

A-310

Overview of Crew Resource Management



Participant Workbook



Prepared by Office of Aviation Services Training Division
and Interagency Aviation Training Partners
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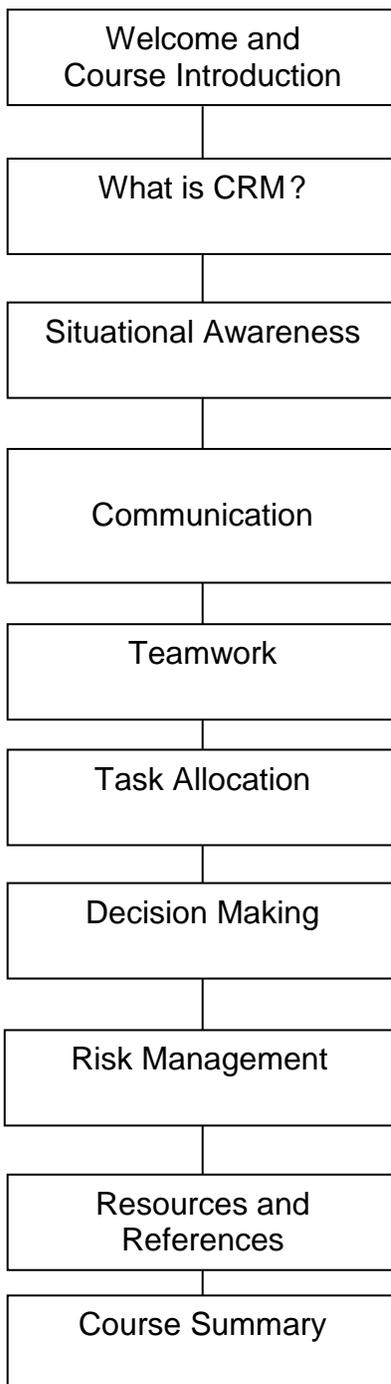
A-310 Overview of Crew Resource Management

Version Control

Version	Description	Date Completed
1.00	Current addition of A-310	11/2007
1.50	Revisions made to current addition – to include objectives, format, IG, electronic presentation, and addition of test material	TBD
1.70	Removed NBC and MMS Logos from front cover. Replaced logos with DOI and USFS.	4/10/2013
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2.0	Expansion of objectives and crosswalk to IG and PPT	1/27/14

A-310 Overview of Crew Resource Management

Course Map



Welcome and Course Introduction

Purpose of the Course

The purpose of this course is to provide the participants with an overview of crew resource management (CRM) skills and techniques, and to illustrate the importance of practicing good CRM to accomplish safe aviation operations.

Introduce Yourself

Your name?

Your position, agency and location?

What type of aircraft/missions you fly?

What do you hope to learn from this course?

Course Objectives:

1. Define crew resource management (CRM).
2. Explain why CRM is important to maintaining safe operations.
3. List the five focus areas of CRM.
4. Define situational awareness (SA) in CRM.
5. Identify at least three indicators of good SA.
6. List at least three clues that indicate a loss of SA.
7. List at least three potential barriers to SA.
8. Define communication.
9. List the three methods of effective communication.
10. Identify at least three potential barriers to effective communication.
11. List at least three indicators of effective teamwork.
12. List at least three ways to address task allocation.
13. List the six steps to good decision making.
14. List the five steps of the risk management process.
15. Identify two CRM strengths and two CRM weaknesses within your operation.

Module 1: What is Crew Resource Management (CRM)?

Module Objectives:

1. Define crew resource management (CRM).
2. Explain why CRM is important to maintaining safe operations.
3. List the five focus areas of CRM.

What does CRM mean to you?

What is CRM?

According to FAA AC-120-51E, CRM is defined as:

- The effective use of all available resources: human, hardware and information to safely accomplish a flight.

Purpose of CRM

- CRM increases effectiveness buy focusing on situational awareness, communication skills, teamwork, task allocation and decision-making within a framework of standard operating procedures (SOP's).

What CRM is Not:

CRM is not a rigid process but rather a set of tools and behavioral markers that can be used to trap mistakes before they can lead to a mishap. CRM is not concerned with the “stick and rudder” skills in flying but rather the interactions of humans with each other and with the aircraft.

CRM should be reinforced regularly to make it more effective. A one-time training is not enough.

It does not address the technical aspects of aviation.

CRM does not eliminate error but may provide a tool to trap that error.

Who is part of the Crew?

Anyone who is integral to the mission.

Why do we need CRM?

- Early on many aviation accidents were caused by faulty equipment. Now it's a different story.
- According to the NTSB, in 2006, human related causes or factors are cited in 91% of part 91 and part 135 aviation accidents.
- Poor decision making, ineffective communication, inadequate leadership and poor task management lead to many accidents.

The Mission of CRM

Prevent accidents by improving crew performance through better crew coordination.

