ANSI UASSC Reference Document

This is Appendix B to the ANSI UASSC *Standardization Roadmap for Unmanned Aircraft Systems* (Version 2.0), June 2020, listing additional committees, standards, and other documents.

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Published General Industry Standards and other Documents:

ASTM International Documents:
- ASTM F2245-18, *Standard Specification for Design and Performance of a Light Sport Airplane*
- ASTM 3082/F3082M-17, *Standard Specification for Weights and Centers of Gravity of Aircraft*
- ASTM F3180/F3180M-18, *Standard Specification for Low-Speed Flight Characteristics of Aircraft*
- ASTM F3115/F3115M-15, *Standard Specification for Structural Durability for Small Airplanes*
- ASTM F3116/F3116M-15, *Standard Specification for Design Loads and Conditions*
- ASTM F963-17, *Standard Consumer Safety Specification for Toy Safety*
- ASTM F2563-16, *Standard Practice for Kit Assembly Instructions of Aircraft Intended Primarily for Recreation*
- ASTM F2930-16e1, *Standard Guide for Compliance with Light Sport Aircraft Standards*
- ASTM F3264-18, *Standard Specification for Normal Category Aeroplanes Certification*
- ASTM F2972-15, *Standard Specification for Light Sport Aircraft Manufacturer's Quality Assurance System*
- ASTM F37 - Light Sport Aircraft
- ASTM F38 - Unmanned Aircraft Systems
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—AMS ADV Aerospace Materials Advisory Group

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- o AS-1C Avionic Subsystems
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—[Aircraft SEAT](#)

—ACBG Airframe Control Bearings Steering Group
- o ACBGPB Plain Bearing
- o ACBGREB Rolling Element

AEROSPACE GENERAL PROJECTS SYSTEMS GROUP COMMITTEES
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- o G-10EAB Executive Advisory Group
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—G-31 Electronic Transactions for Aerospace
—G-32 Cyber Physical Systems Security
—G-34 Artificial Intelligence in Aviation

RELIABILITY, MAINTAINABILITY, AND HEALTH MANAGEMENT SYSTEMS GROUP COMMITTEES
—G-11M Maintainability Supportability & Logistics
—G-11PM Probabilistic Methods Technology
—AISCSHM Aerospace Industry Steering Committee on Structural Health Monitoring
—E-32 Aerospace Propulsion Systems Health Management
—HM-1 Integrated Vehicle Health Management (IVHM)

AIRPORT/GROUND OPERATIONS AND EQUIPMENT SYSTEMS GROUP COMMITTEES
—AGE-2 Air Cargo
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SYSTEMS DEVELOPMENT & SAFETY, COMPONENT PROCESS AND MANAGEMENT SYSTEMS GROUP

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—[G-24 Pb-free Risk Management Committee for ADHP](#)

SYSTEMS MANAGEMENT COUNCIL
—[SAE Life Cycle Logistics Supportability (LCLS) Committee](#)
—SAE [G-41 Reliability](#)
—SAE [G-47 Systems Engineering](#)

SAE ITC Documents:
- SAE-ITC ARINC IA 428, Considerations for Avionics Network Design
- SAE-ITC ARINC IA 650, Integrated Modular Avionics Packaging and Interfaces
- SAE-ITC ARINC IA 654, Environmental Design Guidelines for Integrated Modular Avionics
- SAE-ITC ARINC IA 659, Backplane Data Bus
- SAE-ITC ARINC IA 660, CNS/ATM Avionics, Functional Allocation and Recommended Architectures
- SAE-ITC ARINC IA 670, Guidance for Materials, Processes, and Parts Equivalencies
- SAE-ITC ARINC IA 673, Guidance for the Use of UHF Radio Frequency Identification (RFID)

- SAE-ITC ARINC IA 677, Installation Standards for Low Frequency Underwater Locator Beacon (LF-ULB)
- SAE-ITC ARINC IA 728, Avionics Refrigeration Cooling System (ARCS)
- SAE-ITC ARINC IA 742, Design Guidance for Windshear Warning and Guidance Equipment Language
- SAE-ITC ARINC IA 759, Aircraft Interface Device (AID)
- SAE-ITC ARINC IA 607-3, Design Guidance for Avionics Equipment
- SAE-ITC ARINC IA 608A, Design Guidance for Avionics Test Equipment, Part 1 - System Definition
- SAE-ITC ARINC IA 611-1, Guidance for the Design and Installation of Fuel Quantity Systems
- SAE-ITC ARINC IA 625-3, Industry Guide For Component Test Development and Management
- SAE-ITC ARINC IA 625-4D7, Industry Guide for Component Test Development and Management
- SAE-ITC ARINC IA 651-1, Design Guidance for Integrated Modular Avionics
- SAE-ITC ARINC IA 663-1, Data Requirements for Avionics Component Maintenance
- SAE-ITC ARINC IA 701-1, Flight Control Computer System (FCCS)
- SAE-ITC ARINC IA 702-6, Flight Management Computer System (FMCS)
- SAE-ITC ARINC IA 702A-5, Advanced Flight Management Computer System
- SAE-ITC ARINC IA 737-1, On-Board Weight and Balance System
- SAE-ITC ARINC IA/AEEC, Systems Architecture and Interfaces (SAI) Subcommittee

