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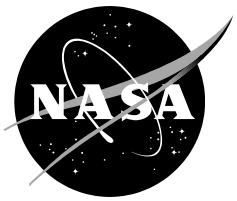

NASA Office of Safety and Mission Assurance Human Factors Handbook

Procedural guidance and tools

Tracy Dillinger Psy.D., FASMA, FAsHFA
NASA Headquarters / OSMA

Nick Kiriokos
NASA Armstrong Flight Research Center

May 2019

NASA STI Program ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NTRS Registered and its public interface, the NASA Technical Reports Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.

- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.

- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.

- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services also include organizing and publishing research results, distributing specialized research announcements and feeds, providing information desk and personal search support, and enabling data exchange services.

For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at http://www.sti.nasa.gov

- E-mail your question to help@sti.nasa.gov

- Phone the NASA STI Information Desk at 757-864-9658

- Write to:
  NASA STI Information Desk
  Mail Stop 148
  NASA Langley Research Center
  Hampton, VA 23681-2199

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The authors would like to acknowledge the time and effort of the Human Factors Task Force that assisted in the taxonomy development, code descriptions, application processes and tools. This team developed the NASAHFACS Taxonomy specifically to fit the NASA range of operations and provide guidance on use of the system.

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This report is available in electronic form at

http://

FOREWORD

As of this writing, the Agency is in its third year of a concerted effort to identify and mitigate Human Factors. Subject matter experts of various backgrounds from across the agency came together to create the Human Factors Task Force. These dedicated volunteers provided time and effort to develop, test, and analyze NASAHFACS. They also created associated tools, and pitched in developing strategic and tactical objectives. None of them worked as hard as Nick Kiriokos, detailed to OSMA, although clearly, much more was involved. He crafted the lion's share of our foundational work, enabling briefings to senior leaders and thus, greater understanding and advocacy for the program. My heartfelt thanks to the HFTF and Nick for getting this and other documents out for use by the NASA workforce.

I also want to thank the Office of Safety and Mission Assurance Deputy – Hal Bell, and Chief, Terry Wilcutt, for their unfailing advocacy in this effort. Socialization within the Agency would not have happened without their consistent belief in the gains of using a tool and language commonly understood across multiple industries.

I'm also grateful to Scott Shappell and Doug Weigmann, colleagues for many years, who reviewed and collaborated on NASAHFACS for greater efficiencies in future generations. And lastly - we still have a long way to go. To you, the reader – the engineer, the program/project manager, the scientist, the safety investigator, etc. – I thank you – and hope the information included in the handbook helps you in your efforts to make the human factor our most POSITIVE contribution to our shared missions and vision - now and in the future.

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Human Factors Technical Manager
Office of Safety and Mission Assurance

25 APR 2019
Date

Concur:

Terry Wilcutt
Chief, Office of Safety and Mission Assurance

25 Apr 2019
Date

SCOPE

This handbook defines the NASA Human Factors Analysis and Classification tool, and provides guidance to the use of NASAHFACS. It illustrates the NASAHFACS Model, describes the data gathering, coding, trending and tracking process, and outlines training and other related resources to support the practice of NASAHFACS throughout NASA.

Acronyms

NASAHFACS	National Aeronautics and Space Administration Human Factors Analysis and Classification System
OSMA	Office of Safety and Mission Assurance

Purpose

This handbook and the associated tools provide guidance necessary to perform an analysis of the events from a comprehensive Human Factors perspective. This framework is systemic and straightforward to assist practitioners in investigations and analyzing human error.

The major content of this Handbook contains the taxonomy structure, definitions and tools. This facilitates a consistent classification of human events and influencing factors. There are two ways to use this tool: This is “primary review” as Mishap Board member or Investigator, or through or “secondary review” retrospectively of events.

TRAINING

TRAINING COURSES

The following one-time training courses are required for all HFTF members and recommended for any individual tasked with participating / performing Mishap Investigations.

Instructor led. - NASAHFACS Certification Course (3 Day) or the HFACS, Inc. course.

Instructor led. - NASAHFACS Refresher Course (2 hour).

Instructor led. - NASAHFACS Executive Course (1 Hour).

