passenger-mile accident rate for airliners is very small compared to the driver-caused-accident rates for automobiles.

Wherever the function of a computer is vital to safety there are always backup computers and other safety provisions. Such systems are designed to be “failsafe.” That is, they are configured such that the system can only fail in a safe mode. There will be a simple computer or two in each guideway vehicle, but tampering or failures in these will be unable to cause accidents. All of the vital guideway computer system will be in locked underground vaults. Viruses will not be a problem since the guideway computer system will be completely separate from the Internet and inaccessible to the hackers and terrorists.

The local control centers, perhaps one for each major section of guideway, might be compared to airport control towers; but the guideway computers, not people, will be in control of the guideways. Pilots, human air-traffic controllers, and railway-traffic controllers are fallible, as we often read. Fortunately we won’t need, and will wisely exclude, human control of the guideway traffic.

“If computers are so great why don’t we get rid of the human air-traffic controllers in the airport towers and have only computers there?” Because our airplanes still have human pilots who make observations and decisions that need to be verbally communicated to the human controllers. And the human controllers read the radars, the weather reports, and the traffic data and computer data, so the humans are needed to give verbal information and directions to the pilots. The air-traffic control system started long before we had computers, and it is still a human-oriented system. Human pilots can fly in any direction, including into mountains, storms, the ground, and into each other. All of the above still occur sometimes. And sometimes an air-traffic controller is at fault.

But we will be starting fresh with the dualmode system, and we can design it for optimum use of the latest automatic computerized sensor and control technologies. The guideway computers will be able to do the total job much safer, faster, and for less money than humans ever could.

Next: [CHAPTER 8](#)
[Transit and Other Vehicles](#)



TRANST VEHICLES??

Isn't this whole Dual-Mode System idea a means of giving people PRIVATE VEHICLES?? Nobody desires transit, not even the Promoters who build those vehicles!! Any vehicle over 15 feet needs to stay on the ground, not on a Guideway System!



FEAR and SAFETY??!!!

People who say or claim they could not trust such a technology really need to evaluate their thinking process, especially if they were ever on a Roller-coaster exposed to the open air environment.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 8

Transit and Other Vehicles

The dualmode guideway system must and will provide excellent transportation for people who don't drive or don't have cars, as well as for those who do.

DUALMODE BUSES

There will be networks of dualmode transit buses that pick up and discharge passengers on the streets in the usual manner; but these buses will also travel on the guideways at uninterrupted high speed on longer sections of their trips. Most commuters who take the dualmode buses to and from their jobs will spend far less time in the commute than they now do.

GUIDEWAY ONLY BUSES

Greyhound™ and other long-distance bus companies will likely have buses on the 200mph guideways only. These will probably have no engines, batteries, or street wheels. And no drivers are needed either. With no drivers neither driver-compartments nor steering wheels and all of the other controls and instruments will be needed. These buses will be **single-mode**—the **guideway** mode. “Drivers” on guideway-only vehicles would contribute nothing, but would reduce the safety, take up space, and increase the cost of the service. No drivers, but the driverless transcontinental buses could have onboard attendants if needed. Driverless buses will be somewhat similar to existing driverless automatic systems such as the shuttles at Denver, Seattle-Tacoma, and some other airports, and like the [People Mover](#) at Morgantown, West Virginia.

The bus stations will be adjacent to high-speed guideways the same as train stations are adjacent to train tracks. Most long-distance guideway buses will be smaller than present Greyhounds however because each bus will be loaded with passengers for a single destination only, and will travel nonstop to that destination. The lack of intermediate stops combined with the constant high speed will reduce average travel times to a fraction of that for conventional trains and buses. Further, the smaller buses will not be a forcing function to build excessively large guideways.

SUBSIDIES AND WELFARE

In the last few decades most transit systems have been operating way in the red, and the deficits are covered by huge government subsidies. There are two major reasons for these subsidies: They are a form of welfare for the economically disadvantaged, and

they are an incentive to get more automobile users to leave their cars at home and use the buses or trains. With dualmode there will no longer be a need to get drivers to take the bus or train instead of drive. But dualmode transit could still be subsidized for the poor to any extent desired, by means of individually granted electronic guideway-bus passes.

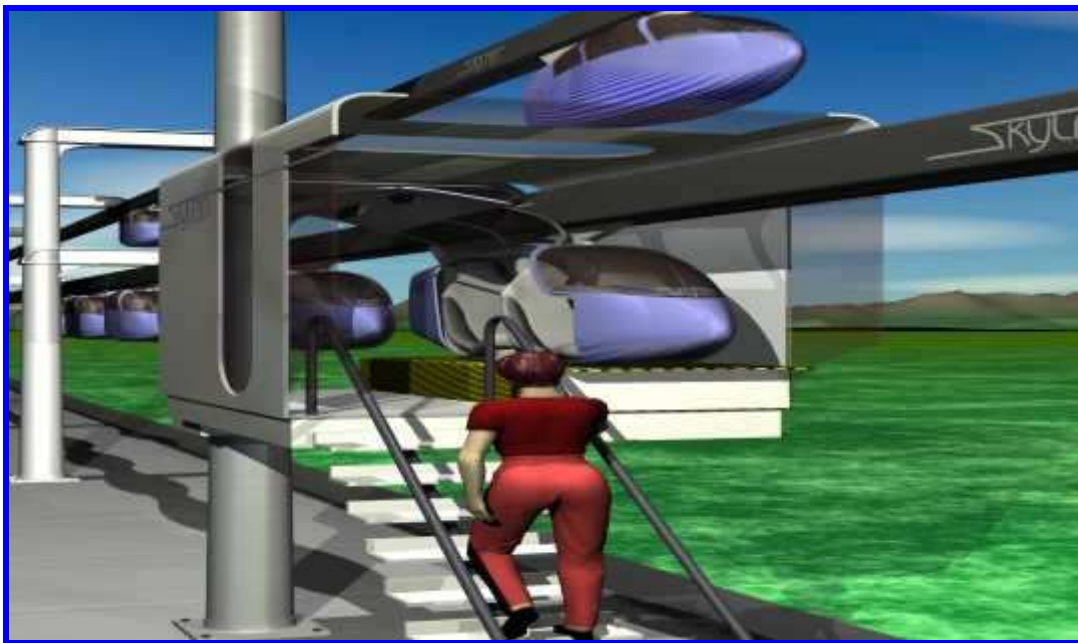
Certain public-service vehicles such as school buses, police, fire engines, emergency vehicles, military, and some government vehicles would doubtless be granted free use of the guideways. But in the author's opinion the guideway system can and should be self supporting.

On the other hand, in more socialistic countries, the guideways could be "freeways," completely free to all users. The dualmode guideway system is flexible and politically neutral: It can operate in any financial mode the politicians and people choose for it.

PERSONAL RAPID TRANSIT

Personal Rapid Transit (PRT) is a concept that has had considerable attention in the last several decades. It proposes the private use of small-automated transit vehicles that would run only on a track or dedicated guideway of some kind, so as to avoid the traffic jams on the streets and highways.

PID COMMENT



Personal Rapid Transit (PRT)

Just as it is stated, another form of TRANSIT! People desire to own their own vehicle. Would you like to enter an enclosed vehicle with filth and stench left behind from someone else?

Some people can become utterly disgusting, we will spare you the gross details, and you get the drift!

A Dual-Mode Vehicle gives mobility to people who would otherwise have no form of private transportation!

PID COMMENT

One objective of PRT is to provide personal service to riders who don't want to ride on mass transit for any of several reasons, and who dislike the delay of intermediate stops. PRT cars would not run on fixed routes or schedules, but would be available on demand, like taxis. Unlike taxis, PRT cars wouldn't have drivers since they would only run on automatic guideways. Like private automobiles, PRT vehicles would normally carry a single commuter or several people who know each other, such as family, friends, car pool, or a business or social group, all going to the same destination. This exclusivity would provide privacy, security, and complete freedom in trip scheduling.

If the dualmode transportation concept did not exist PRT systems would have considerable merit, but dualmode guideways win hands down in any logical comparison with PRT-only guideways. Since people would have to walk to PRT stations, and would be unwilling to walk very far, many more guideways and stations would be required than for dualmode. A good estimate is **eight times** as many PRT as dualmode guideways. The cost of an adequate PRT-only system would therefore be much higher than the cost of a dualmode system. Also, closely spaced PRT lanes required would cause far more traffic diversions, land condemnation, and controversy during construction of the system.

The dualmode system will carry private cars, taxis, buses, freight, small trucks, and **dualmode rental cars**, while PRT guideways would carry PRT cars only. Therefore the market for PRT guideways would be low while the dualmode market will be enormous; the dualmode guideways will be self-supporting while PRT-only guideways would need heavy subsidies.

The national high-speed dualmode guideways will greatly reduce air travel while local PRT systems could not. Dualmode will provide door-to-door service while PRT could not. Since dualmode will get most of the fossil-fuel-powered cars off the highways and PRT would not, dualmode will have much more positive effects upon the fuel crisis and the environment. PRT would accomplish relatively little; while The National Dualmode System will be a comprehensive desperately needed revolution.

PERSONAL RAPID TRANSIT vs. DUALMODE TRANSPORTATION

FACTOR	PRT	DUALMODE
Technologies needed	Available	Available
Power	Electric	Electric
Safety	High	High
Energy impact	Favorable	Very favorable
Environmental impact	Favorable	Very favorable
System cost	Very high	Hign
Will it carry PRT cars?	Yes	Yes
Carry private cars?	No	Yes
Carry transit buses?	No	Yes
Carry Greyhound-type buses?	No	Yes
Carry guideway taxis?	No	Yes
Carry freight?	No	Yes
Carry light trucks?	No	Yes
Carry boats, etc.?	No	Yes
Provide door-to-door service?	No	Yes
Reduce air travel?	No	Yes
Rights of way required?	Many	Far fewer
Resultant popularity	Low	Very high
Resultant market	Low	Enormous
Financial subsidies	Needed	Not needed

DUALMODE RENTAL CAR

Renting a dualmode car will be like renting a regular automobile, except that in addition to street travel dualmode rental cars will also be able to travel the guideways. A dualmode rental car will also be like a PRT car, but much better because it will be able to leave the guideways and take us all the way home. The next morning the dualmode rental car will be at your home ready to use again, while you would have to walk to a guideway if it was a PRT-only system.

Dualmode rental car companies will be independent from the Guideways Authority. Most of the existing rental-car agencies are expected to rent dualmode cars also, and eventually to rent dualmode cars only. Customers will rent dualmode cars at widely dispersed rental-car agency offices and operate them on the streets and guideways like they would private dualmode cars. In summary the dualmode system makes possible private rental cars that combine the advantages of transit buses, Personal Rapid Transit, and present-day rental cars. One could rent a dualmode car or truck for a single trip, or acquire a long-term lease, just as we can now with regular cars and trucks.

DUALMODE TAXIS

The other type of personal for-hire transportation we will have as part of our dualmode system is the dualmode taxi. When we hire an ordinary taxi we hire not only a car but also a full-time driver. With dualmode taxis that arrangement will change in an interesting way. A driver in a dualmode taxi will pick up a passenger at her home or at a building or street, and stay in street mode if the trip is short. On medium to long trips on the guideways the driver will deliver his/her fare **and the taxi itself** to a guideway entry pad, then leave the taxi after collecting a short-trip fare. The driverless taxi and its passenger(s) will automatically enter the guideways and be taken to the desired exit stop (which could be ten miles away or clear across the country). Once the taxi leaves the guideway a different local cab driver will get in and drive his/her new fare to the final destination.

Meanwhile the original driver who left the passenger **and taxi** at the guideway will wait in a shelter for another fare to arrive in a driverless taxi **from** the guideway. A dualmode taxi will be like a rental car plus a **part-time** driver to bring the car to the passenger, chauffeur it on the streets, and to take the car after the fare is delivered to the final destination. On the guideways taxi customers without drivers will have privacy and an extra seat to sprawl in. A dualmode taxi will be like a dualmode rental car plus valet pickup and delivery service.

Not many of us could afford to take a regular taxi across the country, but most of the huge fare would be for the driver's wages, not for rental of the vehicle. Therefore the cost of long dualmode taxi trips will be more like conventional rental-car cost. On a long vacation trip by dualmode taxi, a group in a single cab could get off the guideways and back on as many times as desired, paying a different "driver-guide" a small amount each time they exit and reenter the guideways.

GUIDEWAY FREIGHT

Most of the through freight will be carried in a guideway-only mode without drivers. Many long-distance trucks now have drivers and relief drivers, on-board sleeping facilities, and provisions for eating and other obvious human necessities. Container-like guideway freight vehicles will need no driver's compartment, windshield, lights, seats, dashboard, steering wheel, tires, brakes, engine, transmission system, or

fuel; so they will cost a fraction as much, and their cargo capacity per ton of vehicle will be far higher than it is for trucks.

PID COMMENT



An Experimental (Type X) Non-Motorized Tractor Trailer

This Tractor Trailer was pulled over by numerous Police Officers, who could not believe their own eyes- the vehicle had no motors, engines or batteries!

PID COMMENT

Let's name these very simple but highly effective robotic guideway cargo-container vehicles **Guidetainers**. These will be unmanned guideway vehicles within themselves, like solo boxcars traveling without a train and without a human on board. Since they will have so few parts to fail and no drivers to make human mistakes, maglev guidetainers will be safer than trucks, freight trains, and airfreight. And obviously guidetainers will be much faster, cheaper to buy, operate, and maintain than trucks and planes. Each guidetainer will be loaded with cargo for a single destination, so there won't be any intermediate stops.

PID COMMENT



A real Non-Motorized Tractor Trailer!

The Semi-Trailer attached to this Tractor is 7 feet tall and 30 feet long! A Guideway Container should be no longer than 15 feet, to comply with

spacing and weight regulations. Several Non-Motorized Tractor Trailers were built during the period of 1990 to 2001 at a truck depot in Delanco N.J.! What is truly amazing is skeptics will go to any length to deny that this technology was really in existence!

PID COMMENT

Guidetainers will carry most of the perishable and other time-sensitive cargo now traveling by truck and domestic airfreight. The existing auto-freight companies will probably expand into the guideway-freight business. But with moderate-sized guideways, guidetainers will not be able to carry as large or as heavy loads as railroad freight cars and “semis” can. The railroads will continue to carry bulk loads such as ore and coal, since their ton-mile rates will probably be cheaper than those the guidetainer companies will be able to offer.

Guidetainer freight companies, and other companies with things to move frequently, will have loading and unloading facilities adjacent to a guideway. Loaded guidetainers will also go onto ships. A number of moderate-size guidetainers will fit into a large standard marine-shipping container.

Most of the guidetainers will travel in the wee hours when the guideway-use rates will be the lowest. But there will be no degradation of safety resulting from the presence of guidetainers on the guideways along with cars, because all of the vehicles of all types will run at identical speeds and will be controlled by the same automatic system.

Highway safety will greatly improve when we have the national dualmode system, since most of the passenger vehicles and much of the freight will travel by guideway. Have you ever tried to pass a large semi on a busy highway at night in a heavy rain? We will use the guideways instead and avoid the big rigs. “Between 1993 and 2000 the amount of freight carried by trucks rose 40%” —Industry statistics. A recent news release stated, “Nationwide, trucks collide with cars about 250,000 times a year. In five out of six of the fatal truck-car encounters, it’s the driver of the car who dies.”

The Harleys™, sports-car drivers, mobile homes, large boats on trailers, and logging trucks will stick to the highways. Lots of guidetainers, dualmode express, mail, UPS, and delivery trucks are expected on the guideways, but the big heavy tractor-trailer rigs that survive the dualmode revolution will continue to use the existing highways.

Our present transportation is revolting; we urgently need to revive it—a major revision, a revolution. The acronym, “**REV**” for **THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM**, is going to be handy in future conversations: We will hear things like, “I will take a REV taxi.” “We just bought a REV car.” “She is on the REV-hound bus from Los Angeles.” “Our REV bill is half

what our gasoline bill was a year ago.” “It will be there by REV delivery in the morning.” “Jim’s school has changed to REV buses.” “There is a REV-car rental agency in our neighborhood now.”

Next: [CHAPTER 9](#)
[Maglev and Propulsion](#)

PID COMMENT



Low-Level Flight over Guideway Systems!

The only feasible way to make a flying car is to control its operation via some kind of traction beam. Super Computing will be necessary. Right now, people cannot even see beyond the gasoline engine, so there is little need for going into the research of **Low Level Flight over Guideway Systems!**

PID COMMENT

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 9

Magnetic Levitation and Propulsion

LEVITATION ISN'T JUST A MAGIC TRICK

If it were magic, magnetic levitation would be a good trick because the vehicles it levitates are a lot heavier than is the magician's beautiful assistant. Repulsion maglev was first proposed by US rocket scientist Robert Goddard, and described in the November 1909 issue of SCIENTIFIC AMERICAN. It took us a half-century to use Goddard's rocket inventions, and it will be over a full century before we will use his magnetic-levitation inventions significantly.

Magnetic levitation (maglev) is a well-developed and tested modern technology. It is practical, efficient, safe, quiet, and economically sound. It has already carried a total of over two and two-thirds million paying train passengers in Japan, Canada, and Germany, without an accident (a safety record railroad tracks could never meet.) In October 1993 the Transrapid 07 maglev train ran 279mph at Emsland, Germany. Another type of maglev train, the ML-500 ran at 343 miles per hour in Japan on April 14, 1999. The American Maglev Star train, which is being proposed for installation between the Kennedy Space Center and Cape Canaveral, is planned for speeds up to 350 mph. Another maglev train recently went into operation at Shanghai, China.

But all is not rosy in the railroad business. In recent years a number of maglev trains have been planned then cancelled. As we saw in the previous chapter, coupled trains have major disadvantages that make that concept largely obsolete whether the cars are supported by steel wheels on rails or by maglev. For that reason conventional railroads are dying and I predict that maglev trains will also die.

Currently the association of maglev with the disadvantages of trains is giving maglev technology an undeserved bad name. But divorced from the old concept of coupled trains, magnetic levitation per se is a wonderful technology, and the coming dualmode guideways will be a perfect application for it. Dualmode maglev cars will be physically independent, separately owned, separately powered, and will go their separate ways, just as vehicles on our highways do.

In addition to speed, some of the other advantages of magnetic levitation are obvious: If the cars aren't touching the guideway the wheels or tires won't be wearing out

or going flat. And the guideways won't wear either, so we won't have the equivalent of broken rails or potholes. The noise and vibration generated by steel wheels on rails, or tires on highways, will also be eliminated. Floating on magnetic force is like floating on air, or flying. At this time (April 2006) Google shows over a million items under the word "maglev."

HOW MAGLEV WORKS

I think it was Robert Fulghum who wrote, "[All I need to know is what I learned in kindergarten.](#)" Not quite: To understand maglev we need to go several grades higher; to where we learned, "Like poles of magnets repel and unlike poles attract." There are two basic types of maglev system, and a number of variations in each of these. One type supports the cars by magnetic repulsion, and the other type supports them by magnetic attraction.

PID COMMENT



[Electric Motor Flaws](#)

There are obvious flaws known to a trained technology developer. The battery pack has been the blame for many years by the Electric Motor Industry- this is absolute nonsense!!!

Read the [Unnecessary Energy Crisis](#) by Ret. Colonel Tom Bearden (search [Google](#)) and you may actually learn why you need to get rid of your gasoline vehicle!

PID COMMENT

In some attraction-maglev trains the sides of the cars extend down outside and **below** the edges of raised guideways. In the levitated position the magnets in the car sides are still slightly below magnets in the sides of the guideway. As you will visualize, in this configuration, magnetic attraction lifts the car up above the guideway rather than pulling it down to the guideway. Because of this wrap-around requirement, attraction maglev is probably unusable in the guideways since it makes the necessary full-speed switching from one guideway to another difficult if not impossible. Therefore repulsion maglev is assumed throughout this book.

ENERGY REQUIRED FOR SUPPORT

Lifting the cars off the guideways initially will require a little power and energy. As an example: It would take just less than a half horsepower to lift a one-and-a-half-ton car to a three-inch operating height in three seconds. But the requirement for initial lifting power would last for only several seconds, no further output power or energy will be required to hold the cars at operating height.

If that statement sounds like getting something for nothing, think about the studs in the walls of a house. They require no power or energy in order to hold the roof up. Permanent magnets and superconducting magnets are likewise 100% efficient in this respect. I have a novelty gadget that floats a ballpoint pen in the air by means of permanent magnets. It is ten years old, and the pen floats just as high now as it ever did; yet it has no battery or electric power cord. This isn't violating any laws of physics. Work (energy) equals Force times Distance. In magnetic levitation there is a "force," the weight of the object being levitated, but there is no further change in "distance" (levitation height) once the car is lifted, so no further energy is expended.

But unlike superconductors and permanent magnets, ordinary electromagnets have electrical resistance and are therefore not a hundred percent efficient. If they are used our maglev system would require some continuing input electric power in order to maintain levitation.

INDUCTIVE MAGLEV

This type of maglev system uses permanent magnets in the cars and passive shorted conductor loops in the guideways, or just a solid electrically conductive but non-magnetic plate in the guideways. It requires no electrical input for levitation, but levitates only when the cars are moving. The magnets in the moving cars induce electric currents and associated magnetic fields in the guideway conductors. These guideway fields repel the fields of the moving magnets. In this "inductive maglev" the electrical resistance of the guideway conductors indirectly produces some magnetic drag force that drains a little mechanical energy from the moving cars. A small additional propulsive force from the

linear motors is required to counter this drag force. See SCIENTIFIC AMERICAN, January 2000. It should be noted however, that at high speeds the **aerodynamic** drag on the vehicles is many times the small magnetic drags that are inherent in some maglev systems. One way of looking at the efficiency of such dynamic support is by “Lift-to-Drag ratio,” or (L/D), a parameter widely used in aeronautics. The L/D of the Bechtel maglev system is said to be 100, and that of the Foster-Miller maglev system is 170. The L/D of modern jet transport airplanes averages only 18 to 20.

SUPERCONDUCTING MAGLEV

In theory the efficiency of superconducting magnets is 100%. One example of superconducting maglev is the Miyazaki test track in Japan, which propelled a vehicle at 268 mph back in the mid 1990s. Gordon Danby and James Powell of the United States invented superconducting maglev (Ref: US Patent #3,470,828). Its major advantage is much higher magnetic field strengths than are possible with even the best room-temperature permanent magnets. For instance, In MRI machines without superconductivity a flux density of 0.4 tesla is achievable only with a permanent magnet weighing many tons; but with superconductive magnets, 2.0 tesla is readily achievable.

PID COMMENT



Computer Generated Vehicles!

The scope of Magnetic Levitation is way beyond the average person's knowledge, and yet, it can be broken down into simple elementary physics. So why should a vehicle powered by nothing more than Computers seem impossible? It is time to wake up!

Computers are the next logical step beyond Electric Motors and Gasoline Engines!

Modified Signal and Data Inverters are reworked, and used outside of the field force of modified Generators. Preservation of the “Mineral Rights” to this technology is essential!

PID COMMENT

But superconducting maglev also has many disadvantages, including high initial costs, developmental problems, and essential thermal requirements that are difficult to meet and sustain. With the present state of the art, superconductors are usually special alloys of niobium such as NbTi and NbSn, operating at extremely low “cryogenic” temperatures.

The superconducting electromagnet systems in maglev trains must be cooled down to a few degrees above absolute zero, and then energized with circulating currents of “several hundred thousand amperes.” In order to keep the conductivity “perfect,” to keep this very high circulating current and resulting magnetic field “permanent,” the ultra-low temperature must be continuously maintained by on-board liquefied gas such as helium. Even with the best-insulated “Dewar vessels” (thermos bottles) the onboard supply of cryogenic liquid will boil away in a few hours whether the vehicle is in use or not. Any comparisons between the efficiencies of ordinary and superconductive systems must include the energy expended to liquefy the cryogenic gas.

Superconducting maglev would not be a satisfactory design choice for the private dualmode cars, since the tank of cryogenic liquid in the cars would have to be refilled regularly, or an onboard cryorefrigerator would have to be operated constantly, even if the cars were not used regularly. However, dualmode taxis, buses, trucks, and guidetainers, which would have regular maintenance and much higher use factors, might use superconducting maglev to advantage.

PERMANENT-MAGNET MAGLEV

Modern ceramic and rare-earth-containing magnets are extremely powerful compared to earlier permanent magnets such as Alnico. The latest magnets are over an order of magnitude stronger than the best magnets of a decade ago. And they show virtually no degradation in strength in a decade. But we don’t want to use anything that is “rare,” because we will be building millions of dualmode vehicles and want them to be as inexpensive as possible. However the “rare earth elements” were given that collective title long before we knew much about them or had uses for them. Fortunately most of them are not really rare. Neodymium, which is used in one of the best permanent magnets, is over twice as plentiful in the earth’s crust as lead.

Maglev development is progressing rapidly in the United States, with dozens of technical papers on maglev being presented and dozen of maglev patents being granted

every year. There have been many improvements in all of the different types of maglev, such as by the use of “null flux,” and “Halbach Arrays” to optimize the magnetic fields. Like most other technical equipment, maglev is getting better all of the time. It would fill the bill for REV very nicely today, and will be still better by the time we start designing the system in earnest.

OFFICIAL EVALUATION OF MAGLEV

A September 1993 U.S. Army Corps of Engineers and Department of Transportation document, **FINAL REPORT ON NATIONAL MAGLEV INITIATIVE [NMI] (Doc No. PB 94-100237)**, makes the following statements: “The NMI study concluded that maglev technology has been demonstrated as a technically feasible transportation system. A United States-developed maglev would yield several design improvements that could result in significant performance and economic benefits compared to other high-speed ground alternatives. Most important, by developing an advanced maglev system, the U.S. could compete in both the non-technical and technical aspects of the global maglev market.

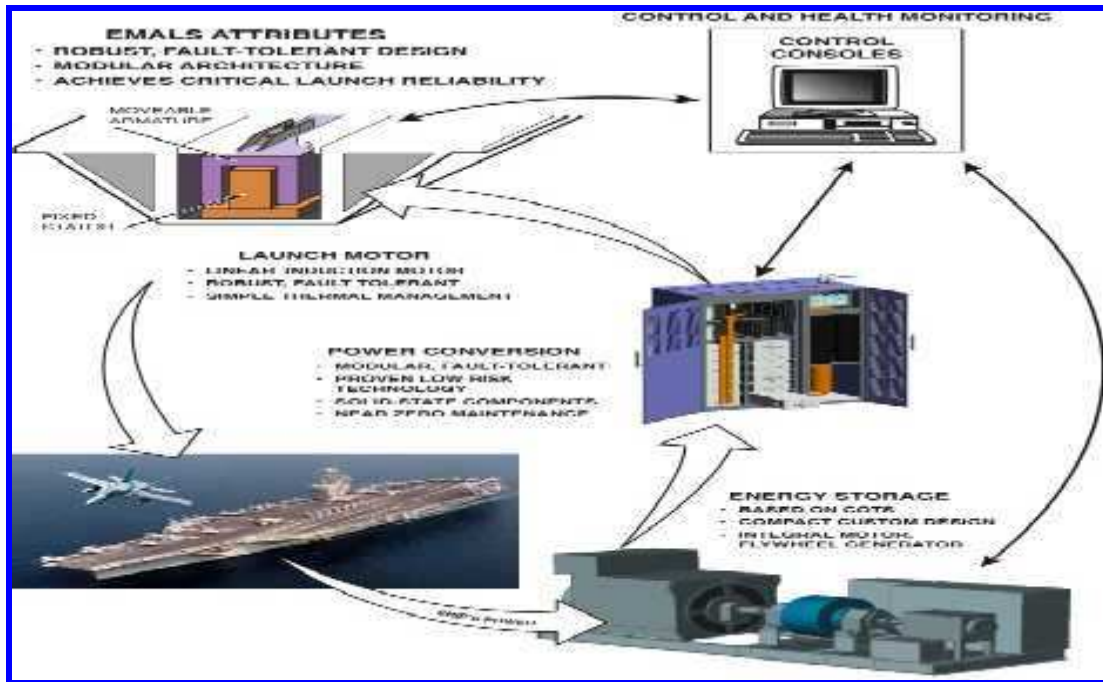
“The NMI study recommends that the Federal Government proceed with a U.S. maglev prototype development program because of the significant public benefits. The recommended program is a three-phase development plan leading to a technical demonstration at a test site.

“The GMSA team found that any maglev system, foreign or U.S. developed, would offer many benefits, including high speed, high capacity, low wear and maintenance, modest land requirements, low energy consumption, low operating costs, alternative fuel choices, and low noise levels. The U.S. concepts, however, offer even better performance potential than foreign maglev systems in the areas of energy efficiency, guideway design, motor design, power transfer, refrigeration demand [for superconducting maglev], and materials and techniques.”

That was thirteen years ago. The thing the NMI study missed entirely at that early date, was that the coming Dualmode Transportation System will use this wonderful maglev technology for cars, buses and trucks to great national and international advantage; while maglev trains, which they had in mind, will largely die out.

POWERING THE CARS ON THE GUIDEWAYS

Maglev vehicles are almost always propelled by “linear motors.” These special electric motors are integrated with the magnetic levitation system and run on power from the guideways. Linear motors are also used in a number of applications that do not use maglev: They are now powering roller coasters, aircraft catapults on carriers, automatic material-handling systems, and are even being studied for satellite launching.

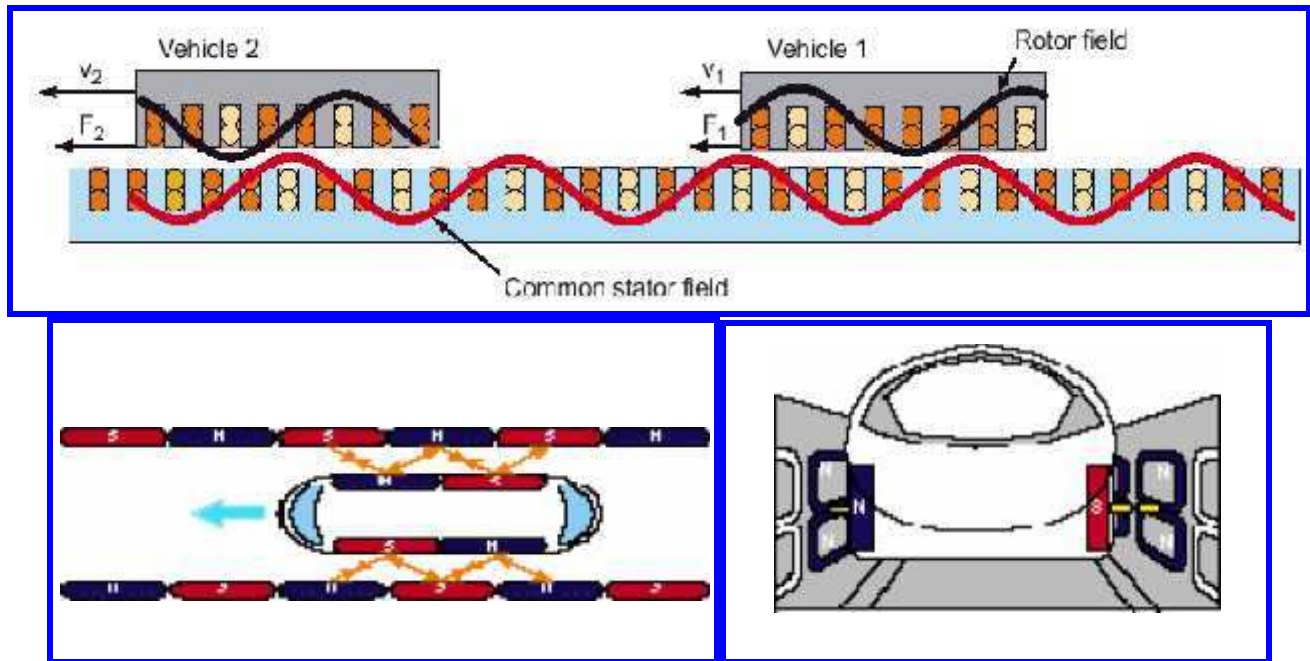


[Mag-Lev Launch Motor!](#)

Once again, we go through extensive research and education to inform the reader. If A Mag-Lev System can launch aircraft, rockets into space, and propel a 300 ton train to 300 MPH! What is so hard about believing that this internalized and modified technology can propel a 2,000 pound car?

