



Railroad Crew Resource Management Training Course

Transportation Track: For Engineers, Conductors, and Dispatchers

Facilitator's Guide



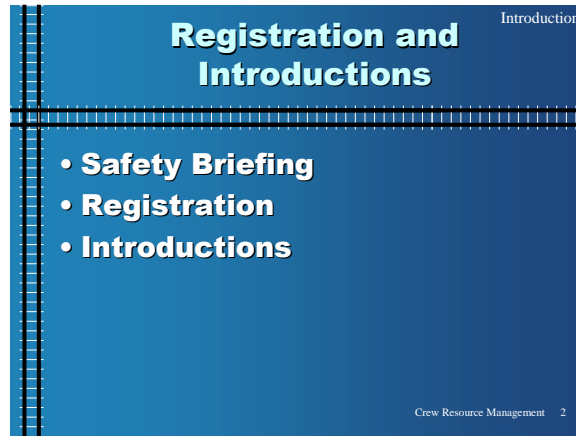
OBJECTIVE OF SLIDE: *To act as a title slide while participants are arriving to the training room.*

Next slide

** Facilitator Notes*



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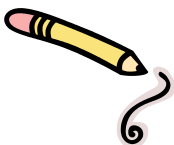


OBJECTIVE OF SLIDE: *To register participants for the course, introduce participants and facilitator(s), and to give a safety briefing.*



DISCUSS:

- *Safety briefing items*
- *Facilitator background and accomplish class records/preparations (While the facilitator is discussing his/her background, have class fill out appropriate sign-in sheet)*
- *Discuss participant background (After the facilitator has finished introducing himself/herself and formal class record/preparations are complete, have each participant introduce him/herself to the group/facilitator and state what his/her job is and how many years he/she has been working that job. Facilitator can use discretion as to whether to acknowledge unusual participant background, which can aid setting the class at ease with the facilitator.)*




Next slide

** Facilitator Notes*

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Introduction

Group Discussion



What are some things you do to ensure safety on the job, on a daily basis?

Crew Resource Management 3



OBJECTIVE OF SLIDE: *Instructor lead focused discussion/exercise and icebreaker.*

Group Discussion

- *Overview: In small groups (4-5), participants answer question on slide. Through this, a list is created on a flip chart of activities that participants carry out to assure and improve safety. Discussion follows. Time: 15 minutes Supplies needed: Flip Chart, Markers*
- *Break class into groups of 4-5 individuals.*



SUGGESTED SCRIPT: “Now that we are in these groups, I want each group to answer this question. I will give you about 5 minutes. Afterward, I am going to ask each group for some of their answers, and I am going to write them down on this flipchart. So, in your small groups think about the things you do on a daily basis, to ensure safety on the job. Someone in the group write down some of these things for your group. Go ahead and get started.”

Give the groups 5 minutes to come up with ideas.

*After 5 minutes has elapsed, have each group give you **one** thing they do everyday that ensures safety on the job. Repeat this activity several times.*



ASK: “What are some of the things you do to ensure safety on the job, on a daily basis?”

Use discussion facilitation techniques.

Probing Questions:

- *“How do you get those things done?”*
- *“Do you do these things on your own?”*
- *“How many other people are involved?”*
- *“Does the way you interact/communicate with these people affect the safety on the job?”*
- *“Do their actions impact your personal safety?”*
- *“Do you have a team-based outlook on job performance and safety?”*

Record the participant's answers on a flip chart, identifying those things that are CRM oriented in the natural course of conversation.

Examples of Possible Answers—Carry my rule book with me, stretches, check equipment, preparation, communicate, call signals, have a job briefing, conduct a de-briefing, get rest, wear proper personnel protective equipment, etc.

Make sure you ask each group to give you an example until you have enough to facilitate a discussion.



SUGGESTED SCRIPT: “Great. These are the things we are doing right now on the job to ensure safety. So guess what. We are already practicing CRM techniques. As we will learn today, CRM has to do with communication (*point out communication examples on flipchart*), technical proficiency (*point out technical proficiency examples on flipchart*), teamwork (*point out teamwork examples on the flipchart*), and situational awareness (*point out situational awareness examples on the flipchart*). The point is—we are already doing some of the things that are important to CRM; however, this course is designed to make us more aware of the things we do and to improve our understanding and practice of CRM skills. That is what this training course is about.”



SUGGESTED SCRIPT: “Let's go over the schedule for today.”

Next slide

 * *Facilitator Notes*



Introduction

Class Schedule

Morning: Modules 1-3

Afternoon: Modules 4-6

Crew Resource Management 4



OBJECTIVE OF SLIDE: *To give participants the schedule for the class.*

** The facilitator can input the exact time schedule of the course on to this slide in the presentation.*



DISCUSS:

- *Length of course*
- *Breaks*
- *Lunch*

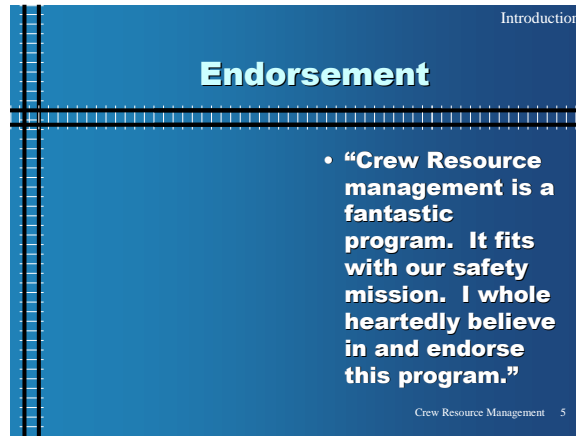
- *Cell Phones—Ideally the facilitator should have all participants turn off their cell phones/beepers or other devices such that they do not interrupt the course. However, some participants might need to accept phone calls during the course. The facilitator should inquire before the start of the course about who needs to accept phone calls.*
- *As the facilitator you should request that anyone requiring the availability of their cell phone should accommodate the class by having the ringer in silent mode.*

Next slide

** Facilitator Notes*



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OBJECTIVE OF SLIDE: *To show the participants that this course is endorsed by senior management or relevant union representatives, thus creating more buy-in.*

** The default condition for this presentation has this slide hidden. Endorsement should be sought by senior management or relevant union representatives. If endorsement is found, this slide can be unhidden from the slide show before the start of the course. To hide/unhide a slide: In PowerPoint click “Slide Show” on the menu bar, then click on “Hide Slide.”*



SUGGESTED SCRIPT: “This Crew Resource Management (CRM) training program is part of the larger safety initiatives here at _____ (name of railroad). Senior management has reviewed this program and is 100 percent behind it. _____ (name of endorser) believes that this program is essential in trying to decrease the number of accidents in the yard, in the shops, and out on the tracks.”

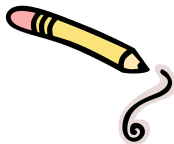


REFER TO SLIDE AND EXPAND: *Read what the senior management or relevant union representatives have stated on slide.*



SUGGESTED SCRIPT: “Let’s begin by looking at what you can expect to get out of your attendance at this course.”

