

"Sensor Web Evolution - Webs of Webs for NASA Science - Focus on small Uninhabited Aerial Systems (sUAS)"

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Abstract:

This paper will describe the evolution of information collection, derivation and delivery mechanisms in webs of NASA sensor webs, with a focus on recent advancements in small Uninhabited Aerial Systems (sUAS).

I will discuss the movement to "Fog Computing", also known as Edge Computing. Fog Computing facilitates the distribution of common operations and networking between edge devices and cloud computing facilities, optimizing the production of actionable intelligence.

Initially, sUASs utilized onboard data collection as standard, with minimal data downloaded directly. Information products were derived in conventional computational environments, generally desk top computers, and information products made available to the Science Community in weeks or months. With the increased availability, and increasingly lower costs, of beyond line of sight (BLOS) satellite based communication, transmission rates and data volumes increased, and processing migrated to Cloud based services. Contemporary sUASs are moving some of that information product derivation to on vehicle services, and are creating a distributed Cloud/Fog environment.

I will describe the technological advances that have made this possible, including low power multi-core Central Processing Units (CPU), and, more recently, the availability of high end Graphical Processing Units (GPU) that consume only a few watts. Intelligent system software, leveraging these hardware advances, finally allows for information product generation on-board, rather than simple data collection. Additionally, intelligent flight control systems now support mutual vehicle to vehicle collaboration, allowing sUASs to create ad-hoc sensor webs on demand, as required.

Also discussed will be the lessons learned by the Authors' development of data systems for NASA's large High Altitude Long Endurance (HALE) UASs like Predator and Global Hawk, and how those lessons are being applied to sUAS development.

This paper will focus on application, rather a deep dive into the technology, and will highlight improving data management through these new technologies.