A Computer Generated Vehicle, or (CGV), is electronically energized, which is totally different from an Electric Vehicle. A CGV requires less energy to operate and run over a long period of time. SKYWHEELS® are an example of a CGV.

Linear motors are different from regular electric motors in that they are not round and don't have a rotating shaft, they run along a line, they are linear. Compared to ordinary motors they are "unwrapped" or straightened out and stretched. Their stationary parts are built into the guideway and their moving (not rotating) parts are rigidly attached to the moving cars. In conventional-motor terms, the "armature" can be either in the guideway or in the car, and the "field" in either opposite location.



Understanding Magnetic Levitation

Either wheels or maglev could be used to support linear-motor-powered cars, but such cars would be propelled by their linear motors, not by wheel traction.

LINEAR SYNCHRONOUS MOTORS

There are two basically different types of alternating-current electric motors: “induction motors”, and “synchronous motors.” Induction motors slow down and provide more torque (turning force) as we load them more heavily, while synchronous motors will only run at the speed dictated by the frequency of the AC power supplied to it. If the load gets too heavy for a synchronous motor it immediately stops: It cannot run at any speed out of synchronism with its power. Two synchronous motors of the same type that are connected to the same power source will run at exactly the same speed. Good examples are plugged-in electric clocks. These clocks have synchronous motors and run from the same precisely controlled alternating current, therefore they all keep exactly the same time.

Both induction motors and synchronous motors are built and used in the linear form as well as in the conventional rotary form. The Linear Synchronous Motor (LSM), is the only logical propulsion for The National Dualmode Transportation System guideways. The synchronism of LSM is the vital feature that makes it perfect for

maintaining the spacing of the cars on the guideways, and allowing very close spacing. The fact that the efficiency of synchronous motors is considerably higher than that of induction motors is another advantage.

A simple way to visualize synchronous-linear-motor propulsion is to compare it with surfboarding. The electric coils in the LSMs will produce traveling magnetic waves comparable in many ways to ocean waves. A surfer positions him/herself on the front side of a wave and “rides it” (gets pushed along). Cars on LSM guideways will be pushed along by magnetic waves in a comparable manner. Each car will ride its own wave, and all of the magnetic waves will travel at exactly the same speed. The distance between the magnetic waves and therefore the distance between the cars on the guideway won’t change; therefore the cars can never crash into each other. They will be like boxes traveling on a conveyor belt.

We may need a “closed-loop” or “feedback” system in order to keep the cars operating at an efficient point on the alternating-current waveform. The 60mph guideway system will require AC power of one frequency, and the 200mph (or whatever speed we decide upon) guideway system will require a higher frequency, or more widely spaced guideway coils. But the frequency or two frequencies will be exact and unchanging throughout the system. The cars on a Miami guideway will therefore travel at exactly the same speed as the cars on a Seattle guideway.

LSM propulsion is usually used in combination with maglev. Parts of these two subsystems, such as permanent or superconductive magnets and electromagnetic coils, may be common to both systems, thus reducing the initial cost and the maintenance costs of the entire system.

Because of their safety, high system-capacity capability, speed, efficiency, simplicity, and above all their ability to synchronize the cars, the use of linear-synchronous-motors in the guideways is the most-vital technical feature of our coming dualmode system. Further chapters of this book will be based upon Linear-Synchronous-Motor guideways. But both maglev technologies and LSM technology are currently in a rapid state of development by over a dozen different organizations and companies. Therefore no predictions will be attempted here as to which dualmode system or LSM system will prevail for The National Dualmode Transportation System.

Without LSM each dualmode guideway car would have to have some kind of sensors to constantly measure the distance between itself and its neighbors, and some kind of speed control system to keep that separation distance constant. This is exactly what human drivers have to do. Our eyes are the sensors that judge the distance to the car ahead, and our foot on the accelerator is the velocity control feature. But human drivers can’t perform these functions anywhere nearly as rapidly, precisely, and safely as

synchronous guideways will. These differences between human and LSM capabilities account for the very high capacity potential for the guideways.

As of March 2006, Google listed seven hundred and fifty thousand items containing the phrase “linear synchronous motors.” I strongly recommend the highly technical, authoritative, and detailed 2000 book, [LINEAR SYNCHRONOUS MOTORS, Transportation and Automation Systems](#), by Jacek Gieras and Zbigniew Piech, published by CRC Press.

NO BRAKES ON THE GUIDEWAYS

On the streets the dualmode cars will use conventional brakes, but on the guideways these brakes can do nothing because the wheels aren’t touching the guideway. That is good. We must **not** have any guideway brakes except the “regenerative braking” provided by the LSM. To “brake” normally means to stop or to slow down. But the regenerative braking will be used to stop a car only in the deceleration ramp at the end of its trip. On a guideway with power loss the regenerative function will serve to help keep all cars at exactly the same speed as all of the other cars.

On the highways and streets, drivers who unwisely or unexpectedly put on the brakes cause a high percentage of the accidents. That won’t happen and can’t happen on the guideways, since there will be no way for humans or the LSM system to produce differences in speed between cars—no way to desynchronize them. Except in emergencies (to be covered later) the guideway traffic will never speed up, slow down, or stop. On the guideways synchronous speed is the safe speed. Conventional braking on the guideways would cause immediate disaster, so there will be no provision for guideway braking.

POWER SAVING

Even though maglev and LSMs are very efficient, energized guideway coils will consume significant electricity even when there are no cars on the guideway. Therefore, to save electricity, the power to sections or blocks of guideway with no traffic on them may be automatically turned off. Approaching cars would trigger sensors well in advance of a turned-off block, to turn on the power ahead. Power to that block would be automatically turned off again when the cars have passed—unless there are other cars approaching. The failure mode of this power-saving system would be “power-on.”

Alternatively, if we put the permanent magnets in the guideways instead of into the cars, and put the AC coils in the cars, then only the cars would use power, never the guideways.

DISCLAIMER

The author has a degree in mechanical engineering, and has also had a number of courses in electrical engineering and electronics, but he is not an expert in maglev or

linear-motor theory and design. He firmly believes that a system essentially as described in this chapter and book is doable, but this is a complex and rapidly growing field, and the experts currently disagree in many areas of it. This book is intended as only a broad-brush preliminary discussion of the great potential for dualmode transportation. Many thousands of engineers and scientists and many hundreds of thousands of man-hours will be required to design the actual system in detail, and test and develop it. The author is long retired, and regrets that he will not be one of the actual do-ers.

Next: [CHAPTER 10](#)

Capacity of the Guideways



**Rush Hour on the Newly Opened 52 Lane,
Double-Decked I-600 Super Highway**

OR

**Two Lanes of a Dual-Mode Magnetic Levitation Guideway would
eliminate the waste of land and natural resources!**

**The picture above will become a real and frightening scenario
for automobile drivers if the Citizens and Federal Government
don't wake up to the coming highway catastrophe.**

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 10

The Capacity of the Guideways

On highways as the speed increases the distance between cars also increases in order to provide adequate braking time. If the car ahead should suddenly slow down, the driver behind needs some mental and muscle-reaction time before he or she can get the brake pedal pushed, and it also takes more stopping distance to brake from a higher speed. These factors cause the capacity of a highway, in number of cars per hour, to decrease with increasing speed.

The obverse of this is seen when traffic gets heavy; it automatically slows down a bit, the cars run much closer to each other, and the highway capacity **increases**. Tests have shown that highway maximum capacity is reached at around 40 miles per hour. But here we are speaking of highway capacity (cars per hour), not the trip time. Trip time always increases as the speed decreases.

On the synchronous guideways things will be much more favorable. There braking can never occur and spacing between cars can be close and constant, therefore the higher the chosen operating-speed the more vehicles per hour the system will handle; and the shorter the trip times become. In mathematical terms, the capacity of the guideways will be directly proportional to the velocity divided by the car spacing (the sum of the average length of the vehicles and the distance between them).

A COMMON FALLACY

There is much pressure on us these days to leave our cars at home and use the buses or light-rail systems. Let us assume that people listen, and transit use doubles. “Wonderful, twice as many people are leaving their cars at home and our traffic problems are solved.” Not by a traffic-jammed mile! On average, about two percent of the travelers are now transit riders. In this example there are now twice as many, or four percent, leaving their cars off the highways. That means the percentage of people driving their cars went from 98% all the way down to 96%. That would do next to nothing toward solving our transportation problems. Do the planners ever look at the arithmetic? Later in this chapter it will be shown that conventional transit systems **couldn’t** carry anywhere near the traffic now being carried by our cars, even if there were ample rail tracks and dedicated lanes for buses.

In defense of the planners, up until now they have had little choice. Those responsible for transportation have spent a lot of time and money proposing everything they could think of that might reduce our transportation problems. Even if they knew it wouldn't work they had to propose something, anything, to reduce the public outcry over lack of action. Currently there is nothing that would do the job. A National Dualmode Transportation System **can** do the job, but most regrettably we won't have it soon enough to avoid considerable chaos.

CONTINUOUS FLOW

A hundred years ago most rural folks got water into their houses by carrying it in buckets from a well, creek, river, or lake. Those old buckets delivered very little water compared to modern plumbing, since a pipe can provide continuous flow and a bucket can't. The same observation applies to transportation—buses and trains are intermittent: They are like one-at-a-time buckets. Automobiles run or “flow” continuously on the highways fairly well. Dualmode cars on the guideways will flow even better, at much higher flow rates.

PID COMMENT



Eliminate the Human Driver!

If you actually think that you are a better and safer driver than a Computer and Guideway System, you are in serious denial. If a Guideway were already in existence in the U.S.A., a Computer can calculate and assess your destination. If you were leaving N.J. bound for California, the Computer will know the conditions of

the entire track. A Human Driver cannot be trusted in strategic situations and cannot compete with the capability of Computer Systems!

PID COMMENT

The large clearances we leave between cars on the highways are necessary because of the unsynchronized traffic, the limitations of human drivers, and the limits of automobile braking and tire traction. And since we can't increase the speed safely with human drivers, the only way to get more highway capacity is to add more lanes. But more lanes bring more pains.

In contrast, dualmode-guideway capacity will be remarkably high because in addition to high constant guideway speeds we can run the vehicles very close together. With synchronization, hardly any space between cars will be needed on the guideways.

Fortunately the technology required for safe very close spacing is already largely available. Mentioning just one such development: In 2000, Peter Mattila, Director of Business Development for MagneMotion, wrote, "For fixed guideway transport systems, to achieve top performance it is critical to be able to run vehicles with very short headway [car spacing]. The magnetic guidance and switching technology [LSM] that MagneMotion has developed allows this capability." Preliminary studies show that about one foot minimum clearance between cars will be plenty in the REV system, therefore the following capacity comparisons will be based upon that figure.

GUIDEWAY CAPACITY COMPARED TO HIGHWAY CAPACITY

Assume the traffic on a very busy highway lane is traveling at an average speed of 60 mph, and the time clearance between cars averages the "two seconds minimum" recommended by many State Patrols. Also assume the average length of the vehicles is 15 feet, and there is an average of 1.2 passengers per car. This works out to 27.64 cars per mile and 1,990 passengers per hour for each highway lane.

For comparison: Assume the cars on a 60mph **guideway** are also 15 feet long and carrying 1.2 passengers each, but there is only one-foot clearance between cars. Then there will be 330 cars per mile, 19,800 cars per hour, and 23,760 passengers per hour. Dividing, we see that one guideway lane would carry almost as much as **twelve** highway lanes.

The California Department of Transportation figures that the maximum capacity of a highway occurs at about 45 miles per hour and about 2,000 cars/hour/lane. Using those slightly different numbers one 60-mph guideway lane would carry the equivalent of ten highway lanes.

Again using the California assumptions, a 200-mph guideway lane at full capacity would be the equivalent of **thirty-three highway lanes**.

I assumed an average of 1.2 persons per car (but I wonder what two tenths of a person looks like). The actual number of occupants per car seems to be even less than 1.2, at least in this area. But what if, in an emergency, we carry an average of six persons per car on a single lane of 200mph guideway? Its capacity would be 396,000 people per hour. Theoretically we could evacuate a city of over a third million people in less than an hour using only one dualmode guideway lane. This we could call high-speed high-volume continuous-flow. Emergency-evacuation planners, please take note.

DUALMODE GUIDEWAYS COMPARED TO BUSES AND TRAINS

The capacities of bus, train, and airline systems depend upon the number of vehicles dispatched per day or per hour, and upon the number of passengers per vehicle. Note that the system capacity is independent of the speed of the vehicles in these “by-the-bucket-full” dispatches. It would be impossible to carry a major percentage of our present highway traffic on any of these systems since the frequency of the departures and arrivals required could not be met. It would take nearly one fully loaded standard forty-seven-passenger Greyhound™ bus **every minute** to allow the elimination of one highway lane full of automobiles. And it would take an astonishing 1,685 Greyhound buses per hour (28 buses every minute) to equal the capacity of one 200-mph dualmode guideway! Oh yes, and we should note that all of the twenty eight 47-passenger buses per minute would have to be completely full, but the cars on the single-lane guideway could do the same job carrying an average of only 1.2 persons each.

With railroads or “light rail” one and a third trains **per minute** carrying a **thousand passengers each** would be required to equal the 66,000 cars-per-hour carrying capacity of one guideway at 200 mph. All of these trains or buses couldn’t possibly be unloaded and reloaded every minute, unless many acres of parallel tracks and lanes were provided at each station. And many many acres for auto parking would be required at each station.

Theoretically we could evacuate a city of over a third million people in less than an hour using only one dualmode guideway lane!

DUALMODE GUIDEWAYS COMPARED TO JETS

If we are in a hurry and the trip is long we now usually fly, but many airports are already operating at capacity—our traffic congestion is not limited to the highways. The good news is that one 200-mph guideway will have the capacity of three fully loaded Boeing 747-400 jumbo jets **per minute**. Try that on any airport.

On the guideways it will take only four hours to “drive” between two cities 800 miles apart. Because of their capacity, speed, low use-fees, and door-to-door service, the cross-country dualmode guideways will greatly reduce domestic airline travel.

When we include the time to make reservations, the travel time to and from the airports, the parking, ticketing, waiting, the stressful security checks, baggage handling, delayed flights, and cancelled flights; the total time from home to final destination will surely average less by guideway than by jet for trips up to a thousand miles or more. In the Gasoline Alley comic strip Skeezix had it right when he observed, “Now we can get there in far less time than it takes to drive to the airport and get checked in.”

Guideway travel will be much cheaper than flying, we will have our own cars to use at our destinations, and let’s not forget comfort, safety, and privacy. Does a crying baby or an obsessive talker in the next seat make for a peaceful flight?

Who needs all of the hassles of flying if we can get to our destinations faster and cheaper by taking our own cars all the way? And who needs the problems from weather, airline strikes, airport expansion; and the residential noise, air pollution, and fuel consumption of jets? A Confession: This heresy is coming from an airplane lover and former private pilot after a 40-year engineering-management career in the aerospace business. He predicts that Boeing will someday be building dualmode systems—and a lot fewer airplanes.

GUIDEWAY SYSTEM EXPANSION

When the guideways are completed, with one lane in each direction, everything will be rosy for many years; the traffic on the guideways will be light, and there will be few delays or frustrations.

But assume that the population continues to increase and the standard of living continues to allow most of us to drive cars (dualmode cars). When the traffic finally begins to approach the guideway capacity in some dense areas it will be time to add a second guideway lane there. Note that adding a second guideway lane doubles the guideway capacity, but adding another lane to a five-lane highway adds only a fifth more capacity. Expanding the guideways will therefore be many times cheaper than continually expanding the highways, as we now do.

On the guideways, if there were a shortage of exit ramps some cars wishing to exit would be forced to continue on to the next exit. If this happened often the paying customers affected would demand and rapidly get more exits installed there. With an automatic guideway-use-fee system, the forces of supply and demand will provide timely expansion of the guideways much faster and more efficiently than do the complex forces that control our “free” but bureaucratic highway system.

On the highways if there is insufficient exit-ramp capacity at some location the exit ramp plus the right lane of the highway jams up. If too many cars squeeze onto the highway, all of the traffic slows down, sometimes way down. We also see this phenomenon when an airport is operating at capacity: The jets line up awaiting their turn to use the takeoff runway, or they stack up in a holding pattern awaiting permission to land. The same delays occur in bus systems and railways when they are crowded.

Note here a very significant advantage that crowded REV guideways will have over crowded trains, airports, and highways: When any of the existing systems are running at or near capacity the system **as a whole** slows down and **all** of the riders and drivers are delayed. But the REV guideways will continue to operate at full synchronous speed clear up to and including full capacity. The only people who may be delayed are the **few** people who can't get onto a guideway because it is full, or those who have to take a later exit ramp, because of insufficient ramp capacity at some places at some times. The **trip-time for the vast majority** of guideway travelers will be as fast during rush hours as during slack-traffic periods.

[Chapter 11](#)

Getting Onto and Off of the Guideways

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 11

Getting Onto and Off of the Guideways

VEHICLE IDENTIFICATION

To use the guideways a driver will pull onto an “entry pad” at the edge of a guideway and shut off the engine. An integrated-circuit chip in the car will then identify the vehicle and its owner to the system. Simultaneously the vehicle will be subjected to an automatic safety test of the few components of the car that are vital to guideway-mode operation and safety. All of this will take perhaps thirty seconds.

PID COMMENT



Morgantown Guideway Track

Morgantown is the most famous and well known Guideway System. This system was built with very little knowledge and experience in Guideway Technologies, although it is still in operation to this date.

The Guideway System built during that time was overweight, and uses more concrete than necessary.

PID COMMENT

If the computer finds any safety problems; or finds anything wrong in the status of the entering car or driver, the system will notify the driver (or sometimes the police) of the problem and divert the car back onto the streets rather than letting it enter the guideways. Problems such as a **stolen-vehicle report, outstanding arrest warrants, lack of current vehicle inspection, no vehicle license, no driver's license, no insurance, or an overdue guideway bill** could be included. Currently we have little real control over illegal use of the streets and highways; but on the guideways we will have automatic means to fully prevent such safety violations and petty crimes, if we choose to use them.

The guideway system will hopefully be paid for by its users, like toll ways and utilities are. But there will be no searching for change at entry pads or exit pads; the REV car identification-chip data, combined with the trip exit-location, will provide the information required for the REV computer to automatically add each additional trip to the bill of the user. The details of our monthly REV bills will be comparable to those of our telephone bills. REV bills will replace gasoline as a budget item.

Data in the car-identification chips will include the length and weight of the vehicles. These parameters will be factors in the formula for determining guideway charges, since more weight will cause a car to use more electricity, and greater length will use more guideway capacity. The fee for putting a big vehicle on the guideway will thus be more than the fee for a minicar. We may decide to charge less for cars with more people in them. This would be the twenty-first-century equivalent of HOV lanes to encourage ride pooling. A photoelectric system would record the number of passengers in each car at the entry pads.

“DRIVER TO SYSTEM”

Before the system will permit a car onto the guideways, the driver must type the code of her desired guideway exit into a keyboard on the dash. (That choice may be changed en route if necessary). Assume the code, LU-WI-4 has been entered. The guideway computer will then show a message on a dashboard screen and also verbally say something like, “You wish to leave the guideways at exit number 4 in Luping, Wisconsin; please press “Y” for yes or enter a corrected exit code.”

The choice of exit will permit the computer system to determine the best route (if it is a trip involving more than one guideway of the network) and to automatically navigate the car from one guideway to the next as needed. The “road maps” will be in the navigation computer's memory.

Like our highway system, the guideway system will require entry ramps from the streets onto the guideways and exit ramps back to the streets from the guideways. But the operation of all cars on the guideway ramps will be automatic.

RETRACTING THE “LANDING GEAR”

Airplanes are dualmode vehicles. As such they require some changes in configuration when they go from the taxi mode to the flight mode, the landing-gear position being the most obvious. Several minor configuration changes will likewise be required in the dualmode cars for REV as they go from one mode to the other.

To provide adequate ground clearance in the street mode the levitation and propulsion magnets, as well as the guidance-rail followers in the cars, will be retracted to a safe distance above the road surface. These magnets and units will be automatically lowered while the cars are on entry pads and automatically raised (retracted) when the cars arrive at exit pads. Accidents due to possible failures in this system couldn't occur, since the cars couldn't run on the streets with the maglev gear down, and couldn't run on the guideways with it up.

ENTRY RAMPS

After a car has been processed and accepted for guideway travel, if the traffic is heavy the system will hold the car at the entry pad until the computer has chosen an upcoming space for it between cars on the guideway. Then it will levitate the car, accelerate it to full synchronous speed, and merge it with the traffic on the guideway.

The above may sound difficult and dangerous, but those things are exactly the steps we now take when we manually accelerate on a highway entry ramp and merge with the traffic flow. However, the limited mental, visual, and physical-coordination skills of human drivers require leaving large spaces between cars. The synchronized automatic merging system on the guideways will make possible the very close car spacing necessary for high system capacity and low aerodynamic drag.

PID COMMENT



Automated Driving

Most people build up these preconceived and unwarranted fears, mostly based on lack of information. Riding in an automobile where someone has the capability at any moment to crash head-on into you should scare you more than anything else. A Guideway Vehicle cannot crash off the Guideway like a automobile slipping off the highway.

PID COMMENT

The LSMs might be operated in an asynchronous induction-motor mode during acceleration, using standard guideway-frequency power. Or they may be left in pure synchronous mode and use tailored AC power of gradually increasing frequency in the entry ramps. Another synchronous method would be to progressively vary the spacing of the LSM coils in the ramps, perhaps in conjunction with AC-frequency ramping.

ACCELERATION AND DECELERATION

In the highway system the entry and exit ramps are long enough to permit the acceleration and deceleration of the cars and trucks within acceptable human acceleration limits and with reasonable thrust and braking requirements. The dualmode guideway system will require similar provisions. If we choose 60mph as the speed for the local guideway system, the ramps will be about the same length as those we use for our present highways. But if we run the intercity and interstate guideways at 200mph or some comparable speed, their ramps will need to be **much** longer, since the distance required to accelerate or decelerate a body varies as the square of the change in velocity. For instance, to go from zero to 200mph at an acceleration of 0.2g, the ramp length would have to be 6640 feet. This isn't something new for us however: At airports we call these long acceleration and deceleration ramps "runways."

The requirement for very long ramps to support very high-speed guideways is a major reason why transfer ramps from the proposed 60mph guideways to the 200-mph guideways and return will be built only away from dense urban areas, just as airports are. In fact, in many cases the placement of high-speed guideway ramps parallel with existing airport runways might make sense. It would make very good sense in many more cases if jet travel largely disappears in the post-petroleum era because of prohibitive costs of petroleum and alternative jet fuels. There could also be legal prohibitions limiting flying for global warming reasons. The author predicts that eventually high-speed guideway travel will largely replace domestic flying. This will definitely be the case if we put the high-speed long-distance LSM guideways into evacuated tubes. Then we could "fly" on maglev at the earth's surface, with very low drag, with no weather problems, and with no high-drag climb-to-altitude and descend time and power requirements.

VELOCITY CONTROL FOR MERGE POSITIONING

The “REV merging” system will be capable of temporarily altering the velocity of merging vehicles to slightly above or slightly below guideway synchronous velocity, so as to accurately position and “slide” them into selected one-car vacant spots on the receiving guideway. Surely there are high-tech ways of doing that, but this senior citizen suggests the following low-tech method of “fine tuning” the velocity of merging vehicles: Generate the power for the merging ramps with an alternator driven by a guideway-synchronous motor through a differential gear system. The third shaft of the differential would be rotated as required by a servomotor controlled by the merge computer. This merge positioning would be done after the vehicles have been accelerated and locked into sync with the guideway power. Merge-position control will be used not only on the entry ramps, but also at merging guideways and at interchange merges. (Readers who understood that paragraph are entitled to gold stars or honorary degrees in 1940s engineering.)

If, for any reason, something goes wrong with any in-process merge, there will be no crash; the computer will automatically abort the merge by directing the car(s) straight ahead into exit deceleration ramps.

EXIT RAMPS

A car exiting the guideways will be slipped out of line to an exit ramp, decelerated, delevitated and stopped. Then the driver will again take charge, driving on the streets in the normal manner to her final destination. Exit ramps will usually precede accompanying entry ramps; therefore, if the traffic on a guideway is really heavy, an entering car could immediately take a spot being vacated by an exiting car. Multiple entry ramps and multiple exit ramps will be required at high-traffic local areas such as shopping malls, factories, stadiums, and convention centers.

The linear synchronous motors in the cars will always be running synchronously while decelerating on the ramps. To explain that apparent oxymoron: There will be no system-supplied power during deceleration. The kinetic energy in the decelerating cars will be regeneratively converted to AC-electric power of decreasing frequency. That frequency will be controlled by the system to produce the desired rate of deceleration. Obviously the spaces between the cars on an exit ramp would decrease as their velocities decrease; therefore each exit ramp could accommodate only a few widely spaced cars at a time. For some technical suggestions on LSM car deceleration, see the [APPENDIX, DECELERATION CONTROL](#).

Next: [CHAPTER 12](#)
[Guidance and Switching](#)

PID COMMENT



MORGANTOWN, W.V.

PID COMMENT

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

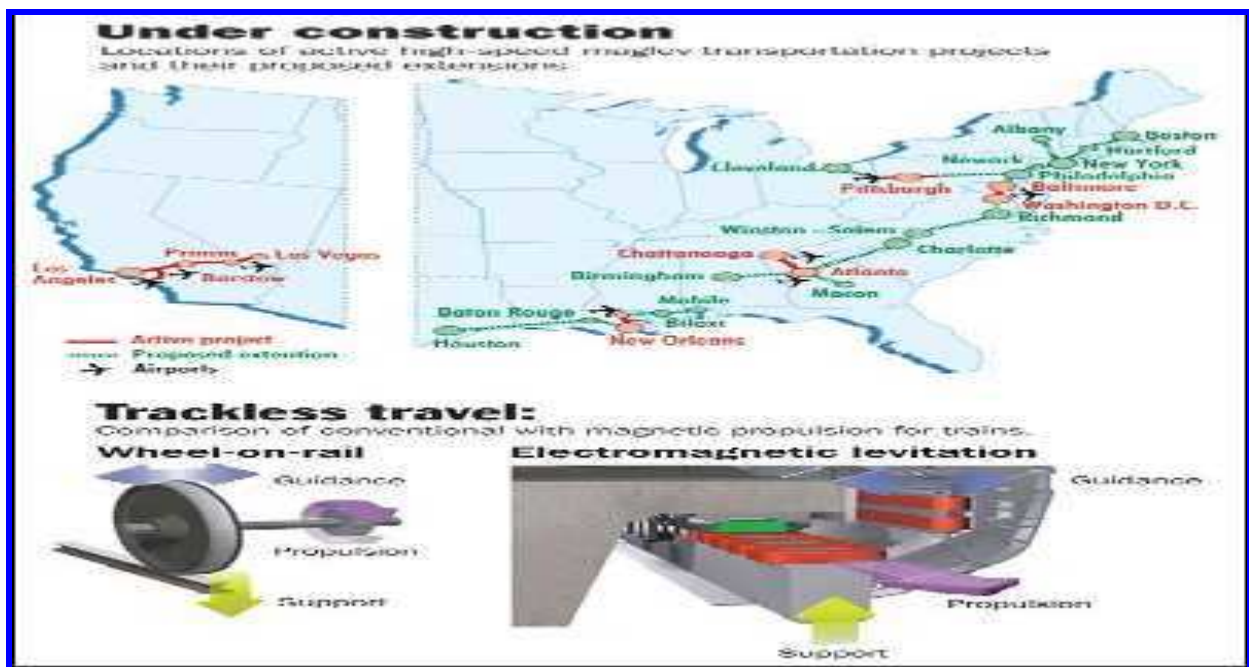
Chapter 12

Guidance and Switching

THE WAY IT IS DONE IN TRAINS AND AUTOMOBILES

Let's examine the basics: The steel wheels on railroad cars have flanges on their inner faces. These flanges, bearing against the sides of the rails, apply side forces that keep the cars centered on the track. Trains are switched from one track to another by physically moving the ends of rails laterally several inches at track junctions. Lateral forces on the wheel flanges bearing against the switched rail ends forcefully turn the train to the selected track. Note that on railroads the engineers (drivers) do not guide or steer the trains in any way, someone on the ground or in a control room sets the switches.

PID COMMENT



PID COMMENT

Automobiles are quite different in these respects. An automobile is guided and turned (switched) from one street to another by the driver steering the front wheels. This manual steering system requires constant attention and action on the part of the drivers.

But automobiles can merge with traffic, and demerge from it at full speed, while individual cars in trains cannot, and whole trains cannot.

Some readers are now wondering, “Why does he bore us with simple stuff that we already know?” Yes we “know” it, but most of us haven’t really thought about it. Before we look for a better way of doing something we need to think about how it is being done now, thoroughly understand it, and ask ourselves why it is being done that way? What are the pros and cons of that method? After this kind of thorough “homework” we will be ready to intelligently look for a better way.

The old flanged-wheel-and-rail system has major limitations and dangerous faults. For one thing, the ends of rails must be physically moved before a train to be switched arrives at the intersection, and moved back to the through-traffic configuration after that train has passed. That system will therefore not permit fast closely spaced cars to be switched independently. Trains have to slow way down before they can switch tracks because of the crude mechanical joints present in that switching system. Even if the switching surfaces were perfect, the train couldn’t be switched at high speed, because the centrifugal forces generated would cause the cars to derail. And railroad accidents continue to occur because switches are sometimes left in the wrong position for oncoming trains. Note that railroad trains are guided and switched by the track, but automobiles are guided and switched from the car. With modern technologies there must be (and is) a far faster and safer switching method than the one used on railroads for over two-hundred years, and faster and safer than the steering system used on automobiles for over a hundred years.

THE GUIDEWAYS GUIDANCE AND SWITCHING SYSTEM

The levitated dualmode cars of the National System will need to switch safely at full guideway speed; and any car on a guideway must be able to automatically switch onto another guideway while cars very close ahead and behind it do **not** switch. Neither the railroad type of switching system nor the automobile type of switching system could fill that bill.

To meet the above requirements, the author strongly advocates the following system: Provide two “guide rails” along the guideways in addition to the maglev that supports the vehicles. ***FIGURE 1*** shows the end view of a guideway car on a guideway. Note the guide rail followers, which are part of the car. The two followers will be coupled together by a toggle linkage such that at any one time the car can engage either one of the guideway guide rails or the other, but never both and never neither.

PID COMMENT

PIC_1

(missing graphic)

PID COMMENT

The guide-rail followers won't normally touch the guide rails, because maglev systems will provide the lateral guidance forces as well as the vertical vehicle-support forces. However, if for any reason the guidance maglev should "bottom out," backup ball-bearing rollers will safely provide the vehicle guidance and switching forces. The tires on these rollers will be polyurethane or a comparable longwearing material, such as used on roller-blade skate wheels. The lateral guidance-force maglev will be of the inductive type, where the guide-rail followers contain permanent magnets, and the guide rails are of a structural, electrically conductive, but nonmagnetic material, such as aluminum alloy.

The two guide rails will be parallel with the guideway, and parallel with each other except at guideway intersections, as illustrated in ***FIGURE 2***. At an intersection where a guideway branches, the left guide rail will follow the left branch and the right guide rail will follow the right branch. The navigation computer will provide commands to the guide-rail-follower mechanism in each car to route the car to its destination.

