From the smallest parts of a private plane to the largest concerns of global airlines, ASTM International committees create and update standards that support safety, performance, innovation, efficiency, and more.

ASTM International standards and test methods help engineers and other professionals who design and build aircraft and their components as well as those who work in related fields such as fuels, pavement, and maintenance.

This work is crucial to aviation authorities such as the U.S. Federal Aviation Administration, the European Aviation Safety Agency, and many others.

ASTM International’s aviation committees and subcommittees have created world-renowned standards for decades. These groups attract the participation of top experts from civil aviation authorities, manufacturers, suppliers, academia, and many other fields.

ASTM International’s footprint in this area continues to grow and evolve as members work to drive performance and innovation while fostering safety.
Standards Support Building Aircraft

**Light Metals and Alloys (B07)**

The committee on light metals and alloys (B07) has developed over 80 standards. The standards focus on aluminum and magnesium and their alloys in cast and wrought mill product form as well as fabricated culvert materials, and their structural design and installation.

The committee’s standards include test methods used throughout the aerospace industry for both quality assurance and design purposes. Properties measured in accordance with these test methods are used to determine design allowable limits published in key documents such as “Metallic Materials Properties Development and Standardization,” which is used by the aerospace industry to satisfy design requirements from major civil aviation and aerospace authorities.

Standards from this group cover topics such as aluminum used in iron and steel manufacture; aluminum and aluminum-alloy extruded bars, rod, tube, pipe, structural profiles, and profiles for electrical purposes.

**B07 subcommittees include:**
- Aluminum Alloy Ingots and Castings (B07.01)
- Aluminum Alloy Wrought Products (B07.03)
- Magnesium Alloy Cast and Wrought Products (B07.04)
- Testing (B07.05)
- Corrugated Aluminum Pipe and Corrugated Aluminum Structural Plate (B07.08)
- U.S. TAG National Committee for ISO/TC 79 on Light Metals and Alloys (B07.09)

**Rolling Element Bearings/ Aerospace (F34.06)**

The aerospace subcommittee (F34.06), part of the committee on rolling element bearings (F34), oversees standards for small parts of important equipment, including high precision bearings used in military and civilian satellites (including weather and communications equipment) as well as guidance systems and control-surface mechanics for defense applications. The subcommittee addresses bearings used in every subsystem in an aircraft, from control surfaces to airframe flex to the landing gear of an F18 landing in a “controlled crash” on an aircraft carrier.

The subcommittee’s mission is to develop standards, promote knowledge, and stimulate research for power takeoff, instrument, and airframe bearings that help ensure everything works properly the first time... and eliminate the possibility of “space junk.”

Globally recognized aircraft manufacturers, their suppliers, government authorities, private defense contractors, space engineers, and other members work together to ensure the highest level of precision, performance, and durability.

F34.06 is one of several subcommittees in the F34 committee.

**F34.06 standards include the following:**
- One specification covers annular ball bearings for instruments and precision rotating components (F2332) used mainly in instrument and precision rotating components.
- A specification for phenolic raw materials for use in bearing cages (F2953) covers basic characteristics for porous laminated phenolic materials intended for use as instrument and thin-section ball-bearing retainers (cages) and the methods of determining these characteristics.
F34.06 addresses bearings used in every subsystem in an aircraft, from control surfaces to airframe flex to the landing gear of an F18 landing in a “controlled crash” on an aircraft carrier.
Since launching in 2004, the aircraft systems committee has grown to more than 100 members who develop standards to support avionic products as well as other electrical and wiring systems.

### Composite Materials (D30)

Sandwich structures – configurations that include outer face sheets or skins and a lightweight inner core – are used on control surfaces, fairing panels, nose radomes, interior panels, floor panels, engine nacelles, and more.

With over 75 members, the subcommittee on sandwich construction (D30.09) develops test methods for determining material and structural properties of these products.

Airlines, material suppliers, government organizations, test laboratories, academicians, and others participate. The subcommittee oversees more than 20 standards on topics ranging from the density of core materials to the flatwise tensile strength of sandwich constructions.

D20.09 is one of several subcommittees in the committee on composite materials (D30), which focuses primarily on such materials with fibrous reinforcement.

