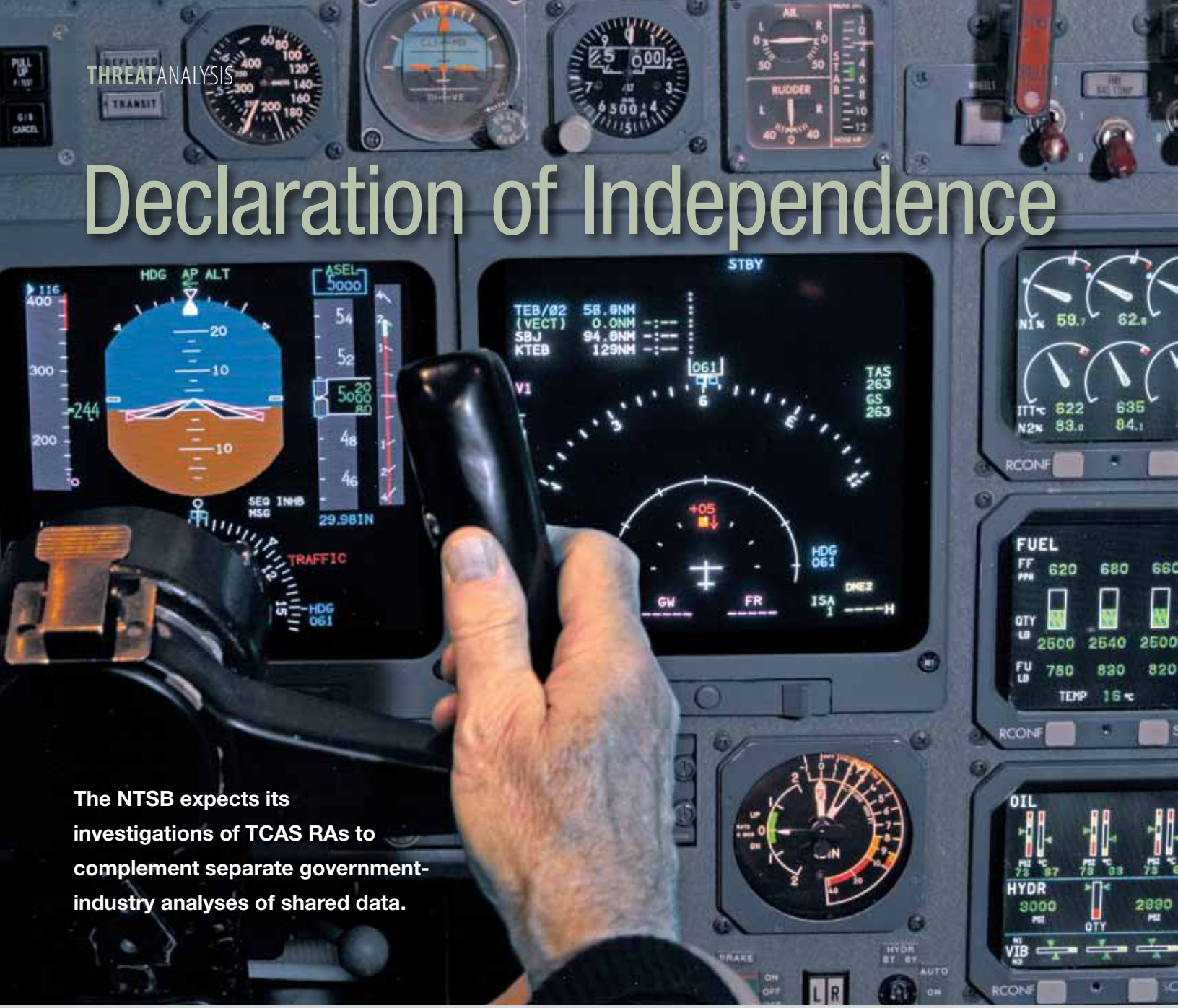
Declaration of Independence



The NTSB expects its investigations of TCAS RAs to complement separate government-industry analyses of shared data.

BY WAYNE ROSENKRANS

As government-industry exchanges of vast banks of operational data flourish, incident-level investigations by the U.S. National Transportation Safety Board (NTSB) can appear to be out of step with the times. Some aviation safety professionals have seen the board's approach to near-midair collisions (NMACs) as a case in point, specifically the latest requirement for operators to report certain resolution advisories (RAs) issued by traffic-alert and collision avoidance systems (TCAS II).[1]

Yet early indications are that NTSB investigations help to rapidly mitigate underlying risk factors of midair collisions, even if limited sometimes to a local application, while large-scale data analysis may take years to deliver system-level risk mitigations. Finding solutions either way has been extremely difficult, NTSB and U.S. Federal Aviation Administration (FAA) officials admit (*ASW*, 8/09, p. 32).

