TWA Constellation crash, Reading, Pennsylvania (1946) ................................................................. 4

A tiny electrical stud caused a fatal accident, resulting in the grounding of all Constellations.

Eastern Airlines DC-4 crash, Port Deposit, Maryland (1947) ................................................................ 9

One of the few "for reasons unknown" crashes in the history of U.S. air accident investigation still has experts puzzled after nearly fifty years.

United Airlines DC-6 crash, Bryce Canyon, Utah (1947) ................................................................. 14

An in-flight fire caused the crash of a DC-6 at Bryce Canyon, Utah.

In-flight propeller reversals (1940s-1960s) ......................................................... 20

Commercial U.S. airline aircraft experienced inadvertent propeller-pitch reversals caused by mechanical and electrical malfunctions in the propeller reversing mechanism.
BOAC Comet crashes, Mediterranean islands of Elba and Stromboli (1954) ................................................................. 26

Two new jetliners exploded in midair; the cause was eventually traced to metal fatigue cracks around a small window in the upper fuselage that developed during pressurization and depressurization cycles.

TWA Super-Constellation and United Airlines DC-7 collision, Grand Canyon, Arizona (1956) .............................................. 33

Two airliners collided in empty airspace—an "impossible" accident that led to the creation of the Federal Aviation Administration.

Lockheed Electra crashes, Indiana and Texas (1959-1960) ............................................................................................... 39

An investigation of unprecedented scope into wing failure occurring in a brand-new airliner eventually blamed a relatively obscure physics phenomenon known as whirl mode.

United Airlines DC-8 and TWA Constellation collision, New York City (1960) ............................................................... 46

A midair collision over Staten Island exposed weaknesses in an air traffic control system supposed to have been completely modernized.

Turkish Airlines DC-10 crash, Ermenonville, France (1974) ............................................................................................. 52

All three hundred and forty-six persons aboard a new DC-10 perished when the jet crashed just after takeoff from Paris.

American Airlines DC-10 crash, Chicago, Illinois (1979) ................................................................................................. 59

Crash after left engine ripped away from aircraft during takeoff killed 273 and prompted the FAA to temporarily rescind the airworthiness certification of the DC-10.

Air Canada DC-9 accident (1979) ................................................................................................................................. 65

The rear portion of a DC-9 fuselage ripped open in flight owing to fatigue cracks that had gone undetected in a recent inspection.

Japan Airlines Boeing 747 crash, Gumma, Japan (1985) ............................................................................................. 70

Crash of a Boeing 747 passenger aircraft caused by metal fatigue from previous repairs found to be faulty and undetected.

Midwest Express Airlines DC-9 crash, Milwaukee, Wisconsin (1985) ................................................................. 76

An inexperienced and improperly trained crew became disoriented after an engine failed during takeoff and flew the otherwise controllable airplane into the ground.
United Airlines Boeing 747 explosion, Hawaii (1989) ................................................................. 81

Explosive decompression caused by a design that allowed a stray electrical signal to overcome a complex electromechanical system of latches and locks.

United Airlines DC-10 crash, Sioux City, Iowa (1989) ................................................................. 87

The crash of a DC-10 aircraft due to an engine explosion and the subsequent loss of hydraulic power led to a massive National Transportation Safety Board investigation.

Lauda Air Boeing 767-300 crash, Thailand (1991) ........................................................................... 94

An inadvertent thrust reverser deployment flipped a jetliner into a crash dive that killed all two hundred twenty-three people on board.

El Al Boeing 747-200 crash, Amsterdam, The Netherlands (1992) .................................................. 101

Separation of both engines from right wing caused 747 to plunge fatally into apartment complex, drawing public attention to safety hazard raised by corroded Boeing engine mounting bolts.

ZR-2 (R-38) disaster, Hull, England (1921) ....................................................................................... 110

Anglo-American airship’s break-up during flight due to faulty design marked the beginning of America’s ill-fated airship program.

Roma crash, Langley Field, Virginia (1922) .................................................................................... 115

Faulty engines and use of a flammable gas caused an early twentieth-century airship to crash and explode, resulting in a large loss of life.

Shenandoah disaster, Ohio (1925) ..................................................................................................... 121

Storm’s destruction of the first American-built airship triggered both a revaluation of airship design and criticism of military policies.

R-101 crash, France (1930) .............................................................................................................. 127

Untested, overweight, unstable, underpowered airship with a gas leak crashed in France during a severe storm, resulting in a hydrogen explosion upon impact.

Akron crash (1933) .......................................................................................................................... 134

Crash of an advanced American airship into the Atlantic Ocean signalled the end of support for the military’s airship program.

