
NEVADA
DOT

Nevada DOT/USDOT FHWA Road Weather Integrated Mobile Observations (IMO 1, 2 & 3) Projects

Acronyms

C2C	Center to Center
DSRC	Dedicated Short Range Communication
EDACS	Enhanced Digital Access Communication System
IMO	Integrated Mobile Observations
JSON	JavaScript Object Notation
MADIS	MADIS (Meteorological Assimilation Data Ingest System)
MDSS	Maintenance Decision Support System
mESS	Mobile Environmental Sensor Station
MMS	Material Management System
NCAR	National Center for Atmospheric Research
NDEX	Nevada Data Exchange
NIMO	Nevada Integrated Mobile Observation
NNG 511	Nevada Next Generation 511
OBU	On-Board Unit
RSU	Road Side Unit

Acronyms

RWMP	Road Weather Management Program
TMDD	Traffic Management Data Dictionary
TMS	Traffic Management System
TSMO	Traffic Systems Management and Operations
WSDL	Web Services Description Language
WxDE	Weather Data Environment
XML	Extensible Markup Language
XSD	XML Schema Definition

Nevada Integrated Mobile Observations (NIMO) Project

Nevada DOT

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- Tamzin Atkins
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- Cody Zampella

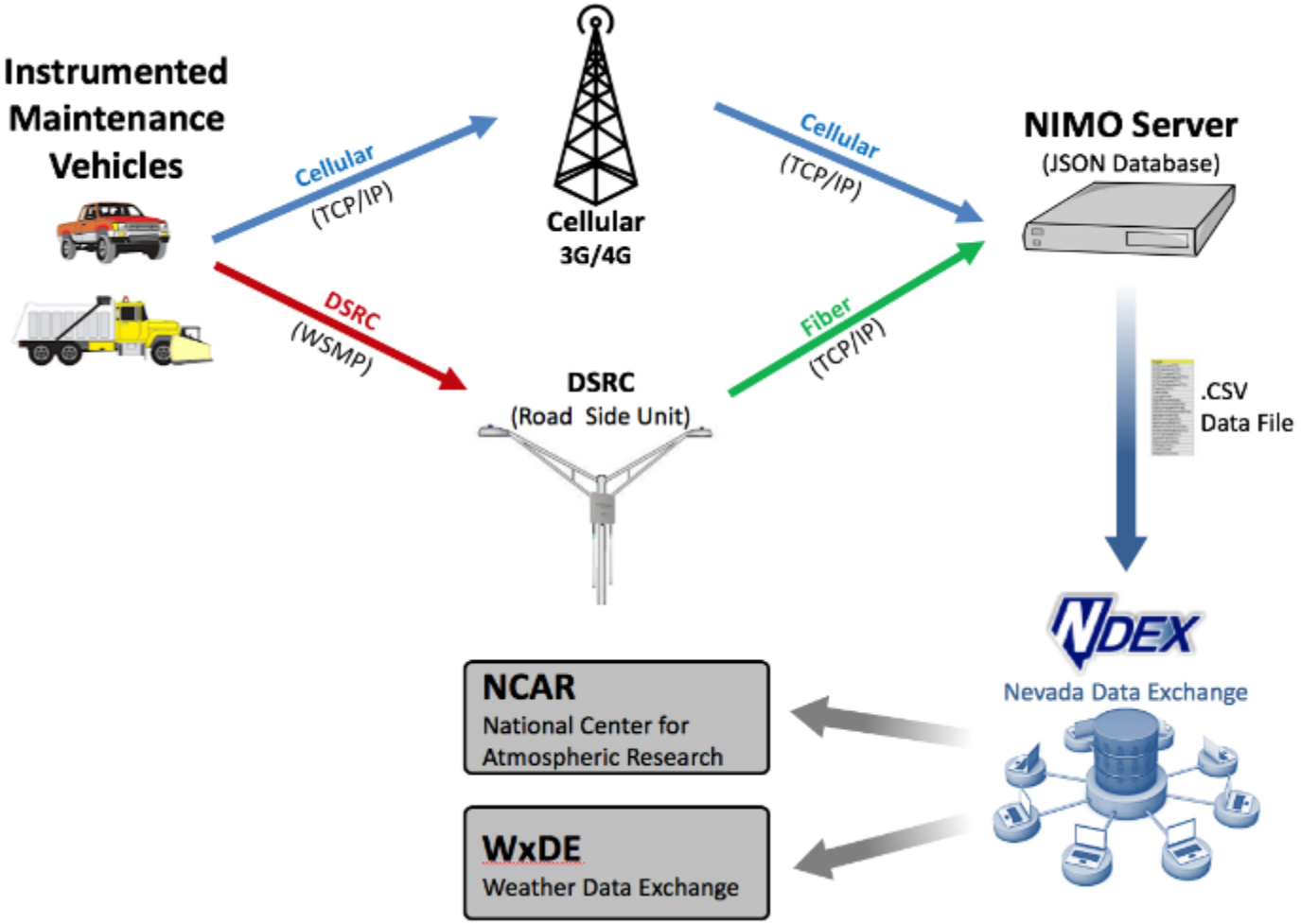
NIMO Project

1. NIMO 1 Project Overview
2. NIMO 2 Project Overview
3. NIMO 3 Project Overview
4. Cost Comparison
5. Moving Forward
6. Pikalert Overview

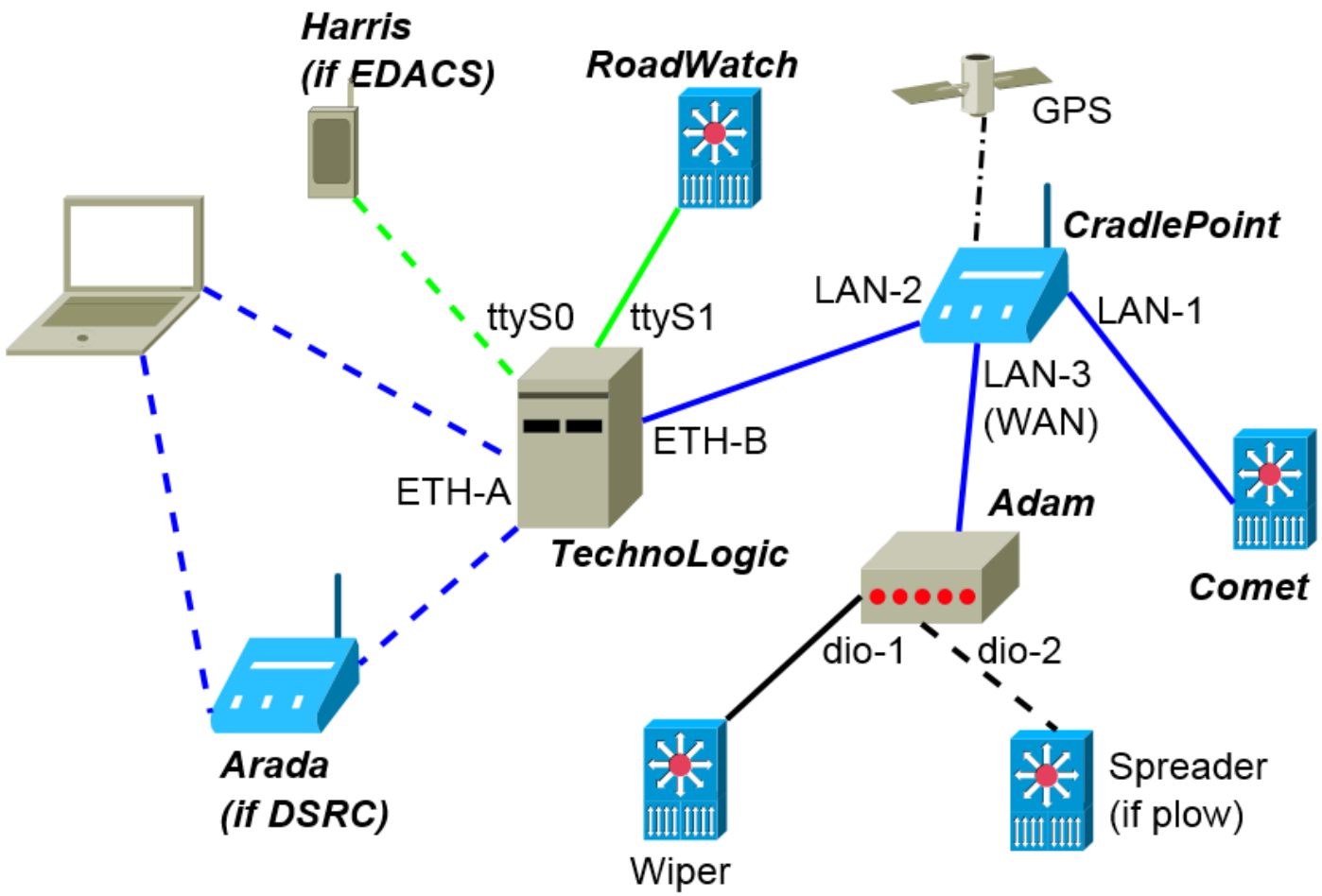
NIMO Phase 3 Dedicated Short Range Communications System

1. Started in 2014 using multi-modal communications.
2. Objectives were to establish an effective and sustainable IMO program and fully incorporate, test, and evaluate the use of Dedicated Short-Range Communications (DSRC) & cellular for telemetry data as part of the IMO system using DSRC along the I-580 corridor between Reno and Carson City; cellular only in the Lake Tahoe area.
3. Modular system installed in ten vehicles.

NIMO Concept of Operations

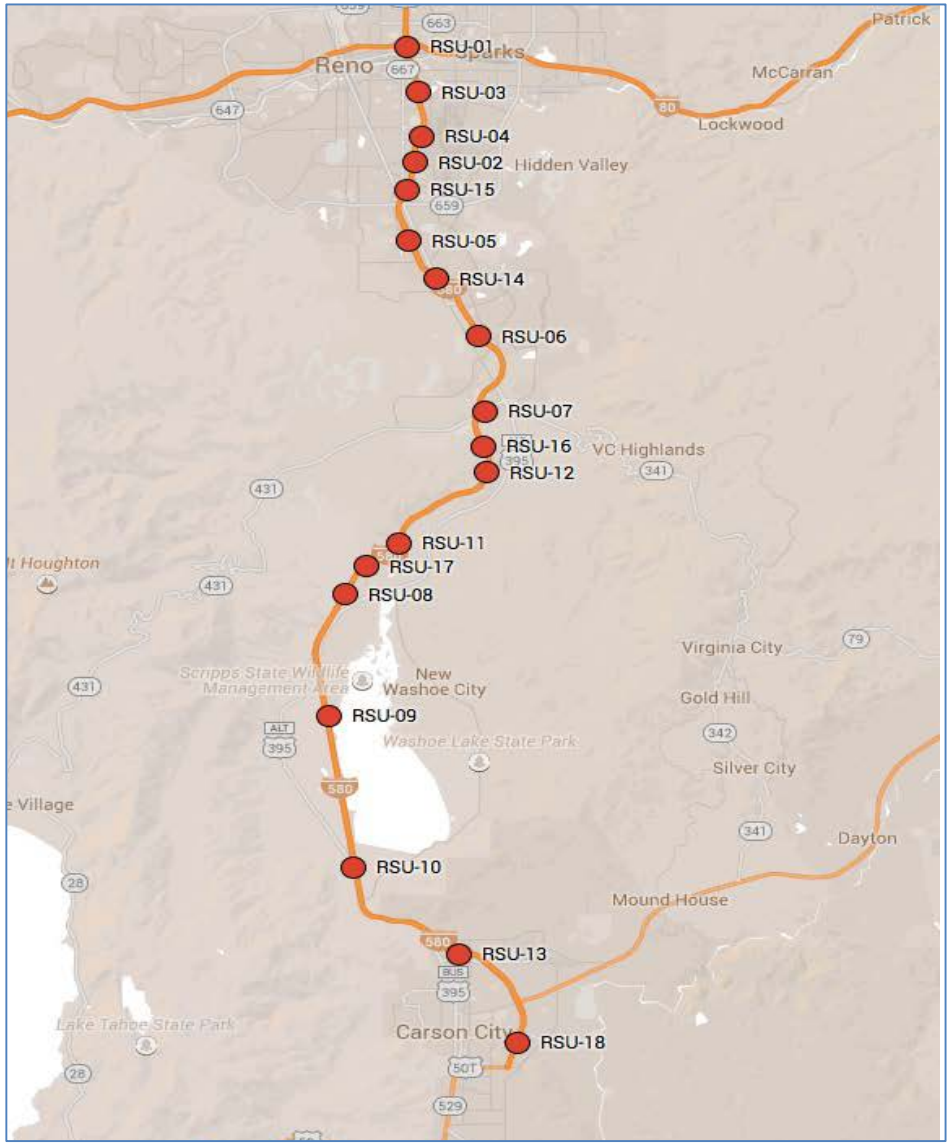


Connectivity Diagram (OBU)



Geo-fencing: Cradlepoint vs. DSRC RSU

DSRC Site Locations



18 Locations along I-580

1. I-80
2. Mill Street
3. Plumb Lane
4. Moana Lane
5. Peckham Lane
6. Neil Road
7. Exit 61, Virginia St
8. Arrow Creek
9. SR 431, Mt. Rose Hwy
10. Galena Forest
11. Steamboat Hills
12. Galena Creek
13. Brown's Creek
14. Parker Ranch
15. Bower's
16. Washoe Valley
17. Arrowhead Dr
18. 5th Street

