

Topic: N163-140

FIRST RF CORPORATION

Curved (Convex) Surface Global Positioning System (GPS) Antenna Design for Submarine Launched Ballistic Missile (SLBM) Trident D5 Flight Test Reentry Bodies

GPS antennas on Navy reentry flight test vehicles provide position and velocity data. The navigation signal is lost for portions of the flight path due to plasma layers. FIRST RF introduction of an improved GPS antenna with greater bandwidth and efficiency provides increased access to the navigation signal. Greater bandwidth provides peak performance in the operating band in the presence of center frequency shifts due to temperature, since the GPS band is still in the wider antenna passband after this shift. Greater efficiency provides higher gain and better link margin. The reduced complexity of this GPS antenna increases the reliability, which leads to higher mission success probability. Since this antenna has already passed environmental testing for the flight profile, the risk for this new GPS antenna is low.

Technology Category Alignment:

Command, Control, Communications, Computers, & Intelligence (C4I)

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SYSCOM: SSP

Contract: N00030-20-C-0205



Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00030-20-C-0205



Tech Talk: <https://youtu.be/EXKsMPy7fHo>

Department of the Navy SBIR/STTR Transition Program

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WHO

SYSCOM: SSP
Sponsoring Program: 0101221N
Joint Warhead Fuze Sustainment
Program: Project 0951
Transition Target: Reentry vehicles
TPOC:
SSP.SBIR@ssp.navy.mil
Other transition opportunities:
Launch vehicles, hypersonic vehicles,
munitions, etc. for NASA, MDA, Air
Force SMC, and private industry.



<https://www.public.navy.mil/subfor/underseawarfaremagazine/issues/arc>
and Image Courtesy of FIRST RF Corporation

WHAT

Operational Need and Improvement: Navy reentry flight test vehicles need the capability to capture GPS data during flight. Currently a flat plate is used in order to mount the antenna and simplify the design. To be more representative of an actual reentry vehicle, which has a rounded surface, using a rounded cover for the GPS antenna in a flight test vehicle is desired.

Specifications Required: The antenna design must accommodate both the L1 and L2 GPS frequencies and must accommodate both the C/A and P(Y) codes. The antenna design will need to handle high temperature, temperature shock, vibration, etc. for the reentry environment.

Technology Developed: FIRST RF has developed a curved surface GPS antenna and array with better performance than legacy options. The new antenna has higher efficiency to obtain greater link margin, and this provides telemetry data over a greater portion of the flight path. The antenna has greater bandwidth to allow for frequency shifts due to the extreme temperatures encountered, while still retaining the full GPS spectrum in the passband of the aperture. Finally, the simple structure and assembly provides increase reliability for greater probably of mission success.

Warfighter Value: This new curved GPS antenna would allow the use of GPS receivers in additional Navy reentry flight test vehicles and could reduce the effort used to recreate a trajectory after flight. The improved reliability enhances the effectiveness of the testing activity, and the performance improvements (bandwidth and gain) provide telemetry data for a longer portion of the flight profile. Since the new curved GPS antenna has reduced mass, there is a benefit to air forms of Navy reentry flight test vehicles.

WHEN

Contract Number: N00030-20-C-0205 Ending on: November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I	N/A	Antenna gain and pattern measurements	4	October 2017
Phase I Update	N/A	Antenna gain and pattern measurements	4	August 2018
Phase II Baseline Program	N/A	Antenna gain and pattern measurements	5	November 2021

HOW

Projected Business Model: FIRST RF is a product oriented company developing advanced technologies for antennas and Radio Frequency (RF) systems including communications, radar, phased arrays, Point Navigation and Timing (PNT), RF compatibility, low observable antennas, Electronic Warfare (EW), and Direction Finding (DF) systems. FIRST RF will produce GPS antennas in an array configuration for integration into Navy reentry flight test vehicles. The integration will be through a prime or directly with the government.

Company Objectives: FIRST RF is a key developer of high temperature antennas for high speed platforms. This GPS antenna fits with FIRST RF Corporation's desire to support antennas for the rugged environments of Navy reentry flight test vehicles. The goal of this project is to produce, test, and deliver GPS antennas for conformal use on Navy reentry flight test vehicles.

Potential Commercial Applications: Commercial launch vehicles need GPS antennas to monitor position during launch. The harsh environments experienced during both launch and recovery make these high-temperature antennas useful.