

# Boeing 737 MAX flight controls

A European document shows aviation regulators were aware that certain flight conditions similar to those experienced in recent crashes could require pilots to manipulate a rarely used wheel in the aircraft's centre console to better control the nose position rather than the usual electronic thumb switch on the control yoke.

## STRUGGLE FOR CONTROL

Information retrieved from the flight data recorder of Lion Air Flight JT610 that crashed into the sea in October last year, showed the "stick shaker" was vibrating the captain's controls, warning of a stall throughout most of the 13 minutes aloft based on what investigators believe to have been erroneous data on its **angle of attack** to the oncoming air.

The airplane's **anti-stall system** repeatedly pushed its nose down, which is how pilots usually get air under the wings. The system reacted based on incorrect sensor reading, prompting an eight-minute battle between the captain pulling the nose back up and computers holding it down.



Pilots flying the same plane a day earlier had experienced a similar problem, but they used switches to shut off the system and trimmed manually.

## ANGLE-OF-ATTACK (AOA) SENSOR

Acts like a windvane, measuring the direction of air to determine the aircraft's angle-of-attack.



## WHAT THE ANTI-STALL SYSTEM PREVENTS

The angle of attack (AOA) is a key flight parameter that must remain narrow enough to preserve lift and avoid a stall.

### Low AOA



For a wing to produce lift, the air flowing past an aircraft must be aligned to the airfoil in order to provide a smooth airflow. Lift overcomes the weight of the aircraft.

### High AOA



As a wing increases its angle of attack, smooth airflow over the wing diminishes and eddies of air form, decreasing lift and causing the wing to approach stall speed.

### Stalling AOA



When a wing stalls, lift will no longer be produced. As the aircraft's weight is unopposed, it will fall towards the ground. But with sufficient altitude, stall recovery is possible by decreasing the AOA.

# B737 Technical Guide

**A Gutmann**



## **B737 Technical Guide :**

**The Boeing 737 Technical Guide (Standard Budget Version)** Chris Brady,2014-10-17 An illustrated technical guide to the Boeing 737 aircraft Containing extensive explanatory notes facts tips and points of interest on all aspects of this hugely successful airliner and showing its technical evolution from its early design in the 1960s through to the latest advances in the re engined MAX The book provides detailed descriptions of systems internal and external components their locations and functions together with pilots notes a detailed guide to airtesting and technical specifications It is illustrated with over 500 black white photographs diagrams and schematics Chris Brady has written this book after many years developing the highly successful and informative Boeing 737 Technical Site known throughout the world by pilots trainers and engineers as the most authoritative open source of information freely available about the 737 THIS IS THE B W PERFECT BOUND VERSION FOR FULL COLOUR HARDBACK COIL BOUND POCKET SIZE OR EPUB VERSIONS SEE OTHER LISTINGS [The Boeing 737 Technical Guide \(Pocket Budget Version\)](#) Chris Brady,2014-10 An illustrated technical guide to the Boeing 737 aircraft Containing extensive explanatory notes facts tips and points of interest on all aspects of this hugely successful airliner and showing its technical evolution from its early design in the 1960s through to the latest advances in the re engined MAX The book provides detailed descriptions of systems internal and external components their locations and functions together with pilots notes a detailed guide to airtesting and technical specifications It is illustrated with over 500 black white photographs diagrams and schematics Chris Brady has written this book after many years developing the highly successful and informative Boeing 737 Technical Site known throughout the world by pilots trainers and engineers as the most authoritative open source of information freely available about the 737 THIS IS THE POCKET SIZE B W BOUND VERSION FOR OTHER SIZES BINDINGS COLOUR OR EPUB VERSIONS PLEASE SEE OTHER LISTINGS **The Boeing 737 Technical Manual** Chris Brady,2006 This book is a plain English illustrated technical guide intended to fill in the gaps left by existing publications It contains facts tips photographs and points of interest rather than simply being a reproduction of the manuals Foreword **Advancements in Electric Machines** J. F. Gieras,2008-11-14 Traditionally electrical machines are classified into d c commutator brushed machines induction asynchronous machines and synchronous machines These three types of electrical machines are still regarded in many academic curricula as fundamental types despite that d c brushed machines except small machines have been gradually abandoned and PM brushless machines PMBM and switched reluctance machines SRM have been in mass production and use for at least two decades Recently new topologies of high torque density motors high speed motors integrated motor drives and special motors have been developed Progress in electric machines technology is stimulated by new materials new areas of applications impact of power electronics need for energy saving and new technological challenges The development of electric machines in the next few years will mostly be stimulated by computer hardware residential and public applications and transportation systems land sea and air At many Universities

teaching and research strategy oriented towards electrical machinery is not up to date and has not been changed in some countries almost since the end of the WWII. In spite of many excellent academic research achievements, the academia-industry collaboration and technology transfer are underestimated or quite often neglected. Underestimation of the role of industry, unfamiliarity with new trends, and restraint from technology transfer results with time in lack of external financial support and a drastic decline in the number of students interested in Power Electrical Engineering.

