

ANSI UASSC Reference Document

This is a companion piece to the ANSI UASSC Standardization Roadmap for Unmanned Aircraft Systems (Version 1.0), listing additional standards and related documents.

Table of Contents

6.4 Avionics and Subsystems.....	1
6.4.3 Detect and Avoid (DAA) Systems.....	22
9.3 Transport and Post-Crash Procedures Involving Biohazards	36

6.4 Avionics and Subsystems

Published Avionics Regulations, Standards and Related Documents: Published UAS Avionics and subsystems standards and regulatory materials from civil, military and space applications include:

FAA Regulations/Documents:

It is recommended to refer to the latest FAA regulations, policy, guidance and associated standards.

- 14 CFR part 25, Airworthiness Standards: Transport Category Airplanes
 - Subpart D—Design and Construction
 - Subpart F—Equipment
 - Subpart G—Operating Limitations and Information
 - Subpart H—Electrical Wiring Interconnection Systems (EWIS)
 - Appendix H—Instructions for Continued Airworthiness (ICA)
- Part 23, Airworthiness Standards: Normal.....Category Airplanes
 - Subpart D—Design and Construction
 - Subpart F—Equipment
 - Subpart G—Flightcrew Interface and Other Information
 - Subpart H—Electrical Wiring Interconnection Systems (EWIS)
 - Appendix A—Instructions for Continued Airworthiness (ICA)
- Part 27, Airworthiness Standards: Normal Category Rotorcraft
 - Subpart D—Design and Construction
 - Subpart F—Equipment
 - Subpart G—Operating Limitations and Information
 - Appendix A—Instructions for Continued Airworthiness (ICA)
 - Appendix B—Airworthiness Criteria for Helicopter Instrument Flight
 - Appendix C—Criteria for Category A
 - Appendix D—HIRF Environments and Equipment HIRF Test Levels
- Part 29, Airworthiness Standards: Transport Category Rotorcraft
 - Subpart D—Design and Construction
 - Subpart F—Equipment
 - Subpart G—Operating Limitations and Information
 - Appendix A—Instructions for Continued Airworthiness (ICA)
 - Appendix B—Airworthiness Criteria for Helicopter Instrument Flight

- Appendix E to Part 29—HIRF Environments and Equipment HIRF Test Levels
- Part 43, Maintenance, Preventive Maintenance, Rebuilding, and Alteration
- Part 91, General Operating And Flight Rules
 - Subpart B—Flight Rules
 - Subpart C--Equipment, Instrument and Certificate Requirements
 - Subpart E--Maintenance, Preventive Maintenance, and Alterations
 - Subpart F--Large and Turbine-Powered Multiengine Airplanes and Fractional Ownership Program Aircraft
 - Subpart G--Additional Equipment and Operating Requirements for Large and Transport Category Aircraft
 - Subpart L--Continued Airworthiness and Safety Improvements
 - Appendix A--Category II Operations: Manual, Instruments, Equipment, and Maintenance
 - Appendix B--Authorizations to Exceed Mach 1 (Sec. 91.817)
 - Appendix D--Airports/Locations: Special Operating Restrictions
 - Appendix E--Airplane Flight Recorder Specifications
 - Appendix F--Helicopter Flight Recorder Specifications
 - Appendix G--Operations in Reduced Vertical Separation Minimum (RVSM) Airspace
- [14 CFR §91.111, Operating near other aircraft](#)
- [§91.113, Right-of-way rules: Except water operations](#)
- [§91.115, Right-of-way rules: Water operations](#)
- [§91.123, Compliance with ATC clearances and instructions](#)
- [§91.181\(b\), Course to be flown](#)
- [§91.205, Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements](#)
- [§91.207, Emergency locator transmitters](#)
- [§91.209, Aircraft lights](#)
- [§91.215, ATC transponder and altitude reporting equipment and use](#)
- [§91.217, Data correspondence between automatically reported pressure altitude data and the pilot's altitude reference](#)
- [§91.219, Altitude alerting system or device: Turbojet-powered civil airplanes](#)
- [§91.221, Traffic alert and collision avoidance system equipment and use](#)
- [§91.223, Terrain awareness and warning system](#)
- [§91.225, Automatic Dependent Surveillance-Broadcast \(ADS-B\) Out equipment and use](#)
- [§91.227, ADS-B Out equipment performance requirements](#)
- [§91.411, Altimeter system and altitude reporting equipment tests and inspections](#)
- [§91.413, ATC transponder tests and inspections](#)
- [§107.25, Operation from a moving vehicle or aircraft](#)
- [§107.29, Daylight operation](#)
- [§107.37, Operation near aircraft; right of way rules](#)
- [§107.39, Operation over human being](#)
- [§107.41, Operation in certain airspace](#)
- [§107.51, Operating limitations for small unmanned aircraft](#)

Most of the following Technical Standard Orders (TSOs) contain companion industry standards:

- TSO-C1e, Cargo Compartment Fire Detection Instruments, 8-19-14
- TSO-C2d, Airspeed Instruments, 6/14/89

- TSO-C3e, Turn and Slip Instrument, 10-15-07
- TSO-C4c, Bank and Pitch Instruments, 4-01-59
- TSO-C5F, Direction Instrument, Non-Magnetic (Gyroscopically Stabilized), 2-02-07
- TSO-C6e, Direction Instrument, Magnetic (Gyroscopically Stabilized), 4-24-08
- TSO-C7d, Direction Instrument, Magnetic Non-Stabilized Type (Magnetic Compass), 6-14-89
- TSO-C8e, Vertical Velocity Instruments (Rate-of-Climb), 4-17-07
- TSO-C10b, Altimeter, Pressure Actuated, Sensitive Type, 9-01-59
- TSO-C10c, Pressure Altimeter System, 10-31-16
- TSO-C11e, Powerplant Fire Detection Instruments (Thermal and Flame Contact Types)
- TSO-C16a, Electrically Heated Pitot and Pitot-Static Tubes, 10-06-06
- TSO-C16b, Electrically Heated Pitot and Pitot-Static Tubes, 1-27-17
- TSO-C30c, Aircraft Position Lights, 5-12-89
- TSO-C34e, ILS Glide Slope Receiving Equipment Operating Within The Radio Frequency Range Of 328.6-335.4, 1-15-88
- TSO-C35d, Airborne Radio Marker Receiving Equipment, 5-05-71
- TSO-C36e, Airborne ILS Localizer Receiving Equipment Operating Within The Radio Frequency Range Of 108-112, 1-25-88
- TSO-C40c, VOR Receiving Equipment Operating Within The Radio Frequency Range Of 108-117.95 MHz, 1-25-88
- TSO-C41d, Airborne Automatic Direction Finding (ADF) Equipment, 5-06-85
- TSO-C43c, Temperature Instruments, 5-30-95
- TSO-C43d, Temperature Instruments, 3-20-17
- TSO-C44C, Fuel Flowmeters, 8-22-06
- TSO-C45b, Manifold Pressure Instruments, 8-22-06
- TSO-C46a, Maximum Allowable Airspeed Indicator Systems, 4-23-68
- TSO-C47A, Fuel, Oil, and Hydraulic Pressure Instruments, 8-08-06
- TSO-C48a, Carbon Monoxide Detector Instruments, 5-06-09
- TSO-C49b, Electric Tachometer: Magnetic Drag (Indicator And Generator), 5-30-95
- TSO-C54, Stall Warning Instruments, 10-15-61
- TSO-C55A, Fuel And Oil Quantity Instruments, 6-08-07
- TSO-C56b, Engine Driven Direct Current Generator/Starter Generators, 6-01-06
- TSO-C59b, Airborne Selective Calling (SELCAL) Equipment, 6-27-16
- TSO-C63e, Airborne Weather Radar Equipment, 10-01-16
- TSO-C66c, Distance Measuring Equipment (DME) Operating Within The Radio Frequency Range Of 960-1215 MHz, 1-18-91
- TSO-C71, Airborne Static ("DC To DC") Electrical Power Converter (for Air Carrier Aircraft)
- TSO-C72c, Individual Flotation Devices, 9-07-90
- TSO-C73, Static Electrical Power Inverter, 12-18-63
- [TSO-C74d, Air Traffic Control Radar Beacon System \(ATCRBS\) Airborne Equipment, 12-17-08](#)
- TSO-C85b, Survivor Locator Lights, 10-22-07
- TSO-C87a, Airborne Low-Range Radio Altimeter, 5-31-12
- TSO-C88b, Automatic Pressure Altitude Reporting Code-Generating Equipment, 2-06-07
- TSO-C92c, Airborne Ground Proximity Warning Equipment, 3-19-96
- TSO-C93, Airborne Interim Standard Microwave Landing System (MLS) Converter Equipment, 11-26-76
- TSO-C95a, Mach Meters, 8-31-07

- TSO-C96a, Anti-collision Light Systems, 4-07-89
- TSO-C99A, Flight Deck (Sedentary) Crewmember Protective Breathing Equipment, 6-05-08
- TSO-C101, Over Speed Warning Instruments, 2-19-87
- TSO-C102, Airborne Radar Approach And Beacon Systems For Helicopters, 4-02-84
- TSO-C104, MLS Airborne Receiving Equipment, 6-22-82
- TSO-C105, Optional Display Equipment For Weather And Ground Mapping Radar Indicators
- TSO-C106, Air Data Computer, 1-15-88
- TSO-C109, Airborne Navigation Data Storage System, 12-09-85
- TSO-C110a, Airborne Passive Thunderstorm Detection Equipment, 10-26-88
- [TSO-C112e, Air Traffic Control Radar Beacon System/Mode Select \(ATCRBS/Mode S\) Airborne Equipment, 9-16-13](#)
- TSO-C113a, Airborne Multipurpose Electronic Displays, 4-30-12
- TSO-C115c, Flight Management System (FMS) Using Multi-Sensor Inputs, 1-09-12
- TSO-C115d, Required Navigation Performance (RNP) Equipment Using Multi-Sensor Inputs
- TSO-C117a, Airborne Windshear Warning And Escape Guidance Systems For Transport Airplanes, 8-01-96
- TSO-C117b, Airborne Windshear Warning And Escape Guidance Systems For Transport Airplanes, 3-27-18
- [TSO-C118, Traffic Alert and Collision Avoidance System \(TCAS\) Airborne Equipment, TCAS I](#)
- [TSO-C118a, TCAS Airborne Equipment, TCAS I, 10-27-14](#)
- [TSO-C119d, TCAS Airborne Equipment, TCAS II with Hybrid Surveillance, 9-5-13](#)
- [TSO-C119e, TCAS Airborne Equipment, TCAS II with Hybrid Surveillance, 6-30-16](#)
- TSO-C121b, Underwater Locating Devices (Acoustic) (Self-Powered), 2-28-12
- TSO-C122a, Equipment That Prevents Blocked Channels Used In Two-Way Radio Communications Due To Simultaneous, 8-26-05
- TSO-C123c, Cockpit Voice Recorder Equipment, 12-19-13
- TSO-C124c, Flight Data Recorder Equipment, 12-19-13
- TSO-C126b, 406 MHz ELT, 11-26-12
- TSO-C128a, Equipment That Prevents Blocked Channels Used In Two-Way Radio Communications Due To Unintentional, 8-26-05
- TSO-C132a, Minimum Operational Performance Standards (MOPS) for Geosynchronous Orbit Aeronautical Mobile Satellite, 12-22-15
- TSO-C137a, Aircraft Portable Megaphones, 1-30-08
- TSO-C139a, Aircraft Audio Systems And Equipment, 2-25-14
- TSO-C141, Aircraft Fluorescent Lighting Ballast/Fixture Equipment, 8-17-99
- TSO-C144a, Passive Airborne Global Navigation Satellite System (GNSS) Antenna, 3-30-07
- TSO-C145d, Airborne Navigation Sensors Using The Global Positioning System (GPS) Augmented By The Satellite Based, 12-20-13
- TSO-C145e, Airborne Navigation Sensors Using The GPS Augmented By The Satellite Based
- TSO-C146d, Stand-Alone Airborne Navigation Equipment Using The GPS Augmented By The
- TSO-C146e, Stand-Alone Airborne Navigation Equipment Using The GPS Augmented By The
- TSO-C147a, Traffic Advisory System (TAS) Airborne Equipment, 9-05-14
- TSO-C151c, Terrain Awareness and Warning System (TAWS), 6-27-12
- [TSO-C151d, TAWS, 8-31-17](#)
- TSO-C153, Integrated Modular Avionics Hardware Elements, 5-06-02
- TSO-C154c, Universal Access Transceiver (UAT) ADS-B Equipment, 12-02-09