PID COMMENT



PIC_2
(missing graphic)

PID COMMENT

If the left guidance follower in a car is engaging the left guide rail that car will turn left or bear left at the next fork in the guideway. Whether or not a car will switch to a connecting guideway or go straight ahead through a junction will depend upon whether its left or its right guidance follower is engaging a guide rail.

The engagement and disengagement of the guide rail follower units will be commanded by the computer and accomplished automatically in each car as required to direct it to its destination. If a computer failure should cause the wrong guidance signal to be sent to a car, or to all cars, or if **no** signals are sent, some cars could be routed to the wrong guideways. But since the left and right followers will be mechanically prevented from being both engaged or both disengaged, no system errors or lapses in communication could cause accidents.

This type of guidance and switching system can operate at any speed and with any car spacing, but each car must be given the command for its particular routing long before a junction is reached. The higher the speed, the earlier the commands are needed. If we assume a maximum of one second is required to actuate the guidance followers in a car, at 60mph the switching signals would have to be received at least 90 feet before the cars reach the junction. On the 200mph guideways, the switching signals must be sent at least 300 feet before each car arrives at the junction. No problem.

Unlike the screeching and laterally lurching ride on trains during switching, a REV car will be quiet and smooth riding during switching, since it will have no physical contact with anything.

Different system innovators have chosen different details in designing guidance and switching systems of this type, so the systems look different from each other but they operate on the same principles for the same reasons. One guidance and switching system of this basic type has been safely routing cars daily on the Morgantown West Virginia “People Mover” since 1975. The author participated in the engineering design of that transportation system.

Next: [**CHAPTER 13**](#)
[Automatic Parking](#)



TRANSIT PARKING!

I guess they won't argue with the trolley drivers next time!

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 13

Automatic Parking

To help alleviate highway traffic jams we add more highway lanes, but adding more lanes on urban streets is usually out of the question. In fact, in a few older U.S. cities and many foreign cities, in some places there is only room enough between some buildings for a single-lane one-way street with no parking.

The dualmode system will greatly reduce traffic on our highways by switching most of the highway traffic to the guideways. But if an increasing number of cars exit from the new guideways into urban areas to park manually, the urban street traffic and parking problems would continue to worsen.

THE SOLUTION

Fortunately REV can and will largely eliminate street congestion as well as highway congestion. Instead of leaving the guideways and then manually parking our REV cars in street mode, **automatic** parking will be provided directly from the guideways in urban and other dense destinations such as sport stadiums. This will eliminate the street-mode portion at the city end of a high percentage of guideway trips entirely. Gone would be the frustrating, time-consuming, and traffic-congestion-causing circulation of cars looking for parking places. Human drivers have to blindly search for parking spots, but the automatic system will know exactly where all empty stalls are and send a car directly to the closest one. This will save energy as well as reduce street traffic. And since the occupants of a car will leave it before it is parked, they will save time. On guideway trips that originate and end in congested areas (in the same or different cities), with automatic parking from the guideways we can avoid the use of the street-mode at **both** ends of the trips.

I suggest that most of the automatic parking systems connected to the guideways be privately owned and operated, the same as parking lots, parking garages, and basement parking facilities in buildings now are. At their choice, businesses will be able to provide either pay or free automatic parking from the guideways for their customers and employees, the same as many businesses now provide parking for customers. Future business advertisements may carry the enticing words “Guideway Parking.”

THE DETAILS

A vehicle on a guideway-parking ramp will stop at a covered drop-off place, usually next to the elevators of a building. Its occupants will get out and lock it. The “abandoned” vehicle, still on a guideway ramp, will then be automatically parked faster and in less space than is required for driver-parked cars.

If the parking installation is large, a large number of drop-off and pick-up spaces will be provided in order to avoid excessive delays at rush times. It will be possible to clear a stadium or concert hall area many times faster that we now do with acres of walk-in-the-rain parking lots.

PID COMMENT



Automated Parking!

Just kidding! Lighten Up!

Some people may feel like doing this to the automobile anyway!

PID COMMENT

When ready to leave the event, mall, or building a car owner will insert a card identifying his or her car into a scanner. Card scanning or cash will be used to pay for the parking where it is not free. The system will then deliver the car to that pickup place

(valet parking with no valet to tip). On leaving the automatic parking area the driver will have the option of staying in the guideway system, or exiting to the streets.

Note that a private vehicle will sometimes make a trip into the city and back, yet never run on the city streets. On the guideways drivers could nap all the way to the office. And there will be no time spent in looking for a parking space or walking to and from the parking space, no parking-violation tickets, no opportunity for other cars or careless parking-garage drivers to ding up the vehicle, no threat of hoodlums vandalizing it, and no way it could be stolen.

An automatic guideway-parking facility will be expensive to install, but its efficiency, convenience and appeal will enable it to more than pay for itself. Since automatic parking from the guideways will greatly reduce street traffic and its many associated costs, speed up emergency services, and make cities more productive and livable, it may make sense for city governments to subsidize guideway-parking installations, both in new buildings and during upgrades of existing buildings.

Automatic or “robotic” parking systems are already developed and being used for regular automobiles worldwide. A March 27, 2006 Google search found two and a quarter million items under “automatic parking garage.” There are many automatic systems available in which the cars are parked in customary rectangular patterns, and some new ones that park the cars in a multi-level radial configuration inside of a huge cylinder, either below or above ground. Adapting these automatic systems for guideway cars will be straightforward.

Next: [CHAPTER 14](#)
[Safety](#)



PATIENCE!

Riding on a Guideway System will teach people a lot of patience. When you are now preoccupied with other things than having to drive, most Commuters will not be in such a rush to get nowhere. When you are on the Internet or watching a good movie, there seems to be no rush!

After getting this far in the REV Book, we figured a little humor would alleviate the tensions. A Guideway System can never make this mistake because either one vehicle or the other will get “permission” from the Master Computer (not HAL), to allow vehicles to enter or exit the Guideway System.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 14

Dualmode System Safety

HUMAN DRIVERS ARE ACCIDENTS WAITING TO HAPPEN

Most of our highway accidents are due to human vision limitations, carelessness, incapacity, inattention, poor judgment, high speed, and over or under braking. “Seventy-five plus percent of the time the factors contributing to crashes are related to driver error.”— Shell Oil Company.

Computers combined with high-tech automatic systems can “see” ahead much better and infinitely farther than human drivers. They make far fewer mistakes, think thousands of times faster, and can direct machines hundreds of times better than humans. Therefore, since it will have no human drivers, our guideway transportation system will be safer than our highways, even though the cars on the guideways will travel faster. The “safe speed” for the guideways will be much higher than the safe speed for highways.

LIMITING SPEED IN STREET MODE?

With REV dualmode cars, street accidents could be reduced if we choose to automatically limit the top speed of their street-mode motors. This kind of control is not an option with our existing automobiles since they have to be capable of highway speeds and they must have the reserve power necessary for accelerating and for passing. With dualmode we could have automatic street-speed limiters in the cars rather than impose speed limits upon the drivers by law. Unlike many human drivers, a speed-limiting system in the cars won’t ignore the legal speed limit. To the speed-limiting system thirty-five would mean thirty-five, not forty-five or fifty. No speeding tickets would ever be given in either mode; we could assign most of our traffic cops to other duties. Speed limits are popular with most people and not with others, but the speed-limit decisions would be left to the public and the lawmakers. The dualmode system can be built to keep car speeds within the law at all times, if that is what we would like to have.

Recreational driving for those who want it will still be available on the highways with regular automobiles. But speed-loving macho kids (of all ages) need to find another place to race. “The leading cause of death among Americans between the ages of 1 and 24 is motor vehicle crashes.”—Shell Oil Co. Thousands of lives will be saved by the guideways; and thousands more could be saved by automatic street-mode speed limiting, especially the lives of driving teenagers and children playing on the streets.

“DRIVERS” CAN’T CAUSE ACCIDENTS ON THE GUIDEWAYS

If a confused or drunk “off-duty driver” should try to use the car’s throttle, steering or brakes while traveling on the guideway, nothing will happen because the street-mode controls will be automatically disabled in guideway mode. And of course when the cars are on the guideways the doors will be automatically locked so the kids can’t open them.

The guideways will always be constant speed, so there will be no passing. The cars will never be able to swerve into an oncoming lane or run off the road. The linear synchronous motors built into the guideways will be incapable of propelling cars in the wrong direction, or of letting different cars run at different speeds.

PID COMMENT



Keeping the PEACE!

A Guideway System will free up the roadways for Pedestrians, Cyclists, and Tractor-Trailers.

Automobile drivers seem to annoy everybody, especially the animals!

State DOT's will eventually figure out that Dual-Mode is the only way to travel!

PID COMMENT

ROAD-RAGE CRIMES WON'T OCCUR

Not on the REV guideways, because there will be no lane changing, passing, or “cutting in.” The system computers, which will be making all of the decisions, will be located in secure underground vaults. Hackers won’t be able to do their dirty work, because the guideway computer system will be entirely separate from the Internet. The guideways could be sabotaged, but no more easily than streets, highways, railroads, or airlines.

FEAR OF THE NEW AND UNKNOWN

As with all new modes of transportation in the past most of the population will be eager to use the dualmode system, but some cautious souls will resist getting onto the guideway for the first time. They may not trust the system, may be afraid of traveling so fast on the ground, or be afraid of traveling so close to other cars (with no rail-car couplings, or even a trailer hitch, between them).

Guideway phobia is not expected to be a continuing problem however. Thousands of people travel daily on trains at a hundred to two hundred miles per hour in Europe and Japan, and most people are willing to fly at over five hundred miles per hour. Almost all people use the highways (which are far more dangerous than the guideways will be).

Since most of the local 60-mph guideway grids are expected to be up and running before the interconnecting 200-mph system is finished, most people will ride and develop trust in the medium-speed guideways first. One reason that 60mph was picked for the local guideways is that “sixty” is a mentally comfortable speed for most people these days. But “eighty” would raise some eyebrows, and “ninety” would seem too dangerous to most—until they can be educated to the many and vital safety differences between highway travel and guideway travel.

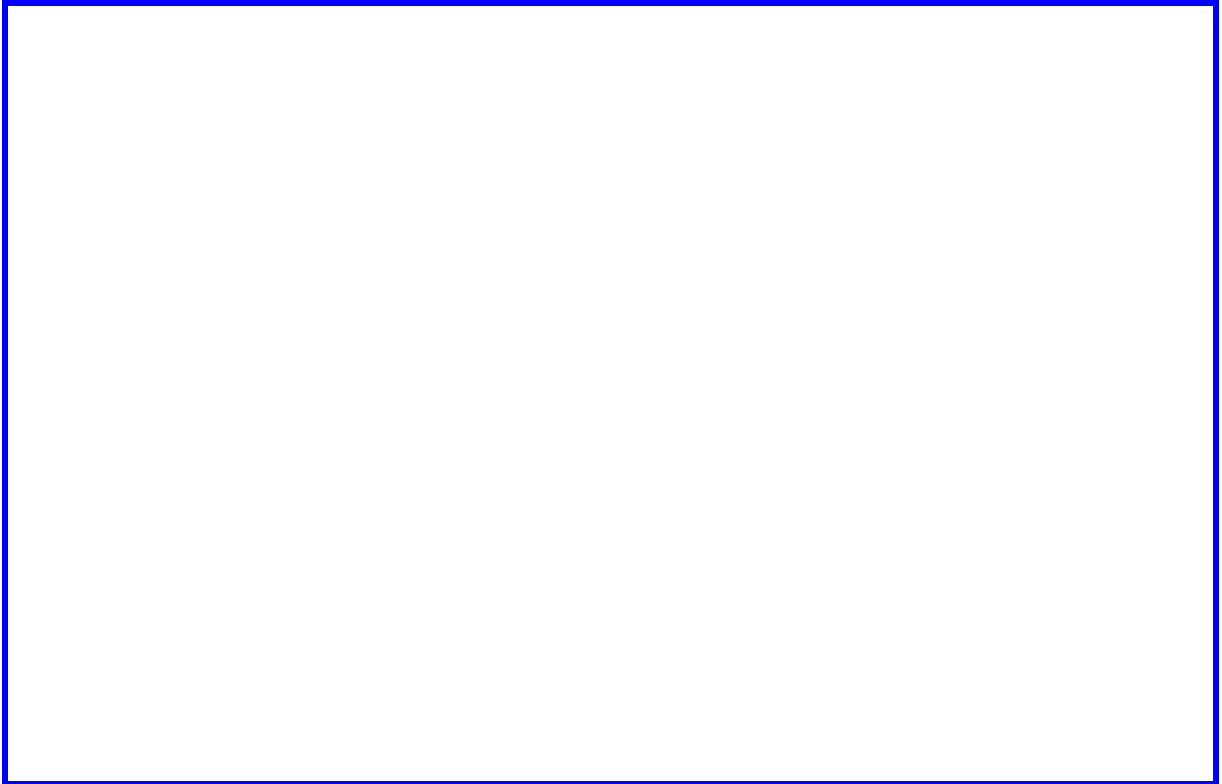
POWER OUTAGES

The power for the guideways will not be transmitted on low lines surrounded by trees, so the reliability of guideway power will be much better than that of some residential power. But even though power failures will be rare, the system must and will be designed such that the loss of guideway power could not cause accidents.

Since all of the cars subject to an outage will be traveling at the same speed and will lose their power simultaneously, they won’t crash into each other but will simply coast to a stop together. The synchronization of the cars will continue after the power is off, through inherent characteristics of the linear-synchronous-motors themselves—the spacing of the cars will remain constant.

LOCAL GUIDEWAY SHUTDOWNS

Power in sections of guideway will need to be shut down occasionally in order to maintain or repair them, and local power failures could also occur. Therefore the system must and will be designed such that shutoff or loss of local power can't cause pileups, and can't interfere with continued operation of the rest of the local and nationwide guideway network. Hopefully the following explanation, in conjunction with **FIGURE 3**, will convey the configuration envisioned by the author.



(missing graphic)

Safe shutdown of REV guideway sections will be accomplished by the use of “turnaround loops.” Circular U-turns will be provided at each end of each section of bi-directional guideway. In normal operation of the system these U-turns will be unoccupied. But at the moment of a local power failure or shutoff, all of the traffic in both directions on the disabled section will be diverted into the U-turns so the traffic will be turned back upon itself. This will form a long closed dumbbell-shaped loop of guideway, shown by dashes in the figure. This loop, which may be miles long, will isolate all of the disabled traffic. The now powerless cars in the loop will partially circle it while coasting to a stop. Synchronism and car-to-car spacing will be maintained by regeneration in the LSMs throughout the deceleration of the powerless cars.

Cars which are approaching the powerless isolated section from both ends, will be simultaneously and automatically turned back by means of another pair of U-turn loops concentric with the first ones at the ends of the disabled section. (All crossing will be at separate elevations.) The computer system will choose detours for the turned-back cars and automatically reroute them. (In normal operation the U-turn loops can also be used to allow any car on the guideway to make an ordinary U-turn and travel back where it came from, if it makes such a request to the system while en route.)

Only one emergency loop is shown in the figure, but the entire guideway system may be visualized as chains of long loops linked together by the U-turns. But actually, in normal operation, the traffic goes straight through in both directions, ignoring the U-turns.

During a power shutdown the guideway radio will direct the drivers of cars delevitated and stopped in an isolated section to drive off the guideway in street mode at the nearest exit ramp. If a car is unable to drive off for any reason, the car behind it can readily push it off. These exited cars will be able to drive on the adjacent highway or street, or to reenter the guideway system beyond either end of the dead section. All cars in a disabled section must leave it and then reenter the guideways, even if the power outage is very brief, since only entry ramps will be capable of accelerating the cars to synchronous speed. As shown, entry and exit ramps for both directions of travel will be provided at each set of U-turns.

The guideway radio will advise all entering drivers and those who are on the guideways, of any local shutdowns, and will keep them posted of any changes while they are en route.

Traffic in and near a disabled section will be inconvenienced, but more distant sections of the system will be completely unaffected. The computer will analyze the changes of plan required for each car affected by a section outage, and will automatically redirect it to the best detour for its particular destination. All of this is very much like the procedures we use when a section of highway or streets are closed. But with the high-tech guideway system it will be done faster, safer, and with less confusion and stress.

NAVIGATION AND MERGING

The Global Positioning Satellite system (GPS) might seem like the obvious tool to keep the computer informed as to where each car on the guideways is at all times so that it can be properly navigated to its destination. But GPS isn't accurate enough for this job, and fortunately there are other better and simpler ways to do it.

We will likely keep track of cars on the guideways by "dead reckoning." This was the navigation system of last-resort for old sailing ships when the weather prevented celestial-navigation readings. If the captain knew where they were when they started,

knew when they left, knew what direction, speed, and how long they had sailed on each tack, knew what time it is “now,” and if his map was accurate, he could “reckon” their present position. But in those days **none** of those things could be accurately determined. Since the input data was poor, these old dead-reckoning calculations frequently gave very poor position information, and doubtless many ships were lost because of it.

But, in spite of its ominous-sounding name, perhaps resulting from its blemished past, dead reckoning is not pseudo science. It consists of nothing but simple physics and arithmetic. Dead reckoning will provide accurate answers for REV because the input data will be accurate. The dualmode guideway system computers will know exactly the position and direction of every car on the guideway at every instant. This constantly changing information will permit reliable and accurate navigation, merging, and demerging data for all cars in the guideway system. Another method for collecting computer data as to where individual cars are would be to query the identification chips in the cars on the fly at selected spots on the guideways. This method **plus** dead reckoning may be used for added safety.

MAGNETIC LEVITATION IS SAFE

Maglev trains have a remarkable safety record. By the end of 1989, the HSST series of German-type experimental maglev trains in Japan and Vancouver Canada had carried 2.67 million paying passengers at speeds up to 191 miles per hour, with a reliability factor of 99.96%, and no accidents. No other form of transportation has ever come close to that record. Several other types of maglev trains have traveled over 300 mph, also with no accidents.

Meanwhile, with private cars as we now know them, we lose nearly as many people on our highways every year as we lost in the Vietnam War. (Vietnam got more press, because highway deaths are taken for granted.) Expanding the time frame, according to Marilyn vos Savant, "Since the start of the Revolution in 1775, about a million Americans have died in wars. And since Henry Ford introduced the mass-produced motorcar in 1913, more than two point five million Americans have met their deaths on the road." Nearly fifty thousand deaths and two million injuries a year occur on U.S. highways. According to a news item, "In the United States more than half of the country's accidental deaths occur in the transportation sector, and more than 90% of these are on the highways."

A Seattle Times headline read: "Forty-two-Vehicle Pileup on I-5. Chain-reaction crash injures 24, closes rain-slick freeway for hours. Two in critical condition." That type of thing happens frequently on our highways; but it could never happen on dualmode guideways. A major factor in the above chain accident and others like it is following too closely for the conditions and the speed being traveled. The recommended two-second spacing (headway) between cars (three or four seconds is recommended at

the higher speeds) is seldom being observed. The more it is violated the higher the accident rates, but the more it is followed the lower the capacity of our highways.

On the driverless 200-mph guideways the synchronized cars will have a minimum time-spacing of roughly five-hundredths of a second at one-foot clearance between cars. This very close spacing will make the system even safer: It is impossible for things practically touching each other to collide very hard. A knockout punch starts way back, not at the opponents jaw.

RADIATION

Like existing trolley buses and electric trains, the linear synchronous motors and maglev of our guideway system will subject the passengers to some electromagnetic radiation and magnetic fields. For over a century humans have lived around high-powered electrical equipment with no apparent ill effects. Some people have now become concerned about the possibility, but the data we have on the subject show no reasons for these concerns.

A 1999 press article reported that a researcher at Lawrence Berkeley National Laboratory had faked links between electromagnetic radiation and cancer. He had tossed out data that didn't support his conclusions. More than 20 studies since have found little evidence that the magnetic fields around electric power radiation cause cancer, a National Institutes of Health panel concluded recently.

I can supply one data point from my own family: My father, who was an electrician in heavy industry, worked with and was often in physical contact with operating industrial synchronous electric motors of over a thousand horsepower. He held that eight-hour-a-day job for thirty some years. He never had a cancer of any kind. He died from the effects of smoking at age 78.

We do know that X-rays, and other powerful ultrahigh-frequency electromagnetic radiation, such as exposure to ultraviolet from the sun, can cause cancer. Because of their very high frequency, microwave ovens may also be dangerous if they leak much radiation. And cell phones, with their very-high-frequency radio waves next to human heads, are under study, but these things are entirely different from 60Hz AC power. Whether or not radiation is dangerous depends upon its frequency. The guideway power frequency will be comparable to if not exactly our regular 60-cycle power, microwaves are a billion or more times higher, and ultraviolet and X-rays are thousands of times higher than that. Engineers at the Canadian Institute of Guided Ground Transport found that "The radiation from Transrapid maglev vehicles won't bother the passengers, their electric watches, or their pacemakers."

"DC" or steady-state magnetic fields such as those from permanent magnets are a different matter than high-frequency electromagnetic radiation, but the media sometimes

confuses the two. However, we see no safety problem in maglev and linear motors from direct magnetism either. “Study finds no cancer risk to kids from magnetic fields,” Cambridge University, Associated Press, December 3, 1999. William Dickhart III stated, “The magnetic flux density in the cabin of the German Transrapid maglev train is about one gauss. The earth’s magnetic field is a half to one gauss, depending upon where on the earth we measure it. A hand-held hairdryer radiates nearly ten gauss, and some electric blankets radiate 100 gauss.” In a mail order catalog I read an ad for a “magnetic therapy” device to wear on the body that claims “eighteen thousand gauss.” Draw your own conclusions. My conclusion is that the ad-writer for that fraudulent device doesn’t know a gauss from a gander.

COMPUTER RELIABILITY

Modern jetliners fly by highly computerized control systems, yet their accident rate is very low compared to that of automobiles. And seventy percent of the airline accidents are from pilot error, not computer problems or something else. Several tiers of redundancy are incorporated in crucial computer systems. If a guideway computer should fail, a backup computer would instantly and automatically take over. But even if the entire computer system should somehow fail the cars won’t crash. The spacing between cars will be held constant by the synchronous propulsion system, not by the computers. It is the design of the guideways and the cars that will keep them safe. All parts of the guideway system will be “failsafe.” By definition failsafe systems are designed such that if they should fail it is only possible for them to fail in a safe mode that won’t endanger life or limb. If there should be a failure on the guideway you are using you might not get to Boston when you expected to, but no one will be hurt.

DUALMODE SAFETY COMPARED TO RAILROADS

Since the REV dualmode guideways will seem somewhat like railroads, let’s compare their potential safety to railroad safety. Accidents due to derailling are common. Derailings will be very rare or nonexistent on the guideways because the guide rails and the guidance system of the dualmode cars will provide much more positive lateral guidance than flanged steel rail wheels on steel rails. Remember that there have been no maglev train “derailings” or any other accident-causing failures.

Another factor we should note is the gauge (the distance between the rails). Railroad “Standard Gauge” (four-feet eight and a half inches) is now much too narrow. It is less than the distance between the wheels on most of our automobiles, yet locomotives and rail cars are far taller, wider, longer, and a great many times heavier. Standard gauge was wide enough for the original rolling stock it was designed for, but the sizes of railroad cars and locomotives continued to grow, while the gauge of the rails couldn’t grow because there were thousands of miles of track and tens of thousands of railroad cars already built. Those standard but too-narrow tracks contribute to a lot of accidents. Our guideway system will be a new start: Its gauge will be optimized for the 21st century, not the 19th.

Opposite-traveling railroad trains routinely share the same tracks, and the time-sharing systems sometimes fail. On August 2, 1999 two trains crashed head on in India. The press wrote, “The final death toll might reach 500. Signal failure may have caused the accident.” But the basic cause of all head-on railroad collisions is running trains in opposite directions on the same track. Accidents are inevitable with such a system. Murphy said, “Anything that can go wrong will.”

Guideway cars will never crash into each other because the cars on a track will all be running at exactly the same speed and in the same direction at all times. Eastbound cars will never and can never share a guideway with westbound cars. The linear motors in the guideways won’t even be able to propel cars in the wrong direction. Did you ever see a surfer riding a wave out to sea instead of in toward the shore? Magnetic waves as well as ocean waves are unidirectional.

Other railway accidents are due to collisions with highway and road vehicles at crossings. In front of me is a newspaper article with the headline, “Amtrak train wreck kills 14.” The train ran into a large truck (or more to the point, a truck got in front of a large moving train). Since trains can’t stop in short distances, and car engines sometimes do stop, and since human drivers are sometimes careless, ignorant, blind, deaf, or stupid, RR grade crossings are a major safety hazard. Yet we still have 280,000 grade crossings in the U.S. All dualmode guideways must and will, from the start, have overpasses or underpasses at all crossings with railroads, roads, highways, pedestrian paths, and with each other.

WEATHER

Slippery wet or icy surfaces won’t cause REV cars to slide off the guideways, because, as we saw in Chapter 11 guide rails will always be guiding the cars. Tire traction will not be a factor either: With maglev the tires won’t even be touching the guideway. Linear motors will propel the cars through magnetic-wave forces, not by applying torque to wheels.

Most of the guideways will be elevated at least several feet; and they will have open structures so as to let snow and debris such as leaves and cones fall through the “tracks.” Railroad trestles with open ties remain free of blocking snow and debris. Also the constant high-speed traffic on most dualmode guideways will blow and melt snow off even better than it is removed by traffic on highways. Ice on highways is a major danger, but a coating of ice on the guideway would be of no concern since ice doesn’t block magnetism.

In mountainous areas we may build snow and avalanche sheds over the guideways, or build the guideways higher than the winter snow depths. These precautions will be a small fraction of the cost of the guideways themselves. Automatic electric heaters in the

guideways might also be used in some spots. All factors considered, weather will be less of a problem for the guideways than it is with any other type of transportation, including airlines.

Electric heaters will be provided in the cars, and air conditioning will be optional for use on the guideways. As on our highways there will doubtless be some shift of traffic from northern east-west guideways to southern east-west guideways in the winter to avoid northern cold, and northerly shifts in the summer to avoid the southern heat.

NATURAL DISASTERS

If a big tree fell across a guideway there would be a problem; so we will clear dangerous trees away from the guideways the same as we clear them away from highways, railroads, and power lines. However, we will never be able to design a transportation system that will be completely immune to disasters: such as tornadoes (put all of the guideways under ground?), floods (put them all on stilts?), or earthquakes (no, don't use stilts). But we can build guideways that will resist disasters at least as well as do the several different transportation systems we now have.

SAFETY BY ELIMINATION

The most effective way, and often the easiest and cheapest way to improve the safety and reliability of something is not to try to improve the offending part, subsystem, situation, or condition, but to **eliminate** it. REV Guideway travel will eliminate the use of a lot of troublesome and sometimes dangerous things.

<u>WHILE TRAVELING ON MAGLEV GUIDEWAYS WE WILL NOT BE USING:</u>	
Engines	Fuel
Transmissions	Traffic lights
Wheels	Road signs
Tires	Sharp turns
Brakes	Slick roads
Steering systems	Flanged-wheel guidance
Throttles	Moving-rail switches
Car Lights	Railroad crossings
Dirty windshields	Human Drivers

<u>BY ELIMINATING THE DRIVERS WE ELIMINATE THE DANGERS OF:</u>	
Lane changing Drunkenness Cutting in Impatience Road rage Tailgating Speeding Bravado Timidity Stupidity Ignorance Inattention Showing off Cell phones Carelessness Forgetfulness Horsing around Looking at instruments Looking at passengers Adjusting air conditioners	Changing music Changing radio stations Controlling of kids Out-of-control kids Eating Strokes Seizures Shaving Drinking Paralysis Heart attacks Combing hair Falling asleep Applying makeup Inexperience of youth Limitations of old age Poor vision Ignoring signs Disobeying laws Driving the wrong way

The guideways will be much safer than our present highways; and the **highways** will also become safer because the traffic on them will be greatly reduced. The automatic guideway parking will reduce congested-area street traffic and make the streets safer as well. As already discussed, if we limit the speed of the street-mode motors in the cars we will further improve street safety.

Not only will REV save tens of thousands of lives a year and untold misery, but also it will save hundreds of millions of dollars per year that is now spent in treating those who are injured on our present systems. And since fewer people will be injured or killed, and fewer cars will be damaged or totaled, the cost of car insurance for all of us should come down. Nah—that won't happen, nothing ever costs less than before.

No form of transportation, including horse and buggy, has ever been completely safe, and dualmode will be no exception. But the REV guideway system promises to greatly reduce accidents due to traffic congestion, weather, and mechanical failures. And the guideways will eliminate accidents due to human drivers, the greatest danger of all.

All factors considered THE DUALMODE TRANSPORTATION SYSTEM will be much safer than any other form of transportation.

Next: [CHAPTER 15](#)

Power and the Environment

PID COMMENT



[Skepticism about GLOBAL WARMING](#)

He wrote, "... convergence of evidence from numerous sources has led me to make a cognitive switch on the subject of anthropogenic global warming. "...[Evidence] around the world has shocked me out of my doubting stance. "It is time to flip from skepticism to activism."

PID COMMENT

Chapter 15

Power and the Environment

CONSERVATION

A lot of people blame the mining, timber, oil, power, automobile, and other industries for damaging Planet Earth, but this is passing the buck. Industries are not at the root of environmental problems; we, the people who buy the products and services industries provide, cause the problems. Without consumers there would be no producers and no environmental damage or depletion of earth's resources. Pogo said, "We have met the enemy and it is us." Of course companies make matters much worse by trying to get us to buy things we don't need. We are a decadent society. Consumption of nearly everything continues to increase because of growing affluence and increasing populations.

According to the U.S. Bureau of the Census middle projections the U.S. Population will be about 325 million in 2020. The world population will be about 7.5 billion by that date, up from around 6.5 billion today. But I wonder if those projections took into account the fact that by 2020 we will be past the world oil production peak. The world population will level off and inevitably fall as available energy per capita falls.

Peak Oil

- ◆ 2% of World Oil Reserves
- ◆ 8% of World Oil Production
- ◆ 5% of World's Population
- ◆ US Consumes 25% of World's Production
— *2/3 imported*

My wife and I are do-it-ourselves environmentalists: We minimize our consumption. We use little water, and especially little hot water (But we bathe every Christmas and Fourth of July, whether we need to or not.) We turn off lights, use the more efficient fluorescent bulbs, and I put this computer into sleep mode when I am not actively using it. When the store clerks ask “Paper or plastic?” if we can manage our purchases without a bag we say, “Neither, thanks. Save the Earth.” Most of the clerks understand our concern, and respond favorably.

We all need to watch ourselves to avoid being hypocritical. We can't logically oppose all timber cutting if we live in houses made of wood and we read things printed on paper. We must not think that energy-gobbling aluminum-reduction plants are bad, because the airplanes we fly in, the pots and pans we use, and the foil we wrap things in are made of aluminum. We can't object to all new copper mines, because our electricity is brought to us over copper wires, and every electrical thing we use contains a lot of copper. We need to watch ourselves on our positions concerning hydroelectric dams, coalmines, oil and gas wells, pipelines, tankers, and nuclear power; because we heat and light our homes, and drive cars with energy harvested by these things.

And we can't fairly argue that these necessary but controversial mines, factories, and infrastructures should all be put in someone else's backyard. To be fair, our personal share of everything that we consume should be produced in our backyard. But who

wants to be **that** fair these days? I was just reading about a group that was trying to prevent the installation of a cell-phone tower in their neighborhood. I trust that none of those complainers use or will ever use cell phones. Maybe they would prefer a steel mill in their backyards instead, so there will be steel for their next cars.

