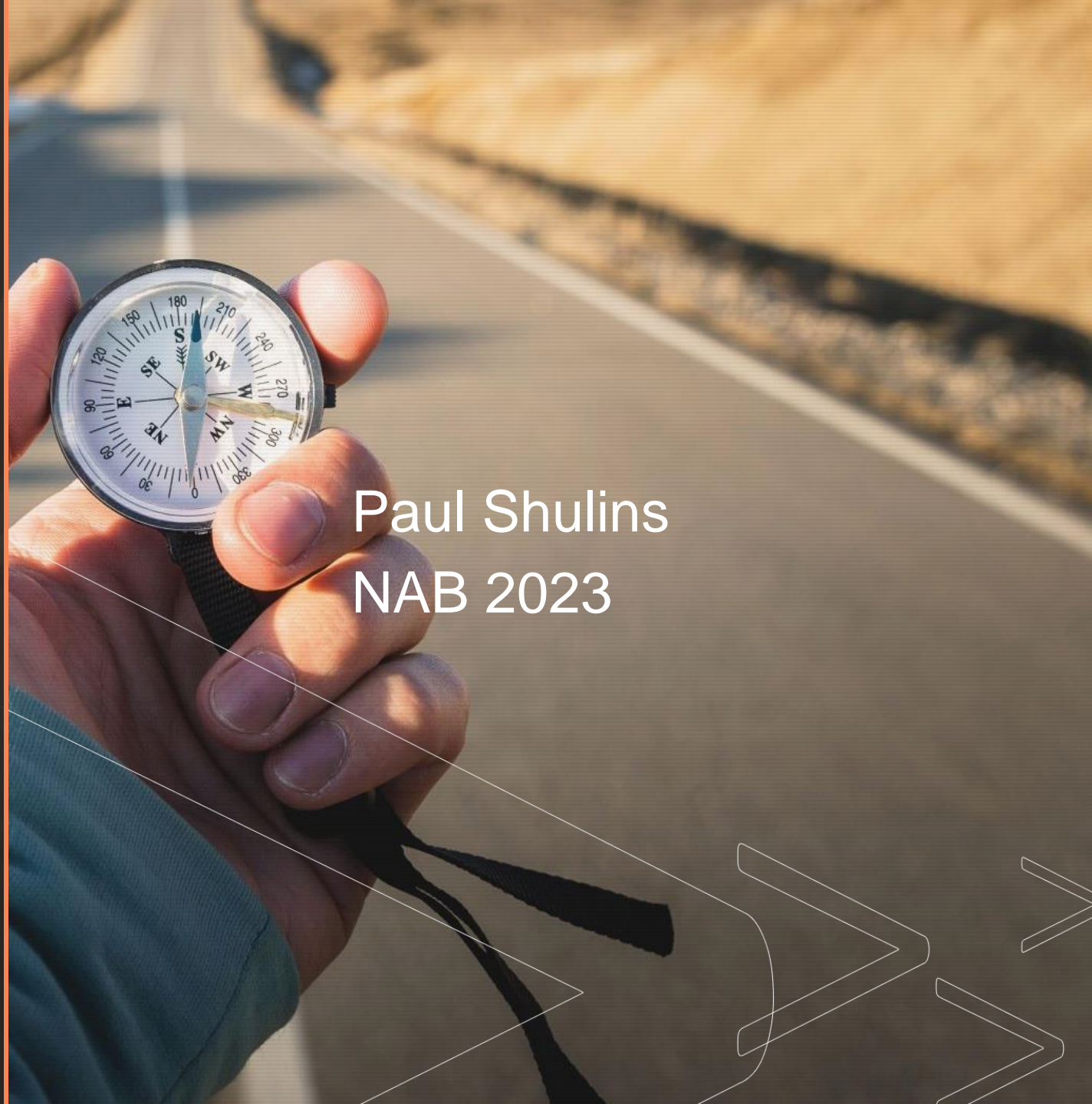


# 20,000 Mile Journey

- 70 Tower Sites
- 423 Broadcast Stations
- 78 Hotels
- 287 Meals out
- 137 Drive through meals
- 1 Cargo Van
- 3 Oil Changes
- 1,074 Gallons of Gasoline
- 3 sets of wiper blades
- 6 Airline Flights



Paul Shulins  
NAB 2023



# Stellar Eclipse for American Tower Corporation

VSWR Protection: Why is it needed?

