PART 7. SENSOR WEB/TESTBED INITIATIVES

2. SENSOR WEB

The concept for Sensor Web is to link together ground and space-based instruments to enable autonomous collaborative observation collections. These observations can be triggered via a variety of sources. Typically, scientific events of interest trigger observation campaigns in an ad hoc sensor constellation and supply multiple data acquisitions as rapidly as possible and in as much depth as possible in a given time period. This is accomplished through a seamless set of software and communications interactions in a system of linked sensors.

Many geophysical phenomena are dynamic and coupled. In order to fully understand them, we need to monitor them and obtain timely coordinated multi-sensor observations from widely dispersed instruments. The need for dynamic coordinated multi-sensor observations has given rise to the concept of Sensor Webs, which characterize future observing systems concepts more capable than today's independent observing systems. Sensor Webs will monitor the intrinsically dynamic behavior of a wide variety of naturally occurring (e.g., wild fires, flash floods, hurricanes, volcanoes) and human-induced (e.g., toxic spills, pollution) events and phenomena. A sensor web approach offers the ability to trigger the imaging of these transient events via in-situ sensors and global-coverage, lower-resolution, on-orbit assets to capture higher temporal, spatial and spectral resolution images.

The tools being developed improve our ability to autonomously monitor multiple independent sensors and coordinate reactions to better observe the dynamic phenomena. These systems enable users to specify events of interest and how to react when an event is detected. The systems monitor streams of data to identify occurrences of the key events previously specified by the scientist/user. When an event occurs, the system autonomously coordinates the execution of the user-desired reactions between different sensors. The information can be used to rapidly respond to a variety of fast temporal events without human intervention.

The key elements of the Sensor Web include autonomous detection of events, autonomous monitoring of detection notifications, autonomous generation of observation requests, and autonomous rescheduling of observations to acquire data of higher temporal, spatial, and spectral resolution. The Sensor Web software consists of three primary components that work in concert to recognize science events, generate prioritized observation requests, and insert observations into the EO-1 mission operations schedule. Science Agents interpret sensor data to extract science phenomena of interest and generate corresponding Science Alerts. The Science Event Manager (SEM) collects Science Alerts, matches them to predefined observation campaigns, and issues prioritized observation requests. The Automated Scheduling and Planning Environment (ASPEN) planning system inserts these observation requests into the EO-1 mission operations schedule. The Sensor Web builds on the successful demonstration of automated mission operations using the Autonomous Sciencecraft Experiment (ASE) software system developed by JPL.

Documentation of efforts to create an above described autonomous Sensor Web system, using EO-1 as a testbed, can be obtained from the links contained in the Table of Contents for Part 7, Section 2.