

Human Factor Analysis



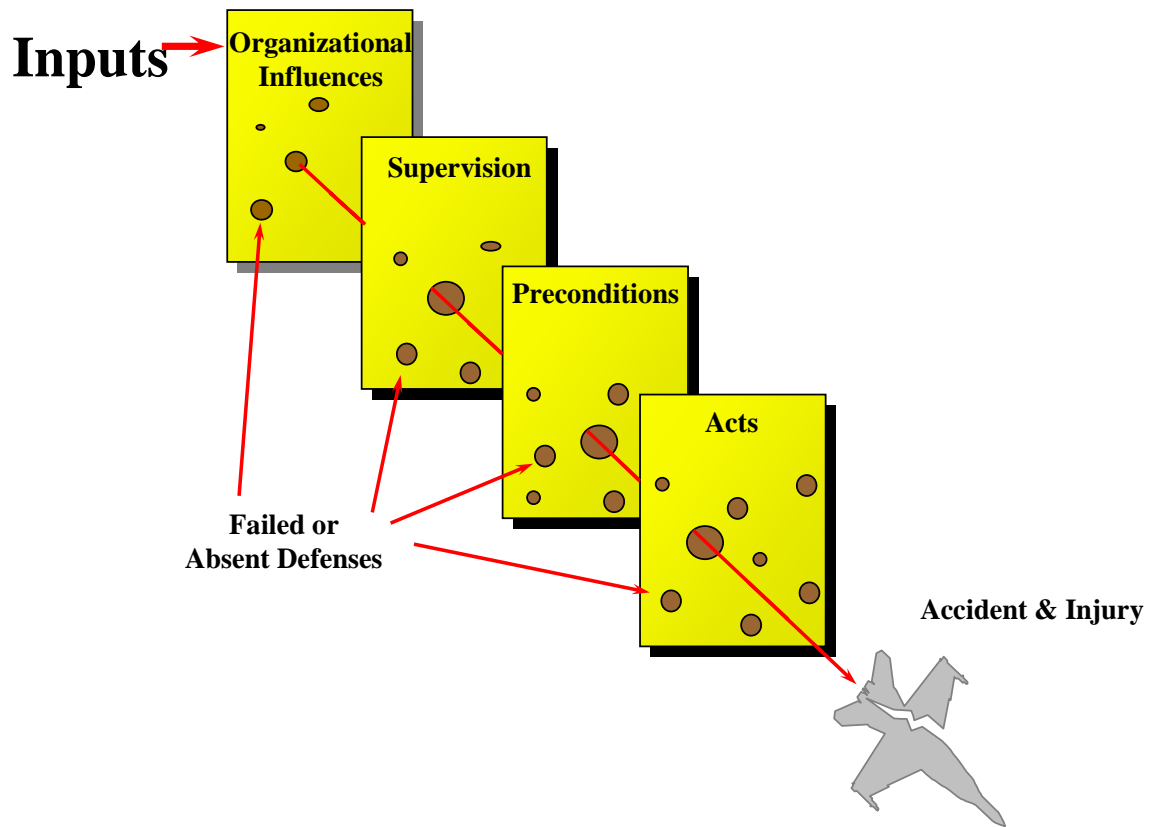
Flip Book

INTRODUCTION

Human error remains the leading cause of Navy and Marine mishaps. Mishaps are rarely attributed to a single cause but are often the end result of a series of errors, sometimes called the “Swiss Cheese Model” (see below). Root cause analysis can be performed in many different ways, but it always comes down to first asking why something occurred. Start with the problem, asking what prompted the problem to happen in the first place. Then keep taking it further and further until you can pinpoint specific processes, policies, or procedures that didn’t work. It all comes down to asking “why?” until you see a pattern in the problem. This HFACS flip book was developed as a tool to guide in root cause analysis, and can also be used to develop interview questions, determine potential ORM hazards, and detect human error trends. The concept of Human Factors Analysis and Classification flip book is to provide a quick reference guide for mishap investigators. This booklet demonstrates a hierarchical approach to link each act to a precondition to supervisory and then organizational role. This tool can help identify the starting point of the investigation.

