

Nevada IMO (NIMO) 2.0

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Nevada DOT

Denise Inda
Mylinh Lidder
Scott Carroll
Rodney Schilling

University of Nevada, Reno

Jeffrey LaCombe
Eric Wang
JP Braz
Pablo Rivera
Bill Nagel

IMO 1.0 Vehicles (Recap)

Snowplows



Two Vehicle Types
(10 each)

Based in NV Districts 2 & 3
Along I-80 Corridor

Light Duty Vehicles (Crew, general purpose)



IMO 1.0 Road & Weather Data (Recap)

Devices	Time & Location Data	Air Temperature	Pavement Temperature	Relative Humidity	Atmospheric Pressure	Maximum Logging Interval (sec)
Airmar	X	X		X	X	1.0
GPS	X					1.0
Omega		X		X	X	1.0
RoadWatch		X	X			1.0
Vaisala		X	X	X		0.2
CANbus		X			X	1.0



NV IMO 2.0 GOALS (Recap)

1. Fill in the gaps in coverage areas (to the extent feasible)
2. Increase coverage in higher-population areas (Reno-Carson)

Higher density data for forecast/nowcast

- Cellular coverage
- Easier to pilot (local to Reno)

3. Develop lower-cost hardware

- Simplify hardware and software
- Remote “push” of software updates

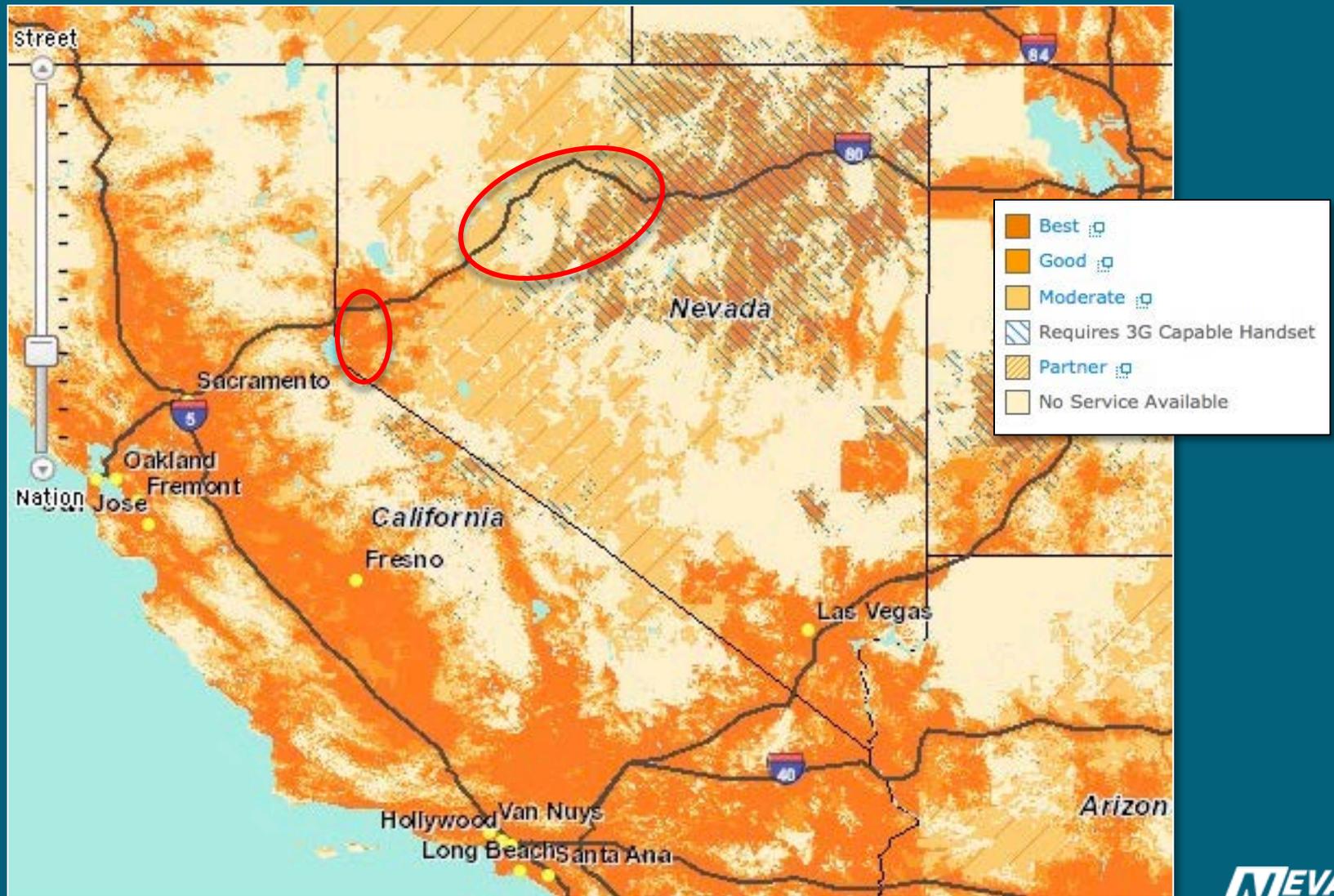
3. Diversify fleet (passenger vehicles)