Notes

Evolution of CRM

- After the Tenerife disaster, NASA held a workshop in 1979 and cockpit resource management was born.
- Most airlines adopted CRM training by 1986.
- It was changed to "crew resource management" in 1989 to include non-pilot crewmembers.
- Accidents continue to happen from CRM issues.
- The FAA mandated CRM training for part 135 aircraft operators as of March 22, 2011.

The Five Focus Areas of CRM:

1. Situational Awareness
2. Communication Skills
3. Teamwork
4. Task Allocation
5. Decision Making

Module 2: Situational Awareness

Notes

Module Objectives:

4. Define situational awareness (SA) in CRM.
5. Identify at least three indicators of good SA.
6. List at least three clues that indicate a loss of SA.
7. List at least three potential barriers to SA.

Definition

Situational Awareness is the accurate perception and understanding of all factors and conditions that affect the safety of flight.

It is an awareness of what is going on around you.

Some Indicators of Good Situational Awareness

- Crew is “ahead of the curve.”
- Essential personnel are included in the mission planning process.
- Crewmembers are aware of the plans for the flight.
- SOPs are adhered to (checklists, policy, written plans, etc.).
- Team members can identify performance degradation in others.

What are Some Clues to Loss of Situational Awareness?

- Confusion or gut feeling.
- No one watching or looking for hazards.
- Use of improper procedures.
- Deviation from SOP's/Policy.
- Failure to meet planned targets.
- Unresolved discrepancies.
- Ambiguity.
- Fixation for preoccupation.

Barriers to Situational Awareness (SA)

Faulty Processing

Perception is our mental picture of reality. The amount and quality of information available limit all pictures of our current operational state. Insufficient information makes

it difficult to ensure that our mental picture is always aligned with reality. Our mental picture is affected by:

Past Experiences: We act on information based on our knowledge. When something looks similar to what we are familiar with, we may react as if it were the same.

Expectations: We interpret information in such a way that it affirms the planned action. For example, we may rationalize that a load weight is accurate when in fact our scale is way off. In reality we could be overloading and aircraft.

Filters: We are provided with information, but we don't use it. We don't pay attention to information that doesn't match our mental picture.

Excessive Motivation

This behavior imposes expectations and filters that affect our ability to fully assess the situation and any safety risks. It includes, but is not limited to, "GET HOME-itis" and an overriding sense of mission importance (e.g. "you have to fly because. . .").

Complacency

Assuming everything is under control affects vigilance. When things are slow, tasks are routine, and/or when objectives have been achieved, complacency can occur. Challenging yourself and/or the team to be prepared for contingencies (e.g. planning or training) can deter complacency.

Overload

Overload causes distraction; fixation; increased errors, and high stress. Prioritizing and delegating tasks and minimizing job distractions can improve safety in conditions of overload.

Fatigue

Fatigue leads to a decrease in your ability to carry out tasks. Several studies have demonstrated significant impairment in a person's ability to carry out tasks that require manual dexterity, concentration, and higher-order intellectual processing. Fatigue may happen acutely, which is to say in a relatively short time (hours) after some significant physical or mental activity. Or, it may occur gradually over several days or weeks. Typically, this situation occurs with someone who does not get sufficient sleep over a prolonged period of time (as with sleep apnea, jet lag, or shift work) or someone who is involved in ongoing physical or mental activity with insufficient rest.

Poor Communications

The level of situational awareness achieved is related to the level and quality of communications observed in the team.

Interaction/Activity: Consequences of Losing Situational Awareness (SA)

NTSB Identification: SEA04GA192.

Accident occurred Monday, September 20, 2004 in Essex, MT

Probable Cause Approval Date: 9/13/2005

Aircraft: Cessna U206G, registration: N206SM

Injuries: 3 Fatal, 2 Serious.

The purpose of the public use flight was to transport four United States Forest Service (USFS) employees to a remote back-country airstrip. The flight's departure was delayed 2 hours due to heavy rain showers and a thunderstorm. The planned flight route was to follow a highway through a river valley with high terrain (peaks above 8,000 feet) on both sides until reaching a point where the highway diverged from the river. At that point, the flight was to leave the highway and follow the river.

Analysis of available weather data indicated that as the airplane proceeded along the river valley, ridge tops on both sides of the valley became obscured. Bases of the overcast were probably about 7,000 feet msl. Ragged clouds and mist were probably present beneath the overcast due to recent rain showers in the area. Slant visibility was likely diminished. Local pilots reported that in these type weather conditions the numerous drainages that feed into the river valley can be similar in appearance.

The pilot made a position call about 15 minutes after takeoff stating that he was over a small town located close to the point where the flight was to leave the highway. This was the last radio communication received from the airplane. Analysis of radar data available for the first 8 minutes of the flight indicated the airplane was not at the position reported by the pilot, but was actually well short of this position. About 15 minutes later, witnesses heard and saw the airplane flying up a drainage located short of the reported position. This drainage ended in a box canyon.

