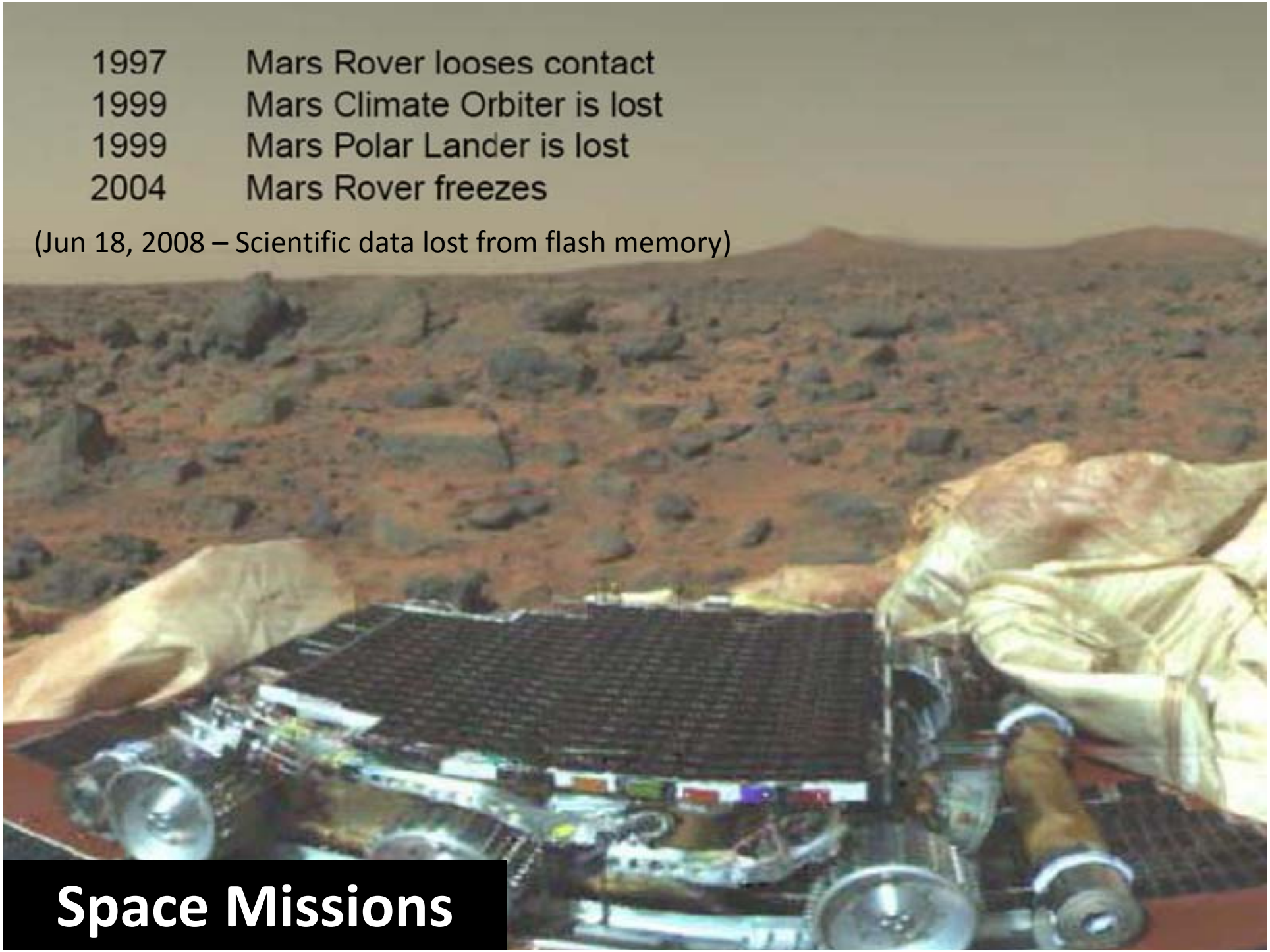
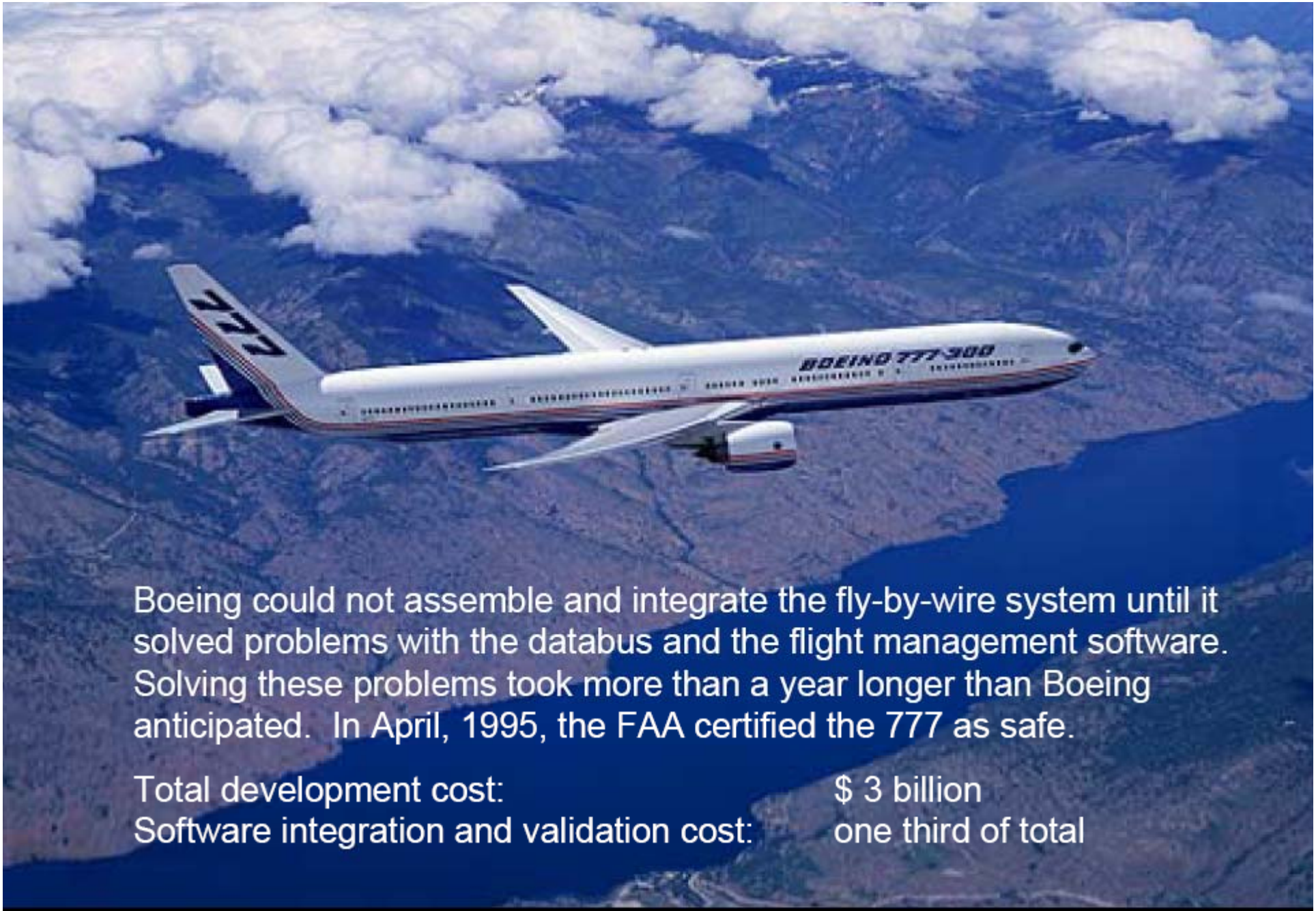
How important is reliability for embedded system software?