Hindenburg crash, Lakehurst, New Jersey (1937) ............................................................................ 140

Last and largest commercial airship destroyed by hydrogen fire while landing.
Automobiles

Chevrolet Corvair suspension and heater controversy (1959-1963) ........................................ 150

Alleged design flaws in the Chevrolet Corvair's rear suspension brought the American automotive industry under federal regulation.

Ford Pinto rear-impact defect (1971-1976) ........................................ 156

Automobiles prone to burst into flames following rear-impact collisions led to a comprehensive recall and prolonged negative publicity and legal entanglements for Ford.

Firestone 500 steel-belted tire failure (1972-1978) ........................................ 163

Seven and a half million Firestone-built tires were recalled when it was discovered their treads were likely to separate from the main structure, especially when driven underinflated.

Audi 5000 sudden acceleration (1978-1986) ........................................ 170

Allegations of "sudden acceleration" led to public relations crises for Audi and the development of the automatic shift lock.

Bridges

Quebec Bridge collapses (1907, 1916) ........................................ 178

Inadequate design estimates of stresses on compression members led twice to the collapse during construction of bridges across the Saint Lawrence River.

Tacoma Narrows Bridge collapse, Washington State (1940) ........................................ 184

The failure that brought an abrupt end to the search for "a slender ribbon bridge deck" also introduced the importance of wind dynamics to bridge design.

Vancouver Second Narrows Bridge collapse, British Columbia (1958) ........................................ 191

The failure of temporary construction support caused the collapse of bridge spans.

King's Bridge failure, Melbourne, Australia (1962) ........................................ 196

"Brittle fracture" of supporting girders attributed to poor material quality and inadequate welding techniques caused the failure of a single-span section of a steel bridge.

Point Pleasant Bridge collapse, West Virginia/Ohio border (1967) ........................................ 202

The country's worst bridge disaster spurred research into the metallurgical properties of high-stress steel and halted use of some experimental cable designs.
West Gate Bridge collapse, Melbourne, Australia (1970) ........................................ 208

Negligence and other human errors were to blame for collapse of a steel span under construction in Melbourne, Australia.

Sunshine Skyway collapse, Florida (1980) ........................................ 214

Part of a bridge and its approach spans collapsed after the Sunshine Skyway bridge was struck by a freighter.

Highway ramp collapse, East Chicago, Indiana (1982) ........................................ 219

Poor quality scaffolding and numerous safety violations led to the fatal collapse of a portion of a highway ramp during construction.

Zilwaukee Bridge failure, Saginaw, Michigan (1982) ........................................ 224

The near-collapse of a bridge segment during the construction of a concrete-span freeway bridge delayed its completion for years and added millions of dollars to the project’s cost.

Mianus River Bridge collapse, Greenwich, Connecticut (1983) ........................................ 229

Collapse of one bridge span was caused by several factors, including lack of proper maintenance over twenty-five years.

Schoharie Creek Bridge collapse, New York State (1987) ........................................ 236

Two long-standing bridge engineering problems—scour and lack of redundancy—converged to destroy a New York State Thruway bridge.

Molasses spill, Boston, Massachusetts (1919) ........................................ 246

A giant, five-story-high steel tank suddenly fractured, releasing millions of gallons of deadly molasses that engulfed people, animals, and property.

Knickerbocker Theatre collapse, Washington, D.C. (1922) ........................................ 251

A theater roof collapsed due to inadequacies in design, fabrication, and construction.

Bronx apartment house collapse, New York City (1936) ........................................ 256

A multistory apartment complex under construction collapsed without warning, causing multiple deaths and injuries.

Buildings and Other Structures

Molasses spill, Boston, Massachusetts (1919) ........................................ 246
Texas Tower radar station collapse, North Atlantic (1961) .................................................................................................................. 261

A manned North Atlantic radar station collapsed owing to a nonrigid design that could not withstand the action of wind and waves.

Ferrybridge cooling towers collapse, Pontefract, England (1965) ............................................................................................................. 267

Design that inadequately accounted for wind forces led to the collapse of three giant water cooling towers, spurring important research into wind dynamics.

Ronan Point tower collapse, London, England (1968) ................................................................................................................................. 271

Inadequate connections between walls and floors caused the progressive collapse of one corner of a prefabricated high-rise apartment building.

Skyline Plaza collapse, Bailey’s Crossroads, Virginia (1973) ......................................................................................................................... 277

Premature removal of temporary wood shoring and formwork caused the collapse of a high-rise apartment building under construction.

Hartford Civic Center Coliseum roof collapse, Hartford, Connecticut (1978) .................................................................................................... 283

Collapse of a space frame roof caused by a lack of bracing of top chord truss members.

Cooling tower collapse, Willow Island, West Virginia (1978) ......................................................................................................................... 289

A cooling power plant tower collapsed as it was being built when construction loads were placed on concrete that had not been allowed to reach adequate strength.