NASA Human Factors in Mishap Investigation SMA-002-15

Human Factors in Mishap Investigation SMA-SAFE-OSMA-4004

Tools

Figure 1: Quick Reference Guide front page

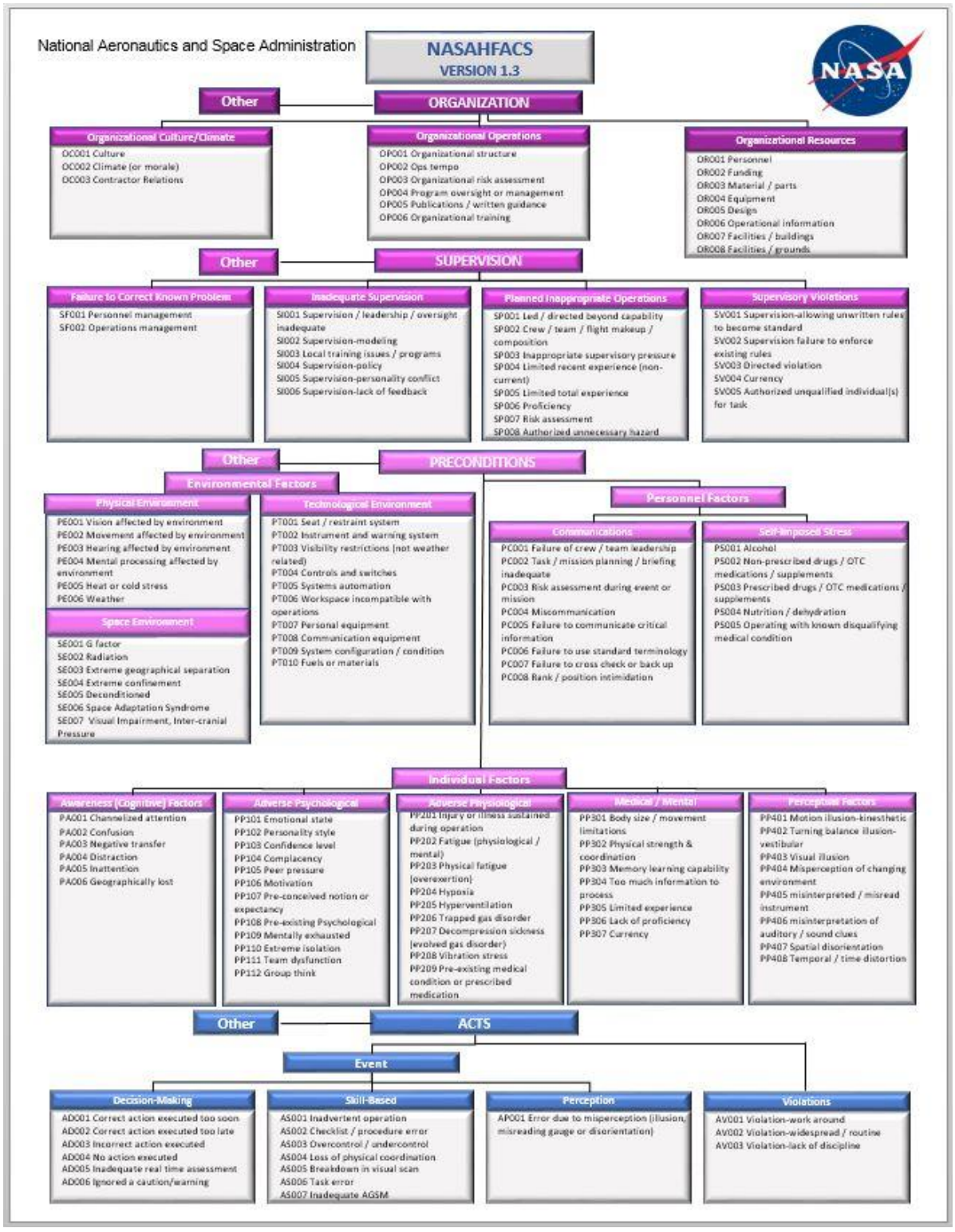
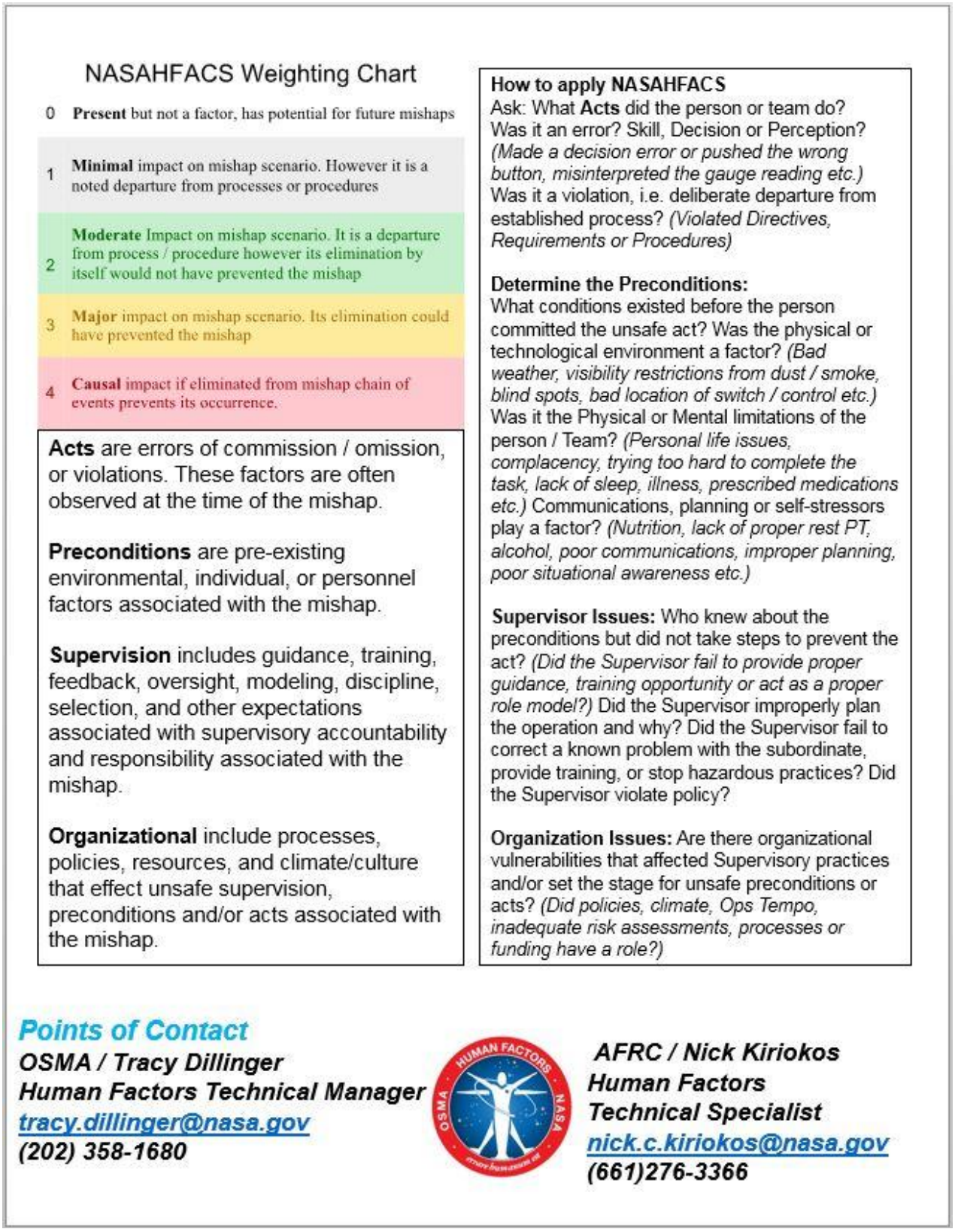


Figure 2: Quick Reference Guide back page



NASAHFACS Weighting Chart

0 **Present** but not a factor, has potential for future mishaps

1 **Minimal** impact on mishap scenario. However it is a noted departure from processes or procedures

2 **Moderate** Impact on mishap scenario. It is a departure from process / procedure however its elimination by itself would not have prevented the mishap

3 **Major** impact on mishap scenario. Its elimination could have prevented the mishap

4 **Causal** impact if eliminated from mishap chain of events prevents its occurrence.

Acts are errors of commission / omission, or violations. These factors are often observed at the time of the mishap.

Preconditions are pre-existing environmental, individual, or personnel factors associated with the mishap.

Supervision includes guidance, training, feedback, oversight, modeling, discipline, selection, and other expectations associated with supervisory accountability and responsibility associated with the mishap.

Organizational include processes, policies, resources, and climate/culture that effect unsafe supervision, preconditions and/or acts associated with the mishap.

