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Boeing 787 Bug (2015)



ben goldacre ✓
@bengoldacre



If you leave your Boeing 787 switched on for 248 days the power shuts off and you fall out of the sky. Epic bug.



US aviation authority: Boeing 787 software bug could cause 'loss of control'
More trouble for Dreamliner as Federal Aviation Administration warns glitch in control unit causes generators to shut down if left powered on for 248 days

theguardian.com

11:41 AM · May 1, 2015 · [TweetDeck](#)

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2015-0936; Directorate Identifier 2015-NM-058-AD; Amendment 39-18153; AD 2015-09-07]

RIN 2120-AA64

Airworthiness Directives; The Boeing Company Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule; request for comments.

SUMMARY: We are adopting a new airworthiness directive (AD) for all The Boeing Company Model 787 airplanes. This AD requires a repetitive maintenance task for electrical power deactivation on Model 787 airplanes. This AD was prompted by the determination that a Model 787 airplane that has been powered continuously for 248 days can lose all alternating current (AC) electrical power due to the generator control units (GCUs) simultaneously going into failsafe mode. This condition is caused by a software counter internal to the GCUs that will overflow after 248 days of continuous power. We are issuing this AD to prevent loss of all AC electrical power, which could result in loss of control of the airplane.

DATES: This AD is effective [INSERT DATE OF PUBLICATION IN THE FEDERAL

248 days?

Lots of computers have clocks that “tick” every 10ms.

$$2^{31} = 2147483648$$

$$2^{31} \text{ ticks} = 21,474,836 \text{ seconds}$$

$$21,474,836 \text{ seconds} = 248.6 \text{ days}$$

The largest positive value you can store in a 32-bit *signed* integer is $2^{31} - 1 = 2147483647$

$$2147483647 + 1 = -2147483648 \text{ (in signed 32-bit arithmetic)}$$

Mars bugs

Mars Climate Orbiter, 1999



Software specification bug

- Lockheed Martin's trajectory software produced thruster firing data in units of pound-force seconds.
- NASA's software on the orbiter expected thruster firing data in units of newton seconds.
- Encountered Mars at altitude of 60km instead of intended altitude of 150km.

Mars Polar Lander, 1999



Crashed on Landing

- Relied on sensors in legs to detect touchdown.
 - Sensors occasionally produced glitched readings.
 - If two consecutive readings indicated touchdown, latch the reading.
- From 5 km to 40 metres, descent mode: don't believe the leg sensors!
 - Turbulent environment, false readings are common.
 - But got two consecutive "landed" readings, so latched the reading.
- At 40 metres, switched to landing mode.
 - Should have cleared latched readings.
 - Didn't, so turned engines off.