BENEFITS OF DOD HFACS

- 1 Structured analysis of human error
 - Sophisticated, complete...yet operational
 - Detects error patterns
- 1 Gets to the “why”... not just the “what”
 - More insightful root cause determination
 - Better CO decisions...more effective ORM
- 1 A new, data-driven approach
 - Supports research across the Force
 - Easily applied to large body of existing data
 - Easily applied to new incidents and mishaps
- 1 Can be used for more than Operational purposes
 - Can be a tool for ORM brainstorming
 - Can help develop interview questions
 - Applies to both on-duty and off-duty evolutions

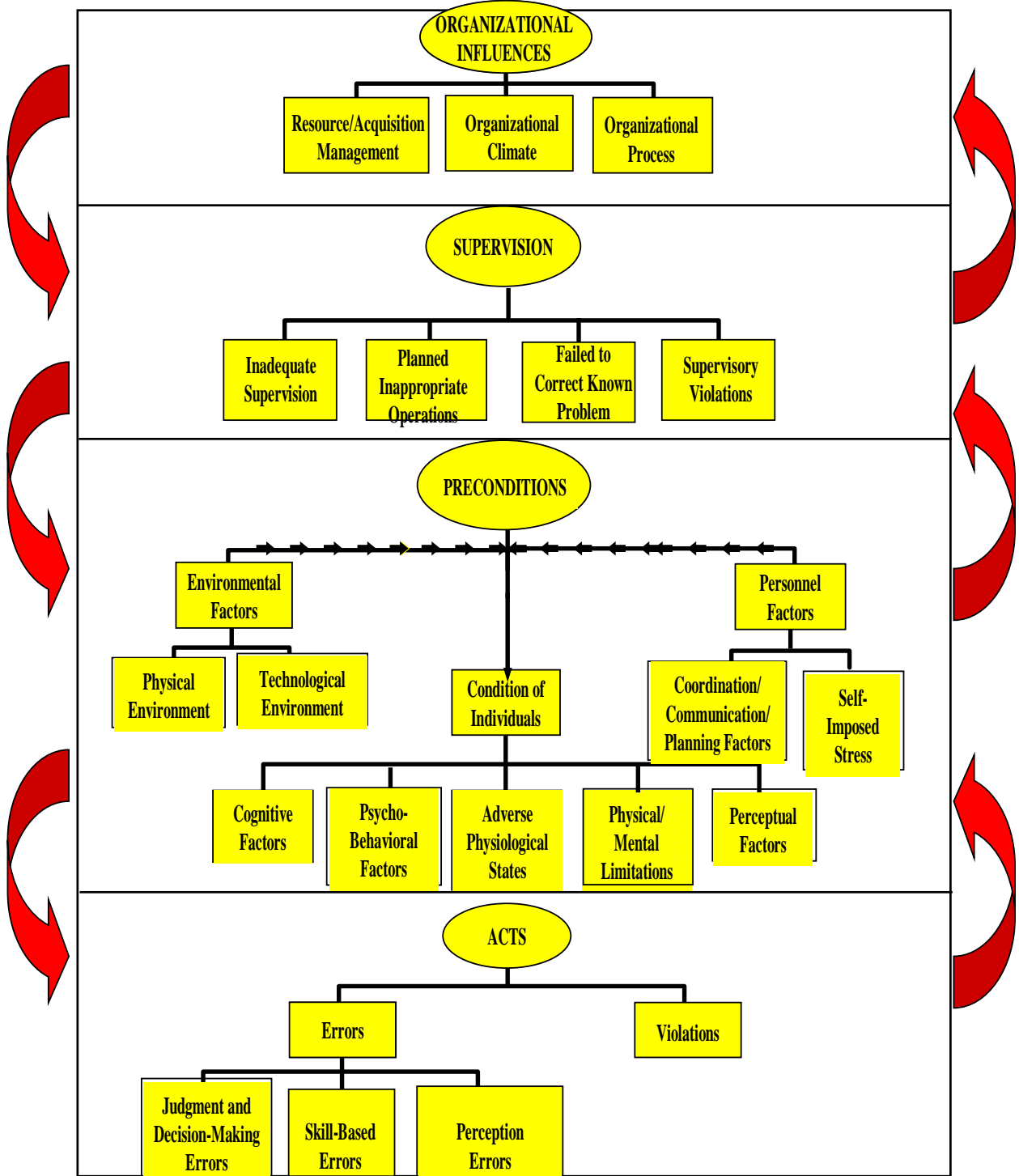


HOW IT WORKS

Start at the lowest level and ask "What did the person do, or not do, to cause the mishap (e.g., pushed the wrong button, made a bad decision, or violated the regulations)?" This is called the "Acts" level. Using the HFACS model on the next page, look at the boxes under "Acts", along with the most common types of errors, and pick those that apply to your situation.

- 1 Next, ask "Why did the person do this unsafe act?" This is what is called the "Precondition" level. Perhaps he was fatigued, going through a divorce, complacent, or was trying to do the procedure in really bad weather. Just like before, look at all the boxes under "Preconditions", along with the most common types, and pick those that apply.
- 1 Now that you know the preconditions for the individual, you look at what the command's role was in this event. Many times we find that someone in the command knew about the person's preconditions, but didn't take steps to prevent disaster, or perhaps there were SOPs in place, but they were unclear or not enforced. This level helps the command to know where they can tighten up things.
- 1 Finally, you look at the organization as a whole. Perhaps the procedures the guy was given to use were unclear or the training he got was inadequate. Sometimes we even find that because of big-Navy budget issues, items are known to be faulty but don't get fixed.