Vehicle Routes

Cellular

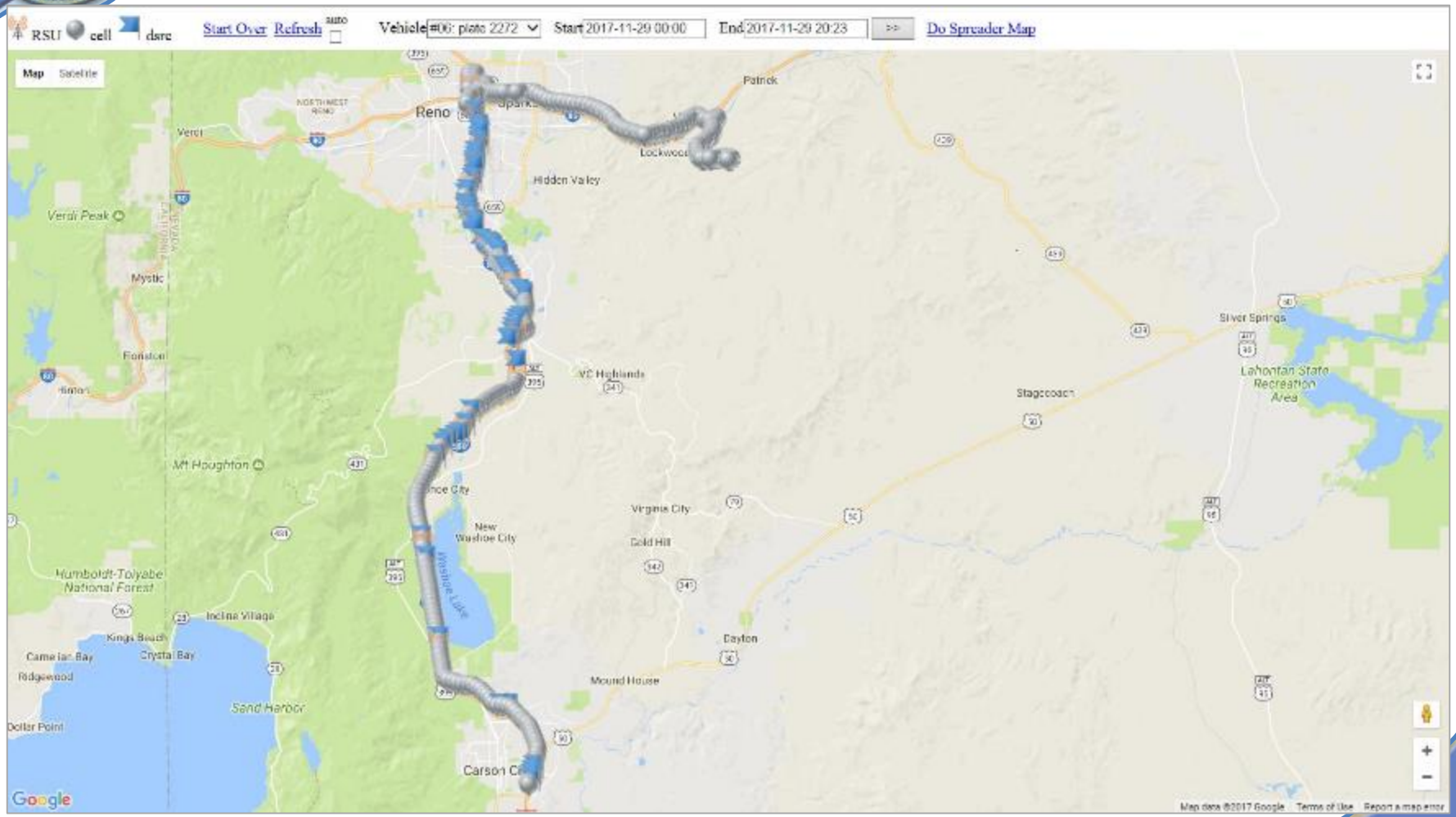
DSRC

18 DSRC Locations

32 Miles DSRC

54 Miles Cellular

IMO 2272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dsrc
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Refresh
auto
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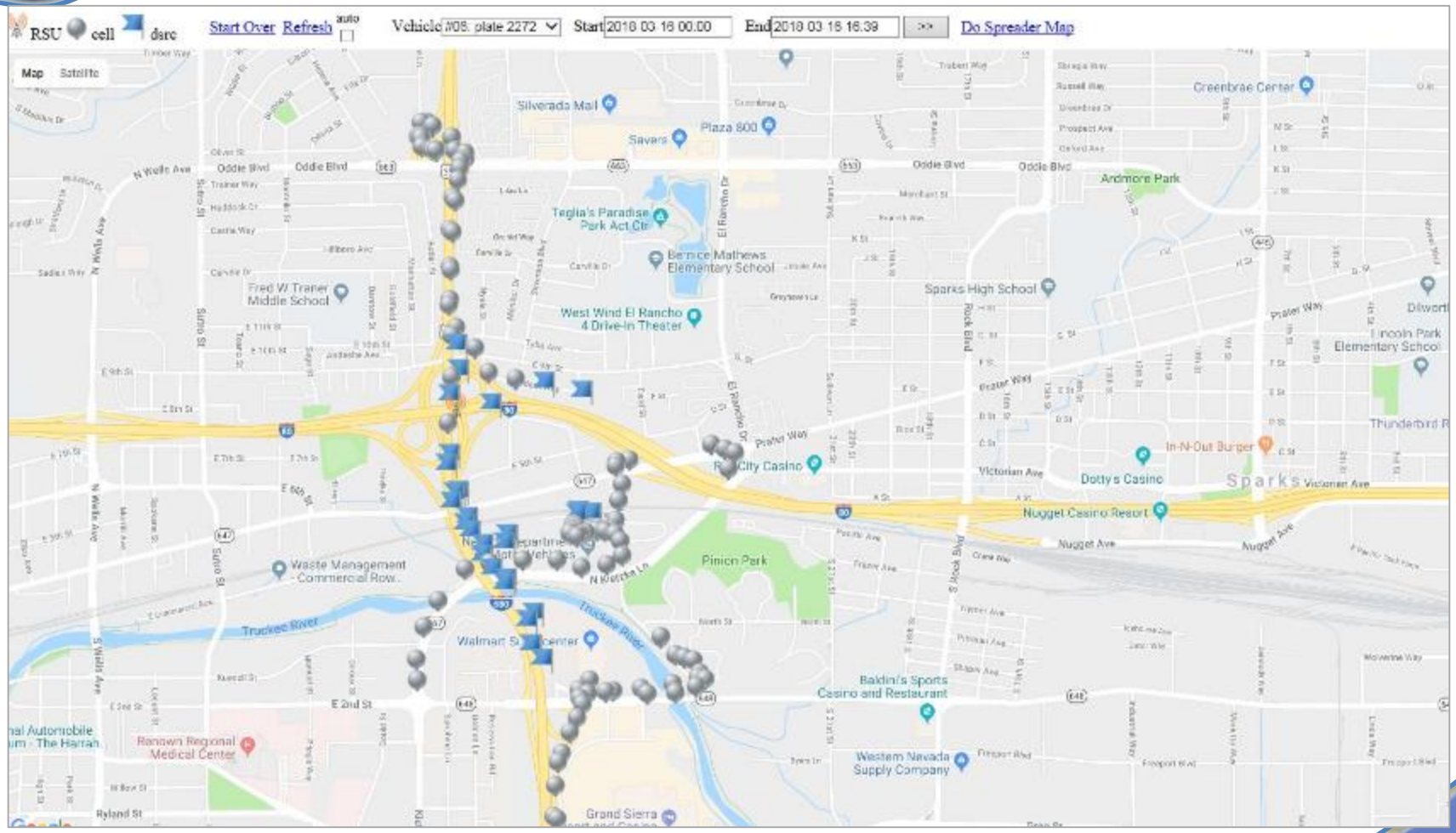
End 2017-11-29 20:23
Do Spreader Map
Map
Satellite
Reno
Sparks
Verdi
Patrick
Lockwood
Hidden Valley
Verdi Peak
Mystic
Floriston
Mt Houghton
VC Highlands
Virginia City
Gold Hill
New Washoe City
Humboldt-Toiyabe National Forest
Incline Village
Crystal Bay
Ridgewood
Sand Harbor
Dollar Point
Dayton
Mound House
Carson City
Stagecoach
Silver Springs
Lahontan State Recreation Area
Google

IMO 2272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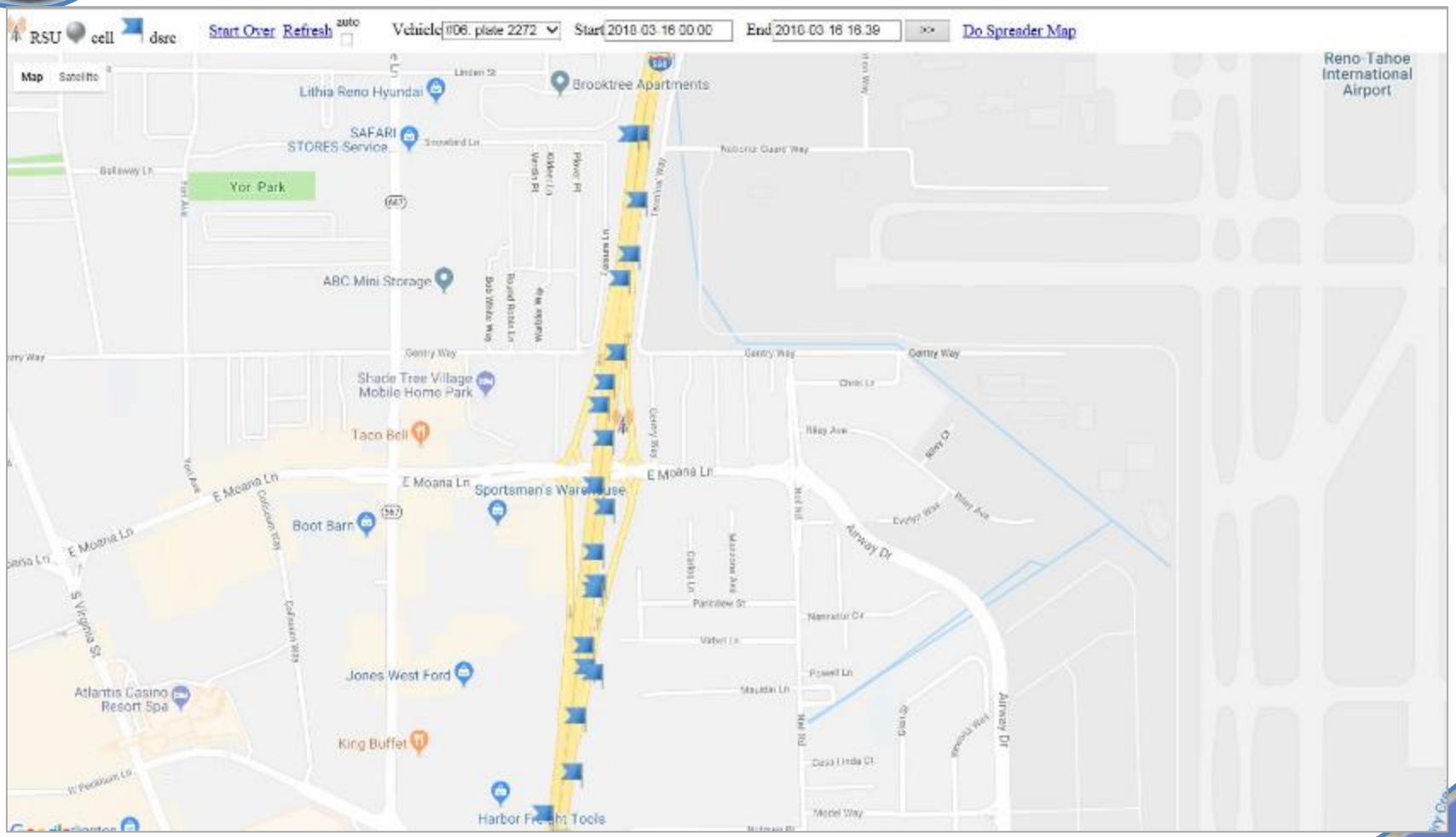
Do Spreader Map
Map
Satellite
Silverada Mall
Plaza 800
Savers
Greenbrae Center
Oddie Blvd
Ardmore Park
Teglia's Paradise Park Act Ctr
Bernice Mathews Elementary School
Fred W Traner Middle School
West Wind El Rancho 4 Drive-In Theater
Sparks High School
Lincoln Park Elementary School
Victorian Ave
Dotty's Casino
In-N-Out Burger
Sparks
Nugget Casino Resort
Nugget Ave
Pinion Park
Waste Management - Commercial Row
Truckee River
Truckee River
Walmart Supercenter
Baldini's Sports Casino and Restaurant
Western Nevada Supply Company
Renown Regional Medical Center
E 2nd St
Ryland St
Grand Sierra

IMO 2272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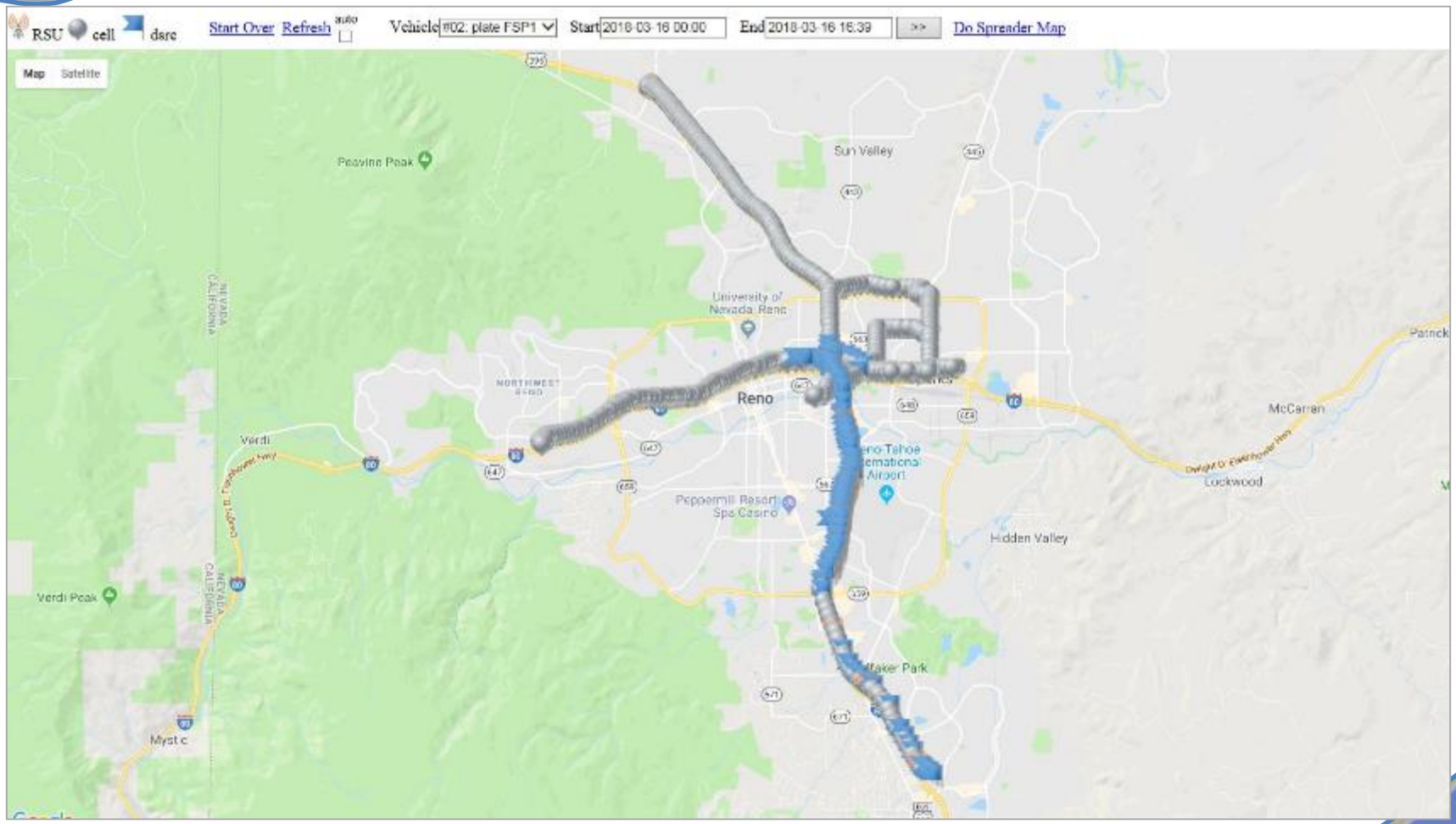
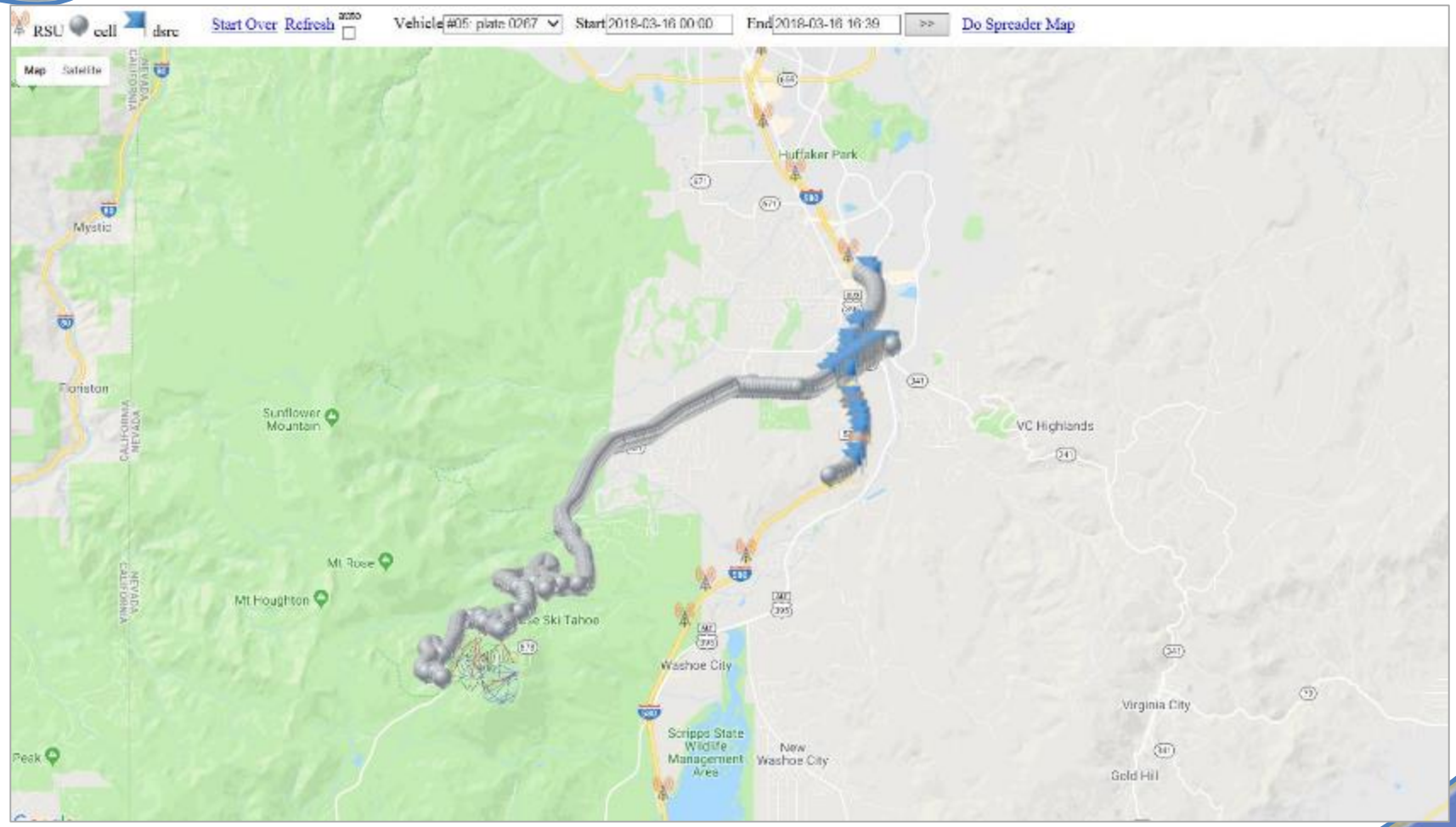
cell
dsrc
Start Over
Refresh
auto
Vehicle
006. plate 2272
Start 2018-03-16 00:00:00
End 2018-03-16 16:39:39
Do Spreader Map
Map
Satellite
Lithia Reno Hyundai
Brooktree Apartments
SAFARI STORES Service
Yori Park
ABC Mini Storage
Shade Tree Village Mobile Home Park
Taco Bell
E Moana Ln
Sportsmen's Warehouse
Boot Barn
Jones West Ford
Atlantis Casino Resort Spa
King Buffet
Harbor Freight Tools
Reno Tahoe International Airport
Gentry Way
Airway Dr