French Guyana, June 4, 1996
t = 0 sec
t = 40 sec
$800 million software failure
Space Missions



Space Missions



Boeing could not assemble and integrate the fly-by-wire system until it solved problems with the databus and the flight management software. Solving these problems took more than a year longer than Boeing anticipated. In April, 1995, the FAA certified the 777 as safe.

Total development cost:	$ 3 billion
Software integration and validation cost:	one third of total

Air Transport

August 2005

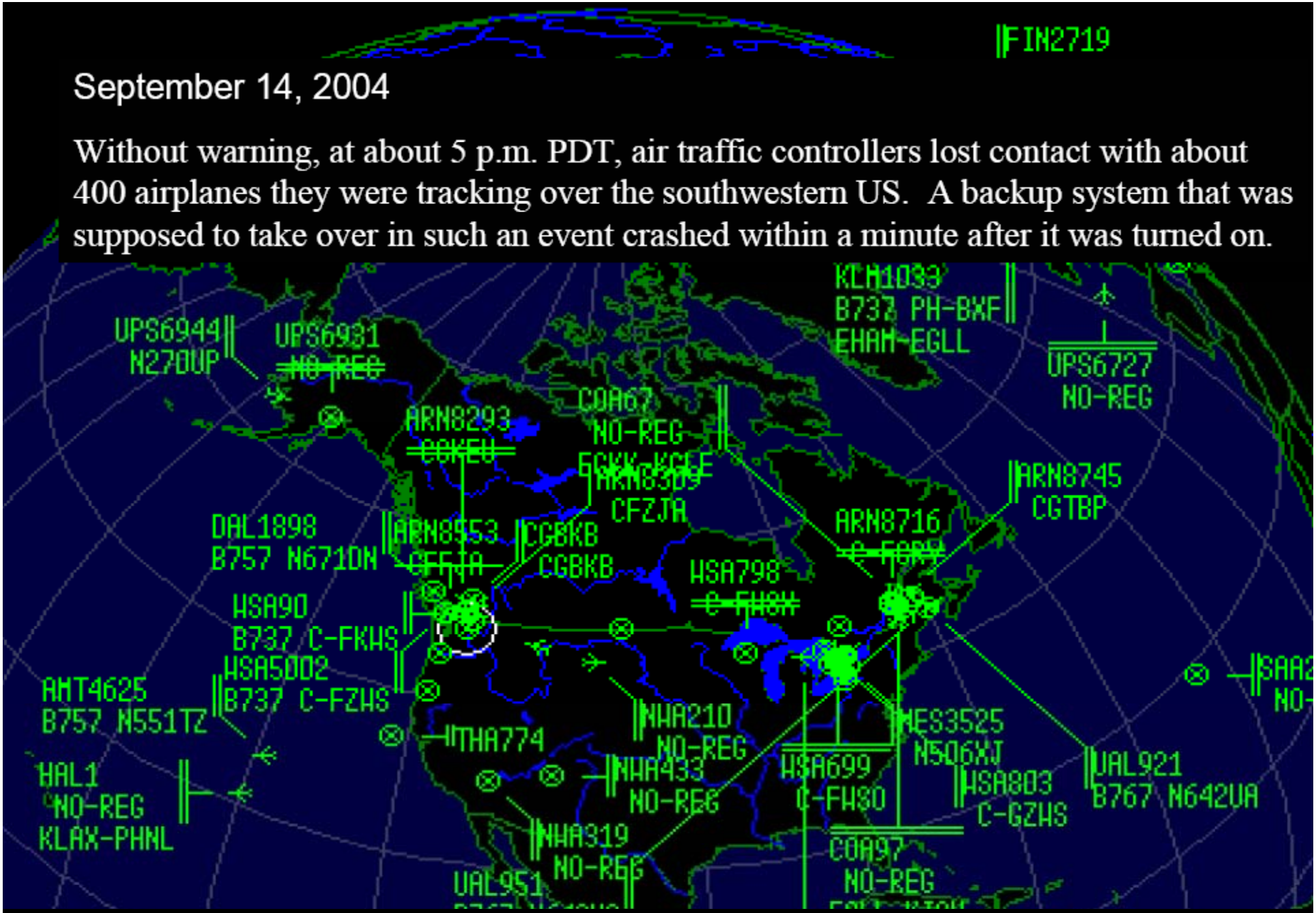
Gerardo Dominguez/zrh.airlinerpictures.net

As a Malaysia Airlines jetliner cruised from Perth, Australia, to Kuala Lumpur, Malaysia, one evening last August, it suddenly took on a mind of its own and zoomed 3,000 feet upward. The captain disconnected the autopilot and pointed the Boeing 777's nose down to avoid stalling, but was jerked into a steep dive. He throttled back sharply on both engines, trying to slow the plane. Instead, the jet raced into another climb. The crew eventually regained control and manually flew their 177 passengers safely back to Australia.

