

## FCC Radar Test Plan

**Summary:** MIT LL has a program with a US DoD sponsor, whereby a set of three (3) identical radar systems are required, each installed in the bed of a truck. The vehicles will be placed along a road adjacent to the target location. All vehicles will be driven by MIT LL employees, and will be moving at varying low speeds (less than 25 mph). Additional staff will be located in or nearby the vehicles in order to operate and monitor the radar systems. The targets for the three radars consists of two UAV systems piloted by MIT LL staff at a nearby field site. Each UAV will utilize either a corner reflector or flat plate reflector to maximize RF reflectivity. Both UAVs will either be stationary or will move in a limited flight pattern as shown in the figure below. The final piece of equipment is a GPS base station which consists of 2 GPS antennas mounted on a metal fixture, a control laptop, and an outdoor wireless access point for transmission of GPS base station corrections.

### Equipment:

- 3x Custom Radar Systems: All Identical, comprised of:
  - o Dell 7920 rack computer
  - o Custom Built Clock Source
  - o ZCU111 FPGA development board
  - o Custom 8x8 element phased array antenna
  - o Inertial Labs INS-D GPS/INS system
  - o Cisco 1562I outdoor wireless access point
- 2x DJI S1000+ UAV Systems:
  - o RFDesign RFD900x Radio Telemetry System
  - o FrSKY Taranis X9D Plus Radio Control Link
- 3x Gasoline Generators
- 3x Toyota Tundra Trucks (or similar)
- 1x GPS Base Station
  - o Dell Latitude laptop computer
  - o Inertial Labs INS-D GPS/INS System
  - o 2x NovAtel GPS-702-GG-HV GPS antennas (receive-only)
  - o ~ 12' metal fixture holding GPS antennas
  - o Cisco 1562I outdoor wireless access point
- Vehicle trailer for equipment storage

Description /website	Details
RFDesign RFD900x: <a href="http://store.rfdesign.com.au/rfd-900x-modem/">http://store.rfdesign.com.au/rfd-900x-modem/</a>	Radio telemetry system for DJI S1000+, operating between 902-928 MHz
FrSKY Taranis X9D Plus: <a href="https://www.frsky-rc.com/product/taranis-x9d-plus-2/">https://www.frsky-rc.com/product/taranis-x9d-plus-2/</a>	Radio control for DJI S1000+, 16-32 channels at 2.4 GHz
Inertial Labs INS-D: <a href="https://inertiallabs.com/products/ins/">https://inertiallabs.com/products/ins/</a>	GPS and INS sensor system
Xilinx ZCU111: <a href="https://www.xilinx.com/products/boards-and-kits/zcu111.html">https://www.xilinx.com/products/boards-and-kits/zcu111.html</a>	RF FPGA development kit

Custom 8x8 element phased array antenna: MIT-LL developed S-Band antenna (2.7GHz -3.3GHz)	Details provided in FCC License exhibit and RFA License
Cisco 1562I outdoor access point <a href="https://www.cisco.com/c/en/us/support/wireless/aironet-1562i-outdoor-access-point/model.html">https://www.cisco.com/c/en/us/support/wireless/aironet-1562i-outdoor-access-point/model.html</a>	For wireless communication between radars and GPS base station

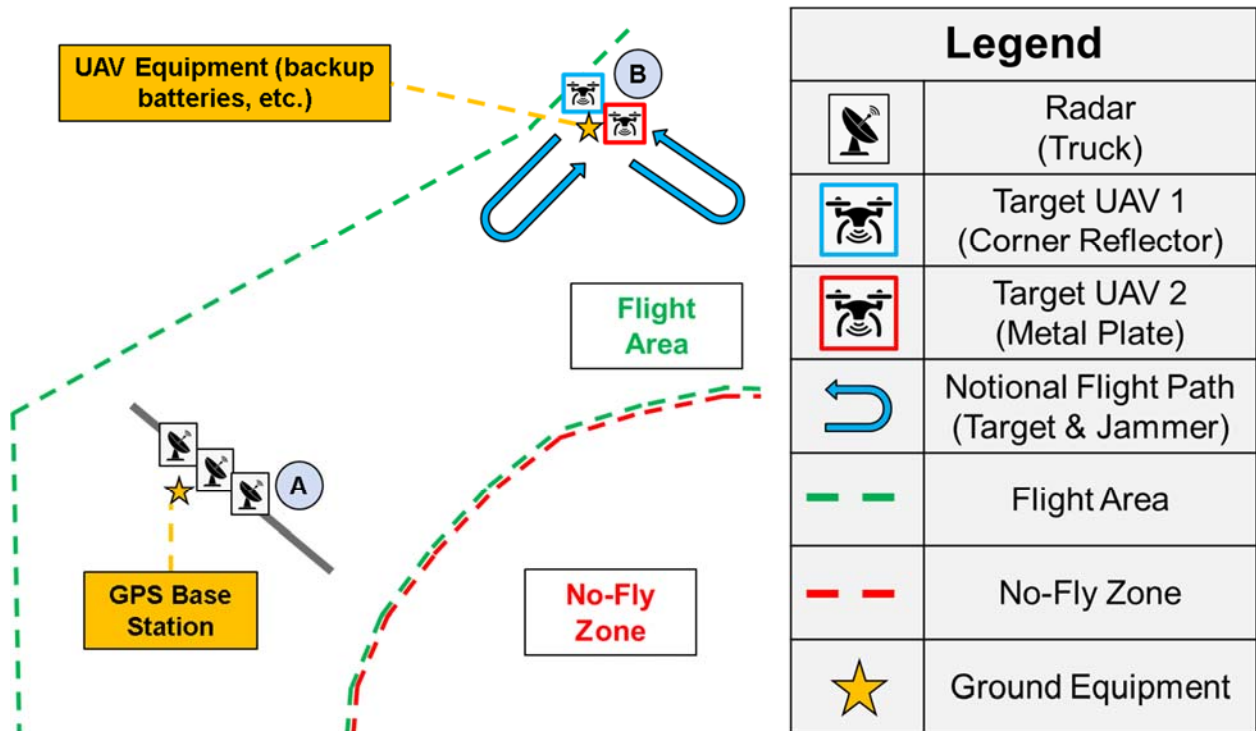
**Personnel:**

4-6 MIT LL Personnel, depending on the level of testing required

- 1 person will be the OIC
- 1 person is designated the Safety Officer

**Test Plan:**

The test setup is shown below.



The team will set up the vehicles at varying distances along the road (A). The UAVs and pilots will be located at a remote site (B). Vehicles will be traveling along the road at a set speed, and data will be collected from the radars. Variations will occur in the number and types of vehicles travelling, the direction of travel, vehicle spacing, and the speed of the vehicles. Initial testing will consist of all vehicles in fixed positions during operation.

The OIC will manage the overall test, while the safety person will ensure that personnel understand the safety hazards have properly mitigated risks. Small Handheld Radios will be used between the drivers and the tester to ensure personnel can hear commands to start and stop the tests.

**Safety:**

Seat belts will be worn at all times

Personnel not in vehicles, will be located behind the radars and at least 10 meters away to ensure personnel are not near the road or in RF path.

The OIC and/or Safety Officer will maintain contact with Range Control at all times via the Range Radios.

Vehicle spacing, speeds, and direction of travel will comply with normal driving behavior.