FSP


RSU
cell
dsrc
Start Over
Refresh
auto
Vehicle
#02: plate FSP1
Start
2018-03-16 00:00
End
2018-03-16 16:39
>>
Do Spreader Map
Map
Satellite
Peavine Peak
Sun Valley
University of Nevada, Reno
Reno
Verdi
McCarran
Lockwood
Peppermill Resort Spa Casino
Hidden Valley
Verdi Peak
Mystic
NEVADA
CALIFORNIA

IMO 0267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End 2018-03-16 16:39
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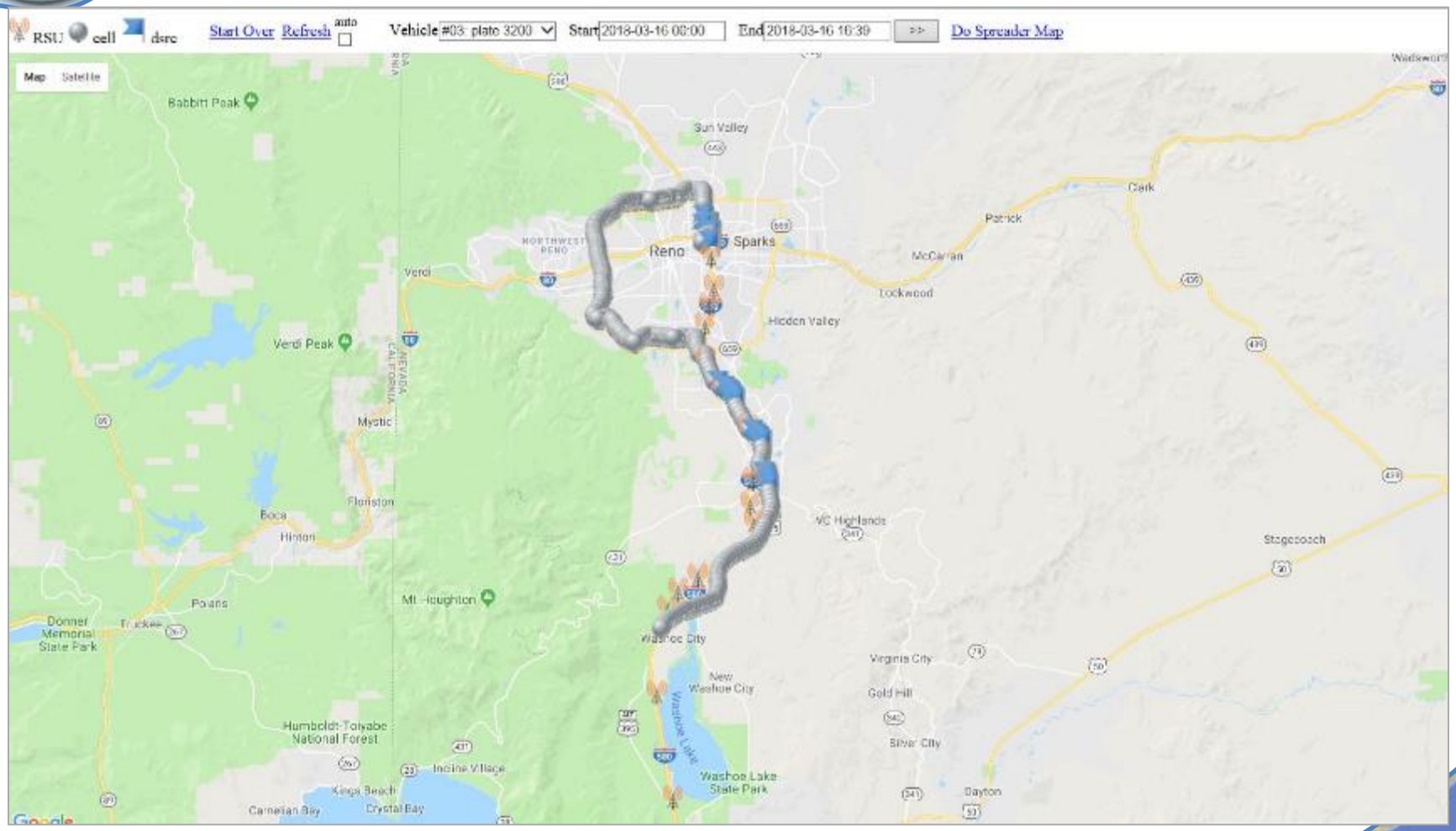
Map
Satellite
Huffaker Park
Mystic
Floriston
Sunflower Mountain
CALIFORNIA
NEVADA
VC Highlands
Mt Rose
Mt Houghton
Ski Tahoe
Washoe City
Virginia City
Scripps State Wildlife Management Area
New Washoe City
Gold Hill
Peak

IMO 3200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dsrc
Start Over
Refresh
auto
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End 2018-03-16 16:39
>>
Do Spreader Map
Map
Satellite
Babbitt Peak
Sun Valley
Reno
Sparks
Verdi
Verdi Peak
Mystic
Boca
Hinton
Floriston
Mt Houghton
Donner Memorial State Park
Truckee
Humboldt-Toiyabe National Forest
Incline Village
Crystal Bay
Carnelian Bay
Washoe City
New Washoe City
Washoe Lake State Park
Virginia City
Gold Hill
Silver City
Dayton
Stagecoach
VC Highlands
Lockwood
Hidden Valley
McCarran
Patrick
Clark
Google

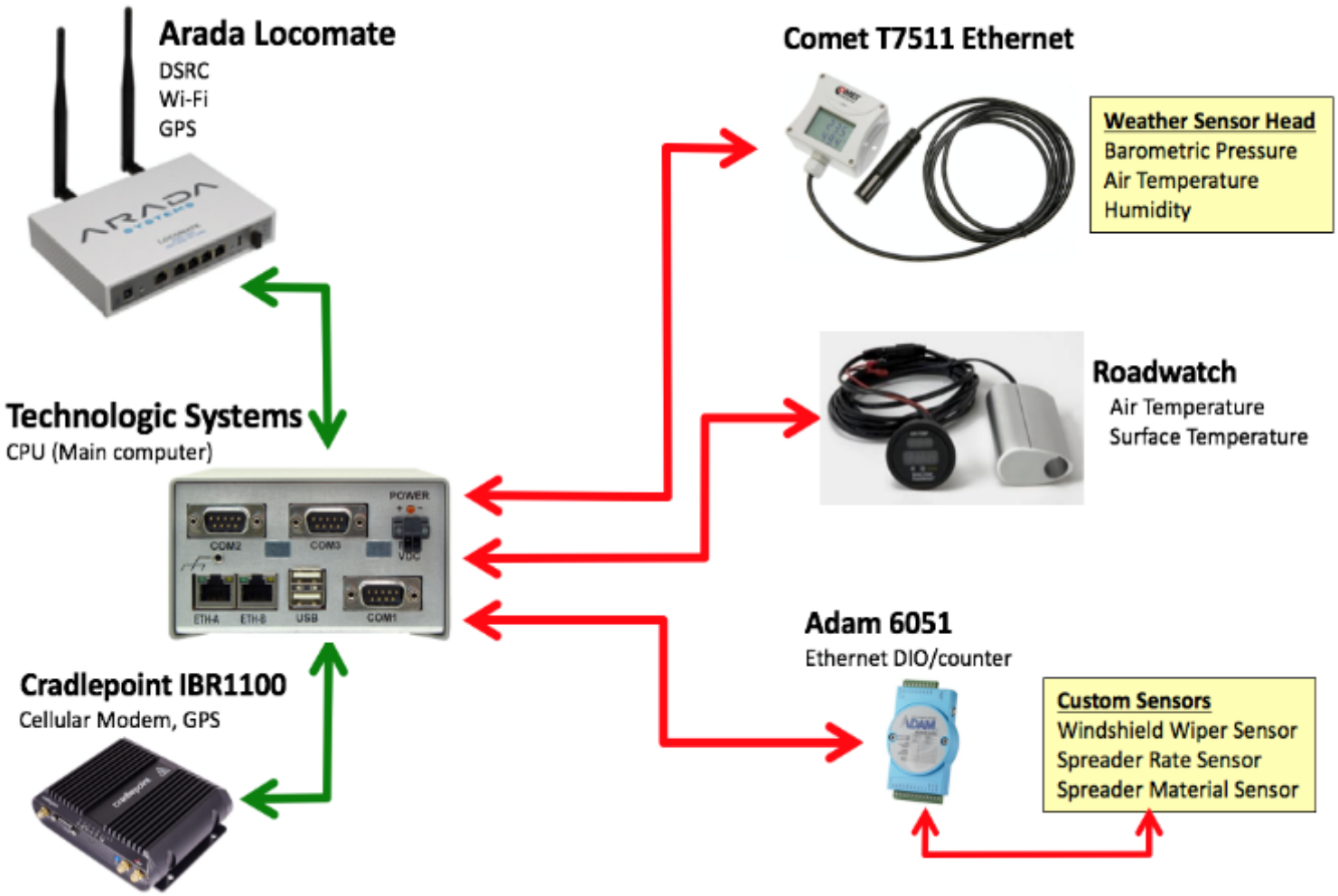
NIMO 3 Vehicles

- 9 Snow plows with instrumented spreader motors and 1 freeway service patrol vehicle
  - 5 in Reno
  - 3 in Carson City

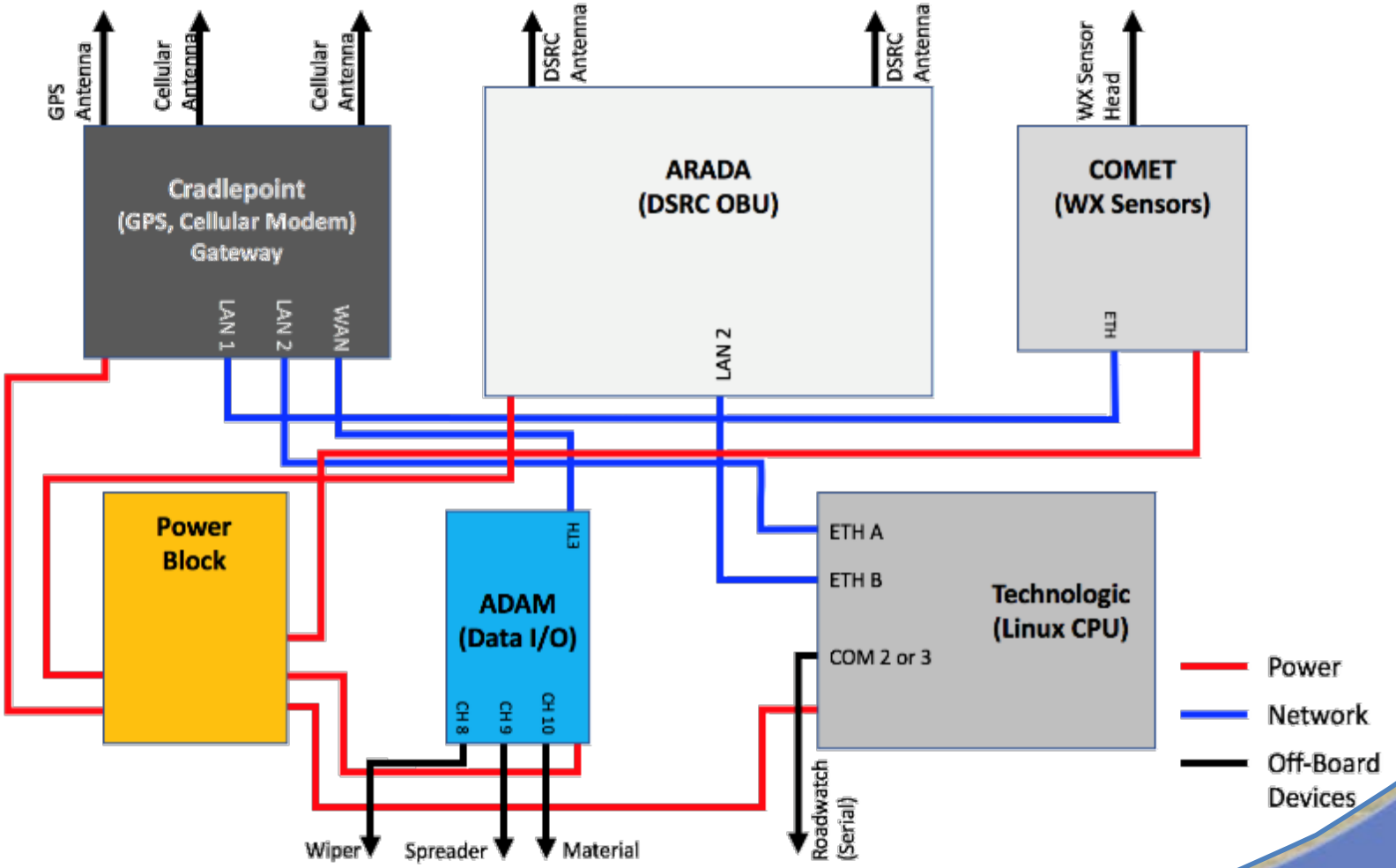
District II IMO Inventory

UNIT #	YEAR	MAKE	MODEL	DESCRIPTION
2272	2007	PETERBILT	357	TANDEM AXLE DUMP TRUCK
1915	2007	PETERBILT	357	TANDEM AXLE DUMP TRUCK
0763	2009	PETERBILT	367	TANDEM AXLE CAB AND CHASIS
2275	2007	PETERBILT	357	TANDEM AXLE DUMP TRUCK
3200	2007	PETERBILT	357	TANDEM AXLE DUMP TRUCK
2274	2007	PETERBILT	357	TANDEM AXLE DUMP TRUCK
3319	2009	PETERBILT	367	TANDEM AXLE CAB AND CHASIS SWL
0323	2007	PETERBILT	367	TANDEM AXLE CAB AND CHASIS
0267	2001	INTERNATIONAL	5000	AWD
R1	2012	FORD	E240	FREEWAY SERVICE PATROL VAN/PU

NIMO 3 On Board Units (OBU)



NIMO 3 OBU Schematic



Example Snow Plow Installation

Use of COTS components.
Only software is "custom" (no custom electronics)

- **Pilot will have 10 vehicles**
- **Retrofits of IMO phases 1 & 2 installs to follow**
- **Typical mount on back wall of passenger cabin behind seats**
- **Transmission frequencies vary with the telemetry mode, ranging from ~10 seconds to 5 minutes**
- **No driver interface/display**
- **No imagery/video**