- TSO-C155a, Recorder Independent Power Supply, 6-09-10
- TSO-C155b, Recorder Independent Power Supply (RIPS), 4-21-15
- TSO-C157a, Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems And Equipment, 9-09-11
- TSO-C157b, Flight Information Services-Broadcast (FIS-B) Equipment, 5-28-15
- TSO-C158, Aeronautical Mobile High Frequency Data Link (HFDL) Equipment, 8-19-04
- TSO-C159a, Next Generation Satellite Systems (NGSS) Equipment, 6-30-10
- TSO-C159b, NGSS Equipment, 9-29-14
- TSO-C159c, NGSS Equipment, 9-09-16
- TSO-C160a, Very High Frequency (VHF) Digital Link (VDL) Mode 2 Communications Equipment, 3-27-12
- TSO-C161a, Ground Based Augmentation System (GBAS) Positioning and Navigation Equipment, 12-17-09
- TSO-C162a, GBAS VHF Data Broadcast Equipment, 12-17-09
- TSO-C163a, VDL MODE 3 Communications Equipment Operating Within The Frequency Range 117.975-137.000 MHz, 8-31-07
- TSO-C164a, Night Vision Goggles, 10-02-15
- TSO-C165a, Electronic Map Display Equipment for Graphical Depiction of Aircraft Position (Own-Ship), 9-30-13
- TSO-C165, Electronic Map Display Equipment for Graphical Depiction of Aircraft Position
- TSO-C166b, Extended Squitter ADS-B and Traffic Information, 12-02-09
- TSO-C168, Aviation Visual Distress Signals, 3-25-04
- TSO-C169a, VHF Radio Communications Transceiver Equipment Operating Within Radio Frequency Range 117.975 To, 9-28-07
- TSO-C170, High Frequency (HF) Radio Communications Transceiver Equipment Operating Within the Radio Frequency, 12-20-04
- TSO-C174, Battery Based Emergency Power Unit (BEPU), 7-25-05
- TSO-C176a, Cockpit Image Recorder Equipment, 12-19-13
- TSO-C177a, Data Link Recorder Equipment, 12-19-13
- TSO-C178, Single Phase 115 VAC, 400 Hz Arc Fault Circuit Breakers, 3-03-06
- TSO-C179a, Permanently Installed Rechargeable Lithium Cells, Batteries and Battery Systems, 4-19-11
- TSO-C179b, Rechargeable Lithium Batteries and Battery Systems, 3-23-18
- TSO-C184, Airplane Galley Insert Equipment, Electrical/Pressurized, 9-30-11
- TSO-C190, Active Airborne GNSS Antenna, 3-20-07
- TSO-C194, Helicopter Terrain Awareness and Warning System (HTAWS), 12-17-08
- TSO-C195b, Avionics Supporting ADS-B Aircraft Surveillance, 9-29-14
- TSO-C196b, Airborne Supplemental Navigation Sensors for GPS Equipment using, 12-20-13
- TSO-C197, Information Collection and Monitoring Systems, 11-15-10
- TSO-C198, Automatic Flight Guidance and Control System (AFGCS) Equipment, 6-02-11
- TSO-C199, Traffic Awareness Beacon System (TABS), 10-10-14
- TSO-C200a, Airframe Low Frequency Underwater Locating Device (Acoustic) (Self-Powered)
- TSO-C201, Attitude and Heading Reference Systems (AHRS), 7-26-12
- TSO-C204a, Circuit Card Assembly Functional Sensors using Satellite-Based Augmentation System (SBAS) for, 5-09-17
- TSO-C204, Circuit Card Assembly Functional Sensors using SBAS for, 12-20-13

- TSO-C205a, Circuit Card Assembly Functional Class Delta Equipment Using The Satellite-Based Augmentation, 5-09-17
- TSO-C205, Circuit Card Assembly Functional Class Delta Equipment Using The Satellite-Based Augmentation, 12-20-13
- TSO-C206, Circuit Card Assembly Functional Sensors using Aircraft-Based Augmentation for Navigation and, 12-20-13
- TSO-C207, Aeronautical Mobile Airport Communication System (AeroMACS), 5-13-14
- TSO-C207a, AeroMACS Airborne Mobile Station (AMS) Equipment, 8-18-17
- TSO-C209, Electronic Flight Instrument System (EFIS) Display, 9-29-16
- TSO-C210, Airborne Head Up Display (HUD), 10-25-17
- [TSO-C211, Detect and Avoid \(DAA\) Systems, 9-25-17](#)
- [TSO-C212, Air-to-Air Radar \(ATAR\) for Traffic Surveillance, 9-22-17](#)
- [TSO-C213, UASs Control and Non-Payload Communications Terrestrial Link System Radios](#)
- [Advisory Circular \(AC\), AC 107-2, Small UAS \(sUAS\), 6-21-16](#)
- [AC 20–170, Integrated Modular Avionics Development, Verification, Integration, and Approval Using RTCA/DO-297 and Technical Standard Order-C153, 11-21-13](#)
- [UAS Traffic Management \(UTM\) Concept of Operations, FAA, 5-18-18](#)
- Various ACs, Regulations, Policy Statements, Special Conditions, etc. in [FAA’s Regulatory and Guidance Library](#)

Various FAA Technical Center sponsored research and technical documents

RTCA, Inc. Documents:

- SC-228, Defining the Collision Avoidance Region for DAA Systems, 8-12-16
- DO-365, *MOPS for DAA Systems*, 5-31-17
- DO-254, *Design Assurance Guidance for Airborne Electronic Hardware (AEH)*
- DO-366, *MOPS for Air-to-Air Radar for Traffic Surveillance*, 5-31-17
- DO-362, *Command and Control (C2) Data Link MOPS (Terrestrial)*, 9-22-16
- SC-228, MOPS for UAS, [AWP-1 - DAA White Paper](#)
- SC-228, MOPS for UAS, [AWP-3 - DAA White Paper Phase 2](#)
- DO-181E, *MOPS for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment* Section 2 as amended by Appendix 2 of the TSO-112e dated 9-16-13
- DO-367, *MOPS for Terrain Awareness and Warning Systems (TAWS) Airborne Equipment*
- [DO-289, Minimum Aviation System Performance Standards \(MASPS\) for Aircraft Surveillance Applications \(ASA\), 12-13-06](#)
- [Other RTCA standards](#)

Institute of Electrical and Electronics Engineers (IEEE) Aerospace Electronics Standards:

- 52-1951 - AIEE Application Guide for Grounding of Instrument Transformer Secondary Circuits and Cases
- 57-1959 - IEEE Thermal Stability of Enameled Wire in Air
- 127-1963 - IEEE Standard for Aerospace Equipment Voltage and Frequency Ratings
- 128-1976 - IEEE Guide for Aircraft Electric Systems
- 132-1953 - Test Code for D-C Aircraft Rotating Machines
- 134-1955 - Trial-Use Test Code for Direct-Current Carbon-Pile Voltage Regulators for Aircraft
- 135-1969 - IEEE Recommended Practice for Aircraft, Missile, and Space Equipment Electrical Insulation Tests

- 136-1959 - Trial-Use Test Procedure and Presentation of Aircraft Generator and Regulator Characteristics
- 137-1960 - IEEE Trial-Use Test Procedure for AC 400 Hz Aircraft Induction Motors
- 138-1960 - Trial-Use Test Procedure for Aircraft Alternating-Current Generators
- 172-1983 - IEEE Standard Definitions of Navigation Aid Terms
- 173-1959 - IEEE Standards on Navigation Aids: Direction Finder Measurements, 1959
- 292-1969 - IEEE Specification Format for Single-Degree-of-Freedom Spring-Restrained Rate Gyros
- 293-1969 - IEEE Test Procedure for Single-Degree-of-Freedom Spring-Restrained Rate Gyros
- 293-1969/Cor 1-2014 - IEEE Standard for IEEE Test Procedure for Single-Degree-of-Freedom Spring-Restrained Rate Gyros -- Corrigendum 1: Table 1 Heading
- 307-1969 - IEEE Standard Definitions of Terms For Solar Cells
- 386-2016 - IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
- 391-1976 - Hi-Power (>300W, peak) Pulse Transformers
- 467-1980 - IEEE Standard Quality Assurance Program Requirements for the Design and Manufacture of Class 1E Instrumentation and Electric Equipment for Nuclear Power Generating Stations
- 517-1974 - IEEE Standard Specification Format Guide and Test Procedure for Single-Degree-of-Freedom Rate-Integrating Gyros
- 521-2002 - IEEE Standard Letter Designations for Radar-Frequency Bands
- 528-1984 - IEEE Standard Inertial Sensor Terminology
- 528-2001 - IEEE Standard for Inertial Sensor Terminology
- 529-1980 - Supplement for Strapdown Applications to IEEE Standard Specification Format Guide and Test Procedure for Single-Degree-of-Freedom Rate-Integrating Gyros
- 529-1980/Cor 1-2017 - IEEE Standard Supplement for Strapdown Applications to IEEE Standard Specification Format Guide and Test Procedure for Single-Degree-of-Freedom Rate-Integrating Gyros
- 647-1981 - IEEE Standard Specification Format Guide and Test Procedure for Single-Axis Laser Gyros
- 647-2006 - IEEE Standard Specification Format Guide and Test Procedure for Single-Axis Laser Gyros
- 671-1985 - IEEE Standard Specification Format Guide and Test Procedure for Nongyroscopic Inertial Angular Sensors: Jerk, Acceleration, Velocity, and Displacement
- 671-1985/Cor 1-2010 - IEEE Standard Specification Format Guide and Test Procedure for Nongyroscopic Inertial Angular Sensors: Jerk, Acceleration, Velocity, and Displacement Corrigendum 1: 4.7.2.6 Short-Term Stability and Annex A Sensor Dynamic Block Diagrams
- 686-1990 - IEEE Standard Radar Definitions
- 686-2017 - IEEE Standard for Radar Definitions
- 700-1953 - AIEE Standard for Aircraft Direct- Current Apparatus Voltage Ratings
- 750-1947 - AIEE Report on Aircraft Electric System Guide
- 750.1-1960 - AIEE Report on Aircraft and Missiles Electric Systems Guide - Sections 000, 100, 200, and 300
- 750.5-1960 - AIEE Report on Aircraft and Missiles Electric Systems Guide Sections 500 and 800
- 750.11-1960 - AIEE Report on Aircraft and Missiles Electric Systems Guide Appendices I, II, and III
- 802-1955 - AIEE Proposed Trail Use Test Code DIRECT -- Current Carbon -- pile voltage regulators for aircraft
- 804-1959 - AIEE Test Procedure and Presentation of Aircraft Generator and Regulator Characteristics
- 805-1960 - AIEE Proposed Test Procedure for Alternating Current 400 Cycle Per second Aircraft Induction Motors
- 806-1960 - AIEE Proposed Test Procedure for Aircraft Alternating Current Generators
- 813-1988 - IEEE Specification Format Guide and Test Procedure for Two-Degree-of-Freedom Dynamically Tuned Gyros
- 836-2009 - IEEE Recommended Practice for Precision Centrifuge Testing of Linear Accelerometers

- 859-1987 - IEEE Standard Terms for Reporting and Analyzing Outage Occurrences and Outage States of Electrical Transmission Facilities
- 952-1997 - IEEE Standard Specification Format Guide and Test Procedure for Single-Axis Interferometric Fiber Optic Gyros
- 952-1997/Cor 1-2016 - IEEE Standard Specification Format Guide and Test Procedure for Single-Axis Interferometric Fiber Optic Gyros
- 1293-1998 - IEEE Standard Specification Format Guide and Test Procedure for Linear, Single-Axis, Non-Gyroscopic Accelerometers
- 1293-1998/Cor 1-2008 - IEEE Standard Specification Format Guide and Test Procedure for Linear, Single-Axis, Nongyroscopic Accelerometers Corrigendum 1
- 1431-2004/Cor 1-2008 - IEEE Standard Specification Format Guide and Test Procedure for Coriolis Vibratory Gyros - Corrigendum 1
- 1554-2005 - IEEE Recommended Practice for Inertial Sensor Test Equipment, Instrumentation, Data Acquisition, and Analysis
- 1559-2009 - IEEE Standard for Inertial Systems Terminology
- 1651-2010 - IEEE Guide for Reducing Bird-Related Outages
- 1672-2006 - IEEE Standard for Ultrawideband Radar Definitions
- 1672-2006/Cor 1-2008 - IEEE Standard for Ultrawideband Radar Definitions - Corrigendum 1
- 1871.1-2014 - IEEE Recommended Practice for Using IEEE 1671.2™ Instrument Description Templates for Describing Synthetic Instrumentation for Classes of Instruments such as Waveform Generators, Digitizers, External Oscillators, and Up and Down Converters
- 11073-10472-2010 - Health informatics--Personal health device communication--Part 10472: Device specialization--Medication monitor
- 62530-2011 - SystemVerilog – Unified Hardware Design, Specification, and Verification Language