**Stratospheric Flight** Andras Sóbester, 2011-06-28. In this book, Dr. Andras Sóbester reviews the science behind high altitude flight. He takes the reader on a journey that begins with the complex physiological questions involved in taking humans into the death zone: How does the body react to falling ambient pressure? Why is hypoxia (oxygen deficiency) associated with low air pressure so dangerous, and why is it so difficult to design out of aircraft? Why does it still cause fatalities in the 21st century? What cabin pressures are air passengers and military pilots exposed to, and why is the choice of an appropriate range of values such a difficult problem? How do high altitude life support systems work, and what happens if they fail? What happens if cabin pressure is lost suddenly or even worse slowly and unnoticed? The second part of the book tackles the aeronautical problems of flying in the upper atmosphere: What loads does stratospheric flight place on pressurized cabins at high altitude, and why are these difficult to predict? What determines the maximum altitude an aircraft can climb to? What is the coffin corner, and how can it be avoided? The history of aviation has seen a handful of airplanes reach altitudes in excess of 70,000 feet: what are the extreme engineering challenges of climbing into the upper stratosphere? Flying high makes very high speeds possible: what are the practical limits? The key advantage of stratospheric flight is that the aircraft will be above the weather, but is this always the case? Part three of the book investigates the extreme atmospheric conditions that may be encountered in the upper atmosphere: How high can a storm cell reach, and what is it like to fly into one? How frequent is high altitude clear air turbulence, what causes it, and what are its effects on aircraft? The stratosphere can be extremely cold: how cold does it have to be before flight becomes unsafe? What happens when an aircraft encounters volcanic ash at high altitude? Very high winds can be encountered at the lower boundary of the stratosphere: what effect do they have on aviation? Finally, part four looks at the extreme limits of stratospheric flight: How high will a winged aircraft ever be able to fly? What are the ultimate altitude limits of ballooning? What is the greatest altitude that you could still bail out from? And finally, what are the challenges of exploring the stratospheres of other planets and moons? The author discusses these and many other questions, the known, the unknown, and the potential unknowns of stratospheric flight through a series of notable moments of the recent history of mankind's forays into the upper atmosphere, each of these incidents, accidents, or great triumphs illustrating a key aspect of what makes stratospheric flight aviation at the limit.

**Airways**, 2007. **Validation of Aircraft Noise Prediction Models at Low Levels of Exposure**, 2000. **QF32** Richard De Crespigny, 2012-08-01. In 2010, what began as a routine long haul flight from Singapore to Sydney came within a knife edge of becoming one of the

world's worst ever air disaster When a sudden mid air explosion shattered engine no 2 of the Qantas A380 the largest and most advanced passenger plane ever built shrapnel ripped through the wing and fuselage creating chaos as it destroyed vital flight systems In other hands the plane might have been lost with all 466 people on board but a supremely experienced flight crew led by Captain Richard De Crespigny managed to safely land it after hours of nerve wracking effort This is the riveting blow by blow story of QF 32 and how a mortally wounded plane was saved *Runway Overrun and Collision Southwest Airlines Flight 1248, Boeing 737-7H4, N471WN, Chicago Midway International Airport, Chicago, Ill, December 8, 2005* United States. National Transportation Safety Board,2007 On December 8 2005 about 1914 central standard time Southwest Airlines SWA flight 1248 a Boeing 737 7H4 N471WN ran off the departure end of runway 31C after landing at Chicago Midway International Airport Chicago Illinois The airplane rolled through a blast fence an airport perimeter fence and onto an adjacent roadway where it struck an automobile before coming to a stop A child in the automobile was killed one automobile occupant received serious injuries and three other automobile occupants received minor injuries Eighteen of the 103 airplane occupants 98 passengers 3 flight attendants and 2 pilots received minor injuries and the airplane was substantially damaged The airplane was being operated under the provisions of 14 Code of Federal Regulations Part 121 and had departed from Baltimore Washington International Thurgood Marshall Airport Baltimore Maryland about 1758 eastern standard time Instrument meteorological conditions prevailed at the time of the accident flight which operated on an instrument flight rules flight plan The National Transportation Safety Board determined that the probable cause of this accident was the pilots failure to use available reverse thrust in a timely manner to safely slow or stop the airplane after landing which resulted in a runway overrun This failure occurred because the pilots first experience and lack of familiarity with the airplane autobrake system distracted them from thrust reverser usage during the challenging landing snip The safety issues discussed in this report include the flight crew's decisions and actions the clarity of assumptions used in on board performance computers SWA policies guidance and training arrival landing distance assessments and safety margins runway surface condition assessments and braking action reports airplane based friction measurements and runway safety areas P ix **Monthly Catalog of United States Government Publications** United States. Superintendent of Documents,1994 February issue includes Appendix entitled Directory of United States Government periodicals and subscription publications September issue includes List of depository libraries June and December issues include semiannual index *Aircraft Alerting Systems Criteria Study: Collation and analysis of aircraft system data* ,1977 **Monthly Catalogue, United States Public Documents** ,1994 *Aircraft Alerting Systems Criteria Study* J. E. Veitengruber,G. P. Boucek,W. D. Smith,1977 *ULD Handling Guide* International Air Transport Association,1986 *Crash Simulation of Vertical Drop Tests of Two Boeing 737 Fuselage Sections* Karen E. Jackson,2002 *Moody's Transportation Manual* ,1996 **Subject Guide to Books** ,1914 Contents v 1 History travel description **Vocational and Technical Resources for**

**Community College Libraries** Mary Ann Laun,1995     *Solutions Manual to Accompany Essentials of Materials Science*  
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