DoD HFACS



“What happened?” (Acts)

SKILL-BASED ERRORS: Errors that occur during an individual’s performance of a routine, highly practiced task that are considered “ingrained” skills.

- ♦ Unintended operation of equipment..... AE101
- ♦ Checklist not followed correctly AE102
- ♦ Procedure not followed correctly AE103
- ♦ Over-controlled/ Under-controlled aircraft/vehicle..... AE104
- ♦ Breakdown in visual scan AE105
- ♦ Inadequate Anti-G straining maneuver AE106

JUDGMENT & DECISION-MAKING ERRORS: Errors that occur when an individual proceeds as he intended, yet the plan proves inadequate or inappropriate for the situation (i.e., “an honest mistake”).

- ♦ Inadequate real-time risk assessment AE 201
(e.g. failure of Time Critical ORM)
- ♦ Failure to prioritize tasks adequately AE 202
- ♦ Rushed a necessary action AE 203
- ♦ Delayed a necessary action AE 204
- ♦ Ignored a Caution/Warning..... AE 205
- ♦ Wrong choice of action during an operation AE 206
(e.g. wrong response to an emergency)

PERCEPTION ERRORS: Unique skill-based and decision-based errors that occur as a result of an individual’s inappropriate response to his degraded or “unusual” sensory inputs (such as sight, hearing, or balance illusions).

- ♦ Incorrect response to a misperception AE301
(e.g. visual illusion or spatial disorientation)

Note: Specific type of skill-based and decision errors will need to be identified with this error.

VIOLATIONS: Are factors in a mishap when the operator intentionally breaks the rules and instructions. Violations are deliberate.

- ♦ Work-around violation..... AV001
(e.g. breaking the rules is perceived as the best solution)
- ♦ Widespread/routine violation AV002
(e.g. habitual deviation from the rules that is tolerated by management)
- ♦ Extreme violation (e.g. a violation not condoned by management) AV003

“Why did they do it?” (Preconditions)

PHYSICAL ENVIRONMENT: Are factors when the environment such as weather, climate, brownout (dust or sand storm) or whiteout (snow storm) affect the actions of individual.