My transmitter already has it right?

What causes problems?

# So, what's the problem?

- Stuff burns up!
- There is no good way to predict when disaster will strike.
- VSWR Changes usually indicate you already have a problem!
- Thermal measurements of transmission lines and elbows can establish a normal baseline and can help detect changes that could lead to a failure.

# A Question of when, not if!

- Mother nature! Expansion and contraction of metal line sections
- Mechanical vibrations over time, metal fatigue
- Improper antenna or transmission line installation
- Loss of transmission line gas pressure
- Property damage
- The rated power level of the system compared to the actual power level being used combine to define the operating margin
- Failure to inspect the tower, antenna and feed line on a regular basis

# Challenges with transmitter behavior

- Solid State RF devices are susceptible to dramatic failure with high VSWR
- Transmitter VSWR foldback circuits are designed to protect RF devices in the transmitter
- VSWR Foldback internal to transmitters can and will cause problems
- Looking at reverse power alone is not enough
- VSWR is a better indication of what is really going on
- Stations should employ external protection for VSWR besides just the transmitter power foldback logic



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# Teflon Melts at 620°F





## Simple formula to calculate VSWR

$$\text{VSWR} = \frac{1 + \sqrt{\frac{\text{REFLECTED POWER}}{\text{FORWARD POWER}}}}{1 - \sqrt{\frac{\text{REFLECTED POWER}}{\text{FORWARD POWER}}}}$$

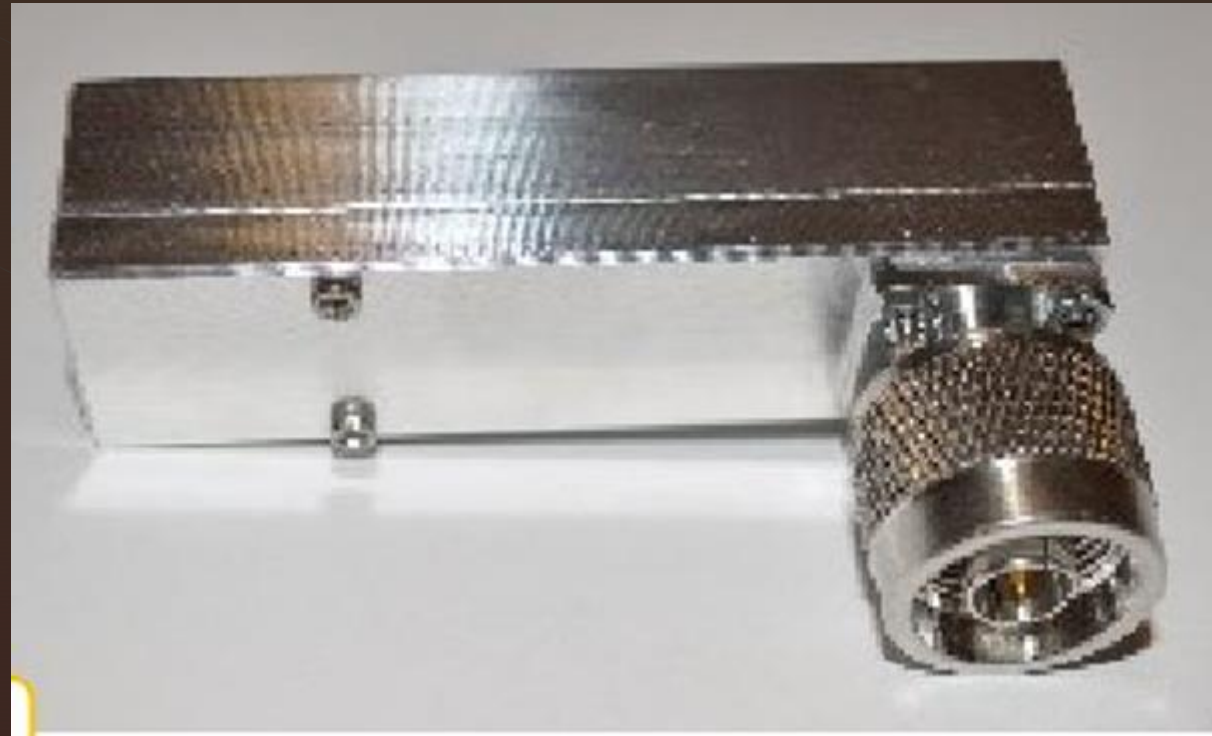
# Feeder Loss



Diagram showing how feeder loss can improve the VSWR seen at the transmitter end of the feeder