Next slide



** Facilitator Notes*

Introduction

Overall Course Objectives

- Understand what CRM is and what it is not
- Understand the loss and gain of situational awareness
- Understand that safety hinges on both individual and team actions

Crew Resource Management 6



OBJECTIVE OF SLIDE: *For participants to understand the overall course objectives.*



SUGGESTED SCRIPT: “These are the overall objectives of this course. These are the things that we want you to know; the things that when you leave here you will be able to do. By the end of this course you should be able to...”

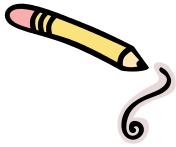
** When going through the objectives of the course, try linking the objectives back to the items listed on the flip chart in terms of the thing the participants do everyday that ensures safety on the job. For example, after stating the objective, “understand the loss and gain of situational awareness,” you can connect it to the item “get enough rest” in the discussion earlier, stating that by getting enough rest and understanding the effects of fatigue, we can have a better understanding of the loss of situational awareness.*



REFER TO SLIDE AND EXPAND:

- Understand what CRM is and what it is not.
- Recognize when you are losing situational awareness and making proper efforts to regain awareness of the situation.
- Understand that safety hinges on both individual and team actions.

Next slide



** Facilitator Notes*

Introduction

Overall Course Objectives

- Know techniques and attitudes that foster effective communication within and between teams
- Be able to describe how job safety is affected by circumstances both on and off the job
- Know CRM practices and appreciate their value in improving railroad safety

Crew Resource Management 7



OBJECTIVE OF SLIDE: *Continuation of previous slide.*



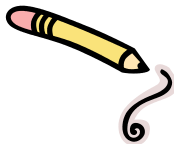
SUGGESTED SCRIPT: “The final three objectives of this course are...”



REFER TO SLIDE:

- “Know techniques and attitudes that foster effective communication within and between teams.”
- “Be able to describe how job safety is affected by circumstances both on and off the job. For example—lack of rest, if you come to work tired it will probably effect how you will work that day. We will learn that we need to communicate to other members of our team about our fatigue before starting a job.”
- “Know CRM practices and appreciate their value in improving railroad safety.”

Next slide



** Facilitator Notes*

Introduction

Course Outline

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness

Crew Resource Management 8



OBJECTIVE OF SLIDE: *After completing this slide, participants should understand (1) that the overall purpose of CRM is to increase safety and (2) the outline of the course.*

It's All About Safety



SUGGESTED SCRIPT: “Like we talked about in the group discussion a few minutes ago, CRM is based in **safety**. Using good CRM techniques will create a safer working environment by decreasing the number of errors. These accidents, as will be discussed in more detail, can cause injuries and even death. By using good CRM techniques you can improve the environment in which you work.

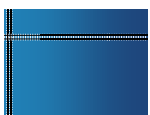
“Thus the overall objective of this course is to get you, when you leave this class, to have a better understanding of CRM principles and how to use CRM techniques effectively, and change certain behaviors to create a safer work environment.”

Really emphasize at the beginning of the point that this training is focused on worker safety.

Course Outline



SUGGESTED SCRIPT: “For the purpose of this training course CRM is broken into six different sections or modules. These are an Introduction to CRM, Technical Proficiency, Situational Awareness, Communication, Teamwork, and Assertiveness. The first module, Introduction to CRM, will give you a broad overview of CRM. The main content of the course comes from modules two through six. We are breaking the content of CRM up into these five modules in order to better understand each one; yet as you will see throughout the course they are all related to each other and intertwined to varying degrees.”



REFER TO SLIDE AND EXPAND:

1. Introduction/Defining CRM
2. Technical Proficiency
3. Situational Awareness
4. Communications
5. Teamwork
6. Assertiveness



SUGGESTED SCRIPT: “We will be using real scenarios developed from the accident/incident investigation reports written by the Federal Railroad Administration (FRA) or the National Transportation Safety Board (NTSB) to illustrate and evaluate these techniques to understand how to use them. Often the narratives are taken verbatim from FRA or NTSB reports with only minor changes made to shorten or summarize the events in the report.”

“So that is what we are going to help you think about today during this course – human factors related errors.”



ASK: “Now when most of our friends and neighbors, or non-railroaders, think about human factors errors on the railroad, what do you think is the first thing that comes to their mind?”

Probing questions:

- “What always gets a lot of attention in railroading?”
- “As a railroader, what do think the average non-railroader thinks of when asked, ‘What are human-factors errors?’”

If they mentioned it in the discussion, say “you mentioned it in the discussion.”

(correct answer–Fatigue)



SUGGESTED SCRIPT: “That is right.....Fatigue.”

Next slide

** Facilitator Notes*

Introduction

Where is Fatigue?

- How is fatigue related to CRM?

Crew Resource Management 9



OBJECTIVE OF SLIDE: *To give participants an introduction to how fatigue is related to CRM.*



SUGGESTED SCRIPT: “Some activities that you might carry out to assure and improve safety are activities related to decreasing fatigue or anti-fatigue measures. Some of these are eating the right kinds of foods and getting enough sleep.”



ASK: “Is there fatigue out there on the tracks?”

Get some answers from group.

Probable answer: Yes



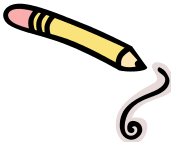
ASK: “So how is fatigue related to CRM?”

Get some answers from group.



SUGGESTED SCRIPT: “As you will discover throughout this program, CRM is a safety program aimed at using all of one’s resources to ensure safe operations. CRM deals with human factors accidents by making individuals more aware of the situation, having better communication skills, and working better as a team, thereby decreasing human error types of accidents. We’ll see as we go through the training program, CRM training is a counter fatigue technique. As each individual and team communicates more proficiently and works together better as a team (remember communication and teamwork are two modules in this program), the team as a whole can help to counteract fatigue in each individual. This is only possible, however, by practicing good CRM techniques. By the end of this program you should have a better understanding of how important it is not to be fatigued and the effects of fatigue, as well as how to counteract fatigue.”

Next slide



* *Facilitator Notes*

Module 1: Introduction

- Explain where CRM techniques originated
- Describe the difference between CRM and crew management
- Describe how CRM can be used to reduce human error accidents
- Name the five main areas of CRM practices



OBJECTIVE OF SLIDE: *To explain to participants the objectives of Module 1.*



SUGGESTED SCRIPT: “So now we are going to begin Module 1, which is an introduction to CRM. By the end of Module 1, you should be able to.....”



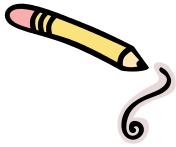
REFER TO SLIDE AND EXPAND:

- Explain where CRM techniques originated.
- Describe the difference between CRM and crew management.
- Describe how CRM can be used to reduce human error accidents.
- Name the five main areas of CRM practices.



SUGGESTED SCRIPT: “Before we can effectively do all these things, we need to agree on what CRM is. So, let’s define what we mean by the term CRM.”

Next slide



** Facilitator Notes*

Introduction

CRM

- A **crew's** effective use of all available resources to achieve safe and efficient train operations

Crew Resource Management 11



OBJECTIVE OF SLIDE: *To define CRM.*



SUGGESTED SCRIPT: “Before I formally introduce the topic of CRM, I want everyone to watch a video that might help us understand where CRM came from. As we will see later in the program, most people attribute the development of CRM to the airline industry. However, we came across a film that was made approximately 50 years ago following a rail accident investigation. It shows that the railroad industry was thinking about human factors accidents, and what we now call CRM, a long time ago. Thus, these ideas are not new to the railroad industry.”