- ♦ Icing/fog on window restricts vision PE 101
- ♦ Weather conditions restricts vision PE 102
- ♦ Vibration effect vision or balance PE 103
- ♦ Dust/smoke in workspace obstructs vision PE 104
- ♦ Windblast in workspace obstructs vision PE 105
- ♦ Cold stress PE 106
- ♦ Heat stress PE 107
- ♦ Extreme forces limits an individual’s movement PE 108
- ♦ Lights of other vehicle/aircraft interfere with performance PE 109
- ♦ Noise PE 110
- ♦ Brownout (e.g. sand storm)/Whiteout (e.g. snow storm) PE 111

TECHNOLOGICAL ENVIRONMENT: Are factors in a mishap when automation or the design of the workspace (e.g., cockpit, inside vehicle, or control station) affects the actions of an individual.

- ♦ Seat and restraint systems problems PE 201
- ♦ Instrumentation and warning system issues PE 202
- ♦ Visibility restrictions (not weather related) PE 203
- ♦ Controls and switches are inadequate PE 204
- ♦ Automated system creates an unsafe situation PE 205
- ♦ Workspace incompatible with operation PE 206
- ♦ Personal equipment interference PE 207
- ♦ Communication equipment inadequate PE 208

SELF-IMPOSED STRESS: Operator demonstrates disregard for rules and instructions that govern the individual’s readiness to perform.

- ♦ Physical fitness level (inappropriate for mission demands) PP 201
- ♦ Alcohol PP 202
- ♦ Drugs/over-the-counter medication/supplements (not prescribed) PP 203
- ♦ Nutrition/diet PP 204
- ♦ Inadequate rest (self-imposed) PP 205
- ♦ Operating with known disqualifying medical condition PP 206

Preconditions (Continued)

COORDINATION/COMMUNICATION/PLANNING FACTORS: Refer to interactions among individuals, crews, and teams involved with the preparation and execution of a mission that resulted in human error or an unsafe situation.

- ◆ Failure of crew/team leadership..... PP 101
- ◆ Failure to cross-check/ back-up..... PP 102
- ◆ Inadequate task delegation PP 103
- ◆ Rank/position intimidation..... PP 104
- ◆ Lack of assertiveness PP 105
- ◆ Critical information not communicated..... PP 106
- ◆ Standard/proper terminology not used PP 107
- ◆ Failure to ensure communicated intentions/actions were understood and followed PP 108
- ◆ Mission planning inadequate PP 109
- ◆ Mission briefing inadequate..... PP 110
- ◆ Failure to re-assess risk and adjust to changing circumstances..... PP 111
- ◆ Information is misinterpreted or disregarded PP 112

AWARENESS (COGNITIVE) FACTORS: Attention management or awareness failures that affect the perception or performance of individuals.

- ◆ Not paying attention..... PC 101
- ◆ Fixation (“channelized attention”) PC 102
- ◆ Task over-saturation (e.g., too much information to process)..... PC 103
- ◆ Confusion PC 104
- ◆ Negative transfer (e.g., using old procedures for a new system)..... PC 105
- ◆ Distraction PC 106
- ◆ Geographically lost (Confusion about location) PC 107
- ◆ Interference/interruption during task..... PC 108

PHYSICAL/MENTAL LIMITATIONS: Limitations in physical or mental capabilities that decrease the ability to cope with a situation.

- ◆ Learning rate limitations PC 401
- ◆ Memory limitations..... PC 402
- ◆ Body size/movement limitations PC 403
- ◆ Coordination deficiency PC 404
- ◆ Technical or procedural knowledge not retained after training PC 405

Preconditions (Continued)

PERCEPTUAL FACTORS: Degraded sensory inputs (visual, auditory, or vestibular) create a misperception of an object, threat, or situation.

