The Waypoint Planning Tool: Real Time Flight Planning for Airborne Science

Yuhin He, Richard Blakeslee, Michael Goodman, John Hall

University of Alabama in Huntsville, NASA Marshall Space Flight Center

ABSTRACT
Airborne real-time observations are a major component of NASA’s Earth Science research and satellite ground validation studies. For mission scientists planning a research airborne mission, the context of meeting navigation objectives is somewhat limited because they are often unaware of the weather conditions that affect the aircraft. Multiple aircraft are often involved in the NASA field campaigns. The coordination of the aircraft with satellite overpasses, other airplanes, and the constantly changing dynamic weather conditions often determine the success of the campaign. A flight planning tool is needed to provide situational awareness information to the mission scientist and help them plan and modify the flight plan successfully.

Scientists at the University of Alabama Huntsville and the NASA Marshall Space Flight Center developed the Waypoint Planning Tool (WPT), an interactive software tool that enables scientists to develop their own flight plans (also known as waypoints) with point-and-click mouse capabilities on a digital map (also with real-time radar and vector data). The development of the Waypoint Planning Tool demonstrates the significance of mission support in responding to the challenges presented by multiple airborne and satellite campaigns. The software helps identify flight boundaries, pre-defined waypoints, and real-time weather parameters, providing the scientist with the tools to develop and analyze the flight plan.

The development of this waypoint tool is directly affected by the technology advances on GIS Mapping technologies. From the standalone Google Earth applications and simple KML functionalities to the Google Earth plug-in and Java Web Start/Topics on web platforms, to the more open-source GIS tool with new, advanced frameworks, the Waypoint Planning Tool has taken its place in technology advancement. The newly developed, cross-platform, modular-designed JavaScript/Lightning Tool is planned to be integrated with the NASA Airborne Science Mission Tool Suite. Adapting new technologies for the Waypoint Planning Tool ensures its success in helping scientists reach their mission objectives.

This presentation will discuss the development process of the Waypoint Planning Tool in responding to field campaign challenges, identify new information technologies, and describe the capabilities and features of the Waypoint Planning Tool with the main aspect, its interface, the name, and the resultant benefits to the airborne science community.

During the 1990s and early 2000s, mission scientists could use an Excel spreadsheet to follow the flight path parameters for aircraft flights. The Google Earth plug-in tools were limited, and scientists would take their own maps and plot the coordinates in Excel to calculate the flight distance and determine the flight path. However, this method was cumbersome and did not provide a real-time view of the flight path.

In 2004, the National Aeronautics and Space Administration (NASA) published its Satellite Data on the World Wide Web (SDDWWW) mission, which became the foundation for the current development of the Waypoint Planning Tool. The tool uses JavaScript/Lightning technology to provide a user-friendly interface for mission scientists to plan and manage real-time flight plans.

As the web technologies advance, the development of advanced web applications that work in a web-based environment and navigation services have been developed. The open-source tool, OpenLayers WMTS, includes several layers that can be integrated with WMTS and other web applications, as well as the browser-based Client Management Systems.

SUMMARY
Waypoint Planning Tool provides a convenient way to create and update flight plans using a point-and-click mouse interface. It includes the coordination among multiple aircraft during pre-flight planning and real-time data to help mission planners take informed decisions.

- Flight data are used to help mission planners make informed decisions
- Features such as aerosol, soil, and river
- Enables multiple vehicle operations and can create multi-formatted output as requested
- Output formats include KML for visualization and FalconView, a navigation tool widely used by NASA
- Used in several multi-agency field campaigns and flight planning

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Author Contact:
Yuhin He
The University of Alabama in Huntsville

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