Video: *Show CRM Video Clip 1 – Trouble at Troublesome*

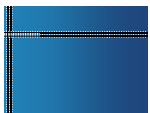
After-video discussion topic: This video was made in the late 1950s, although CRM is not mentioned in the video. This video is about CRM. This video illustrates that these topics have been around for a long time. It is nothing new.



SUGGESTED SCRIPT: “This is the definition we are going to be using throughout this program. CRM is...”



Click on mouse



REFER TO SLIDE:

A crew's effective use of all available resources to achieve safe and efficient train operations.

Explain this definition in laymen terms using an example familiar to the group of learners.



SUGGESTED SCRIPT: “This definition may seem complicated at first; however, it is easier to understand if we break it down into its component parts.”

Next slide



** Facilitator Notes*

Introduction

Crew Concept Discussion

- **Definition of a crew: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”**

Crew Resource Management 12



OBJECTIVE OF SLIDE: *To explain to the participants what we mean by the term crew, as well as give them a framework for understanding that a crew is not just their immediate (elemental) crew but also includes others that they work with (interactive crew).*

Crew Concept Discussion



ASK: “What are some common tasks that you accomplish as **individuals**?”

WAIT! *Don't answer your own question, get some answers from the group.*

Answers might include: operating the train, checking the airbrakes, etc.

*Once participants give you some common tasks that they accomplish as individuals, show how those tasks could **not** be accomplished without the help of other people or team members.*

For example:

Conductor: “I check the train to make sure it is what the manifest sheet says it is”

Facilitator: “Do you accomplish that without input or comment from the engineer?”

Get participants to understand that in the railroad environment, ultimately no one works in total isolation from the efforts of others.



SUGGESTED SCRIPT: “Almost every task in the railroading environment is accomplished not by an individual working by themselves but as part of a larger crew or team.”

Define what we mean by crew and/or team



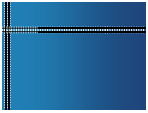
SUGGESTED SCRIPT: “That is why this is called **CRM**. It is crew based just like the work we do. That is also why we define CRM as “A crew’s effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations, but how the crew does. Let’s explore this idea of a crew a little more.”



Click on mouse



SUGGESTED SCRIPT: “A crew is defined as....”

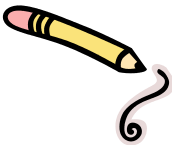


REFER TO SLIDE: “Any group of people working at tasks designed to accomplish a common mission, goal, or objective.”



SUGGESTED SCRIPT: “In railroading, teams or crews can be classified into two types.”

Next slide



** Facilitator Notes*

Two Types of Railroad Teams

- **ELEMENTAL TEAM**—Basic teams that carry out functions at the railroads
Example: *Road Crew or MOW Crew*
- **INTERACTIVE TEAM**—Formed when an elemental team must interact with an outside individual or another elemental teams to safely carry out an activity
Example: *Dispatcher, MOW crew, and road crew working together to move train through a work area*



OBJECTIVE OF SLIDE: *To explain to the participants what we mean by the term crew, as well as give them a framework for understanding that a crew is not just their immediate (elemental) crew but also includes others that they work with (interactive crew).*



SUGGESTED SCRIPT: “These two types of teams are elemental teams and interactive teams. Elemental teams are the basic teams that carry out functions at the railroads. For example, a train crew (engineer/conductor). This is an example of an elemental team.”



ASK: “As a train crew on the job, who else do you interact with besides each other while on a job?”

Answers could be: Dispatcher, MOW, train master, yardmaster, signal maintainer.



SUGGESTED SCRIPT: “Right, when you broaden your concept of what makes a crew, you take into account all of these other people that help you get your work done. This is an interactive team. Interactive teams are those teams that are formed when an elemental team must interact with an outside individual or another elemental team(s) to safely carry out an activity. Many times interactive teams are formed for only a short time; for example, when a train crew, dispatch, and MOW crew must communicate with one another in order to move a train through a work area. Once the train has moved through the work area safely, that interactive team disbands.”

Make sure the participants understand the difference between an elemental team and an interactive team, and give examples of each that are relevant to the participants.



SUGGESTED SCRIPT: “Again, the definition of CRM is: ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ This definition encompasses both elemental teams and interactive teams. Let’s look at some examples of elemental teams in different areas of the railroad industry.”

Next slide



** Facilitator Notes*

Elemental teams (by functional areas)		Introduction
TRANSPORTATION		MECHANICAL
Road Crews		Locomotive Repair Shop Crews
Yard Crews		Locomotive Servicing Crews
Dispatchers		In/Outbound Inspection Crews
Hostlers	ENGINEERING	Car Repair Shop Crews
	Section Gangs	
	Production Gangs	
	Structures (B&B)	
	Signal Maintainers	
	Electrical/Catenary Crews	



OBJECTIVE OF SLIDE: *To make sure the participants understand the difference between an elemental team and an interactive team, and to give examples of each that are relevant to the participants.*



SUGGESTED SCRIPT: “Here are some examples of different elemental teams broken down into different functional areas including transportation, engineering, and mechanical.

Transportation includes all the train, yard, and engineman (TY&E) personnel. For example: road crews, yard crews, dispatchers, and hostlers. These are personnel involved in the direct movement of the trains.

The engineering group includes section gangs, production gangs, structures (Bridge & Building), signal maintainers, and electrical/catenary crews, which exist on some passenger lines. These are the personnel that work on the track, signals, and structures.

The mechanical group includes locomotive repair shop crews, locomotive servicing crews, in/outbound inspection crews, and car repair shop crews. These are the personnel that repair, maintain, and service rolling stock.”



REFER TO SLIDE:

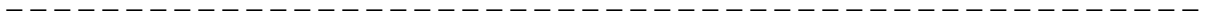
** Go through the different kinds of elemental teams*



SUGGESTED SCRIPT: “Again, the definition of CRM is: ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ This definition encompasses both elemental teams and interactive teams. Let’s go back and look at the definition of CRM again.”



Next slide



** Facilitator Notes*

Introduction

CRM

- A crew's effective use of all available **resources** to achieve safe and efficient train operations

Crew Resource Management 15



OBJECTIVE OF SLIDE: *To have participants understand that there are different types of resources that they use.*

Resources

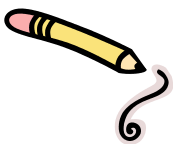


SUGGESTED SCRIPT: “We have defined what we mean by a crew. How about, use of all available resources? What are resources?”



ASK: “What does this mean? What do we mean by resources?”

Don't get answers—lead into next slide.



Next slide

** Facilitator Notes*

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Introduction

Resources?

