AIR TRAFFIC CAUSAL AND CONTRIBUTORY FACTORS

DEFINITIONS AND USAGE NOTES

August 2014 (1.0.1)

The Air Traffic Causal and Contributory Factors taxonomy is a high level categorization of factors that contribute to incidents or accidents involving: loss of airborne separation between aircraft, aerodrome surface loss of separation, loss of separation between aircraft and terrain or obstacles, and other air traffic control anomalies not involving loss of separation.

RECORD OF REVISIONS

Date	Version	Section	Revision
2/2014	1.0		Document Creation
8/2014	1.0.1	Introduction	Applied formatting to list of domains and disciplines. No changes to content.

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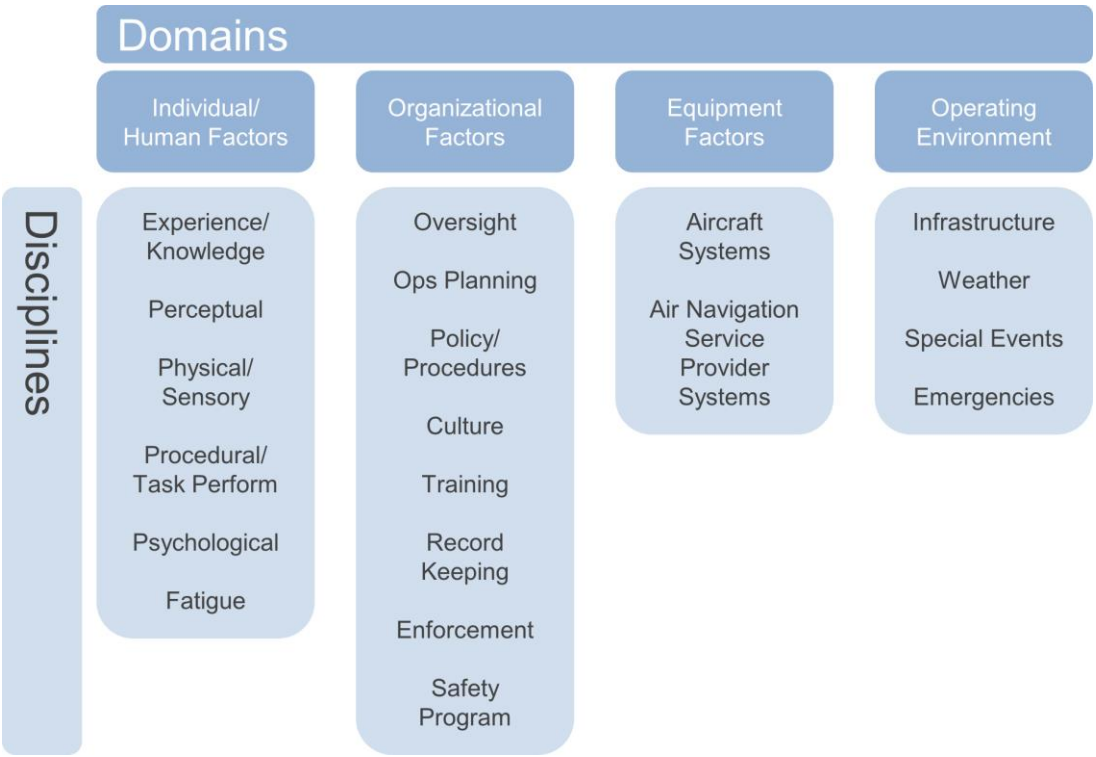
INTRODUCTION

The International Civil Aviation Organization (ICAO) and the Commercial Aviation Safety Team (CAST), which includes Government officials and aviation industry leaders, have jointly chartered the CAST/ICAO Common Taxonomy Team (CICTT). The team was charged with developing common taxonomies and definitions for aviation accident and incident reporting systems. The common taxonomies and definitions are intended to improve the aviation community's capacity to focus on common safety issues. CICTT includes experts from air carriers, aircraft manufacturers, engine manufacturers, pilot associations, regulatory authorities, transportation safety boards, and ICAO, and members from Canada, the European Union, France, Italy, Japan, the Netherlands, the United Kingdom, and the United States. CICTT is co-chaired by a representative from ICAO and a representative from CAST.