Inspection of the accident site indicated that the airplane was in a left climbing turn when it impacted steep terrain near the head of the drainage at an elevation of about 6,600 feet. The airplane nosed over, came to rest inverted, and a fire erupted. Three of the occupants exited the burning wreckage. All communications equipment, survival equipment and foul-weather gear aboard the airplane were destroyed in the fire. One of the three initial survivors died from his injuries the following morning. At that time, the remaining two survivors decided to depart the site for lower elevation due to extreme

cold and precipitation. Searchers found the wreckage later that afternoon. The two survivors walked out to the highway 2 days after the accident.

No abnormalities were noted during examination of the airplane that would have prevented normal operation. When the pilot took a check ride that allowed him to act as pilot in command of public use flights carrying passengers into the back-country, he reported to the check pilot that he had 100 hours flight time in "typical terrain (over mountains)." USFS standards required 200 hours flight time in typical terrain. However, the standards did not define typical terrain. Examination of the pilot's logbook revealed that it did not include a specific record of back country or mountain flying experience. Review of the past 2 years of logbook entries revealed a total of only 15 entries (14 hours flight time) that included a takeoff or landing at a back-country airport.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

- The pilot's misidentification of the airplane's location -- which resulted in his improper decision to fly into the wrong drainage -- and his failure to maintain terrain clearance while executing a turn to reverse course after he realized his navigational error.
- Contributing factors were the low visibility due to mist, obscuration of the mountainous terrain, and the pilot's lack of experience in back country flying.

What could have been clues that loss of SA could have be occurring?

1. _____
2. _____
3. _____

What are some potential barriers to SA in this Accident?

1. _____
2. _____
3. _____

Module 3: Communication

Module Objectives

8. Define communication.
9. List the three methods of effective communication.
10. Identify at least three potential barriers to effective communication.

Definition

Communication: The process of exchanging information to create a shared understanding.

Key Points

- It is critical to pay attention to non-verbal cues.
- Crews must be aware of the different types of communication and how to use them effectively.
- There are many barriers to communication.
- The sender and the receiver must both be engaged in the process.

Ways to Effectively Communicate

- Utilize “challenge and response” to transfer information.
- Respond to inquiries when asked.
- Repeat messages until they are understood.
- Use standard terminology.
- Request and provide clarification when needed.
- Use direct and unambiguous statements.
- Inform all involved when plans change.
- Communicate all information needed to the appropriate personnel.
- Stay tuned to non-verbal communication
- Recognize that a large percentage of communication is non-verbal.

Effective Communication Methods

- **Inquiry:** Capability to recognize a problem and ask the right questions at the right time.
- **Advocacy:** Make your thoughts known. Express concerns and seek ideas from others.

- **Assertion:** Getting across what's on your mind in a professional and respectful way.

Barriers to Effective Communication

- Non-assertiveness
- Preoccupation
- Anger or frustration
- Bias
- Team diversity
- Lack of confidence
- Ambiguous language
- Jargon (ex: MEL, AWOS, RAWS, FTA, ATGS, VHF, FARs)
- Inappropriate priorities
- Organizational structure
- Distraction
- Tunnel vision
- Interruptions
- Status or rank
- Incomplete information
- Overly complex communications

Sender Responsibilities

- State one idea at a time.
- Keep it as simple as possible.
- Explain further if necessary.
- Repeat if needed.
- Ask for feedback.
- Did your choice of words, tone, or body language send a different message?

Receiver Responsibilities

- Effectiveness depends on the ability to listen.
- The receiver must take control of the process and ask questions if anything is unclear.

Listening Skills

- Focus your attention on the message.
- Look for non-verbal cues:
 - Body Position
 - Tone
 - Gestures
 - Eye Movements
- Keep an open mind.
- Verify what you heard; don't just assume that's what they meant.

Briefings

- Keep them interesting and thorough – address coordination, planning, and problems.
- Should be interactive and encourage questions and critiques for improved understanding.
- Adherence to plans and policy is emphasized. SOPs addressed including expectations if they are deviated from.
- Roles and responsibilities are identified
- Post mission briefings should always be planned, completed, and documented.

Interaction/Activity: Accident Review

NTSB Identification: LAX07TA227.

Accident occurred Monday, July 23, 2007 in Happy Camp, CA

Probable Cause Approval Date: 7/30/2008

Aircraft: Bell 205 A1++, registration: N205BR

Injuries: 1 Fatal.

The accident occurred while the helicopter was supporting firefighting efforts with long-line operations. Two days prior to the accident, the division group supervisor (DIVS) anchored a colored reflective panel used for indicating landing and drop zones at the accident location. The DIVS stated that no site assessment was performed at the time of the panel placement because the placement was not intended to be the indicator of the drop zone for blivet deliveries.

The terrain in the area consisted of steep slopes and trees varying in height from 75 to 200 feet. One day prior to the accident, the location of the panel was not changed from the previous day and remained as placed by the DIVS. The accident helicopter,

equipped with a 150-foot-long line, then made the blivet drop within 3 feet of the panel. The marshaller stated he warned the pilot about the proximity of one tree that was located to the right and upslope. Two ground crew members distanced themselves from the blivet drop because they were concerned with their own safety due to the tree hazards. The division safety officer visited the site immediately after the blivet operation and there was no discussion regarding the aircraft use, the drop zone, or any discernment on the part of any crew member regarding the safety of the operation. In addition, there was no discussion about the operation during the "After-Action Review" (AAR) at the overnight camp that evening.

