



日本航空安全啓発センター
Safety Promotion Center

Photos: Wayne Rosenkrans

Precious Lives

Japan Airlines Safety Promotion Center compels reflection on solemn responsibilities of aviation professionals.

BY WAYNE ROSENKRANS | FROM TOKYO



More than 74,000 visitors have toured the Japan Airlines (JAL) Safety Promotion Center since its opening in April 2006. The proportion from outside the company exceeds 40 percent, says Yutaka Kanasaki, director of the museum-like facility near Tokyo International Airport, Haneda. Many are fascinated by the concept, especially the reasoning behind JAL's decision to prominently recount the story known throughout Japan as the "Osutaka Mountain accident." On a southeast ridge of this mountain 24 years ago, this crash of a Boeing 747SR-100 resulted in more loss of life than in any single-airliner accident in history.¹

The center is designed, foremost, to provide safety awareness and education for the airline's employees, Kanasaki said during a November tour for ASW. "Today, 90 percent of our total number of employees — about 50,000 — have never experienced an accident," Kanasaki said. "People entering our company only know Flight 123 from the viewpoint of history. After visiting our Safety Promotion Center, however, they understand an accident as a real thing. Every visitor, including the JAL employee, studies here what safety is."

The experience for employees involves historical and technical education, contemplation of aircraft wreckage and personal effects, and examination of their personal role within the airline's efforts to reduce accident risk.

"Our center has three missions," Kanasaki said. "The first one is to stop the fading out of the memory of the sadness of the aircraft accidents that Japan Airlines experienced in the old days. We are very sorry but Japan Airlines has experienced eight fatal accidents since the foundation of the JAL Group. The last was Flight 123 in 1985. In each accident, many passengers and crew lost their precious lives. The second mission is to inspire JAL employees to establish safety in their minds. The third is to transfer the lessons learned from these accidents to the next generation of people in the JAL Group."

Hideaki Miyachi, a Boeing 747-400 captain and director of the Planning Group, JAL Corporate Safety and Security, said that unlike in some major accidents, everyone concerned

quickly became aware of the most likely causes in the case of Flight 123. "Three weeks after the accident, Boeing informed us that an improper repair had been done for tail strike damage that occurred in June 1978," Miyachi said. "So everybody knew soon that the aft pressure bulkhead had been damaged and — due to the Dutch rolling and uncontrollable condition — that most of the tail had separated in flight and sunk in Sagami Bay. Boeing reacted very quickly and expressed that their repair was the major reason."

Three factors influenced JAL to create the Safety Promotion Center. From December 2004 to December 2005, several errors during flight operations prompted the Civil Aviation Bureau in Japan's Ministry of Land, Infrastructure, Transport and Tourism to issue a business improvement order.

"The March 2005 order from the government directed JAL to improve the company's attitude toward safety," Kanasaki said. "We established the Safety Advisory Group outside of our company. The group then gave us a proposal at the end of 2005 requesting that JAL exhibit the wreckage of Flight 123 for safety awareness education of JAL employees."

Another factor was that some of the bereaved families of Flight 123 many years earlier had requested that JAL exhibit the wreckage for basically the same purpose. Third, the personal sentiments of JAL Group's former CEO Toshiyuki Shinmachi came into play in favor of a permanent exhibit.

Attendance Required

External advice and comments from general visitors, those from outside the JAL Group, influenced a related company policy. Regardless of job title, new employees are required to take the tour as part of the center's safety awareness course. "Almost all general visitors said that the JAL employee must never forget the pain of the victims and the sadness of the bereaved families," Kanasaki said. "These are very heavy words to the JAL employee, and we must keep these words forever to keep flight safety, I believe. Awareness of the same feelings as the bereaved family or the victim is the first step to understand safety."²

Introductory panels about JAL Flight 123 include the "black boxes" recovered from the crash site.





The lower half of the complete aft pressure bulkhead exhibited helps explain the catastrophic in-flight failure.

So far, about 70 percent of JAL employees have taken the course. Some long-time employees also have visited the center in conjunction with evacuation training and ditching training, Miyachi said. “Every single pilot and every single cabin crewmember visited this center in 2008,” he said.

One new employee, a maintenance technician, left a comment saying that before his visit, he believed that his job was to “maintain the machine.” “After the visit, he said he understood that his job is not only the maintenance of a machine but also to keep the safety of passengers’ lives — a very big change in his emotion, I believe,” Kanasaki said.³

Tour Highlights

Operated by Corporate Safety and Security, the center occupies part of the second floor of a mid-rise office building in the Haneda Maintenance

Area. Tours begin in the Library Room, containing the official accident report in Japanese and its English translation; historical and technical books about air transport safety and human factors; and other documents, reports and non-fiction books associated with Flight 123.