In-Development General Industry Standards and Other Documents:

ASTM International Documents:
- ASTM WK51467, *New Specification for Quality Assurance for Manufacturers of Aircraft Systems*
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- ASTM F39 - Aircraft Systems
- ASTM F44 - General Aviation Aircraft

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—[G-11PM Probabilistic Methods Technology](#)
—[AISCSHM Aerospace Industry Steering Committee on Structural Health Monitoring](#)
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SYSTEMS DEVELOPMENT & SAFETY, COMPONENT PROCESS AND MANAGEMENT SYSTEMS GROUP
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- o S-18UAS Autonomy Working Group
- o S-18C ARP5150A and ARP5151A Working Group
- o S-18D AIR6219 SEE Working Group

—G-14 Americas Aerospace Quality Standards

—G-19 Counterfeit Electronic Parts
- o G-19A Test Laboratory Standards Development
- o G-19AD Authorized Distributor
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- o G-19CI Continuous Improvement
- o G-19D Distributor
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- o G-19T Terms and Definitions

—G-21 Counterfeit Materiel
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COMPONENT MANAGEMENT

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—CE-11 Component Parts

—CE-12 Solid State Devices

—G-24 Pb-free Risk Management Committee for ADHP

SYSTEMS MANAGEMENT COUNCIL

—SAE Life Cycle Logistics Supportability (LCLS) Committee

—SAE G-41 Reliability

—SAE G-47 Systems Engineering

6.3   Quality Assurance/Quality Control

Published Standards and other Documents:

SAE International Documents:

- AS9006A, *Deliverable Aerospace Software Supplement for AS9100A, Quality Management Systems - Aerospace - Requirements for Software* (based on AS9100A)

- ARP9134A, *Supply Chain Risk Management Guideline*

- ARP9090A, *Requirements for Industry Standard e-Tool to Collaborate Quality Assurance Activities Among Customers and Suppliers*

- ARP9034A, *A Process Standard for the Storage, Retrieval and Use of Three-Dimensional Type Design Data*

- ARP9009A, *Aerospace Contract Clauses*

- ARP9005A, *Aerospace Guidance for Non-Deliverable Software*

- AS9133A, *Qualification Procedure for Aerospace Standard Products*
- AS9132B, *Data Matrix Quality Requirements for Parts Marking*
- AS9131C, *Aerospace Series - Quality Management Systems - Nonconformance Data Definition and Documentation*
- AS9120B, *Quality Management Systems – Requirements for Aviation, Space, and Defense Distributors*
- AS9115A, *Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations - Deliverable Software (Supplement to 9100:2016)*
- AS9110C, *Quality Management Systems – Requirements for Aviation Maintenance Organizations*
- AS9104/2A, *Requirements for Oversight of Aerospace Quality Management System Registration/Certification Programs*
- AS9102B, *Aerospace First Article Inspection Requirement*
- AS9101F, *Quality Management Systems - Audit Requirements for Aviation, Space, and Defense Organizations*
- AS9003A, *Inspection and Test Quality Systems, Requirements for Aviation, Space, and Defense Organizations*
- ARP9114A, *Direct Ship Guidance for Aerospace Companies*
- ARP9107A, *Direct Delivery Authorization Guidance for Aerospace Companies*
- AS9017, *Control of Aviation Critical Safety Items*
- AS9162, *Aerospace Operator Self-Verification Programs*
- AS9146, *Foreign Object Damage (FOD) Prevention Program - Requirements for Aviation, Space, and Defense Organizations*
- AS9145, *Aerospace Series – Requirements for Advanced Product Quality Planning and Production Part Approval Process*
- AS9138, *Aerospace Series - Quality Management Systems Statistical Product Acceptance Requirements*
- AS9117, *Delegated Product Release Verification*
- AS9116, *Aerospace Series - Notice of Change (NOC) Requirements*
- AS9104/3, *Requirements for Aerospace Auditor Competency and Training Courses*
- AS9104/1, *Requirements for Aviation, Space, and Defense Quality Management System Certification Programs*
- ARP9137, *Guidance for the Application of AQAP 2110 within a 9100 Quality Management System*
- ARP9136, *Aerospace Series - Root Cause Analysis and Problem Solving (9S Methodology)*
- AS6171/1, *Suspect/Counterfeit Test Evaluation Method*
- AS6171/10, *Techniques for Suspect/Counterfeit EEE Parts Detection by Thermogravimetric Analysis (TGA) Test Methods*
- AS6171/11, *Techniques for Suspect/Counterfeit EEE Parts Detection by Design Recovery Test Methods*
- AS6171/2A, *Techniques for Suspect/Counterfeit EEE Parts Detection by External Visual Inspection, Remarking and Resurfacing, and Surface Texture Analysis Using SEM Test Methods*