- ◆ Motion illusion..... PC 501
- ◆ Turning illusion/balance PC 502
- ◆ Visual illusion..... PC 503
- ◆ Misperception of changing environment PC 504
- ◆ Misinterpreted/misread instrument PC 505
(e.g., misjudge altitude/distance/speed)
- ◆ Inaccurate expectation (e.g., seeing/hearing what is expected instead of what is actually there/heard) PC 506
- ◆ Misinterpretation of auditory cues..... PC 507
- ◆ Spatial disorientation -- not recognized PC 508
- ◆ Spatial disorientation -- recognized PC 509
- ◆ Spatial disorientation -- incapacitating PC 510
- ◆ Time distortion PC 511

PSYCHO-BEHAVIORAL FACTORS: Factors when an individual's personality traits, psychosocial problems, psychological disorders, or inappropriate motivation creates an unsafe situation.

- ◆ Pre-existing personality disorder* PC 201
- ◆ Pre-existing psychological disorder* PC 202
- ◆ Pre-existing psychosocial problem* PC 203
- ◆ Emotional state..... PC 204
- ◆ Personality style PC 205
- ◆ Overconfidence PC 206
- ◆ Pressing (e.g., pushing self or equipment too hard) PC 207
- ◆ Complacency (e.g., absence of worry) PC 208
- ◆ Not enough motivation..... PC 209
- ◆ Misplaced motivation PC 210
- ◆ More aggressive than necessary..... PC 211
- ◆ Excessive motivation to succeed (e.g., "do or die") PC 212
- ◆ "Get-home-it is"/"get-there-it is" PC 213
- ◆ Inappropriate response due to expectation PC 214
- ◆ Motivational exhaustion ("burnout") PC 215

* As determined by qualified medical personnel.

Preconditions (Continued)

ADVERSE PHYSIOLOGICAL STATES: Medical or physiological conditions that can result in unsafe situations

- ◆ Effects of G forces (e.g., G-LOC) PC 301
- ◆ Effects of prescribed drugs PC 302
- ◆ Operational injury/illness PC 303
- ◆ Sudden incapacitation/unconsciousness (not due to G)..... PC 304
- ◆ Pre-existing physical illness/injury PC 305
- ◆ Physical overexertion PC 306
- ◆ Fatigue (sleep deprivation) PC 307
- ◆ Circadian rhythm de-synchronization (e.g., jet lag or shift work) PC 308
- ◆ Motion sickness PC 309
- ◆ Trapped gas disorders..... PC 310
- ◆ Evolved gas disorders (e.g., decompression sickness/bends) PC 311
- ◆ Reduced oxygen (hypoxia) PC 312
- ◆ Hyperventilation (rapid breathing)..... PC 313
- ◆ Inadequate adaptation to darkness PC 314
- ◆ Dehydration PC 315
- ◆ Physical task over-saturation..... PC 316

“What errors did the command make?” (Supervision)

INADEQUATE SUPERVISION: Is a factor in a mishap when department-level or command-level supervision proves inappropriate or improper and/or fails to identify hazards, recognize and control risk, provide guidance, training and/or oversight and results in human error or an unsafe situation.

- ◆ Command oversight inadequate SI 001
- ◆ Failed to ensure proper role-modeling SI 002
- ◆ Failed to provide proper training SI 003
- ◆ Failed to provide appropriate policy/guidance SI 004
- ◆ Personality conflict with supervisor SI 005
- ◆ Lack of supervisory responses to critical information SI 006

FAILURE TO CORRECT KNOWN PROBLEM: This is a factor 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.

- ◆ Failed to identify/correct risky behavior SF 001
- ◆ Failed to correct unsafe practices SF 002

PLANNED INAPPROPRIATE OPERATIONS: Are factors in a mishap when supervision fails to adequately plan or assess the hazards associated with an operation and allows for unnecessary risk.