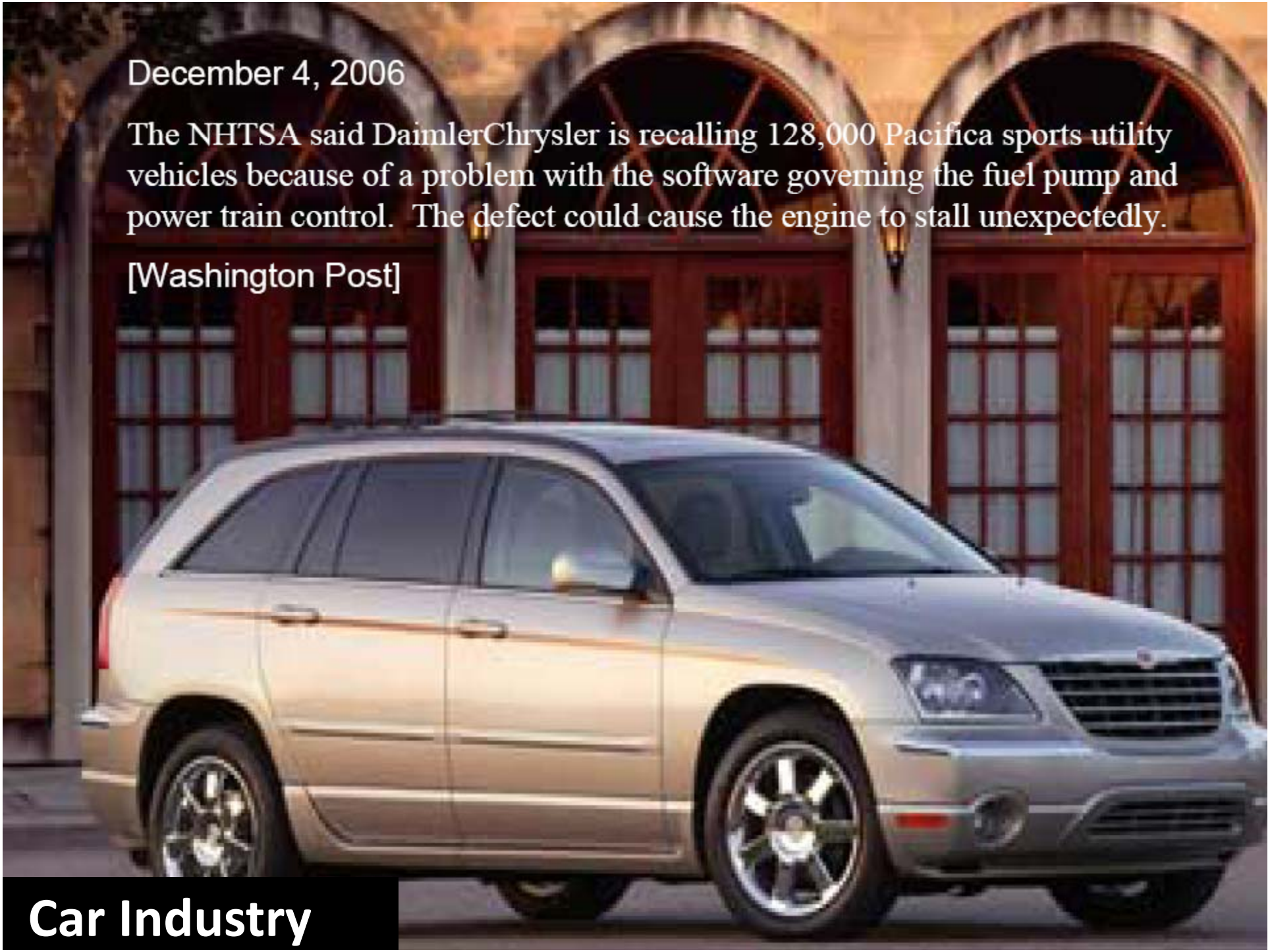
Investigators quickly discovered the reason for the plane's roller-coaster ride 38,000 feet above the Indian Ocean. A defective software program had provided incorrect data about the aircraft's speed and acceleration, confusing flight computers.