### Aircraft Systems (F39)

The angle-of-attack indicator (AOA) for aircraft is a small device with a powerful purpose: It tells pilots the angle at which they can position an aircraft to prevent it from stalling and crashing. Supporting such systems is part of the work of the aircraft systems committee (F39).

Since launching in 2004, the group has grown to more than 100 members who develop standards to support avionic products as well as other electrical and wiring systems. Keeping in mind policy and trade issues, F39 has created standards for industry and aviation authorities to ensure safe designs for both initial certification of new products and continued airworthiness of mature products. This includes standards for inspection and maintenance.

**Subcommittees include:**
- Design, Alteration, and Certification of Electrical Systems (F39.01)
- Inspection, Alteration, Maintenance, and Repair (F39.02)
- Design of Avionics Systems (F39.03)
- Aircraft Systems (F39.04)
- Design, Alteration, and Certification of Electric Propulsion Systems (F39.05)
Keeping Aircraft Safe

The nondestructive testing (NDT) committee (E07) helps ensure that materials are strong enough to absorb mechanical stresses such as flight.

Nondestructive Testing (E07)

For 80 years, the nondestructive testing (NDT) committee (E07) has helped ensure that materials are strong enough to absorb mechanical stresses such as flight.

Almost 600 members and some 40 countries are part of this committee, which has created more than 225 standards for the aviation industry as well as the auto and shipbuilding industries, among others. Manufacturers, vendors, laboratories, and others are represented.

Subcommittees include (among others):
- Radiology (X and Gamma) Method (E07.01)
- Reference Radiological Images (E07.02)
- Liquid Penetrant and Magnetic Particle Methods (E07.03)
- Acoustic Emission Method (E07.04)
- Radiology (Neutron) Method (E07.05)
- Ultrasonic Method (E07.06)
- Electromagnetic Method (E07.07)
- Leak Testing Method (E07.08)
- Nondestructive Testing Agencies (E07.09)
- Specialized NDT Methods (E07.10)
- Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) (E07.11)

KEY NDT STANDARDS

01 Reference radiographs for aluminum and magnesium castings (E155) inspection illustrate discontinuities and reference NDT standards.

02 The terminology for nondestructive examinations (E1316) provides a common language for all NDT standards and initiatives.

03 The practice for liquid penetrant testing (E1417) includes minimum requirements for conducting NDT tests of nonporous metal and nonmetal components.

04 The practice for magnetic particle testing (E1444) establishes minimum NDT examination requirements.

05 The practice for radiographic examination (E1742) provides minimum requirements for radiographic examination of metallic and nonmetallic materials.
Committees Consider the Complete Aircraft

Aerospace and Aircraft (F07)

For almost 50 years, the tests developed by the aerospace and aircraft committee (F07) have helped enhance the safety of aircraft, crew, and passengers. The group creates test methods and other standards for commercial planes, military aircraft, and more.

The committee includes manufacturers, government agencies, testing laboratories, universities, and others. Together this group of about 100 experts have created close to 50 standards.

Three technical subcommittees include: hydrogen embrittlement (F07.04), qualification testing of aircraft cleaning materials (F07.07), and transparent enclosures and materials (F07.08). The groups focus on a wide variety of areas such as hydrogen’s impact on the metal plating process, the effect of chemicals on composite materials, and cleaning and testing windows.

These subcommittees also host workshops. For example, F07.04 hosts a renowned workshop that covers all areas of hydrogen embrittlement technology, including failure mechanisms and prevention. Meanwhile, F07.08’s workshop at times involves discussions of studies on bird-strike damage. These workshops help inform standardization efforts and foster the exchange of ideas for both the manufacturing and testing communities.

General Aviation Aircraft (F44)

General aviation — flights not related to airlines or military operations — is integral to the global economy. This industry includes package deliveries, private transportation, emergency medical services, agriculture, and more. Typically, general aviation relates to small aircraft that seat two to 19 people and that weigh less than 8,600 kg (19,000 lbs.).

The general aviation committee brings together experts from around the world who work to enhance how such aircraft are manufactured and certified, helping foster both safety and innovation.