It is important to note that CICTT does not expect governments, international organizations, and corporations to immediately change existing data systems or existing definitions. The CICTT Air Traffic (AT) Causal and Contributory Factors Working Group recognizes that there are several major AT taxonomies in use around the world, and that various organizations have made considerable investments in these systems. The intent of the CICTT AT taxonomy is to provide a means to translate analogous concepts across different taxonomies, thus enabling researchers to study aggregated data from different sources under a common analytical framework.

The CICTT AT taxonomy consists of a three-tier structure: domains, the first and most aggregated tier; disciplines; and elements. AT domains and disciplines are illustrated in the table below.



This four-domain structure reflects careful alignment with existing, internationally accepted taxonomies. For example, the AT "Individual/Human Factors" and "Organizational Factors" domains were mapped from the CICTT Human Factors taxonomy.

AT Causal and Contributory Factors refer to conditions or events that could affect the severity or likelihood of the following types of incidents:

(1) A loss of radar separation involving instrument flight rules (IFR) aircraft, loss of separation involving visual flight rules (VFR) aircraft in airspace where minimum separation standards are prescribed, a suspected loss of separation involving formation flights, and a loss of separation involving non-radar standards.

(2) An aerodrome surface loss of separation, including any ground surveillance alert between two aircraft, any ground surveillance alert between an aircraft and a vehicle, any suspected loss of runway/airport surface separation between two aircraft, any suspected loss of runway/airport surface separation between an aircraft and a vehicle, or any suspected loss of runway/airport surface separation between an aircraft and a pedestrian.

(3) A loss of separation between an IFR aircraft and terrain or obstacles (for example, operations below minimum vectoring altitude), or an incident involving a VFR aircraft in proximity to terrain or obstructions that the employee providing air traffic services determines affected the safety of flight.

(4) An airborne air traffic control (ATC) anomaly (airspace/altitude/route/speed) not involving a loss of separation. Examples include the following: an instance in which an aircraft enters airspace on other than the expected or intended altitude; an instance where an aircraft operates at an altitude, routing, or airspeed that the employee providing air traffic services determines affected the safety of flight or operations; or an occurrence where an aircraft enters special use airspace (for example, a warning area, military operations area, or ATC-assigned airspace) without coordination and/or authorization.

(5) Events in the aerodrome environment that do not involve a loss of separation, but may affect the safety of operations. Examples include the following: instances in which an aircraft unexpectedly lands or departs, or attempts to land or depart, on a runway or surface; instances in which an aircraft lands or departs on, or flies an unrestricted low approach to, a closed runway (or portion thereof); instances of a go-around initiated by either a flightcrew or ATC involving turbojet aircraft within ½-mile of the arrival threshold not involving practice approaches; instances in which any part of the aircraft has crossed over the runway hold-short line and the controller cancels the takeoff or the flightcrew aborts the takeoff; instances in which an aircraft unintentionally maneuvers off the runway/taxiway; an improper/unexpected presence of a vehicle or aircraft inside the Instrument Landing System (ILS) protected area; the presence of an aircraft, vehicle, or pedestrian on any movement area or runway safety area not intended by ATC.

(6) Instances in which communication with an aircraft was not established or not maintained as expected/intended, and results in alternative control actions or additional notifications by an air traffic controller or a flightcrew, or in a landing without a clearance.

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INDIVIDUAL/HUMAN FACTORS

This domain is defined as a set of disciplines and elements that describe an individual's performance in relation to their environment. The disciplines include Experience/Knowledge, Perceptual, Physical/Sensory, Procedural/Task Performance, Psychological, and Fatigue, all of which include characteristics that may influence how an individual performs in their working environment.

EXPERIENCE/KNOWLEDGE

This discipline includes factors related to the accumulation, application, and demonstration of skills necessary to perform required tasks.

Includes the following elements:

- **Experience:** Factors related to depth of exposure and time in performance of tasks or functions.
- **Qualifications/Training:** Factors related to preparation for currency, documented status, or demonstrated proficiency level to meet or maintain a standard.
- **Knowledge:** Factors related to comprehension of the position, task, assignment, or procedures.

Usage Notes:

- This discipline includes factors related to individual accumulation and application of information gained over time.
- Experience includes total and recent operational experience and amount of time spent performing one's task or assignment. This element includes type and level of exposure an individual has experienced or acquired over time. Example: Total flight hours in an aircraft or time on scope/operational position.
- Qualifications/Training includes total and recent instruction and training received, recurrent instruction/training, type of instruction/training received, or lack of training. Also included in this element are the documented status, ratings, and current certifications of an individual. Example: Recent simulation experience, ground school instruction, classroom instruction/practice.
- Knowledge includes understanding of procedures, tasks, assignments, or positions. Example: Familiarity with local or national directives, aircraft operating handbooks, regulatory requirements, and geographic areas.

