NASA GODDARD SPACE FLIGHT CENTER

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"ADAPTIVE SENSOR FLEET (ASF)"

Developed at NASA Goddard Space Flight Center, the *R&D 100 Award*–winning Adaptive Sensor Fleet (ASF) is a software architecture that enables remote-controlled platforms (such as boats, aircraft, rovers, and satellites) to work collaboratively in support of a single scientific goal. ASF functions as a control system, supervising and autonomously sending commands and tasks to such platforms. The system offers extreme versatility in a variety of science goals and is ideal for oceanographic and planetary research; search-and-rescue operations; and military, mining, and security missions.

ASF had its origins in collaboration between NASA and the National Oceanic and Atmospheric Administration (NOAA) to replace the drifting buoys that were used to conduct measurements in low-atmosphere and oceanographic studies. The goal was to be able to perform more studies through the intelligent control of multiple craft. Used in the Ocean Atmosphere Sensor Integration System (OASIS), ASF provided an economical and practical solution by replacing the buoys with a fleet of remote-controlled boats. ASF gave the boats commands to conduct various studies. Then, as the instrumentation degraded under harsh ocean conditions, ASF commanded the boats to return for refurbishment. The resulting OASIS boats allowed scientists to map ocean phenomena that could not be observed through currently available remote sensing technologies. The boats monitored and controlled by ASF generated significant cost savings for NOAA and NASA, especially in the areas of data calibration and validating the data collected by remote sensing satellites.

ASF is being offered free of charge to organizations collaborating with NASA through a Software Usage Agreement (SUA). For example, ASF is being used in a collaboration with Carnegie Mellon University (CMU), funded by a 3-year NASA Earth Science Technology Office (ESTO) grant to study toxic algae blooms in the Chesapeake Bay estuary. For this project, ASF is being combined with other NASA remote-control technologies as well as with innovative techniques for "telesupervision" from CMU's Robotics Institute. Not only is this effort creating a useful tool for monitoring the environment, but also the advancements in the new system's technology readiness level (TRL) can benefit NASA's Exploration Systems Mission Directorate. NASA could eventually use the system developed under the CMU, NASA partnership for lunar, orbital, or planetary construction and inspection; lunar and planetary in situ resource utilization; and prospecting, mining, transport, and construction. Several commercial and public-benefit applications for the system also exist.