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Travel Editors Roundtable

Top editors of the country's leading consumer travel publications discuss how a difficult economic climate is changing the way their readers view vacations and getaways. PAGE 22

Pilots ignoring 737 pressurization alarms

By Michael Fabey

[EXCLUSIVE]

A Travel Weekly analysis of NASA's Aviation Safety Reporting System has revealed that pilots flying Boeing 737s, the world's most widely deployed passenger aircraft, have frequently been ignoring an onboard alarm horn designed to warn of a critical loss of pressure, and thus a lack of oxygen, in the cockpit.

When the alarm, known as an altitude warning horn, is ignored, the cockpit crew fails to deploy oxygen masks, which can lead to a loss of consciousness, with dire consequences. The most deadly result to date was the August 2005 crash of Helios Airways Flight 522, in which 121 passengers and crew were killed when a Boeing 737-31S crashed into a mountain north of Athens.

Air transportation authorities and Boeing officials have known for more than three years that the crash was caused by hypoxia, a lack of oxygen due to cockpit pressure failure, but only recently has Boeing announced a plan for retrofitting older 737s with an improved altitude alarm system.

However, the FAA has taken several proactive steps since the crash. The latest came late last month, when the agency mandated briefings instructing pilots to heed the altitude horns. At the same time, Boeing

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ALARMS

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began building an improved altitude warning system into its new 737s as it proceeds with plans to retrofit the more than 5,000 737s already in service with FAA-approved signal kits.

"It's considered one of the mega-emergencies," Capt. Karen Kahn, a longtime commercial jet pilot and author of the book "Flight Guide for Success: Tips and Tactics for the Aspiring Airline Pilot," said of pressurization problems that can result in hypoxia. "That warning is very important to pilots. I don't think anyone takes the cabin altitude horn lightly. I don't think it's something people just ignore."

But ignoring the horn is exactly what Boeing 737 pilots have been doing for years, even after it became known that the Helios 522 crash was caused by the crew's failure to respond properly to the warning, with such deadly consequences.

PHOTO BY THANASSIS STAVRAKIS/AP 2005

In August 2005, 121 passengers and crew aboard Helios Airways Flight 522 were killed when the Boeing 737-31S struck a mountain north of Athens. The plane had lost cabin pressure, but the crew failed to respond properly to the plane's altitude warning system.

In fact, pilots kept ignoring the horn even after the FAA, prompted by the Helios 522 crash, issued an emergency airworthiness directive the following year requiring more emphasis, in manuals and in training, on heeding the alarm.

It might seem counterintuitive that commercial pilots, a group that prides itself on emphasizing safety and professionalism, would simply ignore an alarm when the consequences are so potentially deadly. And in fact, there are several reasons why this is happening.

> **Pilots kept ignoring the horn even after the FAA issued an emergency airworthiness directive.**

Perhaps the most important is that in the 737, the horn serves a dual purpose and thus is an ambiguous alarm. Before takeoff, it warns pilots if the aircraft is not configured properly for flight. Pilots have frequently misinterpreted the in-flight warning as an indication of a preflight danger that is no longer a concern and have thus considered it a false alarm.

Adding to the confusion is the fact that pilots often contend with false alarms and related pressurization equipment miscues in flight. Equipment problems, such as alarms sounding when they shouldn't or failing to sound when they should, accounted for about a quarter of the 100 incidents involving warning horns cited in the ASRS from the mid-1990s through February, according to Travel Weekly's analysis of the data.

"One of the classic problems we have in general with warning horns is people tend to ignore them," said Bill Waldock, professor of safety science at Embry-Riddle Aeronautical University. "They go off inadvertently."

The FAA had known about the 737 horn confusion since a year before the Helios 522 crash, thanks to "a safety recommendation from the Irish accident investigation authorities in 2004, recommending addition of a warning light to accompany the warning horn," said FAA spokesman Les Dorr.

Unfortunately, Dorr said, the agency was distracted by another, more urgent pressurization issue with the 737: "At the time, the FAA was investigating a number of reports of airplanes failing to pressurize during climb due to improperly set pressurization switches. The FAA decided at that time that it was best to focus on reducing the likelihood of a depressurization event, rather than on improving the warning system. So, we worked with Boeing to change the

after-takeoff procedures to include specific checks of pressurization switches."

But Travel Weekly's analysis of ASRS data indicates that pilot confusion about the horn long predated the warning from Irish authorities.

In a December 1995 flight during a daylight departure from Las Vegas to Omaha, Neb., the captain of a 737-300 with 133 passengers reported, "A warning horn was experienced. The [first officer] and I believed it to be a brake or a false takeoff warning horn in conjunction with the auto brake, since we had experienced two earlier, similar horns."

But then, the captain reported, "I began to feel some symptoms of hypoxia."

Such symptoms can include "tunnel vision, nausea, euphoria, dizziness, tingling, fatigue and loss of coordination," according to Glenn Harmon, an aerospace physiologist and assistant professor of aeronautical science at Embry-Riddle. "Hypoxia affects people differently, and the rate of onset varies for each person."