GLOBAL WARMING

“Global warming” has been a controversial subject for the last few years, even among the scientists. To start with many scientists said that mankind’s actions have little or nothing to do with it, that this is just another warming cycle in the natural cyclic temperature-swings of nature. But as time went on, more and more qualified scientists came to believe the pollutants that mankind is dumping into the atmosphere in greater and greater amounts are indeed largely responsible for the frightening rate of melting of the glaciers and polar ice caps with resulting higher sea levels, for the serious changes in weather patterns all over the world, including hurricanes, and for the extinction of many species.

SCIENTIFIC AMERICAN magazine has a monthly column called the Skeptic. It is written by Dr. Michael Shermer, who has graduate degrees in experimental psychology and in the history of science. Shermer was a college professor for twenty years, is the founder of the Skeptics Society, Skeptic magazine, and a Distinguished Science Lecture Series at Caltech. His chosen field is questioning and often challenging theories, assumptions, and pseudo sciences.



FLOOD, FLOOD, FLOOD!

How many times will Communities have to be devastated before everyone starts to wise up!

I doubt very much that anyone who experiences a major flood in the town laughs at the Global Warming debate. Some seem to forget too quickly, so it has to happen again!

In his column in the June 2006 issue of SCIENTIFIC AMERICAN Shermer acknowledged that for years he has been skeptical of the theories and “evidence” on global warming, but he no longer is. He wrote, “... convergence of evidence from numerous sources has led me to make a cognitive switch on the subject of anthropogenic

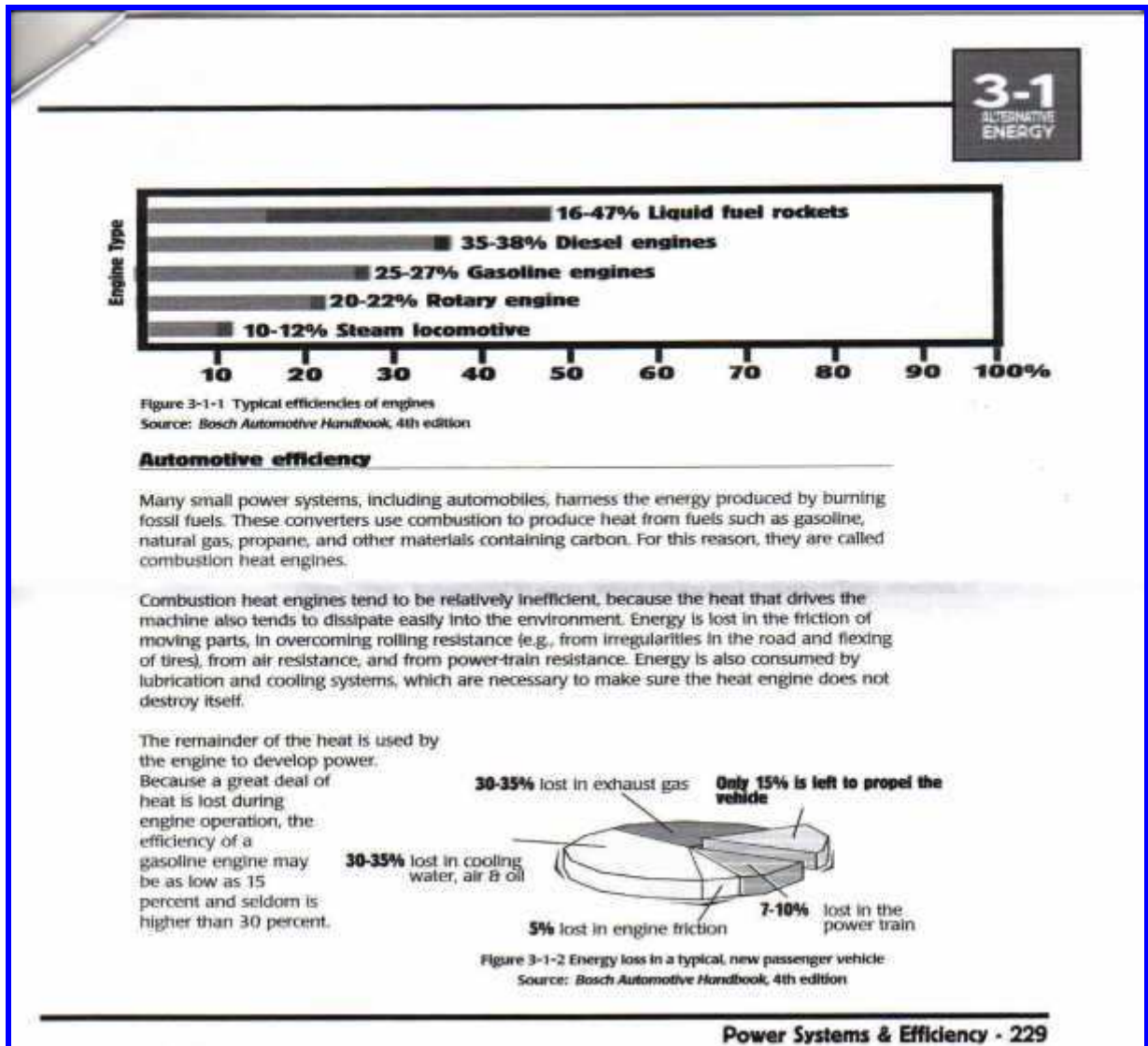
global warming. "...[Evidence] around the world has shocked me out of my doubting stance. "It is time to flip from skepticism to activism."

On June 22, 2006 The National Academy of Sciences released a 155-page report to the US Congress, in which a panel of top climate scientists concluded many things about global warming, including the following: "Human activities are responsible for much of the recent warming." "The Northern Hemisphere is the hottest it has been in 2,000 years." "The warming in the last few decades of the 20th century was unprecedented over the last 1,000 years." "Sharp spikes in carbon dioxide and methane, the two major 'greenhouse' gases blamed for trapping heat in the atmosphere, began in the 20th century after remaining fairly level for 12,000 years. Between 1 AD and 1850 volcanic eruptions and solar fluctuations were the main causes of changes in greenhouse gas levels. But these temperature changes were much less pronounced than the warming due to greenhouse gas levels by pollution since the mid 19th century."

This excess CO₂ is coming mostly from the burning of fossil fuels at ever-increasing rates. Burning anything with carbon in it, including the huge amounts of gasoline and diesel oil used in our cars, trucks, and airplanes, makes carbon dioxide that ends up in the atmosphere. National and International Dualmode Transportation will eliminate the major share of CO₂ generated by transportation, provided that we make the needed electricity by non-CO₂-releasing methods.

POWER AND ENERGY

We are used to flipping a switch and an electric light or some other device comes on, so we tend to think that the source of power for these conveniences is electricity; but that is an oversimplification. Electricity was the carrier of that power, but the energy in it had to come from petroleum, natural gas, water flowing downhill, the fission of uranium, the sun, the wind, biomass, geothermal, or some other real source of energy. By "real" I mean available to us. Electric power is not available in nature, except for lightning, which we have not harnessed. Going back two steps further, most of the sources we use to make electricity originally got their energy from the sun, which in turn gets it from the nuclear fusion of hydrogen into helium. A wise man once wrote: " $E=MC^2$ ", which applies to both nuclear fission and nuclear fusion.



Power and energy are not the same things, by the way. Power is the rate of expending energy. In other words, power is the amount of energy used divided by the time it took to use it. Electric power is measured in watts, kilowatts, or megawatts (one megawatt is a million watts or a thousand kilowatts). But our electric bills list the kilowatt-**hours** of **energy** we have used. When talking about automobile engines we measure their power in horsepower. One horsepower equals 746 watts or 0.746 kilowatts, in case you have been wondering. (If you haven't been wondering, it is still 746 watts.)

PETROLEUM DEPLETION

In 2002 the global price of crude oil averaged twenty dollars a barrel. In April of 2006, as I write this, crude is going for over seventy dollars a barrel. Three-and-a-half **times** as much in only four years. Maybe we have a little problem here.

According to fellow dualmode-transportation researcher and fossil-fuel expert Dr. Richard Guadagno, we are now burning the earth's petroleum reserves at a rate 20 million times that at which they were accumulated in the earth's crust. Like tomorrow we will have maxed out all of the fuel credit we can find, with no way of paying any of it back. We will be petroleum poor almost immediately, and petroleum bankrupt in several decades.

Perhaps you have read of extensive deposits of "tar sands" and "oil shale." But the problem with them is that they are so difficult to extract and refine that we would have to use a lot of energy in digging and processing them; there would be little net energy gained. Therefore these and other fuels from marginally productive deposits will be disappointingly if not prohibitively expensive.

Guadagno went on to say that there is an almost negligible possibility that we will ever find another oil reserve of the size that was found in the Persian Gulf. But if we should be so lucky, at our current rate of consumption that new find would delay our "running-on-empty" point by only about ten more years. The George W. Bush administration is promising (or threatening?) to open up the Arctic National Wildlife Refuge and the Florida Gulf Coast to oil exploration. The Florida Coast is estimated to hold 396 million barrels of oil. That would yield only twenty days worth of the oil consumed in the US alone, according to a New York Daily News article. Should we take that bit of "chemotherapy" or shut down the United States twenty-days sooner? As with terminal cancer, the choice is difficult because the outcome is essentially hopeless either way. Dualmode is the only known therapy that will offer great and extended relief for transportation—if we can develop it soon enough. Again like cancer, early action is of the essence, and we are not early in this case.

When you are creeping along in rush-hour traffic at 5–mph, and you see others whizzing by at 60 or more miles per hour while watching TV on their dashboard screens, you will figure it out!

PEAK OIL PRODUCTION

There are two definitions of “Peak Oil” currently being used. The meaningful one is that at “Peak Production” the worldwide demand for oil will begin to exceed the amount of oil that is being produced, or can be produced in the near future. The other definition, which I suspect was originated by some writer who did not understand the problem, is that at “peak oil” half of the world’s recoverable oil supplies will have been used. This latter “point” is something that can never be determined accurately, and it has little to do with whether or not we are currently producing enough petroleum products to meet the demand. The thing that is going to bite us and cause great upheaval, is the point beyond which we can’t get enough fuel for our cars, and for all of the farm implements, mines, factories, and trucks and freight trains that make and deliver our food and everything else that we consume and depend upon.

A number of experts in the field have studied and written about the worldwide peak-petroleum production date. On February 20, 2005, EV World (Electric-Vehicle magazine) published an article titled, “The Global Nutcracker Called Peak Oil,” by Jan Lundberg. Mr. Lundberg was the former publisher of the oil industry Lundberg Letter, and now directs the efforts of Culture Change. In the EV article Lundberg points out that it will be a relatively long time before “all of the oil is gone,” but that is not the date we should be looking at. The very much closer and much more frightening date is the point of peak production—where all of the available producing wells are being pumped at their full capacity. At that peak the production from old wells will start to decline faster than new wells to replace them can be found, drilled, and pumped. But the demand for oil is not going to peak at that time or for the foreseeable future; the demand will continue to escalate just as it has for over a century.

What will happen right after the peak-oil date? Lundberg devotes several pages to the answers. In very brief summary: Since supply can no longer keep up with demand at that point, there will be an immediate oil shortage that will rapidly escalate. The price of

gasoline, diesel, fuel oil, and natural gas will increase at an ever-higher rate. (Natural gas prices will also go up because it will substitute for oil in some uses. The peak-production date for natural gas may be only twenty years away). And the cost of electricity will go up because some of it is produced from oil and gas. The price of coal will also go up, because half of our kilowatt-hours come from coal, and that percentage will increase. With all energy costing more, the price of food and other necessities will also be forced up.

Without enough gasoline some of us won't be able to get to work, so our jobs won't get done and the GNP will fall—and some paychecks will stop coming. And some of us won't be able to get to the grocery store to buy food. Food availability will also decrease, since many farmers will have to reduce or terminate production because they are dependent upon petroleum-fueled agricultural machinery. The shortage of trucks with fuel in the tanks will keep some food from getting to market even if the food was produced.

If that isn't enough, worry about how most of us temperate-zone dwellers are going to keep our homes warm through shortages of oil, natural gas, and electricity. Most people have been quite oblivious to our enormous and vital dependence upon petroleum. When oil production peaks, all hell is going to break loose.

How soon? In the United States (including Alaska) our peak-production point has already passed—over three decades ago. That is what is meant by our “dependence upon foreign oil;” but as long as our credit is good, we can survive dependence. There is no way on earth (literally) that the United States could become independent of foreign oil, unless we annex the whole Middle East as our fifty-first state. Worldwide the peak production date is estimated by some to be 2006 (which is **this** year, as I write), and estimated by others to occur as late as ten years from now. It will take at least 20 years to build our dualmode system. If that doesn't scare you, you are not listening.

An article very similar to Lundberg's appeared in the September 2004 issue of SCIENTIFIC AMERICAN. Under the title, Oil Haves and Have-nots, author Rodger Doyle covered, in particular, the effects that passing the peak-oil-production date will have on the stock market, the world economy, and the increase in political, national, and international tensions that will result.

Many other thinking people have seen this post-peak-oil catastrophe coming, and have studied it seriously; but little has been written about it in the public press because of major concerns over starting panics and affecting current business: The oil companies don't want to talk about it. The automobile companies don't want to talk about it. And the politicians and administrators don't want to talk about it. This potato is just too hot to handle, but we are going to get much more seriously burned if we fail to handle it.

We can only hope that most of the estimates of the peak-production date turn out to be too early, and hope that the world will wake up and go to work on dualmode—full-speed ahead—now. The sooner we act, the more lives, dollars, pain, frustration, and additional damage to Planet Earth we will save. Civilization will still be in big trouble, but the guideways will greatly reduce the crises.

COAL

More than 90% of the United States fossil fuel reserves are coal, not petroleum or gas, but “Coal supplies only 0.1% of the total national transportation energy requirement.”—Dr. Hal B.H. Cooper, and Richard J. Buck. (That figure was higher when locomotives used coal instead of diesel oil. The railroad people also discovered that oil is more convenient to use than coal.)

Automobiles won’t run on coal, nor will diesel trucks or buses. But slightly over half of our electricity now comes from the burning of coal. Every expert will give us a different answer, but they have said that in something like two hundred years the world’s coal will be largely gone. That is the bad news. The good news (in this case a whimsical byproduct of the bad news) is that the production of man-made global-warming carbon dioxide will decline as we run short of things to burn.

Hopefully, before the coal runs out we will have ample electric power from wind, the sun, geothermal, tidal, and other sustainable nonpolluting 21st-century power sources. Best of all would be achieving that elusive goal, controlled nuclear fusion. The point is that an all-electric dualmode system will not be adversely affected by changes in the sources of its energy; while most automobiles, buses, and trucks as we know them will be out of business when our petroleum is largely gone; and that will be very soon.

We can produce internal-combustion-automobile fuel from coal, but it is expensive, inefficient to produce, and carbon dioxide would be released by the coal-to-oil conversion plants as well as by the vehicles themselves. In an article in the May 2006 SCIENTIFIC AMERICAN, Gunjan Sinha wrote that in 2006 a plant will be built in Gilberton, PA to process 1.4 million tons of coal a year by a Fischer-Tropsch synthesis to produce approximately 5,000 barrels of diesel fuel a day. It is estimated that the price of crude oil needs to be \$60 a barrel or more to make the coal-to-oil process attractive. The intent is to use “waste” coal, discarded because of low energy content. Approximately half of the coal mined ends up in the waste pile at some mines.

However, we must not forget the enormous amount of CO₂ released in the coal-to-oil processing as well as by the diesel vehicles on the highways. “Unless scientists develop methods to sequester CO₂ and find other uses for the gas, the technology might languish, warned Rudi Heydenrich, business manager of South African energy giant, Sasol.” Liquid fuels can also be made from natural gas, at less cost and with less carbon dioxide emission, but natural-gas shortages are already boosting its price enormously.

All bets are off on the old predictions as to when we will run out of coal and natural gas, because they were based on the usage rates at the time the estimates were made. Now, with more demand for electricity, and with gas and coal substituting for oil more and more, the smelly stuff and the black stuff will be gone much sooner. In a Wall Street Journal article it was stated that Appalachian coal cost \$29 per ton in 2002, and \$58 per ton in 2005. **The price of coal doubled in the last three years.** Note that the costs of all three major fossil fuels are **already** climbing very rapidly.

ENERGY FOR THE GUIDEWAYS

When the petroleum and natural gas are gone we will need much more total electric power than we now use. Electricity, which can be made from any source of energy, is our most convenient and versatile energy carrier. Therefore it will be called upon to meet a high percentage of the energy requirements now met by oil and natural gas. In the United States, transportation now consumes 65% of the oil we use (Data from South Carolina Energy Office, Transportation Sector). Our dualmode system, being electric powered in both modes, will use the lion's share of the additional electricity we must then generate. REV must be designed to use only electrical energy in both modes, because electricity is the only single form of energy we can make from all of the different sources of energy that we will have to use during the coming energy crisis.

BIOFUELS

There are currently no alternative fuels that could replace gasoline and diesel oil for a significant percentage of our existing internal-combustion-powered vehicles. Ethyl alcohol, a common biofuel, is often added to gasoline these days. But it, like most fuels, contains carbon (somewhat less than gasoline) and releases global-warming carbon dioxide when it burns. However, there are more basic reasons why we won't be running all of our cars on alcohol, biodiesel or some other biofuel: If we plant the billions of acres of crops needed to make the required enormous amount of biofuels we probably wouldn't have enough arable land left to feed everyone. I suppose we could give people a choice: "Do you want to drive or to eat?" Unfortunately the rich people would drive **and** eat, while the poorest might be unable to do either. Another problem is that in most places crop-growing to make biofuels would require more irrigation, and fresh water in most of the world is an increasingly "endangered species."

Even if we could plant, grow, and harvest enough biomass, then ferment it and distill off the alcohol, or make biodiesel, it would be highly labor intensive and therefore very expensive. Diesel from reclaimed vegetable oils? Sure, make biodiesel out of all the waste vegetable oil we have, but that is a drop in the bucket (or kettle) compared to the fuel we burn in our cars.

POWER FROM THE WIND

Wind power is an indirect form of solar power: Heat energy from the sun creates

“weather” including the winds. Wind turbines continue to be one of the most promising sustainable sources of electric power, but these systems too have their limitations and detractors. Some people don’t like the appearance of wind-turbine “farms” on the landscape, and some people living near them object to the sound made by the rotating turbine blades. Several years ago there was a lot of concern expressed over the danger of the whirling blades to birds and bats, but recent studies have shown that these fears were exaggerated. The Audubon Society is now becoming more accepting of wind turbines except in a few bird-migration paths.

Wind farms have been seen on some horizons for a decade or more, but large modern efficient reliable turbine farms are currently being installed in dozens more locations all over the world, including big wind farms in the seas. The total capacity of operating wind farms worldwide was 59,000 megawatts in 2005. That amounted to 1% of the electricity produced in the world. By 2010, with tens of thousands of additional wind turbines, The World Wind Energy Association expects 120,000 megawatts of wind power to be available. “Wind power is the fastest growing form of electricity generation.”—Wikipedia.

Generally the cost of wind-electric power is now less than a fifth of what it was a decade ago, and the cost will continue to drop as the technology improves and production increases. In some places wind power is said to cost less per KWH than fossil-fuel-generated power. Encouraging indeed, if we can believe it.

As wind-turbine technology has progressed we have seen their supporting towers get taller and taller. There are two reasons for this: A taller tower permits longer turbine blades that generate more power; and the wind velocity increases as we get away from the ground, which generates still more power. What about getting way above the ground, say up in the jet stream where the wind blows at speeds up to 200 miles per hour? But that is at altitudes of twenty to fifty thousand feet. We can’t build towers quite that high, but we could fly kites that high, with special strong light tethers.

The great wind power in the jet stream has not been ignored in our search for sustainable energy sources. Sky WindPower Corporation in San Diego is attempting to develop a practical system of this type. They would use very large wind turbines wherein the blades would both generate power and provide the kite-like lifting surfaces to keep the system up in the jet stream.

SOLAR POWER

Howard Simpson, writing in the Seattle Times of June 9, 2001, reminded us of the limitations of direct solar power—it has as many disadvantages as hydroelectric dams, fossil-fuel power plants, and nuclear power plants. He wrote, “Solar power is about thirty times more expensive than nuclear power and takes 15 square miles to produce

1,000 megawatts of power. That is about the power of one dam. The best-known and most direct way for us to capture power from the sun is to use solar cells (photovoltaic cells). In the past such cells have been very inefficient and their cost has been high, but development of new and better types has been rapid. We may someday see significant power-grid electricity come from solar-cell farms, but like wind-turbine farms and biomass fuel farms, solar-cell farms require a lot of area, and of course work best in the tropics. The average power received from the sun in the temperate zones, when it is shining, is about 340 watts per square meter, but the most efficient solar-electric-power systems currently available can collect and convert only about a tenth of that.

NUCLEAR POWER

Nuclear power plants supply a high percentage of the power in many countries, and they will doubtless continue to do so for decades. Nuclear fission produces over seventy-five percent of the electricity in France. In the United States the figure is twenty-percent nuclear as of 2006. The Three-Mile Island and Chernobyl nuclear-power accidents were serious, and deadly in the latter case, but the lessons we learned from them will reduce future nuclear accidents. However the many dangers associated with nuclear fission power are still of great concern.

Nuclear fission power will probably play a significant role in powering our dualmode guideways in their early years. But if we use a lot of nuclear power, we will eventually run out of suitable uranium ore, maybe about the time we will run out of coal. However, the development of a simple clean safe nuclear-**fusion** power system would be the invention of the twenty-first century. That is the one that would make the future of mankind bright again.

OTHER NONSOLAR ENERGIES

Geothermal energy is popular in volcanic areas such as Iceland. The heat in the earth is “unlimited,” but the technology required to harvest it in non-volcanic areas is still many years off, if it is achievable at all.

The tides are caused by the gravitational effects of both the moon and the sun. They steal their energy primarily from the rotation of the earth, not from the sun’s radiation. Tidal energy will be constantly available (for millions of years anyway) but tidal power plants will be limited to seashores where there are large tide differentials, and further limited to narrow-mouth bays or estuaries that serve to concentrate the energy. The Bay of Fundy in Nova Scotia now has a trial 20-megawatt tidal power plant. The total amount of tidal energy that could be harnessed at that bay is said to be enormous. There are now only three operating tidal-power plants in the world, the largest being a 240-megawatt plant near St. Malo, France. As the need for power increases and its cost rises, we may see more tidal-power plants built.

HYDROELECTRIC POWER

From the energy standpoint current opposition to hydropower is very unfortunate, because it is a form of “free” solar energy, it is plentiful in many areas, the output is relatively constant day and night and from season to season, and the equipment is thoroughly developed, reliable, efficient, easy to maintain, and long lived. No alternative power now being developed has all of these advantages. Hydroelectric power is a major source worldwide, and the primary source of energy in a number of countries and in parts of the United States. Let us hope that it remains so. But the “damn the dams” efforts to save salmon are causing more dams to be removed than there are new dams being built. And hydroelectric power, along with sufficient water for irrigation and domestic use, are being threatened by changing rain and snowfall patterns due to global warming. In the United States we generate less than half as much hydropower now as we did in 1973.

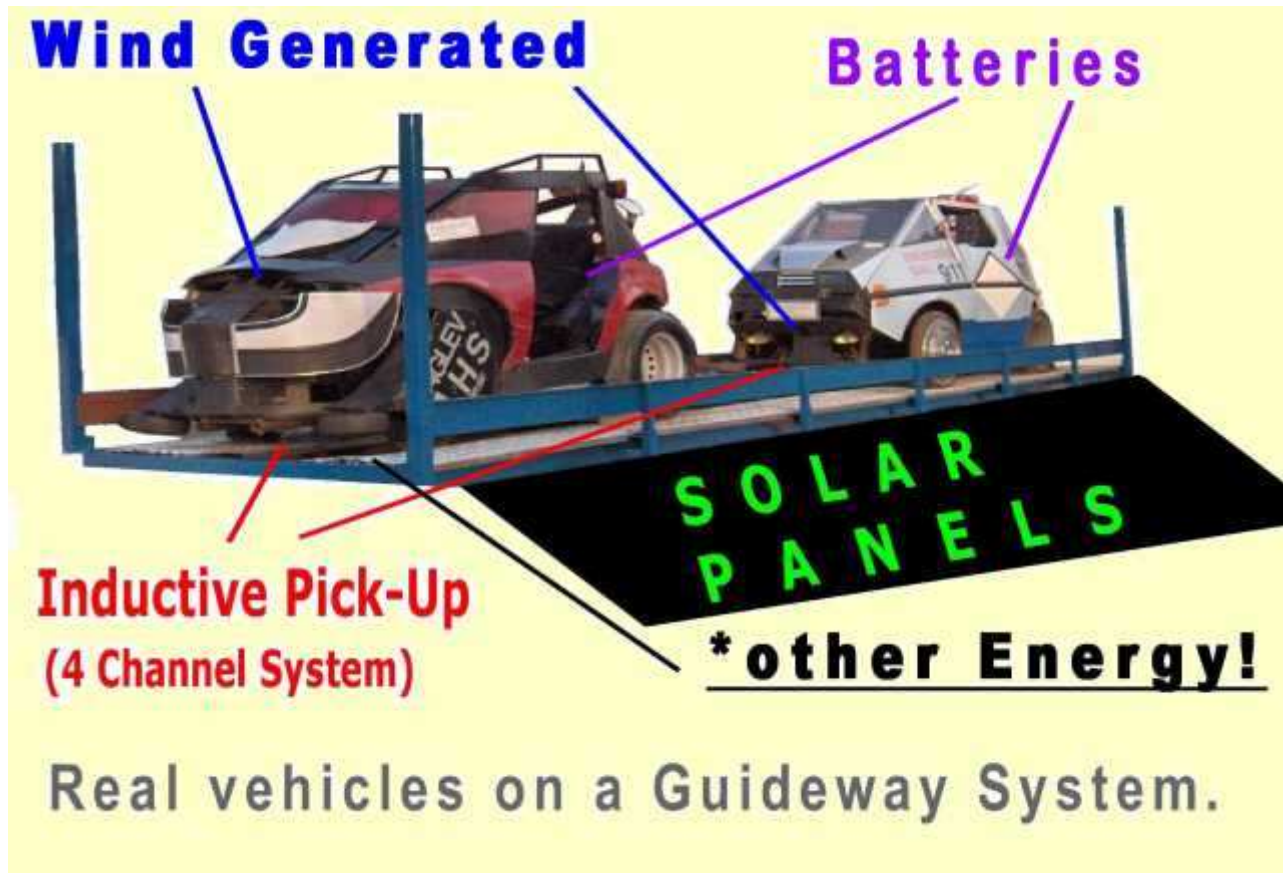
THE BIG SAD PICTURE

In 2005, in the United States, 50% of our electricity was generated from coal, 19.5% was nuclear, 19% was from natural gas, and 3% was from oil, all **fossil fuels, and totaling 91.5%**. Hydroelectric power accounted for 6% of our electricity in 2005. Therefore, if we accept these rounded-off numbers from the Nuclear Energy Institute, **all of our other electric power sources together amounted to only 1.5% of the grand total**. Ladies and Gentlemen, we have a long, long way to go before our nation, or any other nation can generate 100% of their electricity from green sustainable sources. In fact the true picture for the next century is even worse than those numbers indicate, because hydropower is on a steep downward slope for the reasons mentioned.

Have a nice day. Any of you with an in with God are urged to pray for the successful development of practical fusion power. Supporting fusion research wouldn't be a bad idea either. But wherever our electricity will come from, all-electric dualmode appears to be the only concept that will make modern future transportation possible after the fossil fuels are gone.

Next to: [CHAPTER 16](#)

Urban Sprawl



MULTIPLE ENERGY SOURCES!

Using a Guide-way System, vehicles no longer have to rely on a single source of energy. The simple fact that the world's global fleet of 1 BILLION vehicles rely on fossil fuels is complete stupidity. When that energy starts to dry up or become increasingly scarce, the consequences will become phenomenal!

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 16

Urban Sprawl: The Suburbs

When towns first developed, the residents lived close together because walking was about the only way to go anyplace. People near the center of a town had to walk the least; so central land was the most desirable and its population density increased. Urban land prices therefore rose and large lots were subdivided, further increasing central population densities. In the larger cities people began to live literally on top of each other in multistory apartments and tenements.

PID COMMENT



[Sprawl anyone?](#)

The automobile brought about some good opportunities, but now it is time for change. A revolution usually occurs about every 50 years, so something new has to come ASAP!!

There is no feasible way for cities to continue on with ever growing populations in the next ten years. At this current trend, the State of New Jersey will run out of open space in approximately 20 years!

PID COMMENT

Horses, bicycles, and later the streetcars helped to prevent even greater central densities, but density reversal started in earnest when the automobile became common. Cars allowed people to live farther from the center of things—farther from the grocery store, school, church, their work, their relatives and friends, and farther from train stations and bus depots. Our cars make it possible for most of us to have more space, more privacy, be safer, and get back a little closer to nature.

An article in the New York Times, December 5, 1999, informed us that the majority of all Americans now live in the suburbs. The US Census Bureau says that 140 million of us (counting my wife and me) are suburbanites. The article went on to note that modern suburbs are like cities in horizontal form, and that they have almost everything that one will find in high-rise cities. It also observed that most new jobs are in the suburbs.

Having more land to live on doesn't necessarily mean greater cost. I wonder how many acres, or even square miles, of land one can buy in some places for the price of one square foot of land in the center of Manhattan, Los Angeles, London, Tokyo or Paris?

We have just examined the origins of urban sprawl. As our urban areas sprawled out they become less dense and therefore sub-urban. This relatively recent phenomenon developed primarily because of the affordability, convenience, effectiveness, and speed of the private automobile.

URBAN SPRAWL IS GOOD

Urban sprawl in modern civilized society is deplored by some; but whether sprawl is seen as favorable or unfavorable depends upon who is doing the looking and with what in mind. Some suburb bashing is sour grapes from disgruntled city-dwellers, and businesses in the big-city oppose sprawl because it results in loss of urban business to stores in the suburbs. "Cars made the sprawl possible, and more sprawl makes more cars necessary. Then the cars become gridlocked, use up the petroleum, and pollute the atmosphere. Cars are therefore bad, so sprawl must also be bad." That seems to be the mindset of many people, but that is narrow thinking. It assumes that these current

disadvantages of sprawl and excessive automobile traffic are inherent and impossible to correct without eliminating cars and the suburbs. That assumption is wrong.

Dualmode transportation will retain the good in automobiles and the good in sprawl, but get rid of the bad. It will largely solve the fuel, traffic, and environmental problems without packing us back into even more dense cities. Whether some planners like it or not, the advantages of suburban living are so great that suburbia is not going to go away, and neither is private transportation, which made suburbia possible.

I recognize however that good farmland is being taken over by suburbs. This is unfortunate and ultimately destructive. Laws of various kinds and financial incentives are being and must be used to minimize the loss of agricultural land.

We need to note that traffic jams are not due to the total number of cars in the world, but due to an excessive density of cars in local areas at certain times. Sprawl, almost by definition, means a reduction in density, so in the suburbs traffic and parking problems are reduced. Where is traffic congestion worse, in suburbs or in the center of large cities? So we can argue that the suburbs are not the problem, the crowded cities and the choked highways to and from the cities are.

DENSITY IS THE ROOT OF THE PROBLEM

Traffic frustrations are not new. They are functions of population-density, traffic-density, and transportation-system capacity. There were serious traffic jams and accidents in dense cities even when we had only horses and bicycles. A horse-drawn dray in Paris killed Pierre Curie (scientist-husband of Marie) in 1906.

PID COMMENT



City Driving!

People think they are frustrated now, they have not seen nothing yet! As more and more drivers enter the roadways every year, the city becomes

more congested. Driving in Los Angeles or NYC can be a real challenge, especially if you are lost!