The committee has already created numerous standards in areas such as design, construction, systems, performance, quality acceptance tests, and safety monitoring.

These standards are helping to control manufacturing and ownership costs, streamline certification processes, and encourage more people to become pilots.

Manufacturers, suppliers, trade associations, pilots, aircraft owners, and civil aviation authorities are all involved in the committee.

Notably, the U.S. Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) have increasingly turned to the committee’s industry-driven, performance-based standards. This has helped alleviate prescriptive, design-specific requirements that previously led to confusion, delays, high costs, and other negative impacts.

Technical subcommittees include:
- General (F44.10)
- Flight (F44.20)
- Structures (F44.30)
- Powerplant (F44.40)
- Systems and Equipment (F44.50)

KEY F07 STANDARDS

01 The test method for mechanical hydrogen embrittlement evaluation of plating/coating processes and service environments (F519) outlines mechanical tests and acceptance criteria for processes that can cause hydrogen embrittlement in steel. The standards can also help evaluate exposure to fluids, cleaning treatments, or maintenance chemicals that come in contact with plated or coated steel surfaces.

02 The test method for measurement of hydrogen embrittlement threshold in steel by the incremental step loading technique (F1624) measures stress parameters in design or failure analyses. It takes into account the effects of environmental exposure, including processes such as plating. This test can quickly determine the effects of residual hydrogen in part caused by processing or quantify the relative susceptibility of materials under a fixed set of hydrogen-charging conditions.

03 The test method for stress-corrosion of titanium alloys by aircraft engine cleaning materials (F945) helps determine the propensity of turbine engine cleaning and maintenance materials to cause stress corrosion cracking of titanium alloy parts.

04 The test method for abrasion resistance of transparent plastics and coatings (F735) uses oscillating sand to see how well windows and viewing ports resist damage.
NCATT CERTIFICATIONS

The National Center for Aerospace and Transportation Technologies (NCATT) offers personnel certification programs that support safety, integrity, and professionalism in the aerospace workforce while also teaching areas such as aircraft electronics (avionics).

This helps address industry needs for enhanced knowledge and skills.

Technicians can pursue certifications and endorsements for navigation systems, communication systems, assembly, maintenance, and more.
Light Sport Aircraft Standards and Training

KEY LSA STANDARDS

01 The specification for design and performance of a light sport airplane (F2245) covers airworthiness requirements for the design of powered fixed-wing light sport aircraft.

02 The specification for a light sport aircraft manufacturer’s quality assurance system (F2972) establishes minimum requirements for creating a quality assurance system for light sport aircraft or light sport aircraft kits. It applies to aircraft makers seeking civil aviation authority approvals.

03 The specification for pilot’s operating handbook for light sport airplane (F2746) provides minimum requirements for a handbook for an aircraft designed, manufactured, and operated as a light sport aircraft.

Light Sport Aircraft (F37)

The safety of small aircraft with only one or two seats has improved since 2002 in part due to the work of the light sport aircraft committee (F37). The group develops standards for fixed-wing lighter-than-air private planes, gliders, gyroplanes, and more.

Manufacturers, regulators, industry associations, pilots, aircraft owners, and others make up the committee, which addresses issues related to aviation authority guidelines on design, performance, quality acceptance tests, and safety monitoring.

For example, there are two categories of aircraft in the U.S. Federal Aviation Administration’s Certification of Aircraft and Airmen for the Operation of Light Sport Aircraft Rule. This includes special light sport aircraft for personal flight and flight training as well as rental and experimental light sport kit aircraft (any level of kit from zero to 95-percent prebuilt).

EASA and many civil aviation authorities worldwide (including New Zealand, Brazil, Columbia, and the Czech Republic) use the committee’s standards.

These standards have helped manufacturers add many kinds of safety features. The standards address limits such as empty weight and center of gravity, performance specifications, controllability and maneuverability trim, stability, stall speed and handling characteristics, engine cooling and operating characteristics, propeller limits, systems functions, and folding or removable lifting surfaces.