PERCEPTUAL

This discipline includes factors related to degradation of, or false interpretation of visual, auditory, or vestibular systems cues.

Includes the following elements:

- **Situational Awareness:** The perception of environmental elements with respect to time and/or space, the comprehension of their meaning, and the projection of their status after some variable has changed, such as time.
- **Spatial Disorientation/Illusions:** Factors related to an individual's perception of the orientation of the aircraft including but not limited to the false perception of one's vestibular or visual cues.

Usage Notes:

- This discipline includes factors relating to an individual's awareness of their working environment as well as their sense of body position or aircraft attitude. Behaviors related to situational awareness include an individual's perception of the conditions or changes in their operational environment and are often described in relation to decision making or actions. Behaviors related to spatial disorientation are typically cited as the result of false perception and perceptual phenomena. This discipline includes mis-hear, mis-see, illusions, and other perceptual factors.
- Situational Awareness includes the loss or incomplete perception of or change to elements present in an individual's operational environment. This factor may be related to an individual's limited perceptions of their operational environment as well as the individual's ability to maintain a high level of vigilance of a range of elements. Example: The air traffic controller lost situational awareness when he focused on a particular aircraft's emergency, thereby not recognizing a potential traffic conflict with other aircraft in his sector, thus allowing two aircraft to lose required separation. Example: The pilot was distracted from his cognizance of reaching the runway hold-short line by flight management system inputs for his impending flight, thus causing a runway incursion.
- Spatial Disorientation/Illusions includes false perception of the aircraft's attitude or orientation. This factor may include vestibular illusions that can include but are not limited to coriolis vestibular illusion, giant-hand vestibular illusion, somatogravic/acceleration vestibular, graveyard spin, and the leans.
- Spatial Disorientation/Illusions can also include visual illusions such as black hole illusions, landing visual illusions, geometric perspective visual illusion, or autokinesis visual illusion.

PHYSICAL/SENSORY

This discipline includes factors related to a person's physical or sensory characteristics, abilities, limitations, or behaviors.

Includes the following elements:

- **Physical Characteristics:** Factors related to personal body measurements such as size, reach, strength, weight, and limitations that are outside the normal anthropometric design standards.
- **Sensory Ability/Limitation:** Factors related to a person's sensory abilities and limitations, not including psychological or visual/vestibular illusions.
- **Impairment/Incapacitation:** Factors contributing to the impairment or incapacitation of a person's facilities because of medical, physiological, or substance-induced conditions. This excludes visual and vestibular illusions.
- **Health/Fitness:** Factors related to a person's general health, fitness, and lifestyle.

Usage Notes:

- This discipline is used to address physical and sensory characteristics, as well as adverse physiological conditions that can affect an individual's performance.
- Physical Characteristics include personal body measurements such as size, reach, strength, weight, and limitations that are outside the normal anthropometric design standards. Example: Arms too short or legs too long.
- Sensory Ability/Limitation pertains to visual function, the use of corrective lenses, color vision, hearing ability, vestibular function, and tactile function. Example: The controller misread the reporting aircraft's altitude on the scope because of not wearing his corrective lenses (glasses) and mistakenly assigned another aircraft the incorrect altitude.
- Impairment/Incapacitation includes acute factors because of illness, injury, alcohol, illicit drugs, prescription medication, over-the-counter medication, hypoxia/anoxia, hyperventilation, carbon monoxide, neurological, cardiovascular, toxic fumes, motion sickness, decompression/diving, or other loss of consciousness.
- Health/Fitness includes chronic physical issues including fitness; diet such as poor nutrition, fasting, etc.; extended use of medication/drugs; alcohol; smoking; or a predisposing condition.

PROCEDURAL/TASK PERFORMANCE

This discipline includes factors related to the act of completing procedures, tasks, utilizing equipment, or performing operational tasks.

Includes the following elements:

- **Planning/Preparation:** Factors related to the planning or preparation of operational tasks.
- **Inspection:** Factors related to an individual's accomplishment of quality control procedures by assessing system elements.
- **Documentation/Record Keeping Tasks:** Factors related to documentation usage including the completion or use of operational paperwork.
- **Information/Equipment Utilization:** Factors related to the utilization, configuration, or interaction with a system.
- **Monitoring:** Factors related to the systematic observation of the operational environment.
- **Workload Management:** Factors related to the organization and prioritization of work tasks.
- **Coordination:** Factors related to the transfer of information among air traffic controllers and related to the movement of aircraft or the use of airspace.
- **Violations:** Factors related to intentional behavior contrary to applicable regulations and/or policies related to completion of required procedures or tasks.
- **Action/Inaction:** Factors related to a non-intentional behavior contrary to applicable regulations and/or policies related to action, series of actions, or the lack of action.