- AS6171/3, *Techniques for Suspect/Counterfeit EEE Parts Detection by X-ray Fluorescence Test Methods*
- AS6171/4, *Techniques for Suspect/Counterfeit EEE Parts Detection by Delid/Decapsulation Physical Analysis Test Methods*
- AS6171/5, *Techniques for Suspect/Counterfeit EEE Parts Detection by Radiological Test Methods*
- AS6171/6, *Techniques for Suspect/Counterfeit EEE Parts Detection by Acoustic Microscopy (AM) Test Methods*
- AS6171/7, *Techniques for Suspect/Counterfeit EEE Parts Detection by Electrical Test Methods*
- AS6171/8, *Techniques for Suspect/Counterfeit EEE Parts Detection by Raman Spectroscopy Test Methods*
- AS6171/9, *Techniques for Suspect/Counterfeit EEE Parts Detection by Fourier Transform Infrared Spectroscopy (FTIR) Test Methods*
- AS6171A, *Test Methods Standard; General Requirements, Suspect/Counterfeit, Electrical, Electronic, and Electromechanical Parts*
- AS6810, *Requirements for Accreditation Bodies when Accrediting Test Laboratories Performing Detection of Suspect/Counterfeit in Accordance with AS6171 General Requirements and the Associated Test Methods*
- AS6496, *Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition - Authorized/Franchised Distribution*
- AS6301, *Compliance Verification Criterion Standard for SAE AS6081, Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition – Distributors*
- AS6462A, AS5553A, *Fraudulent/Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition Verification Criteria*
- ARP6328, *Guideline for Development of Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition Systems*
- AS5553B, *Counterfeit Electrical, Electronic, and Electromechanical (EEE) Parts; Avoidance, Detection, Mitigation, and Disposition*
- AS6081, *Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation, and Disposition – Distributors Counterfeit Electronic Parts; Avoidance Protocol, Distributors*
- ARP6178, *Fraudulent/Counterfeit Electronic Parts; Tool for Risk Assessment of Distributors*
- AIR6860, *Use of AS5553 for Implementation of Defense Federal Acquisition Regulation Supplement 252-246-7007*
- AS6174/1, *Compliance Verification Matrix (VM) Slash Sheet for SAE AS6174A, Counterfeit Materiel; Assuring Acquisition of Authentic and Conforming Materiel*
- AS6174A, *Counterfeit Materiel; Assuring Acquisition of Authentic and Conforming Materiel*
- AIR6110, *Contiguous Aircraft/System Development Process Example*
- AIR6218, *Constructing Development Assurance Plan for Integrated Systems*
- ARP1834B, *Fault/Failure Analysis for Digital Systems and Equipment*
- ARP4754A, *Guidelines for Development of Civil Aircraft and Systems*
- ARP4761, *Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment*

- ARP5150, *Safety Assessment of Transport Airplanes in Commercial Service*
- ARP5151, *Safety Assessment of General Aviation Airplanes and Rotorcraft in Commercial Service*
- ARP926C, *Fault/Failure Analysis Procedure*

6.4　Avionics and Subsystems

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

Federal Aviation Administration (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
  - o Subpart D—Design and Construction
  - o Subpart F—Equipment
  - o Subpart G—Operating Limitations and Information
  - o Subpart H—Electrical Wiring Interconnection Systems (EWIS)
  - o Appendix H—Instructions for Continued Airworthiness (ICA)
- Part 23, Airworthiness Standards: Normal Category Airplanes
  - o Subpart D—Design and Construction
  - o Subpart F—Equipment
  - o Subpart G—Flightcrew Interface and Other Information
  - o Appendix A—Instructions for Continued Airworthiness (ICA)
- Part 27, Airworthiness Standards: Normal Category Rotorcraft
  - o Subpart D—Design and Construction
  - o Subpart F—Equipment
  - o Subpart G—Operating Limitations and Information
  - o Appendix A—Instructions for Continued Airworthiness (ICA)
  - o Appendix B—Airworthiness Criteria for Helicopter Instrument Flight
  - o Appendix C—Criteria for Category A
  - o Appendix D—HIRF Environments and Equipment HIRF Test Levels
- Part 29, Airworthiness Standards: Transport Category Rotorcraft
  - o Subpart D—Design and Construction
  - o Subpart F—Equipment
  - o Subpart G—Operating Limitations and Information
  - o Appendix A—Instructions for Continued Airworthiness (ICA)
  - o Appendix B—Airworthiness Criteria for Helicopter Instrument Flight
  - o 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
  - o Subpart B—Flight Rules
  - o Subpart C--Equipment, Instrument and Certificate Requirements
  - o Subpart E--Maintenance, Preventive Maintenance, and Alterations
  - o Subpart F--Large and Turbine-Powered Multiengine Airplanes and Fractional Ownership Program Aircraft
  - o Subpart G--Additional Equipment and Operating Requirements for Large and Transport Category Aircraft