PID COMMENT

The guideways will rapidly and almost completely eliminate highway traffic problems. With automatic parking from the guideways they will also greatly reduce urban street traffic problems. And eventually our dualmode system will further reduce street-traffic density by reducing the density of the cities. Current single-mode transit systems, on the other hand, tend to encourage high-density living, since users want to minimize their walk to the closest transit station or bus stop. The extensive revival and use of any conventional transit system would be like regressing to earlier times when people had to walk because there were no automobiles. By reducing population density our universal dualmode system will further encourage the wonderful suburban living that the automobile made possible.

With automobiles, the lower the population density, the fewer the parking problems. But trips that use both autos and public transportation require intermediate parking. In the future, with REV dualmode transportation, there will be no park-and-ride lots, fewer bus depots and passenger-train stations, and much less traffic and parking at airports. Except for cross-country air flights and overseas trips, dualmode cars will seldom be parked at other than their final destinations.

Dense city cores and densely populated residential areas were necessary in earlier times, but the density of the optimal city is now lower because we can travel farther in the same length of time. That is, we could a few decades ago before the gridlocks developed. And better transportation is not the only factor that makes dense living obsolete: The mail system, e-mail, telephone, cell-phone, radio, TV, and Internet have all but eliminated the isolation of those living farther away. The abandonment of large dense apartment-house areas in some major cities is further proof that high density no longer has the value that it once had.

I leave the effects of density upon poor people to the sociologists, except to note that poor people live in the country and suburbs as well as in the cities. Millions gradually migrated to the cities in earlier times for a hopefully better life. Now, with dense areas crumbling, and with much more transportation and jobs available in the country and suburbs, that better life for the poor is often in the suburbs. This will be especially true with our guideway transportation system. These thoughts will be expanded in the next chapter.

There will be much nostalgic defense of obsolete cities. If, in the future, few but the nostalgic and the tourists inhabit, visit, and shop “downtown” (and trends in that

direction have been evident for decades) traffic problems in city cores will largely disappear. Also, as more people stay home and watch the game or the concert on TV, and do more of their shopping on the Internet, there will be fewer traffic problems at those events and at the malls. Crowds of any kind are self-limiting: The joys of being there are balanced against the inconveniences of getting there and back.

Commuters, vacationers, fans going to sporting events and concerts, shoppers, and people visiting friends and relatives will use the REV. In urban and suburban areas trips to the local supermarket will be made in the street mode, and elementary schools will be reached largely by street mode. Since higher-education facilities are generally more distant, many college students who live at home will use the guideways, either in private dualmode cars or by dualmode transit. Trips to the airport will usually be on the guideways, but there will be far less domestic flying.

As further sprawling (which the dualmode system will encourage) takes place, guideway use will increase, making them still more affordable, and more people will be able to live the good life that suburbs.

Next: [CHAPTER 17](#)

Economics of a Dualmode System

PID COMMENT



PID COMMENT

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 17

The Economics of Our Dualmode System

The cost of the guideway system should not be an item in the national budget and should never be added to our taxes, to the deficit, or to the national debt, because it will be a moneymaker, not another expense. The guideway system should be financed by investors and amortized by automatically charging every vehicle that uses it (and most vehicles and their owners will use it.) Those who don't want the guideways won't have to help pay for them. If they later change their minds and use the system, they will be paying their share through guideway use fees.

A national guideway system in the United States, and in many other countries, will make economic sense because there will be a tremendous demand for it use. Unlike products where companies create consumer demand through advertising, a huge demand for better transportation already exists. Present automobile users will be the largest guideway customer group; but the fact that the system will also carry transit, freight, and other commercial vehicles will further increase the profitability of the guideways. And the services to be offered won't be just a little better than the transportation we have now; they will provide huge improvement that few travelers and shippers will pass up.

The guideway system will hopefully be designed, built, and operated as a government-monitored private consortium. The money to build it will probably come from the sale of guideway bonds and stock. Most of the bond and stockholders will also become paying users of the system.

The REV vehicles will not belong to the guideway companies, so they won't be part of the system cost any more than the cost of the cars on our highways is considered part of the cost of the highway system. Most people, companies, and governments will buy and own their dualmode cars; but some will rent or lease them.

Bear in mind that the guideways will be universally used, like our highways are. If we build a light-rail system or a personal rapid transit system it will almost always have to be heavily subsidized because it will have a relatively low use factor. But a dualmode guideway system, built at comparable costs per mile, will accommodate all of the cars, buses, and freight, and therefore won't need subsidies. Quite the opposite, the private and commercial vehicles on the guideways will pay guideway taxes, just as highway vehicles now do through fuel taxes and vehicle taxes.

Guideway use will sell itself. Commuters stuck in highway gridlock who see the adjacent guideway traffic flowing at a constant 60 or 200 miles an hour will most likely start using the guideways, and guideway profits will increase. If one fruit company now shipping its produce by air or truck sees that its competition is shipping by the guideways and their market share is increasing, the guideways will gain still another customer.

WHAT WILL OUR NATIONAL DUALMODE SYSTEM COST?

How the heck should I know? The best guesstimates at this early date would be extremely broad-brush and probably way off. But the enormous total cost of the guideway system will be almost a secondary consideration, since it will be operated as a business, rather than a tax burden. But if you need numbers, my uneducated guess is that the entire national system will cost several trillion dollars. So what? Big projects always cost big money. Like the enormous railroad and the highway systems, the enormous guideway system will be worth its cost many times over.

We read of huge and most discouraging dollar-per-mile figures on some current transportation projects. Understandably these costs, sometimes way over a hundred million dollars per mile, are especially high in dense city areas. We will certainly have some similar high costs per mile of REV guideway in dense areas. And likewise, the lower guideway costs in less dense areas will be comparable to the costs of new rail routes and new highways in these low-density areas. By mass production of the required guideway and electrical/electronic components, maybe some of the rural-area guideways could be built for twenty million dollars per mile or less. Don't quote me.

But much more important than the total cost of the system is the question, "Can it pay for itself?" The answer is, "Definitely yes." The cost of the guideway system will be amortized by a hundred million or more trip fees daily. Let us assume that shortly after the completion of the guideways, on the average they are operating at only one tenth of their capacity, and assume that the guideway-use fee for passenger cars is ten-cents per mile on both the 60 and the 200 mph guideways. As I write, the cost of gasoline is over three dollars per gallon and rising rapidly. If, by some miracle, it is still only three dollars when the guideways are finished (impossible), your regular automobile would have to get 30 mpg in order to match a \$0.10 per mile guideway fee. Ten-cents a mile on the guideways would be a great bargain since the guideway users won't have to fight traffic and will get to their destinations much sooner and safer, with little wear on their vehicles.

PID COMMENT



PID COMMENT

At ten-cents per mile and traffic at one-tenth of capacity, the system would have a gross income of \$1,700,000 per mile of 60-mph guideway per year, and \$5,808,000 per mile of 200-mph guideway per year. Many years later, when “everyone is using the guideways” and the population has also increased, we might be approaching system capacity in places. Running at theoretical full capacity the 200-mph guideways would gross fifty-eight million dollars per mile per year. Not bad. Picking numbers out of the air, if there were ten thousand miles of 200-mph guideway and ten thousand miles of 60-mph guideway, all operating at an average of half capacity 24-7, and the guideway fee still at ten cents per mile, the gross income of the total system would be three hundred and seventy-five billion dollars per year. Big business. I wonder how much AMTRAK is in the red every year?

For simplicity the above figures assumed that all of the guideway traffic was passenger cars. But actually buses, freight, and other commercial vehicles will also generate excellent guideway income. Dick Scherer, systems analyst, wrote, “The guideway system will not only pay for itself but it will make **big** money because of the combined people **and freight** usage.” (Emphasis by Mr. Scherer). Bus traffic could also

be a moneymaker for the guideways, if we choose to subsidize only disadvantaged riders.

As to operating costs: The electricity to power the guideways will be the largest expense, but the entire system will be far more efficient than internal-combustion-engine cars. Few people will be required to operate or control the guideway system, since it will all be automatic, but a large number of employees will be required to design it, develop it, build it, maintain it, and to manage the guideway business.

Earlier we mentioned “Penny-wise but pound-foolish” mistakes. We must spend whatever it takes to design and build guideways with the capability to do all of the wonderful things that this concept offers. All of these uses together will make the most economically sound system. We must build it right the first time. Tailoring an old saying: Don’t degrade our vast guideway system by half-vast penny pinching.

USE FACTOR

Highways are now heavily loaded most of the time, as are the airlines, while railway traffic is now sparse. The distance between trains on a railroad track is enormous. The guideways will carry most of the present highway traffic, and a good percentage of both air traffic and rail traffic. So, within several years after the guideway system is largely finished, its use factor will be high. Most of the time the guideways will have a great deal of traffic on them, therefore the income per mile of guideway will be high. However high use factors normally mean high wear rates and high repair costs. The cost of maintaining our heavily used highways is great (especially in states that allow studded tires). But with a maglev guideway system there will be no physical contact between cars and guideway, and therefore no physical wear. There will still be maintenance costs of other kinds, however.

In thinking about the economics of the system, remember that one 60-mph dualmode guideway lane is equivalent to 10 highway lanes, and a 200-mph guideway lane will carry the traffic of 33 highway lanes. We will therefore have a system that will be operating at a small percentage of its capacity in its early years. As the population continues to increase, the traffic will increase with time, and the profitability of the system will continue to increase.

Freight and other vehicles should be offered lower guideway rates at night when there is less traffic on the guideways. Shifting flexible traffic to the off hours will reduce rush-hour guideway traffic, and delay the need for additional guideway lanes. It will also reduce peak loads on the power grid. There will be no premium-pay for night guidetainer or cross-country bus drivers because there won’t be any drivers, night or day. Some travelers, especially business people, may prefer night trips on the guideways because they can sleep on the way. Since traffic on the guideways never stops or changes speed,

there will be nothing to disturb sleepers other than arrival at their destination. Provisions will doubtless be made for travelers who “have to get up at night.”

DUALMODE-CAR COST

The average cost of private true-dualmode REV cars may be comparable to that of present automobiles. They will need several subsystems not used in current automobiles, but they won't need gasoline engines, gasoline tanks, cooling systems, exhaust systems, or transmission systems. (The electric motors for street mode will probably be built directly into the wheels—four-wheel drive the easy way.)

PID COMMENT



A Dual-Mode Vehicle under construction!

A simple Dual-Mode Vehicle is being developed and can be built by small independent Service Shops. With a complete turn-key Computer System as the power train, there is no need to have big automotive manufacturers. Vehicles can now be made locally!

PID COMMENT

When a person is ready, they will buy a dualmode car instead of another conventional automobile. The motor companies will be delighted to develop and sell us a couple hundred million dualmode cars as soon as it is evident that there will be a guideway system on which to use them. Getting the guideway system will be difficult because that will involve many politicians, organizations and governmental agencies; but getting the cars will be easy.



The cost of building dualmode cars will be high initially. But early users of the guideway will demonstrate its advantages, then the rush will be on and the economies of mass production will bring the cost of dualmode cars way down. Dualmode use will explode like the use of automobiles exploded in the mid twentieth century, and like the Internet and e-mail have exploded in the last decade.

TRILLION-DOLLAR BARGAINS

At this point I am reminded of a couple of historical bargains: I wonder how many hours worth of Oklahoma oil it took to buy Oklahoma plus the dozen or more other states that developed out of the Louisiana Purchase? And how long did Alaskan oil need to flow in order to pay for Alaska, "Seward's Folly"?

Although our dualmode transportation system will be an enormous and super-expensive project, it will be worth many times its cost. In the long run it will be less costly than the additional freeway lanes that would otherwise be required. It is going to take a huge project to solve our huge traffic, environmental, and fuel problems: How many people earlier argued that we couldn't afford to build the streets and huge highway system that we now have? Our dualmode system will not increase taxes; it will indirectly lower them, since the guideway income will be taxed.

PID COMMENT

A Dual-Mode Shop
can build 3 types of
vehicles:

*Auto-Bikes

(non-motorized recumbents)

*Mag-Lev Vehicles

(neighborhood vehicles)

*Dual-Mode Automobiles

(converted cars)



The State of New Jersey
is looking for a solution!

—and so are other States & Countries!



PID COMMENT

DISCLAIMER

“Me don’t no nuttin bout ekonomix.” In case you haven’t noticed, the author is not an economist. He has tried to avoid saying things here that would expose his ignorance, but he is sure that he has failed miserably. He happily leaves the financial part of the proposal to others far more knowledgeable in such matters. But we are talking about simple supply and demand. Railroads and transit systems, which were once profitable businesses, have gone bankrupt and are on the dole because there is no longer sufficient demand for their types of services. On the other hand, the automobile business is brisk because the demand for cars is greater than ever in spite of our present traffic problems and fuel costs. The demand for REV dualmode cars will be enormous because they will be more useful than today’s automobiles, and the automobiles will be motionless for lack of fuel.

Next: [CHAPTER 18](#)
[“It Will Never be Built”](#)

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 18

“It Will Never Be Built”

THE PESSIMISTS

As one of the proud fathers of the dualmode transportation concept I of course love to hear immediate and enthusiastic acceptance of the idea, but occasionally I get arguments instead. Some of those who “don’t buy” dualmode at this point may be among those who have given up hope and believe that we are doomed to be stuck in traffic jams forever. Or maybe they are still unshakably convinced that outlawing or restricting the use of automobiles and getting everyone onto transit systems is the only answer. “Don’t bother me with facts, my mind is made up.” Or perhaps they would prefer continuing to add more highway lanes, and would let things come to a screeching halt when the world’s petroleum is gone. Then there are people who don’t care what happens. Those who fit any one of these categories are wasting their time in reading further. Please go do something else—go sit in a traffic jam, and have a nice day.

PID COMMENT



[Continue to believe in Penny Pinching Politics!](#)

The recent collapse of the Twin Cities Bridge in Minneapolis (July 2007) is just one more reason why we need to maximize our investment dollars in a

better transportation system. You will never get a straight answer to these disasters, constant finger pointing is the method of choice.

PID COMMENT

But some of those with arguments have been helpful because they brought up points I hadn't thought about. In some cases they have resulted in favorable changes in, or additions to my REV proposal. People who question things are essential. It is by having doubts, foreseeing problems, and asking questions of ourselves and others that we gain insights, find mistakes and oversights, and make real progress. Complete unanimity on any subject is rare in human society. Dualmode will be controversial, as all other major innovative endeavors throughout history have been. Therefore we should hear what the naysayers have to say and respond.

Many of the following objections have actually been heard and the others could have been.

“WHY WOULD I WANT TO USE THE GUIDEWAYS?”

I like transportation consultant and dualmode advocate Dave Petrie's response to this one: **“When you are creeping along in rush-hour traffic at 5–mph, and you see others whizzing by at 60 or more miles per hour while watching TV on their dashboard screens, you will figure it out.”**

“I WANT TO DO MY OWN DRIVING.”

Most of us do enjoy driving, at least part of the time. Dualmode vehicle owners will still drive on the streets, but some will want to do more driving than that. And some prefer powerful SUVs or sport cars, and want to be able to enjoy and demonstrate the car's performance. THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM will actually increase the opportunities for highway recreational driving in regular automobiles (if there is affordable fuel available), because most of the cars and freight will be on the guideways, leaving the highways safer and much less crowded.

On the other hand, on long highway trips drivers get tired of driving and passengers get tired of riding. The high speed and lack of stops and traffic jams on the guideways will reduce traveler stress by greatly shortening travel times.

“PEOPLE WON'T TRUST COMPUTERS TO DO THE DRIVING.”

Most accidents on the highways are due to **human-driver error, carelessness, recklessness, poor visibility, drunkenness, or incompetence**. And most airline accidents are due to “pilot error.” The jetliner and the modern automobile are high-tech machines with thousands of things that could go wrong with them including their computers; yet the thing that does go wrong most

often is the human behind the wheel. And there isn't just our own driving or that of our taxi or bus driver to worry about; there are a lot of other failure-prone human drivers on the highways who may crash into us. A more realistic heading for this paragraph would have been, "People shouldn't trust **humans** to do the driving."

Remember that there are already a lot of computers in modern cars, and many more in airliners. In fact computers already do most of the airline flying; the pilot turns on the highly computerized autopilot and lets it fly the plane. How many more airplane accidents would we have had without autopilots? And repeating from a previous chapter: All of the vital computers will have backup computers, and the entire system will be designed such that no possible failures could cause an accident. The design will be "Failsafe."

"I WOULD BE AFRAID TO TRAVEL AT TWO HUNDRED MPH."

There are people who hate speed and those who love speed. We will travel fast in our cars on the guideways without getting traffic tickets, so fear of "The "Fuzz" won't be part of the emotional equation. But "fast" is a relative term. In 1929 my parents bought a new automobile (an "Erskine," built by Studebaker). During a demonstration ride the salesman pushed the car up to 60mph, to show how fast it could go. None of us had ever traveled that fast before. Dad and I loved it, but Mom was terrified. However, I suspect Mom sometimes drove faster than that herself in later years.

PID COMMENT



Stop FOOLING yourself!

When it comes to DISASTERS, EVACUATIONS, or a MAJOR CRISIS, it is almost always the HUMAN that does something foolish, risky or stupid!

In the scenarios of 9/11/2001, and hurricane Katrina & Rita, driving was completely useless. Those who could drive had automobiles that ran out of gas, or broke down, which caused other problems!

PID COMMENT

How we feel about speed depends upon our experience. After people are used to the advantages of safe guideway travel at two hundred-mph or some such speed, they would strongly object to going back to the snail's-pace of only a hundred-mph. And two hundred-mph isn't fast even now. We fly in passenger jets at five to six hundred, the Supersonic Concorde was twice that fast, our astronauts sometimes travel at 25,000-mph or more, and all of us travel safely at 68,000-mph in our constant journey around the sun. Furthermore we can travel extremely close together at that speed, and can kiss without knocking each other's teeth out. Speed alone isn't dangerous; and traveling closely together isn't dangerous if there are no human drivers. On the guideways we will be safe because the cars will be synchronized with each other, much as we are synchronized with each other on our speeding planet.

"It isn't the fall (or speed) that hurts, it is the sudden stop." Highway crashes produce sudden stops. While the cars are on the guideways they will never stop or even slow down, except on the exit ramps. In an emergency the cars will all stop gradually, and since they will be synchronized even after power shutdown there will be no way they can crash into each other. Guideway cars at 200mph will be safer than human-driven cars at 30 mph.

"PEOPLE WON'T UNDERSTAND IT AND WON'T TRUST IT."

It is true that most people will not understand many of the details of the coming dualmode system; but few if us understand all of the technical details of a lot of the things we use and take for granted every day, including our automobiles. Lack of understanding should elicit initial caution, but we all learn from experience what we can and cannot trust.



Once again, STOP FOOLING yourself!

Any kind of GUIDEWAY VEHICLE can outperform a human driver! A vehicle can travel on a Guideway System at 200 MPH on black ice, fog, whiteouts, sandstorms, rainouts, or any other condition that would hinder a human driver. All this can be done without a single collision!

The guideway system will be complex, but actually it won't be particularly high-tech. Almost no new technology will be required. This system will be primarily an integrated combination of well-known and well-developed subsystems. Advances in computers and in maglev in the last decade or two make the national dualmode system completely practicable. Men went to the moon and came back. We have Global Positioning Satellites. We have the Internet. Our dualmode transportation system will be no more technically difficult than those wonderful accomplishments.

“THE DARPA ROBOTS HAVE HAD MANY ACCIDENTS”

You are failing to recognize the extreme differences between maglev guideways and the desert courses for those experimental robotic cars. The guideways will be designed and built as straight, smooth, and safe as possible. The courses for the robots were purposely built crooked, rough, obstacle-strewn, and hard to drive, in order to challenge those automatic autonomous vehicles to their limits and beyond. The desert robots had to have more complex electronics, sensors, and control systems than needed in REV dualmode cars, or in regular automobiles.

“IT DOESN’T SOLVE THE ONE-PERSON/VEHICLE PROBLEM.

Ride-pool advocates and transit advocates have good arguments: An average of only 1.1 to 1.2 people per vehicle is very wasteful. One person per bicycle is OK, because that vehicle requires far less material to make, takes up much less room, and bicycle “fuel” is renewable. However, few of us choose to make the slow, dangerous, and miserable-in-the-cold-and-rain bicycle our vehicle of choice.

If people with environmental concerns (and that should include all of us) get their way, a high percentage of the dualmode vehicles will be small, and hopefully ride pools will be common. Like present ride-pool cars, dualmode pool cars will pick up riders at their homes and return them to their homes. Ride pools now use the HOV lanes. Dualmode ride pools will use the still-better guideways.

“I WOULD NEVER PAY TAXES TO BUILD THE GUIDEWAYS.”

You won’t have to. Initially a few million dollars from the U.S. Department of Transportation for research and evaluation may be needed, but after that the system will be financed by businesses and investors. Private enterprise will invest in anything that shows strong promise of later profit. Transportation is basically a profitable business, but different types of transportation have seen different periods of profitability. Passenger railroads, streetcars, and transit buses all made a lot of profit once upon a time. It was only when they became obsolete due to the emergence of private-car door-to-door transportation that these old systems started losing money and were kept alive by subsidies. The automobile industry is still profitable because cars are still very popular. Not because there are no problems in connection with their use, but because their usefulness still transcends their related problems. That balance will reverse as traffic further increases, global warming accelerates, and petroleum becomes scarcer: The problems in connection with automobiles will soon transcend their usefulness. The worldwide consequences are painful to contemplate.

There is big money to be made in many areas of the coming dualmode age because of the huge demand for solutions to these problems. Although the “railroad barons” of a century ago have received a lot of bad press they did this country a huge service. They got a vital job done efficiently and rapidly. The dualmode guideway barons will now do us a similar service (while taking similar heat).

“YOU WILL NEVER SELL IT TO THE POLITICIANS.”

When I started trying to promote dualmode I wrote to over two hundred politicians (mostly national and local transportation-committee people) to tell them about this wonderful system and to encourage them to take actions to get it built. Boy, was I naïve! The response was negligible. The few who answered at all were polite but completely noncommittal. It took me awhile to understand that this was all I could have expected. Politicians are not expert in evaluating new systems. On average they have no better vision of the future than the average citizen does. And the smart ones have learned to not take chances. For the most part they stick to old solutions (even bad ones), because those are what most of their constituents understand and think they want. That is how politicians get elected and stay elected. But if the **voters** learn of and come to like dualmode, the politicians will immediately like it also—I guarantee.

“IT WOULD HURT BUSINESSES AND DESTROY JOBS.”

This one is an oldie but a goodie. Almost every invention in the history of humanity has hurt some people. The Luddites have a point, but a weak one when examined broadly. Practically all major innovations displaced some workers and changed or eliminated some businesses. But the inventions that survive end up spawning new businesses and providing far more jobs than they destroy. Compare the number of people employed in the automotive industry with the number that once worked in wagon, buggy, harness, and blacksmith shops. The dualmode transportation revolution will provide hundreds of thousands of new jobs, but some retraining will be required. Some labor unions will object and some new unions will form.

“DUALMODE IS TOO REVOLUTIONARY.”

Revolutions, be they social, governmental, military, or technological, are usually controversial; but it is by revolutions of one kind or another that most human progress is made. The separate bits and pieces needed for dualmode transportation are well known, but the effects of their combination and application in this urgently needed system will be revolutionary.

Speaking of revolutions in transportation, the first caveman who tried to ride on the back of an animal probably heard strong objections from some of his fellow cave dwellers. Later some people may have felt that the use of wheels and carts would displease the gods. Using fire and steam to power a vehicle was obviously an idea to be opposed by proper-thinking people. The internal-combustion engine was much too noisy and therefore should have been banned. Iron ships couldn't possibly float. And certainly if humans were intended to fly God would have given us wings.

“ALL TRANSPORTATION INVENTIONS HAVE BEEN MADE.”

When I set off to the University in 1938 to study engineering, my father, who was an electrician, advised me not to take **electrical** engineering. He pointed out that all of the electrical inventions had already been made; he thought that little further electrical progress would be possible. He didn't mention “electronics,” because that word and that field barely existed at that time.

Dad knew about batteries, electric motors, generators, transformers, incandescent lights, “neon lights”, x-ray, electroplating, electric welders, automobile ignition systems, telegraph, telephones, vacuum-tube radios, electric clocks, and electric doorbells—what else could there possibly be? Electrical engineering in his mind was a dead field, and he didn't want me to get stuck in it.

My dad was a very smart man, and an inventor himself. But he, I, and all others at that time were unable to foresee the invention of and the mass production of transistors, integrated circuits, fluorescent lights, radar, tape recorders, television, camcorders, VCRs, CDs, DVDs, LEDs, LCDs, MRI, GPS, electric watches, ultrasound equipment, encephalograms, lasers, industrial robots, autopilots, portable phones, cell phones, communication satellites, computers, the Internet, and dozens of other “indispensable” electrical and electronic inventions. And I must not forget maglev and linear synchronous motors. (Dad lived to see men land on the moon and return, and I participated in the development of technologies required to get them there.)

Are we at the end of the line on major advancements in transportation? **Hardly!** It is interesting to note that we have had major revolutions in air and space travel in the last seventy-five years, but ground transportation has changed very little in that period. It is obvious to some of us that big changes in transportation are not only badly needed, but way past due. The next major step will be The Revolutionary Dualmode Transportation System.

“WHY HAVEN'T THE EXPERTS PROPOSED DUALMODE?”

Someone said, “An expert is a guy or gal from out of town who is carrying a briefcase.” Who are our transportation experts? They are not our politicians, briefcases or not. Transportation officials and committees are expert at ordering studies and spending money, but their expertise is largely limited to existing systems that haven't solved and cannot solve our transportation and related environmental and energy problems.

The experts in existing transportation businesses are apt to oppose dualmode because it will be seen as competition to their current businesses. Five years ago I wrote letters disclosing dualmode to General Motors, Ford, and Daimler Chrysler, and received no positive responses. These and other companies will eventually build millions of dualmode cars—but they don't seem to recognize it yet.

“Amateurs,” people outside of the mainstream of a technology, often, make our revolutionary inventions. This sometimes happens because the experts in that field are in the habit of looking for improvements in the things they are now working on and fail to consider broader more revolutionary approaches. They fail to see the forest for the trees. And a creative employee is generally not allowed to do creative work outside of his or her job description unless that person’s boss and upper management are likewise creative and visionary. “Forget that foolishness and do the job you were assigned to do, we have a schedule to meet.”

Usually a number of inventors will arrive at basically the same solution to a problem when the time for a particular invention is ripe. Our need for an effective transportation system is more than ripe; in fact our traffic is already a rotten stinking mess. Many inventors and engineers are now working on dualmode privately and in small companies. **These** people are the experts in dualmode, and they **are** proposing it

“THERE ISN’T ENOUGH OF A CRISIS FOR DUALMODE YET.”

Of all of the objections discussed in this chapter, this one is the most wrong and the most dangerous. Unfortunately a great many people and organizations fail to act upon upcoming problems in general until the problems becomes crises. “Crisis management” is sadly a much-too-common practice. Specifically, too few people recognize that our transportation and related environmental crises are already at high levels, so we are already very late in starting to develop an effective solution.

PID COMMENT



NO CRISIS????

Anyone who is reading this, and is facing this kind of scenario on a daily basis, is completely out of touch with reality! You cannot wait until the

crisis is beyond a crisis to implement a solution, it must be cut off before it happens if possible. The annual growth rate of traffic should be enough to get you thinking!

PID COMMENT

Even if we decided to build a dualmode system today, with the whole nation behind the effort it couldn't be completed for at least 20 years. By then the petroleum-production peak (which we discussed in [Chapter 14](#)) will have long passed, and we will be suffering many of the crises that are sure to follow that scary event.

[Maybe no one ever figured out how we are going to take corn we need for food to power up millions of extremely wasteful automobiles!!]

“IF IT WAS POSSIBLE IT WOULD HAVE BEEN DONE BEFORE”

Duh. There is a first time for every accomplishment. Would this person have asked the same question before the development of the wheel, the steam engine, the steamboat, the railroads, the automobile, and the airplane?

IT WILL BE DONE

Some people are leery of change, they don't like new things and unproven things, they fear technology, or they may feel nostalgia for earlier and simpler times. And some people just like to argue: Some who don't create things themselves seem to satisfy their egos by criticizing those who do. “The galleries are full of critics. They play no ball. They fight no fights. They make no mistakes because they attempt nothing. Down in the arena are the doers. They make many mistakes because they attempt many things.” — M.W.Larmour

Dualmode will be controversial, but in the opinion of a growing number of experts, it is technically sound and is the right system to build. There will be risks, but “Where there is no risk, there is no achievement.” Wernher von Braun remarked, “I have learned to use the word impossible with the greatest caution”. There is an old saying: “Those who say it can't be done shouldn't stand in the way of those who are doing it.”

The title of this Chapter is wrong; THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM will be built, but not in time to save civilization a tremendous amount of pain after the peak petroleum production date. Kurt Cobb wrote a very thought-provoking article called, [Triage For the Post-Peak Oil Age](#). ([Energy Bulletin](#), May 15, 2006.) In it he lists transportation neither as a hopeless case that we

shouldn't waste time on nor as a situation that will take care of itself, but as a "Code Blue" item that can and must be fixed after Peak Oil. Kurt, we agree with you.

A ray of hope can be seen in the use statistics for Dr. Schneider's Innovative Transportation Technologies website, the home for this book. In 1997 it received 31,456 visits, and has attracted more attention every year. In 2005 it had 1,478,674 visits. Forty-seven times as much attention in eight years. Not bad for a start, but we need a hundred million people to pay attention, not a mere million and a half.

Next: [CHAPTER 19](#)

The Way to Dual-mode



Several research vehicles specifically designed for a Guide-way System were built by the DLF Group Inc. located in Burlington City New Jersey.

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 19

The Way to a Dualmode System

The guideway system must be a nationwide undertaking. Isolated city, county, or state systems where the guideways end at the city limits or state lines would have limited value. Further, the dualmode cars will be readily affordable only in large-scale mass production. Although it must be federally controlled, the national guideway system should be developed, built, and operated by private companies or a consortium. The system management might be comparable to that of our airlines: Those are independent of the government, but Air-Traffic-Control and regulation by the Federal Aviation Administration are essential to their operation, and to public safety.

The guideways need not be and should not be federally owned because, unlike the obsolete bankrupt passenger railroads, the guideways will be used by most people and will therefore readily pay for themselves. Each user will be automatically billed for each trip much as the telephone companies and utilities bill us. The guideway system will therefore be unlike the highway system since “freeways” have no direct income from their customers.

PID COMMENT



Debunking the PESSIMIST!

I wonder how many of those so called PESSIMISTS ride a Roller-coaster, Train, Elevator, Escalator, Ski-Lift, Monorail or Cable Cars! We emphasis this a lot to show just how irrelevant negative thinking is in light of innovation.

PID COMMENT

After the guideways are complete and most people have a dualmode car, all but a lane or two of the major highways could be torn up (Some highway capacity will still be required for loads too large for the guideways, and for recreational drivers and motorcycles). The surplus highway lanes, after they were freed of its concrete shackles, could be sold to adjacent farms and to business-strip developers. However, it may make more sense to keep most of the highway lanes we have and to continue to use them—but they will have far less traffic, few accidents, and will need little maintenance. Also, we must keep enough right-of-way to put in a second lane of guideway where it might be needed sometime in the distant future.

APPLICABLE TECHNOLOGY

Compared to our invention and development of the atom bomb, and compared to our program to land people on the moon and get them back to earth safely, the development of dualmode will be technologically simple. The United States successfully achieved both of those great historical high-tech goals on schedule, even though there was limited related prior technology available upon which to base either one of them.

The REV dualmode system, on the other hand, will require essentially no new technology: We already have automobiles, maglev trains, synchronous linear electric motors, advanced computers, sophisticated software, integrated-circuit control systems, power-generation systems, highway and railway construction technology, advanced materials, and all of the other required bits and pieces. Technologically speaking, the development of the dualmode system will be a huge job, but much more of a routine design, building, integration, and testing effort than it will be one of new science and invention.

