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American Airlines Grounded by iPad Glitch May 2015

In 2012, American Airlines replaced the 35 pounds of paper navigation charts carried by its pilots with iPads that displayed charts upon request. It was the first airline to do so.



On Tuesday and Wednesday, April 28 and April 29, 2015, dozens of American Airlines flights were grounded or seriously delayed because the pilots were not able to access their navigation charts on their iPads. The problem turned out to be an error in the chart app supplied by Jeppesen, a Boeing company that provides both paper and electronic navigation charts for the flying community.

Though unrelated, this incident has increased the concern of the possibility of hacking into an airliner's avionics and taking control of the airplane through the recent provision of Wi-Fi services to passengers on airlines.

The Conversion from Paper Charts to iPads

Until recently, pilots used paper charts for departure, enroute, and approach navigation as well as for finding their way around airport taxiways. A typical flight bag carried on board by a pilot might include 3,000 pages of charts weighing 35 pounds. The pilot must have not only the charts for his intended route, but he also must have all the charts necessary for any diversion of his flight due to an emergency.



Recently, Jeppesen introduced electronic charts and an app that allowed the charts to be downloaded to an iPad. This had the potential of reducing 35 pounds of paper charts with a light-weight iPad. In addition, charts could be accessed with a couple of clicks rather than having to search through a flight bag loaded with manuals. Furthermore, the iPad charts could be updated daily with a few minutes of download time as compared to hours of manually updating paper charts every two weeks.

iPads rapidly became popular for reference, but they initially were not approved by the FAA (the U.S. Federal Aviation Administration) as a replacement for traditional paper charts.

Driven by the obvious advantages of replacing paper charts with iPads, the FAA tested them thoroughly, including subjecting iPads to rapid decompression and ensuring that they would not interfere with critical navigation or electronic equipment. They also concerned themselves with what would happen if an app crashed, but found that the problem could be corrected in seconds with a simple reboot.



The FAA then tried out the use of iPads in a small regional carrier for a couple of years. This test was successful, and in 2012 the FAA approved the use of iPad charts as a replacement for paper charts.

Jeppesen issued a chart app called FliteDeck, available only to commercial and military operators who subscribed to its services. FliteDeck became the first FAA-approved Aviation Moving Map

American Airlines was the first major commercial carrier to deploy electronic flight bags throughout its fleet and to discontinue paper charts. It replaced 8,000 flight bags weighing 35 pounds with 8,000 iPads. The airline estimated that the switch to iPads saved 400,000 gallons fuel annually, providing an annual saving of USD \$1.2 million at the current fuel prices

American's iPad Glitch

At about 7 PM Pacific Time Tuesday, April 28, 2015, some American Airline pilots found that their iPads crashed when they tried to bring up navigation charts. The problem only occurred if the iPads were running Apple's newest operating system, iOS 8.3. Was it an Apple problem or a Jeppesen problem? Both companies refused to accept responsibility, but American Airlines blamed the Jeppesen app.

Many pilots discovered the glitch only after they had taxied to the runway and were setting up for takeoff, a procedure which included bringing up their departure and enroute plates. They had to taxi back to the gate and await a correction. American Airlines said that 24 flights were delayed in this way on Tuesday and 50 delays occurred on Wednesday. Some delays lasted for several hours.

Some pilots solved the problem by getting paper charts that were available at the airport. Others found that using a Wi-Fi connection at the gate to reboot the app cured the problem. American Airlines announced that "our pilots have been able to address the issue by downloading the app again at the gate prior to take-off and, as a backup, are able to rely on paper charts they can obtain at the airport."