Before its effective date of March 8, 2010, the requirement to report certain RAs had been widely opposed as an unwarranted duplication of effort, but the first 12 months of RA investigations reveal more about the board's complementary, check-and-balance purposes.

Investigating RAs has been a long-established process falling "well within our mandate," says Tom Haueter,

© Chris Sorensen Photography — TCAS RA on Dassault Falcon 50EX simulator at Teterboro Learning Center, FlightSafety International

director, NTSB Office of Aviation Safety. "Our decision to go after formalized reporting was basically because of the problem that we didn't know how many RAs were out there," he said. "We previously got this information second-hand many times, and we needed to have reliable reporting of the TCAS RA events in which aircraft are in the positive control area [i.e., Class A airspace, from 18,000 ft through Flight Level (FL) 600 (approximately 60,000 ft)] or at lower altitudes" under instrument flight rules (IFR) if compliance with the RA is necessary to avert a substantial risk of collision between two or more aircraft.

In December 2004, the NTSB had proposed to add RAs to its list of events required to be reported immediately to the board under Title 49 of the Code of Federal Regulations, Part 830, "Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo and Records."

After reviewing public comments in 2005, the board decided to make refinements. The final regulation requires reporting RAs either "when an aircraft is being operated on an [IFR] flight plan and compliance with the advisory is necessary to avert a substantial risk of collision between two or more aircraft, or [when an RA occurs on] an aircraft operating in Class A airspace."

Visitors to the NTSB Web site <www.ntsb.gov> now find on the home page a "TCAS RA" reporting link separate from the link for the nine-page, PDF-format NTSB Form 6120.1, "Pilot/Operator Aircraft Accident/Incident Report." The TCAS RA link simply launches an empty email message from the sender to <tcas@ntsb.gov> but any email program can be used to send a message to this address. "The key for us is getting accurate reports quickly — as fast as we can get them — so we can pull the air traffic control [ATC] radar tapes and interview people if necessary, and make an evaluation," Haueter said. "If we need more data, NTSB staff will contact any person or organization as needed to complete the investigation."

Early Experience

From March 8, 2010, through March 8, 2011, the NTSB received about 950 RA reports. "Of the 950, there were only 260 that we thought merited additional examination to see if something serious was going on," Haueter said. Nine RAs investigated recently include seven that occurred in the 12 months after the effective date of the final rule, one RA from October 2009 and one RA from February 2010.

As to RAs screened so far, "there have been no real surprises … nothing that jumps out in terms of a trend or something unusual," he said. Investigators' reviews of the 260 reports did not support categorization or identification of "pockets" of airspace (hot spots) where more RAs occurred than normal. "The events were about what we have seen before, but we will keep collecting data … and each year we will know better which to investigate, and we will refine the process if necessary," he said. "This is going to take a long time."

Investigation Examples

From Haueter's perspective, the most prominent of the nine RA investigations was an NMAC on Sept. 16, 2010. This collision was averted by an immediate climb maneuver performed by the flight crew of a US Airways Airbus A320 (Figure 1, p. 20). The A320 crew and the pilot of a Beech 99, operated by Bemidji

NTSB TCAS Notification

Date/Time: 9-16-10 1149Z

Flight: 1848

City Pairs: MSP-CLT

Location: MSP Approx.