4. Implement and evaluate applications

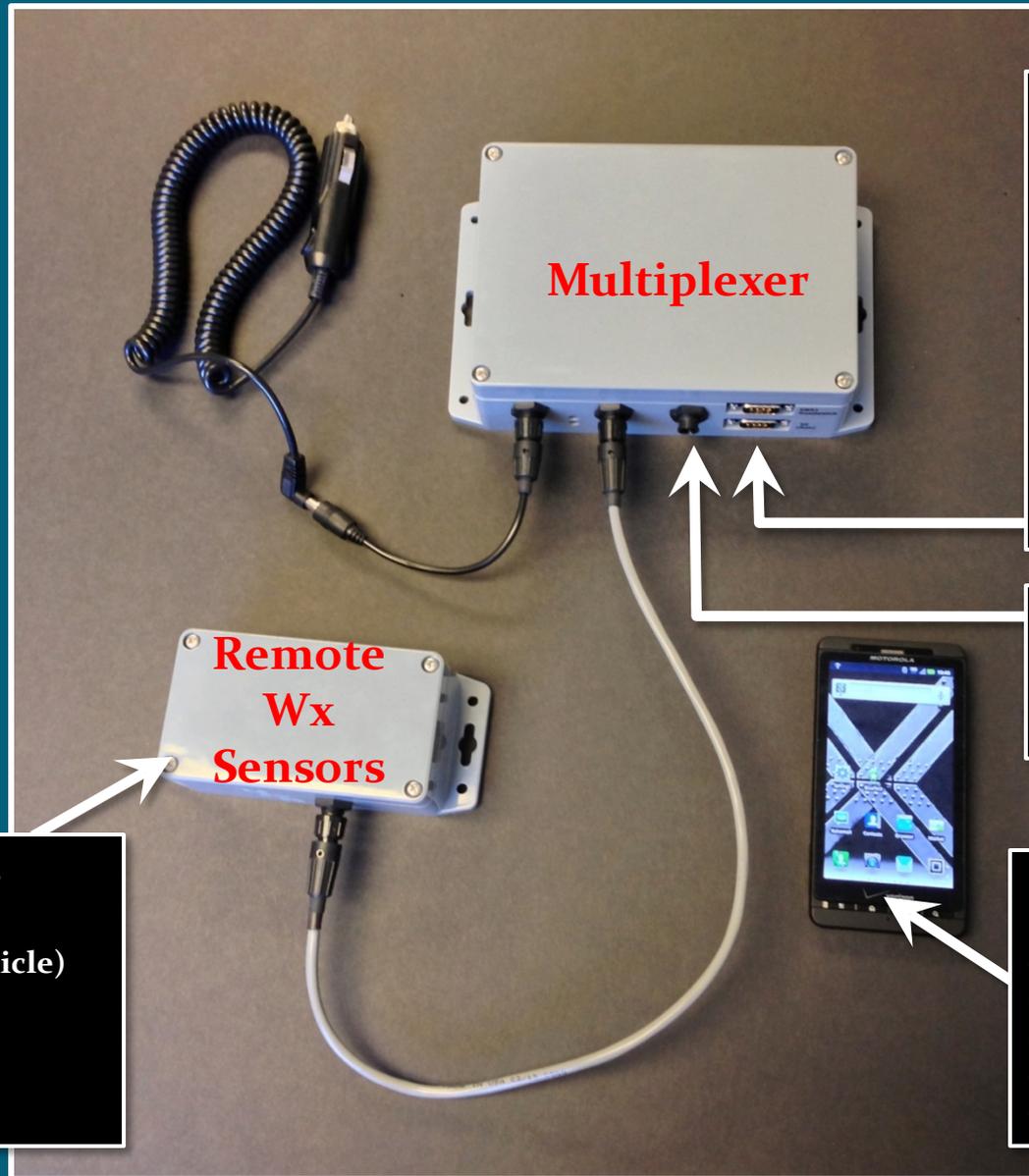
- MMS
- EMDSS
- Others (as time permits)

