Turkish Airlines Boeing 737 TC-JGE crash, Schiphol, Holland, 25th February 2009
(adapted from Dutch Safety Board report, May 2010)

Aircraft was on final approach at Schiphol.
Right autopilot engaged (using right hand radio altimeter).
Approaching glide path from above.

Left radio altimeter system fault caused "-8 feet" altitude signal. This automatically reduced the thrust of both engines to idle ('retard flare mode'). *The system design was non-redundant.*

Landing approach was not stabilised at 1000 feet – pilot should have initiated a go-round.

Right autopilot continued to attempt to follow glide path despite falling speed. Pitch increased until stall warning was activated. The 'approach to stall' procedure was not executed properly, causing aircraft to stall and crash.

"The problems with radio altimeter systems in the Boeing 737-800 fleet had been affecting several airlines, including Turkish Airlines, for many years and were known to Boeing and the Federal Aviation Administration of the United States of America."

"In 2008, 15 of the 2,569 reports regarding the radio altimeter system had an effect on the behaviour of the automatic flight system. Two of these concerned the autothrottle resulting in activation of the 'retard flare' mode. Boeing estimated that in 2008 there were 456 incidents where erroneous radio altimeter height was provided by one of the two radio altimeter systems without a failure warning on the primary flight display."

"Although Boeing and the FAA had, for years, been aware of the fact that the radio altimeter caused problems and affected other systems, this was not considered as a safety problem. Reports of problems with radio altimeter systems justified a renewed analysis of the radio altimeter system."

"From 2003 the Rockwell Collins Enhanced Digital Flight Control System (EDFCS), with an integrated autothrottle, was built into new Boeing 737 NGs. The system control software for the EDFCS was updated four times from 2003 to 2009. In this period the FAA made one update of the operating system software mandatory.
"As part of the operating system software update a function was built into the Collins EDFCS to compare the left and right radio altimeter heights. This reduced the possibility of an activation of an unwanted 'retard flare' mode. The autothrottle 'retard flare' mode can only be activated when the difference between the two radio altimeter heights is not more than 20 feet. The problems with the radio altimeter system remained. The improved software for the Collins EDFCS was installed in new aircraft from 2006 onward. The older generation aircraft which were equipped with a Smiths autothrottle (approximately 1200 aircraft, including TC-JGE) could not use this update. The system control software of the various manufacturers is not interchangeable."

Stall and crash about 1 mile short of runway. 9 dead, 120 injured.