International Civil Aviation Organization (ICAO) Documents:

- Annex 2 – Rules of the Air
- Annex 8 – Airworthiness of Aircraft
- Annex 10 Vol 1 – Radio Navigation Aids
- Annex 10 Vol 2 – Communication Procedures
- Annex 10 Vol 3 – Communication Systems
- Annex 10 Vol 4 – Surveillance and Collision Avoidance Systems
- Annex 10 Vol 5 – Aeronautical Radio Frequency Spectrum Utilization
- Doc 9684 – Manual for SSR Systems
- Doc 9871 – Technical Provisions for Mode S Services and Extended Squitter

Joint Authorities for Rulemaking on Unmanned Systems (JARUS) Documents:

- JARUS WG4 - Detect & Avoid, JARUS DAA
- JARUS WG4 - Detect & Avoid, JARUS DAA CONOPS for VLL operations

American Institute of Aeronautics and Astronautics (AIAA) Documents:

- DAA for Small UASs Using ADS-B, Air Traffic Control Quarterly, 2015
- Minimum Required Detection Range for DAA of UASs, Journal of Aerospace Information Systems (JAIS), 2017
- An Examination of UASs Pilots' Interaction with Air Traffic Control while Responding to DAA Conflicts, Air Traffic Control Quarterly, 2015
- Requirements, Issues, and Challenges for Sense and Avoid in UASs, Journal of Aircraft, 2012
- Foreword Special Issue on UAS Sense and Avoid, Air Traffic Control Quarterly, 2015
- Ground-Based Sense-and-Avoid System for Small Unmanned Aircraft, JAIS: 1-17

- Analysis of Piezoelectric Sensor to Detect Flexural Waves, *Journal of Guidance, Control, and Dynamics (JGCD)*, 2001
- Optimum siting of NEXRAD to detect hazardous weather at airports, *Journal of Aircraft*, 1983
- UAS Sense and Avoid Integrity: Intruder Linear Accelerations and Analysis, *JAIS*, 2017
- Modeling and Simulation of a Ground Based Sense and Avoid Architecture for UAS Operations, *Air Traffic Control Quarterly*, 2013
- UAS Sense-and-Avoid (SAA) Integrity and Continuity Risk, *JGCD*, 2016
- Fielding a Sense and Avoid Capability for UASs: Policy, Standards, Technology, and Safety Modeling, *Air Traffic Control Quarterly*, 2013
- Downwash Detection and Avoidance with Small Quadrotor Helicopters, *JGCD*, 2017
- Generating Certification Evidence for Autonomous Unmanned Aircraft Using Model Checking and Simulation, *JAIS*, 2014
- Pulsed Doppler Radar Detects Weather Hazards to Aviation, *Journal of Aircraft*, 1982
- Range requirements for airborne turbulence detectors, *Journal of Aircraft*, 1969
- Incorporating Uncertainty in Admissible Regions for Uncorrelated Detections, *JGCD*, 2015
- Piecewise Bézier Curves for Avoiding Collisions During Multivehicle Coordinated Missions, *JGCD*, 2017
- Ground-Based Sense and Avoid: Enabling Local Area Integration of UASs into the NAS, *Air Traffic Control Quarterly*, 2015
- Magnetic detector for projectiles in tubes, *AIAA Journal*, 1990
- Downstream Effects of Separation Assurance on Encounters between Unmanned and Manned Aircraft, *Journal of Air Transportation*, 2017
- Vision-Based Obstacle Avoidance of Wheeled Robots Using Fast Estimation, *JGCD*, 2009
- Feasibility of Detecting Spacecraft Charging and Arcing by Remote Sensing, *Journal of Spacecraft and Rockets*, 2014
- Automated Route Generation for Avoiding Deterministic Weather in Transition Airspace, *JGCD*, 2007
- Novel Adaptive Generalized Likelihood Ratio Detector with Application to Maneuvering Target Tracking, *JGCD*, 2006
- Lidar-Based Hazard Avoidance for Safe Landing on Mars, *JGCD*, 2002
- Evolving Philosophies on Autonomous Obstacle/Collision Avoidance of UAVs, *Journal of Aerospace Computing, Information, and Communication*, 2011
- Path Generation Algorithm for Turbulence Avoidance Using Real-Time Optimization, *JGCD*, 2013
- Evolutionary Algorithm for Artificial-Immune-System-Based Failure-Detector Generation and Optimization, *JGCD*, 2010
- An error-detecting test using generated number sequences, *Journal of Spacecraft and Rockets*, 1970
- Two-Line-Elements-Based Maneuver Detection Methods for Satellites in Low Earth Orbit, *JGCD*, 2014
- Investigation into ice detection parameters for turboprop aircraft, *Journal of Aircraft*, 1996
- Satellites for the detection of nonsolar planets, *Journal of Spacecraft and Rockets*, 1981
- Vector Autoregressive Model-Based Anomaly Detection in Aviation Systems, *JAIS*, 2016
- Accounting for State Uncertainty in Collision Avoidance, *JGCD*, 2011
- Evaluation of Collision Avoidance Maneuvers for Parallel Approach, *JGCD*, 1999
- Detecting the Onset of an Impending Thermoacoustic Instability Using Complex Networks, *Journal of Propulsion and Power*, 2016
- Probabilistic reasoning for intelligent wind shear avoidance, *JGCD*, 1992
- Development of a Multichannel Optical Correlation Detector for Sonar Signals, *Journal of Aircraft*, 1966
- Collision-Avoidance Framework for Small Fixed-Wing UAVs, Lorenz Schmitt, *JGCD*, 2014
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- Minimum-Effort Intercept Angle Guidance with Multiple-Obstacle Avoidance, JGCD, 2018
- Real-time Obstacles Avoidance for Vehicles in the Urban Grand Challenge, Journal of Aerospace Computing, Information, and Communication, 2007
- UAV Optimal Cooperative Obstacle Avoidance in a Stochastic Dynamic Environment, JGCD, 2011
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- Robust Joint Target Detection and Tracking for Space Situational Awareness, JGCD, 2018
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- J3016, Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles
- J3018, Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)
- J3092, Dynamic Test Procedures for Verification & Validation of ADS
- J3131, Automated Driving Reference Architecture
- J3164, Taxonomy and Definitions for Terms Related to ADS Behaviors and Maneuvers for On-Road Motor Vehicles
- J3171, ADS-DV User Issues for Persons with Disabilities
- [ARINC 400 Series describes guidelines for installation, wiring, data buses, and databases.](#)
 - ARINC 404 defines Air Transport Rack (ATR) form factors for avionics equipment installed in many types of aircraft. It defines air transport equipment cases and racking.
 - ARINC 424 is an international standard file format for aircraft navigation data.
 - ARINC 429 is the most widely used data bus standard for aviation. Electrical and data format characteristics are defined for a two-wire serial bus with one transmitter and up to 20 receivers. The bus is capable of operating at a speed of 100 kbit/s.
- [ARINC 500 Series describes older analog avionics equipment used on early jet aircraft such as the Boeing 727, Douglas DC-9, DC-10, Boeing 737 and 747, and Airbus A300.](#)
- [ARINC 600 Series are reference standards for avionics equipment specified by ARINC 700 Series.](#)
 - ARINC 600 is the predominant avionics packaging standard introducing the avionics Modular Concept Unit (MCU)
 - ARINC 604 is a standard and guidance for the purpose of designing and implementing Built-In Test Equipment. The standard also describes the Centralized Fault Display System.
 - ARINC 610B provides guidance for use of avionics equipment and software in simulators.
 - ARINC 615 is a family of standards covering "data loading", commonly used for transferring software and data to or from avionics devices. The ARINC 615 standard covers "data loading" over ARINC 429.
 - ARINC 615A is a standard that covers a "data loading" protocol that can be used over various bus types such as Ethernet, CAN, and ARINC 664.
 - ARINC 618 is a standard that covers a data transmission protocol called "Character Oriented Protocol".
 - ARINC 619 is a standard that covers a data transmission protocol over ARINC 429 called "Bit

- Oriented Protocol".
- ARINC 620 is a standard that covers a data transmission protocol called "Datalink Ground System".
 - ARINC 624 is a standard for aircraft onboard maintenance system (OMS). It uses ARINC 429 for data transmission between embedded equipment.
 - ARINC 625 is an Industry Guide for Component Test Development and Management. It provides a standard approach for quality management of Test Procedure Generation within the commercial air transport industry.
 - ARINC 629 is a multi-transmitter data bus protocol where up to 120 terminals can share the same bus. It is installed on the Boeing 777.
 - ARINC 633 is the air-ground protocol for ACARS and IP networks used for AOC data exchanges between aircraft and the ground.
 - ARINC 635 defines the protocols for the HF DL network of radios used for communication and messaging between aircraft and HF Ground Stations.
 - ARINC 653 is a standard Real Time Operating System interface for partitioning of computer resources in the time and space domains. The standard also specifies Application Program Interfaces for abstraction of the application from the underlying hardware and software.
 - ARINC 660 defines avionics functional allocation and recommended architectures for CNS/ATM avionics.
 - ARINC 661 defines the data structures used in an interactive cockpit display system (CDS), and the communication between the CDS and User Applications. The GUI definition is completely defined in binary definition files. The CDS software consists of a kernel capable of creating a hierarchical GUI specified in the definition files. The concepts used by ARINC 661 are similar to those used in user interface markup languages.
 - ARINC 664 defines the use of a deterministic Ethernet network as an avionic databus in modern aircraft like Airbus A380, Bombardier C-Series, and Boeing 787 Dreamliner.
 - ARINC 665 This standard defines standards for loadable software parts and software transport media.
 - ARINC 667 is a Guidance for the Management of Field Loadable Software
 - [ARINC 700 Series describes the form, fit, and function of avionics equipment installed predominately on transport category aircraft.](#)
 - ARINC 702A defines the Flight Management Systems (FMS).
 - ARINC 704 defines the Inertial Reference System (IRS).
 - ARINC 708 is the standard for airborne weather radar. It defines the airborne weather radar characteristics for civil and military aircraft.
 - ARINC 709 defines Distance Measuring Equipment (DME).
 - ARINC 717 defines the acquisition of flight data for recording
 - ARINC 718 describes an Air Traffic Control Transponder (ATCRBS/MODE S).
 - ARINC 724B defines the Aircraft Communications Addressing and Reporting System (ACARS).
 - ARINC 735B defines the Traffic Computer with TCAS.
 - ARINC 738 defines an integrated Air Data Inertial Reference Unit (ADIRU).
 - ARINC 739 is the standard for a Multi-Purpose Control and Display Unit (MCDU) and interfaces.
 - ARINC 740 defines airborne printers.
 - ARINC 741 is the standard for a first-generation L-band satellite data unit.
 - ARINC 743A defines a GNSS receiver.
 - ARINC 744A defines a full-format airborne printer.
 - ARINC 746 is the standard for a cabin telecommunications unit, based on Q.931 and CEPT-E1.
 - ARINC 747 defines a Flight Data Recorder (FDR).