# RF Sensors attached to transmission line directional couplers



# Industrial Modules: 16-bit A/D converters to measure DC samples and calculate VSWR





# Driving and Flying across the continent

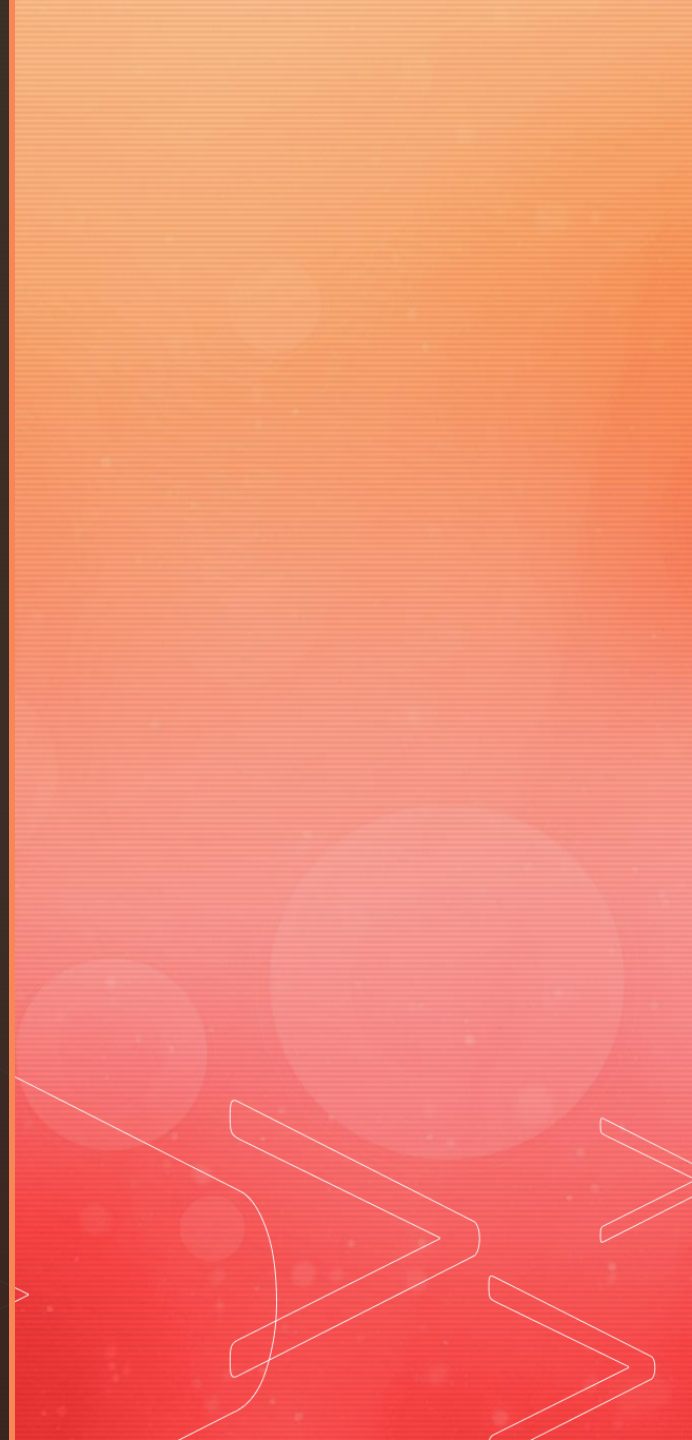
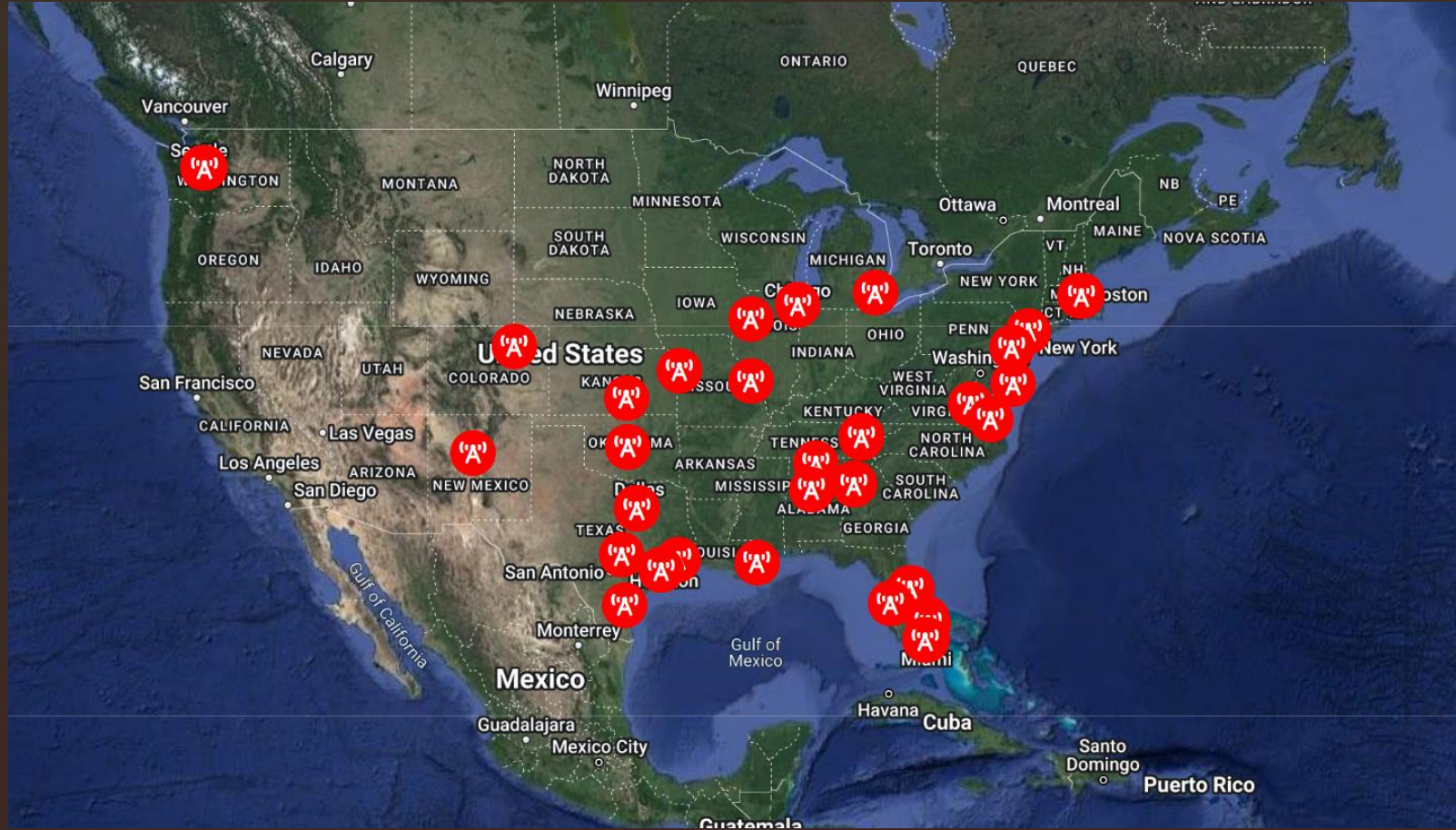