THE PROBLEM IS ...

The development of our National Dualmode System will be locked behind the starting gate as long as the businesses and organizations that will have to design it and build it are not on board. Most of them know little or nothing of dualmode, of the [1974 National Dualmode Conference](#), or of the recent work that is being done on the

concept. Except for the now-defunct [National Automated Highway System Consortium](#), which backed the wrong horse, there have been no recent attempts to get government and industry together to develop a broad unified national solution to our transportation and related environmental problems. And the technical societies have for the most part kept their thinking and technical papers narrowly confined to the existing separate transportation systems. The writer urges all of the transportation industries and societies to start thinking about and working on dualmode systems. Entrenched traditional narrow thinking will be difficult to change, but it must be changed—for the survival of civilization as we know it.

THE WORK IS YET TO COME

Most of the dualmode proposals are little more than conceptual at this time. The engineering and technical work has hardly been started. THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM will be an enormously large venture, probably the largest design and construction effort ever undertaken by mankind. It will require so many diverse fields of technology that no individual, group, corporation or department of government could design all of the details of the system, let alone develop, test, and successfully promote its adoption in all of the necessary places. Dualmode hasn't been adequately considered, if at all, within the research labs or within the transportation industries and within government: It will require much broader thinking than most people in these industries and organizations are currently assigned to do, or are permitted to do.

Part of the problem is that there isn't a single transportation industry, there are many: the railroad passenger and freight industries, the trucking industry, the automobile industry, the bus and other transit industries, the aviation industry, the fuel industry, and the electric power industry. These are largely independent of each other. They originated independently, and some of them compete with each other. These industries, for the most part, have yet to study dualmode, and to understand that joint efforts on a National Dualmode System will be to their great mutual advantage. They are not yet seeing the forest for the trees: The railroad people see only steel wheels, tracks, and a 19th-century system. The maglev people see only maglev trains. The automobile people see only cars on highways. The airplane types see only transportation upstairs. The fossil-fuel industries see only today's profits. The computer and Internet people see only communication and entertainment. (OK, I exaggerate, but you get the idea.)

TO GO FAR WE NEED A CZAR

First we need government recognition, action, and support. But business-as-usual wouldn't get us there fast enough. The appointment of a capable National Dualmode Czar is strongly recommended—a person similar to the one we had on the Manhattan (atomic bomb) Project. He/she should have powers broad enough to get the job done rapidly and efficiently; but of course there must be controls to minimize negative societal and environmental impacts. However, a dualmode czar won't be appointed until The

President and Congress become convinced that we must have a National Dualmode Transportation System. To effectively start at the bottom we must also start at the top.

THE TRANSITION PERIOD

As we have discussed, until the guideway system is fairly complete we will use internal-combustion-powered automobiles on the highways and on the guideways (by first driving them onto guideway pallets). But as soon as possible we should use true dualmode cars that require no pallets. Nonpolluting cars meeting all of the requirements for both modes will be highly preferable from the standpoints of the environment, guideway capacity, and out-of-sight gasoline prices. Some conventional automobiles will continue to use the highways, but highway travel will rapidly lose popularity after the guideways are available—even if fuel is still affordable then.

It will not be cost effective to convert our existing cars into dualmode cars. Many major changes and additions would be required. Anyway, since the building of the guideways will take at least a couple decades, our present cars will be worn out before we will need dualmode cars. The REV cars may look a lot like present automobiles, but under the hood they will be entirely different. Hopefully most of them will also be smaller, lighter, and green (regardless of their color).

After completion of the National Guideway Network a law might be passed, for environmental reasons, which would prohibit the sale of new gasoline-powered dualmode cars. But such decisions will be left to public debate and to our lawmakers. The point is that the National System can be built to accommodate any types of cars we choose to declare legal.

Once the car/guideway interface standardization decisions have been made, the automobile companies can start to produce the vehicles, and guideway construction can get underway. As local 60-mph guideway systems are completed they will be opened for use in order to reduce local traffic problems. The building of the long-distance high-speed guideways and the integration of the entire national guideway network will follow.

If, for any reason, a state or city should refuse to join the dualmode system, the national guideways could simply bypass it. It isn't likely that a region's rejection of dualmode would last for long however. In most cases towns will plead for and compete to get interconnecting guideway service as soon as possible, the same as towns fought for railroad service a century ago. It was often the cities with early railroad connections that grew and prospered. History will effectively repeat itself.

Eventually there will be many times more miles of guideway than there are miles of railroad track: All towns will have dualmode guideway connections to the rest of the country. But if there were holdouts, the residents of those towns would have to drive to the next town in street mode in order to get onto the guideway system.

Little of the automatic guideway parking proposed in [Chapter 13](#) will be available initially. Such parking facilities will be independently funded and will belong to the buildings, companies, or organizations providing them, just as present private parking is. Organizations will add guideway parking when and if they see fit, so parking growth will be incremental. Competition and parking income will encourage businesses to provide automated guideway parking.

THE POLITICS

The newspaper headline read: “Politics ties up action on transportation.” So what else is new? The politics involved in getting things done are almost always daunting; and the realistic view says it will be doubly daunting on the huge and Revolutionary National Dualmode System. But does history offer any reasons for optimism in this case? Referring again to the bomb, a little over fifty years ago this country successfully completed the vitally important and extremely difficult Atom Bomb Project in a very short period of time, giving us the means to end WW-II rapidly. But that was done under wartime conditions and a few courageous leaders unilaterally made some major decisions in minutes or hours, which we would debate for years today.

A few decades ago the Soviet Union, our “cold-war” opponent, was ahead of us in “the space race,” and our pride was hurt. Jack Kennedy set a national goal of putting Americans on the moon by 1970. We did, and we bettered our president’s nine-year-old timetable by five months! Putting people on the moon was a far greater technical challenge than the National Dualmode System will be; yet this system will be far far more important. We can only hope that our desperate need for solutions to our transportation problems will motivate us as much as did our desire to overtake the Russians in space.

The English-Channel Tunnel was politically difficult because it physically connected two nations that were historically antagonistic. However, the “Chunnel” was completed successfully in less than ten years. We will have only ourselves to disagree with on dualmode—and the “Yanks” are already coupled to the “Rebs” by highways.

LABOR

The guideway system will employ hundreds of thousands of people productively during its design and construction, and the dualmode car builders will employ hundreds of thousands more.

In 19th century England the “Luddite” organization of workers destroyed new labor-saving machines to protect their hand-labor jobs. Dualmode won’t be replacing much hand labor; but there will be some changes made. Service-station workers may need to learn battery-charging and how to dispense hydrogen, some highway workers will need to become guideway workers, fuel-producing jobs will change, and we will need fewer bus and truck drivers since the guideways won’t require their services. But

considering its diverse positive effects on business and the economy, like most major innovations of the past dualmode will produce many more jobs than it will destroy.

HOW SOON?

With no political wrangling, with strong leadership, smooth sailing on the engineering and construction fronts, and an all-out national effort we could conceivably have some of our 21st century transportation system operating in as little as a decade. Unfortunately our usual course is to spend billions of dollars and many years on study contracts before anything is designed or built. But our rapidly expanding traffic, rapidly melting ice caps, and rapidly disappearing fuel aren't going to wait; we must hold the study contracts (also known as stalling tactics) to a minimum and spend those billions of dollars and years of time to actually design and build the system. Will our "best effort" produce it in twenty years?

Great interest in the broad subject of transportation already exists because of our daily transportation frustrations. The National Dualmode Transportation System will be much easier to sell to the populace than rapid transit because it will serve the majority of travelers, the automobile-driving public, not just a minority. We won't be buying highly subsidized transportation to give to hoped-for bus or train passengers, we will be investing in our own high-speed low-congestion system, and we will be buying new cars for ourselves, not buses and trains which we personally don't even intend to use.

Quoting a newspaper article, "Since 1969 the vehicle population in the United States has grown six times faster than the human head count. Between 1969 and 1995, the number of vehicles climbed 144% according to a Nationwide Personal Transportation Survey" (of the Federal Highway Administration). The number of households **without** vehicles fell during the same period from 20% to about 8%. The number of households with three or more cars grew from 4.6% to about 19%. There are over twice as many families with three cars as there are families with no cars.

Our ability to foresee the future of dualmode transportation is much better than was our ability to foresee the future of the airplane when the Wright brothers flew in 1903, or to foresee the future of the automobile when Henry Ford decided to produce the Model-T. At that time the need for better transportation wasn't really evident—those radical transportation innovations exposed the needs. Our present needs however, are most painfully evident. We know that unless a revolutionary step is taken our traffic and environmental problems are only going to get worse. I hope and believe that the seriousness of these burgeoning problems, combined with the great promises of the dualmode approach, will be enough to assure its implementation.

We won't give up the convenience of personal cars, and the traditional systems can't relieve the traffic jams, the fuel shortages, or the environmental problems. We have a choice between a dualmode system and national gridlock. We can continue to

complain about the traffic, pollution, highway deaths, global warming, dependence upon foreign oil, the constantly higher price of gasoline, and all the other problems caused by our present transportation systems until it is too late; or we can take the one big dualmode step now and fix most of it. Dualmode is the only known answer that will work without petroleum and still be welcomed by the majority of transportation users and by the environmentalists.

Next: [CHAPTER 20](#)

Dualmode will be Difficult to Sell

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 20

The System Will Be Difficult to Sell

The few dualmode transportation articles in technical magazines, on the Internet, and elsewhere have generated interest, but because so few people are aware of the existence of these articles they have been of very limited value in introducing this system to the public. The difficulties in disclosing and “selling” a revolutionary project of this enormous magnitude have become increasingly evident to those of us working in the dualmode field. The mass media do not recognize dualmode as news because they don’t know about it, and the public doesn’t know about it because the media publishes only news as they see it. This book will hopefully break that stalemate.

PID COMMENT

New Jersey will have 500 Dual-Mode Stations- approximately 23 facilities in each county!



PID COMMENT

Currently dualmode transportation might be compared to a big snowball sitting on top of a rounded snow-covered hill. It is too big and heavy to be moved further by the few who originated it, and few who come up the hill are interested enough to put their weight behind it. Eventually there will be enough people to get it rolling down hill. As it rolls it will pick up more snow and its size will rapidly increase. As the slope of the hill gets steeper the growing ball will gain speed. The originators couldn't stop it now if they wanted to. The proposed dualmode system is infinitely more important than a snowball, but even though such a system will serve mankind remarkably well in many vital ways, it will be difficult to get the ball rolling.

The intelligent-transportation people, the maglev people, the automobile companies, the railroads, the computer people, the research organizations, and the universities are urged to seriously study dualmode transportation. And the voting and traveling public is urged to insist that dualmode systems be studied. Little dualmode work has been done outside of personal efforts and startup-companies, but that is beginning to change. When the pool of supporters reaches critical mass the chain reaction will be underway. Dualmode will snowball.

NOT INVENTED HERE

“Not invented here” (NIH) is a powerful but abstract psychological force that often seriously suppresses, delays, and sometimes even kills promising inventions and innovations. NIH stems from competition, ego, and pride in one’s own. Engineers, executives, and other workers are understandably much more interested in their own ideas and in the products of their own companies than they are interested in competing ideas. The new ideas may be better, but the defenders of the status quo will often either have trouble seeing that fact, or prefer to ignore and deny it.

PID COMMENT



“Not Invented Here” does not apply!

All you have to mention is \$3.00 dollars a gallon! Those who want to continue going broke can do so, others will be saving their money, having to work less hours or be able to afford to get around because they got a Dual-Mode Vehicle when their friends and family didn't!

PID COMMENT

NIH rears its ugly head in many ways, but one of the most common manifestations appears in the reception an “outside” invention is apt to get when the inventor tries to sell it to a company that is already working in the field of that invention. Don't get me wrong, most so-called “inventions” are worthless and **should** be rejected, but NIH also frequently suppresses the few that do have merit. Most of the dualmode inventions are free (in the public domain) but NIH will still be a recurring problem in trying to promote this system.

NIH is not necessarily about money; it is often about pride, jealousy, power, ego, and corporate clannishness.

HUGE PROJECTS PRESENT HUGE PROBLEMS

Michael Hiltzik wrote, “Innovation is inherently antiestablishment.” That is certainly true in this case: Dualmode will upset and change many major establishments. These include the highway organizations, the automobile companies, the railroads, the trucking companies, the transit and bus establishments, a number of labor unions, and other large and long established entities including many government departments and bureaus. There is great power inherent in these giants; the fireworks will be significant.

On the opportunities side, we must show suffering drivers that dualmode will largely solve their commuting problems, convince environmentalists that it will do much to save the earth, tell transportation companies that there are fortunes to be made in the dualmode business, point out to automobile companies the market for a huge number of dualmode cars, alert the unions to a few hundred thousand new jobs, show the produce shippers how fast and cheap their shipping will be, and convince politicians that supporting dualmode will win them votes.

“People are only influenced in the direction in which they want to go, and influence consists largely in making them conscious of their wishes to proceed in that direction,” — T.S.Eliot

THE MEDIA AND DUALMODE

Several dozen dualmode presentations have been made to many types of groups in the last few years, and the reactions have always been favorable. Yet as this is written in April 2006, with minor exceptions the news media have ignored it. Newspapers carry astrology columns and print endless trivia, but in spite of repeated dualmode news releases to them they have largely kept their readers unaware of this very promising, necessary, and doable option to gridlock. They always publish the “ain’t-it-awful” reports on the traffic and environmental problems, but decline to disclose the future solution, or even mention that there is one. Giving them the benefit of the doubt, they haven’t taken the time to understand dualmode, and they may assume that it is crackpot. So far the newspapers are part of the problem, but they will become a necessary part of the solution.

After a slow start, some technical, trade, and special-interest magazines have printed a few dualmode articles. Most politicians are unaware of it or have ignored it. If the automotive industry is doing much on dualmode they are keeping it mostly quiet.

PROMOTING REVOLUTIONARY INNOVATIONS

Negative attitudes in such cases are not surprising. Concepts that are obvious to some are not immediately obvious to all. Also, people in positions of authority or influence (politicians, editors, reporters, business executives, big investors, and professors) are apt to act more conservatively in their areas of expertise than do lay people. Their reputations, jobs, and fortunes could be jeopardized if they hastily support a revolutionary cause that later fails. Big steps must be approached much more cautiously than little steps.

I once had a wise supervisor who instructed me as follows: “If what you have to tell me is important, and you know you are right, then it is your duty to keep telling me until I listen and understand, until you convince me. You must do your best to keep me from making mistakes. I am the boss therefore I will make the decisions, but you must help me to make the correct decisions.” The bosses in the case of REV will be many and diverse, and they will include you. I hope you will insist that Dualmode Transportation be formally evaluated—again. If the concept survives such a study, as it did so well in 1974 (Chapter 4), we should demand that the system be designed, developed, and built, and as soon as possible. Yes, “Demand.” We, collectively, are in charge, through the ballot box and through the marketplace.

Part of the problem in getting national dualmode is that to some people it looks too good to be true; to them it promises too much. Most people, for valid reasons, are suspicious of claimed miracles. And it may seem unlikely that a few amateurs could

have come up with a really promising system that the transportation professionals had missed or ignored. Actually we amateurs had an advantage; we could think broadly because we weren't tied to any particular narrow field that by itself couldn't solve the myriad problems. The automobile people work only to make better automobiles, the train people think only about trains. But open-minded unbiased amateurs freely considered the use of individual cars, guideways, magnetic levitation, synchronous-electric propulsion, and automatic computer control all integrated into one system.

The problems are broadly the same for innovators in all fields. In an article in Technology Review magazine for Jan.-Feb., 1999, Chemical Engineer Robert Langer, holder of more than 330 patents wrote, "When you start doing [innovative] things, no one believes in them, nobody wants to fund them, and companies don't want to do them. And you get criticized a lot. The important thing to remember is that it's not going to be by the efforts of one person or one lab that these problems get solved. What makes these approaches work is ultimately having thousands of people working on them. For me, ideas are like children growing up. I want to nurture them so they are stable and so they will happen." Susan Sarandon wrote, "Change never happens from the top down. Power always yields because it has to." Mahatma Gandhi said: "First they ignore you. Then they laugh at you. Then they fight you. Then you win."

At this point perhaps those who ignore or reject dualmode are making us stronger. A boxer can't win without sparring partners to develop his strength, coordination, tactics, and teach him the game. The opposition to dualmode will teach us the game of salesmanship. But in my travel through life I have found salesmen I didn't like because they didn't meet my minimum standards for honesty and credibility. This book is largely a sales effort, so I had better watch what I write or I could end up disliking myself.

This book does bother me to a degree, because it does sound a bit like the kind of advertising hype I hate. Too many superlatives, too much enthusiasm, hardly what one would expect from a professional engineer. I must plead guilty to bias in this case (if taking a strong position on anything is a sin). The dualmode concept turned out to be far too promising for me to report it in a neutral unbiased manner.

DUALMODE DOESN'T FIT THE ESTABLISHMENT

Comments by reviewers of one of the author's papers on dualmode in April 1999 illustrate some of the types of promotional problems the system faces. One reviewer wrote, "Excellent discussion paper. Publish it as a resource we should keep." That word "keep" scared me. We need to get to work on a dualmode system immediately, not archive the information and passively wait for the future to arrive catastrophically without any action on our part. Dualmode development should have started long before this, not long after things become even more desperate than they are now.

AATS 2005

European Conference
7-8 Nov 2005
Bologna, Italy
 University of Bologna
 San Giovanni in Monte
 Aula Prodi

**Discover the secrets of
 Advanced Automated Transit Systems
 designed to out-perform the car**

This conference looks at the new cutting edge transit systems that are now becoming commercially available and appear to have the potential to compete with the car in suburban travel markets where buses, trams and rail can offer only a poor alternative.

Presentations will cover:

- High speed Railways (Germany)
- Light-rail (France)
- Tram (Netherlands)
- Tram 2005 (USA)

Sponsored and organized by:

- University of Bologna (UNIBO) Transport
- The American Transit Association (ATA)
- ATA International
- CUA Business and Partners

Key Speakers:

- Prof. J. Brackmann, Director of Transport
- Prof. M. Brackmann, Urban Transport and Planning
- Prof. J. Brackmann, Urban Transport and Planning
- Lawrence P. Brackmann, President
- Howard Brackmann, Advanced Transit Systems Ltd
- Dr. J. Brackmann, University of Bologna

Who should attend:

This conference is relevant to anyone with the responsibility for providing good alternatives to the car in situations where conventional forms of public transport are proving ineffective or too expensive or both. Delegates should include:

- Planning and Transport authorities
- Transport
- Transport Managers
- Managers of major Transit authorities
- Transport Operators
- Transport industry manufacturers
- Planning and Transport Consultants

On-line registration, abstract submission, conference info at our web-site:
<http://www.trasporti.ing.unibo.it/aats05/>

That reviewer went on to write: “[There is a] problem with which session [of the technical conference] the dualmode paper could be assigned.” In accord with such limitations, imagine the problems the early automobile met with in the Horse-and-Buggy conventions: “This dreamer wants to present a paper on a horseless carriage. Shall we ignore him, or put his paper in the Wagon-Wheels session? Or maybe it belongs in the Team-Harness session since he proposes to move the carriage by power equaling that of more than one horse.” Another reviewer of that dualmode-paper wrote, “It has no real fit at ITSA.” If dualmode transportation doesn’t fit the goals of the Intelligent Transportation Society of America, where does it fit? I am wondering about the use of the word “Intelligent” in the name of that organization. Should they call themselves “Traditional Transportation Society” instead? Shouldn’t the ITSA expand its categories? There is something terribly unintelligent about prohibiting study of the future because it doesn’t fit the present.

Another type of problem is also seen when dualmode is presented at transportation conferences: The attendees of such conferences are mostly engineers and others who have specific responsibilities in existing transportation fields. They are sent to these conferences by their managements to help the companies in their specialties. Therefore,

where given a choice between attending a dualmode presentation or one in a narrow existing field an engineer in that field is almost forced to miss the dualmode lecture. They can't waste their time on "crackpot" ideas they have never heard of. In spite of the tremendous importance of the subject, dualmode presentations are sometimes poorly attended—because the subject is generally unknown.

SUMMARY

The newspapers, the political structure, the government agencies, the transportation authorities and committees, the technical societies, the universities, the transportation companies, and the automobile companies all have their own agendas. These agendas are full and do not include consideration of dualmode transportation. These organizations in general are not open to radical new thinking on the fringes of their charters. Or at least it is very difficult to get their attention. So this book is more directed to the public, to you, the people who need better transportation.

The intelligent people in most of the mentioned organizations will support dualmode once they really listen, study, and understand it—when it becomes their job assignment. There is the old story of a mule, and its owner who was carrying a club. A concerned passerby asked what the club was for. The mule owner said, "Well—I'll tell you. He is a good mule, but you have to get his attention first." This book is sort of an attention-getting club.

It is said that there are two classes of people in the world: those who separate people into classes, and those who don't. But I have in mind two other classes of people: those who make things happen and those who keep things from happening. Sometimes the latter appear to outnumber the former. I just looked up the word "doer" and found this definition: "One who takes action rather than thinking or talking about things." But in the case of dualmode transportation the thinkers and talkers also belong in the doer class because the dualmode system will initially require a great deal of thinking and talking. The actual designing and building will come later, but it will also require a lot of thinking and talking. Those who will oppose the system will also be useful doers, because their opposition will spur the necessary debates and result in wiser decisions.

In her newspaper column, Marilyn vos Savant, who is credited with the highest known IQ, was asked the following question by a reader: "If we can put a man on the moon, why can't we solve social problems?" In her answer Marilyn pointed out that in science what is right and what is wrong is much clearer. "If a moon mission has an electrical failure that is clearly 'wrong' and all scientists will agree. But in society we argue about what is right and what is wrong. Was it right to send a man to the moon? (For instance, should the money have been spent to feed starving children instead?)"

This difference between sociology and technology is a major part of our difficulty in trying to sell a dualmode system. After studying the system almost all scientists and

engineers will agree that the dualmode concept is technically sound, that it can be built, and that it will work. But the system won't be sold to the public on technical practicability alone. It will be the much more controversial sociological issues that will take time and make the acceptance of this system difficult.

We need to remember that all inventions start out unknown. At their inception they are only known and understood by their inventor(s). When word begins to spread, there will be doubters and ridiculers. A high percentage of new inventions fail, some succeed, and a very few revolutionize society. The Revolutionary Dualmode Transportation System is going to be among those few. This is true because the need for a solution to our transportation and related problems is overwhelming, and the individual traditional fixes we have been applying are not working. A dualmode system is the only solution that can solve most of these problems in one neat package. We must accept the fact that that neat package will be huge and enormously expensive.

Next: [CHAPTER 21](#)
[Help Needed](#)

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 21

Help Needed

“SOMEONE SHOULD DO SOMETHING”

“The world is made up of doers, don’ters, doubters and deadheads. The doers get things done. The don’ters try to stop them. The doubters stick around to see them fall flat on their faces, and the deadheads never know anything is happening.” — Bill Speidel

A person who wrote to “Dear Abby” said, “Whenever I hear myself saying, ‘Someone should do something about it’ I stop and remember that I am a someone, and then I do something about it.”

Someone should try to do something intelligent about our transportation problems, and I ended up being one of those someones. First I had the fun of coming up with the concept of dualmode (initially thinking that I alone had the idea). Then I discovered and got acquainted with many of the other inventors of dualmode. We doers (and we would like to include you) must next disclose dualmode far beyond our little inner circle.

This is a lot of work, so why do I bother? I am not normally an activist, and I have plenty of other worthwhile demands upon my time. Most of us dualmode inventors have given up our patent rights on the system, so we are not doing it for money. This book is free to read on the Internet: I am getting nothing out of it but the work. I won’t get to use the system personally because I am 86 and will be gone before it can be built. So again, why do I work on it? Because of a strong desire to help my fellow humans mold the future of transportation wisely. I’m sorry if that sounds overly noble: Admittedly, some of the effort seems more like fun than work. And—OK—there are some ego satisfactions in doing it.

POLITICIANS AND BUSINESSES

About seven years ago I sent roughly 250 letters on dualmode to politicians and others in positions of authority and got little response. I was most disappointed, but I have learned a few things since then: Not all politicians are endowed with vision; and those who are bright enough to survive in the game of politics may have to spend most of their time working on things they think will earn them votes. When enough of us tell them that we, the voters, want a National Dualmode Transportation System we will see

action. Similar logic applies to businesses. Only when companies see a present or future demand for a product or service will they take action.

DUALMODE TRANSPORTATION PLANNING

Knowing that the Revolutionary National Dualmode Transportation System has to be built, the time that it is taking to spread the word greatly concerns me. I am concerned because billions of dollars and decades of time are still being spent on planning, designing and building more of the obsolete types of transportation systems. These will not adequately solve our transportation and related environmental problems, therefore time and money will be wasted, and the ineffective results will further discourage and alienate the traveling public. It is like putting a lot of money into repairing an old obsolete car when we know that we are going to buy a far better replacement soon. But the problem here is that very few people, so far, know about this much better replacement. We must tell them.

THE UNITED STATES DEPARTMENT OF TRANSPORTATION

The government organization that will have the most influence upon our dualmode system is doubtless the USDOT. This transportation revolution is certainly within the DOT's purview, but like most bureaucracies the USDOT is entrenched and slow moving, and it is difficult to get the right people to seriously consider new approaches. At the moment there isn't even a dualmode organization within the DOT, because they haven't recognized the inevitability of dualmode yet. We need top-level USDOT leadership on this revolution, and there is urgent need to get some more dualmode study contracts underway. I am currently aware of only one. It is with the Center for Energy, Environment, and Transportation Innovation (CEETI) at Texas A&M University.

A major roadblock that startup dualmode companies are repeatedly encountering is a requirement that no transportation system can be considered for use unless it has a track record of successful use for many years. **Catch 22**. No new ideas are allowed until they are developed and old. And they can't be developed because they haven't been developed. By that rule we will have only nineteenth and twentieth-century transportation systems forever.

This nation has people with both the vision and the skill needed to get things rolling. We need one with the stature of Einstein to write the letter to the President to get some attention on the coming national-dualmode-transportation revolution. Will it come from the USDOT or will that organization be dragged along kicking and screaming? This history-making project will present great leadership opportunities in many areas. And if the old organizations fail to pick up the ball perhaps new, more innovative organizations will be formed to do the job.

TO FELLOW TECHNICALLY INCLINED PEOPLE

The author urges all engineers, scientists, technologists, and technical-trades people

to broaden their transportation thinking to include the coming national dualmode transportation revolution. We technical types, in a great many different fields, will be needed by the hundreds of thousands to create, design, develop, and test the system. Without us it could not happen; we have a prime responsibility for making it happen. Not only is it essential that we do it, it is going to be exciting challenging fun. Technical schools, colleges, and universities: It is time to start offering dualmode transportation-system courses. Use this book as a starting text if you want to. Technical societies: Please get on board. And we need a new technical society: “**The Dualmode Transportation Society**,” with branches in many countries.

ACTIVISTS ARE NEEDED

If you now see a need for REV, please help publicize it. Do your bit. Standing in front of bulldozers, blocking street traffic, or bombing the opposition is not my style, but here are some of the things I do to promote the dualmode concept. I tell people where to find this book on the Internet. In my billfold I carry copies of typed slips of paper that give the title of the book and its online address. I hand one out to everyone that shows any interest in serious matters: Matters like, “How are we going to be able to travel the day after tomorrow.” People have to know of the existence of the dualmode transportation concept, need to understand it. The leaders in many different fields need to be sold on it. Businesses need to see that there is an enormous market for this innovation; there is money to be made. Money talks.

HOW TO SPREAD THE WORD

If you support this remarkable project I encourage you to discuss it with your friends, write letters to the editors of your newspapers, send letters to the politicians, refer them to this book and to other articles on dualmode and on the need for it. Urge them to submit Dualmode Bills in Congress. The more letters you send the better. “Grass roots” efforts can be effective, but we need to plant a huge number of seeds: It takes millions of grass roots to produce a lawn or a DUALMODE TRANSPORTATION SYSTEM.

I have written a number of letters to editors, have gotten a few published, and many others were ignored. But in promoting dualmode, even letters that do not get published will help our cause. If the editors who select the letters for publication keep seeing the same subject coming up from different people, they will eventually take notice. Newspapers have to pay attention to public opinion or they lose credibility. And I think that letters signed by more than one person are more effective.

When I read a transportation article or letter that I disagree with I am tempted to write a personal reply to the individual writer, but that would usually be ineffective use of my time. Usually that person’s mind is already made up and not subject to change. And a newspaper letter or article may reach a million or more people, not just one. Debate the opposition, and agree with supporters **in public** rather than in private. The bigger the audience the better.

Attend meetings on local transportation issues. City, county and state transportation boards and committees frequently hold public meetings. Try to introduce the advantages of dualmode at these meetings, but don't be surprised if you get opposition from the chair. Rome wasn't built in a day, but if we keep pecking away at the job eventually people will listen and start to understand.

Talk up dualmode transportation in Internet Chat Rooms. Send the URL for this book, <http://faculty.washington.edu/jbs/rev/revcontents.htm> to all of the appropriate people in your e-mail address book.

Whatever your position in life, you can speak up and help to get the ball rolling. Only you know the ways in which you can help, but your help is needed **now**. The louder and more frequently we insist on dualmode, the faster things will happen.

If not us, who? If not now, when? ----- (Jewish proverb)

THIS BOOK IS NOT COPYRIGHTED

In the interests of introducing dualmode as widely and rapidly as possible, others are encouraged to republish this entire book. No charge. The more it is published in other websites the more it will be read. No permissions are required, but the author requests that he be informed of such intentions or actions in order to keep track of our progress. Quotations from the book are encouraged, and online comments, pro and con, are welcome. Printed-book publishers are also invited to republish the book; and they are free to sell printed copies for profit without paying royalties to the author.

Next: [CHAPTER 22](#)

Conclusions

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Chapter 22

Conclusions

We love our cars, and their number will continue to increase, but our traffic problems must be solved. We will do it by graduating from industrial-age technologies to electronic and computer-age technologies. We built streets in cities centuries ago, railroads over a hundred years ago, and a better highway system fifty years ago. These wonderful systems alone can no longer do the job; we urgently need a high-tech system suited to 21st-century traffic, high populations, the energy crisis, and carbon dioxide abatement. The world has changed in major ways, and these changes demand a major change in transportation.

MANY BIRDS WITH ONE STONE

Traffic congestion is only one part of a complex and grave picture worldwide. We urgently need to solve a whole raft of transportation problems and transportation-related environmental and energy problems. Most previous thinking on these problems has been too narrow in scope. In trying to solve one problem we have sometimes made related matters worse. We must look at the big overall picture—look at the forest as well as the trees. Only an integrated solution will do the whole job.

A dualmode system with maglev and linear-synchronous-motor guideways will solve many more of our transportation and environmental problems than any other system or combination of systems. Dualmode will permit us to make our shopping trips, commutes, business trips, and vacations at high speed in a single vehicle door to door. We will have an environmentally clean system that operates normally in a street mode and operates without human drivers in a high-speed automatic mode. The guideways will be multipurpose like highways are; they will accept private cars and trucks, short-range transit vehicles, long-range buses, taxis, and freight vehicles.

But it is difficult to get people to listen to innovative solutions to complex problems. Perhaps one reason in this case is that most people don't believe in miracles, and dualmode promises much more than we would normally expect from any single solution.

All of the people will never be pleased all of the time, but dualmode will please most of the people more of the time. Those who like to drive for fun will have plenty of

room on the highways when most of the cars move to the guideways. Businesses will rejoice because people will again be able to get to stores and offices readily. Emergency vehicles will get there much faster than they can now. Commuters will get to work and back home faster, safer, cheaper, and with a lot less stress. Dualmode transit will provide faster service than present transit systems. The guideway will be the true “fast lane.”