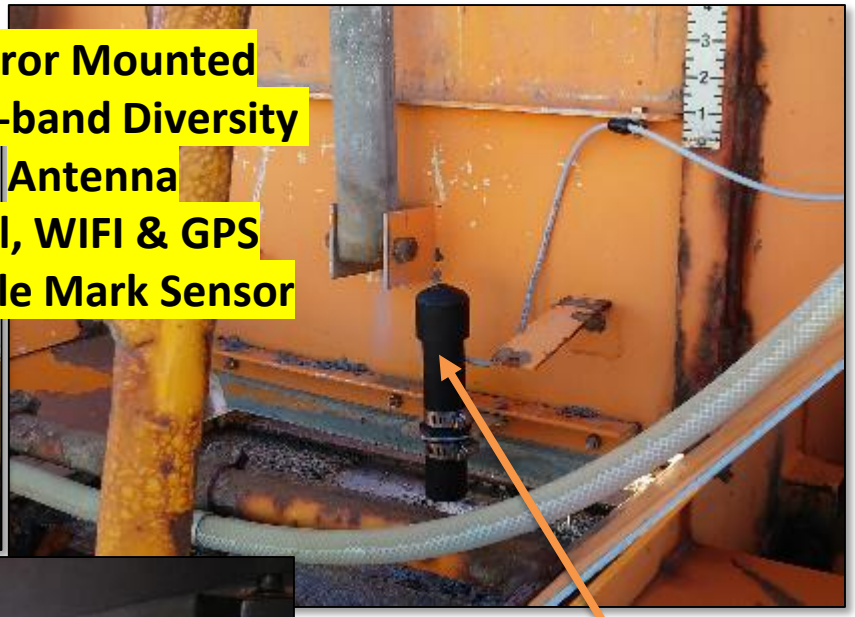
GPS Antenna
DSRC Antenna
Road Temperature Sensor
Air Sensor
Spreader Sensor

NIMO 3 Sensor Package Inventory

SensorId	Manufacturer	Source Unit of Measure	Target Observation Type
ATAirmar	Airmar	Temperature Celsius	NTCIP 1204 ESS Air Temperature
RTRoadwatch	Roadwatch	Temperature Celsius	NTCIP 1204 ESS Surface Temperature
PRAirmar	Airmar	Atmospheric Pressure Bar	NTCIP 1204 ESS Atmospheric Pressure
PROmega	Omega	Atmospheric Pressure kPa (kilopascal)	NTCIP 1204 ESS Atmospheric Pressure
GPGGA	Cradle Point	NMEA 0183 Sentence GPGGA	NMEA 0183 Sentence GPGGA

Plow On-Board Hardware

Mirror Mounted
Multi-band Diversity
Antenna
Cell, WIFI & GPS
Mobile Mark Sensor



Mirror Mounted
Air Temp -
Atmospheric Pressure
Comet Sensor

Rear Mounted
Spreader Rate
Custom Sensor

Behind Passenger
Seat Mounted
OBU – ARADA System

Mirror Mounted
Air/Pavement Temp –
Roadwatch Sensor

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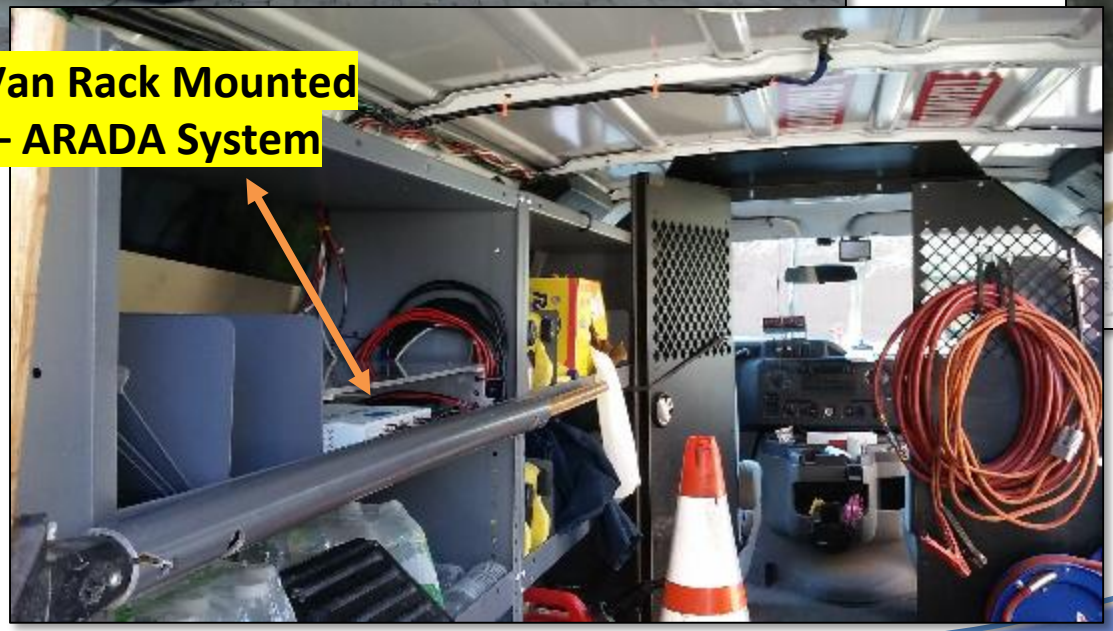
FSP Van On-Board Hardware

Under Front Bumper Mounted Air/Pavement Temp – Roadwatch Sensor

Inside Van Rack Mounted OBU – ARADA System



NEVADA DOT
SAFE AND CONNECTED

IMO Data and Future Data Distribution Points

Nevada
Integrated
Mobile
Observations

Material
Management
System

Enhanced
Maintenance
Decision
Support
System

Additional Information for
- Freight Carriers
- Emergency Responders
- DMS, 511 Motorist Advisories
- Variable Speed Limits
- MADIS/WxDE

NIMO System Architecture

Cellular

In-Vehicle Equipment
- Weather sensors
- Vehicle sensors (OBU, CANBus)
- Equipment sensors (spreader)
- Location sensor (GPS)
- Radio(s)

DSRC

Multi-Mode Receiving Station
- Receives data from mobile vehicles
- Archives and forwards data

U.S. Department of Transportation Federal Highway Administration

NCAR NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Applications
- Current conditions
- Weather data environment
- Forecasts
- Material usage tracking
- Road maintenance recommendations

Data received at frequency of a message every eight seconds

Map the Dataset

1. **Wave Short Message Protocol (WSMP)**
2. **Same "payload" over DSRC and cellular**

- **Date**
- **Time**
- **Location (lat., long.)**
- **Speed**
- **Altitude**
- **Air Temp**
- **Barometric Pressure**
- **Humidity**
- **Dew Point**
- **Road Temp**
- **Wiper Status**
- **Spread Rate**

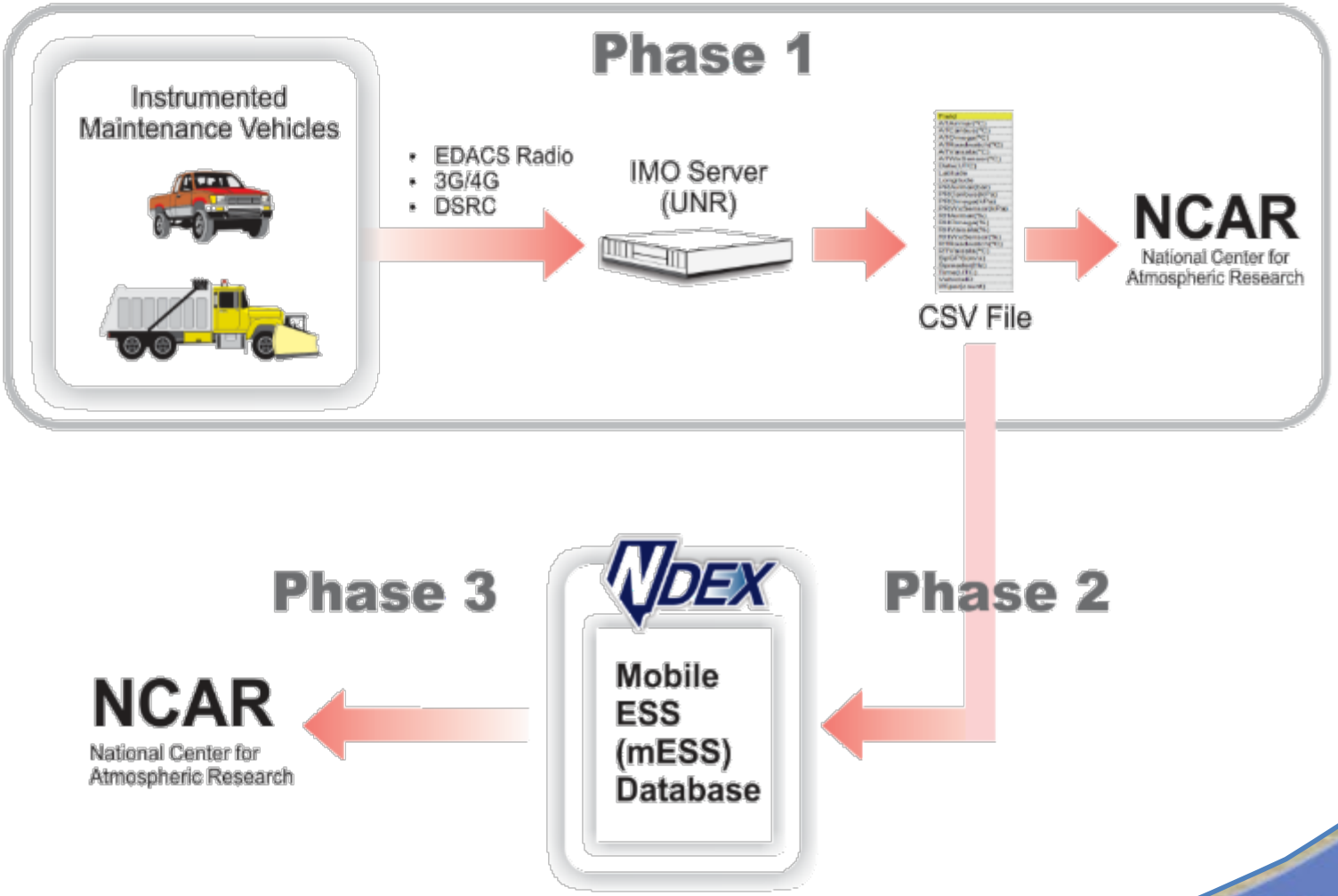
NIMO 3 Sensor Package Inventory

SensorId	Manufacturer	Source Unit of Measure	Target Observation Type
ATAirmar	Airmar	Temperature Celsius	NTCIP 1204 ESS Air Temperature
RTRoadwatch	Roadwatch	Temperature Celsius	NTCIP 1204 ESS Surface Temperature
PRAirmar	Airmar	Atmospheric Pressure Bar	NTCIP 1204 ESS Atmospheric Pressure
PROmega	Omega	Atmospheric Pressure kPa (kilopascal)	NTCIP 1204 ESS Atmospheric Pressure
GPGGA	Cradle Point	NMEA 0183 Sentence GPGGA	NMEA 0183 Sentence GPGGA

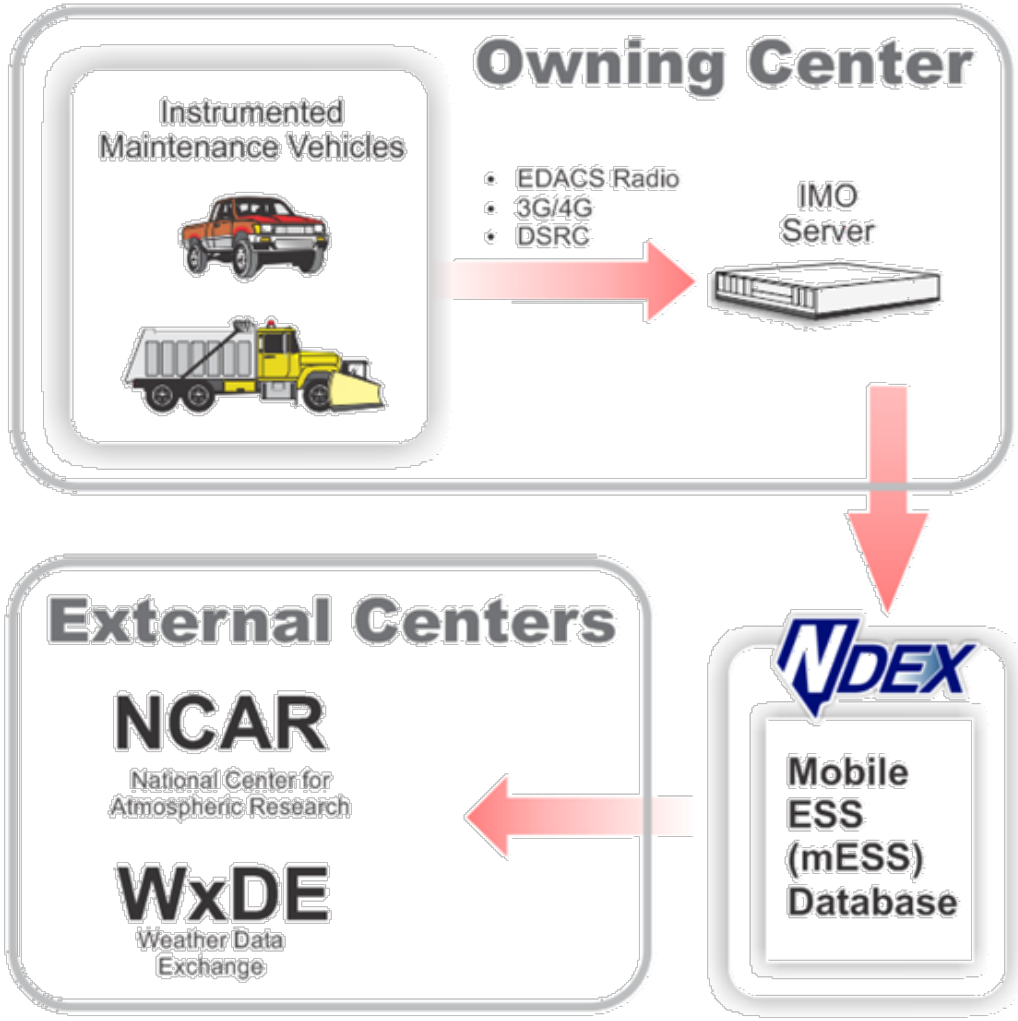
mESS Uses National Standards (Mapped Data Sets / Data Dictionary)

5.1.4	Target Observation Type (See Table 7 - Source and Target Units of Measure)	M	Requires at least one of following.
5.1.4.1	NTCIP1204_essAirTemperature	M	NTCIP 1204
5.1.4.2	NTCIP1204_essAtmosphericPressure	M	NTCIP 1204
5.1.4.3	NTCIP1204_essDewpointTemp	M	NTCIP 1204
5.1.4.4	NTCIP1204_essRelativeHumidity	M	NTCIP 1204
5.1.4.5	NTCIP1204_essSurfaceTemperature	M	NTCIP 1204
5.1.4.6	SAEJ2735_DE_WiperRate	M	SAE J2735
5.1.4.7	SAEJ2735_DE_WiperStatusFront	M	SAE J2735
5.1.4.8	SAEJ2735_DE_TractionControlState	M	SAE J2735
5.1.4.9	SAEJ2735_DE_StabilityControlStatus	M	SAE J2735
5.1.4.10	NTCIP1204_essPaveTreatProductType	M	NTCIP 1204
5.1.4.11	NTCIP1204_essPaveTreatProductForm	M	NTCIP 1204
5.1.4.12	NTCIP1204_essPaveTreatmentAmount	M	NTCIP 1204
5.1.4.13	NMEA0183_SentenceGPGGA	M	NMEA 0183
5.1.4.14	NMEA0183_SentenceGPRMC	M	NMEA 0183
5.1.4.15	mESS_SpreaderCyclesPerSecondHz	M	
5.1.4.16	mESS_WiperCount	M	

mESS / NDEX Implementation Phases



mESS / NDEX Data Architecture



Supported NDEX Messages

Device Types:

- Detector Station
- CCTV
- Dynamic Message Sign (DMS)
- Environmental Sensors (ESS)
- Mobile Environmental Sensors (mESS) – (No National Standard)
- Highway Advisory Radio (HAR)
- Incidents/Events
- Ramp Meter
- Node, Link, Traffic Network

