NATIONAL TRANSPORTATION SAFETY BOARD

An independent federal agency

The Honorable Christopher A. Hart
Acting Chairman
On Behalf of the
National Transportation Safety Board

Before the

Subcommittee on Transportation and Public Assets
Committee on Oversight and Government Reform
United States House of Representatives

Hearing on

Preventing Another MH370: Setting International Standards for Airline Flight Tracking

Washington, DC
February 25, 2015

Chairman Mica, Ranking Member Duckworth, and Members of the Subcommittee, thank you for inviting the National Transportation Safety Board (NTSB) to testify before you today.

The NTSB is an independent Federal agency charged by Congress with investigating every civil aviation accident and significant incidents in the United States and significant accidents and incidents in other modes of transportation – railroad, highway, marine and pipeline. The NTSB determines the probable cause of accidents and other transportation events and issues safety recommendations aimed at preventing future accidents. In addition, the NTSB carries out special studies concerning transportation safety and coordinates the resources of the Federal Government and other organizations to provide assistance to victims and their family members impacted by major transportation disasters.

Today, I would like to summarize for the Subcommittee the paramount role played by recorders in determining the cause of an aviation accident or incident; information the NTSB obtained in a forum we hosted in October 2014 on Emerging Flight Data and Locator Technology; and the series of recommendations we issued last month to the Federal Aviation Administration (FAA) calling for improvements in locating downed aircraft and ways to obtain critical flight data faster and without the need for immediate underwater retrieval.

The Role of Flight Data Recorders and Cockpit Voice Recorders in Aviation Safety

The NTSB depends on flight data recorders (FDRs) and cockpit voice recorders (CVRs) to help determine the causes of accidents and incidents in aviation. Because of their value in investigations, rapid location and recovery of these recorders, and access to the vital information they contain, are among our highest priorities. Flight recorders were first created specifically to capture information about a flight that would assist after a crash and were designed to survive the catastrophic conditions that a crash can entail. Their introduction has been a boon to aviation safety. In many cases recorders are the most significant source of useful information about an accident, and in some cases, they are the only source of information. In addition, the required underwater locator beacons have guided searchers to submerged recorders by their signal, or "ping," when submerged in water. Once activated by submersion in water, the device's batteries can power this signal continuously for at least 30 days. In some newer models, the batteries can power the signal for at least 90 days.

Recorders have ensured the survival of accident data under the harshest conditions. In many cases, they have yielded useful data despite the traumatic forces of accident sequences and despite subsequent immersion in water or being engulfed in fire. The data that recorders preserve have shed light on accident circumstances, helping to guide safety improvements.

Increased engine and system reliability allow today's aircraft to fly farther from a suitable landing point than ever before. Satellite tracking makes it possible to monitor aircraft even in the most remote parts of the globe, and these advances have changed the way we fly. When an accident does happen, it may be in one of these remote locations. It takes longer to respond, and it is more difficult to get the appropriate resources to the search area. Having a starting point to define the search area is critical to success in locating the aircraft.

As we are well aware, in recent years, there have been a few exhaustive, expensive, and well publicized searches for missing aircraft and their recorders. The events involving Air France Flight 447 in 2009 and Malaysia Airlines Flight 370 have raised serious concerns within the NTSB and in other safety organizations here and abroad. After the crash of Air France Flight 447, it took almost two years and $40 million to find the recorders. Investigators are still searching for Malaysian Airlines Flight 370. So far the search has involved 26 countries using 84 vessels and numerous aircraft. As stated in the Australian Transport Safety Bureau's most recent Operational Update Report (February 18, 2015), more than 24,000 square kilometers of ocean floor have been searched without locating the aircraft's CVR, FDR, or any wreckage.

The NTSB's Longstanding Role in Advocating for Improvements in Recorder Technology, Recorder Recovery, and Locating Aircraft After an Accident

From the agency's earliest days, the NTSB has been vitally interested in the effectiveness of recorders. For example, shortly after an accident involving a National Airlines aircraft in New Orleans, Louisiana, on September 3, 1967, the NTSB issued a recommendation[1] to the Federal Aviation Administration (FAA) pointing to CVR inadequacies and called for the FAA to review its installation approvals granted to aircraft operators.