- ARINC 750 defines a VHF Digital Radio.
- ARINC 755 defines a Multi-Mode Receiver (MMR) for approach and landing ARINC 756 defines a GNSS Navigation and Landing Unit.
- ARINC 759 defines an Aircraft Interface Device (AID) ARINC 760 defines a GNSS Navigator.
- ARINC 757 defines a Cockpit Voice Recorder (CVR).
- ARINC 761 is the standard for a second-generation L-band satellite data unit, also called Swift64 by operator Inmarsat.
- ARINC 763 is the standard for a generic avionics file server and wireless access points.
- ARINC 767 defines a combined recorder unit capable of data and voice.
- ARINC 771 is Low-Earth Orbiting Aviation Satellite Communication System.
- ARINC 781 is the standard for a third-generation L-band satellite data unit, also called SwiftBroadband (SBB) by operator Inmarsat.
- ARINC 791 defines Ku and Ka band satellite data airborne terminal equipment.
- [ARINC 800 Series comprises a set of aviation standards for aircraft, including fiber optics used in high-speed data buses.](#)
 - ARINC 801 through 807 define the application of fiber optics on the aircraft.
 - ARINC 810 is a standard for the integration of aircraft galley inserts and associated interfaces
Title: Definition of Standard Interfaces for Galley Insert (GAIN) Equipment, Physical Interfaces.
 - ARINC 811 provides a common understanding of information security concepts as they relate to airborne networks, and provides a framework for evaluating the security of airborne-networked systems.
 - ARINC 812 is a standard for the integration of aircraft galley inserts and associated interfaces.
 - ARINC 816 defines a database for airport moving maps
 - ARINC 817 defines a low-speed digital video interface
 - ARINC 818 defines a high-speed digital video interface standard developed for high bandwidth, low latency, uncompressed digital video transmission.
 - ARINC 821 is a top-level networking definition describing aircraft domains, file servers and other infrastructure.
 - ARINC 822 is the standard for Gatelink.
 - ARINC 823 is a standard for end-to-end datalink encryption.
 - ARINC 825 is a standard for Controller Area Network bus protocol for airborne use.
 - ARINC 826 is a protocol for avionic data loading over a Controller Area Network bus.
 - ARINC 827 specifies a crate format for electronic distribution of software parts for aircraft.
 - ARINC 828 defines aircraft wiring provisions and electrical interface standards for electronic flight bag (EFB).
 - ARINC 834 defines an aircraft data interface that sources data to Electronic Flight Bags, airborne file servers, etc.
 - ARINC 838 provides a standardized XML description for loadable software parts.
 - ARINC 839 is a function definition of airborne manager of air-ground interface communications (MAGIC).
 - ARINC 840 defines the Application Control Interface (ACI) used with an Electronic Flight Bag (EFB)
 - ARINC 841 defines Media Independent Aircraft Messaging
 - ARINC 842 provides guidance for usage of digital certificates on airplane avionics and cabin equipment.

[Other SAE standards](#)

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- AIMS 03-1101 Mark XIIA and Mode S Transponder Bench Performance Test Requirements
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- MIL-STD-882 System Safety Program Requirements
- MIL-STD-883 Test Methods and Procedures For Microelectronics
- MIL-STD-975 Standard Parts Derating Guidelines
- MIL-STD-1472 Human Engineering Design Criteria For Military Systems, Equipment and Facilities
- MIL-STD-1562 Lists of Standard Microcircuits
- MIL-STD-1670 Environmental Criteria and Guidelines for Air Launched Weapons
- MIL-STD-1686 Electrostatic Discharge Control Program For Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
- MIL-STD-1772 Certification Requirements For Hybrid Microcircuit Facility and Lines
- MIL-STD-2155 Failure Reporting, Analysis and Corrective Action System
- MIL-STD-2167 Defense System Software Development
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- MIL-HDBK-471 Maintainability Verification/Demonstration/Evaluation
- MIL-HDBK-781 Reliability Testing For Engineering Development, Qualification and Production
- MIL-HDBK-965 Parts Control Program
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ASTM International Documents:

- [F2411 - 04e1, Standard Specification for Design and Performance of an Airborne SAA System](#)
- F2411 – 04, Standard Specification for Design and Performance of an Airborne SAA System
- F3153-15 Standard Specification for Verification of Avionics Systems
- F2490-05(2013) Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis

- F2799-14 Standard Practice for Maintenance of Aircraft Electrical Wiring Systems
- F2639-15 Standard Practice for Design, Alteration, and Certification of Aircraft Electrical Wiring Systems
- F3011-13 Standard Specification for Performance of Angle of Attack System
- F3236-17 Standard Specification for High Intensity Radiated Field (HIRF) Protection in Small Aircraft

EUROCAE Document(s):

- EUROCAE, ED-112, Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems, Mar 2003

FCC Documents:

- 47 CFR part 87,
- Manual of Regulations and Procedures for Federal Radio Frequency Management
- FCC 10-103 In the Matter of Review of Part 87 of the Commission's Rules Concerning the Aviation Radio Service WT Docket No. 01-289 Third Report and Order Adopted: June 1, 2010 Released: June 15, 2010
- FCC DA-13-239A1 Reminder of ELT Use and Registration

[International Telecommunication Union \(ITU\) Documents](#)

Telecommunications Industry Association (TIA) Documents:

- [TIA Structural standards](#)
- ANSI/TIA-222-H Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures
- ANSI/TIA-322 Loading, Analysis, and Design Criteria Related to the Installation, Alteration and Maintenance of Communication Structures

In-Development Standards and Related Documents include the following:

International Civil Aviation Organization (ICAO) Documents:

- Annex 2 – Rules of the Air, Q1 2018
- Annex 3 – Meteorological Service for International Air Navigation, Q1 2021
- Annex 6 – Part IV – International Operations – RPAS, Q1 2020
- Annex 8 – Airworthiness of Aircraft, Q1 2018
- Annex 10 – Volume IV, Part II – DAA Systems, Q1 2020
- Annex 11 – Air Traffic Services, Q1 2020
- Annex 14 – Aerodromes, Q1 2021
- Annex 19 – Safety Management, Q1 2020
- Manual on RPAS (Doc 10019), Q1 2021
- Procedures for Air Navigation Services – Air Traffic Management (Doc 4444), Q1 2021
- Procedures for Air Navigation Services – Aircraft Operations – Vol I – Flight Procedures (Doc 8168), Q1 2021

SAE International Documents:

- [AS-4JAUS Joint Architecture for Unmanned Systems Committee](#)
 - [AS6062A](#), JAUS Mission Spooling Service Set
 - [AS6111](#), JAUS Unmanned Maritime Vehicle Service Set
 - [AS8024](#), JAUS Autonomous Behaviors Service Set

- **[AS-4UCS Unmanned Systems Control Segment Architecture](#)**
 - [AIR6514A](#), UxS Control Segment (UCS) Architecture: Interface Control Document (ICD)
 - [AS6518A](#), Unmanned Systems (UxS) Control Segment (UCS) Architecture: UCS Architecture Model
 - [AS6522A](#), Unmanned Systems (UxS) Control Segment (UCS) Architecture: Architecture Technical Governance

- **[A-6A3 Flight Control and Vehicle Management Systems Committee](#)**
 - [AIR5273A](#), Actuation System Failure Detection Methods
 - [AIR5875A](#), Methodology for Investigation of Flight Control System Anomalies
 - [AIR6920](#), ARP4754 Process Framework with Checklists and templates for flight control and vehicle management systems
 - [ARP4895B](#), Flight Control Actuators - Dynamic Seals, Collection of Duty Cycle Data
 - [ARP5007B](#), Development Process - Aerospace Fly-By-Wire Actuation System
 - [ARP5775](#), Skew and Disconnect Detection in High Lift Systems
 - [ARP6001A](#), Aerospace - Passive Side Stick Unit, General Requirements for Fly by Wire Transport and Business
 - [ARP6252](#), Aerospace – Rudder and Brake Pedal unit General Requirements for Fly by Wire Transport and Business Aircraft
 - [AS94900A](#), Aerospace - Flight Control Systems - Design, Installation and Test of Piloted Military Aircraft, General Specification For

- **[HM-1 Integrated Vehicle Health Management Committee](#)**
 - [AIR6334](#), A Power Usage Metric For Rotorcraft Power Train Transmissions
 - [AIR6900](#), Applicable Integrated Vehicle Health Monitoring (IVHM) Regulations, Policy, and Guidance Documents
 - [AIR6904](#), Data Interoperability for IVHM
 - [AIR6915](#), Implementation of IVHM, Human Factors and Safety Implications
 - [AIR8012](#), Prognostics and Health Management Guidelines for Electro-Mechanical Actuators
 - [ARP6204](#), Condition Based Maintenance (CBM) Recommended Practices
 - [ARP6290](#), Guidelines for the Development of Architectures for Integrated Vehicle Health Management Systems
 - [ARP6407](#), Integrated Vehicle Health Management Design Guidelines
 - [ARP6883](#), Guidelines for writing IVHM requirements for aerospace systems
 - [ARP6887](#), Verification & Validation of IVHM Systems and Software

[Other SAE In-Development Standards](#)

RTCA Documents:

- [Other RTCA In-Development Standards](#)

DOD Documents:

- Please contact appropriate DOD offices for In-Development Standards.

ASTM International Documents:

- [WK62668, Specification for DAA Performance Requirements](#)
- [WK62669, Test Method for DAA](#)

- WK61183 Revision of F3153 - 15 Standard Specification for Verification of Avionics Systems
- WK62762 New Practice for System Level Verification of Software and Airborne Electronic Hardware on Small Aircraft
- WK52829, New Practice for Simplified Safety Analysis of Systems & Equipment in Small Aircraft
- WK60748, New Guide for Application of Systems-Theoretic Process Analysis to Aircraft
- WK61550, New Specification for Simplified High Intensity Radiated Field (HIRF) Protection in Level 1, Level 2, and Level 3 Aircraft
- WK47489, New Specification for Design, Performance and Manufacturing of Automatic Pilot System
- WK61549, New Specification for Indirect Flight Control Systems in Aircraft
- WK56374, New Practice for Aircraft Systems Information Security Protection
- [Other ASTM In-Development Standards](#)

6.4.3 Detect and Avoid (DAA) Systems

Published Standards: Published UAS DAA Systems standards and regulatory materials (civil, military and space applications) include:

FAA Regulations/Documents:

- 14 CFR §91.111, Operating near other aircraft
- 14 CFR §91.113, Right-of-way rules: Except water operations
- 14 CFR §91.115, Right-of-way rules: Water operations
- 14 CFR §91.205, Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements
- 14 CFR §91.207, Emergency locator transmitters
- 14 CFR §91.209, Aircraft lights
- 14 CFR §91.215, ATC transponder and altitude reporting equipment and use
- 14 CFR §91.217, Data correspondence between automatically reported pressure altitude data and the pilot's altitude reference
- 14 CFR §91.219, Altitude alerting system or device: Turbojet-powered civil airplanes
- 14 CFR §91.221, Traffic alert and collision avoidance system equipment and use
- 14 CFR §91.223, Terrain awareness and warning system¹
- 14 CFR §91.225, Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment and use
- 14 CFR §91.227, ADS-B Out equipment performance requirements
- 14 CFR §91.411, Altimeter system and altitude reporting equipment tests and inspections
- 14 CFR §91.413, ATC transponder tests and inspections
- 14 CFR §107.25, Operation from a moving vehicle or aircraft
- 14 CFR §107.29, Daylight operation
- 14 CFR §107.37, Operation near aircraft; right of way rules
- 14 CFR §107.39, Operation over human being
- 14 CFR §107.41, Operation in certain airspace
- 14 CFR §107.51, Operating limitations for small unmanned aircraft
- Technical Standard Order, TSO-C74d, Air Traffic Control Radar Beacon System (ATCRBS) Airborne Equipment, December 17, 2008
- TSO-C211, Detect and Avoid (DAA) Systems, September 25, 2017
- TSO-C212, Air-to-Air Radar (ATAR) for Traffic Surveillance, September 22, 2017

- TSO-C213, Unmanned Aircraft Systems Control and Non-Payload Communications Terrestrial Link System Radios, September 3, 2018
- TSO-C213, Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment, September 16, 2013
- TSO-C118, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS I, August 5, 1988
- TSO-C118a, TCAS Airborne Equipment, TCAS I, October 27, 2014
- TSO-C119d, TCAS Airborne Equipment, TCAS II with Hybrid Surveillance, September 5, 2013
- TSO-C119e, TCAS Airborne Equipment, TCAS II with Hybrid Surveillance, June 30, 2016
- TSO-C151d, Terrain Awareness and Warning Systems (TAWS), August 31, 2017
- TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment, December 2, 2009
- TSO-C166b, Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information, December 2, 2009
- TSO-C195b, Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance, September 29, 2014
- Advisory Circular, AC 107-2, Small UAS (sUAS), 6/21/2016
- UAS Traffic Management (UTM) Concept of Operations, FAA, May 18, 2018
- Advisory Circular, AC 20-170, Integrated Modular Avionics Development, Verification, Integration, and Approval Using RTCA/DO-297 and Technical Standard Order-C153, November 21, 2013

RTCA, Inc. Documents:

- SC-228, Defining the Collision Avoidance Region for DAA Systems, August 12, 2016
- DO-365, Minimum Operational Performance Standards for Detect and Avoid Systems, May 31, 2017
- DO-254, Design Assurance Guidance for Airborne Electronic Hardware (AEH)
- DO-366, Minimum Operational Performance Standards for Air-to-Air Radar for Traffic Surveillance, May 31, 2017
- DO-362, Command and Control (C2) Data Link Minimum Operational Performance Standards (MOPS) (Terrestrial), September 22, 2016
- SC-228, MOPS for UAS, RTCA AWP-1 - Detect and Avoid (DAA) White Paper
- SC-228, MOPS for UAS, RTCA AWP-3 - DAA White Paper Phase 2
- DO-181E, Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment Section 2 as amended by Appendix 2 of the TSO-112e dated September 16, 2013
- DO-367, Minimum Operational Performance Standard (MOPS) for Terrain Awareness and Warning Systems (TAWS) Airborne Equipment
- DO-289, Minimum Aviation System Performance Standards (MASPS) for Aircraft Surveillance Applications (ASA), December 13, 2006

