Dinner Speech

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"Air Safety"

1. Introduction
   A. The overarching maxim about safe flying: aviate, navigate, communicate.
   B. LORAN symposium is about navigating, and about DEPTH of protections.
   C. Sole-means is about a lack of depth, and hence too slender a margin of safety defenses-in-depth
   D. Consider humorous maxims about air safety, which touch on the issues of depth, or margins:
      (1) You start with a bag full of luck and an empty bag of experience. The trick is to fill the bag of experience before you empty the bag of luck.
      (2) The three most useless things to a pilot are the altitude above you, the runway behind you, and a tenth of a second ago.
   E. That remark about a tenth of a second hints at the close and unforgiving tolerances on which the industry operates:
      (1) The signal from space: About that of starlight, or one ten quadrillionth of a watt (1^{-16}). About 2,000 times lower energy density than the signal from the local TV station on your home antenna.
      (2) Aircraft wiring: 150 miles of it in a typical widebody. 1/10-inch diameter wire carrying 120 or 280-volt current. Insulation, about the thickness of 4 human hairs laid side-by-side. As one wiring expert said, "We're four hairs away from electrocution."
      (3) Flight controls: Jackscrew and gimbal nut on the T-tail of DC-9 and MD-80/90 series aircraft, also in Canadair regional jet: 40,000-inch slack between the nut and the jackscrew. At 41,000-inch slack, it has to be replaced with a matched pair.
      (4) Another flight control example: B737 rudder, with the dual-concentric servo valve, now deemed necessary to replace. The secondary valve could cause an uncommanded rudder reversal if more than .012 inch off null in axial travel.
      (5) Fuel systems: the energy needed to cause an explosion of flammable vapors in a fuel tank has been adjusted downward tenfold since TWA 800. Now: 0.02 millijoule spark sufficient: the energy equivalent of dropping a dime 3/8 of an inch.

2. Shifting the Focus
   A. These statistics underscore the old aphorism: sweat the small stuff and the big things will take care of themselves.
   B. What is the big-picture view of the state of the industry with respect to safety? To help put the navigation issue in context.
   C. Let me zoom out from the tiny tolerances to a broad, across-the-waterfront view.
      (1) Borrow heavily from concerns expressed recently by Kenneth Mead, inspector General of the Dept. of Transportation.
      (2) Augmented by my own perspective as editor of *Air Safety Week*.

3. Walk Across the Safety Waterfront
   A. Mead: A cluster of issues is coming to a head, and safety "is an abyss in this debate." Mead's cluster: indicators of a system pushing to the very limits of the physical and electronic infrastructure: delays, flight cancellations, customer service, air traffic control modernization,

airport infrastructure, and safety. Occurring in the face of the public's seemingly insatiable demand for air travel.

B. Mead: the metrics of safety show an "alarming" negative trend.
   (1) Indicators of the limits being approached:
      (a) Delays: One in 5 flights arrived late in 1999 with delay averaging 50 minutes. In 2000, average delay time increased to nearly 54 minutes, with one in 4 flights delayed or cancelled outright.
      (b) Taxi times: Number of flights with taxi-out time of an hour or more has increased 130% 1995-1999. Mead observes: "Nearly 85% of your delay time will happen on the ground."
      (c) Expanded schedules: To compensate for rising tide of delays, airlines are expanding flight schedules, as much as 30 minutes, on nearly 80% of their domestic routs.
   (2) Cracks in the safety floor:
      (a) Runway incursion numbers are "alarming." Up 60% from 200 in 1994 to 321 in 1999.
      (b) The number continues to rise. 322 this year; if trend continues, the number of incursions will pass the 400 mark in 2000, the highest ever. The rate is increasing along with the absolute number.
      (c) Operational errors: These occur when a controller fails to ensure that separation standards are maintained. Most occur in mid-air. They have increased more than 50% from 764 to 1,154 in 2000.
   (3) Sobering constraints:
      (a) ATC modernization: Most of the effort is aimed at replacing aging equipment with modern gear that is easier to operate and maintain. These programs do not, in and of themselves, provide capacity enhancements.
      (b) Free flight. Phase 1 involves the Passive Final Approach Spacing Tool, pioneered by NASA. It is helping controllers land about 2 additional aircraft at DFW during peak periods.
      (c) Runways: More concrete is needed. In last decade, only 5 new runways were added t the nation's top 29 airports. Another 15 runways under construction or planned for these airports will not be opened for another 3-7 years. Little short-term relief here.
      (d) Satellite navigation. Mead: "Analyses show that a sizeable portion of benefits from satellite navigation is the time passengers are expected to save once the system is in place. However, these savings include small increments in time – a minute or less per trip.