STELLAR ECLIPSE INSTALLATIONS

Fall of 2021



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## “Big Data” Processing

- Record All data continuously on local hard drive every 100 milli-seconds (Forward Power, Reflected Power, VSWR) for each input and output in the system
- Transfer data to cloud server every 5 seconds for near real time web page display
- Then, transfer less time sensitive data every 5 minutes (room Temp, line pressure, flow rates).
- Use Cellular Data (bulk buy) to access difficult sites
- Use algorithms to take advantage of “value trends” i.e. rapidly changing temperatures or pressures require more frequent updates



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# “Big Data” Processing

- Geographically diverse servers
- 2-hour snapshots of servers
- Remote access software to server and tower computers
- Routine backups for tower located computers

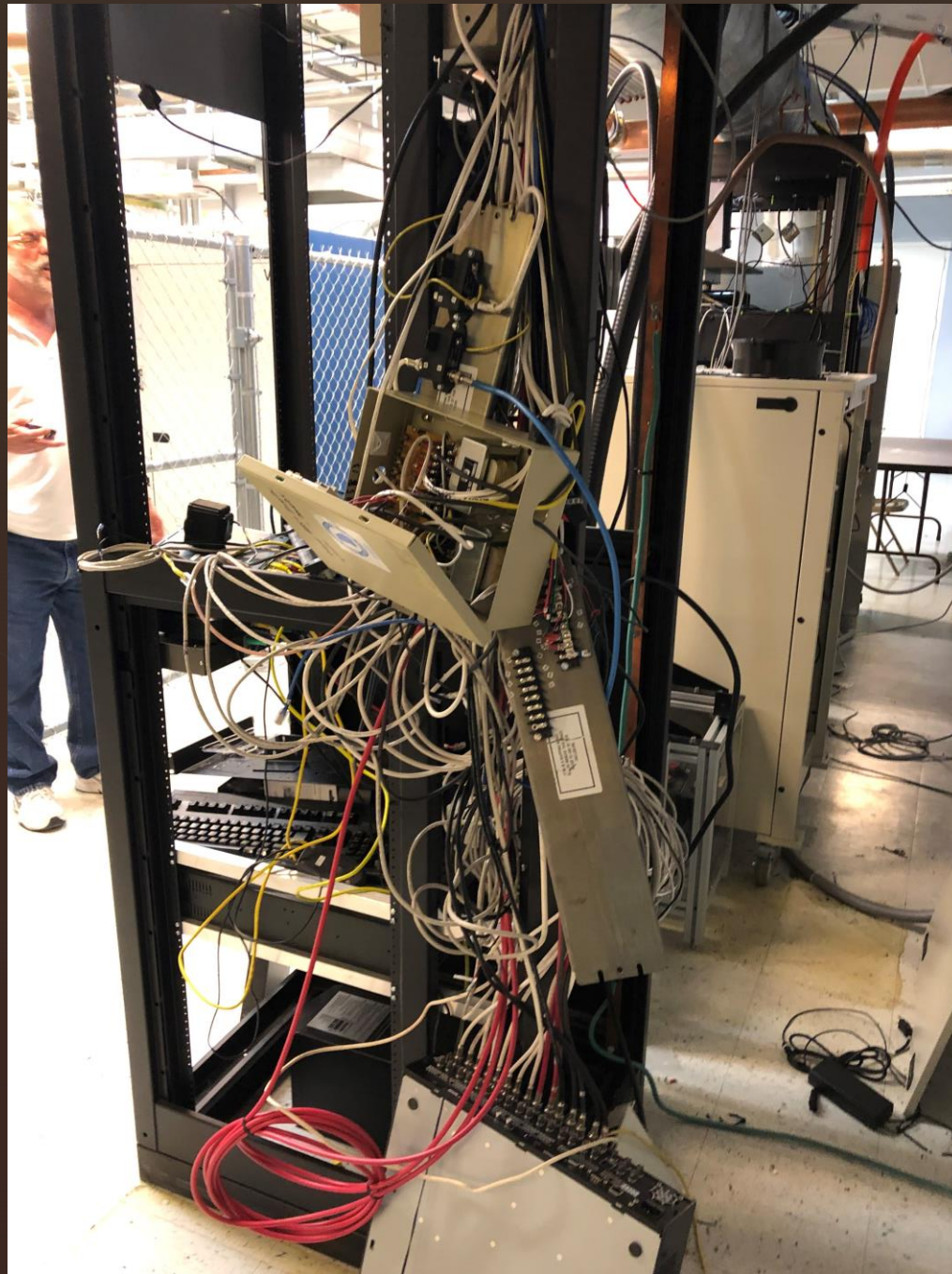


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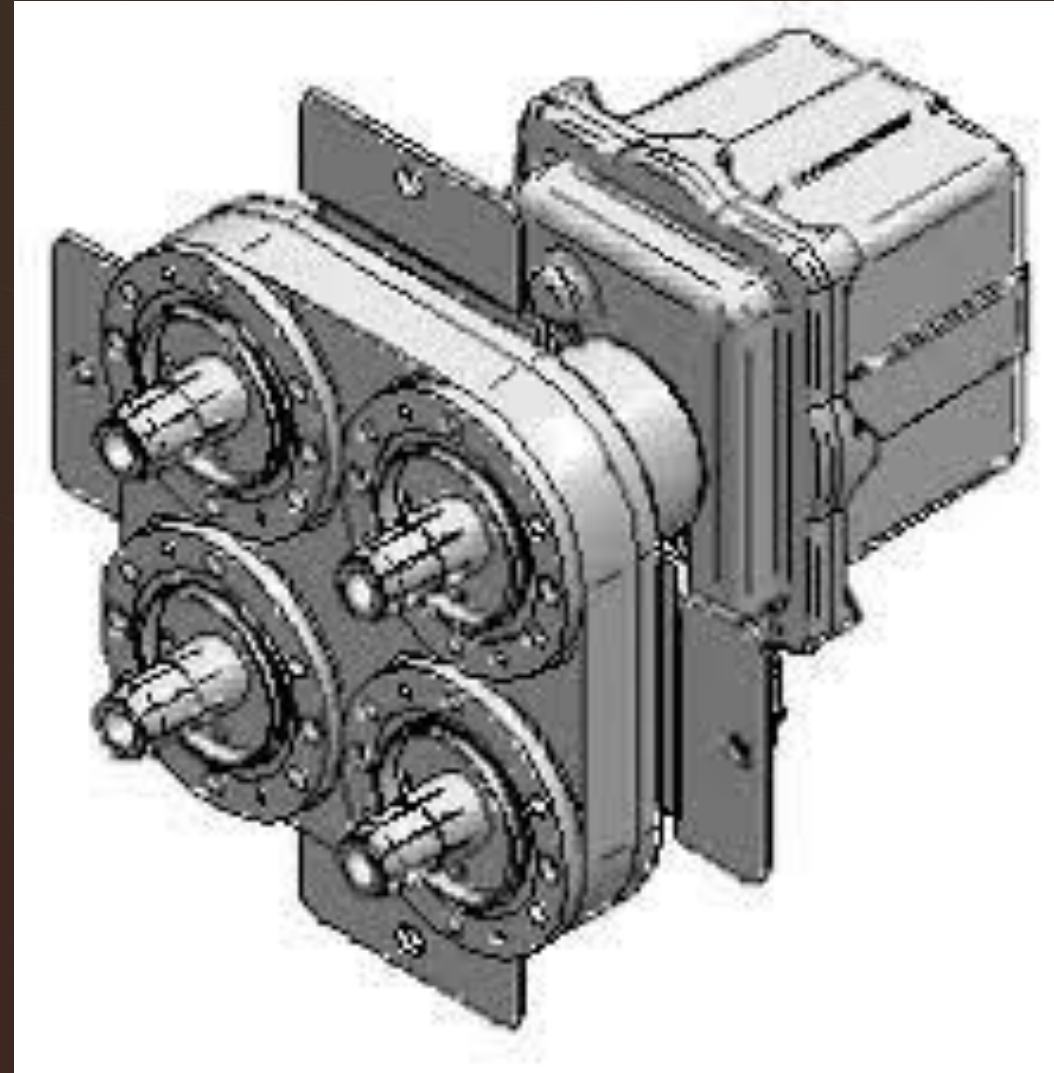