International Civil Aviation Organization (ICAO) Documents:

- Annex 1 – Personnel Licensing
- Annex 2 – Rules of the Air
- Annex 8 – Airworthiness of Aircraft

AIAA Documents:

- [Terminology for Unmanned Aerial Vehicles and Remotely Operated Aircraft \(AIAA R-103-2004\)](#)
- [Guide to the Preparation of Operational Concept Documents \(ANSI/AIAA G-043B-2018\)](#)

- [Guide: Managing the Use of Commercial Off the Shelf \(COTS\) Software Components for Mission-Critical Systems \(AIAA G-118-2006\)](#)
- [Guide: Reusable Software: Assessment Criteria for Aerospace Applications \(AIAA G-010-1993\)](#)
- [Space Systems Verification Program and Management Process \(AIAA S-117A-2016\)](#)
- [Performance-Based Failure Reporting, Analysis & Corrective Action System Requirements \(ANSI/AIAA S-102.1.4-2009\)](#)
- [Performance-Based Failure Review Board Requirements \(ANSI/AIAA S-102.1.5-2009\)](#)
- [Performance-Based System Reliability Modeling Requirements \(ANSI/AIAA S-102.2.2-2009\)](#)
- [Performance-Based Product Failure Mode, Effects and Criticality Analysis Requirements \(ANSI/AIAA S-102.2.4-2015\)](#)
- [Performance-Based Sneak Circuit Analysis Requirements \(AIAA S-102.2.5-2009\)](#)
- [Performance-Based Anomaly Detection and Response Analysis \(ANSI/AIAA S-102.2.11-2009\)](#)
- [Performance-Based Fault Tree Analysis Requirements \(ANSI/AIAA S-102.2.18-2009\)](#)
- [Various Documents and Publications](#)
- Detect and Avoid for Small UASs Using ADS-B, Air Traffic Control Quarterly, 2015, Vol.23: 203-240, 10.2514/atcq.23.2-3.203
- Minimum Required Detection Range for Detect and Avoid of UASs, Journal of Aerospace Information Systems, 2017, Vol.14: 351-372, 10.2514/1.1010479
- An Examination of UASs Pilots' Interaction with Air Traffic Control while Responding to Detect and Avoid Conflicts, Air Traffic Control Quarterly, 2015, Vol.23: 113-135, 10.2514/atcq.23.2-3.113
- Requirements, Issues, and Challenges for Sense and Avoid in UASs, Journal of Aircraft, 2012, Vol.49: 677-687, 10.2514/1.C031606
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SAE International Documents:

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- ARP5707, Pilot Training Recommendations for Unmanned Aircraft Systems (UAS) Civil Operations
- ARP6012A, JAUS Compliance and Interoperability Policy
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- AS5669A, JAUS / SDP Transport Specification
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- ARP6128, Unmanned Systems Terminology Based on the ALFUS Framework
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- AIR5664A, JAUS History and Domain Model
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- AIR5665, Architecture Framework for Unmanned Systems
- AIR5645, JAUS Transport Considerations
- AS5669, JAUS Transport Specification
- AIR5664, JAUS History and Domain Model
- AIR6514A, UxS Control Segment (UCS) Architecture: Interface Control Document (ICD)
- AS6522A, Unmanned Systems (UxS) Control Segment (UCS) Architecture: Architecture Technical Governance
- AS6969, Data Dictionary for Quantities Used in Cyber Physical Systems
- AS6062A, JAUS Mission Spooling Service Set
- AS6111, JAUS Unmanned Maritime Vehicle Service Set
- AS8024, JAUS Autonomous Capabilities Service Set
- ARP5007B Development Process - Aerospace Fly-By-Wire Actuation System

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- J2924, Engineering Probabilistic Methods - Basic Concepts, Models and Approximate Methods for Probabilistic Engineering Analysis
- J2925, System Reliability and Integration
- J2940, Use of Model Verification and Validation in Product Reliability and Confidence Assessments
- J2945/10, J2945/10 Recommended Practices for MAP/SPaT Message Development
- J2945/11, J2945/11 Recommended Practices for Signal Preemption Message Development
- J2945/12, Traffic Probe Use and Operation
- J2945/2, DSRC Requirements for V2V Safety Awareness
- J2945/3, Requirements for V2I Weather Applications
- J2945/4, DSRC Messages for Traveler Information and Basic Information Delivery
- J2945/5, Service Specific Permissions and Security Guidelines for Connected Vehicle Applications
- J2945/6, Performance Requirements for Cooperative Adaptive Cruise Control and Platooning
- J3016, Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles
- J3018, Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)
- J3092, Dynamic Test Procedures for Verification & Validation of Automated Driving Systems (ADS)
- J3131, Automated Driving Reference Architecture
- J3164, Taxonomy and Definitions for Terms Related to Automated Driving System Behaviors and Maneuvers for On-Road Motor Vehicles
- J3171, ADS-DV User Issues for Persons with Disabilities
- [ARINC 400 Series describes guidelines for installation, wiring, data buses, and databases.](#)
 - ARINC 404 defines Air Transport Rack (ATR) form factors for avionics equipment installed in many types of aircraft. It defines air transport equipment cases and racking.
 - ARINC 424 is an international standard file format for aircraft navigation data.
 - ARINC 429 is the most widely used data bus standard for aviation. Electrical and data format characteristics are defined for a two-wire serial bus with one transmitter and up to 20 receivers. The bus is capable of operating at a speed of 100 kbit/s.
- [ARINC 500 Series describes older analog avionics equipment used on early jet aircraft such as the Boeing 727, Douglas DC-9, DC-10, Boeing 737 and 747, and Airbus A300.](#)
- [ARINC 600 Series are reference standards for avionics equipment specified by the ARINC 700 Series.](#)
 - ARINC 600 is the predominant avionics packaging standard introducing the avionics Modular Concept Unit (MCU)
 - ARINC 604 is a standard and guidance for the purpose of designing and implementing Built-In Test Equipment. The standard also describes the Centralized Fault Display System.
 - ARINC 610B provides guidance for use of avionics equipment and software in simulators.
 - ARINC 615 is a family of standards covering "data loading", commonly used for transferring software and data to or from avionics devices. The SAE ARINC 615 standard covers "data loading" over SAE ARINC 429.
 - ARINC 615A is a standard that covers a "data loading" protocol that can be used over various bus types such as Ethernet, CAN, and SAE ARINC 664.
 - ARINC 618 is a standard that covers a data transmission protocol called "Character Oriented Protocol".
 - ARINC 619 is a standard that covers a data transmission protocol over SAE ARINC 429 called "Bit Oriented Protocol".
 - ARINC 620 is a standard that covers a data transmission protocol called "Datalink Ground

- System".
- SAE ARINC 624 is a standard for aircraft onboard maintenance system (OMS). It uses SAE ARINC 429 for data transmission between embedded equipment.
 - ARINC 625 is an Industry Guide for Component Test Development and Management. It provides a standard approach for quality management of Test Procedure Generation within the commercial air transport industry.
 - ARINC 629 is a multi-transmitter data bus protocol where up to 120 terminals can share the same bus. It is installed on the Boeing 777.
 - ARINC 633 is the air-ground protocol for ACARS and IP networks used for AOC data exchanges between aircraft and the ground.
 - ARINC 635 defines the protocols for the HFDL network of radios used for communication and messaging between aircraft and HF Ground Stations.
 - ARINC 653 is a standard Real Time Operating System (RTOS) interface for partitioning of computer resources in the time and space domains. The standard also specifies Application Program Interfaces (APIs) for abstraction of the application from the underlying hardware and software.
 - ARINC 660 defines avionics functional allocation and recommended architectures for CNS/ATM avionics.
 - ARINC 661 defines the data structures used in an interactive cockpit display system (CDS), and the communication between the CDS and User Applications. The GUI definition is completely defined in binary definition files. The CDS software consists of a kernel capable of creating a hierarchical GUI specified in the definition files. The concepts used by SAE ARINC 661 are similar to those used in user interface markup languages.
 - ARINC 664 defines the use of a deterministic Ethernet network as an avionic databus in modern aircraft like the Airbus A380, Sukhoi Superjet 100, the Bombardier C-Series, and the Boeing 787 Dreamliner.
 - ARINC 665 This standard defines standards for loadable software parts and software transport media.
 - ARINC 667 is a Guidance for the Management of Field Loadable Software
 - [ARINC 700 Series describes the form, fit, and function of avionics equipment installed predominately on transport category aircraft.](#)
 - ARINC 702A defines the Flight Management Systems (FMS).
 - ARINC 704 defines the Inertial Reference System (IRS).
 - ARINC 708 is the standard for airborne weather radar. It defines the airborne weather radar characteristics for civil and military aircraft.
 - ARINC 709 defines Distance Measuring Equipment (DME).
 - ARINC 717 defines the acquisition of flight data for recording
 - ARINC 718 describes an Air Traffic Control Transponder (ATCRBS/MODE S).
 - ARINC 724B defines the Aircraft Communications Addressing and Reporting System (ACARS).
 - ARINC 735B defines the Traffic Computer with Traffic Alert and Collision Avoidance System (TCAS).
 - ARINC 738 defines an integrated Air Data Inertial Reference Unit (ADIRU).
 - ARINC 739 is the standard for a Multi-Purpose Control and Display Unit (MCDU) and interfaces.
 - ARINC 740 defines airborne printers
 - ARINC 741 is the standard for a first-generation L-band satellite data unit.
 - ARINC 743A defines a GNSS receiver
 - ARINC 744A defines a full-format airborne printer
 - ARINC 746 is the standard for a cabin telecommunications unit, based on Q.931 and CEPT-E1.

- ARINC 747 defines a Flight Data Recorder (FDR)
- ARINC 750 defines a VHF Digital Radio
- SAE ARINC 755 defines a Multi-Mode Receiver (MMR) for approach and landing SAE ARINC 756 defines a GNSS Navigation and Landing Unit
- ARINC 759 defines an Aircraft Interface Device (AID) SAE ARINC 760 defines a GNSS Navigator
- ARINC 757 defines a Cockpit Voice Recorder (CVR)
- ARINC 761 is the standard for a second-generation L-band satellite data unit, also called Swift64 by operator Inmarsat.
- ARINC 763 is the standard for a generic avionics file server and wireless access points.
- ARINC 767 defines a combined recorder unit capable of data and voice.
- ARINC 771 is under development (2016) now for a low earth orbit (LEO) also called Iridium NEXT by operator Iridium
- ARINC 781 is the standard for a third-generation L-band satellite data unit, also called SwiftBroadband (SBB) by operator Inmarsat.
- ARINC 791 defines Ku and Ka band satellite data airborne terminal equipment.
- [ARINC 800 Series comprises a set of aviation standards for aircraft, including fiber optics used in high-speed data buses.](#)
 - ARINC 801 through 807 define the application of fiber optics on the aircraft.
 - ARINC 810 is a standard for the integration of aircraft galley inserts and associated interfaces
Title: Definition of Standard Interfaces for Galley Insert (GAIN) Equipment, Physical Interfaces.
 - ARINC 811 provides a common understanding of information security concepts as they relate to airborne networks, and provides a framework for evaluating the security of airborne-networked systems.
 - ARINC 812 is a standard for the integration of aircraft galley inserts and associated interfaces
 - ARINC 816 defines a database for airport moving maps
 - ARINC 817 defines a low-speed digital video interface
 - ARINC 818 defines a high-speed digital video interface standard developed for high bandwidth, low latency, uncompressed digital video transmission.
 - ARINC 821 is a top-level networking definition describing aircraft domains, file servers and other infrastructure.
 - ARINC 822 is the standard for Gatelink.
 - ARINC 823 is a standard for end-to-end datalink encryption.
 - ARINC 825 is a standard for Controller Area Network bus protocol for airborne use.
 - ARINC 826 is a protocol for avionic data loading over a Controller Area Network bus.
 - ARINC 827 specifies a crate format for electronic distribution of software parts for aircraft.
 - ARINC 828 defines aircraft wiring provisions and electrical interface standards for electronic flight bag (EFB)
 - ARINC 834 defines an aircraft data interface that sources data to Electronic Flight Bags, airborne file servers, etc.
 - ARINC 838 provides a standardized XML description for loadable software parts.
 - ARINC 839 is a function definition of airborne manager of air-ground interface communications (MAGIC)
 - ARINC 840 defines the Application Control Interface (ACI) used with an Electronic Flight Bag (EFB)
 - ARINC 841 defines Media Independent Aircraft Messaging
 - ARINC 842 provides guidance for usage of digital certificates on airplane avionics and cabin equipment.