- o   Subpart L--Continued Airworthiness and Safety Improvements
- o   Appendix A--Category II Operations: Manual, Instruments, Equipment, and Maintenance
- o   Appendix B--Authorizations to Exceed Mach 1 (Sec. 91.817)
- o   Appendix D--Airports/Locations: Special Operating Restrictions
- o   Appendix E--Airplane Flight Recorder Specifications
- o   Appendix F--Helicopter Flight Recorder Specifications
- o   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)*, 10-17-91
- 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)*, 6-15-61
- 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*, 6-13-84
- 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
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- TSO-C118, *Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS I*, 8-05-88
- 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*, 5-05-17
- TSO-C146d, *Stand-Alone Airborne Navigation Equipment Using The Global Positioning System Augmented By The Satellite Based Augmentation System (SBAS)*, 12-20-13
- TSO-C146e, Stand-Alone Airborne Navigation Equipment Using The Global Positioning System Augmented By The Satellite Based Augmentation System (SBAS), 5-05-17
- 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, *Next Generation Satellite Systems (NGSS) Equipment*, 9-29-14
- TSO-C159c, *Next Generation Satellite Systems (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, *Ground Based Augmentation System Very High Frequency 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*, 9-30-03
- 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
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- 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
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- 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)*, 5-03-16
- 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 Satellite-Based Augmentation System (SBAS) for Navigation and Non-Navigation Position/Velocity/Time Output*, 12-20-13
- TSO-C205a, *Circuit Card Assembly Functional Class Delta Equipment Using The Satellite-Based Augmentation System For Navigation Applications*, 5-09-17
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- TSO-C206, *Circuit Card Assembly Functional Sensors using Aircraft-Based Augmentation for Navigation and Non-Navigation Position/Velocity/Time Output*, 12-20-13
- TSO-C207, *Aeronautical Mobile Airport Communication System (AeroMACS)*, 5-13-14
- TSO-C207a, *Aeronautical Mobile Airport Communication System (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*
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- DO-367, *MOPS for Terrain Awareness and Warning Systems (TAWS) Airborne Equipment*
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- 135-1969 - IEEE Recommended Practice for Aircraft, Missile, and Space Equipment Electrical Insulation Tests
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- Annex 10 Vol 2 – Communication Procedures
- Annex 10 Vol 3 – Communication Systems
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    - 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".

- o ARINC 624 is a standard for aircraft onboard maintenance system (OMS). It uses ARINC 429 for data transmission between embedded equipment.
- o 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.
- o 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.
- o ARINC 633 is the air-ground protocol for ACARS and IP networks used for AOC data exchanges between aircraft and the ground.
- o ARINC 635 defines the protocols for the HFDL network of radios used for communication and messaging between aircraft and HF Ground Stations.
- o 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.
- o ARINC 660 defines avionics functional allocation and recommended architectures for CNS/ATM avionics.
- o 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.
- o 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.
- o ARINC 665 This standard defines standards for loadable software parts and software transport media.
- o 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.
  - o ARINC 702A defines the Flight Management Systems (FMS).
  - o ARINC 704 defines the Inertial Reference System (IRS).
  - o ARINC 708 is the standard for airborne weather radar. It defines the airborne weather radar characteristics for civil and military aircraft.
  - o ARINC 709 defines Distance Measuring Equipment (DME).
  - o ARINC 717 defines the acquisition of flight data for recording
  - o ARINC 718 describes an Air Traffic Control Transponder (ATCRBS/MODE S).
  - o ARINC 724B defines the Aircraft Communications Addressing and Reporting System (ACARS).
  - o ARINC 735B defines the Traffic Computer with TCAS.
  - o ARINC 738 defines an integrated Air Data Inertial Reference Unit (ADIRU).
  - o ARINC 739 is the standard for a Multi-Purpose Control and Display Unit (MCDU) and interfaces.
  - o ARINC 740 defines airborne printers.
    ARINC 741 is the standard for a first-generation L-band satellite data unit.
  - o ARINC 743A defines a GNSS receiver.
  - o ARINC 744A defines a full-format airborne printer.
  - o ARINC 746 is the standard for a cabin telecommunications unit, based on Q.931 and CEPT-E1.
  - o ARINC 747 defines a Flight Data Recorder (FDR).
  - o ARINC 750 defines a VHF Digital Radio.
  - o ARINC 755 defines a Multi-Mode Receiver (MMR) for approach and landing ARINC 756 defines a GNSS Navigation and Landing Unit.