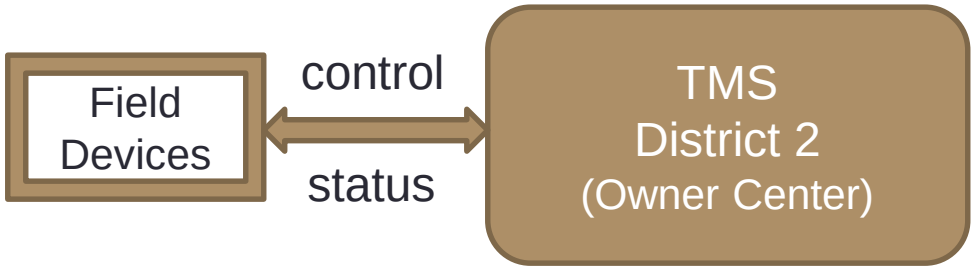
NDEX messages include inventory and device status

NDEX Supported Services

1. Need to authenticate access
2. Need to support request-response
3. Need to support error handling
4. Need to share IMO vehicle inventory
5. Need to share IMO sensor inventory from any vendor-specific sensor
6. Need to share IMO observations
7. Need to preserve vendor-specific sensor data

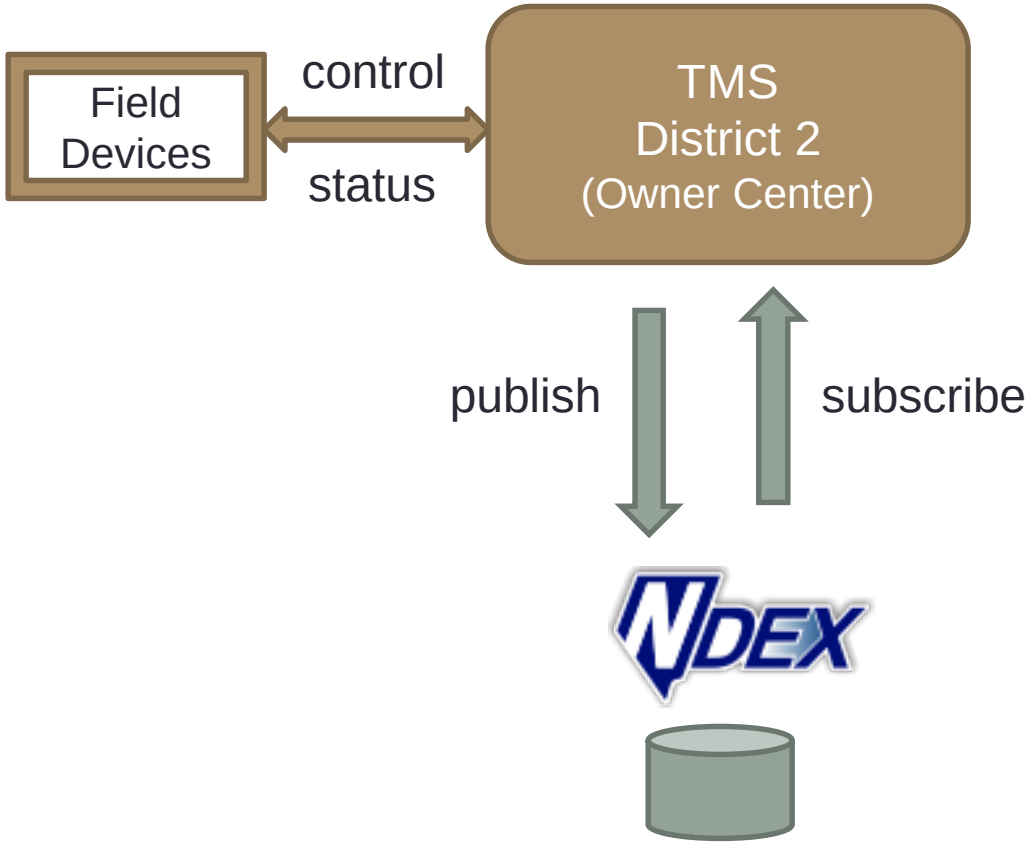
Only the owning center may control field devices