How to apply NASAHFACS
Ask: What **Acts** did the person or team do? Was it an error? Skill, Decision or Perception? *(Made a decision error or pushed the wrong button, misinterpreted the gauge reading etc.)* Was it a violation, i.e. deliberate departure from established process? *(Violated Directives, Requirements or Procedures)*

Determine the Preconditions:
What conditions existed before the person committed the unsafe act? Was the physical or technological environment a factor? *(Bad weather, visibility restrictions from dust / smoke, blind spots, bad location of switch / control etc.)* Was it the Physical or Mental limitations of the person / Team? *(Personal life issues, complacency, trying too hard to complete the task, lack of sleep, illness, prescribed medications etc.)* Communications, planning or self-stressors play a factor? *(Nutrition, lack of proper rest PT, alcohol, poor communications, improper planning, poor situational awareness etc.)*

Supervisor Issues: Who knew about the preconditions but did not take steps to prevent the act? *(Did the Supervisor fail to provide proper guidance, training opportunity or act as a proper role model?)* Did the Supervisor improperly plan the operation and why? Did the Supervisor fail to correct a known problem with the subordinate, provide training, or stop hazardous practices? Did the Supervisor violate policy?

Organization Issues: Are there organizational vulnerabilities that affected Supervisory practices and/or set the stage for unsafe preconditions or acts? *(Did policies, climate, Ops Tempo, inadequate risk assessments, processes or funding have a role?)*

Points of Contact

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EVENT CODING

How to code

Use the Quick Reference Guide (QRG Figure 1) as well as this handbook for the definitions related to nanocodes. Check online to ensure this is the latest version of the handbook at https://sma.nasa.gov/sma-disciplines/human-factors. An electronic version of the QRG and other tools such as the Human Factors Investigators checklist are available at this website as well as Points of Contact.

If the event(s) to be analyzed are Type A, B, C or High Visibility “operational” events, i.e. not a typical slip/trip/fall, retain the data as directed by local Center retention guidelines, for possible inclusion into the Agency’s Annual Human Factors Report developed by HFTF.

Primary Review

Conduct interviews or review witness statements, Policy and Procedure documents, appropriate checklists or training records and any other relevant related material associated with event. Provide appropriate security and confidentiality methods as directed by other NASA requirements. Perform coding of each event by use of this handbook and the Quick Reference Guide. Record findings on the AFRC80062 Human Factors Investigators Checklist to capture results. Provide analysis by executive summary incorporating all findings. Provide analysis and AFRC80062 Human Factors Investigators Checklist to Mishap Board Lead, or Center Mishap Program Manager for records keeping. Retain analysis and checklists as directed by local Center retention guidelines.

Secondary Review

Gather all associated documents (written or electronic report, CAP, checklists etc.) of the incident being analyzed. Review witness statements, Policy and Procedure documents, appropriate checklists or training records and any other relevant related material associated with event. Provide appropriate security and confidentiality methods as directed by other NASA requirements. Perform coding of the event by use of this handbook and the Quick Reference Guide. Record findings on the AFRC80062 Human Factors Investigators Checklist to capture results. Provide analysis by executive summary incorporating all findings. . Provide analysis and AFRC80062 Human Factors Investigators Checklist to Mishap Board Lead, or Center Mishap Program Manager for records keeping. Retain analysis and checklists as directed by local Center retention guidelines.

Use of the Human Factors Investigators Checklists

Use the AFRC80062 Human Factors Investigators Checklist to record factors identified in each Tier. Further breakdown of the classification identifies the specific event by bucket and nanocode in each tier for tracking and trending purposes. Each block of the

checklist (except NMIS event number and Investigators name) has 4,000 character capacity and when printed allows for complete reading of the block.

ANALYSIS CHARTS FOR TRACKING AND TRENDING

Tracking and Trending

Once the event has been coded, transfer the data collected / list generated from the AFRC80062 Checklist into a simple bar chart. See the example in Figure 3. This chart provides a graphic record of the factors identified and along with the checklist Executive Summary, and provides a visual context to the factors. Color coding of the chart to match the Quick Reference Guide is beneficial.

Figure 4 shows an example of a multi-year tracking chart. Typically charts reflect only those Tiers, buckets and nanocodes with a recoded event.