- ◆ Directed mission beyond personnel capabilities SP 001
- ◆ Personnel mismatch SP 002
- ◆ Selected individual with lack of current experience SP 003
- ◆ Selected individual with limited overall experience SP 004
- ◆ Selected individual with lack of proficiency SP 005
- ◆ Performed inadequate risk assessment SP 006
- ◆ Authorized unnecessary hazard SP 007

SUPERVISORY VIOLATIONS: Are factors in a mishap when supervisors willfully disregard instructions or policies, that creating the unsafe situation.

- ◆ Failure to enforce existing rules SV 001
- ◆ Allowing unwritten policies to become standard SV 002
- ◆ Directed individual to violate existing regulations SV 003
- ◆ Authorized unqualified individuals for mission SV 004

“Did organizational errors influence the outcome?” (Organizational Influence)

RESOURCE/ACQUISITION MANAGEMENT: Resource management is a factor when processes or policies influence system safety, result in inadequate error management or create an unsafe situation

- ◆ Air traffic control resources are deficient OR 001
- ◆ Airfield resources are deficient OR 002
- ◆ Operational support facilities/equipment are deficient OR 003
- ◆ Purchasing or providing poorly designed or unsuitable equipment..... OR 004
- ◆ Failure to remove inadequate/worn-out equipment in a timely manner .. OR 005
- ◆ Personnel recruiting and selection policies are inadequate OR 006
- ◆ Failure to provide adequate manning/staffing resources OR 007
- ◆ Failure to provide adequate operational informational resources OR 008
- ◆ Failure to provide adequate funding OR 009

ORGANIZATIONAL CLIMATE: Is a factor in a mishap where the working atmosphere within the organization influences individual actions resulting in human error. (e.g., command structure, policies, and working environment)

- ◆ Organizational culture (attitude/actions) allows for unsafe mission demand/pressure..... OC 001
- ◆ Inappropriate perception of promotion or evaluation procedures lead to an unsafe act OC 002
- ◆ Organizational over-confidence or under-confidence in equipment..... OC 003
- ◆ Impending unit deactivation or mission/equipment change leads to unsafe situation OC 004
- ◆ Organizational structure is unclear or inadequate OC 005

ORGANIZATIONAL PROCESSES: Organizational processes are factors in a mishap if these processes negatively influence performance and result in an unsafe situation.

- ◆ Pace of ops-tempo/workload creates unsafe situation OP 001
- ◆ Organizational program/policy risks not adequately assessed, leading to an unsafe situation OP 002
- ◆ Provided inadequate procedural guidance or publications OP 003
- ◆ Organizational (formal) training is inadequate or unavailable OP 004
- ◆ Flawed doctrine/philosophy leads to unnecessary risks OP 005
- ◆ Inadequate program management leads to unsafe situation OP 006

Sample Case Study

A 21-year-old man was driving his motorcycle home after working the mid-watch. He noticed his LPO's car at a bar along the way, and decided to stop and have a drink with him, even though he was tired. Well, as was usually the case for him, one drink turned into a couple, which turned into several. When he decided to call it a night, he staggered out of the bar into a pouring rain, jumped on his motorcycle, and took off into the night. Feeling invincible, he was speeding and weaving in and out of traffic until he found himself behind a semi-truck whose driver suddenly slammed on the brakes. He didn't see the brake lights in time and lost control of his motorcycle, causing him to swerve into oncoming traffic where he hit a 20-year-old woman's vehicle. The crash killed the woman, but he walked away with only some terrible road rash and other minor injuries.

Before this incident, our motorcyclist had a prior DUI. His command set him up with a meeting with DAPA, but he decided that he didn't need it and didn't go. No one at his command bothered to make sure he followed through with the DAPA. According to his LPO, our motorcyclist was quite the heavy drinker, but no one in his chain of command had counseled him about his drinking habits. Speeding was a repeated offense for him and he had never taken the required motorcycle safety course. He had told his LPO that he had tried to enroll last year, but that there weren't enough classes available.



