

Application Background:

The purpose of this project is to flight test and experiment with point to point data links for application to airborne data services.

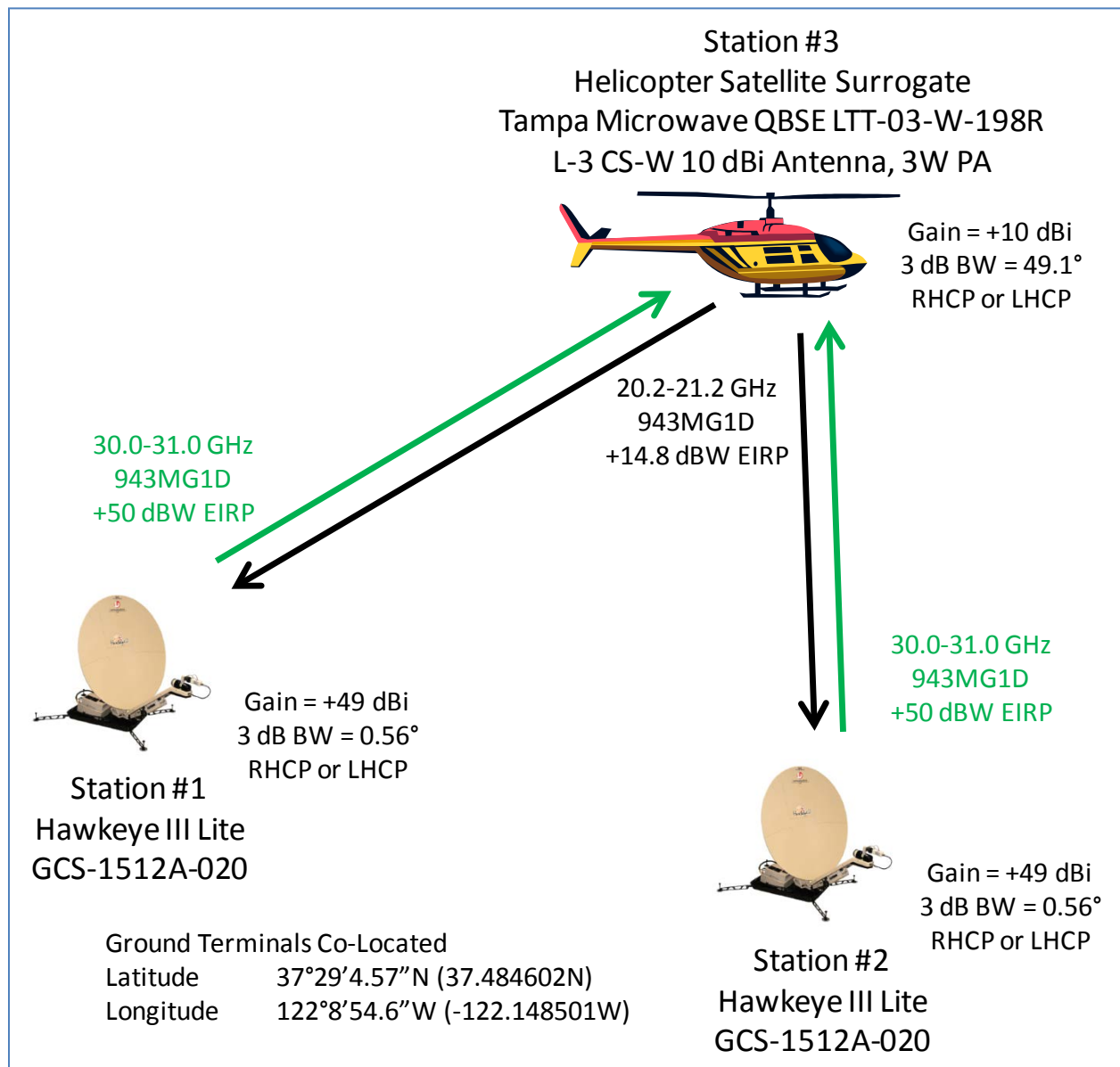


Figure 1 Concept of Operations

Spectrum Requirements and Test Scheduling:

Up to 2 co-located ground stations will transmit to and receive data from a helicopter operating no more than 10 km from the ground stations. The helicopter will be acting as a surrogate Wideband Gapfiller satellite (WGS). Uplink frequency to the helicopter will be 30.0-31.0 GHz