Figure 3. Nanocode Chart`

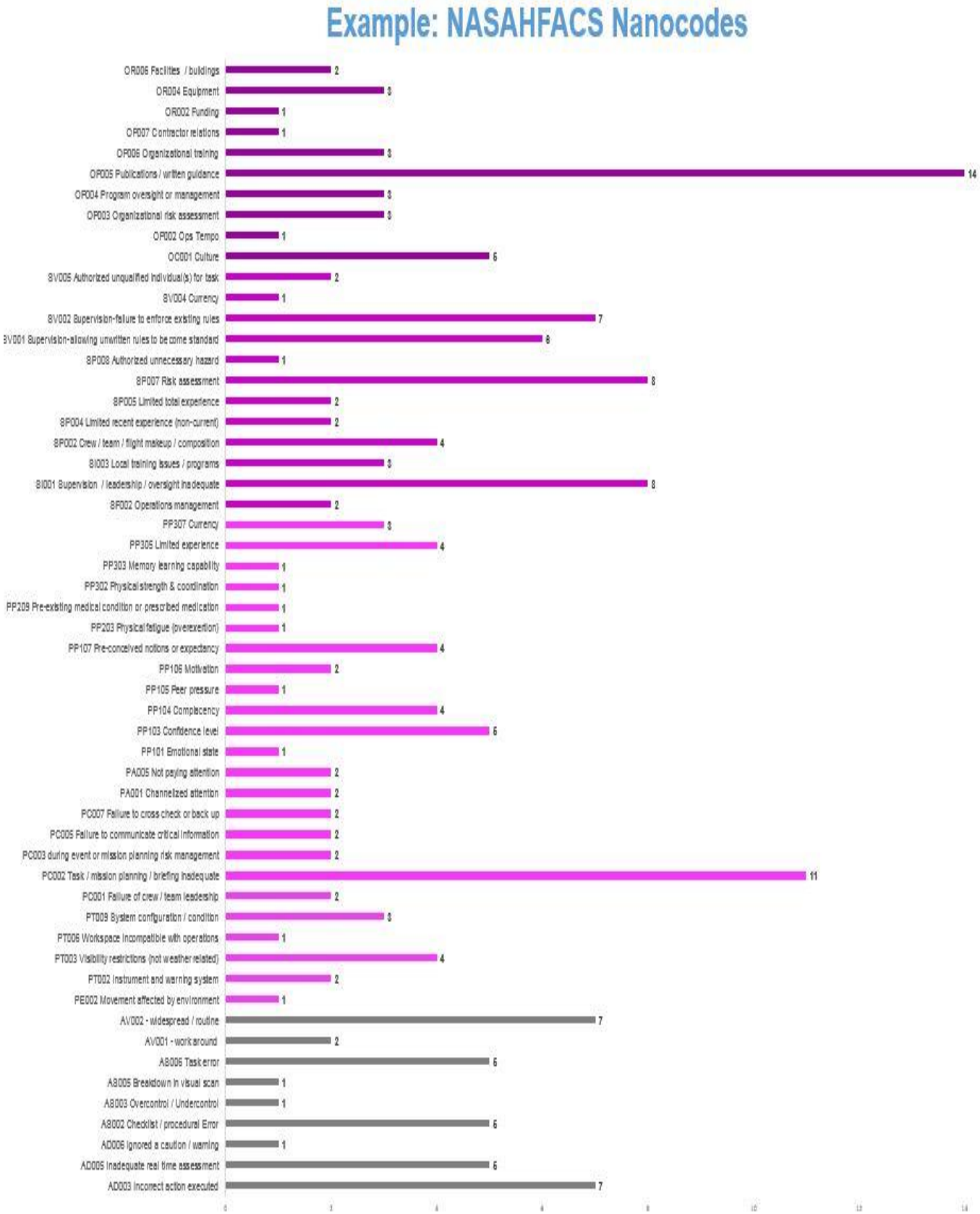
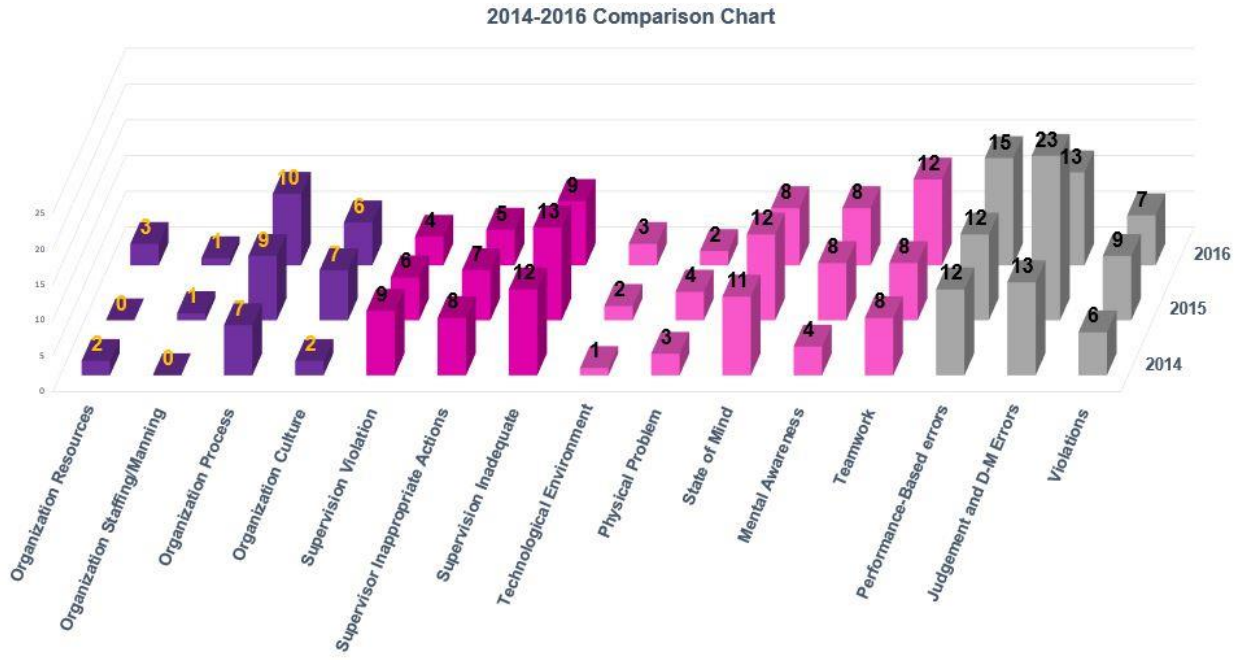


Figure 4. Multi-year (skyscraper) Chart



Reports / Briefs

Per Agency and local policy or procedural documents concerning Mishap Investigations, confidentiality, ITAR etc., prepare briefs and or slides as appropriate to the target audience. Ensure sanitary efforts to prevent the exposure of PII or other sensitive data to persons or entities outside of NASA.

Taxonomy

ACTS

These Influences or Factors are closely tied to the mishap and described as active failures or actions committed by an individual that result in a human event.

Decision Events

Are factors that occur when an individual proceeds as intended, yet the plan proves inadequate or inappropriate for the situation, e.g. “An honest mistake.”

AD001 Correct action executed too soon. Is a factor when an individual takes the necessary action as dictated by the situation, but performs these actions too quickly.

AD002 Correct action executed too late. Is a factor when an individual selects a course of action, but elects to delay execution of the action.

AD003 Incorrect action executed. Is a factor when an individual misprioritizes or selects and executes the wrong course of action to accomplish a task.

AD004 No action executed. Is a factor when an individual does not take the necessary action as dictated by the situation.

AD005 Inadequate Real Time Assessment. Is a factor when an individual fails to adequately evaluate the risks associated with a particular course of action and this faulty evaluation leads to inappropriate decision making and subsequent unsafe situations.

AD006 Ignored a caution / warning. Is a factor when a caution or warning is perceived and understood by the individual but is ignored by the individual.

Skill based Events

These are behavior errors that occur when a specific action is performed in a manner that leads to a mishap.

AS001 Inadvertent Operations. Is a factor when an individual’s movements inadvertently activates or deactivates equipment, controls or switches when the individual had no intent to operate the equipment, controls or switches. This action may or may not be noticed buy the individual.

AS002 Checklist / Procedural Error. Is a factor when an individual accomplishes the wrong written procedure/checklist, fails to accomplish the correct written procedure/checklist or any portion of the right written procedure/checklist.

AS003 Overcontrol / Undercontrol. Is a factor when an individual responds inappropriately to conditions by either overcontrolling or undercontrolling an aircraft/vehicle/system.

AS004 Loss of physical coordination. Is a factor when an individual has a temporary failure of physical coordination or loses their grip during a task or procedure.

AS005 Breakdown in Visual Scan. Is a factor when an individual fails to effectively execute learned / practiced internal or external visual scan patterns.

AS006 Task Error. Is a factor when an individual accomplishes a task or function in the wrong sequence or using the wrong technique, tool, equipment, control or switch. *Only use this code if another code does not apply.*

AS007 Inadequate Anti-G Straining Maneuver (AGSM). Is a factor when the individuals AGSM is improper, inadequate, poorly timed or non-existent and this leads to adverse neuro-circulatory effects.

Perception Events

These are influences or factors when misperception of an object, threat or situation, (such as visual, auditory, proprioceptive, or vestibular illusions, cognitive or attention failures, etc.), results in human error.

AP001 Error due to misperception. When an individual acts or fails to act based on an illusion, misinterpretation of appropriate information, misperception of the environment or a disorientation state.