- o ARINC 759 defines an Aircraft Interface Device (AID) ARINC 760 defines a GNSS Navigator.
  - o ARINC 757 defines a Cockpit Voice Recorder (CVR).
  - o ARINC 761 is the standard for a second-generation L-band satellite data unit, also called Swift64 by operator Inmarsat.
  - o ARINC 763 is the standard for a generic avionics file server and wireless access points.
  - o ARINC 767 defines a combined recorder unit capable of data and voice.
  - o ARINC 771 is Low-Earth Orbiting Aviation Satellite Communication System.
  - o ARINC 781 is the standard for a third-generation L-band satellite data unit, also called SwiftBroadband (SBB) by operator Inmarsat.
  - o 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.
  - o ARINC 801 through 807 define the application of fiber optics on the aircraft.
  - o 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.
  - o 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.
  - o ARINC 812 is a standard for the integration of aircraft galley inserts and associated interfaces.
  - o ARINC 816 defines a database for airport moving maps
  - o ARINC 817 defines a low-speed digital video interface
  - o ARINC 818 defines a high-speed digital video interface standard developed for high bandwidth, low latency, uncompressed digital video transmission.
  - o ARINC 821 is a top-level networking definition describing aircraft domains, file servers and other infrastructure.
  - o ARINC 822 is the standard for Gatelink.
  - o ARINC 823 is a standard for end-to-end datalink encryption.
  - o ARINC 825 is a standard for Controller Area Network bus protocol for airborne use.
  - o ARINC 826 is a protocol for avionic data loading over a Controller Area Network bus.
  - o ARINC 827 specifies a crate format for electronic distribution of software parts for aircraft.
  - o ARINC 828 defines aircraft wiring provisions and electrical interface standards for electronic flight bag (EFB).
  - o ARINC 834 defines an aircraft data interface that sources data to Electronic Flight Bags, airborne file servers, etc.
  - o ARINC 838 provides a standardized XML description for loadable software parts.
  - o ARINC 839 is a function definition of airborne manager of air-ground interface communications (MAGIC).
  - o ARINC 840 defines the Application Control Interface (ACI) used with an Electronic Flight Bag (EFB)
  - o ARINC 841 defines Media Independent Aircraft Messaging
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- MIL-PRF-19500K General Specification For Semiconductor Devices
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- MIL-STD-1670 Environmental Criteria and Guidelines for Air Launched Weapons
- MIL-STD-1686 Electrostatic Discharge Control Program For Protection of Electrical
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- MIL-HDBK-454 Standard General Requirements For Electronic Equipment
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- [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, June 5-9, 2017
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- [Technical Capability Level 2 UTM Flight Demonstration: Description and Analysis,](#) IEEE-DASC 2017, September 17-21, 2017
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- [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 UTM,](#) 17th AIAA Aviation Technology, June 5-9, 2017
- [NASA Technical Memorandum-UTM Data Working Group Demonstration 1 Final Report,](#) April 2017
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- [From Rural to Urban Environments: Human/Systems Simulation Research for Low Altitude UTM,](#) NASA, 16th AIAA Aviation Technology, June 13-17, 2016
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- [F2411 - 04e1, Standard Specification for Design and Performance of an Airborne SAA System](#)
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- 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

- [F3298-19, Standard Specification for Design, Construction, and Verification of Fixed-Wing Unmanned Aircraft Systems (UAS)](#)

European Organization for Civil Aviation Equipment (EUROCAE) Document(s):
- EUROCAE, ED-112, Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems, Mar 2003

Federal Communications Commission (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 other Documents:

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

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

- o [AS6518A,](#) Unmanned Systems (UxS) Control Segment (UCS) Architecture: UCS Architecture Model
  - o [AS6522A,](#) Unmanned Systems (UxS) Control Segment (UCS) Architecture: Architecture Technical Governance

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

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

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

6.4.3   Systems Performing Detect and Avoid (DAA) Functions

Published Regulations, Standards, and Related Materials: 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)](#)
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  - 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.
- o 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.
- o ARINC 660 defines avionics functional allocation and recommended architectures for CNS/ATM avionics.
- o 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.
- o 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.
- o ARINC 665 This standard defines standards for loadable software parts and software transport media.
- o 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.
  - o ARINC 702A defines the Flight Management Systems (FMS).
  - o ARINC 704 defines the Inertial Reference System (IRS).
  - o ARINC 708 is the standard for airborne weather radar. It defines the airborne weather radar characteristics for civil and military aircraft.
  - o ARINC 709 defines Distance Measuring Equipment (DME).
  - o ARINC 717 defines the acquisition of flight data for recording
  - o ARINC 718 describes an Air Traffic Control Transponder (ATCRBS/MODE S).
  - o ARINC 724B defines the Aircraft Communications Addressing and Reporting System (ACARS).
  - o ARINC 735B defines the Traffic Computer with Traffic Alert and Collision Avoidance System (TCAS).
  - o ARINC 738 defines an integrated Air Data Inertial Reference Unit (ADIRU).
  - o ARINC 739 is the standard for a Multi-Purpose Control and Display Unit (MCDU) and interfaces.
  - o ARINC 740 defines airborne printers
    ARINC 741 is the standard for a first-generation L-band satellite data unit.
  - o ARINC 743A defines a GNSS receiver
  - o ARINC 744A defines a full-format airborne printer
  - o ARINC 746 is the standard for a cabin telecommunications unit, based on Q.931 and CEPT-E1.
  - o ARINC 747 defines a Flight Data Recorder (FDR)
  - o ARINC 750 defines a VHF Digital Radio
  - o SAE ARINC 755 defines a Multi-Mode Receiver (MMR) for approach and landing SAE ARINC 756 defines a GNSS Navigation and Landing Unit
  - o ARINC 759 defines an Aircraft Interface Device (AID) SAE ARINC 760 defines a GNSS Navigator
  - o ARINC 757 defines a Cockpit Voice Recorder (CVR)
  - o ARINC 761 is the standard for a second-generation L-band satellite data unit, also called Swift64 by operator Inmarsat.
  - o ARINC 763 is the standard for a generic avionics file server and wireless access points.
  - o ARINC 767 defines a combined recorder unit capable of data and voice.
  - o ARINC 771 is under development (2016) now for a low earth orbit (LEO) also called Iridium NEXT

