

#### Innovations in Low Cost RWIS









# Partners

# Cost limits the number of systems.

Lack of power continues to plague several RWIS sites in Alaska

Communications limit available locations.

Maintenance issues especially power generation systems Improve coverage for MDSS and 511 systems.

## Why?

#### RWIS Project Design Goals

- Keep cost under \$10,000 for base system.
- Power budget under 500 watts
- Function in extreme environment from desert to arctic
- Modular in design
- User Maintained with plug and play sensors
- Flexible power systems
- Flexible communications
- Flexible mounting
- Minimum sensors
  - Air temp
  - Surface temp
  - Humidity
  - Wind speed and direction









#### **Bluetooth Connections**









# Mounting Systems

Bluetooth allows for sensor to be mounted 30 ft. from main box

#### Communications











#### Alaska Field Trials (winter 2016-2017)

- Two sites in Fairbanks area collocated with existing RWIS
  - Cowles Street
  - Badger Road near North Pole
- Used commercial power with battery backup
- Communications: cell phone
- Sensors included
  - Air and surface temperature
  - Wind speed and direction
  - Relative humidity
  - Solar incidence



# Reliability in Alaska

- Downtime was less than 3 hours over 14 months of operation due to the Ground Fault tripping on the commercial power.
- Once the power was reset, the system restarted with no action required by user.
- Winter air temperatures fell below -50 F.



### Performance (Temperature)



Date

#### Performance (Windspeed)



#### Performance (Humidity)



- Wind direction not evaluated yet.
- Ground temperature not compared since the sensor was aimed at snow rather than the roadway.
- Solar radiation not compared since DOT RWIS does not measure this.



### Anticipated Enhancement Modules

- Improved humidity sensor.
- Add low power, low cost camera.
- Fog detection.
- Algorithm to estimate ground thaw for load restrictions using surface temp and weather forcasts.





# Planned Installations

- One system at 12 Mile Summit on Steese Highway
  - Use swappable batteries
  - Cell technology to Maintenance Camp or direct satellite connection
- One System at Eagle Summit
  - Use swappable batteries
  - Direct satellite communication.

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# Questions?

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