On the day of the accident prior to the day's missions, there was no safety assessment or organized AAR conducted. The accident pilot was told that he would be delivering two more blivets to the same drop zone and back hauling the empty blivets that had been delivered the day before. At the intended drop zone, two crew members, who were not the same from the previous day, were so concerned about the potential for an accident that they briefed each other three times on what action would be taken in the event of an accident; however, this was not discussed with the pilot. The panel was not moved and the drop zone site remained in the same location as the previous day. The marshaller communicated with the DIVS that a longer long-line was recommended so the helicopter could remain above the trees; however, the helicopter had already departed.

Witnesses observed that as the blivets were set down on the ground, the helicopter drifted to the right and the main rotor blades contacted a 165-foot-tall tree about 15 feet from the top. The long-line, along with the blivets, remained attached to the helicopter as it made a turn to the left, stopped momentarily, and then flew downhill to ground impact. The helicopter impacted several trees and was destroyed by post impact fire. No anomalies were noted with the airframe and engine that would have precluded normal operation prior to the accident. The helicopter was approved for the pilot to operate the aircraft from the left seat. Visibility to the right side of the helicopter was partially obstructed by aircraft structure, passenger seats, and the seat headrests.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

- The pilot's failure to maintain clearance with the trees during a long-line operation.
- Contributing factors were the Forest Service's inadequate communication between crews, failure to properly assess the safety of the intended drop zone, reduced visibility to the right side of the helicopter, and the trees.

Questions

What are some of the potential communication issues associated with this accident?

How could communication have been improved in this situation?

Module 4: Teamwork*Notes***Module Objective**

11. List at least three indicators of effective teamwork.

Effective Teamwork Indicators

- Balance between respect for authority and respect for assertiveness.
- Need to adhere to SOPs is recognized.
- Necessary resources are available to complete the mission.
- Effects of stress on team are acknowledged.
- Time is available to complete the task.
- Crew remains calm under stress.
- Crew can adapt to personalities of others.
- “Tunnel vision” should be recognized when it sets in.
- “Tone” is professional and courteous.
- Crew is focused on the mission not external pressures or tension.

Module 5: Task Allocation

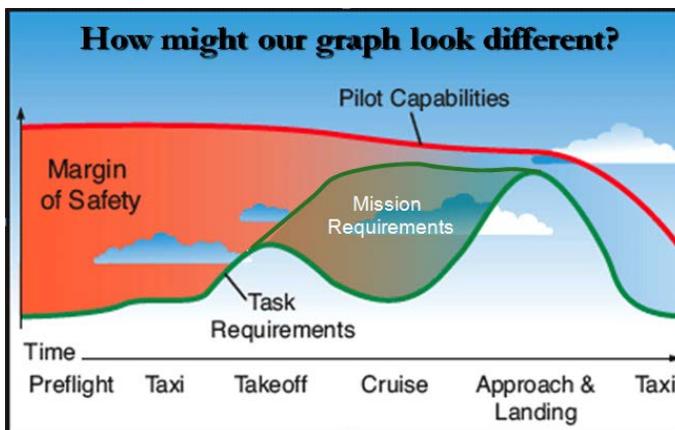
Notes

Module Objective

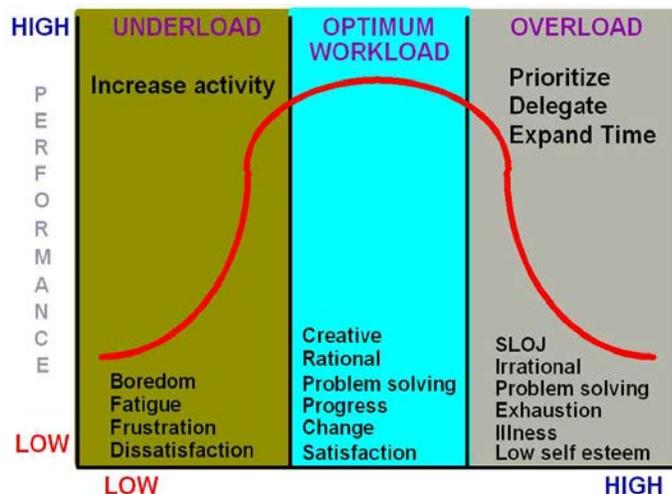
- List at least three ways to address task allocation.

Workload Management

- Speak up if you feel you or one of the crew is overloaded.
- Share tasks with others to maximize efficiency.
- Clearly communicate tasks get or give acknowledgement.
- Prioritize tasks to cover the most important first.
- Be aware of distractions.
- Plan your flight and then fly your plan.



Mission requirements may reduce safety margin more than typical cruise flight.



Module 6: Decision Making

Notes

Module Objectives

13. List the six steps to good decision making.
14. List the five steps of the risk management process.
15. Identify two CRM strengths and two CRM weaknesses within your operation.