The danger of hypoxia has been a concern since early in the history of powered flight, with the introduction of planes that could fly at altitudes at which oxygen is too thin to sustain human life. The National Transportation Safety Board has documented dozens of hypoxia-related aircraft accidents over the past several decades.

In the case of Helios 522, the altitude warning horn sounded as the aircraft passed 12,000 feet after taking off from Larnaca Airport in Cyprus. Instead of donning oxygen masks to prevent hypoxia, the captain started talking on the radio with the company maintenance base at Larnaca, the NTSB said. When air traffic controllers noted confusion on the part of the pilot, followed by silence, two Greek fighter jets were dispatched to intercept the flight. By the time the fighter pilots intercepted the 737, it had reached at least 34,000 feet, the captain's seat was empty and the first officer's seat was occupied by "an incapacitated person," according to the NTSB.

The plane went into a holding pattern. An hour and 12 minutes later, the left engine ran out of fuel, followed 10 minutes later by the right engine. The altitude warning horn did not stop sounding, the NTSB said, until the aircraft plunged below 10,000 feet.

As a result of the crash, Helios executives last November were charged with manslaughter in both Greece and Cyprus.

In addition, U.S. and Cypriot lawyers filed a lawsuit against Boeing in February 2006 on behalf of families of the Helios crash victims in the United States District Court for Northern Illinois in Chicago.

The complaint alleges that a series of design defects in the Boeing 737-300 led to the pilots' failure to understand the nature of the problems they were facing because the of horn's dual duty. The complaint also alleges that Boeing told operators of 737s in 2003 that "flight crews may not recognize the [aircraft pressurization failure] horn as an alert of excessive cabin altitude."

Following the Helios investigation, the FAA issued its initial airworthiness directive in July 2006, noting, "The flight crew subsequently misinterpreted the cabin altitude warning horn as a takeoff configuration warning horn."

The FAA added it had "become aware of a number of other incidents involving 737s in which the flight crew reaction to a valid cabin altitude warning horn was delayed, either because the flight crew misinterpreted the horn as a takeoff configuration warning horn, or because they did not immediately don their oxygen masks.

"Crew reaction may have been delayed because no associated cabin altitude warning light is installed that activates concurrently with the warning horn."

Boeing says it was alerted to several cases before the Helios accident in which the horn had confused crews, and the company advised airlines to train crews about the problem.

When the FAA issued its directive, Boeing said it would change the wording in its manuals from "if the cabin altitude horn sounds" to "if the intermittent cabin altitude/configuration sounds in flight …"

Boeing also said it was developing a design change for the warning system, which Waldock and Kahn applauded.

Boeing says it was alerted to several cases before the Helios accident in which the horn had confused crews, and the company advised airlines to train crews about the problem.

"Very often the cockpit can be a loud, noisy place," Kahn said.

Any pilot confusion, she said, must be cleared up.

Pilots had for some time been warning about confusion or admitting they weren't following procedures meant to keep them from passing out. The ASRS reports continued to mount even after the 1995 incident. [Editor's note: We have posted eight sample pilot reports from the NASA database on TravelWeekly.com.]

The FAA acknowledges that it received four reports of horn confusion between the Helios crash and July 2006, when it issued the first airworthiness directive. Even after that, the FAA received three more reports.

The FAA won't identify any details about those reports, but several reports in the ASRS database show that pilots still were not responding properly. For example:

- January 2007 — When the warning horn sounded at cruise altitude, the pilot of a 737-300 wrote, "My initial thought was, 'What is causing the tkof [takeoff] warning horn to go off?' … I know, and I have read many times, that crews often mistake it for the tkof warning horn. Never thought it would happen to me. At some point in the descent, though, my first officer and I both realized that we … did omit the first two steps of the checklist where we should have put on the oxygen masks. The surprise of the tkof configuration warning horn at altitude with no rapid decompression or apparent pressurization [probably] leads to trying to analyze the [problem] before executing the first two steps of the checklist."
- August 2007 — Again the warning horn sounded at cruise altitude on a 737-300 and, one of the crew would later report, "The captain's initial response to the horn's sounding was, 'What the heck is that?'"

The FAA decided that a second airworthiness directive was in order.

"For the FAA to reissue the [directive], it sounds like they must have had a fair amount of reported problems," Waldock said.

The second directive requires that starting in late March before the first flight of the day and following any change in flight crew members, Boeing 737 crews must be reminded to acknowledge the horn and take prescribed actions.

But the FAA is also depending on Boeing's changes to the warning system. Boeing has an approved design change for newer 737s (737NG -600, -700, -700C, -800, -900 and 900ER) and has been delivering the warning light system on new production 737s since last August, the FAA's Dorr said.

Boeing also completed certification testing of the design change for out-of-production 737 "Classic" models (-100, -200, -200C, -300, -400, -500) late last year, Dorr said, adding the Boeing is "now in the process of developing service information to support retrofit of the in-service fleet. When the retrofit service information is available, we will consider mandating it."

Dorr said the altitude warning system design has several variations that support a number of different 737 configurations.

"Retrofits into the existing fleet are scheduled to begin this spring," Boeing spokeswoman Sandy Angers said. But it's going to take some time before the retrofitting effort can be completed.

In the meantime, Kahn said, "It's unfortunate that we often have to legislate by accident."