Violations

Are factors when the individual *intentionally* breaks the rules and instructions. "*Violations are deliberate."*

AV001 Violation-Work Around. Is a factor when the consequences / risk of violating published procedures was recognized, consciously assessed and honestly determined by the individual, crew or team to be the best course of action. This is typically a single event or occurrence.

AV002 Violation-Widespread/Routine. Is a factor when a procedure or policy violation is systemic in a unit/setting and not based on a risk assessment for a specific situation. It needlessly commits the individual, team, or crew to an unsafe course-of-action. These violations may have leadership sanction and may not routinely result in disciplinary/administrative action. Habitual violations of a single individual or small group of individuals within a unit can constitute a routine/widespread violation if the violation was not routinely disciplined or was condoned by supervisors. This is known as "Normalization of Deviance"

AV003 Extreme Violation – Lack of Discipline. Is a factor when an individual, crew or team intentionally violates procedures or policies without cause or need. These violations are unusual or isolated to specific individuals rather than larger groups. There is no evidence of these violations being condoned by leadership. These violations may also be referred to as “exceptional violations.”

PRECONDITIONS

When environmental factors or conditions of individuals affect performance and this condition contributes to an error.

EVIRONMENTAL FACTORS

Physical or Technological factors that affect the practices, conditions and actions or inactions of an individual or team.

Physical Environment

When factors such as weather, climate, fog, brownout (dust or sand storm) or whiteout (snow storm) affect the actions of individual.

PE001 Vision affected by environment. Is a factor when Environmental conditions affect an individual’s vision and this contributes to an error. Example: vision could be restricted by lighting, smoke, haze, weather, dust, laser, snow, brownout, etc.

PE002 Movement affected by environment. Is a factor when Environmental conditions affect an individual’s movement and this contributes to an error. Example: movement can be restricted by maneuvering forces, vibration, windblast, animals, icy ground, uneven ground, roadway or terrain, etc.

PE003 Hearing affected by environment. Is a factor when Environmental conditions affect an individual’s ability to hear and this restriction contributes to an error. Example: hearing can be restricted by any type of noise, vibration, windblast, etc.

PE004 Mental processing affected by environment. Is a factor when Environmental conditions affect an individual’s ability to mentally process or think about information and this condition contributes to an error. Example: mental processing can be impacted by any type of noise, vibration, temperature, etc.

PE005 Heat or cold stress. Is a factor when an individual’s exposure to heat or cold causes the individual’s performance capabilities to be degraded.

PE006 Weather. Is a factor when weather conditions such as high winds, lighting / storms within pre-declared restrictive limits, or high / low temperatures create an unsafe situation. Use this code if other Physical Environmental codes do not apply.

Technological Environment

Are factors when automation or the design of the workspace affects the actions of an individual.

PT001 Seat and Restraint System Problems. Is a factor when the design of the seat or restraint system, the ejection system or seat comfort has poor impact-protection qualities.

PT002 Instrumentation and Warning System Issues. Is a factor when instrument factors such as design, reliability, lighting, location, symbology, size, display systems, auditory or tactile situational awareness or warning systems create an unsafe situation.

PT003 Visibility Restrictions (not weather related). Is a factor when the lighting system, windshield/windscreen/canopy design, or other obstructions prevent necessary visibility. This includes glare or reflections on the windshield/windscreen/canopy. Visibility restrictions due to weather or environmental conditions are captured under PE001.

PT004 Controls and Switches are Inadequate. Is a factor when the location, shape, size, design, reliability, lighting or other aspect of a control or switch are inadequate.

PT005 Automated System Creates an Unsafe Situation. Is a factor when the design, function, reliability, symbology, logic or other aspect of automated systems creates an unsafe situation.

PT006 Workspace Incompatible with Operation. Is a factor when the workspace is incompatible with the task requirements and safety for an individual.

PT007 Personal Equipment Interference. Is a factor when the individual's personal equipment interferes with normal duties or safety. E.G. Helmets, suits, gloves, etc.

PT008 Communication Equipment Inadequate. Is a factor when communication equipment is inadequate or unavailable to support task demands. This includes electronically or physically blocked transmissions. Communications can be voice, data or multi-sensory.

PT009 System Integration / Configuration / Condition. Is a factor when the integration, configuration or condition of a system is incomplete, incorrect, inadequate or degraded, and this creates an unsafe situation or contributes to an error.

PT010 Fuels / Materials. Is a factor when the nature of a fuel, additive, or material is incompatible with other fuels, additives, or materials in the environment in which it's used, and this leads to an unsafe situation or contributes to an error.

Space Environment

SE001 G-Factors. Is a factor when forces acting on a body as a result of acceleration or gravity, (informally described in units of acceleration equal to one g), and this leads to an unsafe situation or contributes to an error. These forces may be either positive or negative.

SE002 Radiation. Is a factor when radiation, either ionizing or non-ionizing, leads to an unsafe situation or contributes to an error.

SE003 Extreme Geographical Separation. Is a factor when distances of a vehicle or crew in space, prevent timely aid, communications, or other assistance and this separation leads to an unsafe situation or causes an error.

SE004 Extreme confinement. Is a factor when humans experience lengthy periods of time together in a small space with no ability to exit the space or proximity to others.

SE005 Deconditioning. Is a factor when the effect of long term weightlessness creates or contributes to an event or condition.

SE006 Space Adaptation Syndrome. Is a factor during weightlessness in orbit. Symptoms may include nausea, vomiting, anorexia, headache, malaise, drowsiness, lethargy, paleness, and sweating which may contribute to an unsafe situation or lead to an error.

SE007 Vision Impairment and Intracranial Pressure. Is a factor when changes to body fluids during long-term exposure to microgravity on the structure of the eye along with changes in distance and near vision of crew members contributes to an event or condition.

Personnel Factors

When teamwork or self-imposed stress affect practices, conditions, or actions of an individual's performance.

Communication

Refers to the interactions among individuals, crews, and teams involved with the preparation and/or performance of a mission that resulted in an error or an unsafe situation.

PC001 Failure of Crew/Team Leadership. Is a factor when the crew leader failed to establish and maintain an accurate and shared understanding of the evolving mission, or actively manage the distribution of tasks and this failure to lead contributes to an error.

PC002 Task/Mission Planning/Briefing Inadequate. Is a factor when an individual, crew or team failed to complete all preparatory tasks associated with planning/briefing the task/mission.

PC003 Risk assessment during event or mission. Is a factor when team members failed to adequately communicate changes during mission execution and adjust their plan accordingly, and this failure contributes to an error.

PC004 Miscommunication. Is a factor when communicated information is misspoken, misread or misheard and this condition contributes to an error.

