National Aeronautics and Space Administration

Space Technology Mission Directorate

Game Changing Development Program

ATLAS LINKS Electronically Steered Aperture Array System

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Description and goal of project/task

- NASA GSFC and ATLAS Space Operations, Inc. are collaborating through the Space Technology Announcement of Collaborative Opportunity (NASA solicitation NNH17ZOA001K) to advance the state of technology of ATLAS LINKS electronically steered aperture array system.
- ATLAS LINKS system is a state-of-the-art lightweight, high-performance electronically steered aperture array system. This collaboration provides the opportunity to explore the value of ATLAS technology in supporting NASA Near Earth missions.

Technical Approach

Develop and Implement Improved RF Processing Algorithms:

- Review theory and operation of existing system.
- Plan algorithm improvements using deep packet knowledge of relevant missions.
- Implement algorithm improvements.

Develop Test Cases

- Identify relevant test cases for S-band reception, including predicted performance.
- Identify relevant test cases for X-band reception, including predicted performance.
- Identify relevant test cases for S-band transmission, including predicted performance.

System Assembly and Integration

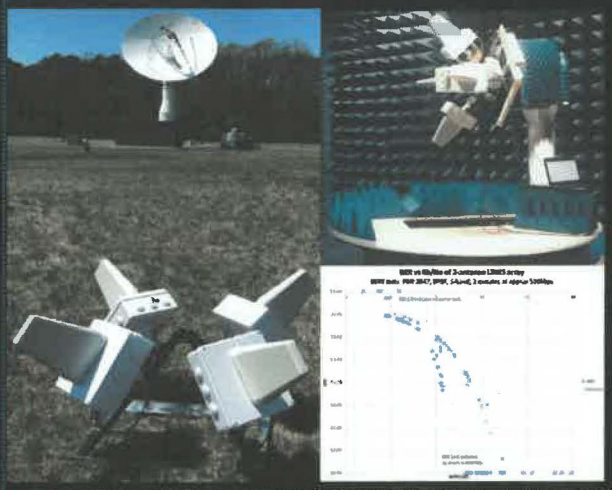
- Develop bill of materials for S/X band array.
- Perform functional checkout of array subcomponents prior to integration.
- Build General Processing Units (GPUs) and perform functional checkout with ATLAS Freedom.
- Integrate Antenna Elements, GPUs, and ATLAS Freedom and perform end-to-end functional checkout.

Complete System Performance Testing

- Execute S-band reception experiments.
- Decode received S-band RF signals and check against predicted performance.
- Decode received X-band RF signals and check against predicted performance.

Addressing NASA Needs

- This technology addresses emerging demands of Near Earth Network (NEN) missions.
- This technology may offer reliable communication links with multiple signals simultaneously in heterogeneous frequencies. An array of receivers, each with multiple antennas, can receive signals from multiple spacecrafts including constellations across the entire sky without requiring moving parts.



ATLAS System and Bit Error Rate (BER) vs Eb/N0 (The energy per bit to noise power spectral density ratio) Curve. Pictures are depicted with vendor concurrence

Accomplishments and Test Results

- Defined Ground System requirements for ATLAS LINKS system compatibility with NASA NEN.
- Provided RF performance requirements for ATLAS LINKS link budget analysis of representative NEN missions.
- Developed S-band test plan, test objectives, test cases and acceptance criteria for demonstration of ATLAS LINKS system.
- Successfully completed first phase of NEN compatibility test.
- Performed S- and X-band Antenna Gain measurements at the GSFC Anechoic chamber.
- Conducted 4-channel S-band BER measurements.
- Successfully downlinked shadow pass signals from representative missions.

Summary

- ATLAS LINKS and NASA successfully completed the first phase of NEN compatibility test, S- and X-band gain measurements, S-band BER test and downlinked signals from representative missions.
- Testing of ATLAS LINKS electronically steered aperture array system is still in progress.
- After Completion of desired tests, NASA and ATLAS will summarize the system performance, current feasibility for space missions, recommended improvements, and likely future feasibility for supporting NASA and commercial missions.

Future Work

- NASA and ATLAS will perform a trade study to select a testing methodology for the X-band reception.
- Execute X-band reception experiments.
- Decode received X-band RF signals and check against predicted performance.
- Design, test and develop S-band transmit system.
- Complete final test report and prototype system.
- Complete final S- and X-band ground system development.