Sample Case Study (Cont)

Causal Factor 1:

ACTS: What caused him to lose control?

Judgment & decision-making errors:

- ♦ Delayed a necessary action (AE204)

He did not brake in time, causing him to hard-brake and lose control.

PRECONDITIONS: Why did he delay braking?

Self-imposed stress

- ♦ Alcohol (PP201)

Psycho-Behavior Factor

- ♦ Overconfidence (PC205)

Alcohol increased his reaction time.

He was feeling invincible.

SUPERVISION: Could the command have influenced his braking skills?

- ♦ None noted.

Motorcycle classes could have taught him better driving skills.

ORGANIZATIONAL: Could the Navy have influenced his braking skills?

Organizational Processes:

- ♦ Organizational (formal) training is inadequate or unavailable (OP 004)

Causal Factor 2:

ACTS: What caused him to not see the truck's brake lights in time?

Skilled-Based Error

- ♦ Breakdown in visual scan (AE105)

PRECONDITIONS: Why did his scan break down?

Physical Environment

- ♦ Weather conditions restricted vision (PE102)

Self-Imposed Stress

- ♦ Alcohol (PP201)
- ♦ Inadequate rest (self-imposed) (PP205)

Psycho-Behavior factors

- ♦ More aggressive than necessary (PC211)

Pouring rain reduced visibility.

Alcohol blurred his vision.

Felt tired from staying up after his duty day.

Weaving in and out of traffic impaired his visibility.

SUPERVISION: Could the command have influenced his scanning skills?

- ♦ None noted.

Motorcycle classes could have taught him better scanning skills.

ORGANIZATIONAL: Could the Navy have influenced his breaking skills?

Organizational Processes:

- ♦ Organizational (formal) training is inadequate or unavailable (OP 004)

Causal Factor 3:

ACTS: What caused him to drive recklessly (speeding, DUI, weaving in and out of traffic)?

Violations:

- ♦ **Extreme Violation (AV003)**

He intentionally violated speeding rules and chose to drive under the influence.

PRECONDITIONS: Why did he violate the rules?

Self-imposed stress

- ♦ **Alcohol (PP201)**

Alcohol impaired his judgment.

Psycho-Behavior Factor

- ♦ **Overconfidence (PC205)**

He was feeling invincible.

- ♦ **Personality style (PC205)**

He felt rules don't apply to him and denied he has a drinking problem.

Coordination/Communication/Planning

- ♦ **Failure of crew/team leadership (PP101)**

LPO failed to take action, and prevented intoxicated Sailor from driving.

SUPERVISION: Could the command have influenced his extreme behavior?

Inadequate Supervision

- ♦ **Command oversight inadequate (SI 001)**

Command did not ensure sailor went to DAPA appointment.

Failure to Correct Known Problem

- ♦ **Failure to identify/correct risky behavior (SF001)**

Command knew he was a heavy drinker, but did not council him.

ORGANIZATIONAL: Could the Navy have influenced his extreme behavior?

- ♦ **None noted.**

This booklet is a result of a collaborative effort from many contributors. Both a print and electronic version of this booklet is available. The electronic version is available on line at the Naval Safety Center's Home Page:

http://www.safetycenter.navy.mil/aviation/aeromedical/downloads/human_factor_analysis_flip-book.pdf.

Acknowledgment:

Assistant Command Surgeon, Naval Safety Center - NRFK_SAFE_Code14@navy.mil

Aerospace Experimental Psychologist, Naval Safety Center- NRFK_SAFE_Code14@navy.mil

Aerospace Physiologist, Aviation Survival Training Center, Norfolk
NRFK_SAFE_Code14@navy.mil

Senior Mishap Investigator, Naval Safety Center, NRFK_SAFE_Code13@navy.mil

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CAPT John J Lee MC, USN
Command Surgeon
Naval Safety Center
NRFK_SAFE_Code14@navy.mil