DOD Documents:

- DOD Policy Memorandum 15-002, Guidance for the Domestic Use of Unmanned Aircraft Systems, February 17, 2015
- DOD-NATO, STANAG 4671, Unmanned Aerial Vehicles Systems Airworthiness Requirements
- [DOD-NATO, STANAG 4702, Rotary Wing UAS Airworthiness Requirements](#)
- [DOD-NATO, STANAG 4703, Light UAS Airworthiness Requirements](#)
- [DOD-NATO Standard, AEP-80, Rotary Wing UAS Airworthiness Requirements, 2014](#)
- [07-1-003 Unmanned Aircraft Systems \(UAS\) Sensor and Targeting, July 27, 2010](#)
- [DOD-NATO, Guidance For The Training Of Unmanned Aircraft Systems \(UAS\) Operators, April 22, 2014](#)
- [07-2-032 UAS Navigation System Test, US Army, July 27, 2010](#)
- [DOD-NATO, Interoperable Command And Control Data Link For Unmanned Systems \(IC2DL\) – Operational Physical Layer / Signal In Space Description, November 14, 2016](#)
- US Army Ground Based Sense and Avoid System (GBSAA)
- DOD Unmanned Aircraft Systems (UAS) Airspace Integration, May 28, 2014
- Ground-Based Sense and Avoid: Enabling Local Area Integration of UASs into the National Airspace System, US Army
- Top Level Sense and Avoid Performance Requirements Based on See and Avoid Efficacy, US Army, 2015
- Systems Engineering of SAA Systems, US Army Unmanned Aircraft Systems, US Army UAS Common Systems Integration Product Office, 2015
- [Others](#)

NASA Documents:

- ADS-B Mixed sUAS And NAS System Capacity Analysis and DAA Performance, April 2018
- An Evaluation of Detect and Avoid (DAA) Displays for UAS: The Effect of Information Level and Display Location on Pilot Performance, 2015
- [NASA, Industry Complete Third Phase of UAS Flight Testing, September 16, 2015](#)
- [Two Month UAS Flight Test Series Concludes, July 8, 2016](#)
- [UAS Traffic Management \(UTM\) National Campaign II](#), AIAA SciTech Forum, January 8-12, 2018
- [Small UAS Flight Testing of Enabling Vehicle Technologies for the UAS Traffic Management Project](#), NASA Technical Memo, April, 2018
- [Small Unmanned Aircraft Electromagnetic Interference \(EMI\) Initial Assessment](#), Jung, Jaewoo, et. al., ICNS 2018, April 10-12, 2018
- [Assessing C2 Communications for UAS Traffic Management](#), ICNS 2018, April 10-12, 2018
- [ADS-B Mixed SUAs and NASA System Capacity Analysis and DAA Performance](#), ICNS 2018, April 10-12, 2018
- [Real-time Risk Assessment Framework for UAS Traffic Management \(UTM\)](#), 17th AIAA Aviation Technology, Integration, and Operations Conference. June 5-9, 2017
- [A Path Planning Algorithm to Enable Well-Clear Low Altitude UAS Operation Beyond Visual Line of Sight](#), 12th USA/Europe Air Traffic Management Research and Development Seminar (ATM 2017), June, 2017
- [Implicitly Coordinated Detect and Avoid Capability for Safe Autonomous Operation of Small UAS](#), 17th AIAA Aviation Technology, Integration, and Operations Conference, June 5-9, 2017
- [Preliminary Risk Assessment for Small UASs](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017

- [Hazards Identification and Analysis for UAS Operations](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [Experimental Flight Testing for Assessing the Safety of UAS Safety-Critical Operations](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [Off-nominal Trajectory Computation Applied to UAS Traffic Management](#), IEEE-DASC 2017, September 17-21, 2017
- [An Integrated System for Autonomous Search and Track with a small Unmanned Aerial Vehicle](#), AIAA SciTech Forum, January 9-13, 2017
- [Making a Risk Informed Safety Case for Small UAS Operations](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [Real-Time Radar-Based Tracking and State Estimation of Multiple Non-Conformant Aircraft](#), January 9-13, 2017
- [Evaluation of Early Ground Control Station Configurations for Interacting with a UAS Traffic Management \(UTM\) System](#), 8th International Conference on Applied Human Factors and Ergonomics, July 17-21, 2017
- [Model-driven Development of Safety Architectures](#), 20th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS 2017), September 17-22, 2017
- [Modeling the Safety Architecture of UAS Flight Operations](#), 36th International Conference on Computer Safety, Reliability and Security (SAFECOMP 2017), LNCS 10488, pp. 162-178, September 13-15, 2017
- [Sense and Avoid for Small UASs](#), AIAA SciTech Forum, January 9-13, 2017
- [Developing a Generalized Trajectory Modeling Framework for Small UAS Performance in the Presence of Wind](#), AIAA SciTech Forum, January 9-13, 2017
- [High-Fidelity Multirotor UAS Simulation Development for Trajectory Prediction Under Off-Nominal Flight Dynamics](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [SAFEGUARD Progress and Test Results for A Reliable Independent On-board Safety Net for UAS](#), IEEE-DASC 2017, September 17-21, 2017
- [Failure Mode Effects Analysis and Flight Testing for Small UASs](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [3D LiDAR SLAM Integration with GPS/INS for UAVs in Urban GPS-Degraded Environments](#), AIAA SciTech Forum, January 9-13, 2017
- [Technical Capability Level 2 UAS Traffic Management \(UTM\) Flight Demonstration: Description and Analysis](#), IEEE-DASC 2017, September 17-21, 2017
- [UAS Technical Capability Level 2 UAS Traffic Management \(UTM\) Flight Demonstration: Description and Analysis](#), IEEE-DASC-September 17-21, 2017
- [Concepts of Airspace Structures and System Analysis for UAS Traffic Flows for Urban Areas](#), AIAA SciTech Forum, January 9-13, 2017
- [Flight Test Evaluation of an UAS Traffic Management \(UTM\) Concept for Multiple Beyond-Visual-Line-of-Sight Operations](#), 12th USA/Europe Air Traffic Management Research and Development Seminar (ATM2017), June 26-30, 2017
- [Safe Autonomous Flight Environment \(SAFE50\) for the Notional Last "50 ft" of Operation of "55 lb" Class of UAS](#), AIAA SciTech Forum, January 9-13, 2017
- [Enabling Airspace Integration for High-Density On-Demand Mobility Operations](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [Small UAS \(sUAS\) Categorization Framework for Low Altitude Traffic Services](#), IEEE-DASC 2017, September 17-21, 2017

- [Small UAS \(sUAS\) Trajectory Modeling in Support of UAS Traffic Management \(UTM\)](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [NASA Technical Memorandum-UTM Data Working Group Demonstration 1 Final Report](#), April 2017
- [NASA Technical Memorandum-UAS Reports \(UREPs\): Enabling Exchange of Observation Data Between UAS Operations](#), February 2017
- [Towards A Computational Framework for Autonomous Decision-Making in UAVs](#), AIAA SciTech Forum, January 9-13, 2017
- [NASA Technical Memorandum-UTM TCL 2 Software Requirements](#), April 2017
- [Estimation, Navigation and Control of Multi-Rotor Drones in an Urban Wind Field](#), AIAA SciTech Forum, January 9-13, 2017
- [Initial Study of An Effective Fast-time Simulation Platform for UAS Traffic Management](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [UAV Trajectory Modeling Using Neural Networks](#), 17th AIAA Aviation Technology, Integration and Operations Conference, June 5-9, 2017
- [ICAROUS-Integrated Configurable Algorithms for Reliable Operations of Unmanned Systems](#), IEEE-DASC 2016, September 26-29, 2016
- [Safety Considerations for UAS Ground-based Detect and Avoid](#), IEEE-DASC 2016, September 26-29, 2016
- [Architecting a Safety Case for UAS Flight Operations](#), 34th International System Safety Conference (ISSC), August 8-12, 2016
- [Feasibility of Varying Geo-Fence around an UA Operation based on Vehicle Performance and Wind](#), IEEE-DASC, September 26-29, 2016
- [UAS Traffic Management \(UTM\) Simulation Capabilities and Laboratory Environment](#), IEEE-DASC 2016, September 26-29, 2016
- [Rapid Trajectory Prediction for a Fixed-Wing UAS in a Uniform Wind Field with Specified Arrival Times](#), 16th AIAA Aviation Technology, Integration, and Operations Conference, June 13-17, 2016
- [Applying Required Navigation Performance Concept for Traffic Management of Small UASs](#), ICAS 2016, September 25-30, 2016
- [UAS Traffic Management \(UTM\) Concept of Operations](#), 16th AIAA Aviation Technology, Integration and Operations Conference, June 13-17, 2016
- [Multi-Rotor Aircraft Collision Avoidance using Partially Observable Markov Decision Processes](#), AIAA Modeling and Simulation Technologies Conference, June 13-17, 2016
- [From Rural to Urban Environments: Human/Systems Simulation Research for Low Altitude UAS Traffic Management \(UTM\)](#), 16th AIAA Aviation Technology, Integration and Operations Conference, June 13-17, 2016
- [NASA UAS Traffic Management National Campaign - Operations Across Six UAS Test Sites](#), IEEE-DASC 2016, September 26-29, 2016
- [Assessing the Impact of Operational Constraints on the Near-term UAS Traffic Management Supported Market](#), 16th AIAA Aviation Technology, Integration and Operations Conference, June 13-17, 2016
- [UAS Industry Growth: Forecasting Impact on Regional Infrastructure, Environment, and Economy](#), IEEE-DASC 2016, September 26-29, 2016
- [Safely Enabling UAS Operations in Low-Altitude Airspace](#), 2015 UTM Convention, October 2015
- [Integrating UAS into the Managed Airspace Through the Extension of ARINC Cloud Services](#), Integrated Communications Navigation and Surveillance (ICNS) April 18-20, 2017
- [Google UAS Airspace System Overview](#), October, 2015

- [Determining Safe Access with a Best-Equipped, Best-Served Model for Small UASs](#), Amazon white paper, October, 2015
- [Revising the Airspace Model for the Safe Integration of Small UASs](#), Amazon white paper, October, 2015

ASTM Documents:

- [ASTM F2411 - 04e1, Standard Specification for Design and Performance of an Airborne Sense-and-Avoid System](#)

9.3 Transport and Post-Crash Procedures Involving Biohazards

Published Standards and Related Materials: While not UAS-specific, published biohazards standards, as well as U.S. Federal government and inter-governmental and United Nations (UN) materials (for civil, military and space applications) relevant to this issue include but are not limited to those listed below. They are divided into two categories: 1) transportation of biohazards, and 2) post-crash procedures, mitigations, and containment.

(1) Transportation of biohazards:

FAA Regulations/Documents:

It is recommended to refer to the latest FAA regulations, policy, guidance, and associated standards.