C. Mead believes capacity benchmarks are needed for top 30 airports. What can the system reasonably be expected to handle, under good weather conditions, without experiencing major delays.
   (1) Immediate term (next year or two)
   (2) Intermediate term (next 4-5 years)
   (3) Longer term (next 8-10 years)

D. So we have a capacity crunch, forcing compromises that are eroding the margins of safety.

E. Evans' list of additional safety issues facing the industry. Not just the U.S. -- globally:
   (1) Pilot proficiency: 2 crashes this year, one at Bahrain and the other at Patna, India, involving failed go-arounds in good weather. American Airlines: pumping an extra $1 billion into recurrent training. Loss of huge pool of military pilots (a form of airmanship subsidy the industry enjoyed for many years).
   (2) The electric jet: Bob Baker, American Airlines, said recently with chilling candor: "We have found that the electric airplane is an extremely demanding challenge even to our experienced pilots."
   (3) Maintenance mishaps (including ground handling): In 16 accidents in past 5 years in which people were killed and/or aircraft were lost, more than half involved mistakes outside the cockpit:
      (a) 2 basic weight and balance accidents
         Feb. 2000 Emery DC-8F
         Aug. 1997 Fine Air DC-8F
      (b) 8 accidents, including Alaska Air flt 261, maintenance and ground procedures related.

(4) Communications: English. April 1, 1999 near repeat of the 1975 tragedy at Tenerife, Canary Islands. Taxiing China Air B747F narrowly missed by KAL on takeoff. China Air pilots didn't speak a word of English. 2 translators (radio operators) in cockpit. At LAX, special procedures for aircrews with known limited proficiency in English. In an industry where instant comprehension and quick reflexes can by that tenth of a second between a near miss and disaster, this situation is unconscionable.

(5) Cabin safety: Economy class syndrome; recent case of 28-year old who died of deep vein thrombosis after 20-hour flight from Sydney to London). Air quality and amount. Germs. Emergency evacuation (extending the distance between doors from 60 to about 80 feet, and the coming double-decker. British Airways engineering review of cabin air quality (prompted by reports of fainting pax). In-flight turbulence injuries. "The hazards' within" include flimsy overhead bins and latches, unsecured serving carts.

(6) Fuel tanks: 20 fuel tank explosions and more than 500 dead. The record of the reigning design philosophy (to hunt down all ignition sources while accepting the presence of flammable vapors) is not good. Fear of another (Mother's Day 1998 grounding of high-time 737's). Ongoing: FAA-industry fuel tank inerting harmonization working group.

(7) Electrical systems: E&E bay unprotected with fire detection and suppression. Swissair 111 investigation will document deficiencies in design, installation and maintenance practices (e.g., hooking IFEN to flight-essential bus).

(8) ETOPS: Ongoing effort to extend the one-engine out flight planning to 207 minutes (3 hours, 27 minutes). 225, 240 and unlimited ETOPS on the horizon. Related issue: Polar routes. Adequacy of emergency response; divert airfields (pick up truck with a couple Halon extinguishers?). Not one additional ounce of added Halon on the B777 – metering rate was changed.