by operator Iridium
- o ARINC 781 is the standard for a third-generation L-band satellite data unit, also called SwiftBroadband (SBB) by operator Inmarsat.
- o 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.
  - o ARINC 801 through 807 define the application of fiber optics on the aircraft.
  - o 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.
  - o 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.
  - o ARINC 812 is a standard for the integration of aircraft galley inserts and associated interfaces
  - o ARINC 816 defines a database for airport moving maps
  - o ARINC 817 defines a low-speed digital video interface
  - o ARINC 818 defines a high-speed digital video interface standard developed for high bandwidth, low latency, uncompressed digital video transmission.
  - o ARINC 821 is a top-level networking definition describing aircraft domains, file servers and other infrastructure.
  - o ARINC 822 is the standard for Gatelink.
  - o ARINC 823 is a standard for end-to-end datalink encryption.
  - o ARINC 825 is a standard for Controller Area Network bus protocol for airborne use.
  - o ARINC 826 is a protocol for avionic data loading over a Controller Area Network bus.
  - o ARINC 827 specifies a crate format for electronic distribution of software parts for aircraft.
  - o ARINC 828 defines aircraft wiring provisions and electrical interface standards for electronic flight bag (EFB)
  - o ARINC 834 defines an aircraft data interface that sources data to Electronic Flight Bags, airborne file servers, etc.
  - o ARINC 838 provides a standardized XML description for loadable software parts.
  - o ARINC 839 is a function definition of airborne manager of air-ground interface communications (MAGIC)
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- [NASA, Industry Complete Third Phase of UAS Flight Testing, September 16, 2015](#)
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- [Revising the Airspace Model for the Safe Integration of Small UASs,](#) Amazon white paper, October, 2015

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

6.5   Electrical Systems

Published Standards and other Documents:

SAE International Committees and Documents:
AE-7A Generators and Controls Motors and Magnetic Devices:
- AS20708/139B, S*ynchro* C*ontrol Transmitter, Type* 31CX6a
- AS20708/14B, Synchro, Control Transmitter, Type 15CX4D
- AS20708/15B, Synchro, Control Transformer, Type 15CT4C
- AS20708/16B, Synchro, Control Differential Transmitter, Type 15CDX4D
- AS20708/17B, Synchro, Torque Differential Transmitter, Type 15TDX4C
- AS20708/19B, Synchro, Torque Receiver Transmitter, Type 15TRX4A
- AS20708/1B, Synchro, Control Transformer, Type 11CT4E
- AS20708/20B, Synchro, Control Transmitter, Type 15CDX6C
- AS20708/21B, Synchro, Control Transformer, Type 15CT6D
- AS20708/22B, Synchro, Control Differential Transmitter, Type 15CDX6C
- AS20708/23B, Synchro, Torque Receiver Transmitter, Type 15TRX6A
- AS20708/25B, Synchro, Control Transformer, Type 16CTB4B
- AS20708/29B, Synchro, Control Transformer, Type 18CT4C
- AS20708/2B, Synchro, Control Transmitter, Type 11CX4E
- AS20708/30B, Synchro, Control Differential Transmitter, Type 18CDX4C
- AS20708/31B, Synchro, Torque Differential Transmitter, Type 18TDX4C
- AS20708/32B, Synchro, Torque Receiver Transmitter, Type 18TRX4A
- AS20708/33B, Synchro, Control Transmitter, Type 18CX6C
- AS20708/34B, Synchro, Control Transformer, Type 18CT6D
- AS20708/35B, Synchro, Torque Receiver Transmitter, Type 18TRX6B
- AS20708/36B, Synchro, Control Differential Transmitter, Type 18CDX6D
- AS20708/39C, Synchro, Control Transformer, Type 19CTB4B
- AS20708/3B, Synchro, Torque Receiver, Type 11TR4C
- AS20708/45B, Synchro, Control Transmitter, Type 23CX4D
- AS20708/46B, Synchro, Control Transformer, Type 23CT4C
- AS20708/47B, Synchro, Control Differential Transmitter, Type 23CDX4C
- AS20708/48B Ty*, Synchro, Torque Differential Transmitter,*pe 23TDX4C
- AS20708/49B, Synchro, Differential Receiver, Type 23TDR4B
- AS20708/4B, Synchro, Torque Transmitter, Type 11TX4C
- AS20708/500B, Synchro, Torque Receiver, Type 26V-10TR4
- AS20708/50B, Synchro, Torque Receiver Transmitter, Type 23TRX4A
- AS20708/52B, Synchro, Control Transmitter, Type 23CX6D
- AS20708/53B, Synchro, Control Transformer, Type 23CT6D
- AS20708/54B, Synchro, Control Differential Transmitter, Type 23CDX6C
- AS20708/55B, Synchro, Torque Differential Transmitter, Type 23TDX6C