Good crew decision making is critical in breaking the poor judgment chain that can lead to a mishap.

Six Steps to Good Decision Making

1. Identify personal attitudes that may be hazardous to a safe flight.
2. Learn behavior modification techniques.
3. Learn how to recognize and cope with stress.
4. Develop risk assessment skills.
5. Use all available resources.
6. Evaluate you own decision making skills.

Decision Making Key Points

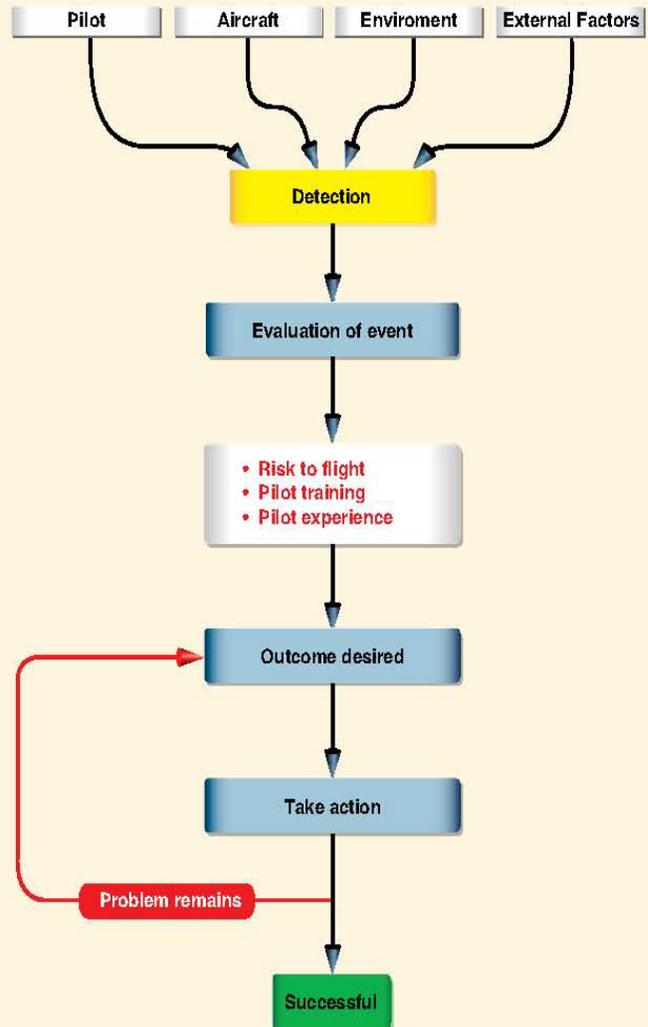
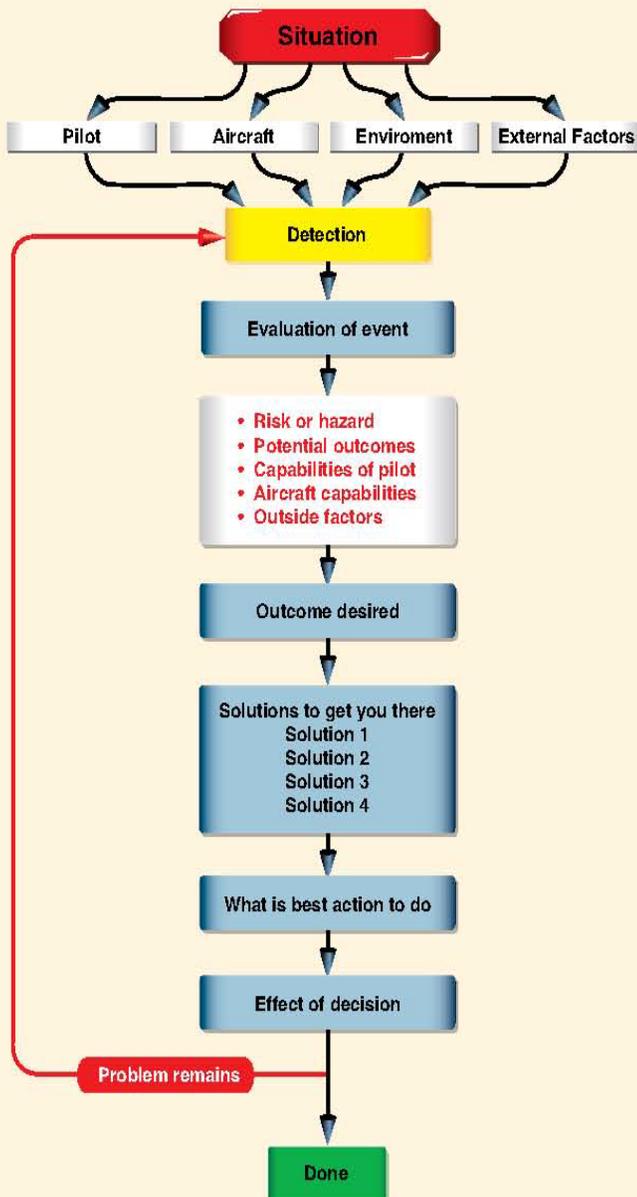
- Decisions are clearly stated and acknowledged by team.
- “Bottom lines” for safety are established and shared.
- Mission plan is shared with everyone involved.
- All are encouraged to share ideas, opinions and recommendations.
- Should be and open and free environment.