September 14, 2004

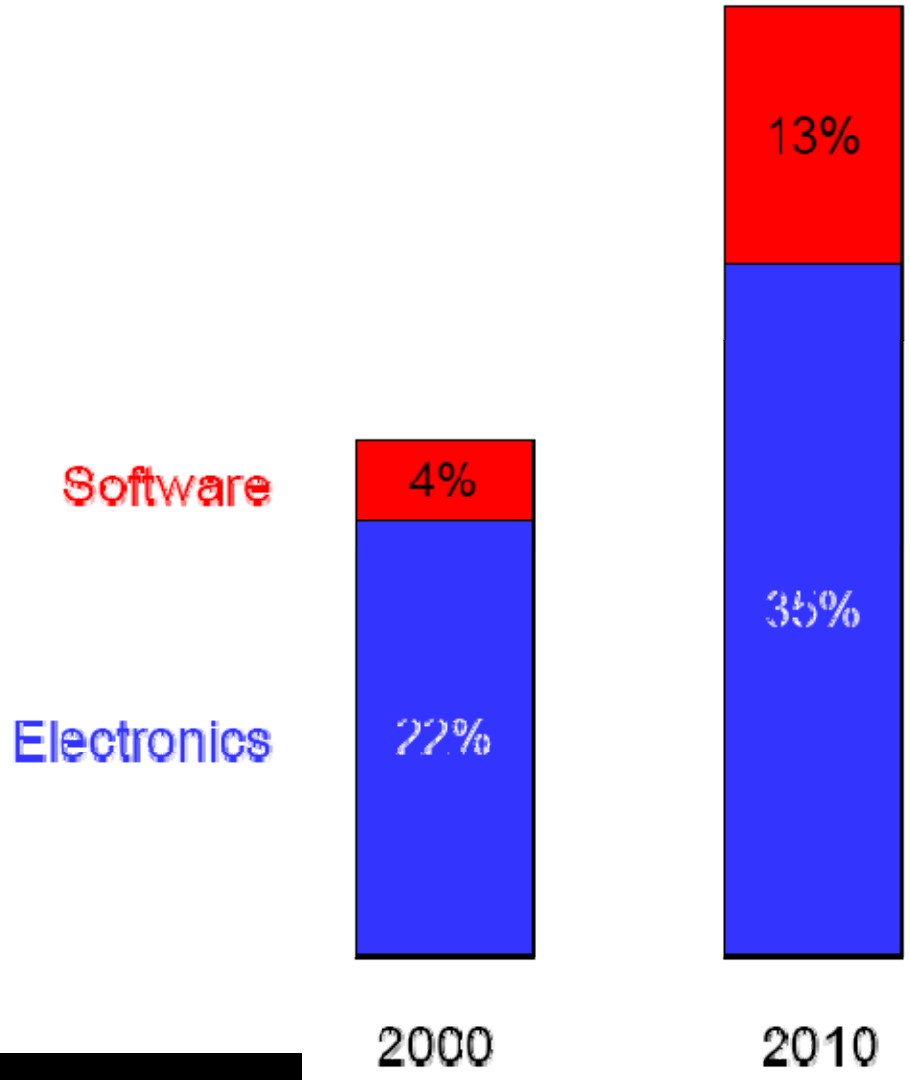
Without warning, at about 5 p.m. PDT, air traffic controllers lost contact with about 400 airplanes they were tracking over the southwestern US. A backup system that was supposed to take over in such an event crashed within a minute after it was turned on.



