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Workshop Addresses Aviation Community

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Delta Airlines had an unprecedented experience in 2011: For the first time, one of its flights was rerouted because of space weather activity. Flight 189 from Detroit, Mich., to Beijing, China, had to reroute due to solar activity that occurred 24–28 September 2011. Over the last decade most airlines that fly routes across the North Pole region have had diversions as a result of solar activity. As cross-polar air traffic increases, standing at 10,993 one-way crossings in 2011, the aviation industry is becoming more aware of the impacts that space weather can have on operations, communications, and navigation, as well as the issue of increased radiation exposure for passengers and flight crew on board.

With the aim of determining what aviation users need from the space weather community and what service providers can do, a 1-day aviation workshop was held in conjunction with NOAA's Space Weather Workshop. The 23 April workshop brought together aviation industry representatives including pilots, dispatchers, union representatives, and regulators, as well as space weather forecasters and scientists from the government, academic, and private sectors. The workshop was organized into three sessions: (1) what aviation users need, (2) what can be done by service providers, and (3) looking ahead. These focused sessions, outlined here, represent the first steps taken toward answering how space weather observations and forecasts can be better integrated into aviation operations.

Needs of Aviation Users

Radiation exposure monitors are not currently required on aircraft anywhere in the world, but several speakers in this session identified the importance of such monitors. To utilize this type of technology to its fullest potential, it is important for everyone in the industry to understand how solar activity relates to the aviation operating environment. Mike Stills of United Airlines suggested that space weather information be communicated to dispatchers in a manner emphasizing applicability, readability, and dispatcher comprehension. Session attendees also agreed that space weather needs to be included in daily weather briefings, but such information cannot be conveyed without the proper education and training.

Genene Fisher from the National Weather Service suggested that education is essential at all levels: dispatchers, air traffic control, pilots, crew and passengers, space tourists, management, etc. This raises two questions: How does each airline educate its employees about space weather, and can the scientific community provide tailored education material for aviation companies? United, American, and Delta Airlines already include space weather in briefings for polar flights.

A suggestion was made that the NOAA Space Weather Prediction Center (SWPC) add a "stoplight" product for aviation (red indicating that the environment is highly disturbed, yellow indicating that the environment is slightly disturbed, and green indicating that no disruptions are expected) and consider including a new H ("high-energy") scale for radiation, based on readings of >100 MeV protons from the Geostationary Operational Environmental Satellite. Also, if a radiation event begins while a plane is airborne, there needs to be a way to alert the pilot and define an ideal flying altitude appropriate to the situation.

Service Providers

The second session worked to formulate operations concepts and aviation needs. These included a forecast for the Global Navigation Satellite System, the ability to better assess radiation exposure, and space weather impacts on high-frequency and very high frequency communications. Christopher Mertens from NASA noted that there is currently a Web interface customized for pilots: the Nowcast of Atmospheric Ionizing Radiation for Aviation Safety model (http://sol.spacenvironment.net/~nairas/), which provides real-time predicted radiation dose rates from physics-based models. It is important that the information provided by the service providers be delivered in a format easily interpreted by the end users, for example, as a simple color-coded map (see Fig-

ure 1).

Looking Ahead

The workshop concluded with a discussion on how to move forward with providing space weather services to the aviation community. A key recommendation was that the space weather community, government, academia, and private industry must provide more actionable and easily understood products allowing for an appropriate response to given solar-terrestrial occurrences. Participants agreed that there must be harmony across all airlines and NextGen and SESAR (envisioned air traffic navigation schemes) in the event of space weather activity. The importance of receiving and supplying consistent information, ignoring media hype, and getting to the facts was stressed, a lesson learned from the April 2010 Icelandic volcanic ash event. Ultimately, broadening NOAA SWPC space weather services and increasing awareness of and education about space weather's implications for Earth will lead to an improved response by airlines, limiting disruptions to aviation operations.

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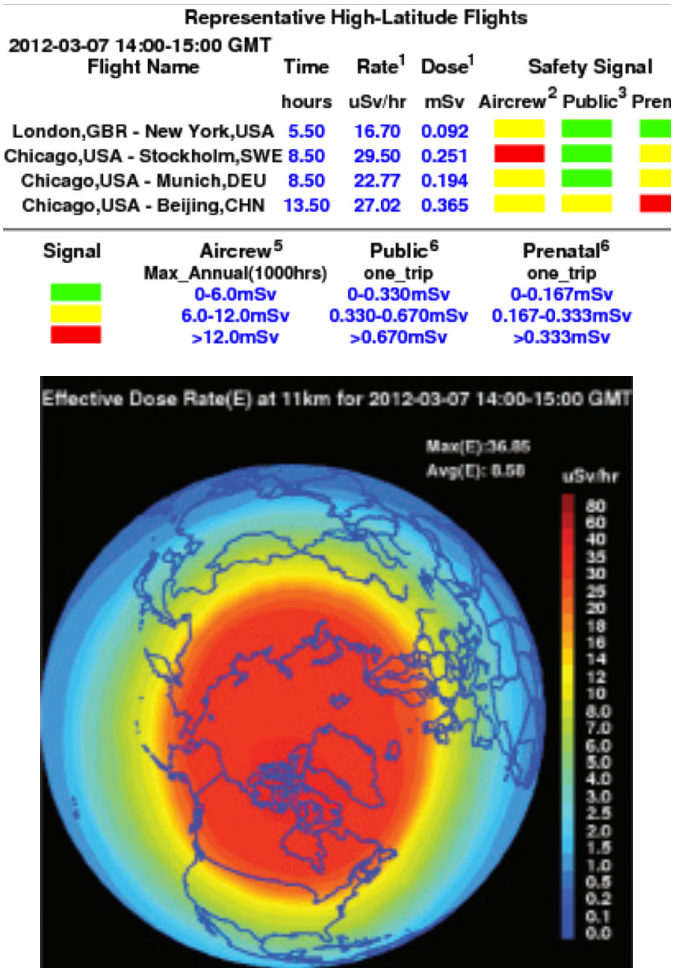

Figure 1. NASA's NAIRAS model predictions during March 2012 solar storm events. Shown is the effective dose rate (E, in microsverdrups per hour) at an altitude of 11 kilometers for 7 March 2012 from 14:00 to 15:00 GMT with the maximum rate of 36.85 and the average rate being 8.58. Credit: Christopher Mertens, NASA.