Kemper Arena roof collapse, Kansas City, Missouri (1979) ............................................................................................................................. 295

Roof of award-winning arena collapsed when fatigued bolts failed during a rainstorm.

Alexander Kielland oil-drilling rig collapse, North Sea (1980) .......................................................................................................................... 301

Faulty welding was responsible for a crack in one of the legs supporting an offshore oil-drilling rig; the crack led to the collapse of the leg and the fatal capsizing of the rig.

MGM Grand Hotel fire, Las Vegas, Nevada (1980) ........................................................................................................................................... 307

Second most deadly hotel fire in United States history led to a nationwide revaluation of fire codes.
Harbour Cay condominium collapse, Cocoa Beach, Florida (1981) ........................................... 313

A five-story concrete residential building collapsed during construction owing to a combination of design errors and construction problems.

Hyatt Regency Hotel walkways collapse, Kansas City, Missouri (1981) ........................................... 317

The collapse of two suspended walkways caused by a simple design change resulted in the worst structural failure to date in the United States.

Ocean Ranger oil-drilling rig sinking, North Atlantic (1982) ....................................................... 326

A broken window on an offshore oil-drilling rig precipitated a catastrophic chain of events that caused the sinking of the rig and the death of all on board.

L’Ambiance Plaza collapse, Bridgeport, Connecticut (1987) ....................................................... 332

An apartment building collapsed during lift-slab construction, probably caused by an inadequate design for connecting the floor slabs to the column-mounted lifting mechanisms.

Ecological disaster, Sudbury, Ontario (1883 to present) ............................................................ 340

The area around Sudbury, Ontario has been deforested by emissions from years of nickel and copper open roast smelting.

Cadmium poisoning, Toyama, Japan (1912-1955) ................................................................. 345

Mining runoffs containing toxic cadmium collected in drinking and irrigation water and poisoned Japanese villagers, causing degenerative Itai-Itai disease.

DDT insecticide contamination (1939 to present) ................................................................. 350

Contamination of the ecological system resulting from the use of DDT has exposed the potential destructiveness of pesticides.

Love Canal toxic waste contamination, Niagara Falls, New York (1942-1953) ................................. 354

A Niagara Falls, New York, neighborhood, built on top of a toxic waste dump, had to be abandoned in 1980 after it was determined to be a threat to public health.

Dumping of radioactive waste from a plutonium-producing reservation has contaminated the environment along the Columbia River.

Mercury poisoning, Minamata Bay, Japan (1955 to present) ................................................................................. 367

Industrial pollution caused often fatal Minamata disease among local residents, leading to legal action against the firm immediately responsible and the local and federal governments.

Agent Orange contamination, Vietnam (1961-1971) ........................................................................................ 372

Use of the defoliant Agent Orange during the Vietnam War caused debilitating medical problems among both the Vietnamese population and American military personnel.

Dioxin contamination, Times Beach, Missouri (1971) ......................................................................................... 379

A Missouri town had to be evacuated after the town was contaminated by the deadly chemical compound, dioxin.

Methylmercury seed poisoning, Iraq (1971-1972) .............................................................................................. 385

Human consumption of seed grain treated with fungicide and intended only for planting resulted in nervous system damage and death to many individuals.


Sudden and devastating explosion at a British cyclohexane processing plant prompted a reevaluation across Europe of chemical plant safety.

Dioxin contamination, near Seveso, Italy (1976) .............................................................................................. 397

Worker errors and an unanticipated chemical reaction led to the release of a highly poisonous cloud of dioxin and widespread contamination.

Toxic vapor leak, Bhopal, India (1984) .............................................................................................................. 403

A toxic vapor leak resulted in massive loss of life and widespread injury.

Toxic vapor leak, Institute, West Virginia (1985) .............................................................................................. 411

An explosive failure of a temporary storage tank containing an aldicarb oxime mixture caused a toxic vapor leak at a chemical plant, injuring one hundred and thirty-five people.
Failure of a poorly constructed concrete dam founded on unsuitable bedrock caused a destructive and fatal flood, followed by an explosion of gas lines and a devastating fire, in the industrial town of Austin, Pennsylvania.

Failure of a dam constructed over a defective foundation killed hundreds and attested to the importance of thorough geological investigations of dam sites and state supervision of local waterway projects.

Failure of the rock foundation caused the collapse of a thin-walled concrete arch dam.

A huge mass of rock and mud rushed into the reservoir behind the Vaiont Dam, forcing a wall of water over the dam and onto villages in the valley below and causing thousands of deaths.

Subsidence of land beneath an earthfill dam caused the dam to leak and, within hours, to fail, releasing water into the suburbs downstream and causing five deaths and massive property damage.

The collapse of a dam built on fractured, water-permeable volcanic rock inundated an agricultural valley and killed eleven people.