- Equipment
- Computer Resources, Paperwork
- People

Crew Resource Management 16



OBJECTIVE OF SLIDE: *To have participants understand that there are different types of resources that they use.*

Resources



SUGGESTED SCRIPT: “When we talk about resources, we mean equipment,”



Click on mouse

“Computer Resources or Paperwork,”



Click on mouse

“and People,”



Click on mouse

Equipment



SUGGESTED SCRIPT: “An example of equipment is the tools we use. For example, the readouts on the control panel, the sound of certain equipment, Radio, Cell phones.”

Computer Resources, Paperwork



SUGGESTED SCRIPT: “Computer resources and paperwork are also a resource. For example, a wheel report, etc.”



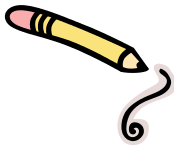
People

SUGGESTED SCRIPT: “Lastly, a resource we all work with to carry out our jobs is people. Because we work in crews or teams, we use other people to get the job done. That is the essence of being in a team. Why have a team doing the work, if an individual can do the work all by himself/herself. Seeing other people and fellow crewmembers as a resource is extremely important.”

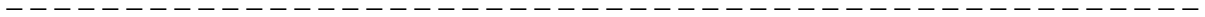


Click on mouse

“As you will see, the bulk of CRM training will revolve around how we interact with others in the work place to get tasks done.”



Next slide



** Facilitator Notes*

Introduction

What CRM is **NOT**

- **NOT:** A crew calling program
- **NOT:** A quick fix that can be implemented overnight
- **NOT:** A short-term accident-reduction program

Crew Resource Management 17



OBJECTIVE OF SLIDE: *To show the participants what CRM is not.*

What CRM is NOT



SUGGESTED SCRIPT: “At first the term CRM or the letters CRM may bring to mind a variety of other concepts that you have heard previously. Thus, to avoid any confusion or pre-conceptions, we want to make clear what CRM is **NOT**. I am going to point out a few of these topics that have been traditionally confused with the CRM that we will be discussing today.”



Click on mouse



REFER TO SLIDE AND EXPAND: “Not a crew calling program. At many railroads the department that schedules train crews is called crew management. However, although the names are similar, this is not related to crew calling or learning how to schedule crews.”



Click on mouse

“Not a training program administered in only a few specialized or fix it cases.”



Click on mouse

“Not a quick fix that can be implemented overnight.”



Click on mouse

“Not a short-term accident-reduction program. It will take some time to implement CRM in the railroad environment as it will for CRM have a noticeable effect on safety and accidents.”



SUGGESTED SCRIPT: “Nobody should have any preconceived ideas about what CRM is. This way you will not have any fixed ideas of what you are about to hear as we progress through the rest of the day.”



Next slide

** Facilitator Notes*

Introduction

CRM is.....

- **A human factors training program based in safety**
- **Process that addresses the entire crew and other related staff**
- **Heightened awareness of attitudes and behaviors of crewmembers and their impact on safety**

Crew Resource Management 18



OBJECTIVE OF SLIDE: *To have participants understand in a broad conceptual manner, what CRM is.*

CRM is



SUGGESTED SCRIPT: “Now I am going to give you a little background information on what CRM is.”



Click on mouse



REFER TO SLIDE AND EXPAND: “Because so much of CRM revolves around how we as humans interact with our environment, CRM is considered a human factors training program. CRM is based in safety (as opposed to a technical training program which describes how to perform specific job functions). It focuses on human capabilities and limitations with respect to human/system interfaces, operations, and system integration, which all focus on the safety of work. It is based on the idea that everyone wants everyone here to be able to go home at the end of the day with no injuries.”



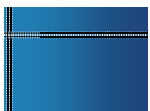
Click on mouse



REFER TO SLIDE AND EXPAND: “CRM is a process that addresses the entire crew and other related staff. It is a comprehensive system for improving crew performance and involves the entire crew and how they work as a team.”



Click on mouse



REFER TO SLIDE AND EXPAND: “CRM entails a heightened awareness of attitudes and behaviors of crewmembers and their joint impact on safety. Thus it looks directly at attitudes and behaviors.”



Next slide

** Facilitator Notes*

Introduction

CRM is.....

- **Team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely***
- **Forum that encourages individuals to examine their behavior and make adjustments to improve teamwork**
- **Focuses on effectiveness of the team rather than just the competence of individuals**

Crew Resource Management 19



OBJECTIVE OF SLIDE: *To continue to have participants understand in a broad conceptual manner, what CRM is.*

CRM is

REFER TO SLIDE AND EXPAND: “CRM provides a team-based framework through which to evaluate conditions, apply rules, and perform work tasks *safely*. It is looking at work from the perspective of a team rather than from an individual.”



Click on mouse

REFER TO SLIDE AND EXPAND: “CRM is a forum that allows individuals to examine their behavior and make individual decisions on how to improve teamwork. Part of working together as a team, and what we are going to talk about today, is realizing that you do work as part of a team and that your actions affect the members of your team. Being conscious of this is the first step to improving teamwork because it allows team members to think about how what they are doing is going to affect their team members. This understanding can help team members adjust the way they work in a team environment and their communication with their team. This, in turn, can greatly improve safety.”



Click on mouse

REFER TO SLIDE AND EXPAND: “A focus on the function of crewmembers as teams, not as a collection of technically competent individuals. For example, as we will talk about in a moment, CRM has been in place in the airline industry for several years. Prior to it being implemented, there were cases where senior captain would tell the co-pilot, “Listen, I’m the captain of this plane, I am going to fly it, do everything, and make all the decisions by myself.” These pilots would not listen to, take input from, or let the co-pilots be involved in the flight or decisions about the flight. There were many accidents as a result of this, and many times the last thing heard from the co-pilot on the black box recorder was, “I knew you were going to do that.” The captain was failing to use a valuable asset (highly-trained and experienced co-pilot). The co-pilot, who knew the captain was missing something that

affected the safety of the flight, himself, and the passengers, lacked the assertiveness to overcome the cultural pressure of “the captain is always right,” to point this out to the captain. Many of these pilots had the highest scores on tests of technical skills; thus they were some of the most technically competent pilots the airline had. However, they did not know how to work in a team environment, and that cost them their lives.”

Possible expansion: Compare and contrast how basketball players perform during the season with their team and how they usually play in an all-star game (with a collection of players from different teams). During the regular season, with practice each player learns teamwork and knows the ins and outs of his/her team. Thus, from the beginning to the end of the regular season, there tends to be a change from the group as a collection of individual players to a team. During an all-star game, players throughout the league are re-combined into other teams. Although the players on each all-star team are the best of the best, typically the all-star teams do not function very well as a ‘team.’ Thus many times the ‘all-star’ game is a very ‘sloppy’ game.

Next slide



** Facilitator Notes*

Introduction

History & Background of CRM

- Started in airlines
- Moved outside the cockpit
- Moved into other industries
- Similarity between tasks/teams
- National Transportation Safety Board recommends CRM for rail

Crew Resource Management 20



OBJECTIVE OF SLIDE: *To give participants background information on CRM.*

History/Background of CRM



SUGGESTED SCRIPT: “Before we get started explore some background on CRM.”