with EIRP limited to +50 dBW. Downlink frequency transmitted from the helicopter will be 20.2-21.2 GHz with an EIRP of +14.8 dBW. In order to minimize potential interference to the WGS satellite system, the helicopter will be restricted to an area north of the ground stations. This will prevent the ground stations from radiating in the direction of the satellite constellation at the equator. Interference to any WGS ground stations that may be in the vicinity, will be minimized because they are pointed southward towards the equator. WGS terminals receiving 20.2 - 21.2 GHz meets MIL-STD-188-164B. The side-lobe level (SLL) should be $G(\theta) = -10$ dBi for $48^\circ \leq \theta \leq 180^\circ$. As Menlo Park is located at 37.5°N , and our helicopter will fly to the north over the San Francisco Bay with below 30° elevation from any possible WGS terminals locations, the aforementioned -10 dBi SLL is the worst case. The interference from our helicopter to the victim WGS terminal will be -98 dBm in our test geometry of 5 km range, which translates to -128 dBm/MHz. In comparison, an adjacent satellite causes co-channel interference to the WGS terminal. An adjacent-satellite carrier is less than -112 dBW/MHz/m² per MIL-STD-188-164B, which is received by the victim WGS terminal's side lobe. To match the interference level of -128 dBm/MHz, a 1.5 dBi side lobe is required. Following MIL-STD-188-164B SLL limit of $G(\theta) = 29 - 25 \log_{10}(\theta)$ dBi with $\theta < 20^\circ$, its equivalent adjacent satellite separation is greater than 12° , which is easily met in deployed satellite fleets.

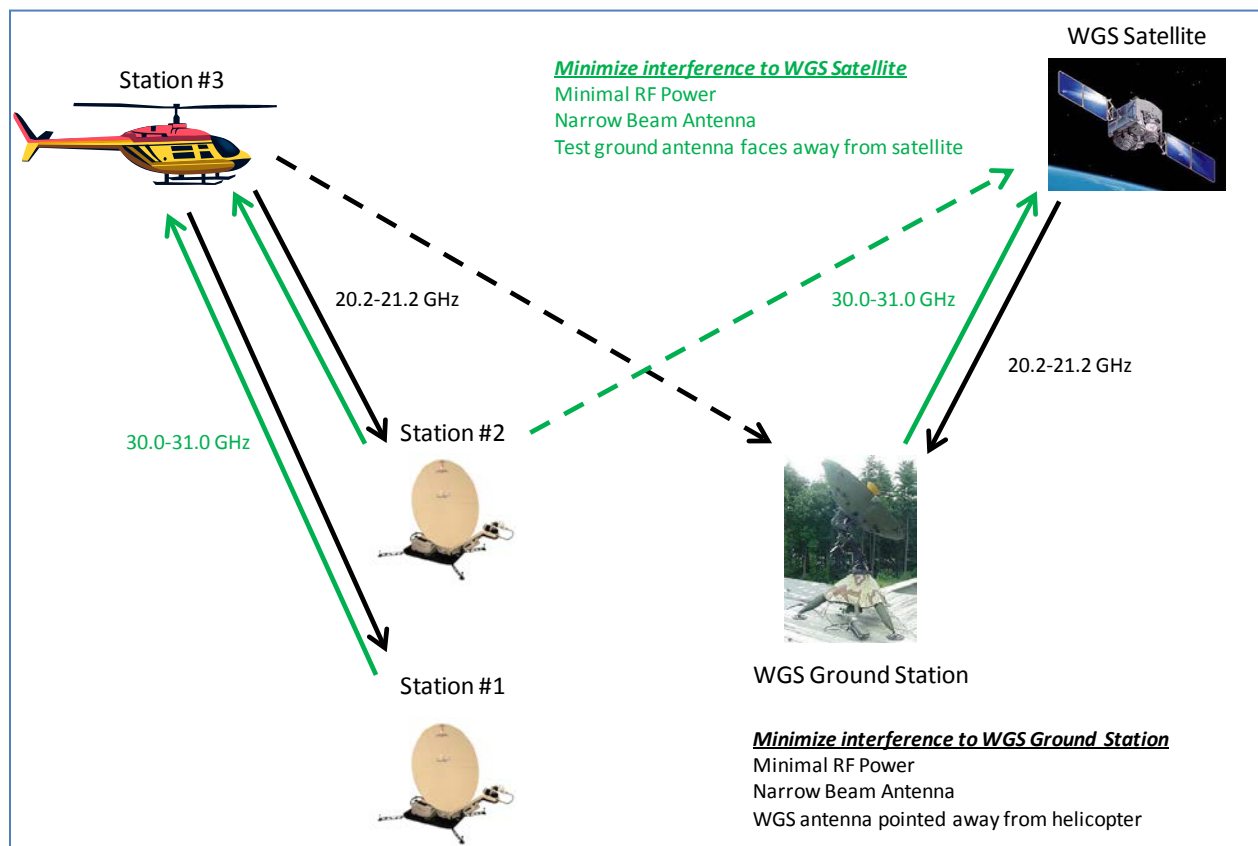


Figure 2 Interference Scenario

Location of Testing

The location of the ground stations and aircraft transmission boundary is shown in a Google Earth map in Figure 3. It is anticipated that the helicopter flight path will be over San Francisco

Bay and directly north of the ground stations indicated by a pin in the figure. Maximum range will be 10 km. Location of the ground stations are at the pin in the figure and the GPS coordinates are indicated.



Figure 3 Ground Station Location and Aircraft Boundary.