NDEX Architecture



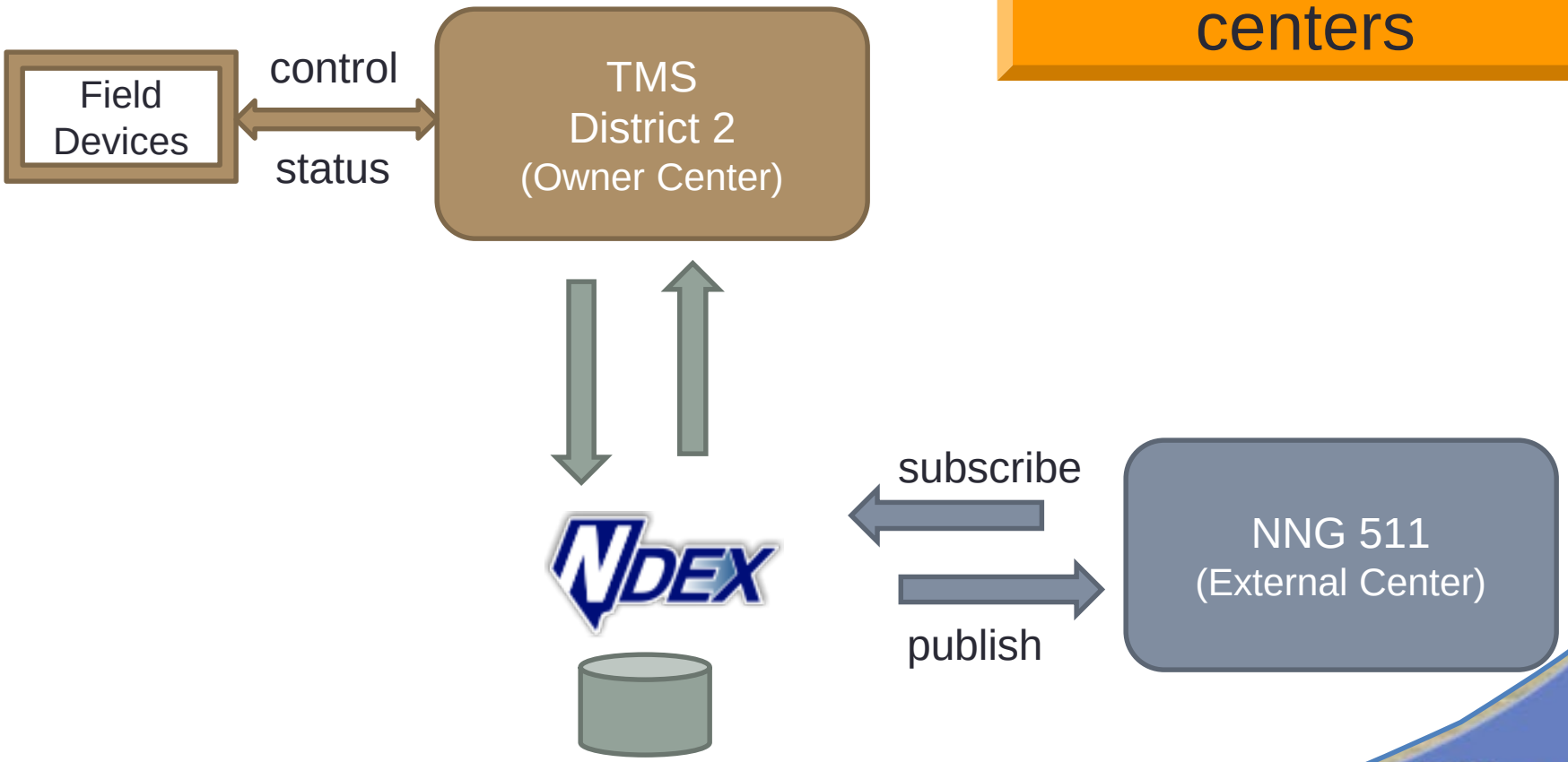
NDEX Architecture

NDEX receives data from the owning center



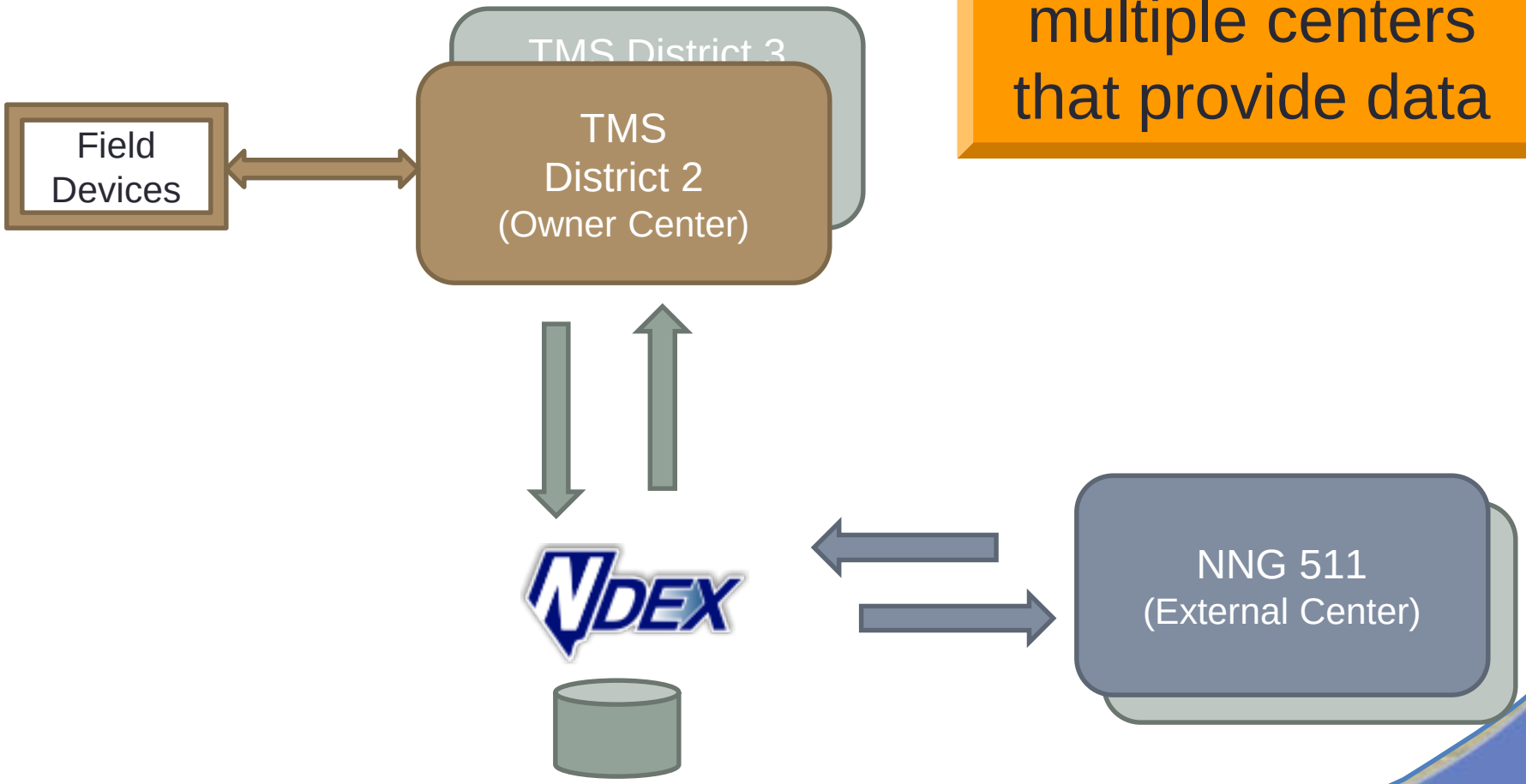
NDEX Architecture

NDEX shares data with external centers



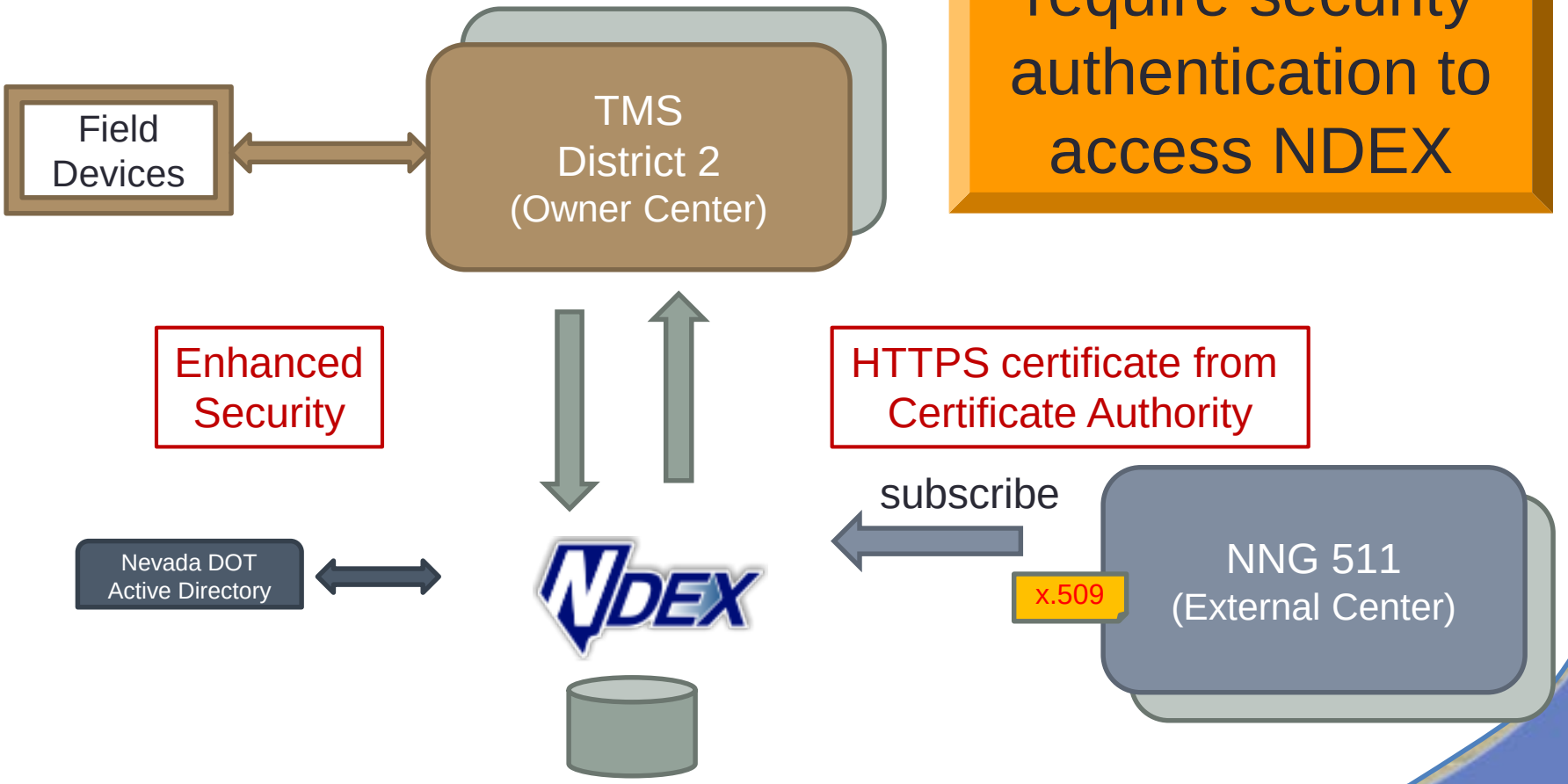
NDEX Architecture

NDEX works with multiple centers that provide data



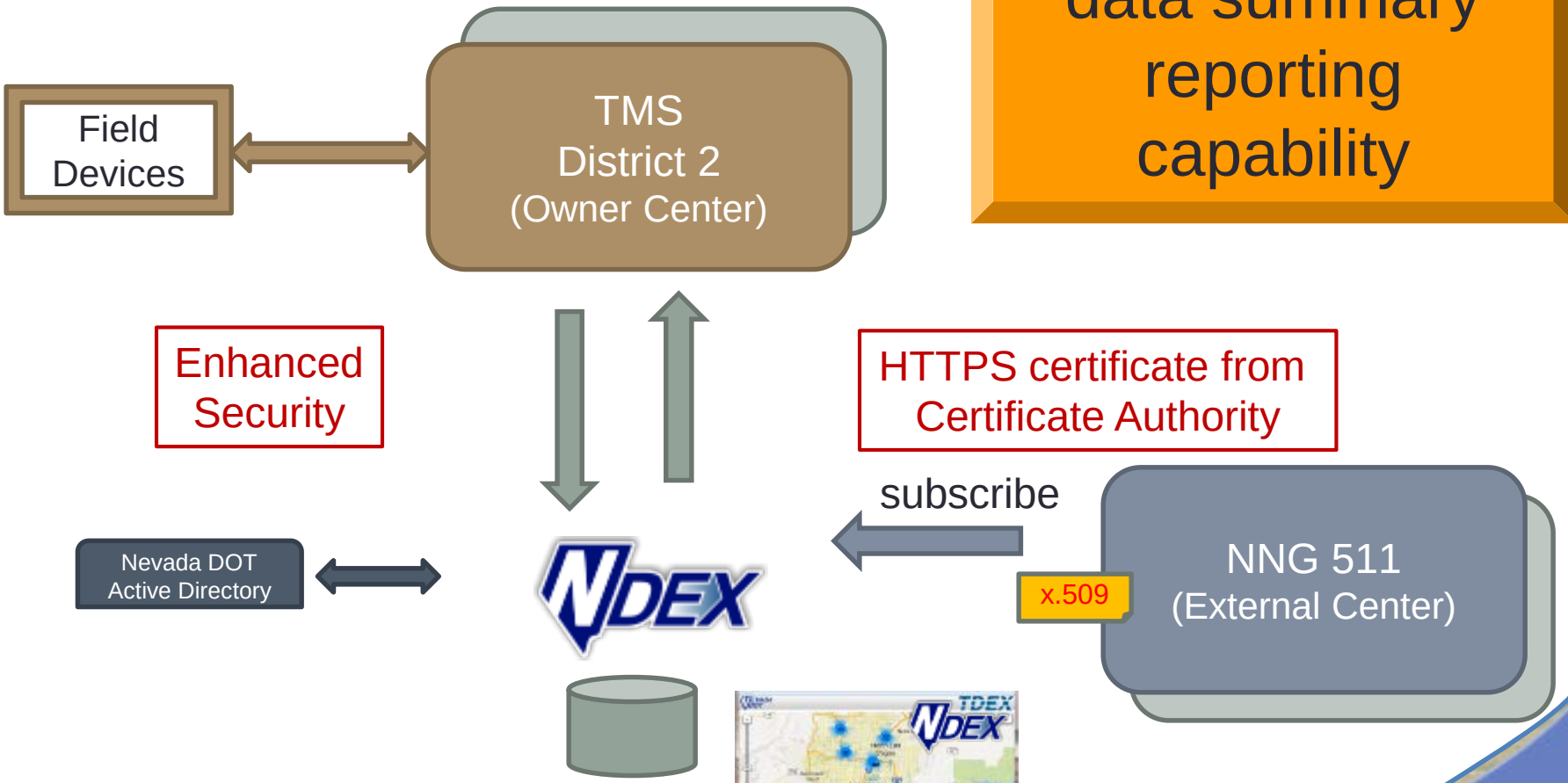
NDEX Architecture

External centers require security authentication to access NDEX



NDEX Architecture

NDEX provides data summary reporting capability



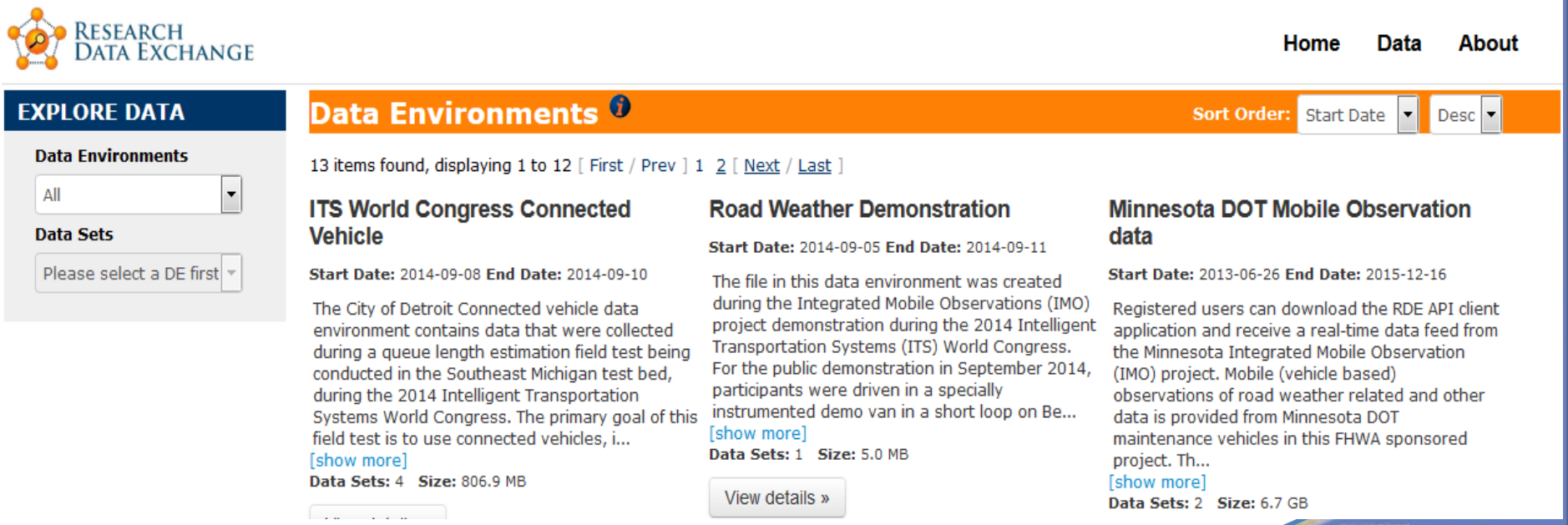
Sample Observation Report Message


```
{
        "ObservationReportMsg":{

    "RequestId":"123",
    "OrganizationId":"imo.unr.edu",
    "CenterId":"IMO",

    "ObservationReports":[

  {"VehicleId":"D2-0423","DateTime":"2015-09-17T00:00:19Z","Latitude":39527500,"Longitude"
119792500
        ,"Bearing":46,"Elevation":333,"Speed":46,"Observations":[

        {"SensorId":"ATRoadwatch","SourceValue":"17.1"},
        {"SensorId":"ATWxSensor","SourceValue":"18.3"},
        {"SensorId":"RHWxSensor","SourceValue":"24.6"},
        {"SensorId":"PRWxSensor","SourceValue":"86.1"},
        {"SensorId":"RTRoadwatch","SourceValue":"22.8"},
        {"SensorId":"SpGPS","SourceValue":"12.7986"},
        {"SensorId":"Spreader","SourceValue":"0"},
        {"SensorId":"WiperCount","SourceValue":"0"}
          ]
  }
  ,
  {"VehicleId":"0423","DateTime":"2015-09-17T00:10:19Z","Latitude":39527500,"Longitude":-
119792500
        ,"Bearing":46,"Elevation":333,"Speed":46,"Observations":[


        {"SensorId":"ATRoadwatch","SourceValue":"17.1"},
        {"SensorId":"ATWxSensor","SourceValue":"18.3"},
        {"SensorId":"RHWxSensor","SourceValue":"24.6"},
        {"SensorId":"PRWxSensor","SourceValue":"86.1"},
```


Source Value is Stored in the NDEX along with the associated NTCIP 1204 ESS/RWIS value

IMO References

- DSRC SAE J2735 DSRC Message Set Dictionary
- NTCIP 1204 ESS Interface Protocol
- https://wxde.fhwa.dot.gov/
- https://www.its.dot.gov/data/



NDEX Key Stakeholders (Users)

- Traffic Management Centers (D2 Reno, D3 Elko, & D1 / FAST / Las Vegas)
- External Centers (UNR, UNLV, UC Davis, & DRI)

ROAD OPERATIONS CENTER NEVADA DOT

ROAD OPERATIONS CENTER NEVADA DOT

FAST

University of Nevada, Reno

UNLV

UCDAVIS UNIVERSITY OF CALIFORNIA

DRI Desert Research Institute

NEVADA DOT SAFE AND CONNECTED

NDEX Key Stakeholders (Users)

- Other County and City TMCs (RTC South / Seeing Orange)
- NDOT 511 (VoltDelta), Nevada Highway Patrol (NHP), and Waze
- Future integration: NOAA / Weather Data Environment (WxDE), and RTC North (Washoe County)

mESS / NDEX Lessons Learned

- **Data**
  - Do not use XML due to the size (a single message from a single vehicle can be up to 4k in size)
  - JSON is compact and in a readable format
  - When implementing DSRC very carefully consider the 3Vs in data storage: velocity, variety, and volume
  - Expect messages at a frequency of every 8 seconds or less
  - Consider your fleet size into your data storage calculations
  - 1 TB of stored and backed up data is equivalent to 2.3 TB of data
  - Consider technologies as NoSQL for data storage
  - Carefully consider a realistic data retention policy

DSRC FCC & FCC License

DSRC FCC/FAA Site Registration: All site registrations completed.

1.	I580 / Mill Street	FAA Determination completed, FCC ASR and registration completed.
2.	I580 / Plumb Lane	FAA Determination completed, FCC ASR and registration completed.
3.	I580 / Neil Road	FAA Determination completed, FCC ASR and registration completed.
4.	I580 SB before exit 59	FAA Determination completed, FCC ASR and registration completed.
5.	SR431 WB / DMS#4	FAA Determination completed, FCC ASR and registration completed.
6.	I580 / Parker Ranch	FAA Determination completed, FCC ASR and registration completed.
7.	I580 / Bower's DMS#1	FAA Determination completed, FCC ASR and registration completed.
8.	I580 / Washoe Valley	FAA Determination completed, FCC ASR and registration completed.
9.	I580 / Galena Creek Bridge	FAA Determination completed, FCC ASR and registration completed.
10.	I580 / Steamboat Hills	FAA Determination completed, FCC ASR and registration completed.
11.	I580 / Northgate (Carson)	FAA Determination completed, FCC ASR and registration completed.
12.	I580 / Exit 61 (Virginia St)	FAA Determination completed, FCC ASR and registration completed.
13.	I580 / Exit 63 (Peckham)	FAA Determination completed, FCC ASR and registration completed.
14.	I580 / Galena Forest	FAA Determination completed, FCC ASR and registration completed.
15.	I580 / Brown's Creek	FAA Determination completed, FCC ASR and registration completed.
16.	I580 / 5th St (Carson)	FAA Determination completed, FCC ASR and registration completed.
17.	I580 / Moana	FAA Determination completed, FCC ASR and registration completed.
18.	I580 / I80 Interchange	FAA Determination completed, FCC ASR and registration completed.

NIMO Lessons Learned

- **Phase 3**
  - Modular architecture design
  - Multi-modal capable
  - Retrofit capable for EDACS low-bandwidth trunked radio where necessary
  - Application on the server to interface with the Nevada Data Exchange (NDEX) utilizing the Traffic Management Data Dictionary (TMDD)
  - Data exchange with WxDE and MADIS
  - Proprietary/research equipment have a short shelf life (resources)

Cost Comparison

NIMO Cost Comparison

Item		IMO 1	IMO 2	IMO 3
Main Processor System		$800	$100	$400
EDACS capable radio		$900	$0	$0
Device Multiplexer		$0	$173	$0
Custom Weather Sensor		$0	$75	$200
Roadwatch sensor w/RS232		$750	$750	$750
Airmar GPS/weather sensor		$1,000	$0	$0
OBD/J1939 Scan Tool		$625	$150	$0
Comet sensor				$600
Arada Locomate				$1,200
Cradlepoint cellular modem				$800
Custom cabling		$100		$150
Custom mounting hardware		$150		$150
Non-Recurring Totals:		**$4,325**	**$1,248**	**$4,250**
Recurring Data Expenses			$36/month	$15/month

**Does NOT include costs of instrumenting spreader

Moving Forward

Dedicated Short Range Communication
For Rural ITS
Jackson, Wyoming
May 18, 2018

NIMO Moving Forward

- Complete the UNR transition to NDOT
- Final Report to FHWA
- National IMO Standard
- EDC4 commitment for Pathfinder
  - Pathfinder (Assessment/Institutionalized)
    - NDOT will focus on getting more consistent actionable messages out to the public.
    - NDOT would like to host a workshop or peer-exchange with the NDOT PIO's, NWS PIO's, and other state experts that have a strong formalized program
- EDC4 commitment for IMO

NIMO Moving Forward

- IMO (Institutionalized)
  - NDOT as part of the initial IMO pilot is finalizing it's assessment of the data collection and is developing the needs/requirements for the MDSS and MMS
  - NDOT participated in a peer exchange with PikAlert and will utilize the open source platform for its current data to provide an enhanced MDSS and to assist traveler's information dissemination.

- Tasks: NDOT Maintenance to contract with NCAR for MDSS and MAW
  - MDSS
    - GIS segments to NCAR
    - IMO vehicle data verified to NCAR
    - NCAR review maintenance treatments
    - RWIS data through the web services

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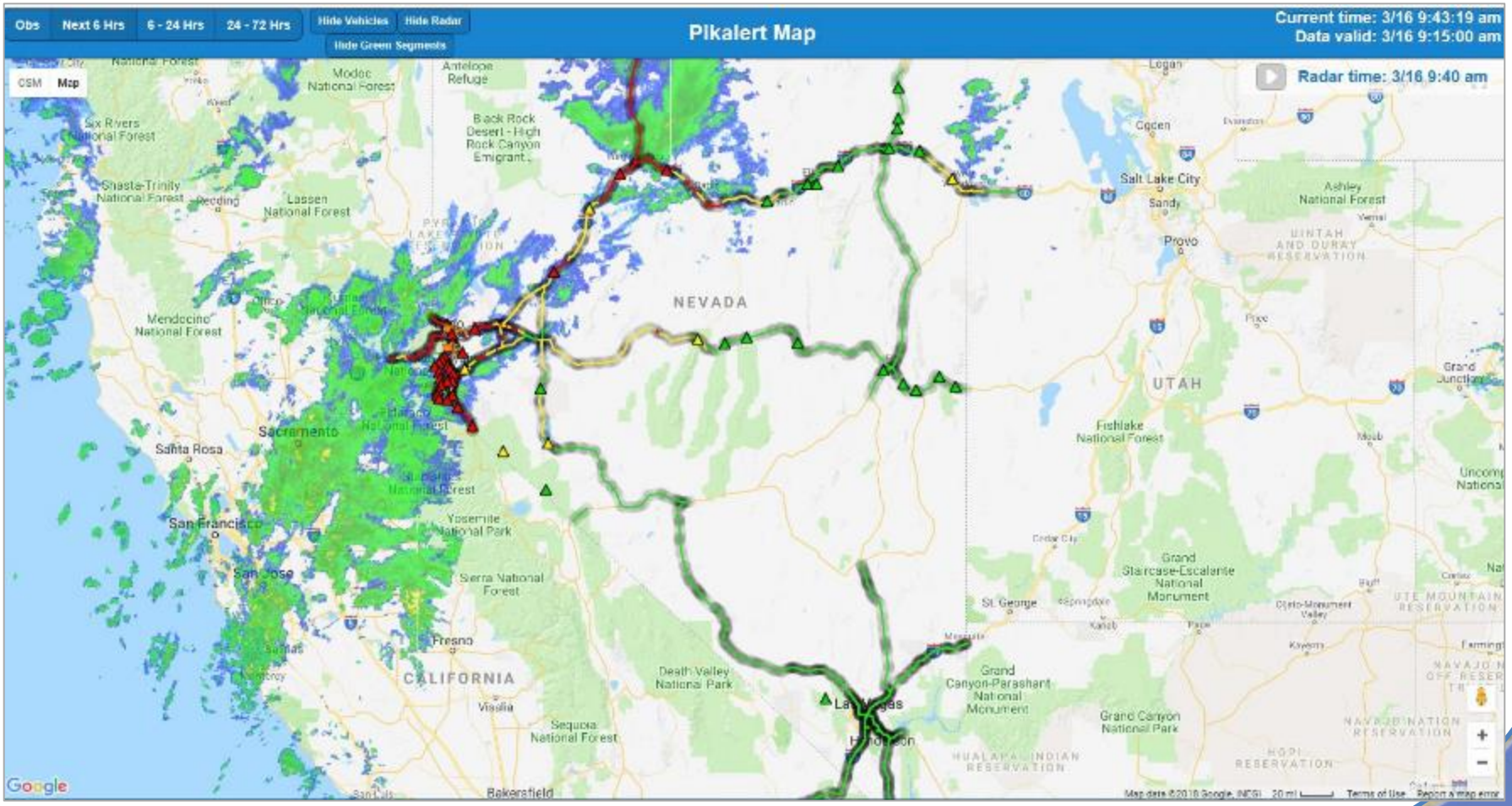