(9) Fatigue: Recent *CBS 60 Minutes* segment: pilots sleeping in the cockpit. Remember, maintenance technicians can be ordered to work back-to-back shifts. Potential for both in-flight and maintenance judgment errors (crash at Little Rock June 1, 1999, near end of 14 hour duty day).

(10) Security: A Potemkin village. Portals do not detect explosives in one's pocket. Electronic devices can be rigged to function properly while concealing a timer. Only a small percent of bags are examined by EDS (explosive detection) systems, yet these million-dollar machines are underutilized. Bifurcation of responsibility: airports, for security of real estate, airlines for security of what goes on the airplane; elsewhere in world, airport authorities are totally responsible. Is our security system, with airlines in charge, intended to maximize screening or minimize schedule disruption?

(11) Icing: Hundreds of regional jets entering service with hard wings (e.g., no leading edge devices). Widespread apprehension: vulnerability to icing, and a repeat of the early DC-9 experience. Air Canada accident at Fredericton, Canada, in 1997. 50-pax CRJ stalled just before touchdown, ploughed into snowbank off the runway. Nobody killed, but airplane totaled. Sealant on leading edge of wing either missing or protruding 2-3mm. TSB final report: "The protruding sealant can produce a significant detrimental effect on the airflow over the wings at high angles of attack. The sensitivity of the CL-65 wing to its surface condition was not made apparent in either the approved maintenance program, the maintenance manual, or the aircraft operating manual."

(12) Oversight: The Federal Aviation Administration as guardian of the public trust. Underfunded and under siege. POI of American Airlines: have 16 people, need 20 + an analyst. ATOS (Air Transport Oversight System) dead in the water without adequate staffing. Notes from a retreat after last summer's fiasco involving lack of FAA oversight at Alaska Airlines (Not "sleepless in Seattle," but "sleeping in Seattle"):

- Nick Lacey, director of flight standards: "Serious questions are being asked by the Congress and the White House. Is this agency performing its duty on safety?" "We cannot afford an accident with a new carrier and an unqualified inspection team in place."
- Tom McSweeny: "Tough questions…why did 230 people have to die for us to figure out that fuel tanks could be improved?" Congress is proposing an oversight committee…the message is that our board of directors – Congress – is not confident in

our ability to manage. It's as simple as that. They do not believe that we are aware of what's going on in our system."

F. That's my "dirty dozen" of threats to air safety. Inspector General Mead's concerns about runway incursions and operational errors round out this crude but telling "walkabout" of the state of the industry.

4. The common thread
   A. Depth is under duress. Across the board.
   B. Your fight for dissimilar, redundant navigation systems is part of the larger tapestry.
   C. Putting the sole means issue in context:

The company commander and his 1stSgt. were in the field. As they hit the sack for the night, the 1stSgt. said, "Sir, look up into the sky and tell me what you see?"

The CO replied, "I see millions of stars."

The 1stSgt. asked, "And what does that tell you, sir?"

CO: "Astronomically, it tells me that there are millions of galaxies and potentially billions of planets. Theologically, it tells me that God is great and that we are small and insignificant. Meteorologically, it tells me that we will have a beautiful day tomorrow. What does it tell you, 1stSgt?

"Well, sir, it tells me someone stole our tent."

D. The point: Let's remember the obvious. We must not let the tent of redundancy be stolen away from a navigation philosophy with a proven safety record.

Biography

David Evans is the Editorial Director for the Phillips' Aviation Group, and Managing Editor of *Air Safety Week,* a publication with extensive international distribution. He has a long and distinguished career in aviation journalism, and has received many awards for his work from the National Press Club and other professional journalism groups. Most recently, he became the first individual to receive two Royal Aeronautical Society's Millenium Aerospace Journalist of the Year Awards, in 1999 and 2000. This award is considered to be the "Oscar" of aviation journalism.

His background has also included extensive service as an officer in the US Marine Corp, and a stint as a Media Fellow at the Hoover Institute on War, Revolution and Peace at Stanford University. David has degrees from the University of Illinois and the University of Nebraska, and has done post-masters work at The George Washington University.

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