Started in the Airlines



Click on mouse



SUGGESTED SCRIPT: “Official CRM training started in the airline industry. CRM was first developed as cockpit resource management by the National Aeronautics and Space Administration (NASA) and commercial airlines a quarter century ago in order to combat the increasing numbers of aircraft accidents that were attributed to pilot error. Research into the causal factors of these accidents found that, in many cases, the actual performance failure that led to the crash was related to improper crew coordination or improper communication of critical information within the crew, rather than a lack of flying skill or technical knowledge on the part of the pilots. Thus CRM was created specifically to stop the kinds of airline accidents we just talked about on the previous slide. This early CRM involved leadership training for the captains and assertiveness training for the co-pilots.”

Moved Outside the Cockpit



Click on mouse



SUGGESTED SCRIPT: “Since that early work and positive results found as a result of CRM, CRM training and its concepts have evolved within commercial aviation to include not only pilots but the entire flight crew, air traffic controllers, ground crews, and aircraft maintenance personnel.”

Moved Into Other Industries



Click on mouse



SUGGESTED SCRIPT: “After seeing the successful results in the airline industry, other industries started to pick up CRM. Military aviation, tank, and shipboard crews have all adopted CRM training programs, so have commercial shipping, medical, nuclear power, and other industries. For example, a surgical team in the medical industry has to work together in order to perform an operation/surgery. Often, life threatening mistakes can occur as a result of miscommunication between the surgeon, anesthesiologists, and nurses (*give an example if possible*). In all cases, positive safety benefits have accrued from instituting formal training in core CRM skills, such as crewmember proficiency, improved communication and teamwork among crewmembers, conflict resolution, and maintaining situational awareness.”

Similarity Between Tasks/Teams



Click on mouse



SUGGESTED SCRIPT: “Many similar functions take place in these other industries and the airline industry. Many of these job tasks are very similar in their use of CRM-related activities (for example, situational awareness, communication, and teamwork). There are also similarities between all these industries in terms of the types and sizes of crews that operate and the interaction between members of those crews.

“As many of you know, the NTSB keeps a record of every accident in all transportation industries including the airline industry, marine/commercial shipping industry, and rail industry. They categorize accidents according to many different factors in order to get a better understanding of the exact causes of accidents and where problems are occurring. The FRA also keeps records of reported accidents and categorizes them by cause, injury or death count, and cost for repair.”

NTSB Recommends Rail CRM



Click on mouse



ASK: “Can you think of some reasons why NTSB recommended this for the rail industry?”

Get answers from participants.



SUGGESTED SCRIPT: “This is because everyone here works in a team/crew environment where a high level of situational awareness, communication, and teamwork is needed in order to accomplish the work safely. Also, similar to these industries, the railroad is a high consequence industry, meaning that if a team fails to function properly, there can be enormous negative consequences.”



SUGGESTED SCRIPT: “Specifically, it was after a rail accident at Butler, IN, in 1998 that NTSB recommended to FRA, the Association of American Railroads (AAR), the American Short Line and Regional Railroad Association (ASLRRA), Norfolk Southern Railway (NS) and other railroads to develop a “Train CRM” program. This recommendation was based largely upon the positive benefits that NTSB had seen from CRM programs in other transportation industries from CRM implementation.

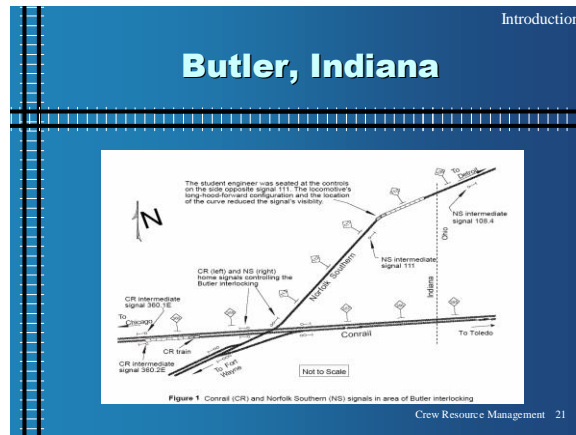
“Let’s go into a little more detail of that Butler, IN accident, so we can understand the event that really set this in motion.”

Next slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To go into more depth on the Butler, IN Example.*



SCENARIO: BUTLER, IN

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Butler, IN” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “Butler, IN” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario, questions, and some of the possible answers.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.



Click on mouse during the discussion to show several more pictures of accident scene. These pictures include a map of where the accident occurred, as well as the student engineer’s view of signal 111 from the locomotive cab.

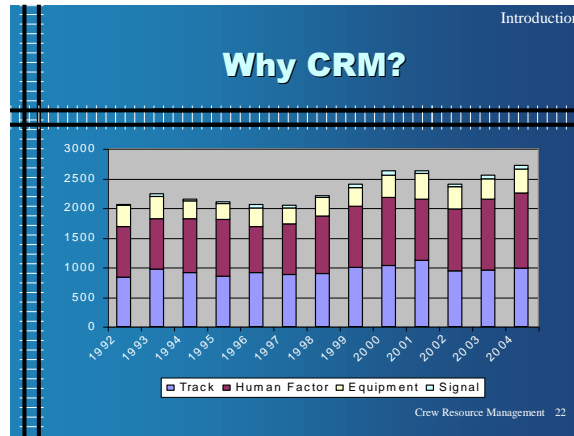


SUGGESTED SCRIPT: “Let’s look at some statistics on the number human factors accidents throughout the industry.”

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To show the proportion of human factors accidents in the rail industry.*

Why CRM?



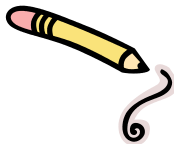
SUGGESTED SCRIPT: “As you can see, this graph shows the number of train accidents per year for the last 10 years. The axis on the left represents the number of accidents each year. The axis on the bottom represents each year. Each bar represents the total number of accidents that occurred that year in the rail industry.

“Each bar is also broken into different sections, representing the type of accident. The blue section at the bottom represents accidents that are caused by defects in track. The yellow at the top represents the number of accidents caused by equipment failure. The green at the very top (might be hard to see) represents the accidents caused by signal failures.

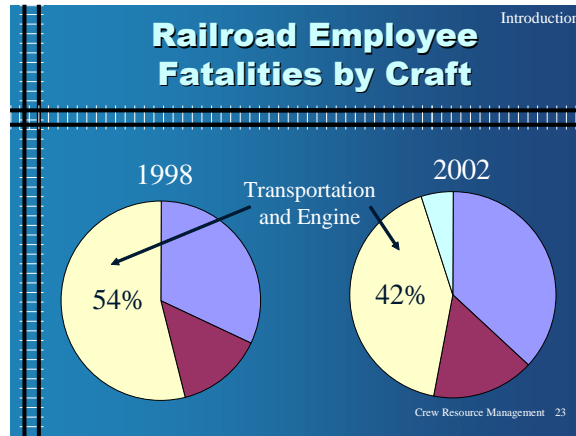
“This purple section represents the number of accidents caused by human factors. These are accidents often caused by failure to use proper CRM skills—the exact topic that we are talking about here today. Looking at the graph you can see that a human failure, that is failures of you and me, causes more accidents than track, signal, or equipment failure. In fact, in recent years the number of accidents caused by human factors alone are comparable to the number of accidents caused by track, signal, and equipment combined. Much of this trend can be attributed to improvements in the mechanical reliability of components in the other areas over time, resulting in human factors-caused accidents becoming a larger percentage of the total accident rate. This illustrates why we are here today to discuss some methods for tackling this cause of railroad accidents.”