Usage Notes:

- This discipline includes situations where an individual failed to follow a procedure, plan, or coordinate with others or made an unintentional error. Example: The pilot did not complete the Before Landing Checklist, or the controller did not complete the Position Relief Briefing Checklist.
- Planning/Preparation refers to tasks such as performance calculations, weight and balance calculations, weather planning, flight planning, navigational planning, traffic management planning, arrival and departure sequencing, and fuel planning.
- Inspection includes quality control activities such as preflight inspection, post maintenance inspection, and scheduled and routine maintenance inspections.
- Documentation/Record Keeping Tasks includes errors related to use of flight logs and manifests, use of aircraft logs, flight strips, position logs, maintenance logs, pilots logs.
- Information/Equipment Utilization includes flight equipment usage, use of automation, use of air traffic control (ATC) equipment and systems, use of manuals, checklists, overlays,

visual aids (J-rings) and charts, use of policies and procedures, and use of available resources.

- Monitoring includes task monitoring, monitoring equipment/instruments/controller scope, monitoring communications, monitoring other person/crewmember, monitoring other aircraft, and monitoring environment. Examples include failure to monitor automation, displays, or instruments. This element is distinct from mis-see and mis-hear.
- Workload Management is used for task scheduling, task load shedding, task allocation, and task overload. Example: The air traffic controller was busy manually updating flight strips and did not notice the impending loss of separation of two aircraft under his control.
- Coordination includes tasks such as handoffs, position relief briefings, point-outs, information exchange, coordination between ground and local controllers, and sector/team coordination.
- Violations include intentional acts related to completion of required tasks, workarounds, aviation regulation violations, and other willful disregard for rules or regulations. This factor relates to intentional actions, inactions, or behaviors related to requirements associated with task completion. Example: The air traffic controller intentionally disregarded all readbacks for clearances he was delivering in order to provide separation for an overloaded sector.
- Action/Inaction are non-intentional behaviors such as incorrect action selection, incorrect or inadequate action performance, incorrect action sequence, delayed action, lack of action, forgotten action/omission, incomplete action, or unnecessary action. Note this factor can relate to a range of behaviors such as misspeaking (e.g., “air traffic controller misspoke aircraft callsign”) and should be used if a behavior is not specifically referenced in the other procedural factors.

This discipline includes factors related to thinking or acting, such as learning, memory limit, mental capability, personality, or attitudes (not including physiological issues).

Includes the following elements:

- **Attention/Distraction:** Factors related to a person's management of concentration, focus, and understanding of a situation under their direction and control.
- **Cognitive Limitation:** Factors related to a person's mental or cognitive limitations, e.g., the operational demand exceeds the mental capabilities of the operator.
- **Information Processing/Decision Making:** Factors related to the ability to process available information in the decision-making process and assessment of risk.
- **Mental/Emotional State:** Factors related to an individual's mental or emotional state of well-being.
- **Personality/Attitude:** Factors related an individual's traits, temperament, habits, or inclination.

Usage Notes:

- This discipline includes non-observable states including psychological factors and cognitive limitations. **Care should be taken when assigning these elements because some judgments are generally subjective.**
- Attention/Distraction includes task fixation and diversion of focus. Examples include failure to pay attention, lack of focus on tasks, individual ability to remain on task and likelihood to become distracted.
- Cognitive Limitation includes cognitive overload, memory limit, and operational exceedance. This includes operational demand exceeding the mental capabilities of the individual. Example: Multiple aircraft reporting in-flight emergencies at the same time overwhelmed the controller.
- Information Processing/Decision Making includes but is not limited to identification, interpretation, and prioritization of visual or auditory data; understanding and comprehension of information; and judgment, expectation, assumption, and assessment of operational risks. Examples include use of operational decision points such as decision to reject a takeoff or decision to execute (or issue) a go-around.
- Mental/Emotional State includes but is not limited to personal stress, anxiety, boredom, apprehension, and denial.
- Personality/Attitude includes issues of self-confidence, confidence, or reliance on equipment; complacency, motivation, or response to pressures; and personality issues such as aggressive, assertive, or lack of assertiveness.