Your role: “I’m not in charge, what’s my role in the decision making process?”

- Crewmembers should speak up and state their information persistently until there is resolution.
- “Challenge and response” should be used.
- Question the actions and decisions of others.
- Seek help when needed.
- Everyone should be open and non-defensive.
- **If you see something, say something.**

A. Analytical

B. Automatic/Naturalistic



DECIDE Model for Aeronautical Decision Making:

- Detect that that a change has occurred.
- Estimate the need to counter or react to the change.
- Choose a desirable outcome for the success of the flight.
- Identify actions which could successfully control the change.
- Do the necessary action to adapt to the change.
- Evaluate the effect of the action.

Recognize Hazardous Attitudes and Know How to Address Them

- Anti-Authority: “Don’t tell me what to do.”
 - Wonder if you know it all? You don’t.
- Impulsivity: “Let’s go, let’s go.”
 - Use Checklists.
- Invulnerability: “Can’t happen to me.”
 - Recognize that anyone can make a mistake.
- Macho: “I’m the man, just ask me.”
 - Know your limits and don’t exceed them (personal minimums).
- Resignation: “What the point anyway?”
 - Don’t let others think for you. It’s your behind!

Interaction/Activity: Video Review

Mission: Pick up rescuer at the top of a rock buttress following a search and rescue operation. The rescue has been completed and the only thing remaining to do is pick up one person and return to the helibase.

NTSB Identification: **WPR10LA359**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter
Accident occurred Monday, July 19, 2010 in Wells, NV
Aircraft: BELL 206, registration: N3185A
Injuries: 1 Serious, 3 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On July 19, 2010, at 1616 hours Pacific daylight time, a Bell 206L-3, N3185A, impacted terrain near a camp site following a search and rescue mission near Wells, Nevada. El Aero Services, Inc., operated the helicopter that was rented to the Elko County Sheriff’s Department, under the provisions of Title 14 Code of Federal Regulations Part 135. The commercial pilot received serious injuries, the three firefighters were not injured; there were no ground injuries. The helicopter sustained substantial damage.

Visual meteorological conditions prevailed for the flight and a company flight plan had been filed. According to the Sheriff of Elko County, the flight had been dispatched to assist a rock climber that had become stranded on a cliff precipice near Angel Lake in the Humboldt National Forest. Prior to responding to the site, the pilot coordinated with ground crews regarding location, weights of the fire fighters and their gear, and current weather conditions. Responding personnel noted that the temperature was about 75-degrees Fahrenheit with winds in the area at the time of the accident. Witnesses

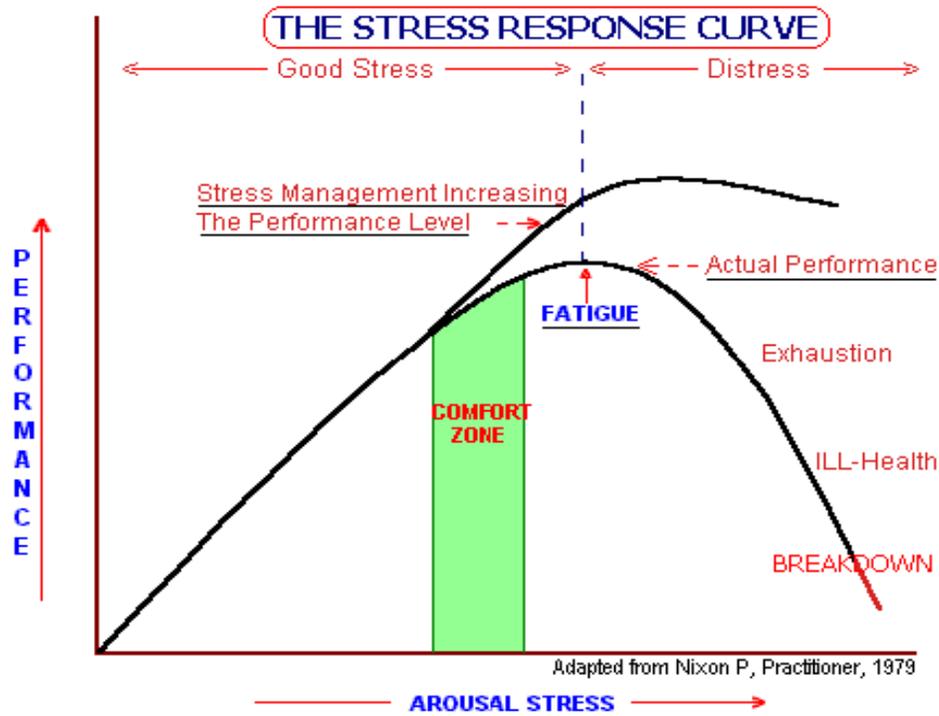
observed the helicopter lift off from the cliff face, and make a turn to the right. The helicopter moved very fast down the cliff face, disappeared below the tree line before coming back into view prior to impact with the ground.