** This graph was created from data gathered from the “Railroad Safety Statistics Interim Report, 2003,” published by FRA.*

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To show the proportion of human factors accident in the rail industry (by craft).*



SUGGESTED SCRIPT: “These two pie charts represent the fatalities that occurred on the railroad in the years 1998 (left pie chart) and 2002 (right pie chart). The pie chart is broken up into the percentage of fatalities by the craft. As you can see, transportation and engine have the highest percentage of fatalities of any of the crafts in the rail industry. This is typically true for almost all years.”

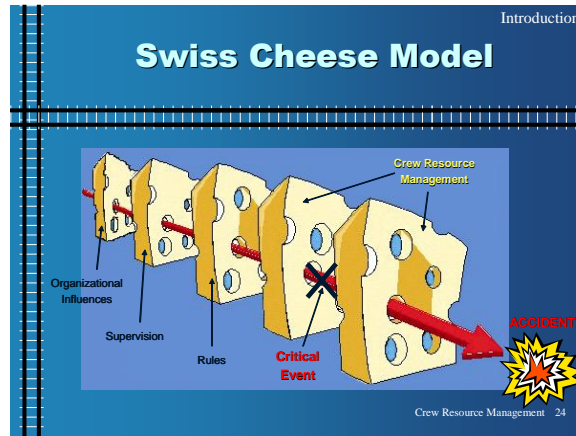


SUGGESTED SCRIPT: “Everyone in this room, as transportation and engine employees, has a lot to lose when an accident occurs. As we saw from the previous graph, most of these fatal accidents are caused by human error. That is why developing an understanding of CRM skills is so important for the group sitting in this room right now.”

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To show the participants the Swiss Cheese Model, which is a way to think about how accidents happen.*

** This graph is based on James Reason's (1990) Swiss Cheese Model/Approach to understanding human error, and it has been modified to be more understandable and relevant to the current audience. Reference: Reason, J. (1990). Human error. New York: Cambridge University Press.*



SUGGESTED SCRIPT: “We all know that when an accident occurs, it is very difficult to look back and point to one specific cause of that accident. There are usually several factors/causes that can add up and result in an accident. I realize that there are many factors involved in an accident, and I am sure all of you in this room realize that. Even the accident investigators like NTSB and FRA understand that. For example, when NTSB reports on a railroad accident, they list all the contributing factors of an accident, including organizational factors, supervisory factors, and human factors. As a result, NTSB reports can become very long due to the level of detail included. NTSB accident reports also give recommendations to the regulators (FRA), the organization (railroad), supervisors, and crews, stating what each can do to prevent these accidents from occurring in the future.

“The Swiss Cheese model reflects the idea that many different factors/causes can lead up to an accident. The reason for talking about it now is that throughout this program we are going to be talking about and going through, in detail, several accident scenarios to reinforce the CRM skills we are discussing. Because this is a CRM class, we are going to be concentrating on those causes and factors related to the crew. We are going to try to give you some ideas of what you can do to prevent accidents from occurring as a result of not working together as a team. It would do us no good to concentrate today's time on organizational factors because there is not much that you or I can do to change organizational factors. However, we can change the way we work together with our fellow crewmembers, which is what CRM is all about, and why we are here today.

“In this model, the red arrow is a potential accident. Each piece of cheese is a filter that would seek to block or prevent a potential accident from occurring. Imagine that there are lots of other potential accidents that are coming in from the top left of the model but are being blocked by the pieces of cheese (filters). The problem is that there are holes in the pieces of cheese where it is ineffective in blocking the accident. Each hole in a piece of cheese is a hole

in the filter, where an accident can get through. When a potential accident comes in from the left, it has the potential of being blocked by organizational influences, supervision, rules, or by effective CRM.

“Let’s talk about some of these filters. Let’s start with the organizational filter.”



ASK: “What are some of the things that an organization does in order to prevent accidents from occurring?”

Discuss organizational influences.

Organizational influences include:

- *Equipment (Holes–bad equipment)*
- *Facilities (Holes–poor facilities)*
- *Training (Holes– inadequate training)*
- *Funding (Holes– lack of funding)*
- *Design (Holes–poor design)*
- *Organizational Safety Climate (Holes–poor safety climate)*
- *Policies (Holes–unsafe Policies)*



ASK: “What are some of the things that a supervisor does in order to prevent accidents from occurring?”

Discuss supervisory influences.

Supervision includes:

- *Training (Holes–lack of training in a specific area)*
- *Leadership (Holes–lack of leadership)*
- *Motivation (Holes–lack of Motivation)*
- *Knowledge (Holes–does not give subordinates enough info, job/safety briefings, etc)*
- *Adherence to policies (Holes–lets subordinates break the rules)*



ASK: “How do rules prevent accidents from occurring?”

Discuss how rules prevent accidents.

Rules include:

- *Create Safe Standards (lack of rule or unsafe rule)*



ASK: “How does CRM prevent accidents from occurring?”

Discuss how CRM prevents accidents from occurring.

CRM includes:

- *Technical Proficiency (Holes–lack of technical proficiency)*
- *Situational Awareness (Holes–lack of situational awareness)*
- *Communication (Holes–lack of communication)*
- *Teamwork (Holes–lack of teamwork)*
- *Assertiveness (Holes–lack of assertiveness)*



SUGGESTED SCRIPT: “As you can see from the model, the importance of working together as a team and practicing good CRM skills is paramount to preventing accidents. First, as everyone in this room knows, you are the last defense in preventing an accident. You are the ones out there running the trains. Second, as you can see from the model, CRM has two chances to prevent an accident. First, it can prevent an accident by stopping an error from occurring in the first place. With train crews, for example, by communicating and working together as a team, it can prevent the running of a signal. Second, after the initial error (running of the signal), if the crew communicates, regains situational awareness, prioritizes, and works together as a team, an accident (collision) can be prevented.”

“So, even though we understand that there can be many factors involved in an accident, which are all important, what we are talking about today is CRM. The last two filters in the model. The last two ways to prevent an accident from occurring. This is what we in this room can have a direct effect on and what can make us safer and even save our lives.”

Next slide



** Facilitator Notes*

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Introduction

Benefits of CRM Practices

- **Increased safety**
 - Decrease errors that result in accidents
 - Accidents are costly
- **Intangible benefits**

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OBJECTIVE OF SLIDE: *To show the participants the overall benefits of CRM training.*

Increased Safety



Click on mouse



SUGGESTED SCRIPT: “As stated previously, CRM is a safety program, meaning the overall objective of this CRM training is to improve safety.”



Click on mouse



SUGGESTED SCRIPT: “How can the application of CRM techniques make the workplace safer? Well, CRM training makes the workplace safer because using CRM skills can decrease the occurrence or the impact of mistakes and errors which result in accidents. It has been shown to decrease the number of accidents related to human factors in other industries, and, as was shown in that previous graph, human factors remains a big contributor to accidents in the rail industry.”



ASK: “What are some of the results or outcomes of accidents? What do accidents cause?”