Diethylstilbestrol, a synthetic estrogen, can cause cancer and reproductive abnormalities in individuals whose mothers used the drug.
Thalidomide (1950s-1960s) ........................................ 468

Widespread use of an improperly tested drug led to the birth of thousands of malformed babies, half of whom died within weeks of birth.

Silicone-gel implants (1960s-1990s) ................................ 475

Silicone-gel breast implants leak or rupture, causing inflammation, fever, arthritis, scleroderma (a hardening of the skin), and other health problems.

Dalkon Shield (1970s-1980s) ........................................ 481

An intrauterine birth control device is fatal for some women and causes spontaneous abortions, internal injuries, infertility, and birth defects.

Nuclear Plants

Kyshtym power plant explosion, Sverdlovsk, Russia (1957) ........................................ 488

A failure in the cooling system caused an explosion at a nuclear waste storage site.

Windscale reactor complex fire, England (1957) ........................................ 493

World's first major commercial nuclear power plant disaster at Great Britain's facility for making plutonium.

SL-1 experimental reactor explosion, Idaho (1961) ........................................ 499

One of the United States' first experimental nuclear reactors exploded as a result of a combination of mechanical failures and operator error.

Browns Ferry power plant fire, Decatur, Alabama (1975) ........................................ 505

Fire in the electrical system of a nuclear power plant resulted in the most serious commercial nuclear power accident up to that time.

Three Mile Island accident, Middletown, Pennsylvania (1979) ........................................ 510

The worst accident in the history of American commercial nuclear power generation caused a partial meltdown of the reactor core.

Radioactive waste spill, Tsuruga, Japan (1981) ........................................ 518

Due to human error, nearly four thousand gallons of radioactive wastes escaped from a nuclear power plant in Japan.


Failure of a pipe in a nuclear power plant caused shutdown of the reactor and release of radioactive gas to the atmosphere.
The world's worst nuclear power plant disaster occurred when human errors led to a dangerous heat and steam buildup, triggering two enormous explosions.

A state-of-the-art ocean liner sank after hitting an iceberg.

Fracturing of all-welded cargo ships used in World War II put the use of welding rather than riveting in shipbuilding under question.

The Andrea Doria sank after colliding with another liner, the Stockholm, off Massachusetts.

An oil tanker ran onto rocks off the coast of France after its steering system failed.

An oil tanker ran aground in Prince William Sound, Alaska, resulting in a catastrophic oil spill.

Explosion of seven ground-to-air Nike missiles during installation of new safety and arming mechanisms resulted in ten casualties.

Unexpected ignition of the fourth stage section of a rocket undergoing repairs after a failed launch attempt killed a Soviet Field Marshal.

Deaths of three astronauts during a ground test due to a flash fire evidently set off by a wiring malfunction exposed need for higher design, manufacturing, and safety standards at NASA.
Soyuz spacecraft reentry crash, Orenburg, Russia (1967) ......................................................... 586

Fatal crash due to spacecraft’s landing parachutes becoming entangled after flight and reentry control failure sent the Soviet manned space program into decline at a crucial phase of the “space race.”

Apollo 13 oxygen tank rupture (1970) ......................................................... 591

Explosion in service module oxygen tank, forcing three-man crew to abandon their mission and use lunar module as an emergency “lifeboat,” led to cutbacks in the Apollo program.

Soyuz II reentry disaster (1971) ......................................................... 598

Death of three Soviet cosmonauts during reentry due to cabin seal malfunction represented a significant technical setback for the Soyuz manned spacecraft program.

Skylab meteoroid shield failure (1973) ......................................................... 603

Loss of the NASA orbiting space laboratory’s meteoroid shield and one solar array was caused by failure to account for aerodynamic loads during launch.

Challenger explosion (1986) ......................................................... 609

An explosion shortly after launch caused by faulty solid rocket booster seals destroyed the shuttle and killed its crew of seven, forcing a retrenchment of NASA’s shuttle program.

Submarines

Squalus sinking, off New Hampshire (1939) ......................................................... 620

Mechanical failure in the operating gear of an air intake valve occurred during an underwater dive, allowing the aft part of the vessel to fill with water and sink the submarine.

Thetis sinking, Liverpool Bay, England (1939) ......................................................... 626

Sinking of British submarine, set off by human error, led to design improvements and recognition of need for sophisticated rescue procedures.

Thresher sinking, Atlantic Ocean (1963) ......................................................... 631

A nuclear submarine plunged beneath its “crush depth” and sank, killing all 129 crew members.

Scorpion sinking, Atlantic Ocean (1968) ......................................................... 638

Unexplained sinking of submarine gave impetus to development of deep-sea rescue and search submersibles and raised concerns about safety of powering submarines with nuclear reactors.

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