Air Transport

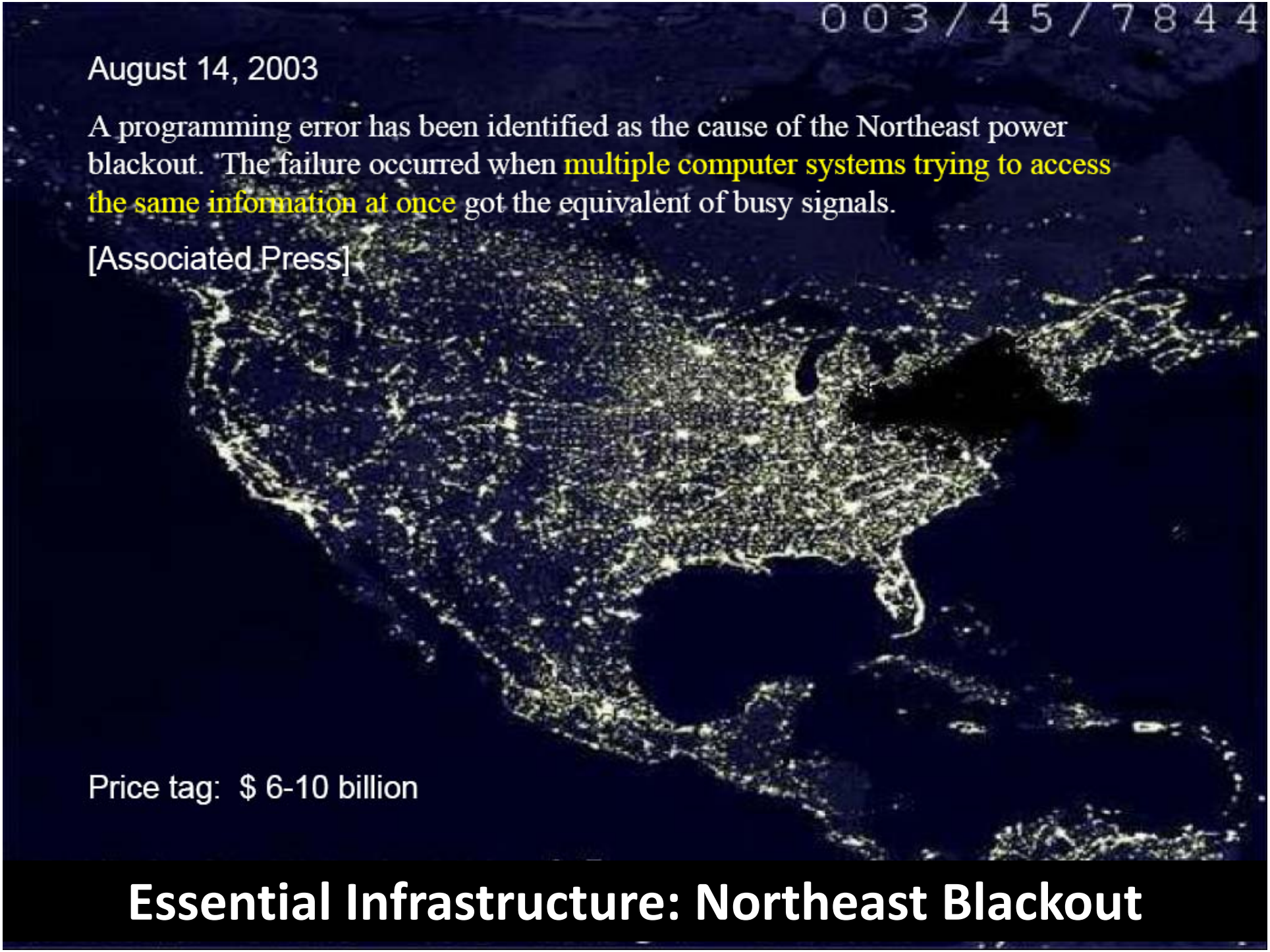

December 4, 2006
The NHTSA said DaimlerChrysler is recalling 128,000 Pacifica sports utility vehicles because of a problem with the software governing the fuel pump and power train control. The defect could cause the engine to stall unexpectedly.
[Washington Post]
Car Industry

