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 spacecraft objectives is accomplished because they are now fully informed on the weather conditions that affect the aircraft. Multiple aircraft are often involved in the NSF/FAA field campaigns. The coordination of the aircraft with satellite overpasses, other aircraft, 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 scientists and help them plan and modify the flight trajectory to success.

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 (flight) with real time radar and vector data. The development of the Waypoint Planning Tool demonstrates the importance of mission support in responding to the challenges presented during NASA field campaigns. The software planning and design teams helped identify major improvements needed in the flight planning, including elements of development. Finally, the Waypoint Planning Tool has gone through three rounds of development and analysis process.

The development of this way point tool is directly affected by the technology advances on GIS/Maping technologies. From the standalone Google Earth application and simple KML functions to the Google Earth Program and Java web applications on web platform, as well as to the open source GIS tools with new JavaScript frameworks, the Waypoint Planning Tool has passed in its phase of technology advancements. The newly created, cross-platform, modular designed JavaScript controlled Waypoint Tool is planned to be integrated with the NASA Airborne Science Mission Tool Suite. Adapting new technologies for the Waypoint Planning Tool moves it closer to 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 key new information technologies and describe the capabilities and features of the Waypoint Planning Tool with the main aspect of testing the program and the resultant benefit to the science community.

motivations
- Mission scientists and flight crews require well-developed flight plans
  - Indicate way point location and timing, flight pattern over target area
  - Flight vector, etc.
  - Enhanced coordination between aircraft during planning
  - Change ability to input coordinates and changes
  - User-friendly interface to ease flight planning
  - Displays in-flight based application in the viewing
  - Additional level to KML Application to this data
  - No key tool available and make Mission Scientists:
    - Acceptance integration tool development and not suitable for mission planning
  - Other planning tools added to Excel type functions rather than point-and-click to create flight plan

CAPABILITIES
- Easily creates, updates and publish flight waypoints
- Provides situational awareness, data in real time satellite images, weather tracking, threat assessment, etc.
  - Have flight coordination between multiple aircraft and flight plan users.
  - Integrates with pre-determined aircraft flight path for real-time mission coordination
  - Traditional awareness tool
  - Multi user support and more cross-platform integration

CAUTIONS
- Javascript environment is only suitable for adding some features
  - JavaScipt-based web application’s development
  - Above meeting updating in real-time flight plans at the same time realtime application

As the web technology advances, the client side web-based map applications that work in a multi-user environment becomes an increasing trend. The Waypoint Planning Tool is developed by using client-side JavaScript framework and OpenLayers Map API. With both in key management and map projection capabilities, this client side tool can be tightly integrated with KML and other web applications, as well as web-based Central Management Systems.

SUMMARY
Waypoint Planning Tool provides a convenient way to create and update flight plans using a point-and-click mouse interface.
- Assist in the coordination among multiple aircraft during pre-flight planning
- Real-time data are used to help in mission planning to make informed decisions
- Fits the need of various users, including Mission Scientists, Mission Managers, Pilot, and others
- Permits multiple waypoint layout and formats and can create multi formatted output as required. Output formats include KML for visualization and Focal View, a navigation tool widely used by pilots.
- Used in several multi-agency field campaigns for flight planning

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- The Waypoint Planning Tool is a part of the Real-Time Mission Monitor whose support is provided by NASA’s Mission Operations and Earth Science Technology Office (MOT) and the Mission Operations and Earth Science Technology Office (MOT).
- The Waypoint Planning Tool is optimized for the desktop version of the Firefox or Internet Explorer web browsers.

Author Contact:
Yuhin He
yhe@UAH.edu

More Information
For more information, please visit: http://www.uah.edu/comp/aj/pwp/ for contact details.