Subcommittees include:

- Glider (F37.10)
- Airplane (F37.20)
- Power Parachute (F37.30)
- Weight Shift (F37.40)
- Gyroplane (F37.50)
- Lighter than Air (F37.60)
- Cross Cutting (F37.70)

F37 standards address limits such as empty weight and center of gravity, performance specifications, controllability and maneuverability trim, stability, stall speed and handling characteristics, engine cooling and operating characteristics, propeller limits, systems functions, and folding or removable lifting surfaces.
Training in Light Sport Aircraft Standards

ASTM International offers a two-day course with hands-on experience in using light sport aircraft standards.

The course covers:
- Requirements to obtain an LSA certificate,
- Quality control and production procedure strategies to ensure compliance,
- How to incorporate standards requirements in company processes,
- How to determine and show compliance with standards,
- Connecting references from civil aviation authorities with the use of standards and their requirements, and
- Hands-on experience in safety risk assessment, inspection, records analysis, and more.
Meeting Emerging Needs

Unmanned Aircraft Systems (F38)

Unmanned aircraft systems (drones) are taking to the skies more and more for both fun and commercial use. Standards from the committee on unmanned aircraft systems (F38) support the use of drones in military and commercial applications — checking crops, filming real estate, tracking animal populations and migrations, and cleaning up oil spills. The committee’s vision is routine, safe UAS operations in civil airspace through standardization. The committee oversees more than a dozen standards on airworthiness; flight operations; and personnel training, qualification, and certification. More are underway: drafts on testing small UAS, safety for flying over people, and design and construction of fixed-wing UAS, to name a few.

Aerospace Personnel (F46)

To help fill the need for highly skilled aerospace technical workers, the committee on aerospace personnel (F46) brings together a diverse group of aviation stakeholders to help with training the next generation. The committee is developing standards to define core competencies of aerospace personnel. Its first standard (F3245, guide for aircraft electronics technician personal certification) provides an approach for evaluating subject and task knowledge as well as task performance of people who maintain aircraft and their electrical and electronic systems. Additional standards are underway for core competencies, power plants, airframe and systems, equipment and furnishings, and more.

To help with efforts to certify aircraft maintenance technicians and other aerospace workers, SpaceTEC Partners Inc. and ASTM International have signed a memorandum of understanding. The partnership will help ensure that aviation workers have needed knowledge and skills.

KEY F38 STANDARDS

01 The specification for design and construction of a small unmanned aircraft system (sUAS) (F2910) applies to sUAS under 25 kg (55 lbs).
02 Compliance with the practice for seeking approval for extended visual line of sight or beyond visual line of sight small unmanned aircraft system operations (F3196) supports getting such approvals.
03 The guide for training for remote pilot in command of unmanned aircraft systems endorsement (F3266) describes requirements for safe sUAS commercial operation.
04 The specification for design, construction, and verification of fixed-wing unmanned aircraft systems (sUAS) (F3298) covers airworthiness requirements.
Commercial Spaceflight (F47)

To help support the safety of space tourists on commercial spaceflight, a committee has begun work on related standards. The commercial spaceflight committee (F47) currently focuses on proposed standards in the areas of occupant safety in sub-orbital and orbital vehicles.

Commercial spaceflight companies and organizations, astronauts, and other experts are developing standards that include:

- Fault Tolerance for Occupant Safety of Suborbital Vehicles (WK59508);
- Storage, Use, and Handling of Liquid Rocket Propellants (WK59169); and
- Commercial Spaceflight Terminology (WK59628).

F47 members feel that their work needs to help ensure safety and reliability and to foster global interoperability so that vehicles developed in one country can be sold in another.
**Aviation Fuels (D02.J0)**

Turbine engines, fuel systems, and airport fuel equipment — as well as the fuel itself — are all crucial to aviation.

As part of ASTM International’s largest technical committee (petroleum products, liquid fuels, and lubricants D02), the subcommittee on aviation fuels (D02.J0) develops standards that help ensure the safety of passengers while also supporting a robust and diverse fuel supply chain.

Members of the subcommittee include government officials, major fuel producers, small biofuel and renewable fuel firms, and others. More than 500 members from over 40 countries are represented in the subcommittee.

The group has produced dozens of standards that address topics ranging from ground-based octane rating procedures for turbocharged/supercharged spark ignition aircraft engines to aviation turbine fuel containing synthesized hydrocarbons.