Taxpayers will no longer be burdened with expensive new transit systems that fail to solve the traffic problems. Investors will love the safe sensible dualmode bonds. The dualmode system will favorably impact the deficit and the national debt. Hundreds of thousands of new jobs will open up. The automotive and many other businesses will have new opportunities. Generation of global-warming carbon dioxide and other atmospheric pollutants will be sharply reduced. The constantly rising cost of gasoline will become of little concern to most travelers. And when motor fuels are effectively gone (as they will be soon) the world can still travel (if we build the National Dualmode Transportation System soon enough). Finally, Mother Earth herself will be happier because she will be cleaner, quieter, greener, have a chance to repair some of the damage human travelers have caused, and be able to keep some of her goodies in the pantry for a longer time.

DUALMODE WILL FIX IT

Airplanes are also serious polluters, but national dualmode will greatly reduce domestic air travel. In these days of high security measures at airports, that will be doubly welcome. Airplanes and automobiles are noisy, but the airplanes will be fewer, and electric cars on the streets and the guideways will be much quieter.

Internal-combustion engines cause major pollution, but dualmode vehicles won't use them.

Dualmode will make possible the use of electricity for most transportation when petroleum is in short supply.

Our highways are much too congested, but most highway traffic will move to the guideways.

We have kept adding more highway lanes (which are always filled immediately), but a single lane of guideway will usually be enough for all of the traffic for years to come.

The streets are now jammed and parking is difficult, but automatic off-street parking of guideway cars will reduce urban traffic.

Traveling wastes a lot of time, but guideway travel times will be much reduced.

Sometimes we can't find a service station, but on the guideways cars will have unlimited range without a fuel tank.

Battery-electric cars, with their short range and low power, are not suitable for highway use, but in street mode REV car batteries will be very adequate.

Fog, sun-glare, and darkness make driving dangerous, but the automatic guideway system will always "see" perfectly.

Snow, ice, and rain cause slick-highway pileups, but the linear motors in the guideways won't depend upon wheel traction.

Failure to stop, and lane changing, cause accidents, but there will be no stoplights or lane changing on the guideways.

Road rage, drinking, carelessness, and other human shortcomings are now major problems, but humans won't be doing the driving on the guideways.

THE END AND THE BEGINNING

Because of our desperate need for major transportation and related environmental improvements worldwide, the author feels obligated to see that the National and International Dualmode Transportation System concept gets enough exposure and serious study that it will be either accepted on its merits, or rejected for valid reasons. The government, transportation planners, affected organizations and corporations, and leading individuals in all walks of life must not reject it hastily. The people, the long-suffering drivers, riders, businesses, and taxpayers deserve to know, must know, and will know of its potential. The defense rests. The jury—the people—will decide. When all is said it will be done—and the sooner the better.

Next: [APPENDIX](#)

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Appendix

FLYING-AUTOMOBILE DUALMODE SYSTEMS

Much effort has gone into the development of roadable airplanes or flying cars. Among others there was the 1917 Curtiss Autoplane, the 1938 Waterman Arrowbile, the 1939 Pitcairn Roadable Autogyro, the author's 1939 sketches of AeroAuto, the 1946 Convair Skycar IV, the 1946 Fulton Airphibian, the 1947 ConVairCar, and the 1947 Plane-Mobile. Molton Taylor's Aerocar was one of the most promising. It was granted full FAA certification in 1956, but only seven were produced. The author is indebted to Peter Bowers, and his book, UNCONVENTIONAL AIRCRAFT, for much of the above information.

Graduating from two-dimensional travel on the ground to three-dimensional travel in the air, and adding the limitless number of free ready-built as-the-crow-flies paths the air provides, would seem like a tremendous forward (and upward) leap. In reality, the use of roadable airplanes as a dualmode transportation system has great disadvantages. Our fixed paths on the ground (roads and rails) not only avoid the danger of falling but also provide a huge amount of protection from collisions. An automobile driver usually only needs to look ahead, while a safe airplane pilot must constantly look in all directions, including up and down. And in the air there are additional fallible humans involved—the air-traffic controllers.

Many airports are already operating at capacity; the traffic jams resulting from putting most of our cars into the air would be unthinkable. Surface dualmode offers huge capacity in a single lane because the cars can travel safely extremely close together. Highway capacity is many times less per lane because there we must allow a hundred to two hundred feet between cars for safety. In the infinite and unmarked paths of the air we must maintain not just feet but often miles between vehicles for adequate safety. Even with that third dimension, safe capacity in the air may be less than it is on the highways, depending upon the collision-avoidance equipment we have and the rules we adopt.

If a high percentage of the population were to use roadable airplanes for daily transportation we would have to have a huge number of new airports, and the roads to the airports would be jammed with vehicles. The airspace would also be jammed and very unsafe, especially under conditions of poor visibility. Vertical-takeoff-and-landing

hybrids would reduce the problems only slightly. Midair collisions would become more common than ground-traffic collisions, and the fatality rates would be much higher.

The requirements for airplanes are so different from the requirements for cars that hybrids are always poor airplanes, poor cars, or both. To date the only satisfactory power plants for airplanes burn fossil fuels, so roadable airplanes would still be polluting, noisy, and on the ground when the oil is gone. Also, roadable airplanes would have to meet vehicle and operator licensing requirements for both the highways and the airways—a bureaucratic nightmare.

PID COMMENT



PID COMMENT

“The Jetsons.” use appealing-looking personal air cars in their comic strip, but to meet the requirements of the real world these would have to be automatically navigated and controlled, provide vertical take-off and landing, be non-polluting quiet safe and affordable, use no fossil fuels, fly in all weather, and somehow solve the difficult traffic problems we have mentioned. All of these requirements won’t be met for fifty years, if ever.

Amphibian automobiles, a few of which have been built, are also dualmode vehicles, but they would be even less of a solution for our traffic problems than air cars would be.

DECELERATION CONTROL

“An alternator may be used to generate electrical power when driven mechanically, or it may be used as a motor to develop mechanical power when driven electrically. An alternating-current generator and a synchronous motor may be one and the same

machine.” --E.A.Loew, in DIRECT AND ALTERNATING CURRENTS, McGraw-Hill.

Professor Loew was thinking in terms of rotating synchronous machines, but his statement also applies to linear synchronous machines. The linear magnet coils in the guideways, interacting with the magnets under REV cars, will act as motors to propel the cars whenever thrust is required to keep them at synchronous speed. But if the cars are going down hill these machines will act as AC generators (alternators) and pump electrical energy back into the system. The cars will run at exactly the speed established by the frequency of the applied power in either case, but the phase of the sine wave of voltage generated by a synchronous machine will lag that of the applied voltage slightly when the machine is acting as a motor, and lead it slightly when the machine is acting as a generator.

If we have more than one car in a string on an exit-ramp they will have to be synchronized in order to keep the spacing between the cars constant. All of the linear motors in an exiting string must remain locked into the ramp frequency, and that frequency must gradually decrease in order to decelerate the string of cars as a unit. They would then all come to a stop at the same time on the final portion of a single exit ramp. Their drivers would then drive off onto the streets one by one, much as cars in line at a traffic light start up when the light turns green.

An exit ramp will be provided with the AC guideway power until the last car of an exit train entering it has demerged from the guideway. At that point the guideway power to the ramp will be automatically switched off, but the cars will still be electro-magnetically connected to each other through the ramp. If any car in the train then tends to travel faster than the others, its “motor” will start to act as an alternator, and phase shift will produce a regenerative braking effort, which will keep that car from closing the gap in front of it.

Likewise the motor of any car in the train with a tendency to slow down faster than its mates will draw enough generated power from the other cars in the train to hold it to exactly the speed of the other cars at that moment. No cars could ever lead or lag by more than a small percentage of one cycle of the alternating current frequency being generated at that moment; they will decelerate precisely together; the distances between cars will remain constant. They will act like a railroad train coasting to a stop, but their couplings will be electromagnetic instead of mechanical.

For a while after an exit train has demerged from a guideway it will decelerate naturally, since the aerodynamic drag due to its yet high speed will rapidly absorb kinetic energy from the cars. As the velocity of the train decreases, however, the drag will become insufficient to produce deceleration rates consistent with affordable exit-ramp lengths. Remember that the cars are still levitated and without ground or wheel friction. They would coast and coast; and the brakes in the cars can’t be used with the road wheels

off the ground. Therefore, to supplement the rapidly dissipating aerodynamic drag, we will put an electronically controlled “brake” on the **frequency** of the alternating current that is being generated in the exit-ramp coils by the cars passing over them.

Next: **BIBLIOGRAPHY**

THE REVOLUTIONARY DUALMODE TRANSPORTATION SYSTEM

Bibliography and Links

America's First Steamboat, Locomotive and Car? Steven Lubar, Invention & Technology magazine, Spring 2006

Control of PRT Systems, Dr. J. Edward Anderson, Journal of Advanced Transportation, 32:1, 1998, pp 57-74

Crackpot or Genius, A Complete Guide to the Uncommon Art of Inventing (book), Francis Reynolds, Barnes & Noble, 1999

Dangers of Ocean Acidification, Scott Doney, Scientific American, March 2006

Defusing the Global-Warming Time Bomb, Scientific American, March 2004

Dualmode, the Transportation of the Future, Reynolds, 2000
<http://faculty.washington.edu/jbs/itrans/reynolds-aspen.htm>

Dual Mode Transportation National Conference, Proceedings, Transportation Research Board, 1974, <http://faculty.washington.edu/jbs/itrans/dm-toc.htm>

The Dualmode Transportation Revolution, Reynolds, 2004,
<http://faculty.washington.edu/jbs/itrans/reynolds34.htm>

The Electronic Motorist, Ronald Jurgen, IEEE Spectrum (magazine), March 1995

The Flipping Point, Michael Shermer, Scientific American, June 2006

Fusion Energy,
<http://www.taipeitimes.com/News/bizfocus/archives/2006/05/28/2003310459>

The Future of Transportation, Scientific American, October 1997

Guidance, Switching, and Freight, Reynolds, 2001,
<http://faculty.washington.edu/jbs/itrans/reynolds24.htm>

High Speed Ground Transportation Systems Conference, Proceedings, Orlando, 1992

HiLoMag, The Future Transportation of the World? F.D. Reynolds, "Seoul 2000"

FISITA, World Automotive Congress, Korea, Paper # F20001387

Hybrid Vehicles Gain Traction, Romm and Frank, Scientific American, April 2006

Hydrogen from Solar Radiation, Scientific American, May 2006, page 24

Innovations from a Robot Rally, W. Gibbs, Scientific American, Jan. 2006

Innovative Transportation Technologies, Prof. Jerry B. Schneider,
<http://faculty.washington.edu/jbs/itrans>

Jet-Stream Power, <http://www.wisegeek.com/what-is-the-jet-stream.htm>

Linear Synchronous Motors, (book) Gieras and Piech, CRC Press, 2000

Maglev: A New Approach, Richard Post, Scientific American Magazine, January, 2000

Maglev Shows Great Promise for Dualmode Guideways, Reynolds: A letter published in Transportation Quarterly, Fall, 2002

MagneMotion, Dr. Richard Thornton, <http://www.magnemotion.com/>

Oil Haves and Have-Nots, Scientific American Magazine, September 2004

On the Road to Fuel-Cell Cars, Scientific American Magazine, March 2005

Peak Oil Crisis, Tom Whipple, Falls Church News-Press, May 16, 2006
<http://www.fcnp.com/610/peakoil.htm>

Personal Rapid Transit vs. Dualmode Transportation Reynolds, 2002
<http://faculty.washington.edu/jbs/itrans/PRTvsDM.htm>

A Perspective on Maglev Transit and Introduction of the PRT Maglev
<http://faculty.washington.edu/jbs/itrans/suppes.htm>

Platooning, Car Coupling, and LSM, Reynolds, 2001,
<http://faculty.washington.edu/jbs/itrans/reynolds22.htm>

Put the Intelligence in the System, Not in the Vehicles, Reynolds, 1999, SAE Technical Paper Number 1999-01-2953

Rental Cars, PRT, and Dualmode Rental Cars, Reynolds, 2002
<http://faculty.washington.edu/jbs/itrans/reynoldsrentalcars.htm>

Roads into the Future, (book) Robbert and Rudolf Das (Netherlands), ISBN 90-5121-612-2, Tirion, Baarn, 1999

Superconducting Maglev, U.S. Patent No. 3,470,828, Gordon Danby and James Powell

Super Trains (book), Joseph Vranich, 1991

Synchronous or Clear-Path Control in PRT systems, J.E. Anderson, Journal of Advanced Transportation, 30:3, 1996

The Next Hundred Years, (book), Brown, Bonner, and Weir,(Caltech), Viking Press, 1957

The Transportation System of the Future, Reynolds, The Futurist, Magazine, Sept./Oct., 2001 <http://faculty.washington.edu/jbs/itrans/reynoldsfuturist.htm>

Tomorrow's Transportation, (book) W.L. Garrison & J.D. Ward, Artech House, 2000

Transportation Database, U.S. Government, <http://www.transtats.bts.gov/>

Triage for the Post-Peak Oil Age, Kurt Cobb, Energy Bulletin, 5/15/2006
<http://www.evworld.com/view.cfm?section=communique&newsid=11920>

Unconventional Aircraft (book), Peter Bowers, TAB, 1984

Vehicles of Change, Burns, McCormick, & Borroni, Scientific American, October 2002

Warning: The Hydrogen Economy May be More Distant Than it Appears, Popular Science, January 2005

Wind Turbines, A Second Wind, James Chiles, Smithsonian Magazine, March 2000.

Next: [ABOUT THE AUTHOR](#)

Back to: [CONTENTS](#)

Comparison Matrix of Ready and Emerging Innovative Transportation Technologies

Both ready and emerging technologies are included in this matrix. Links are provided to more detailed on-line information about all technologies. The current status of emerging transportation technologies (i.e. not currently available for sale or not currently in revenue operation somewhere) in the world is evaluated. Technologies that are developed and ready for sale have a yellow background.

The status of each emerging technology has been self-evaluated by the inventors/developers of that technology, as of early 2001. Updates will be made as they become available. The definitions of the symbols used in the matrix are given below, following the comparison table.

System Name	Location	Status of Design Engr.&Testing				Cost Target	Active Mkting?	Operating?
		Vehicle	Guideway	C&C Software	Test Program			
<u>Aerobus</u>	USA, TX	Currently for sale, was operational several years ago in Europe and Canada. System currently being constructed in China						
<u>Aerorail</u>	USA, TX	Conceptual only						
<u>Aerorider</u>	Netherlands	Three-wheel bicycle with one-passenger enclosurer, for commuting						
<u>Atmostrack</u>	U.K.	Conceptual only - would use compressed air for propulsion						
<u>Austrans</u>	Australia	M/H	H	M	H	M	H	M
<u>Autoshuttle</u>	Germany	M	M	L	L	M/MH	M	M
<u>ATN</u>	New Zealand	Automated transportation network - a PRT/dualmode concept						
<u>Autran</u>	USA	M	M	M	N	L	L	N
AVT-Train	USA, CA	Conceptual only - high speed train that carries autos and people						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
Bee Hive	USA, CA	Conceptual only - uses trucks to carry small vehicles on urban freeways						
<u>Blade Runner</u>	U.K.	Uses vehicles with rubber tires and retractable steel wheels for dualmode capabilities, cargo and passenger modes						
<u>BT</u>	Korea	High-capacity dualmode concept under development, website features excellent animations of system in operation, many application illustrations						
<u>Cabintaxi</u>	USA, MI	Extensive test facility and program completed in Germany in 1970's, control system needs update, shuttle version operational since 1976, currently seeking implementation funds for an initial project						

Capsi	South Africa	Conceptual only, PRT approach uses small vehicles in a tube						
City Mobility	Netherlands	Conceptual only						
City Shuttle	USA, GA	Conceptual only, designed to provide a shuttle service for major activity centers and other high density areas in the city						
CompuCar	Germany	Conceptual only, small electric cars on automated guideway, dualmode possible eventually						
CULOR	USA	L	L	L	L	L	L	L
CyberCab	Netherlands	H	H	H	H	L	H	H
CyberCab	Finland	Concept only, as described in 1996 book about the future						
CyberTran	USA, CA,NY	H	H	M/H	M/H	L	M/H	M/H
Dragonfly MonoMetro	U.K.	Suspended monorail, final stages of design, prototype to follow, patents pending						
Electronic Guideway System (EGS)	USA, CA	Conceptual Only - Quadmode small vehicle system						
Evac. Tube Transport	USA, FL	L/M	L/M	L/M	L	VL-MH	M/H	L/M
Fast Tube System	U.K.	L	L	L	N	-	M/L	L
FlexiTrain	New Zea.	M	M	M	L	VL	M	L
Flash	USA, OK	Conceptual only, small supported vehicle						
Flyway	Sweden	L	L	L	N	VL	M	L
General Atomics, Urban Maglev	USA, CA	One of FTA's Urban Maglev contractors, prototype operational, demonstration planned at California University in Pennsylvania						
Gimbal Craft	USA	H	H	L	M	VL	M	M - ops. prototype available
Higherway	USA, WA	N	N	N	N	L	L	N
HighRoad	USA,GA	L	H	H	N	MH	H	N
HiLoMag	USA, WA	National dualmode system with high-capacity synchronous maglev guideways (conceptual only)						
HSST maglev	Japan	For sale, extensive test and demo program continuing, first application in Japan is under construction.. Being studied in the U.S. under a FTA Urban Maglev contract (See Photo index #4 for photos of vehicles).						

<u>Individual Mass Transit</u>	USA, OR	A three-tier dualmode concept, conceptual only						
<u>Intelligent Grouping Transport</u>	UK, London	An area wide, dial-a-ride concept, using advanced communications technologies - called Taxibus - utilizes relatively small vehicles						
Interstate Traveler	USA, MI	Maglev concept under development, includes palletized dualmode, cargo, solar driven hydrogen production and municipal utility capabilities						
<u>InTransSys</u>	USA, CO	Dualmode concept, extensive documentation and video available						
<u>JPods</u>	USA, MN	Small, suspended, computer controlled vehicles, development underway, very good slide show at their website						
<u>LEVX maglev by Magna-Force</u>	USA-WA	Prototype 6-passenger vehicle being developed, uses permanent magnets for suspension and linear motors for propulsion, test track being constructed near Port Angeles, Washington						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
MAGLEV 2000	USA, FL.	M	M/H	L	L	L/M	L	L
<u>Magnemotion, Urban Maglev</u>	USA, MA	One of FTA's Urban Maglev contractors, working toward demonstration project planned for near future, prototypes operating						
Magnetrans	USA, CA	H	M	H	M	M	H	M
Magplane pipeline	USA, MA	H	H	H	H	VL	M	H
<u>Magplane passenger</u>	USA, MA	M	M	M	L	MH	H	N
Magtube, Inc.	USA, CA	Evacuated tube concept using maglev, focused on moving freight						
<u>MegaRail</u>	USA, TX	M	M/H	L	L	VL	H	L/M, Video available
MicroRail	USA, TX	M	H	L	L	VL	H	Prototype early '02
<u>Mitchell</u>	USA, OR	M	H	M	H	L	M	N - but ops. Video avail.
<u>Monomobile</u>	USA, OH	M	M	L	M	VL	M	M
<u>Modern Transport System Corporation</u>	USA, CA	Developing novel maglev system, some prototype components currently operational						
Modular Automated Individual Transport	European	L	L	M	L	VL/L	M	N - good documents

ParkShuttle	Netherlands	Two systems in full operation (Amsterdam Airport since late 1997 and Rotterdam since early 1999; more systems being deployed						
Parry People Mover	UK	Features trams of several sizes, powered by a flywheel, no overhead wires. First application now (2003) underway in the UK.						
<u>Pathfinder</u>	USA, MI	M	L	L	L	M	M	L
<u>POSTECH PRT Project</u>	Korea	Research and development project at Pohang University, includes 40m test track and operational vehicle, Phase II program completed 2003						
<u>PRISM</u>	USA, MI	Dualmode concept being developed at Ford Research Laboratory						
<u>PRT 2000</u>	USA, MA	Development and test program completed in 2000, awaiting market interest, currently (2003) inactive.						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
<u>Personal Electric Rapid Transit System (PERTS)</u>	Virginia,USA	Maglev, dualmode concept, developed at VPI, scale model constructed, video available						
<u>Puget Pullway</u>	USA, WA	A dualmode concept that utilizes a modification of existing freeways						
Rideway	USA, CA	Conceptual only, moving beltway with passive vehicles						
<u>Robocab</u>	USA, MD	Small automated vehicles on exclusive guideway, prototype vehicle constructed and being tested						
<u>Roadrunner</u>	USA/UK	A very large bus concept						
<u>RUF</u>	Denmark	M/H	H/M	L	H	M	M	H
<u>RUMBA</u>	Germany	Conceptual only, tube transport concept						
Schmid Peoplemover	Germany	System for helping pedestrians get across heavily traveled roadways and other barriers to pedestrian movement						
<u>Segway</u>	USA	Conceptual only - a palletized dualmode concept						
<u>Serpentine</u>	Switzerland	H	H	H	M	VL	M	M
<u>Skybikes, Bike Trains</u>	USA	Conceptual only- specially designed facilities for serious bike transport						
<u>SkyTaxi</u>	Russia	Conceptual, small rail vehicles on interesting elevated guideway, in-vehicle switches planned						
<u>Sky Train</u>	USA, FL	Redesigned to incorporate fully proven light rail components				MH	M/H	N
<u>SkyTran</u>	USA	Conceptual only - high speed, small vehicle, low cost, maglev						
<u>Skyweb Express</u>	USA, MN	H	H	H	M	L	H	M
SmartSkyways	USA, CO	L	L	L	N	L	L	L
SMRTram	USA, MD	Conceptual - electric, large-vehicle, two-way travel with one lane						
<u>SwissMetro</u>	Switzerland	Maglev vehicle in a tube, considerable research has been conducted						

<u>Synchro-Rail</u>	U.K.	Development of full-size prototype started in 2000 under government Smart grant, 1st transport version (an Inclinator) to be installed end of 2001, awaiting market interest						
<u>System 21</u>	USA, SC	M	H	M	L	MH	H	M/L
<u>TriTrack</u>	USA, TX	H	L	N	L	VL	L	L
<u>TubeXpress</u>	USA, NJ	Prototypes built and tested, produce market-ready						
<u>TubeWay</u>	Germany	Concept only, uses air pressure and capsules for passenger and cargo						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost	Mkting?	Operating?
<u>ULTra</u>	U.K.	H	H	H	H	L	H	M
<u>Unitran</u>	Russia	Test facility constructed, testing underway. See website for details						
<u>Urbanaut</u>	USA, OR, WA	M	M/H	M/H	MH	H	M	M
<u>VMTS</u>	USA, WA	Conceptual only - uses large truck to haul small electric vehicles on freeways						
<u>Whoosh</u>	U.K.	Conceptual only - monorail that uses compressed air for propulsion						
<u>York PRT</u>	U.K.	Appears to be a reincarnation of Raytheon's PRT 2000 technology						

Symbols Used to Describe the Status of Design Engineering and Testing Programs for Each Technology

Vehicle Development
H = Highly developed, fully built, being tested or ready for testing M = Partially developed, some components and/or reduced scale prototype built and tested L = Still mostly on paper, some engineering studies completed N = All on paper or elsewhere
Guideway
H = Highly developed, full scale or scale model built, some testing accomplished M = Engineering design, analysis and cost studies completed L = Still mostly on paper, some engineering studies completed N = All on paper or elsewhere
Command and Control Software
H = Software fully developed, simulation capability tested and available for application studies M = Software designed, partially developed, no simulation capability available as yet L = Concepts in mind, some preliminary studies completed N = Not much progress yet
Testing Program
H = Test track built and being used for vehicle and software testing and

demonstrations M = Section of test track built, some testing accomplished L = Only small scale or prototype test facilities available N = No progress on test program other than planning so far
Cost Target (rough estimate of system capital cost, which includes all necessary components for operational system - contact vendor for specifics)
H = More that \$30 million/mile (\$18.75/km) MH = \$20-30 million/mile (\$12.5-\$18.75/km) M = \$10-20 million/mile (\$6.25-12.5/km) L = \$5-10 million/mile (\$3.125-6.25/km) VL = Less than \$5 million/mile (\$3.125/km)
Active Marketing Program?
H = Established and active sales/marketing program, some market research undertaken M = Brochures, videos, extensive written materials, active website L = Some details and illustrations available N = Not ready for this yet
Operational System Available for Inspection?
H = Test facility in operation and can provide rides and be inspected M = Operating prototype available as are simulation results L = Illustrations and/or static models available N = Nothing available so far

Requests for additions, deletions, improvement or correction should be sent to [Jerry Schneider](#)



Last modified:



RUF

RUF Dual Mode System



Magna Force



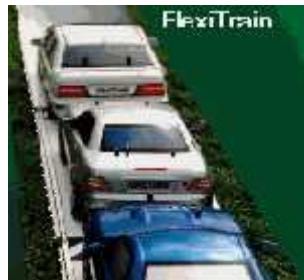
Ultra System



Skyweb Express



SkyTran



FlexiTrain



Austrans



CyberTran



CyberCab



PRT 2000



SIPEM



Smart Skyways



HiLoMag



MegaRail



SkyCar



Serpentine



ParkShuttle



Urbanaut



Cabintaxi



Morgantown



JPod



Aerobus



System 21



Aerorail



swiss metro



American MagLev



TransRapid



MagPlane



HSST



AutoShuttle



Culor



AVT-Train



CyberCab - Finland
CyberCab



Fast Tube System
Fast Tube System



FlyWay



HighRoad



Pathfinder



Magnetrans



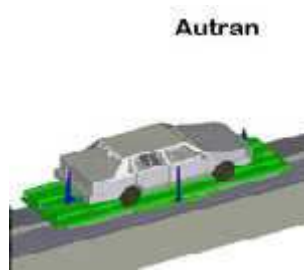
MAIT



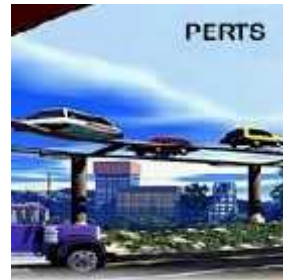
Interstate Traveler



[Aeromobile](#)



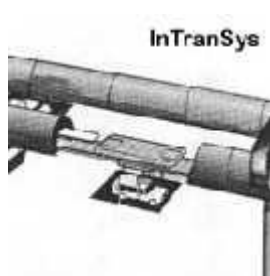
[Autran](#)



[PERTS](#)



[RUMBA](#)



[InTranSys](#)



[Maglev 2000](#)



[Segway](#)



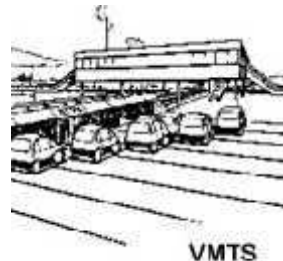
[Sky Train](#)



[Synchro Rail](#)



[Unitran](#)



[VMTS](#)



[SMRTtram](#)



[Monomobile](#)



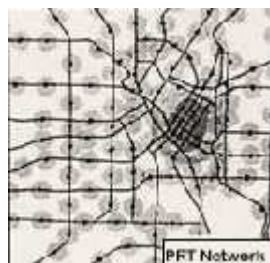
[Cabin Lift](#)



[AeroMovel](#)



[Highway](#)



[Minneapolis-St. Paul PRT](#)



[MTSC](#)



[Whoosh](#)



[SportTaxi](#)



TriTrack



Las Vegas Monorail



Dallas Ft Worth
Airport
Automated People
Mover



Solar Transit



Automated
Transportation
Network



Team Monorail



Cascade Monorail



Metrail



Korea PRT



HyTran



Haynes Aero



Uno



Space Car



Skycar



Monomobile



LevX



Sky Bus, India
Sky Bus



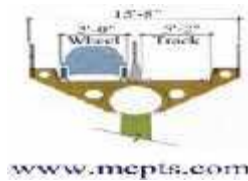
STU



Urbanaut



<http://www.gizmag.com/go/3282/>
Scooto



www.mepts.com
[McCrory Personal Transport System](#)



[TubeWay](#)



[AirTrain](#)



[GRT Urban People Mover](#)



[Maglev Aerotrain](#)



[Railway Technology](#)



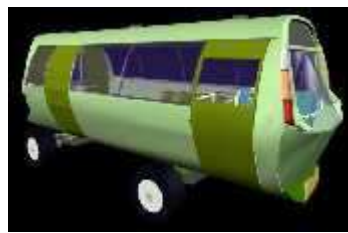
[People/Cargo Mover](#)



[The Air Car](#)



[MIT Concept Car](#)



[AMotion](#)



[Smart Car](#)



[Wilshire Monorail](#)



[Mister PRT](#)



[Translohr](#)



[Silver Bullet in Palo Alto](#)



[Redmond, WA](#)



[Cities 21](#)



[SpiritRail](#)



[Coaster System](#)



[Aeroscraft](#)



Bombardier



General Atomics



Doppelmayr Cable
Car



City Shuttle



City Mobility System



POMA



Dual-Mode Vehicle



APGM



FLASH



FLYAWAY



HighRoad



Mezzanine Transit



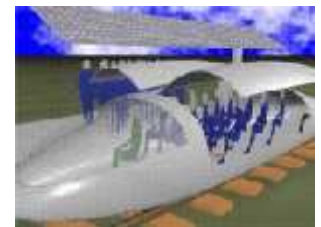
Vectus PRT



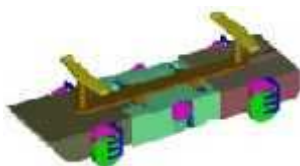
LABIS



Knolle Magnatrans



UltraLight Rail



Autran



Monic PRT



MonoMobile



TUBULAR RAIL



Parry People Mover



SMRtTRAM



FLEXTAXI



Blabe Runner



SporTaxi



SkyCabs



Road Runner



Tube Express



SkyCab



CityMobile



METRAIL



PRT Project



VECTUS



MagTube



ACABION



MISTER "Netro"



Autonomous
Transportation
System



Las Vegas Monorail



MonicPRT



SIKA



[NOWAIT Transit](#)



[American Standards
Institute for
Automated Transport
Systems, LLC](#)



[Vectus](#)



[Super Trains](#)



[MIST-ER](#)



[String Transport
Unitsky](#)



[The Coaster](#)



[MiniMetro](#)



[Aptera](#)



[TIG / m Trolley](#)



[PRT Project](#)

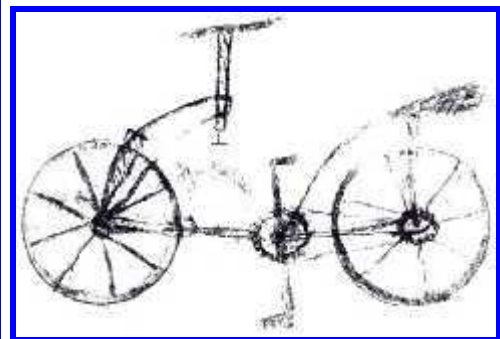


[FastTransit](#)



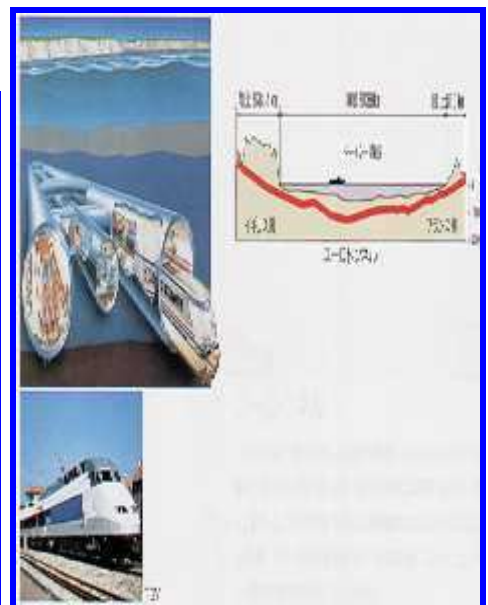
[MASDAR](#)

Some relevant informative pictures that do not appear in the REV Book. The average person does not realize all the innovations that have been kept back to promote useless automotive technology.

