

# Secondary: GPS Array for Ionospheric Sounding

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## Secondary Diagnostic: GPS Array

- ▶ Objectives:
  - Determine if acoustic waves from the DAG shots perturb the ionosphere
  - Relate ionospheric response to shot parameters
- ▶ Secondary Diagnostic
- ▶ Sensors:
  - Four dual-frequency GNSS high-precision geodetic receivers
  - Self-contained digitizers, no telemetry
  - Power supplied via existing seismic/acoustic photovoltaic systems



# System Design: Receivers





# System Design: Location

One GPS receiver at the end of each Thor line.

Stations:

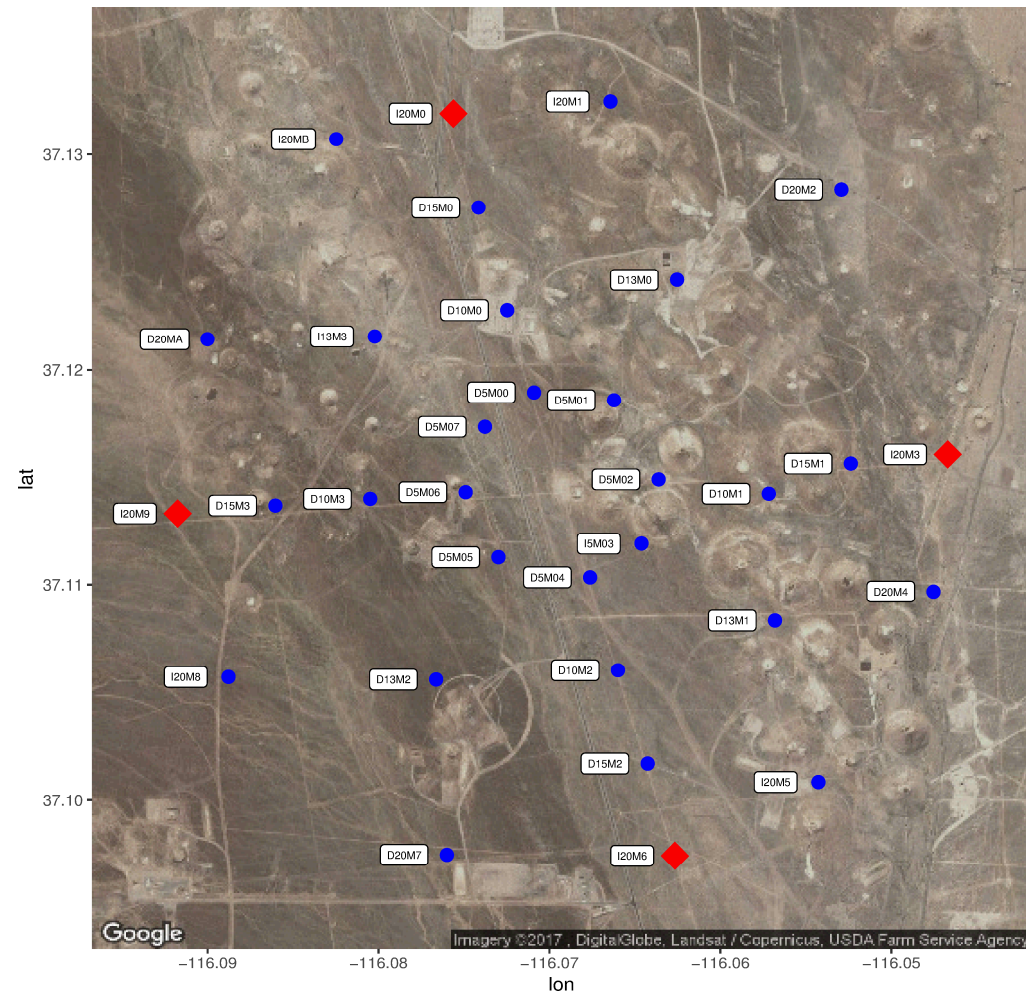
I20M0

I20M3

I20M6

I20M9

Install prior to DAG - 1 and run continuously through series.  
Download data after each shot.





# Readiness

## ► Technical

- Design: Off-the-shelf hardware
- Hardware/Assembly
  - Need to source GNSS receivers and verify proper operation (JPL)
- Qualification/Demonstration
  - Since DAG-1 is not expected to produce a measureable signal, it will be used as a test run for DAG 2-4.

## ► Hardware

- GNSS unit and housing
- Interface to existing photovoltaic system

# Readiness

## ► Procedures/Checklists

- Install systems prior to mandatory dry runs for DAG - 1.
- Verify system operation during DAG - 1, where no signal is expected
- For the following shots:
  - T – 24 hours: Check unit to make sure it is operating correctly
  - After shot: recover data (no specific timeline)

## ► Authorizations

- Covered under site REOP and Seismic/Infrasound work package

## ► Installation Needs from the NNSS

- Interface to photovoltaic system on ground stations

## ► Training

- No specific training required beyond seismic/infrasound field work



# Risk

## ► Risk to Diagnostic Goals

- Autonomous operation -> risk of unit failure during shot
- Poorly developed ionosphere (should not be an issue since shots happen late morning/early afternoon)
- Null detection: not a “risk” as it benchmarks system performance

## ► Risk to Personnel

- Commensurate with seismic/infrasound station maintenance

## ► Risks to other diagnostics

- The unit is an autonomous receiver and will not interfere with other instrumentation or operations on site

## Operations Summary

- ▶ Access needed before shots: T – 24 hours to verify sensor operation
- ▶ Location of personnel during shots: BEEF
- ▶ Fielding Team: Danny Bowman (SNL), Mike Pauken (JPL), Attila Komjathy (JPL)
- ▶ Resources needed from Execution Team
  - Power from station photovoltaic system
- ▶ Frequencies provided to NNSS: N/A
- ▶ ES&H Concerns: None specific to this operation
- ▶ Go/No Go Criteria: Sensors operating nominally at T – 24 hours
- ▶ Plans for changing sensor/systems after experiment for the next DAG experiment None



## Post Shot Data Deliverable

- ▶ Required deliverable: GPS sounding data from -24 to +24 hours relative to shot; accompanying report
- ▶ Timeline for delivery: 4 weeks
- ▶ Quality analysis: Noise levels in the ionosphere
- ▶ Written documentation: A report describing the experiment setup and sounding results.

## Next Steps

- ▶ Source GNSS receivers and test them (Fall 2017)
- ▶ Install receivers at DAG site (Spring 2018)