Get answers from participants.



Click on mouse



SUGGESTED SCRIPT: “We all know that accidents are costly. They cause injuries, loss of life, property damage, and lost time. In 2001, it cost the U.S. railroad industry as a whole over 74 million dollars to replace/fix the trains, cars, equipment, and/or track as a result of just human error in train operations. We all know train accidents are costly things. We also know that they can be fatal.”

** These statistics come from the FRA’s online accident data base. It can be found at <http://safetydata.fra.dot.gov/officeofsafety/Default.asp>.*

** Statistics about the cost of accidents and the number of fatalities at a particular railroad might make more of an impact in this section. You can search the FRA’s online accident database by railroad.*

Intangible Benefits



Click on mouse



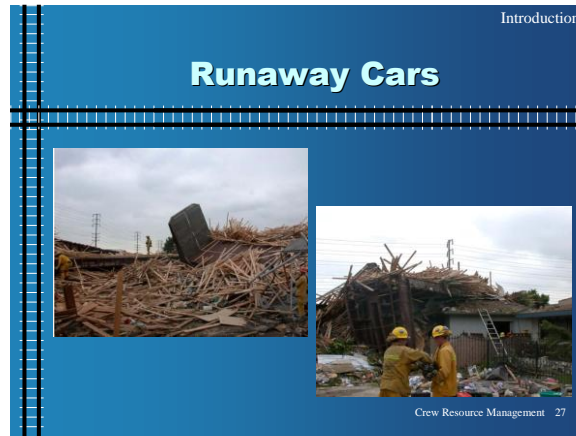
SUGGESTED SCRIPT: “Practicing good CRM techniques also has intangible benefits. For example, by practicing proper CRM techniques, a more relaxed and less stressful work environment can be created. An improved work environment can also have a positive impact on home life.”

** Add a personal example from the facilitator stating that when he/she works in these environments he/she likes going to work and enjoys work more than when working in a stressful environment.*

Next slide

** Facilitator Notes*





OBJECTIVE OF SLIDE: *To go through an example of a CRM-related accident.*

CRM-Related Accidents



SUGGESTED SCRIPT: “So now we know what a human factors accident is, and we know that effective CRM can help decrease these accidents and increase safety. However, before we start getting into the bulk of the program, I think we should actually look at some more real-life examples of human factors accidents in which the individuals involved did not practice good CRM.”

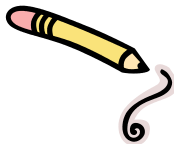


SCENARIO: RUNAWAY CARS

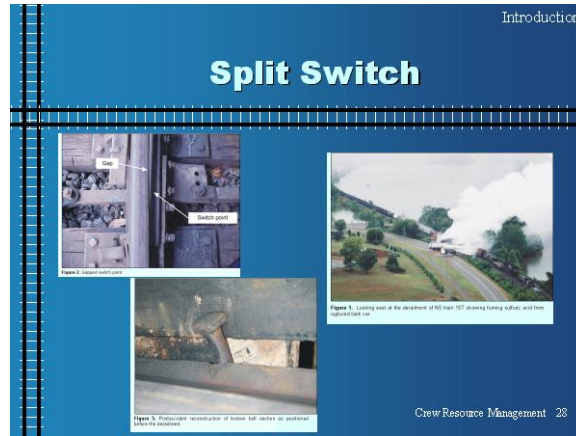
- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Runaway Cars” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Runaway Cars” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

The facilitator should encourage/cause the participants to evaluate for themselves exactly how this accident example is related to human factors and CRM. If dispatchers are included in the class, you may ask them to focus on Phase II of this scenario, which describes the reaction of the dispatch center to the runaway cars. If not, the facilitator may ask the participants to focus on Phase I and then describe Phase II for the entire class.

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To go through an example of a CRM-related accident.*



SCENARIO: SPLIT SWITCH

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Split Switch” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.
- Read the scenario titled “Split Switch” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.
- When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.

Figures on this slide

Figure 2. A gapped switch point.

Figure 5. Post-accident reconstruction of broken bolt section in position before the derailment.

Figure 1. Looking east at the derailment of NS train 15T showing fuming sulfuric acid from ruptured tank car.



ASK: “Do these examples give you a better understanding of the kinds of accidents and incidents that we are discussing about today?”



SUGGESTED SCRIPT: “Hopefully, these examples and your own experience will give you a general framework for understanding some of the topics and issues we are going to discuss today. Then you will be able to think about them in a more real sense, in light of your day to day work. We will have more examples throughout this program.”



SUGGESTED SCRIPT: “Before we go on to the next slide, I want to make one thing clear. Most of the time, when we make a mistake it doesn’t result in an accident like the ones we just discussed. The CRM techniques we will learn today also relate to the mistakes and errors we make that don’t result in these huge accidents. We need to realize that we are aiming for reducing mistakes and errors, regardless of whether they result in an accident, because sooner or later, the errors will result in an accident.”



ASK: “Can you think of a time when you were a part of a crew that made a mistake that did not result in an accident?” *WAIT!!! Don’t get answers from participants.* “Before we go on to the next slide let me give everyone a few seconds to think back to when we made an error that could have resulted in an accident but didn’t. I’m sure it has happened to everyone here.”

Next slide



** Facilitator Notes*

Introduction

Main CRM Elements

- **Technical Proficiency**
- **Situational Awareness**
- **Communication**
- **Teamwork**
- **Assertiveness**

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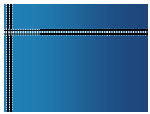


OBJECTIVE OF SLIDE: *To show participants the main elements of CRM.*

Main CRM Elements



SUGGESTED SCRIPT: “As stated at the beginning of the course, the content of this CRM course is broken into five different sections or modules. These are technical proficiency, situational awareness, communication, teamwork, and assertiveness. We are breaking the content of CRM up into these five modules in order to better understand each one; yet as you will see throughout the course they are all related to each other and intertwined.”



REFER TO SLIDE AND EXPAND:

“The first module is technical proficiency. It refers to knowing the equipment that you use and the procedures for using it so that you can execute the task. It also describes your knowledge of the rules and how to apply them.

“The second module or main area of CRM is situational awareness. In the railroad working environment, crews and individuals in those crews must be aware of the situation and the environment around them at all times. An understanding of how to be situationally aware, how to recognize when you are not, and how to regain situational awareness is an integral part of developing CRM skills and workplace safety.

“Next is communication. We all know what communication is, but it is **not** just talking to someone else. We are going to look at it more broadly. We define communication as the flow of information among all crewmembers. This way we can discuss things like implicit or understood communication, body language, assertiveness in communication, use of hand signals, two-way communication, and picking up cues from the tone in which people may speak. All of these relate to proper communication skills that will be helpful in the railroad operating environment.

“The fourth module is teamwork. Teamwork refers to the crew’s ability to work together to achieve some outcome. It is the idea that we all need to work together and make our individual performance support team performance.

“The final module is assertiveness. Being assertive entails being appropriately persistent, timely, clear, focused, and can include proposing a solution to a problem. Many times being assertive at the right time can prevent an accident from occurring. In this module we will talk about steps to take for assertive communication.”