Altitude: 400 ft AGL RA

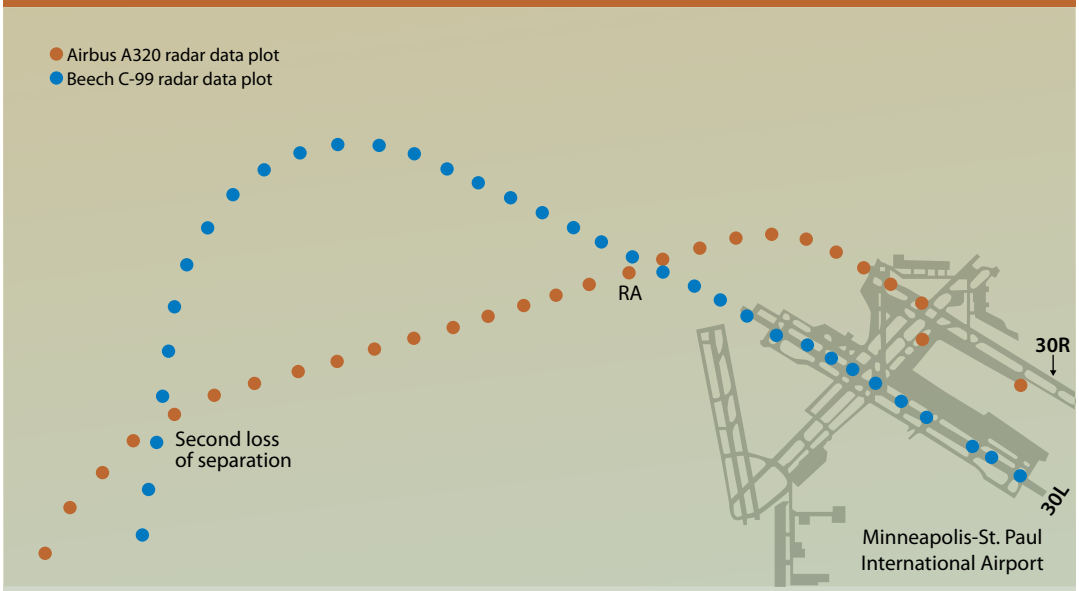
Type: Climb ATC

Facility/Frequency: MSP Tower

Captain Statement:

At 0635 local time we pushed back at KMSP from gate C-11 and taxied to 30R. At 0649 we were cleared for takeoff to fly runway heading (299 deg). At 400 ft AGL the F/O (pilot flying) called for runway heading, at the same time KMSP tower told us to turn left to a heading of 260 and call dept. at 124.7 (from the original of 125.75). We turned to HDG 260 and at that time we received a TCAS RA. We were in a normal takeoff climb rate when the TCAS commanded a much greater climb to clear the conflicting traffic. The F/O responded with a swift pull-up. During this time I observed a red target on the TCAS display to our immediate left, that showed a –100 ft. (We were in the clouds at about 500 ft and could not see the aircraft.) Within just a few seconds I heard the whine of turboprops go under our aircraft from left to right. After this the TCAS gave a "clear of conflict" and we returned to normal flight. After the flight I consulted with KMSP ATC and learned that the tower controller on 30R turned us into the path of a Beechcraft 99 departing from 30L. I have been on the A320 for 8 years and am very grateful of the TCAS and computer systems installed in the Airbus family of aircraft, they worked very well to allow us to survive this event.

NTSB Investigation of TCAS RA and NMAC Incident



NMAC = near-midair collision; TCAS = traffic-alert and collision avoidance system; RA = resolution advisory

Note: The flight crew of the Airbus A320 increased their climb rate in response to the TCAS RA; the Beech C-99 was not TCAS-equipped. The incident occurred Sept. 16, 2010.

Source: U.S. National Transportation Safety Board (NTSB)

Figure 1

Aviation Services, had been cleared to conduct takeoffs and departure turns in instrument meteorological conditions from parallel Runways 30R and 30L, respectively, at Minneapolis-St. Paul (Minnesota) International Airport. Airport weather conditions included a reported ceiling at 900 ft and visibility of 10 mi (16 km).

After takeoff, the A320 crew had received and complied with an ATC instruction to turn left to heading 260. The air traffic controller responsible for the Beech 99 cargo flight's departure instructed the pilot to take off and turn left to heading 180. However, the pilot delayed his compliance with the turn instruction for about 2.0 nm (3.7 km) until reminded, and the controller did not look at the radar display or otherwise realize that this delay was causing the path of the Beech 99 to intersect the path of the A320. The NTSB investigation found that about one minute after the TCAS RA, the same controller issued a vector to the Beech 99 pilot that caused a second, unreported loss of separation — a radar proximity of 500 ft and 1.23 nm (2.28 km).

The Beech 99 conflict with the A320 occurred because of the controller's assumption that the Beech 99 pilot had turned immediately after takeoff, Haueter said. "That kind of assumption in the ATC system is one we have seen before," he said. "By being able to see radar tracks and make safety recommendations, hopefully we can prevent this issue from leading to an accident." The factual report noted that the incident controller was distracted by a taxiing aircraft pilot's questions about an ATC instruction.

Unlike large-scale analyses of operational data, documents in this public docket — accessible via the NTSB Docket Management System <dms.ntsb.gov/pubdms/search> — provide details from radar track replay analysis and the transcribed audio recordings of pilot-controller communication; interviews with pilots, local controllers and ATC supervisors; analysis of applicable ATC rules, procedures, typical route coordination, radar/visual separation practices, radar range setting, automatic acquisition of radar target data tags, position relief briefings, and duty assignments; and analysis of the incident controller's training, fatigue, duties and past performance issues.