PC005 Failure to communicate critical information. Is a factor when an individual does not communicate information imperative to successful task or mission completion with appropriate persistence, and this condition contributes to an error. Example: lack of assertiveness. **E.G. Information not entered in maintenance log book, engineering order, work card, Poor shift turnover)**

PC006 Failure to use standard terminology. Is a factor when an individual does not use clear and concise terms, phrases, hand signals, etc. defined by standards and training, and this condition contributes to an error.

PC007 Failure to cross-check or back-up. Is a factor when a crew member(s) fails to actively monitor or back-up other crew members' action or decisions and this condition contributes to an error.

PC008 Rank/Position Intimidation. Is a factor when the differences in rank or position of the team or crew caused a decrease in mission performance capabilities and this decrease contributes to an error.

Self-Imposed Stress

Are factors when an individual demonstrates disregard for rules that govern the individual's readiness to perform or exhibits poor judgment when it comes to readiness and this contributes to an error.

PS001 Alcohol. Is a factor when the acute or residual effects of alcohol impair performance and this impairment contributes to an error.

PS002 Non prescribed drug /OTC medications / supplements. Is a factor when an individual takes any drug, other than prescribed, that interferes with performance and this interference contributes to an error. This includes nicotine or caffeine in sufficient quantities to cause impairment of normal function.

PS003 Prescribed drug /OTC medications / supplements. Is a factor when an individual takes any prescribed drug, medication or supplement that interferes with performance and this interference contributes to an error. This includes nicotine or caffeine in sufficient quantities to cause impairment of normal function.

PS004 Nutrition and/or dehydration. Is a factor when an individual has an inadequate nutritional state, poor dietary practices or dehydration as a result of excessive fluid losses or insufficient fluid intake and this condition degrades performance and contributes to an error.

PS005 Operating with known disqualifying medical condition. Is a factor when an individual intentionally performs duties with a known disqualifying medical condition and this condition contributes to an error.

Individual Factors

Is a factor in a mishap if cognitive, psycho-behavioral, adverse physical state, or physical/mental limitations affect practices, conditions or actions of individuals and result in human error or an unsafe situation.

Awareness Cognitive Factors

Are factors when attention management conditions affect an individual's performance and this state contributes to an error.

PA001 Channelized attention. Is a factor when an individual is focusing all attention on a limited number of cues and excludes other cues of an equal or higher priority and this condition contributes to an error.

PA002 Confusion. Is a factor when an individual is unable to maintain a cohesive and orderly awareness of events and required actions, and experiences a state

characterized by bewilderment or lack of clear thinking and this condition contributes to an error.

PA003 Negative Habit (using old procedures for a new system). Is a factor when an individual reverts to a highly learned behavior used in a previous system or situation and this condition contributes to an error.

PA004 Distraction. Is a factor when an individual has an interruption of attention and/or inappropriate redirection of attention and this condition contributes to an error. This includes Habit Pattern interference; e.g. when an individual is performing a highly automated / learned task or checklist and is distracted by another cue / event that results in the interruption and subsequent failure to complete the original task or results in skipping steps in the original task.

PA005 Inattention. Is a factor when an individual has a lack of a state of alertness or readiness to process immediately available information and this state contributes to an error.

PA006 Geographically Lost. Is a factor when the individual is at a different location from where one believes they are.

Adverse Psychological

Are factors when an individual experiences a psychological event that compromises performance and this condition contributes to an error.

PP101 Emotional State. Is a factor when the individual is under the influence of a strong positive or negative emotion and that emotion interferes with duties.

PP102 Personality Style. Is a factor when the individual's personal interaction with others creates an unsafe situation. Examples are authoritarian, over-conservative, impulsive, invulnerable, submissive or other personality traits that result in degraded performance.

PP103 Confidence level. Is a factor when an individual overestimates or underestimates their personal capability, the capability of others or the capability of their vehicle or equipment, and this condition contributes to an error.

PP104 Complacency. Is a factor when the individual has a false sense of security, is unaware of, or ignores hazards and is inattentive to risks.

PP105 Peer pressure. Is a factor when an individual feels a threat to self-image and thereby feels pressured to perform a task or mission despite concerns about the task or mission and this condition contributes to an error.

PP106 Motivation. Is a factor when the individual's motivation to accomplish a task/mission is excessive, weak, indecisive or when personal goals supersede the organization's goals.

PP107 Pre-conceived notion or expectancy. Is a factor when an individual has a mental framework of expectations that predisposes them to a certain course of action regardless of other cues and this mental framework contributes to an error.

PP108 Pre-existing psychological condition. Is a factor when a qualified professional determines an individual meets Diagnostic and Statistical Manual criteria for a personality, psychological or psychosocial disorder/problem and this disorder/problem contributes to an error.

PP109 Mentally Exhausted (Burnout). Is a factor when the individual has the type of exhaustion associated with the wearing effects of high operational and/or lifestyle tempo in which operational requirements impinge on the ability to satisfy personal requirements and leads to degraded effectiveness.

PP110 Extreme Isolation. Is a factor when an individual is subject to long term isolation and this condition contributes to an error.

PP111 Team Dysfunction. Is a factor when a team is subject to isolation, long term close proximity, or confinement and this condition contributes to an error.

PP112 Group Think. Is a factor when a group, team or organization overtly or insidiously work towards consensus and conformity over independent critical analysis and decision making and this condition leads to an error.

Adverse Physiological

Are factors when an individual experiences a physiological event that compromises performance.

PP201 Injury or illness existed during operation. Is a factor when a pre-existing physical illness, injury, deficit or diminished physical capability due to the injury, illness or deficit, that causes an unsafe situation or contributes to the mishap sequence. This includes operationally-related medical conditions, toxic exposure, over-exertion, motion sickness, etc. *Do not use this code to capture injury or illness that does not cause an unsafe situation or contribute to the mishap sequence.*

PP202 Fatigue (Physiological/Mental). Is a factor when an individual's diminished mental capability due to restricted or shortened sleep, mental activity during prolonged wakefulness or normal, 24-hour rhythmic biological cycle (circadian rhythm) disturbance degrades task performance. Fatigue may additionally be described as acute, cumulative or chronic.

PP203 Physical fatigue (Overexertion). Is a factor when an individual's diminished physical capability is due to overuse.

PP204 Hypoxia. Is a factor when insufficient oxygen supply to the body causes an impairment of function. This code includes G-induced loss of consciousness.

PP205 Hyperventilation. Is a factor when the effect of ventilating above the physiological demands of the body causes the individual's performance capabilities to be degraded.

PP206 Trapped gas disorder. Is a factor when gasses in the middle ear, sinuses, teeth, or intestinal tract expand or contract on ascent or descent causing an unsafe situation.

