



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** April 7, 2000

**In reply refer to:** A-00-23 through -27

Honorable Jane F. Garvey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

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On June 23, 1998, about 1601 eastern daylight time, a Piper PA-31 Navajo, N711LD, and Grayhawk 06, a Navy Grumman E-2, were involved in an air traffic control (ATC) operational error,<sup>1</sup> which occurred about 20 miles southwest of Bradford, Pennsylvania. Both airplanes were operating on instrument flight rules (IFR) flight plans under control of the Federal Aviation Administration's (FAA) Cleveland Air Route Traffic Control Center (ARTCC) Bradford sector. Grayhawk 06 was northbound, en route from Norfolk, Virginia, to Wellsville, New York, and N711LD was westbound, en route from Elmira, New York, to Akron, Ohio.

The sector controller cleared Grayhawk 06 to descend from 18,000 feet to 10,000 feet but failed to notice that this created a conflict with N711LD, which crossed Grayhawk 06's flightpath from east to west at 16,000 feet. The two airplanes passed within 2 miles horizontally and 100 feet vertically. Conflict alert and operational error detection program software<sup>2</sup> both activated as a result of this error but not in time for the controller to intervene and prevent loss of separation. Traffic conditions at the time of the error were extremely heavy and complex; as many as 29 aircraft were in the vicinity of the Bradford sector during the period surrounding the error. There were thunderstorms in the area at the time of the incident, and several aircraft were holding because of congestion in the New York area.

### Classification of Operational Errors

An anonymous report made to both the Department of Transportation's Inspector General's Office and to the Safety Board alleged that the reported incident involving N711LD and

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<sup>1</sup> FAA Order 7210.3, "Facility Operation and Administration," defines an operational error as "an occurrence attributable to an element of the air traffic system which results in less than applicable separation minima between two or more aircraft." In this incident, the aircraft were required to be separated by 1,000 feet vertically and 5 miles horizontally.

<sup>2</sup> ARTCCs are equipped with conflict alert and operational error detection program software to monitor aircraft paths and attempt to warn controllers when two aircraft are predicted to pass closer than permitted under standard IFR separation rules; in addition, this software alerts air traffic supervisors when two aircraft actually lose separation after a conflict alert prediction.

Grayhawk 06 occurred because of excessive traffic demand in the Bradford sector, that it was the third operational error to occur in Cleveland ARTCC airspace within a 45-minute period, and that the previous two errors had not been reported.<sup>3</sup> The Board requested radar data and other information from the FAA on all three incidents alleged to be errors and was able to corroborate the allegations in the anonymous report. FAA Headquarters Air Traffic Investigations staff subsequently determined that, although the circumstances of the two unreported errors were otherwise unremarkable, the Cleveland ARTCC had improperly followed the procedures for processing operational errors contained in FAA Order 7210.3, "Facility Operation and Administration." They also determined that the unreported errors, in fact, should have been reported.

The Safety Board's investigation revealed that the methods used by facility personnel on June 23, 1998, to calculate the minimum vertical and horizontal separation distances failed to comply with the intent of the procedures for identification of operational errors contained in FAA Order 7210.56, "Air Traffic Quality Assurance." In one of the unreported errors, the calculation of vertical separation between two airplanes was determined following improper adjustments to transponder-reported altitudes. In the other unreported error, the lateral separation between the two airplanes was calculated by using measurements between targets that did not result in the determination of "the most probable trajectory," as required by FAA Order 7210.56. This failure to comply with FAA Order 7210.56 by facility personnel resulted in two of the three operational errors not being reported. The Board is concerned that such noncompliance may indicate that current training for ATC personnel responsible for determining whether separation standards have been violated is not adequate. Therefore, the Safety Board believes that the FAA should ensure that ATC personnel receive specific instruction in the acceptable methods for determining whether separation standards have been violated.

The Safety Board is also concerned that such noncompliance with the procedures in FAA Order 7210.56 for identifying operational errors may not be limited to Cleveland ARTCC. Because ATC operational errors may indicate that potential safety problems exist (such as those demonstrated here) in the entire air traffic system, not just in a certain sector, it is important that operational errors be properly identified, reported, and investigated to ensure that they receive the proper attention from FAA management. Therefore, the Safety Board believes that the FAA should review its procedures for ensuring that ATC personnel responsible for identifying operational errors understand and comply with applicable FAA directives.