Along one wall, panels summarize 10 major accidents that have occurred worldwide since airlines began operating turbine-engine airplanes. The adjacent panel chronologically shows the JAL accidents alongside 38 other fatal accidents involving large commercial jets. Other panels summarize the airline’s seven fatal accidents before Flight 123, including the probable cause of each and safety actions taken.

The Display Room is the largest area. Its centerpiece is both halves of the recovered aft pressure bulkhead. They are mounted horizontally for close inspection because of the

bulkhead’s critical role in the accident. Surrounding panels explain the causes of the accident and measures taken to prevent a recurrence.

Other major exhibits of the Display Room include a scale model of the airplane in JAL livery of the time, the vertical stabilizer root section, the vertical stabilizer upper section, the lower rudder’s upper section, sections of the aft fuselage, and four damaged passenger seats.

The introductory wall in the Display Room presents a multi-panel summary of the Flight 123 accident, showing the estimated flight path overlaid with excerpts transcribed from the cockpit voice recorder; a graph of selected data from the 74-parameter digital flight recorder (DFDR) validating the sequence of events; a diagram of areas of the aft fuselage and tail that separated during flight; diagrams of aircraft parts, which

have hand-painted numbers, coded to indicate the sites where they were recovered and the parts never recovered; and a cabin layout showing which seats were occupied by the crewmembers and passengers killed, and those occupied by passengers who survived.

The tour begins at a panel on which a white line shows the estimated flight path of Flight 123, a normal departure and climb to Flight Level 240 (approximately 24,000 ft) from Haneda, then a descent to Flight Level 220 and an erratic 32 minutes of uncontrollable flight from soon after the aft pressure bulkhead ruptured to the crash site.

The main point of the reassembly and display of specific pieces of wreckage is to show how they contributed to understanding what happened. “The root section of the vertical stabilizer leading edge connected the tail section with the fuselage, for example,” Kanasaki said. “Parts of the vertical stabilizer leading edge, no. 5 to no. 11, were found and retrieved from the crash site. Pieces numbered 13, 14, 15 and 16 are parts of the vertical stabilizer; no. 13 was found and retrieved from the mountainous area in the Tokyo suburbs. Numbers 14, 15 and 16 were found and retrieved from the crash site. The no. 17 wreckage, the upper section of the lower rudder, was retrieved from Sagami Bay.”

The DFDR-derived graph of aircraft altitude, airspeed, longitudinal acceleration and roll attitude data — along with video narration and a flight crew–air traffic control (ATC) voice re-enactment — give visitors a minute-by-minute sense of what the flight crew experienced while attempting to maintain stable flight, turn, climb, descend and communicate with ATC. “The longitudinal acceleration data continue normally until the data skips, meaning that some impact force was applied in the forward direction,” Kanasaki said.

A video associates this impact force with rupture of the aft pressure bulkhead and air pressure from the cabin destroying the empennage, including the vertical stabilizer and the fuselage tail section. Fifty-five percent of the vertical stabilizer was lost, and the four hydraulic lines — which supplied hydraulic pressure to

an actuator for the upper and lower rudders — were severed causing total loss of fluid.

“From this time, all other data show the abnormal situation,” Kanasaki said. “The pitch instability — phugoid motion — and the roll attitude data also showed the [Dutch roll] oscillation from this time, a combination of yawing and rolling.”

On the tour, the exhibit of the upper and lower halves of the aft pressure bulkhead, combined with a video and scale models of repairs conducted after the 1978 tail strike, explain how the instantaneous failure along the joint caused cabin air to open a hole of about 2 to 3 sq m (22 to 32 sq ft) in the bulkhead.

A three-dimensional terrain model depicts three points of impact — the airplane struck a single larch tree, made a U-shaped gouge in a ridge line, then descended at 340 kt into a remote forest of larch trees 1,565 m (5,135 ft) above sea level about 2.5 km (1.4 nm) north-northwest of Mount Mikuni at the boundary of Gunma, Nagano and Saitama Prefectures.

Splice Plate Lesson

Explaining this catastrophic failure of the aft pressure bulkhead, Kanasaki said that the splice plate repair — as designed by the Boeing aircraft-on-ground team and approved by JAL and aviation authorities — would have provided a continuous load path except for changes during installation that did not conform to the approved design.