PP207 Decompression sickness (evolved gas disorder). Is a factor when inert-gas evolves in the blood causing an unsafe situation. This includes chokes, CNS, bends or paresthesia or other conditions caused by inert-gas evolution (i.e. air gas embolism).

PP208 Vibration stress. Is a factor when an individual's exposure to vibration causes physical or cognitive performance decrement. Example: Excessive exposure to blast, repeated exposure to equipment frequency (i.e. helicopters).

PP209 Pre-existing medical condition or prescribed medication. Is a factor when an individual's pre-existing physical illness, injury or use of prescribed medication degraded performance.

Medical / Mental

Are factors when an individual, temporarily or permanently, lacks the physical or mental capabilities to cope with a situation and this condition contributes to an error.

PP301 Body Size/Movement Limitations. Is a factor when the size, strength, dexterity, mobility or other biomechanical limitations of an individual creates an unsafe situation. It must be expected that the average individual qualified for that duty position could accomplish the task in question.

PP302 Physical Strength & Coordination (inappropriate for task demands). Is a factor when the relative physical strength and/or coordination of the individual is not adequate to support task demands.

PP303 Memory / learning capability. Is a factor when an individual inadequately acquires or is unable to remember training or has lapses in the ability to recall past experiences or training and this affects or degrades performance contributes to an error.

PP304 Too much information to process (cognitive task oversaturation). Is a factor when the quantity or complexity of information an individual must process exceeds their mental resources available to process and act on this information and this condition contributes to an error.

PP305 Limited experience. Is a factor when an individual has inadequate practice with a task or mission and cannot properly execute this task or mission and this condition contributes to an error.

PP306 Lack of proficiency. Is a factor when an individual's capability to accomplish a task or mission does not meet the performance levels expected from the individual's skill level and this condition contributes to an error.

PP307 Currency. Is a factor when an individual has not met the general training or recurring training requirements for the job/weapon system and is considered non-current.

Perception

Are factors resulting in degraded sensory inputs (visual, auditory or vestibular) that create a misperception of an object, threat or situation.

PP401 Motion Illusion – Kinesthetic. Is a factor when physical sensations of the ligaments, muscles or joints cause the individual to have an erroneous perception of orientation, motion or acceleration. (If this illusion leads to spatial disorientation you must code PC508.)

PP402 Turning/Balance Illusion – Vestibular. Is a factor when stimuli acting on the balance organs in the middle ear cause the Individual to have an erroneous perception of orientation, motion or acceleration. (If this illusion leads to spatial disorientation you must code PP407)

PP403 Visual Illusion. Is a factor when visual stimuli result in an erroneous perception of orientation, motion or acceleration. (If this illusion leads to spatial disorientation you must code PC407)

PP404 Misperception of Changing Environment. Is a factor when an individual misperceives or misjudges altitude, separation, speed, closure rate, road/sea conditions, aircraft/vehicle location within the performance envelope or other operational conditions.

PP405 Misinterpreted/Misread Instrument. Is a factor when the individual is presented with a correct instrument reading but its significance is not recognized, it is misread or is misinterpreted.

PP406 Misinterpretation of Auditory/Sound Cues. Is a factor when the auditory inputs are correctly interpreted but are misleading/disorienting or when the inputs are incorrectly interpreted and cause an impairment of normal performance.

PP407 Spatial Disorientation. Is a factor when an individual's failure to correctly sense a position, motion or attitude of a vehicle or of oneself within the fixed coordinate system provided by the surface of the earth and the gravitational vertical leads to an error. Spatial Disorientation can be Type 1, 2 or 3. Type 1 (Unrecognized) is when a person's cognitive awareness of one or more of the following varies from reality: attitude; position; velocity; direction of motion or acceleration. Proper control inputs are not made because the need is unrealized. Type 2 (Recognized) is when recognized perceptual confusion is induced through one or more of the following senses: visual; vestibular; auditory; tactile; proprioception or kinesthetic. Proper control inputs are still possible. Type 3 (Incapacitating) is when an individual is unable to make proper control inputs for safe operation of the aircraft or system due to a conflict (often extreme) between the sensory systems identified in Type 2.

PP408 Temporal/Time Distortion. Is a factor when the individual experiences a compression or expansion of time relative to reality. This is often associated with a "fight or flight" response.

SUPERVISION

Is a factor in a mishap if the methods, decisions or policies of the supervisory chain of command directly affect practices, conditions, or individual actions and result in human error or an unsafe situation.

Failure to Correct a Known Problem

Are factors in a mishap when supervision fails to correct known deficiencies in documents, processes or procedures, or fails to correct inappropriate or unsafe actions of individuals, and this lack of supervisory action creates an unsafe situation.

SF001 – Personnel Management. Is a factor when a supervisor fails to identify an operator, maintainer, or aviator who exhibits recognizable risky behaviors or unsafe tendencies or fails to institute remedial actions when an individual is identified with risky behaviors or unsafe tendencies.

SF002 – Operations Management. Is a factor when a supervisor fails to correct known hazardous practices, conditions or guidance that allows for hazardous practices within the scope of his / her authority.

Inadequate Supervision

Is a factor in a mishap when supervision proves inappropriate or improper and fails to identify hazard, recognize and control risk, provide guidance, training and/or oversight and results in human error or an unsafe situation.

SI001 Leadership/Supervision/Oversight Inadequate. Is a factor when the availability, competency, quality or timeliness of leadership, supervision or oversight does not meet task demands and creates an unsafe situation. Inappropriate supervisory pressures are also captured under this code.

SI002 Supervision – Modeling. Is a factor when the individual's learning is influenced by the behavior of supervisors and when that learning manifests itself in actions that are either inappropriate to the individual's skill level or violate standard procedures

SI003 Local Training Issues/Programs. Is a factor when one-time or recurrent training programs, upgrade programs, transition programs or any other local training is inadequate or unavailable (etc.) and this creates an unsafe situation. (Note: the failure of an individual to absorb the training material in an adequate training program does not indicate a training program problem. Capture these factors under **PP303 Memory/learning capability)**. The failure of an individual to recall learned information under stress or while fatigued despite attending an adequate training program does not indicate a training program problem. Capture these factors under **PA003 Negative Habit (using old procedures for a new system).**

SI004 Supervision – Policy. Is a factor when policy or guidance or lack of a policy or guidance results in unintended consequences.

SI005 Supervision – Personality Conflict. Is a factor when a supervisor and individual member experience a "personality conflict" that leads to a dangerous error in judgment / action.

SI006 Supervision – Lack of Feedback. Is a factor when information critical to a potential safety issue had been provided to supervisory or management personnel without feedback to the source (failure to close the loop).