This discipline includes factors referring to a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair an individual's alertness and ability to safely operate an aircraft, control air traffic, or perform safety-related duties. Fatigue is a complex state that includes a lack of alertness and a reduced capacity for mental and physical performance.

Includes the following elements:

- **Sleep-Related Factors:** These factors include the amount of recent sleep, chronic sleep debt, hours awake, and fragmented/disturbed sleep.
- **Circadian Factors:** These factors include the time of day when the event occurred, circadian low, and circadian misalignment.
- **Sleep Disorders:** A group of syndromes characterized by disturbance in the amount of sleep, quality or timing of sleep, or in behaviors or physiological conditions associated with sleep. There are about 70 different sleep disorders.

Usage Notes:

- Fatigue can be commonly expressed as "too tired to perform or function properly."
- Task intensity and workload are not suggested for inclusion in the Fatigue taxonomy because of a lack of a common standard from which to determine a stratified workload state, and its correlation to human fatigue.
- Similarly, health and drug issues are not suggested for inclusion in the Fatigue taxonomy as they are covered elsewhere in the taxonomy and may or may not directly affect fatigue.
- Sleep-Related Factors: These factors include the amount of recent sleep (the total amount of sleep for the 72-hour period preceding an incident/event, chronic sleep debt (the difference between the amount of sleep a person received over the 72 hours preceding an incident/event and the amount of sleep they would have received with 8 hours of sleep each day), hours awake (the total time awake since the last major sleep period that preceded the incident/event), and fragmented/disturbed sleep (multiple sleep episodes per 24-hour period, and/or awakenings during sleep because of internal or environmental factors).
- Circadian Factors: "Circadian misalignment" refers to issues related to recently crossing multiple time zones, or to rotating, inverted or variable work/sleep schedules. "Circadian low" refers to time of the incident/event in relation to the time periods of 0300 to 0500 or 1500 to 1700—the primary and secondary windows of circadian low (WOCL).
- Sleep Disorders: A group of syndromes characterized by disturbance in the amount of sleep, quality or timing of sleep, or in behaviors or physiological conditions associated with sleep. There are about 70 different sleep disorders.

ORGANIZATIONAL FACTORS

This domain refers to factors related to organizational oversight, support, and monitoring of organization programs, policies, and personnel.

Includes the following disciplines:

- **Oversight:** Factors related to the oversight, support, and monitoring of personnel, and organization policies.
- **Operational Planning/Scheduling/Resource Management:** The acquisition and allocation of aircraft, personnel, parts, materials, facilities equipment, automation, information infrastructure, tools, budget, publications, and any other required resources to support the execution of operations.
- **Policies/Procedures:** Factors related to guidance and instructions (e.g., manuals) set forth by the organization.
- **Culture:** Factors related to the working atmosphere, climate, or norms that influence safety practices.
- **Training Program:** Factors related to the adequacy, effectiveness, completeness, and management of the organization's training and examination program.
- **Documentation/Record Keeping:** Factors related to the creation, storage, and retrieval of organizational records.
- **Enforcement:** Factors related to the enforcement actions of the organization and its adherence to organization enforcement policies.
- **Safety Program:** Factors related to the availability, adequacy, and adherence to an organization safety program.

Usage Notes:

- Note that in this domain, "Training" refers to factors related to the delivery of training, for example, its frequency, completeness, or the training system's measures of training effectiveness. This is distinguished from "Training" in the "Human/Individual Factors" domain, which refers, for example, to an individual's level of proficiency and the amount and quality of training taken.
- This domain is used to capture factors related to characteristics, behaviors, and norms relating to the organization.
- Oversight includes oversight/supervision of personnel, oversight/supervision of operations, oversight/supervision of maintenance, equipment monitoring, parts and tools tracking, document revision tracking, and oversight of regulatory compliance.