Production Cost of Automobiles

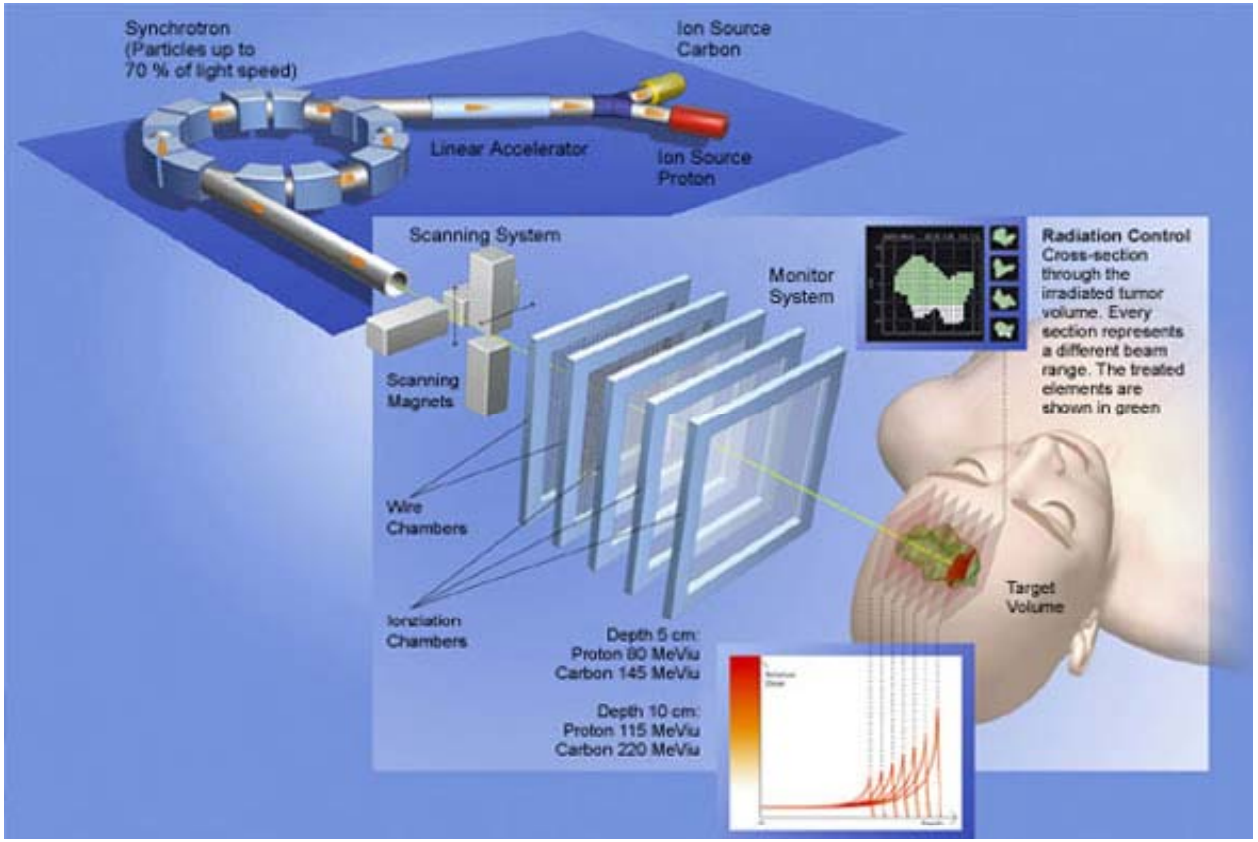


[MIT Tech Review]