Planned Inappropriate Operations

Are factors when supervision fails to adequately assess the hazards associated with an operation and allows for unnecessary risk. It is also a factor when supervision allows non-proficient or inexperienced personnel to attempt missions beyond their capability or when crew or flight makeup is inappropriate for the task or mission.

SP001 Led / Directed beyond Capability. Is a factor when supervisor/management directs personnel to undertake a mission beyond their skill level or beyond the capabilities of their equipment.

SP002 Crew/Team/Flight Makeup/Composition. Is a factor when, in the opinion of the investigator, the makeup of the crew or of the flight should have reasonably raised obvious safety concerns in the minds of crewmembers involved in the mission, or in any other individual directly related to the scheduling of this mission.

SP003 Inappropriate supervisory pressure. Is a factor when inappropriate pressures of supervision cause an individual to feel pressured to perform a task or mission despite concerns about the task or mission, and this condition contributes to an error.

SP004 Limited Recent Experience (Selected…noncurrent). Is a factor when the supervisor selects an individual whose experience for a specific maneuver, event or scenario is not sufficiently current to permit safe mission execution.

SP005 Limited Total Experience. Is a factor when a supervisor selects an individual who has performed a maneuver, or participated in a specific scenario, infrequently or rarely.

SP006 Proficiency. Is a factor when a Supervisor assigns an individual or team that is not proficient in a task, mission or event.

SP007 Risk Assessment. Is a factor when supervision does not adequately evaluate the risks associated with a mission or when pre-mission risk assessment tools or risk assessment programs are inadequate.

SP008 Authorized Unnecessary Hazard. Is a factor when supervision authorizes a mission or mission element that is unnecessarily hazardous without sufficient cause or need.

Violations

Are factors in a mishap when supervision while managing organizational assets willfully disregards instructions, guidance, rules, or operating instructions and this lack of supervisory responsibility creates an unsafe situation.

SV001 Supervision –failure to enforce existing rules. Is a factor when unit (organizational) and operating rules have not been enforced by the normally constituted authority/supervisor.

SV002 Supervision –Allowing unwritten Policies to become standard. Is a factor when it is perceived and followed by the individual, although it has not been formally recognized by the organization.

SV003 Directed Violation. Is a factor when a supervisor directs a subordinate to violate existing regulations, instructions or technical guidance.

SV004 Currency. Is a factor when an individual has not met the general training requirements for his job/weapon system and is considered "non-current" and supervision/leadership inappropriately allows the individual to perform the mission element for which the individual is non-current.

SV005 Authorized Unqualified Individual(s) for Task. Is a factor when an individual has not met the general training requirements for the job/weapons system and is considered non-qualified but supervision/leadership inappropriately allows the individual to perform the task for which the individual is non-current.

ORGANIZATION

This level describes the methods, decisions or policies of an organization and how they affect both supervisory and individual task and mission accomplishment.

Culture / Climate

Are factors when the attitudes, values, beliefs or morale negatively impact operations and/or increase operational risk.

OC001 Culture. Is a factor when Attitudes, beliefs or values that are shared by the people and groups of an organization and drive inappropriate kinds of behavior by employees in particular situations and control the behavior of organizational members towards one another. Use this code when these attitudes, beliefs or values allow for an environment of unsafe mission demands and/or increased operational risk.

OC002 Climate / Morale. Is a factor when the perception of stress and/or morale within an organizational Climate reflects the pride or disgrace a member feels in working in their organization and their sense of the personnel's cohesiveness within the organization. Use this code when this stress or morale allows for an improper or inadequate environment and/or increased operational risk.

OC003 Contractor Relations. Is a factor when relationships, communications, or inter-operability between the organization and contractors (Prime or Sub) is not optimal and this creates an unsafe working relationship. This includes the oversight and insight.

Processes

Are factors when organizational processes, procedures, risk management and oversight negatively impact operations.

OP001 Organization Structure. Is a factor when the chain of command of an individual or structure of an organization is confusing, non-standard or inadequate and this creates an unsafe situation.

OP002 Ops tempo. Is a factor when the pace of deployments, workload, additional duties, and/or ancillary requirements increase operational risk.

OP003 Organizational risk assessment. Is a factor when the potential risks of a large program, operation, or process are improperly or inadequately assessed.

OP004 Program Oversight or Management. Is a factor when programs have inadequate acquisitions management, design analysis e.g. design review boards, SMSR, FRR's etc. and program oversight or management to obtain the correct quantity/quality of equipment.

OP005 Publications / Procedures / Written guidance. Is a factor when the quality, quantity, acquisition/supply or updating of publications, procedures and/or written guidance are inadequate or improper and this creates increased operational risk. Examples include: Vehicle operating manuals, instructions, directives, technical manuals, etc.

OP006 Organizational training. Is a factor when the quality, quantity or availability of training provided by the organization is inadequate or improper and this creates increased operational risk. Examples include: one-time or initial training programs, upgrade programs, transition programs or other training that is conducted outside the local unit.

Resources

Are factors when the people or products an organization needs to accomplish a mission are inadequate or improper and this condition reduces system safety or increases operational risk.

OR001 Personnel. Is a factor when the quality, quantity or selection of personnel is inadequate or improper and this creates increased operational risk. Examples include: unit under-manned based on manning documents, selection of personnel based on lower standards than appropriate for adequate performance, staffing or personnel placement inappropriate for mission demands.

OR002 Funding. Is a factor when the category, quantity or acquisition of money (financial resources) is inadequate or improper and this creates increased operational risk. Examples include: Too much money for operations and maintenance, but not enough money to procure new equipment, a decrease in funds provided by the organization with the expectation to maintain current mission requirements.

OR003 Material / Parts. Is a factor when the quality, quantity or acquisition/supply of consumable material is inadequate or improper and this creates increased operational risk. Examples include: availability of expendable, consumable or replacement parts.

OR004 Equipment. Is a factor when the quality, quantity or acquisition/supply of equipment is inadequate or improper and this creates increased operational risk. Examples include: equipment or vehicle inappropriate to a mission, not enough equipment or vehicles to accomplish the mission.

OR005 Design. Is a factor when the design of equipment, tools, workspace or flight article is inadequate or improper and this creates increased operational risk or contributes to an event.

OR006 Operational Information. Is a factor when the quality, quantity or acquisition/supply of information is inadequate or improper and this creates increased operational risk. Examples include: weather briefings/forecasts, intelligence, operational planning material or other information necessary for safe operations.

OR007 Facilities / Buildings. Is a factor when the quality or quantity of facilities is inadequate or improper and this creates increased operational risk. Examples include: poor facility design, inadequate facility space, not enough facilities.

OR008 Facilities / Grounds. Is a factor when the quality or quantity of roads, sidewalks, outside training areas, parking lots, common areas, etc. are inadequate or improper and this creates increased operational risk.