- Operational Planning/Scheduling/Resource Management refers to the availability or adequacy of personnel, equipment, facilities, or documents and information, scheduling of personnel, crew pairing, equipment scheduling, maintenance scheduling, and task scheduling.
- Policies/Procedures refers to the availability and adequacy of the organization's policies, procedures, manuals and other guidance. Examples include policies or procedures that are out-of-date, not widely disseminated, unclear, or inadequate. This element includes, but is not limited to, policies/procedures related to the provision of air traffic services (such as navigation procedures and traffic management procedures), flight operations, and other procedures not elsewhere classified.
- Culture includes organizational or team-wide operating practices, pressures, and demands or expectations from the organization to perform or meet operational goals and timelines.
- Training Program refers to the organization's training program, including overall program management, course curriculums, instruction, instructors, course evaluations, adequate recurrent training program, adequate remedial training program, and examinations.
- Documentation/Record Keeping includes organizational records and documentation such as operation records, personnel records, testing records, and maintenance records.
- Enforcement refers to actions to ensure compliance with the policies of the organization regarding personnel performance, operational procedures, regulatory requirements, equipment requirements, and company/organizational policies.
- Safety Program considers the availability, adequacy, and adherence to the organization's safety program.

EQUIPMENT FACTORS

This domain refers to factors that involve: (1) aircraft and aircraft systems, (2) equipment required for the provision of air traffic control (ATC)/air navigation services, and (3) equipment required for the installation, maintenance, and support of ATC equipment and facilities. Causal and contributory factors include cases where such equipment is not functioning as designed (i.e., malfunction), not functioning as intended (i.e., design flaw), or inoperative (i.e., either as a result of a planned outage or unplanned failure). This domain includes factors related to ergonomics or machine design issues. Causal and contributory factors specifically addressing the human-machine interface are classified under "Human/Individual Factors."

AIRCRAFT SYSTEMS

This discipline refers to factors that affect aircraft in such a way as to cause, or contribute to, a loss of separation with another aircraft, an unintended loss of separation with terrain or obstacles, or other air traffic anomaly.

Includes the following elements:

- **Aircraft Airframe Systems:** Factors such as mechanical, electrical, hydraulic, pneumatic, and other systems that make up the central workings of an aircraft. This includes hardware and software within advanced aircraft systems.
- **Aircraft Structural Systems:** Factors related to aircraft components intended to withstand all aerodynamic forces and design objectives. This includes items such as fuselage, wings, empennage, and landing gear.
- **Aircraft Propeller/Rotor Systems:** Factors related to aircraft propeller/rotor systems, which provide thrust as a result of engine rotating forces.
- **Aircraft Powerplant Systems:** Factors related to an aircraft's means of power/thrust for propulsion. This includes reciprocating and turbine systems.
- **Aircraft, Not Elsewhere Classified (NEC).**

Usage Notes:

- Aircraft Airframe Systems includes factors related to aircraft air conditioning systems, autopilot/flight systems, communications systems, electrical components, fire control/protection systems, flight controls, fuel delivery and containment systems, hydraulic systems, ice and rain protection systems, instrumentation, navigation, lighting, oxygen, vacuum, cabin systems, and cargo components.
- Aircraft Structural Systems includes airframe materials, furnishings, doors, wings, stabilizers, fuselage, nacelles/pylons, and windows.

- Aircraft Propeller/Rotor Systems includes propeller and rotor assemblies, including propeller, spinner, and hubs.
- Aircraft Powerplant Systems includes components central to the operation of reciprocating and turbine engine systems.
- Aircraft, NEC includes all other systems not elsewhere classified within existing aircraft systems elements.

AIR NAVIGATION SERVICE PROVIDER SYSTEMS

This discipline refers to factors that involve air navigation service provider systems. These systems include automation, communication, navigation, surveillance, weather observation and reporting, facilities, maintenance and operation support, and system and services management.

Includes the following elements:

- **Air Traffic Control Automation:** This element refers to automated air traffic control (ATC) systems that facilitate the management of the ATC system.
- **Air Traffic Control Communication Systems:** This element refers to ATC equipment required to exchange information among various agents in the air space system.
- **Air Traffic Control Navigation Systems:** This element refers to systems that provide the means of controlling the movement of aircraft, non-aircraft vehicles or pedestrians from one location to another in the airspace system.
- **Air Traffic Control Surveillance Systems:** This element refers to systems that provide aircraft or non-aircraft vehicle location information in the airspace system.
- **Air Traffic Control Weather Systems:** This element refers to systems that provide weather information collection, processing, display and alerting functions.
- **Air Traffic Control Maintenance and Operation Support Systems:** This element refers to systems related to (a) the maintenance of air navigation service provider equipment and facilities, and (b) operations support services such as the aeronautical information database and safety information sharing and reporting database systems.
- **Air Traffic Control Facilities Systems:** This element refers to building systems and/or equipment that support the functions of ATC.
- **Air Navigation Service Provider Systems, Not Elsewhere Classified (NEC)**.