- Airworthiness Standards, 14 CFR parts 23/25/27/29 (Airplanes and Rotorcrafts)
- Part 43, Maintenance, Preventive Maintenance, Rebuilding and Alteration
- Part 91, General Operating And Flight Rules
- [14 CFR §91.111, Operating near other aircraft](#)
- [§91.115, Right-of-way rules: Water operations](#)
- [§107.39, Operation over human being](#)
- [§107.41, Operation in certain airspace](#)
- [§107.51, Operating limitations for small unmanned aircraft](#)
- Part 119 - Certification: Air Carriers And Commercial Operators
- Part 121 Subpart G Manual Requirements (14 CFR §121.135)
- Part 121 Subpart Z – Hazardous Materials Training Program
- Appendix O to Part 121 Hazardous Materials Training Requirements for Certificate Holders
- Part 135 Subpart A – General (14 CFR §135.21 Manual Requirements/Contents)
- Part 135 Subpart K – Hazardous Materials Training Program (§135.501-507)
- Part 135 Subpart L – Helicopter Air Ambulance Equipment, Operations and Training Requirements [See 49 CFR §175.1(d)]
- Part 145 – Repair Stations – HM Manuals and Training Requirements
- [§414.19\(a\)\(b\), §414.101, §414.103, §401.5, §415.51, §415.55, §415.59\(a\)](#),
- Commercial Space Transportation Rules (Parts 400, 401, 404, 405, 406, 413, 414, 415, 417, 420, 431, 433, 435, 437, 460)
- [Other applicable parts of 14 CFR system](#)
- [AC 121-37A, Voluntary Disclosure Reporting Program – Hazardous Materials](#)
- [AC 121-30 - 14 CFR Part 121 and Part 135 Dangerous Goods Transportation Operations](#)
- [AC 120-61B, In-Flight Radiation Exposure, 11/21/2014](#)
- [AC 20-68B, Recommended Radiation Safety Precautions for Ground Operation of Airborne Weather Radar, 08/08/1980](#)

- [Order 2150.3C](#) - FAA Compliance and Enforcement Program
- [October 23, 2014](#) - FAA Press Release Statement on Ebola
- [Order SH 1650.9B, Transportation of Hazardous Materials](#)
- [FAA Statement before the Senate Homeland Security and Government Affairs Committee, "S. 2836, The Preventing Emerging Threats Act of 2018: Countering Malicious Drones, 2018](#)
- [FAA Civil Aerospace Medical Institute \(CAMI\)](#)
- [CAMI Forensic Toxicology Research Team \(AAM-611-TOX\)](#)
- Development and Test of the Explosive Exit Concept for Civil Transport Aircraft, FAA Tech Center, 1970
- Various ACs, Regulations, Policies, etc. in [FAA's Regulatory and Guidance Library](#)

DOT PHMSA Regulations:

DOT PHMSA regulates hazardous materials for all DOT modes (air, vessel, rail and highway) as it pertains to incidents, shipping, marking, labeling, emergency response, training, hazardous materials security plans (CDC toxins) and packaging.

- [Title 49, Transportation](#)
- 49 U.S. Code Chapter 51, Transportation of Hazardous Material
 - [§ 5101, Purpose](#)
 - [§ 5103a, Limitation on issuance of hazmat licenses](#)
 - [§ 5104, Representation and tampering](#)
 - [§ 5105, Transporting certain highly radioactive material](#)
 - [§ 5106, Handling criteria](#)
 - [§ 5107, Hazmat employee training requirements and grants](#)
 - [§ 5108, Registration](#)
 - [§ 5109, Motor carrier safety permits](#)
 - [§ 5110, Shipping papers and disclosure](#)
 - [§ 5111, Repealed. Pub. L. 109-59, title VII, § 7111, Aug. 10, 2005, 119 Stat. 1899\]](#)
 - [§ 5112, Highway routing of Hazmat](#)
 - [§ 5113, Unsatisfactory safety rating](#)
 - [§ 5114, Air transportation of ionizing radiation material](#)
 - [§ 5115, Training curriculum for the public sector](#)
 - [§ 5116, Planning and training grants, monitoring, and review](#)
 - [§ 5117, Special permits and exclusions](#)
 - [§ 5118, Hazmat technical assessment, research and development, and analysis program](#)
 - [§ 5119, Uniform forms and procedures](#)
 - [§ 5120, International uniformity of standards and requirements](#)
 - [§ 5121, Administrative](#)
 - [§ 5122, Enforcement](#)
 - [§ 5123, Civil penalty](#)
 - [§ 5124, Criminal penalty](#)
 - [§ 5125, Preemption](#)
 - [§ 5126, Relationship to other laws](#)
 - [§ 5127, Judicial review](#)
 - [§ 5128, Authorization of appropriations](#)
- 49 CFR parts 100 through 188
- [Subtitle B, Other Regulations Relating To Transportation](#)
- [Chapter I, Pipeline and Hazardous Materials Safety Administration, DOT](#)

- [Subchapter A, Hazardous Materials and Oil Transportation](#)
- [Part 107, Hazardous Materials Program Procedures](#)
- §172.101, Hazardous Material Table - Proper Shipping Names
- UN3373, Biological Substances, Category B (Exceptions)
- UN2900, Infectious Substances, Affecting Animals, 6.2
- UN2814, Infectious Substances, Affecting Humans, 6.2
- 172.800(b)(13), A select agent or toxin regulated by CDC under 42 CFR Part 73 or the USDA under 9 CFR part 121
- §172.200, Shipping Paper Requirements
- §172.800(b)(13), A select agent or toxin regulated by CDC under 42 CFR Part 73 or the USDA under 9 CFR part 121
- §172.800(b)(13), A select agent or toxin regulated by CDC under 42 CFR Part 73 or the USDA under 9 CFR part 121
- §172.300, Marking
- §172.323, Infectious Substances
- §172.400, Labeling
- §172.432, Infectious Substances
- §172.500, Placarding
- §172.600, Emergency Response Telephone Number
- §172.700, Training
- §172.800, Hazardous Materials Security Plans
- §172.800(b)(13), A select agent or toxin regulated by CDC under 42 CFR Part 73 or the USDA under 9 CFR Part 121
- Part 173, Shippers, General Requirements for Shipments and Packagings
- 49 CFR part 175, Carriage by Aircraft
 - [Subpart A, General Information and Regulations](#)
 - [§175.1, Purpose, scope and applicability](#)
 - [§175.3, Unacceptable hazmat shipments](#)
 - [§175.8, Exceptions for operator equipment and items of replacement](#)
 - [§175.9, Special aircraft operations](#)
 - [§175.10, Exceptions for passengers, crewmembers, and air operators](#)
 - [§175.20, Compliance and training](#)
 - [§175.25, Passenger notification system](#)
 - [§175.26, Notification at cargo facilities of hazmat requirements](#)
 - [§175.30, Inspecting shipments](#)
 - [§175.31, Reports of discrepancies](#)
 - [§175.33, Shipping paper and notification of pilot-in-command](#)
 - [§175.34, Exceptions for cylinders of compressed oxygen or other oxidizing gases transported within the State of Alaska](#)
 - [Subpart B, Loading, Unloading and Handling](#)
 - [§175.75, Quantity limitations and cargo location](#)
 - [§175.78, Stowage compatibility of cargo](#)
 - [§175.88, Inspection, orientation and securing packages of hazmat](#)
 - [§175.90, Damaged shipments](#)
 - [Subpart C, Specific Regulations Applicable According to Classification of Material](#)
 - [§175.310, Transportation of flammable liquid fuel; aircraft only means of transportation](#)

- [§175.501, Special requirements for oxidizers and compressed oxygen](#)
- [§175.630, Special requirements for Division 6.1 \(poisonous\) material and Division 6.2 \(infectious substances\) materials](#)
- [§175.700, Special limitations and requirements for Class 7 materials](#)
- [§175.701, Separation distance requirements for packages containing Class 7 \(radioactive\) materials in passenger-carrying aircraft](#)
- [§175.702, Separation distance requirements for packages containing Class 7 \(radioactive\) materials in cargo aircraft](#)
- [§175.703, Other special requirements for the acceptance and carriage of packages containing Class 7 materials](#)
- [§175.704, Plutonium shipments](#)
- [§175.705, Radioactive contamination](#)
- [§175.706, Separation distances for undeveloped film from packages containing Class 7 \(radioactive\) materials](#)
- [§175.900, Handling requirements for carbon dioxide, solid \(dry ice\)](#)
- 49 CFR part 178, Test requirements for packagings for infectious substances
- [DOT and OSHA Criteria for Biohazards](#)

DOT PHMSA Documents:

- [How to Use the HMR](#)
- [HazMat Transportation Requirements](#)
- [DOT Chart 16 – Hazmat Marking, Labeling and Placarding Guide](#)
- [Are You Preparing Suspected Ebola Contaminated Waste for Transportation?](#)
- [Do You Know if You Are Shipping Hazardous Materials?](#)
- [What You Should Know: A Guide to Developing Hazardous Materials Training Program](#)
- [HazMat Transportation Training Requirements](#)
- [HM Transportation Security Requirement Plans](#)
- [Guide to Performance Packaging Codes](#)
- [Transporting Infectious Substances Safely](#)

Additional DOT PHMSA Resources for Infectious Substances:

- [Transporting Infectious Substances brochure](#)
- [Interim - Planning Guidance for Handling of Solid Waste Contaminated with a Category A Infectious Substance](#)
- [Ebola Virus Disease for Clinicians](#)
- [Transporting Infectious Substances Overview](#)
- [Infectious Substance Special Permits - Why is a special permit needed to transport suspected or confirmed Ebola contaminated waste?](#)
- [Emergency Response Guidebook 2016 for Infectious Substances](#)
- [SP-16266](#) – Stericycle, Inc. Lake Forest, IL
- [SP-16278](#) – Stericycle, Inc. Lake Forest, IL
- [SP-16279](#) – See Individual Authorization Letters
- [Packaging of Ebola Contaminated Waste](#)
- [Are you preparing suspected Ebola Contaminated Waste for transportation?](#)
- [Safety Advisory Notice: Packaging and Handling Ebola Virus Contaminated Infectious Waste for Transportation to Disposal Sites](#)

- [DOT Guidance for Preparing Packages of Ebola Contaminated Waste for Transportation and Disposal 10/30/2014](#) – PHMSA Docket 2014-0134; Notice 14-04: Safety Advisory: Packaging and Handling Ebola Virus Contaminated Infectious Waste for Transportation to Disposal Sites
- PHMSA HM Interpretations found in [eCFR](#) under Specific 49 CFR Regulation Sections.

PHMSA Interpretations:

- [17-0076](#) – Live Viruses Stored for Manufacturing Purposes and Transported
- [16-0028](#) – State Government Transportation of Infectious Substances -New York State Department of Health
- [15-0020](#) – Transportation of Cultures Classified as Division 6.2, Category A, Infectious Substances
- [10-0188](#) – American Veterinary Medical Association

International Civil Aviation Organization (ICAO) Documents:

Annex 8 to the Convention on International Civil Aviation contains international standards and no recommended practices. The remaining below Annexes contain both.

- Annex 6 - Operation of Aircraft
- Annex 8 - Airworthiness of Aircraft
- Annex 12 - Search and Rescue
- Annex 13 - Aircraft Accident and Incident Investigation
- Annex 16 - Environmental Protection
- Annex 17 - Security
- Annex 18 - The Safe Transportation of Dangerous Goods by Air
- Annex 19 - Safety management
- [Infectious Substances ICAO Document for the Safe Transportation by Air 2005-2006](#)
 - Special Provisions: A81, A140
 - Packing Instruction: 620
 - Classification: 2; 6.3
 - Proper Shipping Names:
 - UN2900, Infectious Substance, affecting animals, Class 6.2
 - UN2814, Infectious Substance, affecting humans, Class 6.2
 - Max. net qty per package - Passenger Aircraft: 50 mL (liquids) 50 grams (solids)
 - Max. net qty per package - Cargo Aircraft: 4L (liquids) 4 kg (solids)
 - Packaging for Cat. A: 6; 6.1
- [ICAO Joint Statement on Ebola Virus Disease, 2014](#)

UN World Health Organization (WHO) Documents:

- [Travel and transport risk assessment: Interim guidance for public health authorities and the transport sector, 2014](#)
- [Guidance on Regulations for the Transport of Infectious Substances 2017–2018 ; Previous Versions 2005-2016](#)
- [Key Facts - Ebola Virus Disease, 2018](#)

U.S. Centers for Disease Control and Prevention (CDC) Regulations/Documents:

CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) regulations can be found in the following sections of the Code of Federal Regulations (CFR). Click on the links to take you to the regulation.

