AVOIDING DANGEROUS WEATHER ON

LONG OCEANIC FLIGHTS

An Intelligent System

Flight crews, for the first time, can now anticipate hazardous storms while navigating long-range, oceanic routes. Knowing a 40,000-foot convective storm is ahead allows flight crews to reroute its flight path, saving on fuel costs, manpower, and injuries to the passengers and crew. NCAR scientists and engineers have developed in-flight diagnostic products that augment the tools pilots use in transoceanic route planning.

GLOBAL CONVECTIVE WEATHER HAZARDS

Long, oceanic flights have historically had limited access to detailed weather information. While over-land flights have access to ground-based radar networks for information on storms, that same information has been unavailable to pilots on transoceanic flights. Inflight displays of products depicting convective hazards are needed by pilots of transoceanic aircraft to assist with strategic route planning during long flights of up to 17 hours.

DISTILLING A MOUNTAIN OF DATA

The Remote Oceanic Meteorology Information Operational (ROMIO) Demonstration is a project sponsored by the FAA's Weather Technology in the Cockpit (WTIC) program. It is focused on analyzing oceanic aviation inefficiencies in current or future NextGen operations caused by gaps in either the available meteorological information or in the technology utilized in the cockpit. Using an

Benefits & Impacts

- Pilots can reference products up to 50,000 feet
- Pilots get inflight displays depicting convective hazards for supplemental use
- Pilots can plan strategic avoidance maneuvers

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operational demonstration to uplink convective weather products into the cockpit of domestic airlines, this effort helps to identify and analyze operational gaps.

In 2018, the WTIC ROMIO team began the operational demonstration with Delta Air Lines, United Airlines, and American Airlines. Following the ROMIO Operational Plan, all aspects of the demonstrations were carefully planned and included the availability and ingest of meteorological data sets, the creation of weather products, their dissemination to the aircraft and their display.

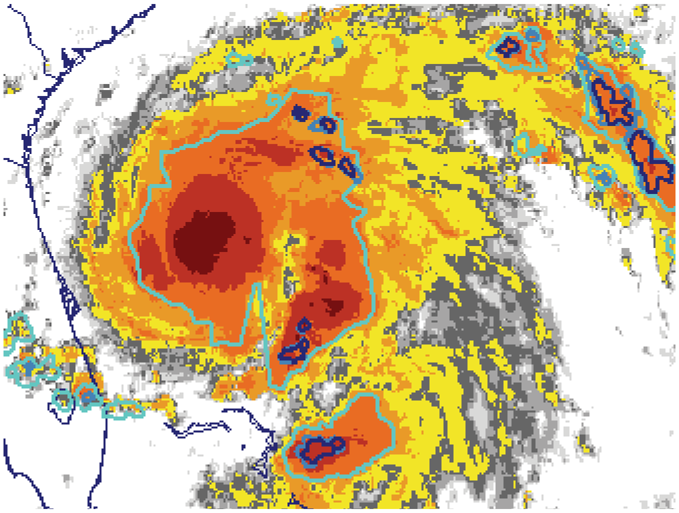
DECISION SUPPORT SYSTEM

Geostationary satellites provide critical data used by the two products: the Cloud Top Height (CTH) and the Convection Diagnosis Oceanic (CDO). The CTH matches the satellite brightness temperature to an atmospheric temperature and then to the pressure level from a Global Forecast System model sounding to estimate the height of the cloud top. Particular CTH contours between 30,000-50,000 feet are selected for their relevance to aircraft flying transoceanic routes.

The CDO product defines hazardous regions by combining several satellite-based algorithms with geostationary and global lightning data. These inputs are scaled, weighted, and combined in a data fusion methodology with gridded output which defines the likelihood of a convective hazard. While the CTH product defines the entire storm structure, including the anvil, the CDO product illuminates the location of the updrafts where the convective hazards reside. For uplink, polygons of each product are created to reduce communications bandwidth.

Training the flight crews on the capabilities and limitations of the products, understanding how pilot decision-making is facilitated with the convective products, and soliciting flight crew feedback were completed. A similar effort has been completed for dispatchers at the Airline Operations Centers and air traffic controllers at three Air Route Traffic Control Centers.

Development of the ROMIO Viewer was completed by Basic Commerce & Industries, Inc. (BCI) and includes the ability for pilots, dispatchers and air traffic controllers to provide feedback after the end of a flight or during a shift. Virginia Polytechnic



Cloud Top Height and the Convection Diagnosis Oceanic Products

Institute and State University is collecting and analyzing the feedback to understand how the products filled existing gaps in meteorological information or in the technology utilized in the cockpit and how the products may change decision making by all parties.

The Global Weather Hazard (GWH) project began in 2015 with a partnership between Lufthansa Airlines, BCI, NCAR and the Weather Solutions Division of the Sutron Corporation. This project is a commercial effort that has expanded coverage to a global domain with latitude limits of -50S to 70N. The convection products are up-linked into the flight deck and subsequently displayed on an electronic flight bag application called the eRoute Manual that was developed by Lufthansa Integrated Dispatch Operation.

SUPPORTING NEXTGEN

On the home front, NCAR has been a leader in supporting the FAA NextGen, the national priority of meeting the growing air transportation needs of the future. Demand for air traffic services is expected to rocket, possibly on the order of three times today's demand levels. Because weather conditions can seriously restrict aircraft operations, how this information is observed, forecast, disseminated, and used in decision-making is of critical importance. The products developed by the NCAR Aviation Applications Program have been designed to fulfill the needs of the transoceanic aviation community.

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