Testbed for Development of a DSP-Based Signal Processing Subsystem for an Earth-Orbiting Radar Scatterometer

Douglas Clark, Mike Shirbacheh, and others??

A testbed for evaluation of general-purpose digital signal processors in earth-orbiting radar scatterometers is discussed. Because general purpose DSP represents a departure from previous radar signal processing techniques used on scatterometers, there was a need to demonstrate key elements of the system to verify feasibility for potential future scatterometer instruments. Construction of the testbed also facilitated identification of an appropriate software development environment and the skills mix necessary to perform the work.

A testbed was constructed with three Astrium MCMDSPs, based on the Temic TSC 21020 general purpose DSP. Commercial data conversion hardware and high-speed serial communication hardware was interfaced to the MCMDSPs to allow demonstration of the key interfaces between subsystem elements: DSP program loading, synchronization and communication between multiple DSPs, interface to the scatterometer radio frequency subsystem, commanding, and science data delivery to the instrument data handling subsystem.

A baseline set of requirements for the radar signal processing subsystem was established. From these requirements, signal processing algorithms such as digital filters and FFTs were developed using a combination of standard library functions and custom code. A software framework was developed to coordinate execution of the periodic signal acquisition and processing routines with asynchronous and subsynchronous commanding and timekeeping functions. Emphasis was placed on developing modular code that would be applicable to a number of potential future instruments.

Performance of the DSP subsystem was evaluated in terms of measured vs. theoretical execution speed, timing accuracy, power consumption, and computational accuracy.