Which hazardous attitudes may have been present?

What are some ways they could have been mitigated?

Stress

- Stress can change physiological and psychological patterns and forces you to adapt.
- It is inevitable and necessary.
- Every person has an optimal stress level.
- Once the threshold is exceeded performance degrades rapidly.
- Monitor others for signs of stress overload, and challenge them if it's creating a hazard.



Stress Effects

- Stress has a gradual effect leading to subtle clues that you may be beyond your ability to respond appropriately.
- Stress is cumulative.
- As stressors add up, eventually performance and judgment will decline.
- A superior pilot uses superior judgment to avoid stressful situations which call for use of superior skills.

Interaction/Activity: Stress and Flying

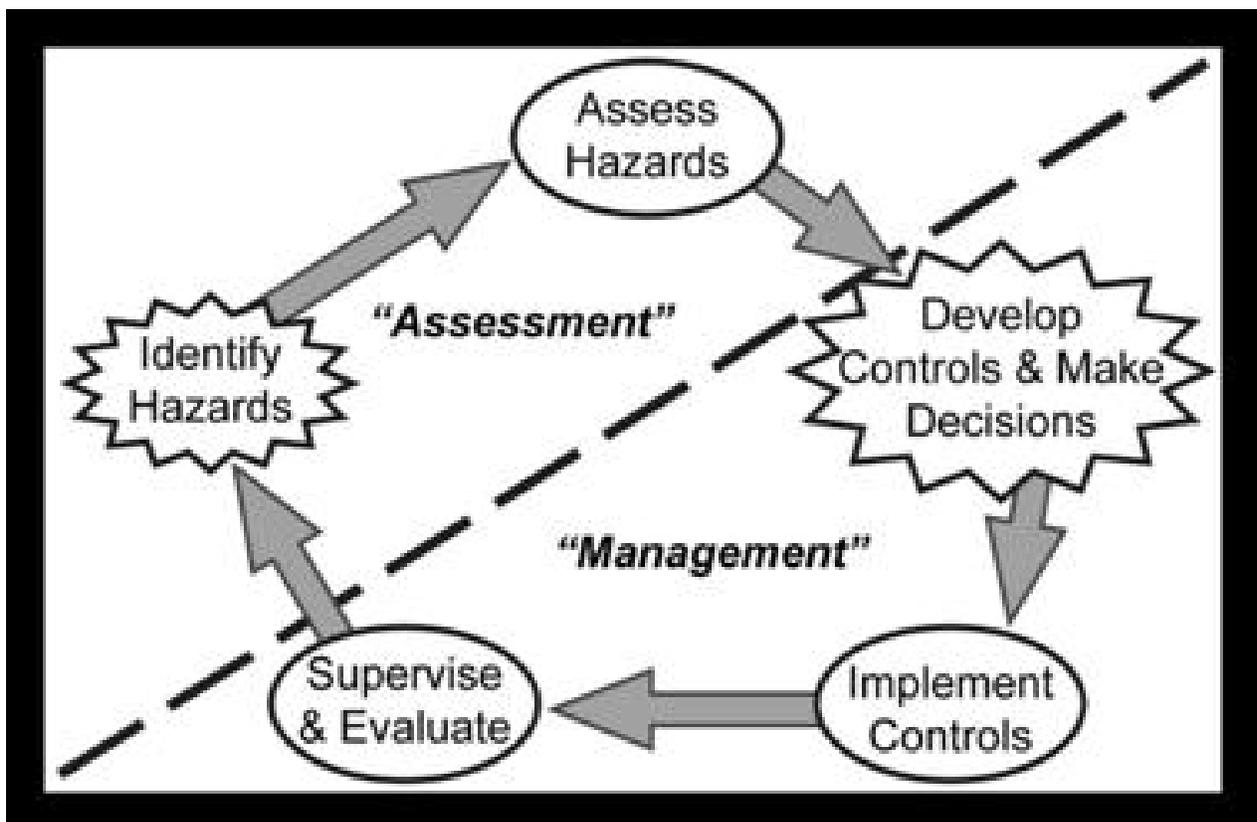
List some stressors in your aviation operations.

How can they be mitigated?

Risk Management Fundamentals

- Everyone in aviation is responsible for managing risk.
- The simple question: “Is the accomplishment of the mission worth the risk?”
- Risk management should be approached systematically.
- The process should be a continuous loop.

The Risk Management Process



Interaction/Activity: Identifying CRM Strengths and Weaknesses

Based upon the content of this course, identify two CRM strengths and two CRM weaknesses within one of your own operations.

How can or could you improve CRM to mitigate the weaknesses?