The associated reports also describe the FAA's quality assurance investigation, include three local directives to controllers issued before completion of the NTSB investigation, and cite the planned follow-up actions by quality assurance staff from FAA headquarters. The docket also contains an NTSB comparison of similarities between this incident and an ATC operational error that resulted in loss of separation

on Nov. 11, 2010, between two airliners departing from these same runways.

First Probable Cause

The probable cause has been determined for a serious incident that occurred March 25, 2010, when the flight paths of a Continental Airlines 737 and a Gulfstream II crossed within 1.04 nm (1.93 km) and 300 ft in Class A airspace over Worton, Maryland. Just before the incident, the GII was at FL 290 and the 737 was at FL 360. An operational error by the controller responsible for the GII occurred during her attempt to simultaneously vector this flight crew to pass clear of Aberdeen Restricted Area and to position the GII more than 5.0 nm (9.3 km) behind the 737, the report said.

The probable cause was, "The [radar controller for sector 10/12 of the Washington Air Route Traffic Control Center] issued an improper vector and descent clearance to the GII that put the airplane on a converging flight path with the B737. Contributing to the incident was the failure of the FAA's training program to correct ongoing controller performance deficiencies before certifying the [manual controller for sector 10/12] to work without immediate supervision." The documents in the public docket are similar in scope to those for the Minneapolis incident.

Strict NTSB Independence

In response to the 2004 and 2008 notices of proposed rulemaking for Part 830, the airline industry and the FAA urged the NTSB to endorse, rely upon or — ideally — participate in the existing voluntary non-punitive FAA-industry processes for reporting and analyzing RAs. Often mentioned was joining in the FAA Aviation Safety Information Analysis and Sharing (ASIAS) program, which currently has 35 participating airlines. The NTSB declines to do so, although some have seen the resulting limited access to data as a disadvantage.

"Certainly the FAA and airlines can take their data and look at it through the ASIAS viewpoint; we can't," Haueter said. "We are not linked into ASIAS."

Some observers may have misconstrued the statutory safety-oversight role of the NTSB, and how this limits relationships with the FAA and the industry. "We have a 'watchdog' function over the FAA, and one of our functions is to oversee ATC safety," Haueter said. "As the regulatory agency running the ATC system, they can make changes. So they do their own investigations of RAs, and we do ours. This works quite well as a system. Certainly, we will share with the FAA any of our information."

Meanwhile, many advantages accrue from the increased RA reports reaching the NTSB. "We now have a better handle on what's going on … numbers to back up what we have been looking at," Haueter explains. "Yet each of these events is unique, so it has been hard to pin down exactly where we definitely see improvement necessary."

The most important driver of these NTSB investigations, Haueter said, is ensuring a detailed awareness of how the few unsafe situations developed and resulted in the RAs. His basic message to pilots and airlines willing to read investigation reports is: "Be vigilant; watch out for situations where you might lead yourself or ATC may inadvertently lead you into another airplane's airspace."

Educating the Industry

Uncertainty persists for now about how many RA reports typically will arrive per year at the NTSB, but outside predictions of many thousands have not materialized, and polite reminders have been effective in enforcing compliance by all operators involved in each reportable event. "One thing we do know from the first year is that there has been a lot of over-reporting," Haueter said. "Some people reported TCAS RAs that they did not have to report, so we are educating the industry, and I imagine in the following years, we will see the number decrease a bit."

Flight crews, pilots and operators can use as a general guideline the FAA definition of an NMAC, given that "the infinite variety of encounter geometries does not lend itself to specific [RA-reporting] guidance that would apply to every possible scenario," the NTSB said. An NMAC is "an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 ft [152 m] to another aircraft, or a report is received from a pilot or a flight crewmember stating that a collision hazard existed between two or more aircraft."

An explanation in the final rule also clarified, "[RAs] that command maximum vertical speed, 'reversal' advisories that require a change in vertical direction after the initial advisory is issued, or encounters that result in zero vertical separation between the aircraft involved are all examples of the types of advisories that the NTSB believes may be indicative of substantial collision risk. Conversely, [RAs] issued to aircraft operating on closely spaced parallel approaches or in other circumstances where there is no substantial risk of collision need not be reported under this rule."

To read an enhanced version of this story, go to <flightsafety.org/aerosafety-world-magazine/may-2011/ntsb-tcas>.

Note

1. The NTSB uses the international term *airborne collision avoidance system (ACAS).*