Jeppesen's Response

Jeppesen issued a worldwide NavData notice on April 28 that indicated that the problem was caused by Apple's new operating system and that Jeppesen was waiting for a fix from Apple:

ATTN RE: FliteDeck and iOS 8.3 (Affects both FliteDeck Pro and Jeppesen Mobile FliteDeck)

There is an issue within iOS 8.3 and the compatibility of some bluetooth GPS devices that inhibits the moving map and display of ownship in the FliteDeck application. A current workaround for wifi+cellular devices is to rely on the internal GPS capability of the device. For those iPads that are wifi only and have updated to iOS 8.3 the present resolution is to wait for Apple to patch the current version of iOS. We do not have an estimated fix time from Apple but expect that a patch will be pending shortly.



The Problem Is Found

Unfortunately for Jeppesen, American Airlines found the problem the next day on Wednesday, April 29th. The issue was, in fact, caused by a Jeppesen error. A duplicate chart for Reagan National Airport had been included in American Airlines' chart database. The Jeppesen app could not reconcile the duplicate chart, causing it to shut down.

The problem was cured by uninstalling and reinstalling the app. Until the Jeppesen chart database was corrected, American Airline pilots flying into or out of Reagan had to use paper charts rather than the app.

Potential of Hacking Airline Avionics

Though not directly related, the GAO (U.S. Government Accountability Office) had issued a report just a week earlier warning that “unsecured connections between the passenger Wi-Fi networks and the avionics systems on some Boeing and Airbus planes could make it possible for a hacker to gain access to navigational controls and commandeer the plane.” The GAO noted that onboard firewalls intended to protect avionics from hackers could be breached if flight control and entertainment systems used the same wiring and routers.

The report was in response to a pair of security experts’ admission that they had connected to the network ports beneath their seats on more than a dozen flights to sniff traffic and uncover vulnerabilities.

The FAA has concurred with this concern and is working with the U.S. National Security Agency (NSA) to identify needed changes. These organizations have issued an alert that describes the signs that flight crews should be looking for:

- Report any suspicious activity involving travelers connecting unknown cables or wires to the IFE (in-flight entertainment) system or unusual parts of the airplane seat.
- Report any evidence of suspicious behavior following a flight, such as IFE systems that show evidence of tampering or the forced removal of covers to network connection ports.
- Report any evidence of suspicious behavior concerning aviation wireless signals, including social media messages with threatening references to Onboard Network Systems, ADS-B, ACARS, and Air Traffic Control networks.
- Review network logs from aircraft to ensure any suspicious activity, such as network scanning or intrusion attempts, is captured for further analysis.

Our Personal Experience

Both my wife and I are general aviation pilots. In fact, Janice is a flight instructor. We use flight charts on our iPads. Rather than the Jeppesen charts (which are quite expensive), we instead use charts from ForeFlight. They are wonderful moving map displays, showing our position via GPS on departure, enroute, approach, and taxiway charts. They provide both VFR charts (Visual Flight Rules charts for good weather) and IFR charts (Instrument Flight Rules charts for bad weather).

However, our experience has led us to the conclusion to always have paper charts with us (yes, our flight bag is pretty heavy). One challenge is glare. Light coming into our cockpit often makes the screens unreadable unless we block the light with our hands. Even glare shields don’t help. Flying a complex instrument approach into an airport is no time to have to lose the use of a hand or to have to continually squint at a glared screen.

Another surprising problem is that our iPads have a tendency to overheat with the sun beating on them through the cockpit windows. When they do, they shut down. Without paper charts as a backup, we then would be without navigational information.

In large airliners, the iPads can be positioned to avoid these problems. However, iPads without paper backup may never be used successfully in general aviation.

Summary

The Internet of Things (IoT) is rapidly growing to integrate all of the devices in our lives. As American Airlines' experience has shown, this can lead to problems due to software errors introduced by humans. The American Airline's challenge was resolved with nothing more than a serious inconvenience to many of its passengers, but it could have resulted in a life-threatening situation.

Adding to the concern of software errors is the ability to hack systems. The GAO's alert that airline flight control systems could be taken over by hackers via the in-flight Wi-Fi entertainment system exposes a serious threat posed by IoT.

Acknowledgements

Material for this article was taken from the following sources:

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