Resources and References

AOPA Joseph T. Nall Report

<http://www.aopa.org/asf/publications/nall.html>

FAA CRM Advisory Circular 120-51E Crew Resource Management Training

[http://rgl.faa.gov/Regulatory and Guidance Library/rgAdvisoryCircular.nsf/0/80038cf51aace53686256e24005cbb23/\\$FILE/AC120-51e.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/80038cf51aace53686256e24005cbb23/$FILE/AC120-51e.pdf)

FAA Aeronautical Decision Making Advisory Circular

http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/22624

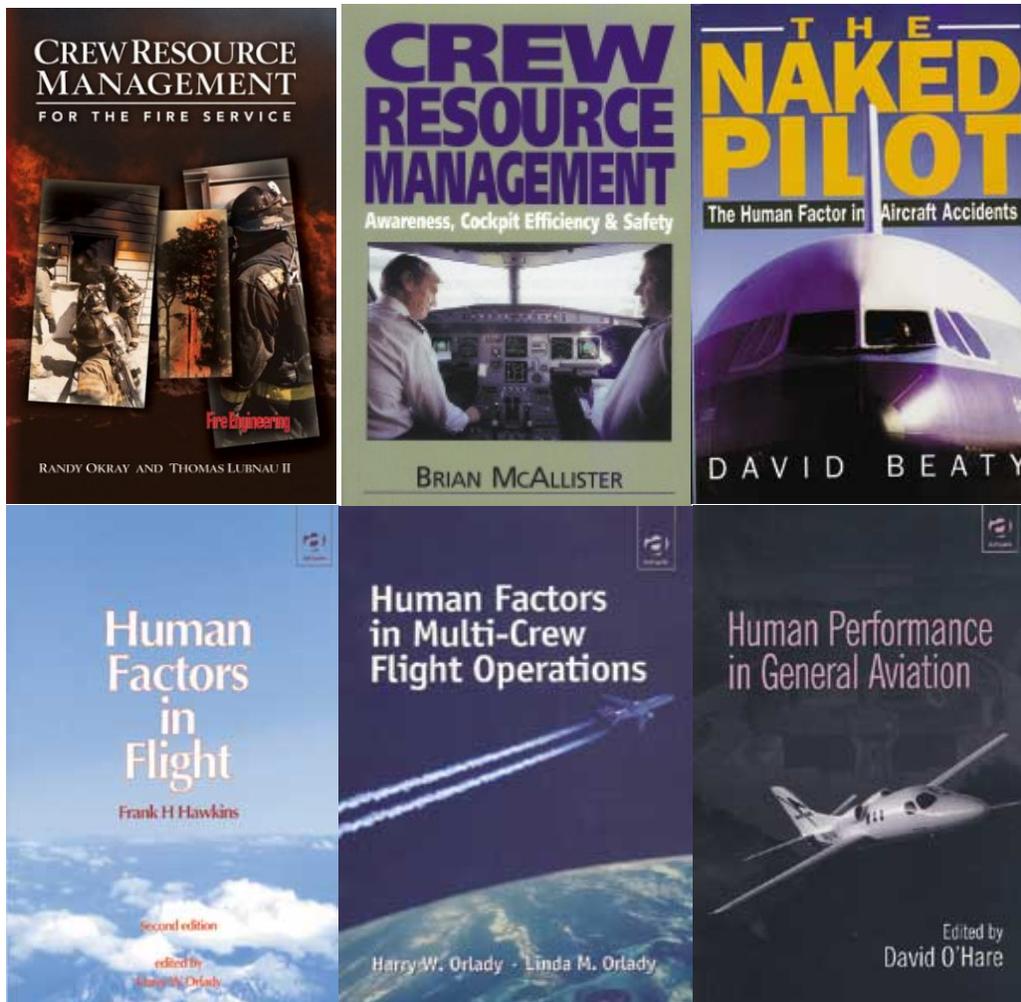
NTSB Annual Review of Aircraft Accident Data

http://www.nts.gov/Publictn/A_stat.htm

United States Coast Guard Team Coordination Training Guide

<http://www.uscg.mil/auxiliary/training/tct/default.asp>

Suggested CRM Reading



Course Summary

Key Points to Remember

- “Crews” can refer to a single pilot or many individuals.
- CRM is a method to enhance coordination to increase effectiveness and safety.
- Human error is the cause of the vast majority of aviation accidents. By practicing good CRM, we can reduce that number.
- CRM is an essential component to safety, regardless of technical skill.

Objectives Review

You should now be able to:

1. Define crew resource management (CRM).
2. Explain why CRM is important to maintaining safe operations.
3. List the five focus areas of CRM.
4. Define situational awareness (SA) in CRM.
5. Identify at least three indicators of good SA.
6. List at least three clues that indicate a loss of SA.
7. List at least three potential barriers to SA.
8. Define communication.
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12. List at least three ways to address task allocation.
13. List the six steps to good decision making.
14. List the five steps of the risk management process.
15. Identify two CRM strengths and two CRM weaknesses within your operation.

If you have any additional questions on CRM, please ask your instructor at this time.

Please be sure to complete the course evaluation.