### Traffic Monitoring and Assessment

FAA traffic management specialists are controllers assigned to the traffic management unit, which is an ATC unit responsible for monitoring major traffic flows within ATC facilities and maintaining a balance between capacity and demand. The FAA developed the Enhanced Traffic Management System (ETMS) Traffic Situation Display and accompanying monitor alert software to assist traffic management personnel in analyzing traffic flows and notify them of situations in

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<sup>3</sup> The Safety Board's investigation determined that the two previous errors were not reported outside the facility because after being examined by the responsible management officials they were classified as "non-reportable."

which an airport or control sector is expected to experience demand in excess of a specified level known as the Monitor Alert Parameter (MAP). The MAP is generally based on the average time aircraft spend in a sector and is initially set according to procedures provided in FAA Order 7210.3, "Facility Operation and Administration." Chapter 17, section 7 of that order states the following:

the...MAP establishes a numerical trigger value to provide notification to facility personnel, through the MA [monitor alert] function of the ETMS, that sector/airport efficiency may be degraded during specific periods of time....The ability of a functional position or airport to provide ATS [Air Traffic Service] may be affected by a variety of factors (i.e. NAVAID's [navigational aid outages], meteorological conditions, communications capabilities, etc.); therefore, MAP is a dynamic value which will be adjusted to reflect the capabilities of the functional position or airport.

Also according to FAA Order 7210.3, if ETMS predicts that traffic demand will exceed the established MAP during any 15-minute period, the monitor alert function will generate a visual alert to air traffic management personnel who are then required to assess the information and, if the alert appears to be valid, notify the operational supervisor for the affected sector. The supervisor can then take appropriate action.

When severe weather or other conditions reduce the number of aircraft that can be safely handled by sector controllers, the numerical value of a particular sector's MAP should be reduced in accordance with FAA Order 7210.3, which states the following:

The MAP value will be dynamically adjusted to reflect the ability of the functional position to provide ATS. During periods of reduced efficiency the MAP will be dynamically adjusted downward and conversely, when efficiency is improved, the MAP will be adjusted upward, but not to exceed the baseline or documented, adjusted value.

According to FAA Order 7210.3, determination and reduction of the appropriate MAP value is the joint responsibility of the sector controllers, operational supervisors, and traffic management unit personnel. Under normal conditions, the MAP for the Bradford sector is set to 18. At the time of the incident, the sector's ability to handle traffic was degraded by weather and holding aircraft; therefore, the MAP should have been reduced to a number (significantly lower than 18) determined on the basis of these conditions,<sup>4</sup> but it was not. Further, Bradford sector traffic demand peaked well in excess of 18, but no alert was generated to warn air traffic managers or operational supervisors of an impending or existing problem.

The Safety Board's investigation revealed that the Cleveland ARTCC has no procedure to ensure the necessary adjustment of sector MAP numbers; this lack of procedure degrades the

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<sup>4</sup> The exact number to which the MAP should have been reduced cannot be determined because it is a subjective number determined by ATC personnel based on their experience, weather conditions, equipment performance, and other factors.

system's ability to issue appropriate monitor alert warnings. During visits to other ARTCCs, Board investigators found that other traffic management units also did not adjust MAPs as required. Therefore, the Safety Board believes that the FAA should direct ATC facilities using ETMS monitor alert software to establish procedures to ensure compliance with the dynamic MAP adjustment requirements contained in FAA Order 7210.3, "Facility Operation and Administration."

Safety Board investigators also attempted to determine why no alert was issued to warn ATC personnel of the excessive traffic demand in the Bradford sector. Monitor alert trajectory predictions for each sector are based on predicted climb and descent gradients used in conjunction with routes and final cruise altitudes contained in IFR flight plans. Traffic is allocated to a particular sector at a particular time in accordance with the trajectories predicted by this process. If the actual flightpaths of the aircraft differ from those predicted trajectories, ETMS traffic predictions and monitor alert counts will be inaccurate.