“The stress between the upper and lower halves of the bulkhead was concentrated in the

Kanasaki, top,
and Miyachi.



center row of the three rows of rivets,” he said. “An excessive load was applied in the center row and made a small crack around the rivet holes. Due to the repeated application of cabin pressurization during every takeoff and landing, the crack propagated little by little, and seven years later — at the 12,319th flight after the repair — the aft pressure bulkhead ruptured from this repaired area.” A tail compartment pressure-relief vent door functioned as designed “but was too small to relieve the high pressure from the big hole in the aft pressure bulkhead,” he added.

Displays positioned around the bulkhead halves highlight the complex corrective and proactive measures implemented. International and government-mandated measures focused on enhancement of maintenance programs, aircraft modification and organizational reinforcement for safety enhancement.

For example, Boeing design modifications for newly manufactured 747s included the use of reinforced aft pressure bulkheads and changes to routing of hydraulic lines. Modifications suitable for retrofit included adding a cover plate for the maintenance inspection access hole inside the vertical stabilizer and adding a hydraulic fuse to prevent fluid loss from one system if downstream plumbing ever were damaged. The U.S. Federal Aviation Administration’s Lessons Learned Library at <accidents-ll.faa.gov> also has an analysis of international improvements prompted by JAL Flight 123 among 40 worldwide accidents selected for safety education.

One corner of the Display Room has glass showcases containing keys, pens, eyeglasses, wristwatches and small debris, and panels showing five final handwritten messages. “Japan Airlines keeps about 2,700 personal

items that remained but whose ownership we could not identify,” he said. “We selected 17 of these items to show how big the impact of the crash was. The five watches show the correct time of the impact, they stopped at 1856.

“Debris was collected by one member of a bereaved family who picked up items every time he visited Osutaka Mountain. They have been donated by him. Three panels have the actual last messages written by five passengers. One is written on a timetable of Japan Airlines. A sixth message is a memo written by one of the cabin attendants. She expected an emergency landing and wrote the content of the emergency announcement on her notebook.”

Emotional Evolution

JAL has been open to suggestions about the center and further refinements. During its first two years, for example, each tour concluded at the personal effects area but some visitors left comments asking for reconsideration of the emotional impact of this order of presentation.

In January 2008, the company’s response was to add Display Room 2. “The newer exhibits show how close monitoring of aircraft has succeeded in limiting further damage or loss of lives,” Kanasaki said. “One display is a list of four accidents in which every safety factor worked well due to the best effort by the people involved. The other display is a chronological table that shows the relationship between these accidents and related technical improvements.” The improvements are broken down and graphically linked to subjects such as aircraft structure, warning systems and fire mitigation.

Policy updates on recurrent training at JAL recently have directed employees

to participate at their earliest opportunity in the center’s updated two-day safety promotion course, which includes a day trip to historically important sites outside Tokyo that are associated with the Flight 123 accident.⁴

To read an enhanced version of this story, go to the FSF Web site <www.flightsafety.org/asw/nov09/jal-center.html>.

Notes

1. Operated as JAL Flight 123, the airplane crashed at approximately 1856 local time Aug. 12, 1985, among the mountains of Ueno Village, Tano County, Gunma Prefecture, during a scheduled passenger flight from Tokyo International Airport, Haneda, to Itami International Airport, Osaka, Japan. A total of 505 passengers and 15 crewmembers were killed, and four passengers received serious injuries. The aircraft was destroyed, and a fire occurred at the crash site.
2. The night of the Flight 123 crash, Kanasaki was a junior-level aircraft maintenance technician suddenly called back to work at Haneda, Miyachi said. Kanasaki gathered heavy jackets, boots, gloves and other equipment for a first-response team. The next day, he was dispatched to Yokohama, where he sketched recovered parts on the shore of Sagami Bay and faxed his drawings to company specialists.
3. Two other new employees of JAL Group left comments saying, “The most important meaning [was] to find that our job has strong linkage with the passenger’s life,” and “I will visit ... again whenever I forget a mission of my job.”
4. Sites include the Ueno Village Memorial Park, which contains an interment vault, engraved names of passengers and crewmembers killed, and a monument sculpted to represent hands pressed together in prayer; the Osutaka Mountain trail, marked with a plaque containing excerpts from commemorative remarks by former U.S. National Transportation Safety Board Chairman James E. Burnett Jr.; the Flight 123 monument at the crash site; and a prayer bell.