- AS20708/56B, Synchro, Torque Receiver Transmitter, Type 23TRX6B
- AS20708/5B, Synchro, Torque Receiver, Type 26V-11TR4C
- AS20708/62B, Synchro, Torque Receiver Transmitter, Type 31TRX4A
- AS20708/66B, Synchro, Torque Receiver Transmitter, Type 31TRX6A
- AS20708/67B, Synchro, Torque Differential Receiver, Type 31TDR6B
- AS20708/68B, Synchro, Torque Differential Transmitter, Type 31TDX6C
- AS20708/6B, Synchro, Torque Transmitter, Type 26V-11TX4C
- AS20708/70B, Synchro, Torque Receiver Transmitter, Type 37TRX4A
- AS20708/74B, Synchro, Torque Receiver Transmitter, Type 37TRX6A
- AS20708/76B, Synchro, Torque Differential Transmitter, Type 37TDX6A
- AS20708/78B, Synchro, Control Transmitter, Type 26V-08CX4C
- AS20708/79B, Synchro, Control Transformer, Type 26V-08CT4C
- AS20708/7B, Synchro, Control Transformer, Type 26V-11CT4D
- AS20708/80B, Synchro, Torque Receiver Transmitter, Type 26V-08CDX4C
- AS20708/81B, Synchro, Control Differential Transmitter, Type 11CDX4B
- AS20708/8B, Synchro, Control Transmitter, Type 26V-11CX4C
- AS20708/94C, Synchro, 60 and 400 Hz, Size 23
- AS20708/9B, Synchro, Control Differential Transmitter, Type 26V-11CDX4C

AE-8A Elec Wiring and Fiber Optic Interconnect Sys Install:
- ARP4404C, Aircraft Electrical Installations
- AIR6820, Electrical Wiring Fuel Compatibility
- ARP6881, Guidelines for the Use and Installation of Bonded Cable Harness Supports
- AIR4465A, Design and Handling Guide Radio Frequency Absorptive Type Wire and Cables (Filter Line, AS85485)
- AIR5468B, Ultraviolet (UV) Lasers for Aerospace Wire Marking
- AIR5558, Ultraviolet (UV) Laser Marking Performance of Aerospace Wire Constructions
- AIR5575A, Hot Stamp Wire Marking Concerns for Aerospace Vehicle Applications
- AIR5717, Mitigating Wire Insulation Damage During Processing and Handling
- ARP5062A, Recommended Test Fluids for Electrical Components Used on Aircraft Exterior or for Ground Support Near Aircraft
- ARP5369B, Guidelines for Wire Identification Marking Using the Hot Stamp Process
- ARP5607A, Legibility of Print on Aerospace Wires and Cables
- ARP5614, Guidelines for Harness Critical Clamp Locator Marker Installation on Electrical Cable Assemblies
- ARP6167, Etching of Fluoropolymer Insulations
- ARP81490A, Transmission Lines, Transverse Electromagnetic Mode
- AS21378A, Plugs And Cable Assemblies, External Power, Aircraft, 230/400 VOLT, 400 Hertz
- AS24122A, Wiring Harness - External Power, 115 Volt AC, Single Phase

- [AS24208A, Cable and Plug Assembly, External Power 115/200 VOLTS 3 Phase, Single Point Refueling](#)
- [AS25019A, Cable Assembly, External Electric Power, Aircraft, 28 VOLT DC, Jet Starting](#)
- [AS25064A, Conduit, Flexible, Radio Frequency Shielding](#)
- [AS25065A, Ferrule, Flexible Conduit, Radio Frequency Shielding](#)
- [AS25066, Conduit Assembly, Nut, Flexible, Radio Frequency Shielding](#)
- [AS25067A, Conduit Assembly, Flexible, Radio Frequency Shielding](#)
- [AS4461C, Assembly and Soldering Criteria for High Quality/High Reliability Soldering Wire and Cable Termination in Aerospace Vehicles](#)
- [AS5649A, Wire and Cable Marking Process, UV Laser](#)
- [AS5942, Marking of Electrical Insulating Materials](#)
- [AS7974/2A, Cable Assembly, External Power, Aircraft 115/200 VOLT, 400 Hertz Power Distribution Flight Line (for A/E 24A-166A)](#)
- [AS7974/4A, Cable Assembly, External Electric Power, Aircraft, Single-Jacketed 115/200 VOLT, 400 Hertz](#)
- [AS7974/5A, Cable Assembly, External Electric Power, Aircraft, Single-Jacketed 270 VDC, 90 KW](#)
- [AS7974A, Cable Assemblies and Attachable Plugs, External Electrical Power, Aircraft, General Specification for](#)
- [AS90328A, Cable Assembly, External Electric Power, Aircraft 115/200 VOLT, 400 Hertz](#)
- [AS90347A, *Cable Assembly, External Electric Power, Aircraft 28 VOLT DC, Operating Power*](#)

7.11 Design and Operation of Aerodrome Facilities for UAS

Published Standards and Other Documents:

<u>ICAO:</u>
- ICAO Annex 14, Volume I - *Aerodromes*
- ICAO Annex 14, Volume II – *Heliports*
- ICAO Doc 9640, *Manual of Aircraft Ground De-Icing/Anti-Icing Operations*
- ICAO Doc 9150, *Stolport Manual*
- ICAO Doc 9981, *Aerodromes*
- ICAO Doc 9774, *Manual on Certification of Aerodromes*
- ICAO Doc 9157, *Aerodrome Design Manual – Part 1 - Runways, Part 2 - Taxiways, Aprons and Holding Bays, Part 3 - Pavements, Part 4 - Visual Aids, Part 5 - Electrical Systems, Part 6 - Frangibility*
- ICAO Doc 9137, *Airport Services Manual - Part 1 - Rescue and Fire Fighting, Part 2 - Pavement Surface Conditions, Part 3 - Wildlife Control and Reduction, Part 5 - Removal of Disabled Aircraft, Part 6 - Control of Obstacles, Part 7 - Airport Emergency Planning, Part 8 - Airport Operational Services, Part 9 - Airport Maintenance Practices*
- ICAO Doc 9184, *Airport Planning Manual - Part 1 - Master Planning, Part 2 - Land Use and Environmental Management, Part 3 - Guidelines for Consultant/Construction Services*
- ICAO Doc 9636, *International Signs to Provide Guidance to Persons at Airports and Marine Terminals*