After an engine fan assembly disintegrated during the flight of another National Airlines passenger aircraft near Albuquerque, New Mexico, on November 3, 1973, resulting in 1 fatality and 24 injuries, the NTSB's investigation disclosed a malfunction in the FDR. Testimony during the NTSB's public investigative hearing and subsequent data recovery efforts by NTSB staff disclosed that of the 13 aircraft in the carrier's fleet, 7 had been operating with undetected malfunctions which would have precluded recovery of acceptable data. As a result of its investigation, the NTSB issued 3 recommendations[2] to the FAA to take appropriate corrective actions to ensure the proper operation and reliability of these recorder systems.

In 1975, the NTSB issued a special study entitled "Flight Data Recorder Readout Experience in Aircraft Accident Investigations 1960-1973"[3] . The report was based on a review of 509 accident and incident flight recorder readouts over a 14-year period. The report mentions 4 cases where the FDR was not recovered because the wreckage was in deep water and could not be located. It also describes an earlier NTSB safety recommendation[4] that led to the FAA amending Part 121 of the Federal Aviation Regulations (FAR) to require each recorder to be equipped with an approved underwater locator beacon to assist in locating the recorder under water.

The special study also describes the crash of Trans World Airlines Flight 841 in the Ionian Sea on September 8, 1974. The NTSB's Aircraft Accident Report[5] for this accident recounts the following efforts to recover the flight recorder:

[1] A-67-030
[2] A-73-116, A-73-117, and A-73 -118
[3] Report No. NTSB-AAS-75-1
[4] A-72-56
[5] Report No. NTSB-AAR-75-7, March 26, 1975

In accordance with 14 CFR 121.343, an underwater locator beacon (Dukane Model N15F210B) was mounted on the recorder. According to its manufacturer, this locator (Pinger) had an operating depth of 20,000 feet, a detection range of 2,000 to 4,000 yards, and was capable of transmitting acoustic signals for 30 days after activation by water.

From September 8, 1974, to September 20, 1974, air, surface, and subsurface units from the U.S. Sixth Fleet attempted to locate the recorder by conducting visual, radar, and acoustic searches; however, their efforts were unsuccessful. The Safety Board then contracted the Supervisor of Salvage, Department of the Navy, to search the area in which the Sixth Fleet believed the wreckage to be located. On October 4, 1974, salvage experts using a dipping hydrophone system, detected the pinger signal in an area with a depth of 10,380 feet.

Neither the FDR nor the CVR was recovered.

Faced with the likely high costs of recovering the aircraft wreckage and the recorders, the possibility that the pinger separated from the flight recorder at impact or that the recorder with the attached pinger were separated from the main wreckage, there were no further recovery efforts.

The NTSB is also interested in ways to recover critical flight data in a more timely manner without immediate underwater retrieval of flight recorders. Locating and recovering flight recorders in over-water accidents has been more problematic than those occurring on land. Once recovered, flight recorders have been highly reliable, and data have been successfully downloaded. However, there have been rare instances in which recorders have not been recovered or data were lost due to damage from exposure to severe fire or underwater conditions. Because of this, in March 1999, the NTSB issued a recommendation[6] asking the FAA to require the installation of dual combination flight recorders that include both CVR and FDR functionalities on board newly built aircraft. In issuing the recommendation the NTSB pointed out that since 1983, there had been 52 accidents and incidents in which information from either a CVR or FDR or both were lost due to interruption of electrical power following an engine or generator failure or crew action.

In addition to recommending improvements in recorders required to be installed in aircraft subject to Part 119, 121, 125, or 135 of the FAR, the NTSB has also issued recommendations calling for replacement of the emergency locator transmissions (ELTs) in most general aviation airplanes subject to Part 91 of the FAR. Although Congress, in 1970, enacted a statutory requirement mandating the installation of ELTs in most of these aircraft, the NTSB has repeatedly called for improvements and replacement of older model beacons. As a result of the NTSB's investigation of a 9-fatality accident involving a Department of Interior operated Cessna 208B in Montrose, CO on October 8, 1997, the agency recommended that the FAA require the installation of newer, digital 406 megahertz ELTs. A subsequent recommendation in 2007 recommended that the FAA seek authority from Congress to require upgrades of Technical

[6] A-99-17

Standard Order (TSO) C 126 [406 megahertz] ELTs prior to the discontinuance of satellite processing of 121.5 megahertz ELT signals.[7] To date, however, the FAA has responded that it cannot require the installation of 406 megahertz ELTs and will not seek statutory authority to do so. Without satellite detection capabilities, aircraft broadcasting at 121.5 MHz can only be discovered if overflying aircraft monitor 121.5 MHz and report audible signals to air traffic control and, even then, no exact accident location can be discerned.