http://dot.rap.ucar.edu/emdss/?state=nevada

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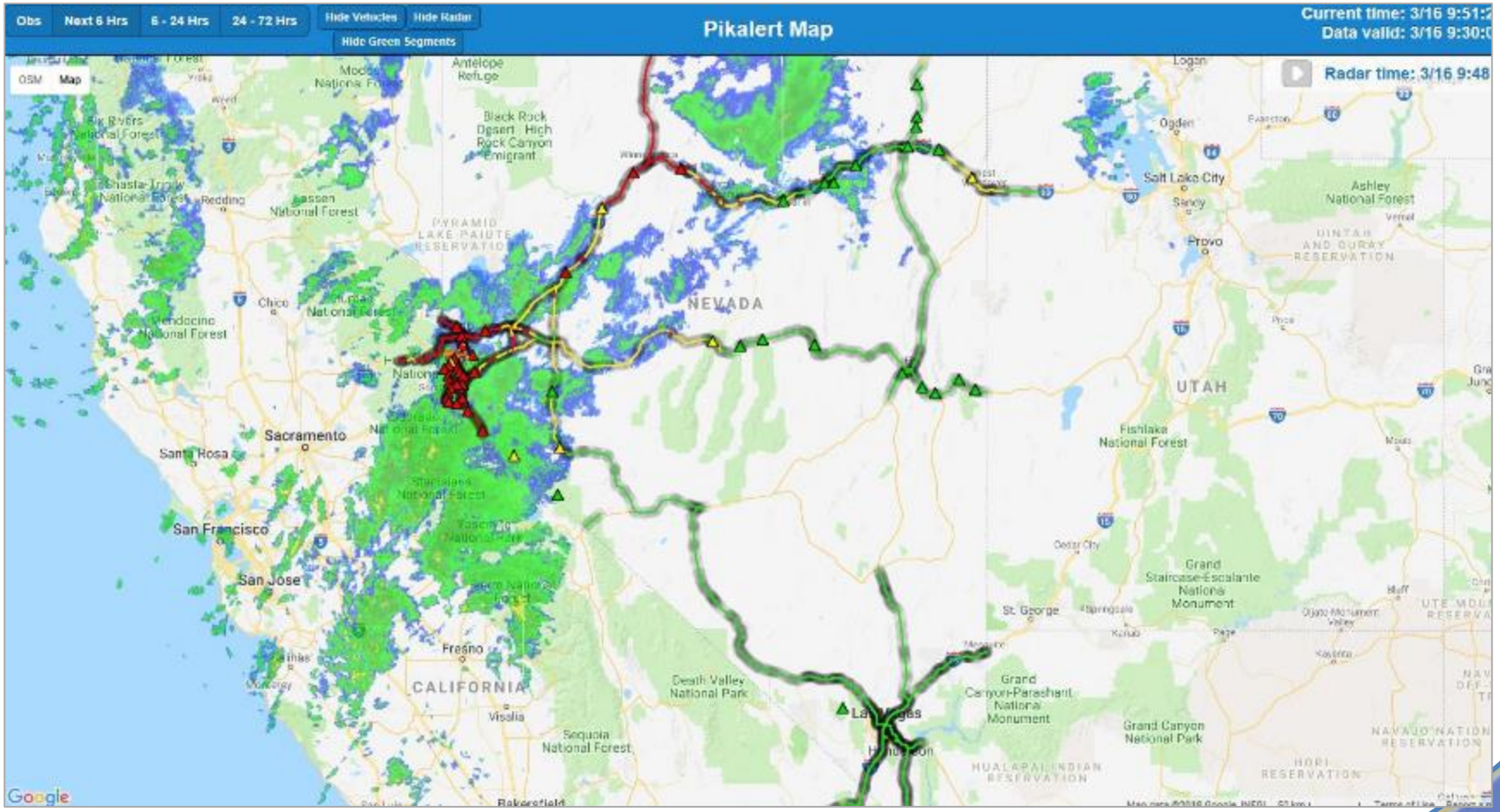

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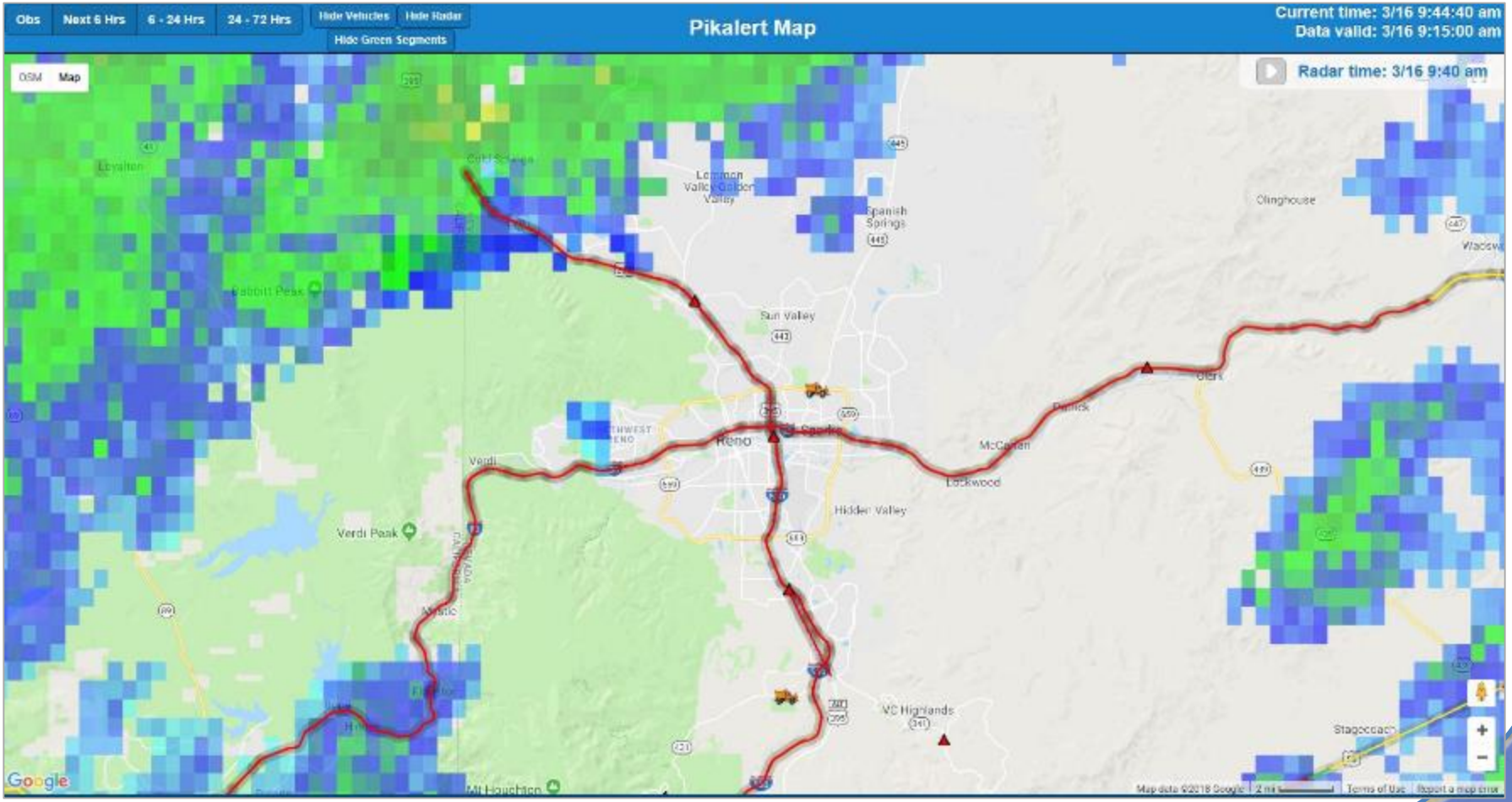
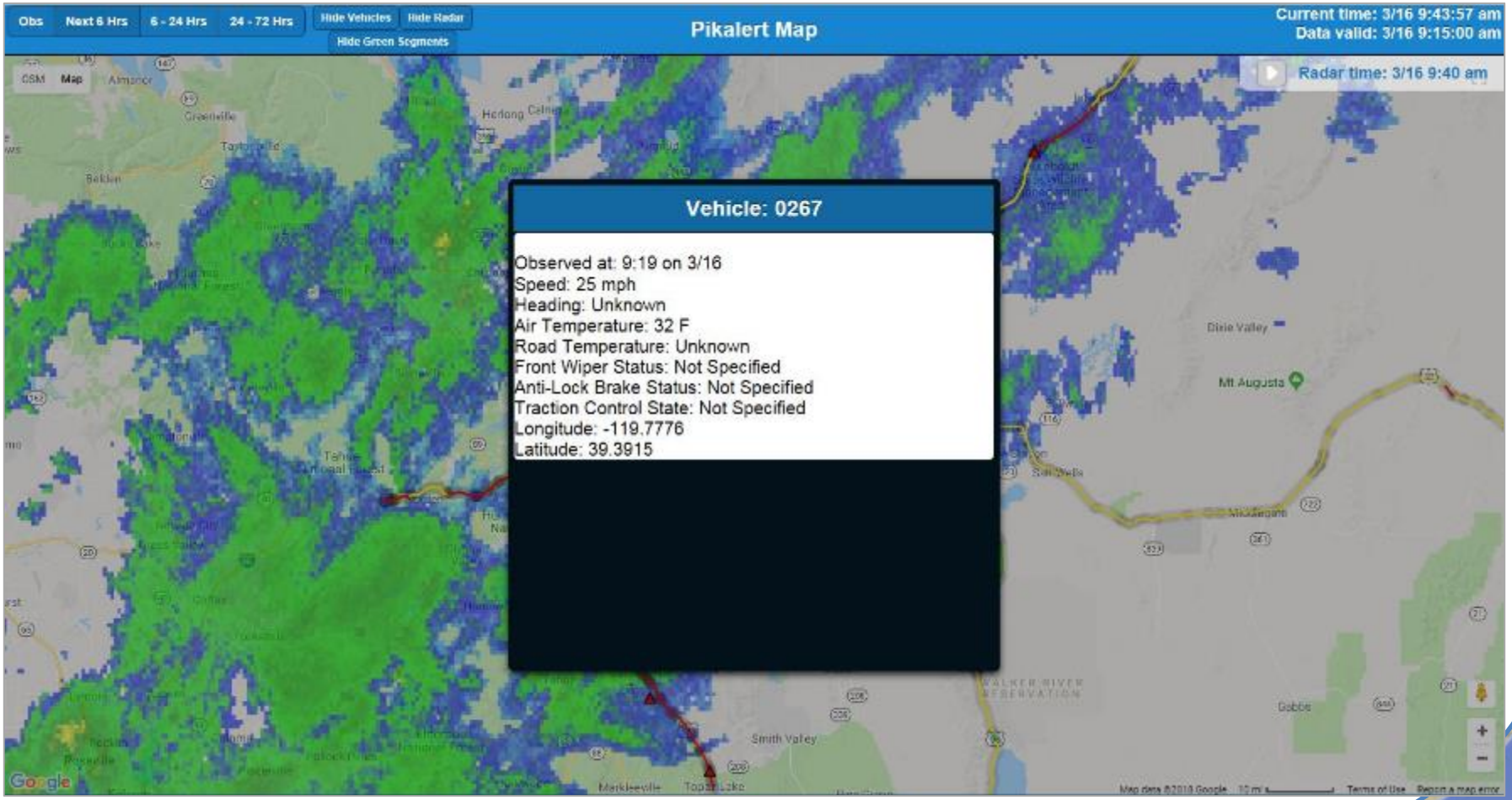
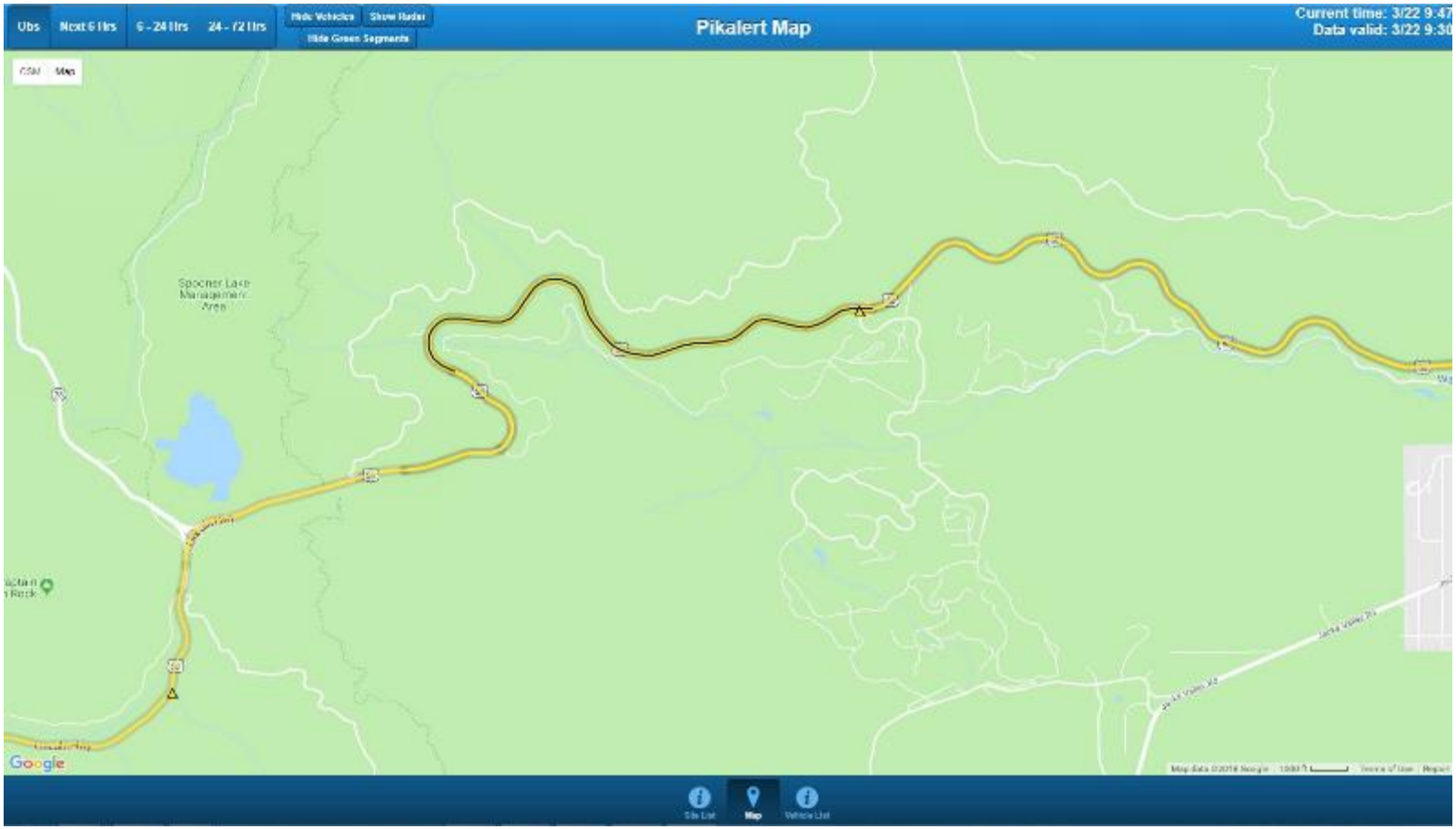

Obs
Next 6 Hrs
6 - 24 Hrs
24 - 72 Hrs
Hide Vehicles
Hide Radar
Hide Green Segments
Pikalert Map
Current time: 3/16 9:44:40 am
Data valid: 3/16 9:15:00 am
Radar time: 3/16 9:40 am
OSM
Map
Reno
Sparks
Verdi
Verdi Peak
Sun Valley
Spanish Springs
Lemmon Valley-Golden Valley
Hidden Valley
McCarran
Lockwood
Patrick
Olinghouse
VC Highlands
Stagecoach
Mt Houghton
Google