Car Industry



Essential Infrastructure: Northeast Blackout



Radio Therapy

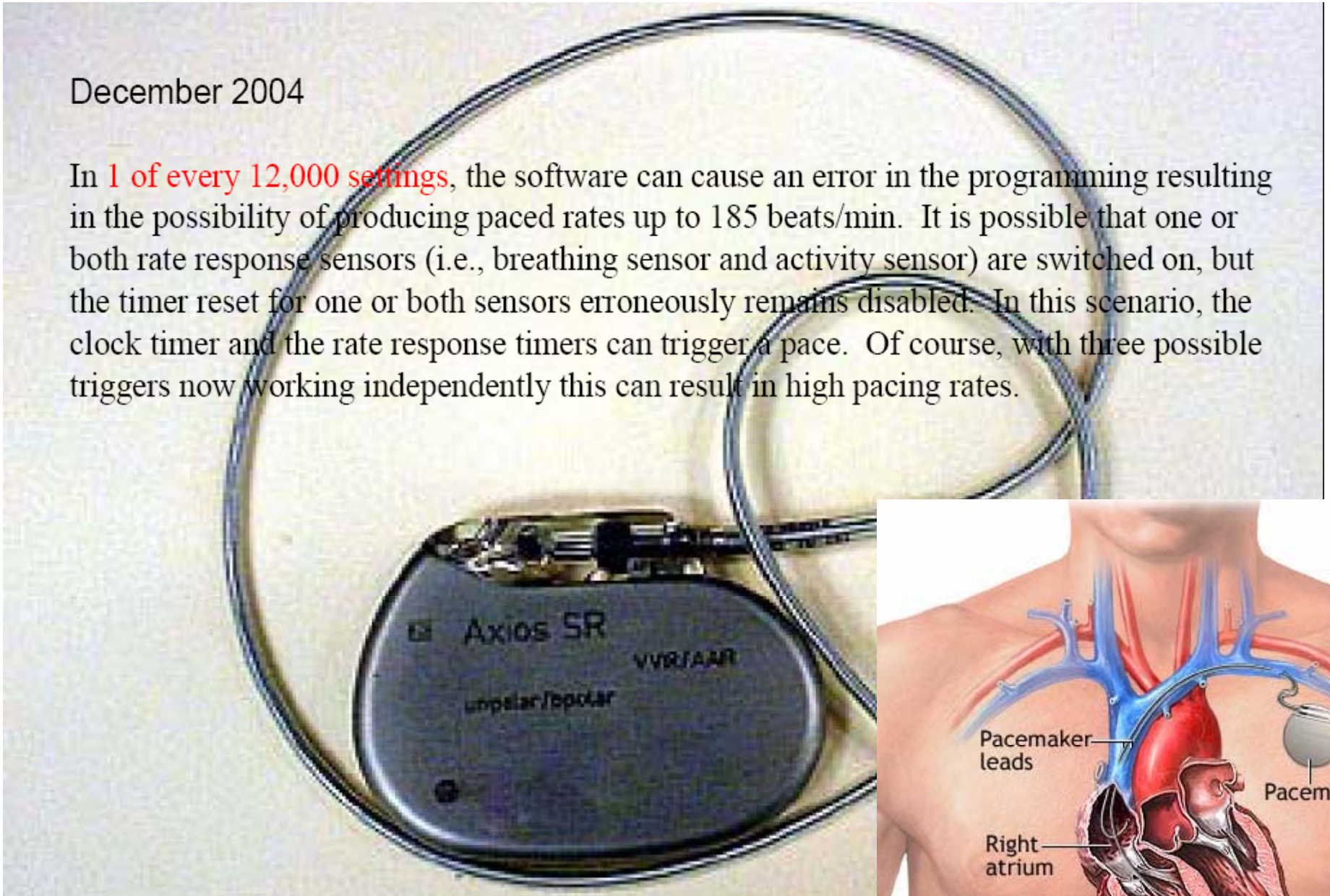
Between June 1985 and January 1987, a computer-controlled radiation therapy machine, called the Therac-25, massively overdosed six people. These accidents have been described as the worst in the 35-year history of medical accelerators [6].

Nancy Leveson
Safeware: System Safety and Computers
Addison-Wesley, 1995

Life-Critical Medical Devices

December 2004

In 1 of every 12,000 settings, the software can cause an error in the programming resulting in the possibility of producing paced rates up to 185 beats/min. It is possible that one or both rate response sensors (i.e., breathing sensor and activity sensor) are switched on, but the timer reset for one or both sensors erroneously remains disabled. In this scenario, the clock timer and the rate response timers can trigger a pace. Of course, with three possible triggers now working independently this can result in high pacing rates.



[Journal of Pacing and Clinical Electrophysiology]

Life-Critical Medical Devices