Usage Notes:

- Air Navigation Service Provider Systems includes all the hardware, software, and equipment used to facilitate the movement of aircraft from the air traffic navigation service provider perspective. This discipline includes factors directly related to hardware, software, or equipment itself. Example: The air traffic controller's land telephone system failed preventing coordination of traffic with adjacent sector. This discipline does not include buildings or structures, which are classified under Operating Environment–Infrastructure.
- The demarcation between "Automation" and "Surveillance" in air traffic management may sometimes become blurred. Automation generally refers to the display and data processing in systems like Automated Radar Terminal System (ARTS), Standard Terminal Automation Replacement System (STARS), En Route Automation Modernization (ERAM), and surveillance systems refer to the radar or hardware-based sensors, which establish the position of aircraft/vehicles. Newer surveillance systems (e.g., Airport Surveillance Radar

(ASR–11), Automatic Dependent Surveillance–Broadcast (ADS–B)) now employ significant levels of data processing, and interface with display systems on a level imperceptible to most users. Thus, "Automation" can become a ubiquitous term that overlaps both categories. It is important for investigators to understand the difference when assigning causal taxonomies, and for mitigation strategies to focus on system interdependencies.

- Air Traffic Control Automation includes air traffic information management, traffic flow, flight and surveillance processing, pre- and post-flight plan processing, infrastructure services, air traffic safety and security services, time management. Examples of air traffic information management systems include Automatic Terminal Information Systems (ATIS), Automated Text-To-Voice (ATTV), En Route Information Display Systems (ERIDS), and Hazardous In-flight Weather Advisory System (HIWAS). Examples of traffic flow systems include traffic flow advisor, operator/service provider collaborative decision-making (CDM) systems, and CDM network (hardware and software used to display output from CDM systems to airline operations centers). Flight and surveillance processing systems include Automated Radar Terminal Systems, oceanic surveillance/tracking systems, ERAM, and the User Request Evaluation Tool (URET).
- Air Traffic Control Communication Systems includes air-ground communications equipment, emergency communications equipment, recording systems, and voice switches.
- Air Traffic Control Navigation Systems include ground-based radio navigation systems (very high frequency (VHF) Omni-directional Range (VOR), Instrument Landing System (ILS), non-directional beacon (NDB)), navigation control systems, satellite navigation systems, and visual navigation systems.
- Air Traffic Control Surveillance Systems include ground-based primary surveillance, satellite and ground-based secondary surveillance, surface and approach surveillance. This includes the integrated software components.
- Air Traffic Control Weather Systems include weather data collection systems (e.g., Automated Surface Observing System (ASOS), and the Automated Weather Observing System (AWOS)), and weather data processing systems (e.g., aerodrome weather information system).
- Air Traffic Control Maintenance and Operation Support Systems include air traffic operations support, air traffic support control evaluation system, and system/services management.
- Air Traffic Control Facilities Systems include systems in air traffic manned and unmanned facilities including facility environmental systems (air conditioning and heating) and power systems. This includes, but is not limited to, systems deployed in automated flight service stations, and area/terminal control centers.

OPERATING ENVIRONMENT FACTORS

This domain includes system states and circumstances that influence flight operations and air traffic management. Included in this domain are air traffic and aerodrome infrastructure, airspace factors, weather, special events, and emergencies.

INFRASTRUCTURE

This discipline refers to constructed tangible and intangible objects in the airspace and surface environment that together constitute the underlying framework of an air navigation system. It includes aerodrome infrastructure (pavement, communication systems, lighting systems, sensors, operations support, and safety and security systems), international and domestic airspace boundaries, and special use airspace.

This includes the following elements:

- **Aerodrome Infrastructure:** Factors related to the presence of constructed tangible and intangible objects in the airport environment (e.g., buildings, terminals, pavement, runways, taxiways, fixes, traffic pattern, and operational runway configuration changes) specifically excluding aircraft and air traffic control equipment.
- **Airspace:** Factors pertaining to the specific dimensions and/or boundaries of the airspace through which aircraft traverse.
- **Infrastructure, Not Elsewhere Classified (NEC).**

Usage Notes:

- Aerodrome infrastructure includes—

  (1) Aerodrome design and layout: factors such as the configuration of runways and taxiways, and the location of airport structures;

  (2) Aerodrome pavement including elements such as holding areas, perimeter roads, ramps, runways and taxiways; and mechanical systems such as engineered material arresting systems;

  (3) Aerodrome signage and markings;

  (4) Aerodrome operation support including deicing facilities, gate operations, snow removal, terminal support operations, and aerodrome maintenance;

  (5) Aerodrome safety and security systems including aerodrome rescue and firefighting, foreign object debris detection, aerodrome perimeter security, wildlife mitigation;

  (6) Aerodrome Aids and Lighting Systems include airfield-specific systems such as land and hold short lighting systems, runway and taxiway edge lighting systems, runway centerline and touchdown lighting systems, taxiway lighting systems, miscellaneous airfield aids (e.g., aerodrome rotating beacon and obstruction lights), runway status light systems, final approach runway occupancy signal systems, etc.