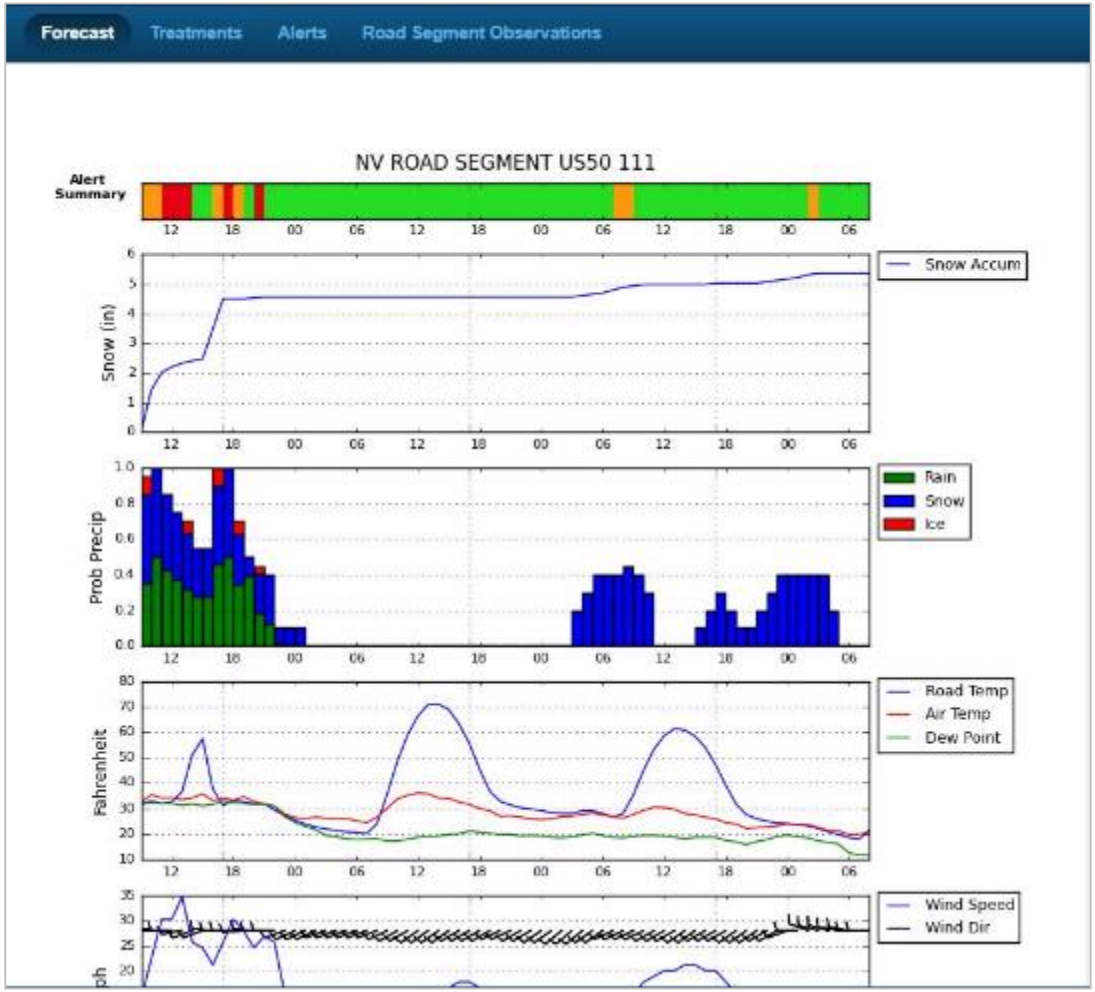
Pikalert


Obs
Next 6 Hrs
6 - 24 Hrs
24 - 72 Hrs
Hide Vehicles
Hide Radar
Hide Green Segments
Pikalert Map
Current time: 3/16 9:43:57 am
Data valid: 3/16 9:15:00 am
Radar time: 3/16 9:40 am
OSM
Map
Vehicle: 0267
Observed at: 9:19 on 3/16
Speed: 25 mph
Heading: Unknown
Air Temperature: 32 F
Road Temperature: Unknown
Front Wiper Status: Not Specified
Anti-Lock Brake Status: Not Specified
Traction Control State: Not Specified
Longitude: -119.7776
Latitude: 39.3915
Dixie Valley
Mt Augusta
Smith Valley
Gabbs
Markleeville
Topaz Lake
Google

Pikalert US 50 Spooner Summit



Pikalert US 50 Spooner Summit



Pikalert US 50 Spooner Summit

Forecast	Treatments	Alerts	Road Segment Observations
Thurs 3/22 9:35 am			**Treatment:** Plow and Apply Prewet Caliber at Concentration 6.637 **Condition:** Road temp: 32, Explanation: Treatment exceeds maximum. May need additional plowing.
Thurs 3/22 10:00 am			**Treatment:** Plow and Apply Prewet Caliber at Concentration 6.415 **Condition:** Road temp: 32, Explanation: Treatment exceeds maximum. May need additional plowing.
Thurs 3/22 11:00 am			No treatment recommended at this time
Thurs 3/22 12:00 pm			**Treatment:** Plow and Apply Prewet Caliber at Concentration 6.977 **Condition:** Road temp: 33, Explanation: Treatment exceeds maximum. May need additional plowing.
Thurs 3/22 1:00 pm			No treatment recommended at this time
Thurs 3/22 2:00 pm			**Treatment:** Plow and Apply Prewet Caliber at Concentration 7.917 **Condition:** Road temp: 51, Explanation: Normal anti-icing operations.
Thurs 3/22 3:00 pm			No treatment recommended at this time
Thurs 3/22 4:00 pm			**Treatment:** Plow and Apply Prewet Caliber at Concentration 9.337 **Condition:** Road temp: 36, Explanation: Treatment exceeds maximum. May need additional plowing.
Thurs 3/22 5:00 pm			No treatment recommended at this time
Thurs 3/22 6:00 pm			**Treatment:** Plow and Apply Prewet Caliber at Concentration 9.167 **Condition:** Road temp: 33, Explanation: Treatment exceeds maximum. May need additional plowing.
Thurs 3/22 7:00 pm			No treatment recommended at this time
Thurs 3/22 8:00 pm			No treatment recommended at this time
Thurs 3/22 9:00 pm			No treatment recommended at this time
Thurs 3/22 10:00 pm			**Treatment:** Plow and Apply Prewet Caliber at Concentration 14.22 **Condition:** Road temp: 29, Explanation: Normal anti-icing operations.
Thurs 3/22 11:00 pm			No treatment recommended at this time
Fri 3/23 0:00 am			No treatment recommended at this time
Fri 3/23 1:00 am			No treatment recommended at this time
Fri 3/23 2:00 am			No treatment recommended at this time

Pikalert US 50 Spooner Summit

Forecast | Treatments | Alerts | **Road Segment Observations**

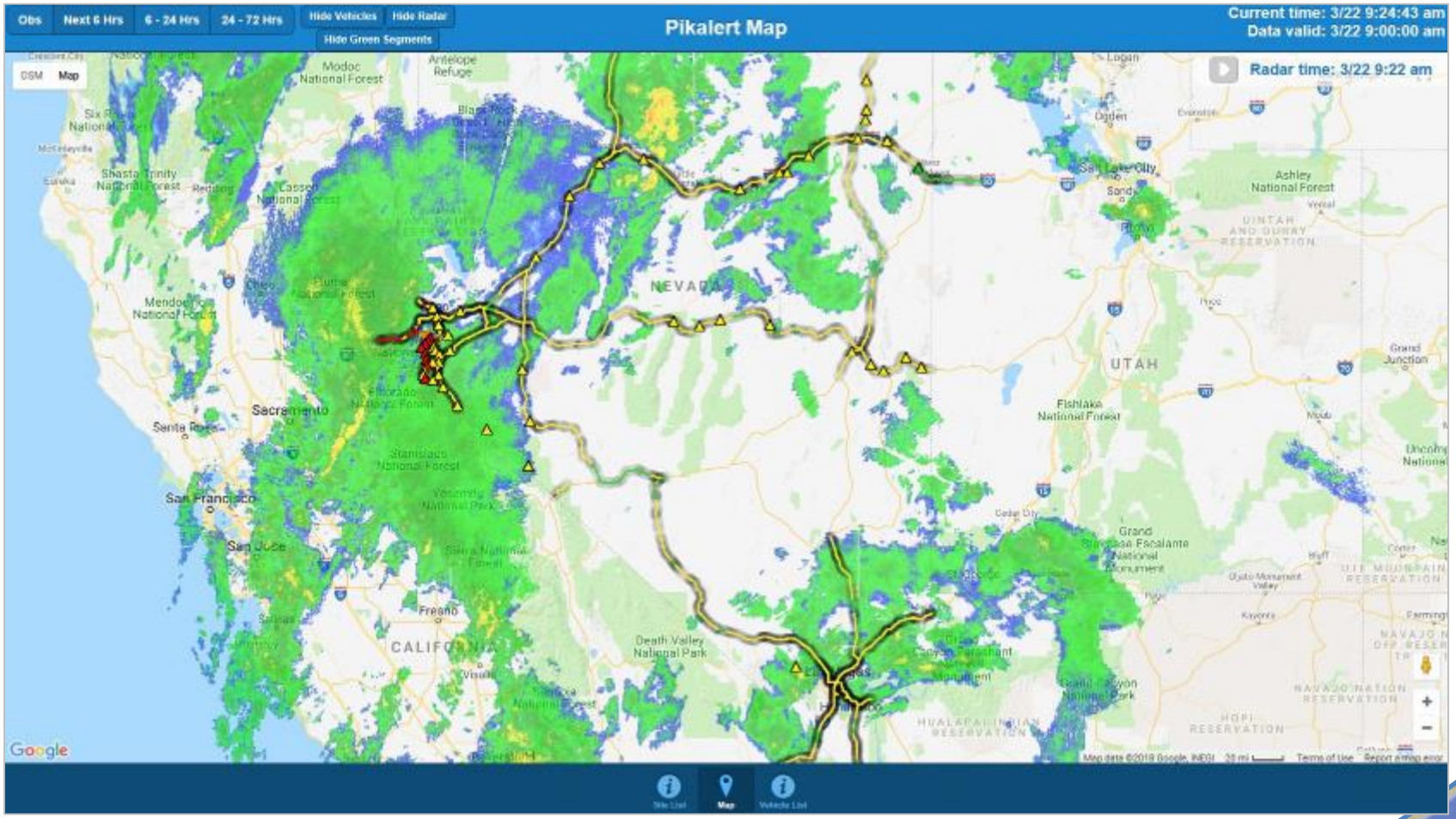
Site Name	NV ROAD SEGMENT US50 111
Site Type	Road Segment
Mean Air Temp	40 deg F
Model Air Temp	35 deg F
Model Dewpoint Temp	33 deg F
Radar Reflectivity	26.00 dBZ
Dual Pol Digital Hybrid Reflectivity	missing
Mean Barometric Pressure	missing
Model Barometric Pressure	767 mb (22.66 inch Hg)
Dual Pol Hybrid Hydrometeor Classification	40.00
Mean Vehicle Speed	missing
Number of Valid Speeds	missing
Mean Vehicle Air Temp	missing
Mean Vehicle Barometric Pressure	missing
Mean Vehicle Surface Temp	missing
Number of Wipers On	missing
Number of Wipers Off	missing

Pikalert US 50 Spooner Summit

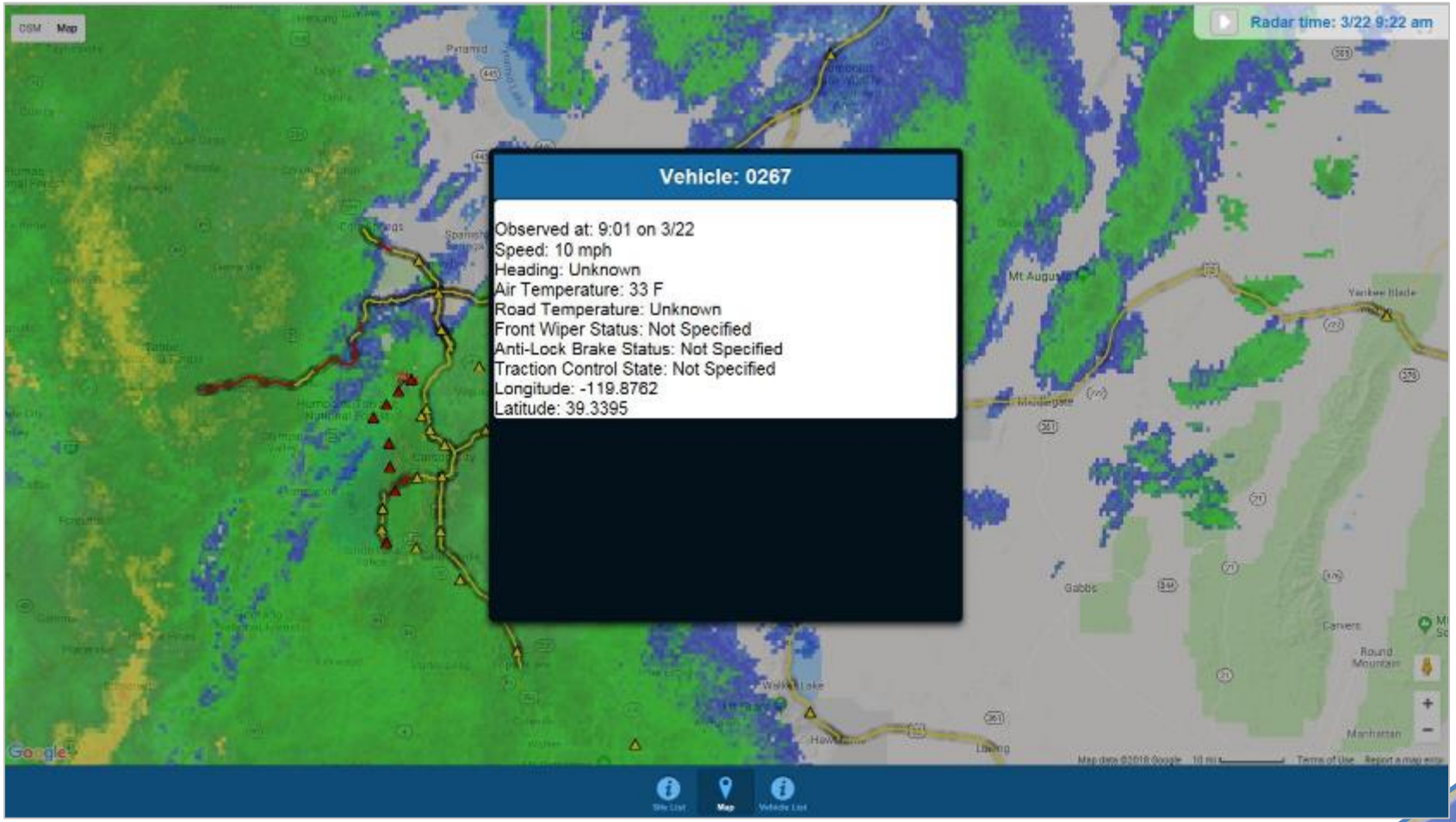
Forecast | Treatments | **Alerts** | Road Segment Observations

Thurs 3/22 9:35 am	🟡	**Advisory:** Precip: moderate rain, Pavement: wet, Visibility: low
Thurs 3/22 10:00 am	🟡	**Advisory:** Precip: heavy mixed, Pavement: wet, Visibility: low
Thurs 3/22 11:00 am	🔴	**Warning:** Precip: heavy snow, Pavement: slick, icy, Visibility: blowing snow
Thurs 3/22 12:00 pm	🔴	**Warning:** Precip: light snow, Pavement: slick, icy, Visibility: blowing snow
Thurs 3/22 1:00 pm	🔴	**Warning:** Precip: light snow, Pavement: wet, Visibility: blowing snow
Thurs 3/22 2:00 pm	🟢	Clear
Thurs 3/22 3:00 pm	🟢	Clear
Thurs 3/22 4:00 pm	🟡	**Advisory:** Precip: moderate snow, Pavement: wet, Visibility: low
Thurs 3/22 5:00 pm	🔴	**Warning:** Precip: heavy snow, Pavement: slick, icy, Visibility: heavy snow
Thurs 3/22 6:00 pm	🟡	**Advisory:** Precip: light mixed, Pavement: wet, Visibility: normal
Thurs 3/22 7:00 pm	🟢	Clear
Thurs 3/22 8:00 pm	🔴	**Warning:** Precip: light snow, Pavement: slick, icy, Visibility: normal
Thurs 3/22 9:00 pm	🟢	Clear
Thurs 3/22 10:00 pm	🟢	Clear
Thurs 3/22 11:00 pm	🟢	Clear
Fri 3/23 0:00 am	🟢	Clear
Fri 3/23 1:00 am	🟢	Clear
Fri 3/23 2:00 am	🟢	Clear

Pikalert March 22, 2018



Pikalert March 22, 2018



Pikalert March 22, 2018

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