In the Bradford incident, several aircraft in the sector had requested altitudes well above flight level (FL) 270, the upper limit of the Bradford sector airspace. However, because of traffic restrictions implemented to reduce the workload of the sector above Bradford, the low-altitude sectors surrounding Bradford cleared these aircraft only to FL 270, instead of their requested, higher altitudes. The affected aircraft were then handed off to the Bradford sector instead of the sectors above it. However, the aircraft's flight plan altitudes were not amended to permanently reflect the change. Instead, controllers chose to use the temporary altitude function of the radar data processing system to display "T" altitudes in the data blocks of these aircraft. Temporary altitudes are not reported to ETMS and do not affect flight data distribution by the National Airspace System (NAS) flight data processing system.

Because the ETMS was operating with incorrect altitude data on these flights, it misallocated the affected aircraft to sectors that they were not, in fact, going to enter; this caused inaccurate monitor alert predictions. Failure to update the assigned altitudes in the stored flight plans when it became apparent that these aircraft would be remaining at FL 270 prevented their flight strips<sup>5</sup> from being printed at the Bradford sector. These two occurrences reduced the reliability of the ETMS and contributed to the lack of a monitor alert being generated for the Bradford sector. Controllers questioned about the use of temporary altitudes stated that they were uncertain about their effects on flight data processing and ETMS predictions.

The FAA is increasingly relying on the use of automated systems, such as ETMS, for traffic monitoring and demand assessment. Much of the data used by ETMS to perform trajectory estimation and other predictive tasks are sent to the system as an indirect result of NAS computer entries made by controllers. However, air traffic controllers questioned about ETMS and monitor alerts appeared to have very little knowledge about ETMS processing and what information it uses to produce its predictions. The Safety Board is concerned that if controllers

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<sup>5</sup> Flight strips are paper strips prepared by controllers for each flight that flies a flightpath that include an airplane's intended course, speed, FL, and estimated time of arrival. Strip count is a secondary method of predicting the imminent arrival of aircraft in a sector and is often used by supervisors and sector controllers as an indicator of potential demand.

do not understand the effects that their actions have on the data made available to ETMS, they may inadvertently mislead the system and reduce its effectiveness, as occurred in this case. Therefore, the Safety Board believes that the FAA should provide air traffic controllers with annual refresher training designed to ensure that they understand the relationship between NAS and ETMS, including an overview of ETMS predictive functions, the data flow and message types exchanged between NAS and ETMS, and the various factors that may affect the accuracy of ETMS predictions.

The excessive traffic level in the Bradford sector was discovered only as a consequence of the subsequent operational error investigations and would possibly not have been discovered or received management attention if the error had not occurred. The FAA appears to have no formal process for the identification and investigation of situations in which a sector is subjected to excessive traffic demand when no otherwise reportable event takes place. The Safety Board is aware that the FAA has implemented a process for reporting and tracking ATC equipment problems through Unsatisfactory Condition Reports (UCR); however, no similar system exists for procedural problems. Therefore, the Safety Board believes that the FAA should establish a formal method for ATC personnel to report instances in which sectors become overloaded (similar to the UCR process), so that the circumstances causing or permitting overloading can be identified and addressed.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Ensure that air traffic control personnel receive specific instruction in the acceptable methods for determining whether separation standards have been violated. (A-00-23)

Review its procedures for ensuring that air traffic control personnel responsible for identifying operational errors understand and comply with applicable Federal Aviation Administration directives. (A-00-24)

Direct air traffic control facilities using Enhanced Traffic Management System monitor alert software to establish procedures to ensure compliance with the dynamic Monitor Alert Parameter adjustment requirements contained in Federal Aviation Administration Order 7210.3, "Facility Operation and Administration." (A-00-25)

Provide air traffic controllers with annual refresher training designed to ensure that they understand the relationship between National Air Space (NAS) and Enhanced Traffic Management Systems (ETMS), including an overview of ETMS predictive functions, the data flow and message types exchanged between NAS and ETMS, and the various factors that may affect the accuracy of ETMS predictions. (A-00-26)

Establish a formal method for air traffic control personnel to report instances in which sectors become overloaded (similar to the Unsatisfactory Condition Report process), so that the circumstances causing or permitting overloading can be identified and addressed. (A-00-27)

Chairman HALL and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall  
Chairman