- **Control of Communicable Diseases**
 - [42 CFR part 34: Medical Examination of Aliens](#)

- [Part 70: Interstate Quarantine](#)
- [Part 71: Foreign Quarantine](#)
- **Occupational Safety and Health**

 - [42 CFR part 37: Specifications for Medical Examinations of Coal Miners](#)
 - [Part 81: Guidelines for Determining Probability of Causation under EEOICPA 2000](#)
 - [Part 82: Methods for Conducting Dose Reconstruction under EEOICPA 2000](#)
 - [Part 83: Procedures for Designating Classes of Employees as Members of the Special Exposure Cohort under EEOICPA 2000](#)
 - [42 CFR part 84: Approval of Respiratory Protective Devices](#)
 - [Part 85: Requests for Health Hazard Evaluations](#)
 - [Part 85a: Occupational Safety and Health Investigations of Places of Employment](#)
 - [Part 86: Grants for Education Programs in Occupational Safety and Health](#)
 - [Part 87: National Institute for Occupational Safety and Health Research and Demonstration Grants](#)
 - [Part 88: World Trade Center Health Program](#)
- **Public Health Assessments and Health Consultations**
 - [42 CFR part 90: Health Assessments and Health Effects Studies of Hazardous Substances, Releases, and Facilities](#)
- **Clinical Laboratory Standards**
 - [42 CFR part 493: Laboratory Requirements](#)
- **Select Agents and Toxins**
 - [42 CFR part 73: Select Agents and Toxins](#)
- **Reference Biological Standards and Biological Preparations**
 - [42 CFR part 7: Distribution of Reference Biological Standards and Biological Preparations](#)
- [Emergency Medical Services and Air Medical Transport](#)
- [What is Ebola Virus Disease on the CDC's website](#)
- [Transporting Infectious Substances Safety, 2015](#)
- [Specimen Labeling, Storage and Handling](#)
- [Ebola Lab Guidance](#)
- [Packaging and Transporting Infectious Substances](#)
- [This Amazing Jet Will Transport Ebola Victims From Africa To The U.S.](#)
- [Travel Health Notices](#)

United States Postal Service (USPS) Documents:

[Publication 52 – Hazardous, Restricted and Perishable Mail](#)

- 3 Hazardous Materials
- 4 Restricted Matter
- 5 Perishable Matter
- 6 International Mail
- 7 Air Transportation Requirements
- Appendix A – Hazardous Materials Table – Postal Service Mailability Guide
- Appendix B – Numerical Listing of Proper Shipping Names by Identification (ID) Number
- Appendix C – USPS Packaging Instructions for Mailable Hazardous Materials
- USPS Packaging Instruction 1A, 1B, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 3B, 3C, 3D, 4A, 4B, 5A, 6A, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 7A, 8A, 8B, 8C, 9A, 9B, 9C, 9D, 9E, 10A, 10B, 10C

- Appendix D – Hazardous Materials Definitions
- Appendix E - References
- Postal Service Publications and Reference Materials
- Other Publications

NFPA Documents:

- NFPA 101, Life Safety Code
- NFPA 471, Recommended Practice for Responding to Hazardous Materials Incidents
- NFPA 472, Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents
- NFPA 473, Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents
- NFPA 475, Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program
- NFPA 1581, Standard on Fire Department Infection Control Program
- NFPA 1992, Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies
- NFPA 1994, Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents
- NFPA 1999, Standard on Protective Clothing and Ensembles for Emergency Medical Operations
- NFPA 2400, Standard for Small Unmanned Aircraft Systems (sUAS) Used for Public Safety

AIAA Documents:

- [Special Project: Fire, Explosion, Compatibility, and Safety Hazards of Hypergols - Hydrazine \(AIAA SP-084-1999\)](#)
- [Special Project: Fire, Explosion, Compatibility, and Safety Hazards of Hypergols - Monomethylhydrazine \(AIAA SP-085-1999\)](#)
- [Special Project: Fire, Explosion, Compatibility, and Safety Hazards of Nitrogen Tetroxide \(AIAA SP-086-2001\)](#)
- [American National Standard Guide to Safety of Hydrogen and Hydrogen Systems \(AIAA G-095A-2017\)](#)
- [Guide: Global Aerosol Models \(GAM\) \(AIAA G-065-1999\)](#)
- [Standard: Criteria for Explosive Systems and Devices on Space and Launch Vehicles \(AIAA S-113A-2016\)](#)
- [Commercial Launch Safety \(AIAA S-061-1998\)](#)
- [Various Documents and Publications](#)

SAE International Documents:

- ARP997D, Installation and Stowage Provisions for Emergency Equipment in the Transport Aircraft Passenger Cabin, 2012-08-30
- [AC-9 Aircraft Environmental Systems Committee](#)

DOD Documents:

- [DOD Establishes Ebola Task Force, 2014](#)
- [DOD Helps Fight Ebola in Liberia and West Africa, 2014](#)
- [DOD Brings Unique Capabilities to Ebola Response Mission, 2014](#)
- [Pentagon builds units to transport Ebola patients](#)
- DOD Directive No. 5134.08, Biohazards (Nuclear, Chemical and Biological Defense Programs), 2013

- DOD-NATO, Toxic Hazards in Aviation, 1981

DHS Documents:

- [Emergency Management \(EMS/Passenger Airport Screening\) Ebola](#)
- [Ebola Response](#)
- [DHS Ebola Response Needs Better Coordination, Training and Education](#)
- [Remarks of the ICAO Symposium and Innovation in Aviation Security](#)

US Department of Agriculture (USDA) Documents:

- 9 CFR Part 121, Possession, Use, And Transfer Of Select Agents And Toxins
- [§121.1, Definitions](#)
- [§121.2, Purpose and scope](#)
- [§121.3, VS select agents and toxins](#)
- [§121.4, Overlap select agents and toxins](#)
- [§121.5, Exemptions for VS select agents and toxins](#)
- [§121.6, Exemptions for overlap select agents and toxins](#)
- [§121.7, Registration and related security risk assessments](#)
- [§121.8, Denial, revocation, or suspension of registration](#)
- [§121.9, Responsible official](#)
- [§121.10, Restricting access to select agents and toxins; security risk assessments](#)
- [§121.11, Security](#)
- [§121.12, Biosafety](#)
- [§121.13, Restricted experiments](#)
- [§121.14, Incident response](#)
- [§121.15, Training](#)
- [§121.16, Transfers](#)
- [§121.17, Records](#)
- [§121.18, Inspections](#)
- [§121.19, Notification of theft, loss, or release](#)
- [§121.20, Administrative review](#)
- [Ebola Preparedness and Response Updates](#)

USAID Documents:

- [Ebola the Recovery](#)

National Institute of Health (NIH) Documents:

- [NIH Safety, Regulation & Guidance](#)
- [Memo from NIH Associate Director for Science Policy on Biosafety Stewardship Month, 10/1/2015](#)
- [FAQ on Biosafety Stewardship Month](#)
- [Recommendations of the Advisory Committee to the Director, CDC, Concerning the NIH Intramural Laboratory Safety Program, 5/4/2015](#)
- [Next Steps: Biosafety and Biosecurity at the NIH](#)
- [Fact Sheet: Biosafety and Biosecurity in the United States, 12/16/2014](#)
- [NIH Director's memo to IBC chairs, contacts, and biological safety officers, 8/28/2014](#)
- [Ensuring Biosafety and Biosecurity in U.S. Laboratories, Office of Science and Technology Policy, 8/28/2014](#)
- [Enhancing Biosafety and Biosecurity in the United States, The White House, 8/18/2014](#)

- [Biological & Chemical Safety \(Compliance\)](#)
- [Mercury Free Campaign](#)
- [NIH Office of Animal Care and Use](#)
- [Radiation Safety](#)
- [Scientific Equipment & Instrumentation Services](#)
- [Waste Management](#)
- [NIH Policies and Procedures for Promoting Scientific Integrity, November 2012](#)
- [Guidelines for the Conduct of Research at NIH, May 2007](#)
- [NIH Biennial Report, 2014 and 2015](#)

International Air Transport Association (IATA) Documents:

- [Dangerous Goods Regulations-Infectious Substances](#)
- [IATA Statement on Ebola Outbreak, 2014](#)

Environmental Protection Agency (EPA) Documents:

- [Disinfectants for Use Against Ebola](#)

NASA Documents:

- [Hazardous Material Summary Tables \(HMSTs\)](#)
- [NASA Nanotechnology-Based Biosensor Helps Detect Biohazards](#)
- [Space Radiation Risks](#)
- [Radiation-Related Risk Analysis for Atmospheric Flight Civil Aviation Flight Personnel](#)
- [Basics of BioSafety](#)
- [BioSafety Review Board Environmental Factors Branch Habitability and Environmental Factors Division, June 2007](#)
- [NASA Presentation at International Symposium, NASA News, 7/17/2003](#)
- [Fighting Diseases NASA Takes it Outside, 8/24/2004](#)

Occupational Safety and Health Administration (OSHA) Documents:

- [29 CFR part 1910, Subpart H, Hazardous Materials](#)
- [29 CFR §1910.101, Compressed gases \(general requirements\)](#)
- [§1910.102, Acetylene](#)
- [§1910.103, Hydrogen](#)
- [§1910.104, Oxygen](#)
- [§1910.105, Nitrous oxide](#)
- [§1910.106, Flammable liquids](#)
- [§1910.107, Spray finishing using flammable and combustible materials](#)
- [§1910.109, Explosives and blasting agents](#)
- [§1910.110, Storage and handling of liquefied petroleum gases](#)
- [§1910.111, Storage and handling of anhydrous ammonia](#)
- [§1910.119, Process safety management of highly hazardous chemicals](#)
- [§1910.119 App A, List of Highly Hazardous Chemicals, Toxics and Reactives \(Mandatory\)](#)
- [§1910.119 App B, Block Flow Diagram and Simplified Process Flow Diagram \(Nonmandatory\)](#)
- [§1910.119 App C, Compliance Guidelines and Recommendations for Process Safety Management \(Nonmandatory\)](#)

- [§1910.119 App D, Sources of Further Information \(Nonmandatory\)](#)
- [§1910.120 - Hazardous waste operations and emergency response](#)
- [§1910.120 App A, Personal protective equipment test methods](#)
- [§1910.120 App B, General description and discussion of the levels of protection and protective gear](#)
- [§1910.120 App C, Compliance guidelines](#)
- [§1910.120 App D, References](#)
- [§1910.120 App E, Training Curriculum Guidelines \(Nonmandatory\)](#)
- [§1910.122, Table of contents](#)
- [§1910.123, Dipping and coating operations: Coverage and definitions](#)
- [§1910.124, General requirements for dipping and coating operations](#)
- [1910.125, Additional requirements for dipping and coating operations that use flammable liquids or liquids with flashpoints greater than 199.4 *F \(93 *C\)](#)
- [§1910.126, Additional requirements for special dipping and coating operations](#)
- [- Bloodborne pathogens](#)
- [§1910.1030 App A, Hepatitis B Vaccine Declination \(Mandatory\)](#)
- [Safety and Health Topics: Ebola](#) (Background, Hazard Recognition, Medical Information, Standards, Control & Prevention, and Additional Resources)
- [Hazard Communication Standards](#) Pictogram (HCS)/(GHS) on [OSHA's website](#)
Federal Register: [March 26, 2012](#) – OSHA Hazard Communications GHS
- [Hazard Communication Fact Sheet](#)
- [Hazard Communication](#) Website
- §1910.1030(d)(2)(xiii), Specimens of blood or other potentially infectious materials shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping.
- [Quick Reference Guide to the Bloodborne Pathogens Standard](#)

Various Documents from Other Sources:

- [Transporting Blood And Urine Samples, Steve MacArthur, April 22, 2011](#)
- [Air Crew Radiation Exposure - An overview \[Regulators, airlines, and flight crews are paying more attention to cosmic radiation. But what is the risk, and how can it be managed?\], Susan Bailey, 2000](#)
- [Radiation Dose to the Global Flying Population, MIT, 2016](#)
- [Occupational Cosmic Radiation Exposure and Cancer in Airline Cabin Crew, University of Tampere, 2013](#)
- [FedEx Hazmat Shipping Guide](#)
- Drone transportation of blood products, Transfusion Practice, Amukele, et. al., 2017

ASTM International Documents:

Various ASTM Technical Committees related to biohazards:

- [E27 - Hazard Potential of Chemicals](#)
- [E34 - Occupational Health and Safety](#)
- [E48 - Bioenergy and Industrial Chemicals from Biomass](#)
- [E54 - Homeland Security Applications](#)
- [F40 - Declarable Substances in Materials](#)
- [F04 on Medical and Surgical Materials and Devices](#)

(2) Post-Crash Procedures, Mitigations, and Containment:

The following regulations, policies, guidance, industry standards, etc. are used as procedures to manage and contain post-crash biohazards:

- 49 CFR 171.15, Immediate notice of certain hazardous materials incidents
- 49 CFR 171.16, Detailed hazardous materials incident reports
- 49 CFR 175.31, Reports of discrepancies
- PHMSA DOT 5800.1 Form – [Guide for Preparing Hazardous Materials Incident Report](#)
- FAA ADG Policy 2009-01 – Hazardous Materials Incident and Safety Response
- FAA AXH Field Ops – Trans Item #7 - Incident Reporting and Response
- FAA ADG Policy 2016-0X – Incident/Discrepancy Report Response Work Processes DRAFT
- [FAA FSIMS 8900.1 Volume7, Chapter 1, Section 2, Incident Investigations](#)
- [FAA FSIMS 8900.1 Volume7, Chapter 1, Section 1, Accident Investigations](#)
- [FAA FSIMS 8900.1, Volume 6, Chapter 11, Section 1, Transportation of Oxygen Generators \(Chemical\)](#)
- [NTSB Accident Investigative Process](#)