The limitations of this archaic method of detection played a role in an October 26, 2011 accident in Lexington, Oregon involving a Cessna 182R. The NTSB's investigation found that both occupants initially survived the crash. While one injured occupant was able to exit the airplane, it took him 4 hours to find a location where he could call for help. When first responders arrived the pilot had died, even though the airplane's 121.5 MHz ELT was still operating. The NTSB concluded that a notification from a functional 406 MHz ELT would have been received within minutes of the crash, significantly reducing the emergency response time and greatly increasing the chances of the pilot's survival.

The NTSB has also issued safety recommendations on cockpit image recording systems and protection against deactivation of recording systems. In April 2000, in response to investigations of several accidents involving a lack of information regarding crewmember actions and the flight deck environment, including ValuJet Flight 592, SilkAir Flight 185, Swissair Flight 111, and EgyptAir Flight 990, the NTSB issued two recommendations to the FAA. One recommendation[8] asked the FAA to require that that in-service aircraft operated under 14 CFR Part 121, 125, or 135 be equipped with a crash-protected cockpit image recording system. The second recommendation[9] asked for similar action for newly manufactured aircraft that would be operated under 14 CFR Part 121, 125, or 135. Both recommendations also asked that the FAA require placing recorder system circuit breakers in locations the flight crew could not access.

The NTSB now believes it is appropriate to clarify these recommendations by separating the issue of recorder system circuit breaker accessibility from the issue of cockpit image recording systems and to update the recommendations by incorporating government and industry developments in cockpit image technology.

In the SilkAir and EgyptAir crashes, the CVR and FDR recordings provided limited information about crew actions and the status of the cockpit environment. Further, in the Air France Flight 447 crash and the September 3, 2010, crash of a Boeing 747-44AF, operated by United Parcel Service while attempting to return to Dubai International Airport following an in-flight cargo fire, the accident aircraft were equipped with FDRs that greatly exceeded the minimum parameter requirements. However, in these accidents, critical information related to the cockpit environment conditions (for example, crew actions and visibility), instrument indications available to crewmembers, and the degradation of aircraft systems was not available

[7] A-07-51
[8] A-00-30. In 2006, the NTSB reiterated SR A-00-30 as a result of its investigation of a 2004 accident involving Corporate Airlines Flight5966, a BAE-J3201 aircraft, in Kirksville, Missouri.
[9] A-00-31

to investigators. Modern cockpit imaging systems can provide the information needed to help determine the cause of these types of accidents.

Recent NTSB Activities and Actions

Notwithstanding the NTSB's nearly 50 years of aviation accident investigations and role in securing improvements in recorder capabilities and locator technologies, the agency clearly recognizes that sophisticated aircraft accident investigation and analysis cannot be accomplished without recorded flight data. In order for our important work to continue and make a difference in saving lives, we must ensure that the technologies are available to locate aircraft wreckage and recorders after an accident and that critical flight data can be recovered.

NTSB Public Forum on Emerging Flight Data and Locator Technology

The NTSB has long been concerned about rapid recovery of recorded information to guide investigations, help determine accident causes, and develop recommendations to prevent recurrences. To focus attention on this issue, the NTSB convened its *Emerging Flight Data and Locator Technology Forum* on October 7, 2014, in Washington, D.C. Forum discussions among government, industry, and investigative experts helped identify the following safety issues:

- The need for improved technologies to locate aircraft wreckage and flight recorders following an accident in a remote location or over water.

- The need for timely recovery of critical flight data following an accident in a remote location or over water

The Forum included 4 panels:

Panel 1, consisting of officials from the FAA, the European Aviation Safety Agency, and the International Civil Aviation Organization (ICAO), discussed the organizational framework and structure of the US and international regulatory and standards bodies

Panel 2, consisting of representatives from Boeing Commercial Airplane Company, Airbus, Honeywell, and Inmarsat, addressed the airframe manufacturer, supplier, and infrastructure provider's perspectives on technology solutions to provide more timely location and recovery of flight data following an accident

Panel 3, consisting of representatives from France's Bureau d' Enquêtes et d'Analyses, the Naval Sea Systems Command, L3 Communications Company, DRS Technologies Canada Ltd., and FLYHT Aerospace Solutions Ltd., summarized possible technical solutions that can assist in wreckage location, recorder retrieval, and flight data recovery. The panel also addressed the technical details of two specific technologies -- a deployable flight recorder system and a method for wireless transmission of flight data.

