## 2.0 Brief History of the Development of Transportation

Depiction of a onager-drawn Sumarian cart (c. 2500 BC)

For thousands of years, humans have sought to make the movement of people and cargo easier and more efficient than walking or using load-bearing animals alone. The invention of the wheel eventually led to the development of the cart, wagon, and carriage. Although improved upon, the animal-drawn cart/wagon/carriage remained the main form of transportation for over 5,000 years. Not until 1672 AD, when Ferdinand Verbiest built what may have been the first steam-powered car, did various new forms of transportation begin to be developed. Most initial forms adopted and applied the principle of converting heat (e.g. steam) into mechanical energy, thereby producing power (e.g. measured in horsepower). Subsequent steam-powered inventions included the steam carriage, steam boat, steam locomotive, and transatlantic steamship. The 1700s and 1800s saw many inventions which improved transportation significantly, such as the bicycle, motorcycle, elevator, escalator, hot-air balloon, ridged airship, and the first car powered by an internal combustion engine.

Wright Flyer I, first manned, powered flight, 1903

The 20th and 21st centuries saw an exponential increase in scientific knowledge and discoveries, many of which stemmed from studies and experimentation surrounding various forms of transportation. One of the most important events in air transportation was made on December 17, 1903, at Kitty Hawk, NC, where Orville Wright is credited with making the first sustained manned, powered flight in the "Wright Flyer I". He traveled 37 meters (~120 feet), at a speed of 10.9km/h (~6.8mph), at about 3m (~10ft) above the ground.[1] Many transportation developments followed to include the Ford Model T and the assembly line manufacturing concept, as well as the diesel engine, jet engine powered aircraft, nuclear-powered vessels, supersonic flight, spaceflight, and high-speed Maglev trains.

Boeing commercial passenger jet aircraft, fossil-fuel powered

Transportation and technological innovations of late have focused on reducing pollution, improving safety and efficiencies through automation, and reducing operational costs. The use of alternative/clean fuels such as solar, hydrogen, and electric, coupled with technologies such as Global Positioning System (GPS) navigation, networking, collision avoidance, and integrated 3D accelerometers and gyroscopes in Micro Electro-Mechanical Systems (MEMS) are transforming many forms of transportation. Some innovative products that are already in use today include the Segway, semi-autonomous cars, Unmanned Aerial Vehicles (UAVs), and electric/solar-powered manned aircraft.

Since ***knowledge*** is now estimated to be ***doubling every 13 months***,[2] we can anticipate multiple innovations in transportation which provide more efficient, safer, and cleaner/greener technologies, systems and processes. The prospect of future innovations, along with current capabilities, should motivate the U.S. government and U.S. companies to be first to develop and implement a new, national, standardized, networked ATS, and promote it and sell it worldwide.

[1] https://en.wikipedia.org/wiki/Wright_brothers

[2] https://lodestarsolutions.com/keeping-up-with-the-surge-of-information-and-human-knowledge/