FILL IN THE GAPS FROM IMO 1.0

DENSE DATA— FOCUS ON POPULATED AREAS



NIMO 2.0 Vehicle Hardware



Off-the-Shelf Serial Devices:

Road Watch

- Air Temperature
- Surface Temperature

Also useable for:

- Vaisala Surface Patrol
- OBD Scan Tools
- EDACS Radios

Custom Sensors:

Pulse Counters

- Spreader shaft speed

Weather Sensors

(I2C)

(remote mount on vehicle)

- Air Temperature
- Barometric Pressure
- Relative Humidity
- Dew Point

Main Processor

(Android-OS Cellular Phone)

- GPS (location, time)
- Cellular data link
- Accelerometers
- Compass
- Bluetooth OBD link

NIMO 2.0 System Framework



PRIORITIZED MODE-SWITCHING TELEMETRY

- *Cellular when available*
- *EDACS when cellular not available (rural)*
- *Store-and-forward when necessary*



MULTI-MODE RECEIVING STATION

- *Receives data from mobile stations*
 - *Cellular*
 - *EDACS radio*
- *Archives and forwards data*



APPLICATIONS



NIMO 2.0 Cost Comparison

Item		IMO 1	IMO 2
Main Processor System		\$800	\$100
EDACS capable radio		\$900	\$0
Device Multiplexer			\$173
Custom Weather Sensor			\$75
Roadwatch sensor w/RS232		\$750	\$750
Airmar GPS/weather sensor		\$1,000	\$0
OBD/J1939 Scan Tool		\$625	\$150
Custom cabling		\$100	
Custom mounting hardware		\$150	
Non-Recurring Totals:		\$4,325	\$1,248
Recurring Data Expenses			\$36/month
**Does NOT include costs of instrumenting spreader			

NIMO 2.0 Vehicle Plans (Recap)

- 25 new vehicles (Total = 45)
 - 3 snow plows along I-80 using IMO 1.0 hardware
 - 7 snow plows using IMO 2.0 hardware
 - 15 LDV and PV using IMO 2.0 hardware

IMO1 & 2 Vehicle Installations

	Snowplow	Light-Duty Vehicle
IMO1		
Planned	11	9
Installed	11	9
IMO2		
Planned	10	15
Installed	10	6

**vehicle installations
proceeding all summer

NIMO 2.0 Challenges

- Assessing vehicle transmission capability - hard to determine if a vehicle is being used or not
- Access to NDOT vehicles was not always easy (3 months without any installation – back on track now)
- Weather sensor circuit corrosion problem addressed and deployment of repaired sensors has been made
- Power management issues seem to have been resolved (2+ months without incident)
- Browser/platform incompatibilities limited access to EMDSS and MAW applications

Future Plans

- Interface IMO₂ hardware with EDACS radio (multi-modal capability)
- Further evaluate sending message alerts to drivers via EDACS radio
- Onboard spreader measurements (MMS)
- How to manage/maintain current equipped fleet after end of IMO₂
- Evaluate benefits of friction coefficient measurements

Lessons Learned

- Proof of concept for 800MHz radio communications (future evaluation of multi-modal and P25)
- Evaluate long term options, costs and capabilities before expanding and further developing equipped fleet
- Need buy-in and support from end users (greater communication and education paired with applications)