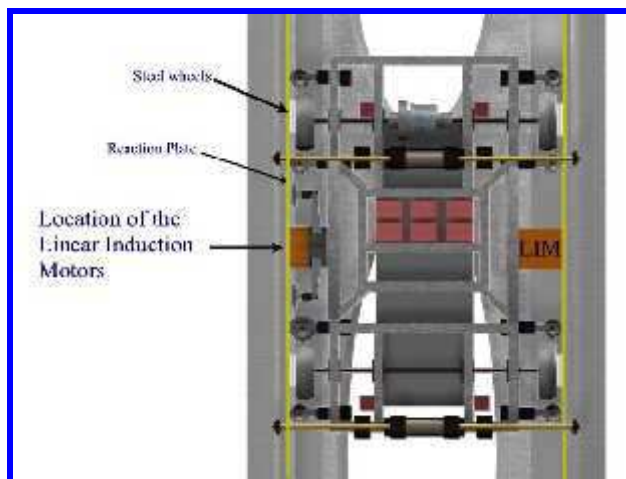












- Capacity of 20 Freeway Lanes at 10% of Cost
- A Dual Guide Way Can Move 150 Million Passengers Yearly

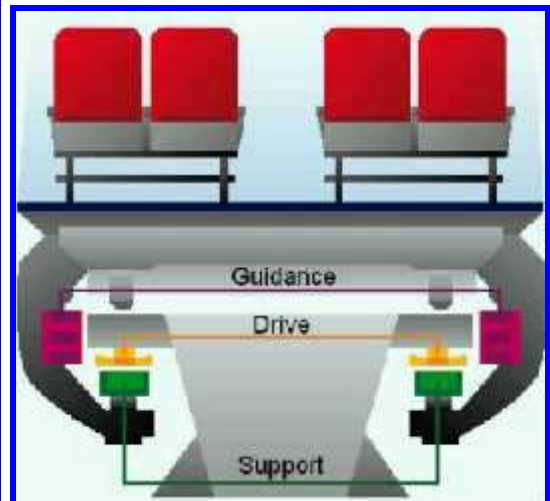
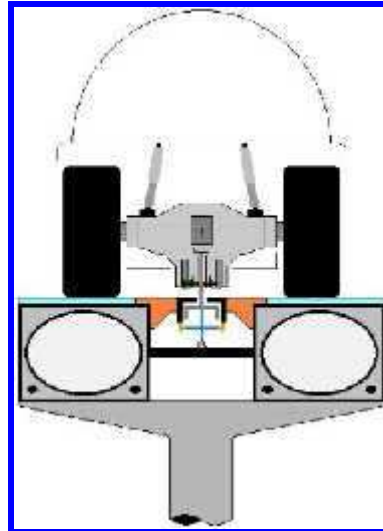
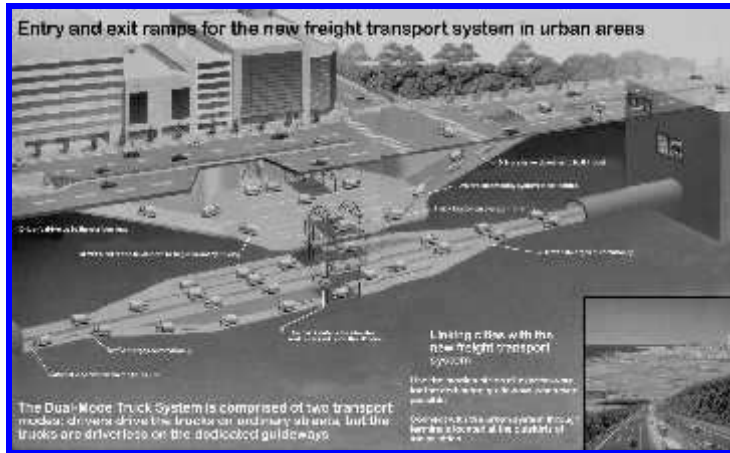


Figure 2. The test vehicle shown in this photo shows the Halbach Array. The Halbach array can be seen beneath the car and suspended from above. The array generates a magnetic field that repels from the track without contact. The car is suspended in the air, floating and centering the car above the track.



Inductive model test track being researched at LLNL. The vehicle wraps around the Halbach Array to create EMF, Mag-Lev Trains and Vehicles of the future will be based on this principle for propulsion.





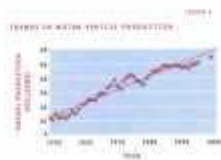


OLD TECHNOLOGY, NEW PROBLEMS

The University and 7677 surface water and light made in 2003 on average of about 40,000 each day. Nonpoint-source runoff rates in 2003 to top 17 million. The primary cause of water quality decline, according to the project has been past urban use of fertilizers. The most serious problem is water bodies: 150 million gallons per year in 2003, up from 10 million years in 1980, but this is part of the world's population growth. By 1990, 60 percent of the population was urban, and by 2000, 10 percent of the population was urban. From a commercial perspective, 17 percent of the world's population will move by 2020 and the world's population will be 1.2 billion—400 million.

Robert can use powerful, reliable, and numerous, strong, possibly both fluid and stable. We then like to use more than 10 minutes a typical one-on-one with about 10 minutes of free play in quiet time. The remainder 40 minutes, a single session in the form of a test and training, we have a

Automobile, personal technology has not fundamentally changed since the late sixties except for more driving. The time value of money in the United States is a 14 percent figure. Japanese manufacturers have used plural technology 80 percent in facilities. Today's use of technology has altered only incremental change in a 100 years with technology. Unfortunately, the most important thing being depleted are resources to maintain. 94 Percent more means a simple back-sitting's acceptable. There is no technology with an evolution of a time energy basis. There is technology to deal with energy change.







Comparison Matrix of Ready and Emerging Innovative Transportation Technologies

Both ready and emerging technologies are included in this matrix. Links are provided to more detailed on-line information about all technologies. The current status of emerging transportation technologies (i.e. not currently available for sale or not currently in revenue operation somewhere) in the world is evaluated. Technologies that are developed and ready for sale have a yellow background.

The status of each emerging technology has been self-evaluated by the inventors/developers of that technology, as of early 2001. Updates will be made as they become available. The definitions of the symbols used in the matrix are given below, following the comparison table.

System Name	Location	Status of Design Engr.&Testing				Cost Target	Active Mkting?	Operating?
		Vehicle	Guideway	C&C Software	Test Program			
Aerobus	USA, TX	Currently for sale, was operational several years ago in Europe and Canada. System currently being constructed in China						
Aerorail	USA, TX	Conceptual only						
Aerorider	Netherlands	Three-wheel bicycle with one-passenger enclosure, for commuting						
Atmostrack	U.K.	Conceptual only - would use compressed air for propulsion						
Austrans	Australia	M/H	H	M	H	M	H	M
Autoshuttle	Germany	M	M	L	L	M/MH	M	M
ATN	New Zealand	Automated transportation network - a PRT/dualmode concept						
Autran	USA	M	M	M	N	L	L	N
AVT-Train	USA, CA	Conceptual only - high speed train that carries autos and people						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
Bee Hive	USA, CA	Conceptual only - uses trucks to carry small vehicles on urban freeways						
Blade Runner	U.K.	Uses vehicles with rubber tires and retractable steel wheels for dualmode capabilities, cargo and passenger modes						
BT	Korea	High-capacity dualmode concept under development, website features excellent animations of system in operation, many application illustrations						

<u>Cabintaxi</u>	USA, MI	Extensive test facility and program completed in Germany in 1970's, control system needs update, shuttle version operational since 1976, currently seeking implementation funds for an initial project						
<u>Capsi</u>	South Africa	Conceptual only, PRT approach uses small vehicles in a tube						
City Mobility	Netherlands	Conceptual only						
<u>City Shuttle</u>	USA, GA	Conceptual only, designed to provide a shuttle service for major activity centers and other high density areas in the city						
<u>CompuCar</u>	Germany	Conceptual only, small electric cars on automated guideway, dualmode possible eventually						
<u>CULOR</u>	USA	L	L	L	L	L	L	L
<u>CyberCab</u>	Netherlands	H	H	H	H	L	H	H
CyberCab	Finland	Concept only, as described in 1996 book about the future						
<u>CyberTran</u>	USA, CA,NY	H	H	M/H	M/H	L	M/H	M/H
Dragonfly MonoMetro	U.K.	Suspended monorail, final stages of design, prototype to follow, patents pending						
<u>Electronic Guideway System (EGS)</u>	USA, CA	Conceptual Only - Quadmode small vehicle system						
<u>Evac. Tube Transport</u>	USA, FL	L/M	L/M	L/M	L	VL-MH	M/H	L/M
Fast Tube System	U.K.	L	L	L	N	-	M/L	L
<u>FlexiTrain</u>	New Zea.	M	M	M	L	VL	M	L
<u>Flash</u>	USA, OK	Conceptual only, small supported vehicle						
<u>Flyway</u>	Sweden	L	L	L	N	VL	M	L
General Atomics, Urban Maglev	USA, CA	One of FTA's Urban Maglev contractors, prototype operational, demonstration planned at California University in Pennsylvania						
Gimbal Craft	USA	H	H	L	M	VL	M	M - ops. prototype available
Higherway	USA, WA	N	N	N	N	L	L	N
<u>HighRoad</u>	USA,GA	L	H	H	N	MH	H	N
<u>HiLoMag</u>	USA, WA	National dualmode system with high-capacity synchronous maglev guideways (conceptual only)						

HSST maglev	Japan	For sale, extensive test and demo program continuing, first application in Japan is under construction.. Being studied in the U.S. under a FTA Urban Maglev contract (See Photo index #4 for photos of vehicles).						
<u>Individual Mass Transit</u>	USA, OR	A three-tier dualmode concept, conceptual only						
<u>Intelligent Grouping Transport</u>	UK, London	An area-wide, dial-a-ride concept, using advanced communications technologies - called Taxibus - utilizes relatively small vehicles						
Interstate Traveler	USA, MI	Maglev concept under development, includes palletized dualmode, cargo, solar driven hydrogen production and municipal utility capabilities						
<u>InTransSys</u>	USA, CO	Dualmode concept, extensive documentation and video available						
<u>JPods</u>	USA, MN	Small, suspended, computer controlled vehicles, development underway, very good slide show at their website						
<u>LEVX maglev by Magna-Force</u>	USA-WA	Prototype 6-passenger vehicle being developed, uses permanent magnets for suspension and linear motors for propulsion, test track being constructed near Port Angeles, Washington						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
MAGLEV 2000	USA, FL.	M	M/H	L	L	L/M	L	L
<u>Magnemotion, Urban Maglev</u>	USA, MA	One of FTA's Urban Maglev contractors, working toward demonstration project planned for near future, prototypes operating						
Magnetrans	USA, CA	H	M	H	M	M	H	M
Magplane pipeline	USA, MA	H	H	H	H	VL	M	H
<u>Magplane passenger</u>	USA, MA	M	M	M	L	MH	H	N
Magtube, Inc.	USA, CA	Evacuated tube concept using maglev, focused on moving freight						
<u>MegaRail</u>	USA, TX	M	M/H	L	L	VL	H	L/M, Video available
MicroRail	USA, TX	M	H	L	L	VL	H	Prototype early '02
<u>Mitchell</u>	USA, OR	M	H	M	H	L	M	N - but ops. video avail.
<u>Monomobile</u>	USA, OH	M	M	L	M	VL	M	M
<u>Modern Transport</u>	USA, CA	Developing novel maglev system, some prototype components currently operational						

<u>System Corporation</u>								
Modular Automated Individual Transport	European	L	L	M	L	VL/L	M	N - good documents
ParkShuttle	Netherlands	Two systems in full operation (Amsterdam Airport since late 1997 and Rotterdam since early 1999; more systems being deployed)						
Parry People Mover	UK	Features trams of several sizes, powered by a flywheel, no overhead wires. First application now (2003) underway in the UK.						
<u>Pathfinder</u>	USA, MI	M	L	L	L	M	M	L
<u>POSTECH PRT Project</u>	Korea	Research and development project at Pohang University, includes 40m test track and operational vehicle, Phase II program completed 2003						
<u>PRISM</u>	USA, MI	Dualmode concept being developed at Ford Research Laboratory						
<u>PRT 2000</u>	USA, MA	Development and test program completed in 2000, awaiting market interest, currently (2003) inactive.						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost?	Mkting?	Operating?
<u>Personal Electric Rapid Transit System (PERTS)</u>	Virginia,USA	Maglev, dualmode concept, developed at VPI, scale model constructed, video available						
<u>Puget Pullway</u>	USA, WA	A dualmode concept that utilizes a modification of existing freeways						
Rideway	USA, CA	Conceptual only, moving beltway with passive vehicles						
<u>Robocab</u>	USA, MD	Small automated vehicles on exclusive guideway, prototype vehicle constructed and being tested						
<u>Roadrunner</u>	USA/UK	A very large bus concept						
<u>RUF</u>	Denmark	M/H	H/M	L	H	M	M	H
<u>RUMBA</u>	Germany	Conceptual only, tube transport concept						
Schmid Peoplemover	Germany	System for helping pedestrians get across heavily traveled roadways and other barriers to pedestrian movement						
<u>Segway</u>	USA	Conceptual only - a palletized dualmode concept						
<u>Serpentine</u>	Switzerland	H	H	H	M	VL	M	M
<u>Skybikes, Bike Trains</u>	USA	Conceptual only- specially designed facilities for serious bike transport						

<u>SkyTaxi</u>	Russia	Conceptual, small rail vehicles on interesting elevated guideway, in-vehicle switches planned						
<u>Sky Train</u>	USA, FL	Redesigned to incorporate fully proven light rail components				MH	M/H	N
<u>SkyTran</u>	USA	Conceptual only - high speed, small vehicle, low cost, maglev						
<u>Skyweb Express</u>	USA, MN	H	H	H	M	L	H	M
SmartSkyways	USA, CO	L	L	L	N	L	L	L
SMRTram	USA, MD	Conceptual - electric, large-vehicle, two-way travel with one lane						
<u>SwissMetro</u>	Switzerland	Maglev vehicle in a tube, considerable research has been conducted						
<u>Synchro-Rail</u>	U.K.	Development of full-size prototype started in 2000 under government Smart grant, 1st transport version (an Inclinator) to be installed end of 2001, awaiting market interest						
<u>System 21</u>	USA, SC	M	H	M	L	MH	H	M/L
<u>TriTrack</u>	USA, TX	H	L	N	L	VL	L	L
<u>TubeXpress</u>	USA, NJ	Prototypes built and tested, produce market-ready						
<u>TubeWay</u>	Germany	Concept only, uses air pressure and capsules for passenger and cargo						
System Name	Location	Vehicle	Guideway	Software	Test ?	Cost	Mkting?	Operating?
<u>ULTra</u>	U.K.	H	H	H	H	L	H	M
<u>Unitran</u>	Russia	Test facility constructed, testing underway. See website for details						
<u>Urbanaut</u>	USA, OR,WA	M	M/H	M/H	MH	H	M	M
<u>VMTS</u>	USA, WA	Conceptual only - uses large truck to haul small electric vehicles on freeways						
<u>Whoosh</u>	U.K.	Conceptual only - monorail that uses compressed air for propulsion						
<u>York PRT</u>	U.K.	Appears to be a reincarnation of Raytheon's PRT 2000 technology						

Symbols Used to Describe the Status of Design Engineering and Testing Programs for Each Technology

Vehicle Development
H = Highly developed, fully built, being tested or ready for testing
M = Partially developed, some components and/or reduced scale prototype built and tested

L = Still mostly on paper, some engineering studies completed N = All on paper or elsewhere
Guideway
H = Highly developed, full scale or scale model built, some testing accomplished M = Engineering design, analysis and cost studies completed L = Still mostly on paper, some engineering studies completed N = All on paper or elsewhere
Command and Control Software
H = Software fully developed, simulation capability tested and available for application studies M = Software designed, partially developed, no simulation capability available as yet L = Concepts in mind, some preliminary studies completed N = Not much progress yet
Testing Program
H = Test track built and being used for vehicle and software testing and demonstrations M = Section of test track built, some testing accomplished L = Only small scale or prototype test facilities available N = No progress on test program other than planning so far
Cost Target (rough estimate of system capital cost, which includes all necessary components for operational system - contact vendor for specifics)
H = More that \$30 million/mile (\$18.75/km) MH = \$20-30 million/mile (\$12.5-\$18.75/km) M = \$10-20 million/mile (\$6.25-12.5/km) L = \$5-10 million/mile (\$3.125-6.25/km) VL = Less than \$5 million/mile (\$3.125/km)
Active Marketing Program?
H = Established and active sales/marketing program, some market research undertaken M = Brochures, videos, extensive written materials, active website L = Some details and illustrations available N = Not ready for this yet
Operational System Available for Inspection?
H = Test facility in operation and can provide rides and be inspected M = Operating prototype available as are simulation results L = Illustrations and/or static models available N = Nothing available so far

Requests for additions, deletions, improvement or correction should be sent to [Jerry Schneider](#)

Dual-Mode Energy Infrastructure Briefing

An overview for the feasibility of rebuilding the American Economy based on the DLF GLOBAL Wireless Energy Infrastructure Business Plan (ver. 9.05 01/2009)

A. Fund 100,000 Service Shops across the USA-

1. Certification Plan for Service Shops looking to develop or build Dual-Mode Vehicles.
 - a.) A Federal Mandate will give small Service Shops a stronger market position against major manufacturers.
 - b.) Expansion capital can be used to hire employees, expand the business and purchase equipment.
 - c.) Community based Vocational and Technical Training Programs on Dual-Mode.
2. Automotive Industry should be MANDATED to build Dual-Mode Vehicles in exchange for federal bailouts.
 - a.) Standardize components for use on a Guideway System.
 - b.) Institute a Consortium to oversee global Guideway Vehicle Developments.
 - c.) Appoint a “Dual-Mode Czar” as the official expert on Dual-Mode Systems.
3. Train existing Mechanics and Engineers on Dual-Mode Systems.
 - a.) State Licensing for Dual-Mode Vehicles using a Guideway System.
 - b.) State Inspections for use of Dual-Mode Vehicles on a Guideway System.
 - c.) Federal and State Certification of Non-Motorized Vehicles for use on a Guideway System.
4. Prepare the existing Guideway Manufacturing Partners located in Texas and Alabama.
 - a.) Equip the existing Fabrication facilities with specs on the Guideway structure.
 - b.) Employ additional Erector Fabrication Companies as needed.
5. Finalize deal negotiations for [4643 Mulberry St. Philadelphia Pa.], [Union Landing Rd. Cinnaminson N.J.] and [Willingboro HQ for {proposed Broad and High St. Burlington City N.J.}]
Dual-Mode Station Locations. All other pending locations are not listed.
 - a.) Provide proposals to Local Officials representing these locations.
 - b.) Plan site surveys for the best possible locations.
 - c.) Present marketing plans for the community.

B. 10 Million JOBS within 10 years-

1. Institute a curriculum on Dual-Mode Technologies for High Schools and Colleges.
 - a.) Define JOB Demographics based on available Service Shops.
 - b.) Locate Professors knowledgeable on Mag-Lev and Guideway Systems.
 - c.) Solicit Universities to teach Dual-Mode Systems.
 - d.) Forecast JOB Placement criteria.
2. Retrain dislocated workers on Dual-Mode Technology and Systems.
 - a.) Assess skills of existing Employees for testing criteria.
 - b.) Institute curriculum in JOB CORPS Training Programs.
3. Assemble another Conference on Dual-Mode Transportation in Washington D.C.,.

- a.) A “Call for Technologies” Conference will bring forth new innovations.
- b.) A Call for Papers on Dual-Mode Transportation.
- c.) Review the Exploratory Analysis for various Automated Technology Innovations.
- d.) Implement a Request for Quote for marketing Dual-Mode Technology internationally.

C. International Investment Plan-

1. Implementing the Dual-Mode Plan with little or no Federal or State Funding.
 - a.) Market the existing Dual-Mode Facility locations as a technology landmark.
 - b.) Have the President or a Top Official do PSA’s on Dual-Mode Transportation.
2. Public / Private Partnership Initiatives.
 - a.) Solicit Transportation Bonds for building the Guideway System.
 - b.) Solicit Institutional Investors for investment in Dual-Mode Systems.
3. Federal or State Oversight Committee and Due Diligence Plans.
 - a.) Manage the Investment Portfolio.
 - b.) Solicit for Guideway Investments and Partnerships.
4. \$1.4 Trillion invested into the USA for building the Guideway System (to pay down the deficit in approximately 4 years).
 - a.) Bonds offer long term stability for Investors.

D. The Guideway System-

1. A Revolutionary Renewable Power System-
 - a.) Remote Back-Up Power for Home or Business.
 - b.) Abundant renewable sources for transportation usage.
2. A Revolutionary Transportation System-
 - a.) “Unlimited Guideway Capacity” meaning 1 Guideway lane replaces 12 freeway lanes!
 - b.) An Emergency Evacuation System for Cities and States.
3. A Revolutionary Computer System-
 - a.) Computers play a new role in Vehicle Propulsion and Automation.
 - b.) Computing braces for unveiled advancements in Guideway Flight Engineering.
4. A Revolutionary “Mobile” Warehouse System-
 - a.) Small Businesses can now compete with “Big Box” facilities.
 - b.) Orders can arrive within 1 hour of order placement.
5. A Revolutionary “Virtual Factory” System-
 - a.) Local Fabrication can build Dual-Mode Vehicles in real time!

E. State of Texas House Bill 3588

1. The Trans-Texas Corridor Feasibility Study provided open ROW for a feasible Dual-Mode Project (Dept. of Defense CTE Level 7).
 - a.) States need to follow the TEXAS Right of Way plans for Dual-Mode Vehicle implementation.

F. New Jersey Regulatory Support-

1. The Low Speed Bill- (Congressman John Adler and Assemblyman John Wisniewski).

2. The Personal Rapid Transit Study- (Senators Paul Sarlo and Joseph V. Doria Jr. and Assemblyman John Wisniewski).
3. The Containerized Freight Study- (signed by acting Governor Richard J. Codey).
4. Turnpike Toll Assessment- (N.J. Dept. of Transportation).
5. Non-Motorized Vehicle Regulation- (currently not available).

G. Marketing Awareness-

1. Market Dual-Mode to Countries based on their economic capability and capacity- (ie. Velomobiles for India vs. Guideway Cars for European markets).
2. Market within the USA to promote an immediate Economic Solution.
3. A Three in One Solution (Energy, Transportation, Computing) to merge Industries into the 21st Century using Information Technology as the driving factor.
 - a.) Inform the public that a potential solution is here, to minimize the economic downturn.

H. Other States and their achievements-

1. New York- (Ithaca PODCAR Conference)
2. California- (San Jose Advanced Transportation RFQ)
3. Washington- (WSU Innovative Transportation Technology Website)
4. Nebraska- (Call for Papers on Dual-Mode Transportation)
- 5 Wisconsin- (Call for Papers on Dual-Mode Transportation)
6. Texas- (TxDOT HB 3588 and Texas A&M University TTI Division)
7. Maryland- (Washington D.C. hearing on Dual-Mode 1974 & 2006)
8. Virginia- (VDOT Call for PRT 2008)
9. Tennessee- (Low Speed Vehicle Initiatives)
10. Minnesota- (Minneapolis Skyweb Express PRT R&D)
11. Colorado- (Smart Skyways I-70 Corridor Study)
12. W. Virginia- (Morgantown Group Rapid Transit System)
13. New Jersey- (Tube Express Systems)
14. Florida- (Disney World Monorail and Cars)

I. International achievements for Advanced Transportation-

1. Denmark- (RUF Transportation Feasibility Study).
2. Japan- (Haikon Japanese Dual-Mode Bus on Rails).

J. DLF GLOBAL needs [to do list]-

1. Raise additional Energy Source Provider Partners under an advanced charter.
2. Market the Service Shop Certification process to raise capital.
3. Market existing Dual-Mode Locations and create a Dual-Mode Ad Campaign.

K. The Bottom Line-

A verifiable National Stimulus Plan has already been drafted for the creation of jobs to rebuild the American Economy.

Marketing the Dual-Mode Campaign

<u>Option A-</u> <u>Total- \$500,000</u>	\$30,000 to build several viable Dual-Mode Vehicles	\$70,000 to assemble a portable erectable Guideway Track (1000 ft. and able to fit on 4 40' flatbeds)	\$400,000 to market the Dual-Mode Station Plan to Service Shops, the US Government and Countries
<u>Option B-</u> <u>Total- \$200,000</u>	\$30,000 to build several viable Dual-Mode Vehicles	\$70,000 to assemble a portable erectable Guideway Track (1000 ft. and able to fit on 4 40' flatbeds)	\$100,000 to market the public via the Internet
<u>Option C-</u> <u>Total- \$30,000</u>	\$10,000 to build a Dual-Mode Vehicle	\$10,000 for a 40' Guideway Track section / operational hardware	\$10,000 to attract media and press coverage
<u>Option D-</u> <u>Total- \$20,000</u>	\$10,000 to build a Dual-Mode Vehicle	\$10,000 for a 40' Guideway Track section / operational hardware	N/A

This briefing was drafted from the original DLF Group Inc. ESP License Owner's Business Plan for "Developing a Web-Based Electric Utility Infrastructure" written in December 1999. This Business Plan was updated on December 10th 2006 (version 8.95) with an interactive CD-ROM and will be further updated by December 2009 on DVD format.

The growing worldwide demand for an Advanced Transportation System has made this briefing critical to the survival of the United States Government and U.S. Corporations looking for new market potential and a viable Economic Stimulus Plan.

Speeding into the future

Willingboro-based firm develops technology for dual-mode, nonmotorized vehicle.

By David Maccar
Staff writer

dmaccar@phillyburbs.com
609-871-8068

BURLINGTON CITY — Imagine the possibilities of a vehicle that runs on a modest amount of electricity rather than combustible fuel, has the same power as a conventional vehicle, reaches speeds of 100 mph, produces no emissions and can traverse freeways on its own, guided by a computer.

Something out of a science fiction movie? Perhaps, but one local company says the technology is not as complex as some might think and will become a reality in the near future.

It's a dual-mode, nonmotorized vehicle, and the concept is being propelled by Ron Dobisch and Warren Tucker II of the Willingboro-based management firm DLF Group Inc.

DLF has found a believer in Steven Toughill, owner of the Volkstech shop on High Street, which specializes in repairing and modifying Volkswagens, Audis and Porsches.

Toughill said applications for the dual-mode technology are limited only by the imagination, something that always has interested Volkstech founder Don Reinhardt, who Toughill said is designing and working with hydraulic, propane and electric-powered vehicles.

"There's so much versatility there, it's endless. It's how much can you imagine and then taking that imagination and actually applying it to a physical something," Toughill said. "We've been following the progress of this and we want to get involved with it. We want to do something different."

The vehicles use a unique combination of flywheels, generators, computers, gears and batteries to get the most power out of the simplest design possible, a concept DLF has been developing for about 30 years.

The fuel-free vehicles can weigh between 2,000 and 6,000 pounds and cost between \$15,000 and \$25,000, depending on different configurations that range from personal conveyances to small cargo vehicles



ROSE SHIELDS / STAFF PHOTOGRAPHER

Warren Tucker II (from left), of the Willingboro-based management firm DLF Group Inc., speaks with William McGarrity (brown jacket) of Burlington Township on Oct. 2 in Burlington City about job opportunities for building nonmotorized vehicles. Looking on are Ron Dobisch and Tucker's brother, Raymond Tucker, both of Willingboro.

and minibuses, according to Tucker.

Tucker said he hopes to have a polished prototype outfitted as an affordable armored vehicle for use by municipal police forces completed in 30 to 60 days.

Once an infrastructure is created, the vehicle would have the added capability of traveling on a designated lane of a highway or street called a guide-way, where it would be automatically driven to its destination by computer and powered by a rail imbedded in the lane.

"Once you enter the guide-way, the vehicle is inspected by the computer and once it's on, you sit back and enjoy your coffee and the vehicle would drive on its own," Tucker said.

Being computer-controlled would allow the vehicles to travel close together, thereby using the maximum capability of the guide-way.

Building and maintaining the infrastructure, the computer systems and the vehicles themselves are the first steps, which Tucker said will create many local jobs as well as job training opportunities for vocational schools and colleges.

DLF representatives have been to Rowan and Drexel universities and plans to visit Princeton, the Massachusetts Institute of Technology, and local vocational schools in 2010.

Tucker's vision involves different components being built

at different machine, automotive and tool shops in the area, such as Volkstech, with DLF managing the entire project, he said.

"Shops would have to be certified and would have to have the capabilities to build the products needed," he said. "We have about 150 to 200 shops in the Burlington County area, South Jersey and in Philadelphia on the table right now and we're working to put more shops online."

Toughill said the technology, which could conceivably lead to emissions-free public transportation, cargo vehicles and personal conveyances, has to be recognized as a possibility and not just a pipe dream.

"I hope the people out there in the world, especially the politicians, can see this and not be closed-minded to it," he said. "It's the real deal, there's no question about it."

Mayor James Fazzzone said he would be happy to see a breakthrough project like DLF's get its start in the city.

"If he becomes the next Thomas Edison or Bill Gates, we'd like to be in on that and we don't know that he's not," Fazzzone said. "Hopefully this thing takes off the way he would like it to take off."

America Should Embrace Alternative Transportation Modes

Few are aware of the street-legal non-motorized vehicle (NMV), which uses micro-processed co-generation technology (computers, flywheels, magnetism and a battery pack) for propulsion (Re: "Re-Inventing the Wheel,"



A non-motorized vehicle (NMV) prototype.

Winter 2009 issue). The emission-free NMV blends the best of transit, automobiles, cycling and flight, while leaving out the negative aspects associated with those modes.

There are 12 types of NMVs being developed in the U.S., Canada, India, Ukraine and China. The City of Burlington, N.J., is an international landmark for the development of NMVs and "dual-mode" vehicles that

can run on both standard roads and guideway systems.

The NMV was built with a guideway system in mind, allowing everyone equal access to mobility. A guideway system along a few major corridors with a modest toll would

create new revenue streams for states and local municipalities.

The use of a guideway system gives commuters the benefit of "autopilot" in their own private vehicle, a feature that most people would gladly pay for. Having time to sip the coffee, read the paper, relax or nap (for the bold ones) is a luxury that the most expensive cars cannot offer. A 6-foot wide guideway system can move 12 freeway lanes of traffic at 60 mph.

Freight can be the main source for financing the guideway system. A readily available statewide evacuation plan is more feasible using guideways instead of highways.

The guideway system is America's alternative transportation solution. A guideway can use multiple sources of renewable energy

Continued on page 28

Letters

continued from page 2

(solar, wind, ocean, biomass, etc.).

The guideway system has been proven for well over 200 years around the world. Roller coasters, elevators, trains, escalators, monorails and maglev vehicles have a higher level of safety and reliability than random automobiles speeding on a highway.

A plan to fund 100,000 service shops across America to build NMVs and dual-mode vehicles has been in the works since 1999. A dual-mode petition before the U.S. Congress was somewhat successful in 2006, and now a more aggressive approach is being implemented. Several million jobs can very easily be created from the service shop plan, and the U.S. government must take this initiative

very seriously, or stand to lose their opportunity to rebuild America against nations that will readily see the benefits of non-motorized vehicles.

— WARREN TUCKER II
Technology Integrator
New Venture Associates II
Willingboro, N.J.

FINALLY!

**THE
END!**