The group also works to develop greener, energy-independent fuel life cycles and processes.

**The subcommittee (D02.J0) has six sections:**
- Jet Fuel Specifications
- Spark and Compression Ignition Aviation Engine Fuels
- Combustion and Thermal Properties
- Additives and Electrical Properties
- Fuel Cleanliness
- Emerging Turbine Fuels

**Aviation Fuel and Petroleum Lab Tech Training**

ASTM International training courses in aviation fuels complement the organization’s standards development activities.

For example, a two-day class focuses on how specifications help ensure fuel quality and why they affect product performance. The class covers key test methods, manufacturing and transportation issues, and the interaction of fuels with aircraft engines and ground equipment.

For petroleum lab technicians, ASTM International offers self-guided online training modules designed to supplement existing internal lab quality assurance/quality control programs. Each module addresses a specific test method, many of which are referenced in the flagship specification for aviation turbine fuels (D1655). This includes video demonstrations, checklists, data sheets, glossaries, and quizzes, focused on test methods such as flash point, distillation, viscosity, hydrocarbons, sulfur, and more.

**Proficiency Testing: Aviation Fuel**

ASTM International’s Proficiency Testing Programs (PTP) offer labs worldwide an essential measure for quality management through comparing their results with those of other labs that conduct the same tests. Participants gain an edge in internal monitoring while also helping prepare for accreditation.

The aviation turbine fuel (Jet A) program involves hundreds of global participants. It provides a statistical quality assurance tool through more than 30 tests covering the involved parameters. Three times per year, samples are distributed with testing instructions and report forms. Following data submission, statistical summary reports are distributed to participants. Another program covers military jet fuel with a twice-yearly schedule.
The Aircraft-Pavement Interface

Vehicle-Pavement Systems (E17)

Airport pavements play an important role in takeoffs, landings, and taxiing. They have a direct impact on the safety of all types of aircraft.

The committee on vehicle-pavement systems (E17) plays a crucial role in pavement management technologies, vehicle pavement interactions, intelligent transportation systems, and more.

The group of over 150 experts includes transportation officials, university researchers, engineering and design firms, equipment providers, testing laboratories, roadway consulting firms, and others.

The committee has developed more than 70 standards that cover areas such as skid resistance, calculating the international runway friction index, computing the pathway roughness index, and measurement of tire/pavement noise.

Notably, the committee works on standards related to roadway and tire friction. Adequate levels of friction help with steering, control, and stopping before and after flights. Civil aviation authorities require airports to know friction levels and their relationship to ground conditions.

Aviation-related subcommittees include:
- Field Methods for Measuring Tire Pavement Friction (E17.21)
- Surface Characteristics Related to Tire Pavement Slip Resistance (E17.23)
- Tire and Slider Characteristics (E17.24)
- Methods for Measuring Profile and Roughness (E17.31)
- Pavement Testing and Evaluation (E17.41)

KEY E17 STANDARDS

01 The test method for airport pavement condition index surveys (D5340) covers the determination of airport pavement conditions through visual surveys of asphalt-surfaced pavements.

02 Test methods for repetitive (D1195) and nonrepetitive (D1196) static plate load tests of soils and flexible pavement components, for use in the evaluation and design of airport and highway pavements, outline procedures for testing subgrade soils and compacted pavement components.

03 The practice for correlations of values from continuous friction measurement equipment to determine maintenance levels for use at airports (E2666), with a tire that is specified in another standard (E1551), is used to perform airport summer maintenance evaluations.
ASTM International technical committees highlighted in this piece include:

- Aerospace and Aircraft (F07)
- Aerospace Personnel (F46)
- Aircraft Systems (F39)
- Aviation Fuels (D0.J0)
- Commercial Spaceflight (F47)
- Composite Materials (D30)
- General Aviation Aircraft (F44)
- Light Metals and Alloys (B07)
- Light Sport Aircraft (F37)
- Nondestructive Testing (E07)
- Rolling Element Bearings/Aerospace (F34.06)
- Unmanned Aircraft Systems (F38)
- Vehicle-Pavement Systems (E17)