FAA:
- FAA Advisory 150/5390-1B – Heliport Design Guide
- AC 150/5390-2C, *Heliport Design (for vertiports operating as heliports)*
- AC 150/5370-10C *Standards for Specifying Construction of Airports*

ASTM
- ASTM F2849 - 10(2019), *Standard Practice for Handling of Unmanned Aircraft Systems at Divert Airfields*

HSAC (Helicopter Safety Advisory Conference):
- HSAC RP UASRP 15-1 Unmanned Aerial Systems Guidelines
- HSAC RP 161, *Helideck Design New Builds, 2nd Edition, Final*
- HSAC RP 162 *Legacy Helidecks, 2nd Edition, Final*
- HSAC RP 163, *Inspection Maintenance and Operation of Offshore Helidecks, 1st Edition, 1st Amdt (December 2019)*
- HSAC RP 164, *Standardization of Helideck Information Plates, 2nd Edition, Final*
- HSAC RP 191, *Offshore Helideck Incident Bowtie, 2nd Edition (December 2019), Final*
- HSAC RP 1992-1, *HELIDECK HELIPORT OPERATIONAL HAZARD WARNING(S) and PROCEDURE(S)*
- HSAC RP 1992-4, *GAS VENTING, HELIDECK HELIPORT OPERATIONAL HAZARD WARNING(S) and PROCEDURE(S)*
- HSAC RP 1992-5, *CLOSED HELIDECKS HELIPORTS , HELIDECK HELIPORT OPERATIONAL HAZARD WARNING(S) and PROCEDURE(S)*
- HSAC RP 1993-2, *OFFSHORE HELIDECKS LANDING COMMUNICATIONS*
- HSAC RP 1994-1, *HELICOPTER RAPID REFUELING PROCEDURES (HRR)*
- HSAC RP 2004-1, *OFFSHORE HELIDECK INSPECTIONS*
- HSAC RP 2004-2, *JET FUEL QUALITY CONTROL PROCEDURES*
- HSAC RP 2004-6, *HELICOPTER UNDERWATER ESCAPE TRAINING (HUET) AND HELICOPTER EGRESS*
- HSAC RP 2004-7, *HELIDECK HAZARDS*
- HSAC RP 2016-1, *Helideck Design New Builds Revision*
- HSAC RP 2016-2, *Legacy Helidecks Revision*
- HSAC RP 2016-3, *Inspection, Maintenance and Operations of Offshore Helidecks, Initial Issue (25Mar2019)*
- HSAC RP 2016-4, *STANDARDIZATION OF HELIDECK INFORMATION PLATES*
- HSAC RP 2019-1, *Offshore Helideck Incident Bowtie, Initial Issue (25Mar2019)*

ICC:
- ICC, *International Building Code (IBC)*
- ICC, *International Fire Code (IFC)*

NFPA:
- NFPA-1, *Fire Code* (Speaks to aviation and airport operations and includes extracts from NFPA 2, NFPA 418 and NFPA 855)
- NFPA-2, *Hydrogen Technologies Code*
- NFPA-402, *Aircraft Rescue and Fire-Fighting Operations*
- NFPA-403, *Aircraft Rescue and Fire-Fighting Services at Airports*
- NFPA-407, *Aircraft Fuel Servicing*

- NFPA-408, *Aircraft Hand Portable Fire Extinguishers*
- NFPA-409, *Aircraft Hangars*
- NFPA-410, *Aircraft Maintenance*
- NFPA-415, *Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*
- NFPA 418, *Standard for Heliports*
- NFPA-423, *Construction and Protection of Aircraft Engine Test Facilities*
- NFPA-855, *Standard for the Installation of Stationary Energy Storage Systems (Includes a Chapter on Used and Off Spec batteries currently being expanded to any battery storage, would also apply to refueling energy storage needs)*
- NFPA-2400, *Small Unmanned Aircraft Systems (sUAS)*

In Development Standards and Other Documents:

NFPA:
- NFPA 418, *Standard for Heliports* (Revision)

9.3   Transport and Post-Crash Procedures Involving Biohazards

Published Regulations, 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

U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (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

United Nations 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

National Fire Protection Association (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)

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 documents include the following:
- AIR1168/1A, Thermodynamics of Incompressible and Compressible Fluid Flow
- AIR1168/3A, SAE Aerospace Applied Thermodynamics Manual Aerothermodynamic Systems Engineering and Design
- ARP85G, Air Conditioning Systems for Subsonic Airplanes
- AS4073B, Air Cycle Air Conditioning Systems for Military Air Vehicles
- AS8040C, Heater and Accessories, Aircraft Internal Combustion Heat Exchanger Type

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

United States Agency for International Development (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](#)