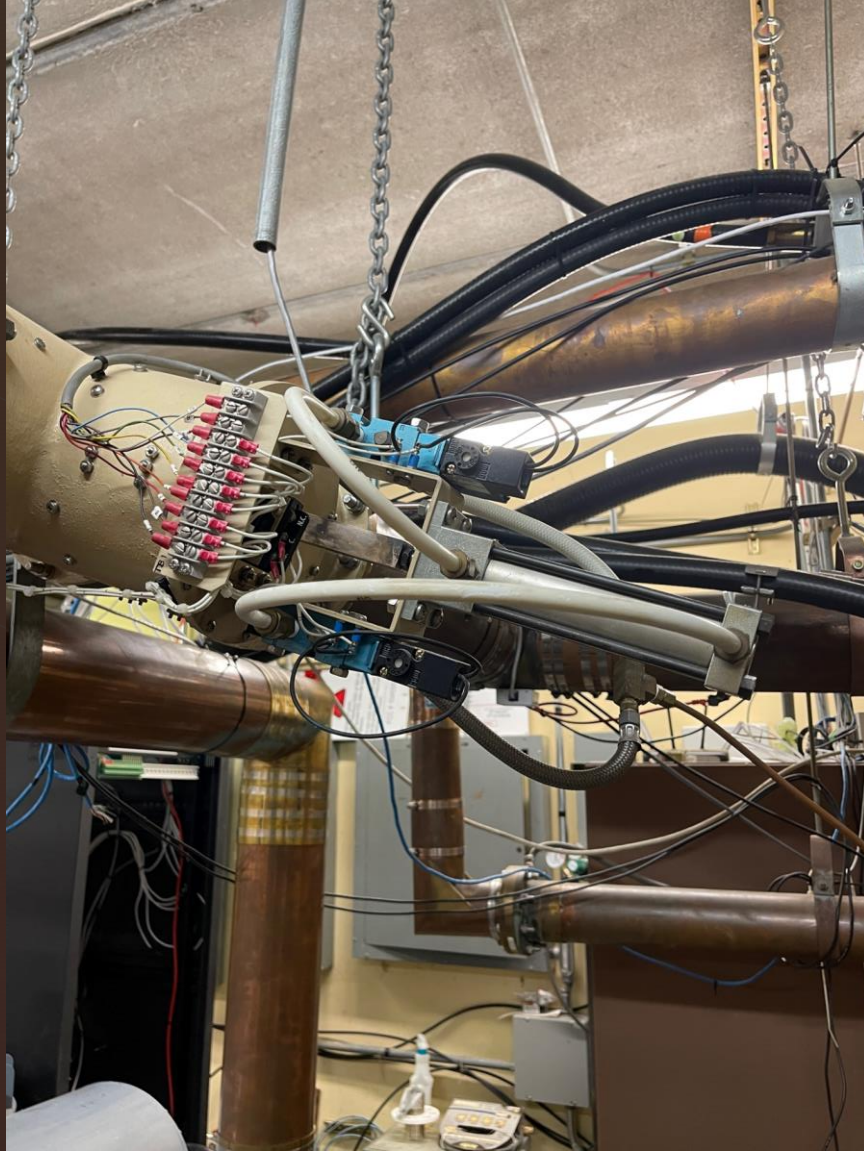


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## Typical Motorized coax switch



# Pneumatic Switch rarely found in civilian service





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# Challenges of being on the road

- Managing inventory
- Vehicle security
- Federal Express deliveries
- Scheduling site access
- Monitoring weather conditions
- Managing on the road expenses





