NASA SBIR/STTR Technologies

Proposal No. -Reconfigurable Radar Transceiver design using Direct Digital Synthesis

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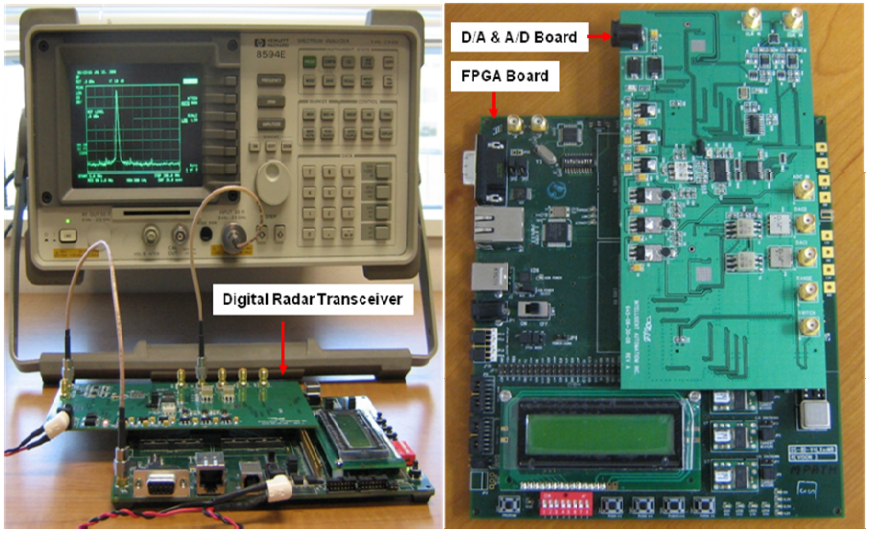
Identification and Significance of Innovation

- High update rate software configurable Direct Digital Synthesizer (DDS) design. The state-of-the-art DDS ICs can operate at 1 GHz update rates. IAI proposes to achieve the same or higher update rates, with increased flexibility (in frequency and phase tuning) which arises from the software defined nature of the DDS implementation.
- High-sampling rate (400 MHz and above), multi-channel digital receiver design. On-board signal processing capabilities will be integrated in the receiver design.
- Digital implementation of direct RF generation techniques for L-Band frequencies. Flexible and scalable analog up-conversion techniques would be implemented to generate frequencies in the S-Band, X-Band, going up to the Ku band frequencies.
- Scalable and modular hardware architecture to support multiple radar missions. Such a design approach would also address the issue of portability between different reconfigurable logic device families/ vendors.
- Technology transition to adapt the radar design to meet space qualified standards.

Expected TRL Range at the end of Contract (1-9): 6



Technical Objectives and Work Plan

Objective 1: Design a reconfigurable, multi-channel digital radar transceiver. Initial design would focus on COTS component acquisition and integration. Emphasis would be given to evolve this design to meet space qualified hardware standards.
Objective 2: Implement waveform generating firmware, supporting multiple radar operating modes. Techniques to reconfigure the digital radar hardware via standard user interfaces (Ethernet, USB or RS232) would be tested. The focus will be to enable the end-user to specify waveform parameters and configure the radar using a user-interface running on a PC.
Objective 3: Integrate commonly used radar-receiver signal processing architectures as a part of the embedded firmware. The objective here is to maximize on-board processing capabilities, which simplifies the data-link implementation and data handling for space based applications.
Objective 4: To implement flexible and scalable RF generation techniques (mainly at L band and S band), using analog up-conversion. Direct Digital RF waveform generation techniques would also be considered, which would significantly reduce analog front-end components.
Objective 5: Use the reconfigurable radar test-bed to perform laboratory based testing. Scenarios of interest to NASA Goddard will be emulated and tested to verify correct functionality of the radar transceiver.

NASA and Non-NASA Applications

NASA applications

1. High bandwidth channel sounders
2. Weather surveillance radar for aircrafts
3. Earth science measurements like surface deformation, topography and soil moisture measurements
4. Space based radar missions
5. Non-cooperative target tracking radar in air space

Non- NASA commercial applications

1. Reconfigurable radar for commercial applications
2. Cognitive Radios/ Radar for Defense related applications
3. High bandwidth arbitrary waveform generator
4. UAV based applications (due to the small form factor and plow power). This would

include UAV based radar applications

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NON-PROPRIETARY DATA