Panel 4, consisting of representatives from the Air Line Pilots Association, American Airlines, and the FAA, addressed obstacles that need to be overcome to implement new and emerging technologies that would allow for a more efficient recovery of flight data.

Other noteworthy information provided at the forum includes the following:

Deployable recorder technologies: These technologies can be used to recover flight data without the delay of a long and expensive underwater recovery. Deployable recorders have been used in military and over water helicopter applications since the 1960s and are currently available from several manufacturers. They combine traditional FDR and CVR functions into one unit and are capable of providing a comparable amount of flight data. They are designed to separate from the aircraft upon fuselage structural deformation or when submersed in water. If in water, they float indefinitely on the surface. These units are also equipped with ELTs that operate on the 121.5 megahertz and 406 megahertz frequencies for location and recovery. Standards already exist for automatically deploying flight recorders.

Triggered flight data transmission: A manufacturer of flight data transmission technology testified that triggered flight data transmission was not only feasible, but also already in service on some aircraft. Additionally, at this time, manufacturers and operators are equipping their aircraft with commercial satellite communications systems that can support broadband video, voice, and data transmissions. Commercial satellite systems on the market today are primarily used for passenger and crew connectivity and can support speeds of 200-400 kilobits per second. Higher speed capability is forthcoming. Such bandwidth would enable real-time parametric flight data transmission to begin after a triggering event as well as transmission of a limited amount of stored flight data recorded before the triggering event.

NTSB Recommendations Addressing Better Ways to Find Aircraft Accident Sites and Retrieve Critical Flight Data

On January 22, 2015, the NTSB issued a series of safety recommendations to the FAA[10] calling for improvements in locating downed aircraft and ways to obtain critical flight data faster and without the need for immediate underwater retrieval. The NTSB also re-emphasized the need for cockpit image recorders on commercial airplanes.

In issuing its recommendations, the NTSB recognized there are significant ongoing international industry and regulatory efforts to develop and adopt standards for enhanced aircraft position reporting and supplemental methods for recovering flight data. Achieving these goals on a global basis will demand a harmonized approach that addresses the needs of many stakeholders and ensures that domestic and foreign parties operate under equivalent standards. We also strongly support the need for performance-based standards for emerging technologies and data recovery. We applaud Ambassador Lawson and ICAO for their continued important work in addressing these issues.

[10] A-15-1 to -15-6.

The NTSB recommendations urge the FAA to:

- Require that all aircraft used in extended overwater operations (i.e., operations that occur over water at a horizontal distance of more than 50 nm from the nearest shoreline) and operating under Part 121 or Part 135 of the FAR that are required to have a CVR and an FDR, be equipped with

    - a tamper-resistant method to broadcast to a ground station sufficient information to establish the location where an aircraft terminates flight as the result of an accident within 6 nautical miles of the point of impact, and

    - an airframe low frequency underwater locating device that will function for at least 90 days and that can be detected by equipment available on military, search and rescue, and salvage assets commonly used to search for and recover wreckage.

- Require that all newly manufactured aircraft used in extended overwater operations and operating under Part 121 or Part 135 of the FAR that are required to have a CVR and an FDR, be equipped with a means to recover, at a minimum, mandatory flight data parameters; the means of recovery should not require underwater retrieval. Data should be captured from a triggering event until the end of the flight and for as long a time period before the triggering event as possible.

- Coordinate with other international regulatory authorities and ICAO to harmonize the implementation of the above-identified requirements recommended by the NTSB for locating where an aircraft terminates flight as the result of an accident and recovery of mandatory flight data parameters.

- Identify ways to incorporate adequate protections against disabling flight recorder systems on all existing transport category aircraft.

- Require that all newly manufactured transport category aircraft incorporate adequate protections against disabling flight recorder systems.

Closing

I commend the Subcommittee for holding this hearing on these critical aviation safety issues—issues that are receiving the highest level of attention internationally and within the United States. With the hard work underway by international organizations, foreign governments, the U.S. Government, and the aviation community, clear, steady progress is occurring to implement improvements to our already remarkably safe aviation system.

Thank you for inviting me to testify today. I am happy to answer your questions.