(7) Operational runway configuration changes; and

(8) Aerodrome surface conditions.

- Airspace infrastructure includes design factors such as controller-based boundaries (e.g., area/terminal control centers), regulatory-based boundaries, international boundaries, and airspace reserved for military operations (i.e., restricted airspace) or state functions (i.e., prohibited airspace).
- Infrastructure, NEC includes infrastructure factors that are not elsewhere classified in this discipline such as non-aerodrome buildings or structures.

This discipline includes factors pertaining to meteorological factors surrounding an event.

Includes the following elements:

- **Light Conditions:** Factors involving ambient brightness or darkness.
- **Visibility:** Factors involving fog or other obscuration phenomena.
- **Precipitation:** Factors involving rain, hail, snow, sleet, or similar phenomena.
- **Winds:** Factors involving the movement of air relative to the surface of the earth.
- **Temperature:** Factors involving heat or cold that affect systems or human performance.
- **Weather General, Not Elsewhere Classified (NEC)**.

Usage Notes:

- Weather is the state of the atmosphere, regarding short-term or instantaneous conditions.
- Light Conditions includes having vision obscured because of flying into the sun.
- Visibility includes ceiling, reported visibility, runway visual range, and other factors relating to the greatest distance one can see and identify objects.
- Precipitation includes rain, hail, snow, or sleet in the aircraft operating environment including airport and flight environment. This element includes contamination on the runway environment that would affect takeoff, landing, or braking performance.
- Winds include crosswinds, headwinds, tailwinds, gusts, wind shear, microbursts, clear air turbulence, and mountain waves.
- Weather General, NEC includes factors not elsewhere classified such as icing conditions.

This discipline includes factors related to large-scale planned events or those events affecting national security.

Includes the following elements:

- **Airshow/Fly-in:** Factors related to large congregations of aircraft for the purpose of promoting aviation.
- **Other Large Public Event/Conference:** Factors related to special events not specifically pertaining to aviation.
- **Flight Check Operations:** Factors relating to the certificating authority's verification of navigation aids and facilities.
- **Lifeguard Operations:** Factors related to expedited handling of priority medical aircraft.
- **Aerial Observation Flights:** Factors related to airborne reconnaissance missions.
- **Dignitary Movement:** Factors related to the movement of state aircraft.
- **Skydiving/Balloon Activity:** Factors related to parachute jumps or lighter-than-air vehicles.
- **Special Events, Not Elsewhere Classified (NEC)**.

Usage Notes:

- Other Large Public Event/Conference includes events such as coordinated flyovers at sporting events or flight restrictions imposed for security of large public events.
- Flight Check Operations include ILS calibrations or Area Navigation (RNAV) approach verifications.
- Lifeguard Operations include planned medical evacuation operations and organ transport warranting use of the "Lifeguard" call sign.
- Aerial Observation Flights includes missions such as natural disaster assessment, low-level photography missions, and law enforcement activities.
- Dignitary Movement includes the movement of aircraft requiring special security procedures, such as the movement of domestic or foreign state aircraft.
- Skydiving/Balloon Activity pertains to the act, and not the temporary (NOTAM) or permanent (restricted) airspace boundaries.
- Special Events, NEC includes factors relating to the Special Events discipline that cannot be classified in any other element under the discipline.

EMERGENCIES

This discipline includes factors related to non-routine, unplanned occurrences involving some level of system degradation, equipment malfunction, operator incapacitation, or environmental circumstances, such that it requires immediate corrective action to restore safety of the flight or operation.

Usage notes:

- Emergencies include aircraft security events, controller declared emergency landings, expedited handling, operator- or pilot-declared emergencies, aircraft technical emergencies, and medical emergencies. Also included under this discipline are other circumstances requiring immediate or expedited corrective action, including items such as weather avoidance, traffic collision avoidance, and ground proximity warning.