This antenna range is used routinely to measure antenna radiation patterns, antenna to antenna isolation, full up radio frequency system performance and for the development of state-of-the-art antenna measurement technologies. The uniqueness of this facility lies in the techniques, developed by AFRL, for measuring the effects of airborne interactions on aircraft antenna radiation patterns in a simulated flight environment. Interactions include those caused by metallic structures such as external weapons, electronics pods, and fuel tanks. The data obtained is used to characterize antenna performance for various aircraft configurations, to optimize an antenna design or physical placement to achieve specific performance levels, or to validate antenna modeling and simulation software. The site is open and operational year round and can operate up to the secret level. Newport, as part of AFRL Rome, is included in the NTTA Manual of Regulations and Procedures for Federal Radio Frequency Management as an “Experimental Station” with the inherent broad range of frequency authorizations and flexibility.

The Newport facility is configured into eight independent measurement ranges. The eight ranges are fully instrumented with signal sources, antennas, amplifiers, receivers, computers, displays, recording systems, fiber optic interfaces, positioner controllers, and high-speed multiplexers systems covering the frequency ranges of 50 MHz to 60 GHz. The ranges are typically operated with full-size airframes installed on special heavy-duty, high angular accuracy (\( \pm 0.05^\circ \)), 3-axis positioners to accurately simulate all possible flight attitudes. All ranges and both hills are interconnected with a fiber optic network which interfaces the range control centers to range instrumentation as well as to a high speed link connection back to the AFRL facilities in Rome, NY.

There are many significant beneficial features associated with range testing at Newport. To be specific: data collected at the Newport facility can be done for a fraction of the cost of data collected via flight testing. These tests are repeatable with a very high level of accuracy which allows for comparative evaluations following system design changes or modifications. Newport is a development environment with an emphasis on flexibility. Customers are not locked into a fixed Test Plan and are able to modify their requirements as needed. Additionally, to support this flexibility, AFRL has a complete fabrication facility located in Rome. This sheet metal, wood, plastics and paint shops are capable of building antenna mounts, whole airframe structures, which included fuseguses, wings, and tail sections. A wide variety of mock weapons, pods and fuel tanks have also been fabricated by the craftsmen at Rome.
Newport site include the: A-10, F-16 (A/C), F-15 (A/C), F-18 (A/C), F-22, F-35 (CTOL, STOVL, CV) MH 60 SEAHAWK and sections of the B-1B and KC-135. Five foot, 14 foot, and 40 foot Ground Planes are available and may be installed as required.

Measurements of aircraft antenna radiation patterns are accomplished by illuminating the antennas, mounted on the specified airframe, with a uniform RF field at the frequencies of interest. The airframe is then slowly rotated or tipped as data is continuously collected to produce patterns of amplitude and phase versus azimuth angle or elevation angle. AFRL uses a state-of-the-art FARO laser location system (a 3D measurement system with accuracy of .001 inches at approximately 30 feet) to precisely position antennas on the full-sized airframes.

Measurement Instrumentation

Each range operates with a state-of-the-art automated RF measurement system. Three networked and distributed computer systems based on the Linux operating system are used for real-time data acquisition, real-time operator graphical data visualization and RF transmitter control. The system provides extremely efficient and accurate RF measurements by managing the high speed switching and multiplexing of antenna elements, RF frequency, transmit polarization and other parameters that may be required for the specific test program. Locally developed and maintained measurement system software provides the flexibility required for the measurement, control and monitoring of modern antenna systems. Data quality control is maintained with real-time and off-line graphical data visualization tools and anomaly detection software.

Range Uses

In addition to antenna pattern and isolation measurements, Newport is an ideal facility for characterizing installed system level performance parameters. The performance of direction finding systems, communications systems, EW systems, and experimental systems can be assessed in a realistic free-space environment with both the antenna and the system hardware in the loop.

Coordinate System

Measurement angles are referenced to the pilot’s position. They represent the angular direction to the transmitted signal with respect to the airframe. Two types of cuts are taken around the airframe with respect to this coordinate system. Conic cuts are taken by varying the azimuth angle around the airframe’s yaw axis. Elevation cuts are taken vertically around an axis lying in the plane of the pitch and roll axis.

Data

All antenna pattern data is provided on CD in a standard ASCII format which is easily imported and viewed by common software applications (i.e., Matlab, Excel, Linux suite of Open Office Tools). The data is separated and categorized according to the measurement parameters. The CD contains a directory structure organizing the data in a convenient html, ‘browser readable’ format.