

# Sensor Web Position Paper

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We, along with ESTO [1], view a sensor web as potentially one part of a **cognitive web**, a collection of resources for understanding Earth processes that as a whole is able to display adaptive, goal-directed behavior. In our view, a cognitive web includes, in addition to a collection of observing systems, the set of data repositories and tools used to generate data products, as well as a collection of models that provide the goals of observation.

To be a cognitive web, a representation of current observation goals and the tasks being performing to accomplish these goals is required. There must be a means to recognize when changes to the sensing environment threaten to thwart the accomplishment of those goals. A cognitive web must be self-adapting to changes in its own configuration, e.g., by adding or removing nodes. It must be able to recognize opportunities for modifying its data acquisition plans in order to improve overall performance. It must act as a coordinator of resources, an optimizer of tasks, and a broker for data products [2]. Whether the overall web goal is, for example, to characterize the physical and chemical properties of a storm water runoff plume or to characterize the microclimates associated with high yield crops [1], there should be mechanisms for continuously transforming the results of measurements or predictions from models into new tasks for remote sensors on UAV or space platforms, or to vary the frequency with which samples from in situ sensors are taken.

Enabling a cognitive web involves three main capabilities: **goal-generation**, the formulation of Earth science investigation goals from forecast models or as the result of previous observations; **observation planning**, the transformation of the goals into cognitive web actions to accomplish them; and **cognitive-web reconfiguration** that executes the plans. The figure below shows the components of a cognitive web (as a “web of webs”), and a collection of systems (whether fully or partially automated) that collectively enable the coordination of activities of the different webs into a cognitive web. We use the term **model-based observation** to refer to the process of planning observations based directly on goals (such as validation or monitoring goals) generated from Earth science models. A similar notion is found in NASA planning documents [3].

## References

- [1] A Notional Sensor Web Concept. PDF File. <http://esto.nasa.gov/AIST-ROSES>
- [2] IS Technologies for a Hazard Monitoring and Mitigation System Using Sensor Webs. PDF file. <http://esto.nasa.gov/AIST-ROSES>.
- [3] National Aeronautics and Space Administration (2005) Draft Earth Science Research Plan, January 2005.