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# Logistics company

## WAREHOUSING

### Warehousing Solutions

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#### DEMANKO

### Explore More

#### Solutions

##### Over-the-Road

- Full truck load & Less-than-truck load
- Special Equipment

##### Drayage

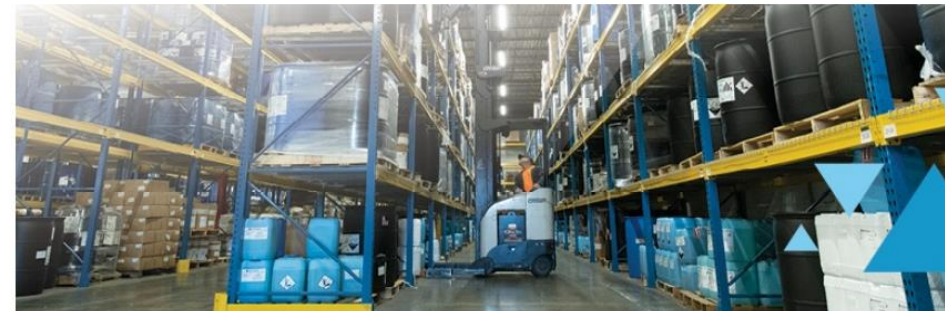
##### Project Cargo

- Trans-loading

##### Intermodal

##### Warehousing

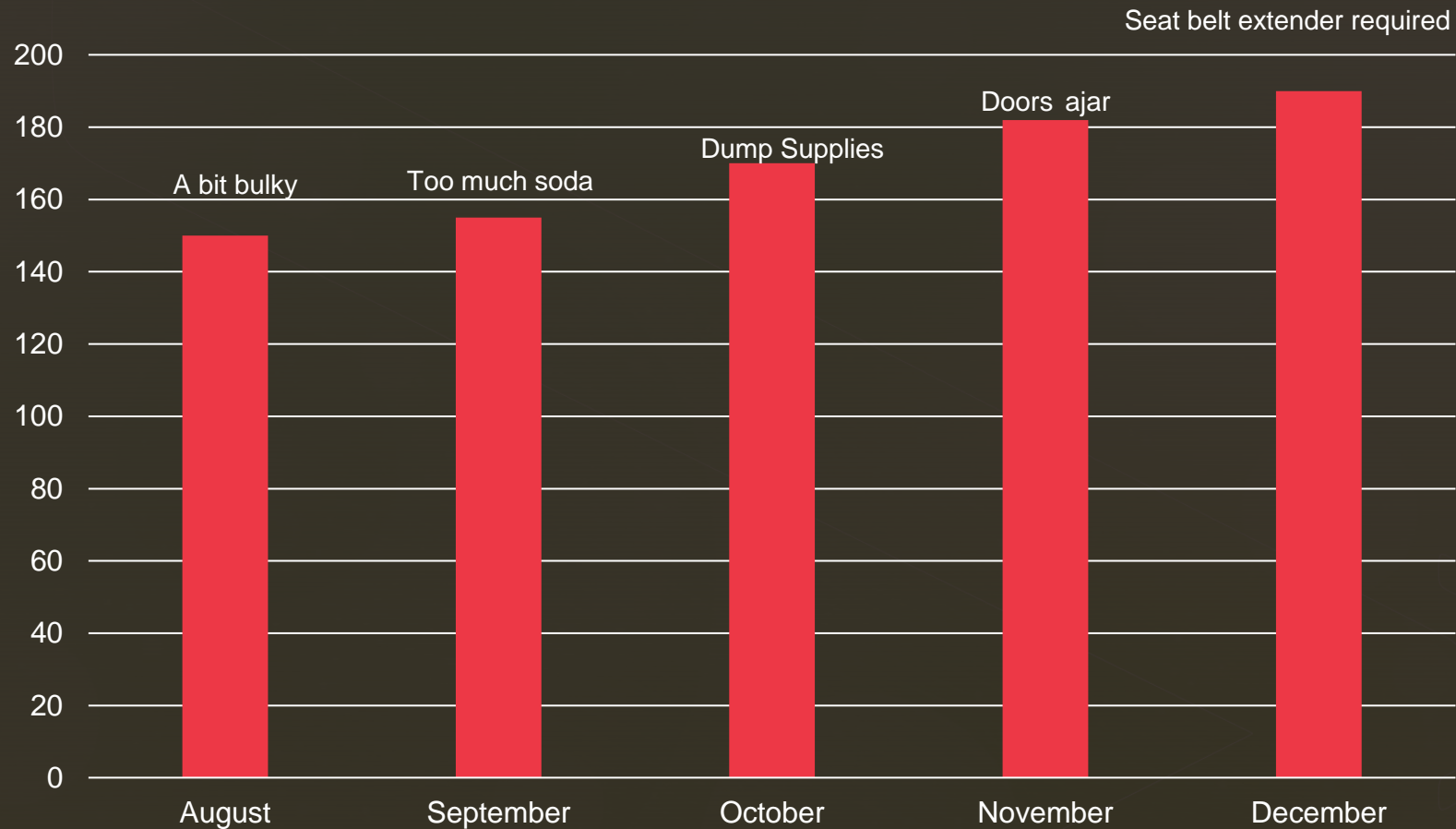
##### Ocean



### Demanko Logistics offers a complete warehouse solution.

- Short & long-term storage
- Reefer and temp controlled
- Bulk & over-sized cargo
- Special handling
- Order preparation
- Pick & pack
- US customs bond

# Body mass directly proportional to time on road





# Effective Multiplex Facility Program Management

- Require all stations to connect to the interlocks
- Calibrate system at least annually (forward and reflected power)
- Require all stations to participate in annual interlock checks
- Have regular multiplex group meetings to discuss the operation of the facility, upgrades, tower and combiner inspections, room cleaning, business matters, etc.



# Conclusions:

- Broadcast transmission systems are expensive, complex, exposed to the elements, and difficult to access when certain components are located thousands of feet in the air.
- Repairs are always expensive both from a parts and labor standpoint and possible lost air-time.
- You have a significant investment in your transmission system, it makes good sense to use cutting edge technology to help minimize problems and maximize the life of your asset.
- To ensure your viewers and listeners receive a reliable crisp immersive experience that they can count on when they need you the most, put the power of a good VSWR Protection and monitoring system to work for you today and enjoy an ROI you can take to the bank.
- Your signal is worth protecting!



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