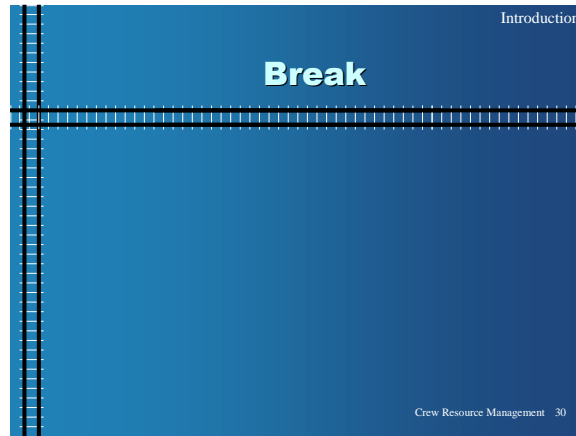


SUGGESTED SCRIPT: “As you might have already noticed, although technical proficiency, situational awareness, communication, teamwork, and assertiveness can be seen as five distinct elements, they usually interact with each other in the real working environment. For example, let’s say that you notice (situational awareness) that a new employee is having trouble working some piece of equipment (technical proficiency). You decide to call the conductor training the new employee and tell him that the new employee might need some more help (communication). However, the conductor doesn’t understand the importance of the situation; thus you use certain assertiveness techniques to communicate to the training conductor the urgency of the situation (assertiveness).”

Next Slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To be a placeholder for participants while taking a break.*

Allow participants to take a 10-15 minute break.



** Facilitator Notes*

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Technical Proficiency

Module 2: Technical Proficiency

Learning objective:

- **Name the three elements of technical proficiency as related to CRM practices**

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OBJECTIVE OF SLIDE: *To show the participants the learning objective of Module 2.*

Module 2: Technical Proficiency



SUGGESTED SCRIPT: “Let’s start in on module 2, technical proficiency. This will be the shortest of all of the modules today because this is where you currently get most of your training. However, we will talk about how an individual’s and a team’s technical proficiency can affect situational awareness, communication, and teamwork. After you have completed this module, you should be able to name the three elements of technical proficiency as related to CRM practices.”

Next Slide



** Facilitator Notes*

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Technical Proficiency

Elements of Technical Proficiency

1. Knowing your equipment
2. Knowing your procedures
3. Skilled performance

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OBJECTIVE OF SLIDE: *To show the three elements of technical proficiency.*

Three Elements of Technical Proficiency



SUGGESTED SCRIPT: “Technical proficiency means just that. In order to practice good CRM skills, everyone first must be good at doing all the tasks of his/her jobs. One needs to be thorough and able in three different areas: equipment, procedures, and execution.”

Knowing Your Equipment



SUGGESTED SCRIPT: “You must know your equipment; for example, an engineer must know how to use airbrakes, or how to use the radio. The conductor must know how to use the radio as well. The dispatcher must know how to use the dispatch computer system.”

Knowing Your Procedures



SUGGESTED SCRIPT: “You need to know your procedures; for example, engineers need to know the procedure involved in setting up the airbrakes, or the federal locomotive inspection. Conductors need to know the procedures involved in taking and reading back train orders, while dispatchers need to know the procedures involved in logging train orders.”

Skilled Performance



SUGGESTED SCRIPT: “Lastly, each one of you needs to be able to actually physically perform the tasks.”



SUGGESTED SCRIPT: “In order to be technically proficient, we need all three of these together. We cannot work safely, and perhaps not work at all, if we are missing even one. For example, perhaps you know the equipment and can perform the task; however, if you don’t know the proper procedures for using the equipment or performing the task, it can cause accidents and injury.

“Many of us assume that each individual in a work team (or crew) is proficient at performing the tasks making up his/her job. Technical proficiency is a key component to CRM because it is easy to see that in order for individuals to perform their job safely, they must know both their equipment and procedures and be able to execute their job properly. For example, it does no good for a team to have good communication skills, have situational awareness, and work well together if the individual members of the crew do not know how to do their job properly. Thus, technical proficiency is fundamental to CRM. However, because much of the other training provided by each railroad is focused on teaching you about the specific technical aspects of your job, we do not deal with these subjects in great detail in CRM training.”

Next slide



** Facilitator Notes*

Technical Proficiency

Technical Proficiency

- **Evaluating the technical proficiency of fellow crewmembers**
 - New rules/procedures
 - New crewmembers

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OBJECTIVE OF SLIDE: *To show participants that at times they need to evaluate or assess the technical proficiency of fellow crewmembers.*



SUGGESTED SCRIPT: “An important dynamic of technical proficiency and its relation to CRM is your ability to evaluate (or assess) the technical proficiency of your fellow crewmembers. For example, sometimes new equipment or procedures are implemented here at the railroad. These can be large changes like remote control or smaller changes like filling out paperwork differently. Changed procedures and/or equipment, no matter how large or small, will affect the situation, communication, and teamwork of individuals in one or more work groups. Such changes have effects on the practices encouraged by CRM.

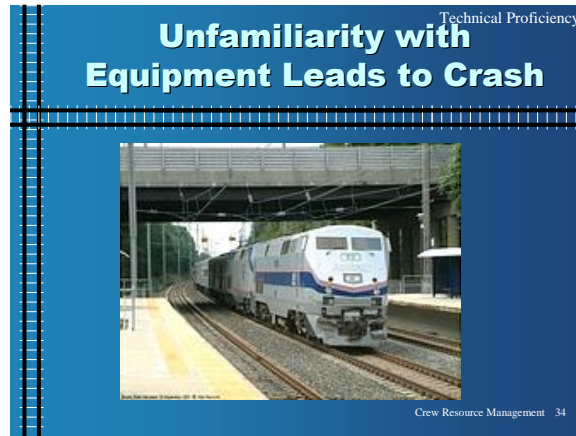
“Likewise, many times the technical proficiency of new employees is not at peak levels. Learning also occurs on the job. These individuals may not have as much knowledge about equipment and procedures, and do not execute the task like an experienced engineer, conductor, or dispatcher would. Similarly, even experienced members of a team have a tendency to depend on their experience; they may not know the proper procedures and can get in a habit of executing a task incorrectly.

“Part of working as a team and having good CRM skills is being aware of team members who are lacking in technical proficiency and knowing how to effectively communicate this to all the team. We will talk about this later in the program.”

Next Slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To give an example of a real-life incident where unfamiliarity with equipment leads to a crash.*



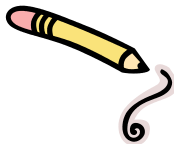
SCENARIO: UNFAMILIARITY WITH EQUIPMENT LEADS TO CRASH

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Unfamiliarity With Equipment Leads To Crash” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Unfamiliarity with Equipment Leads to Crash” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “Lets go on to module 3, situational awareness.”

Next slide



** Facilitator Notes*

Situational Awareness

Module 3: Situational Awareness

Learning objective:

- **Understand situational awareness and how job safety is affected by circumstances both on and off the job**

Crew Resource Management 35



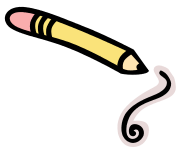
OBJECTIVE OF SLIDE: *To show the overall learning objective of situational awareness.*

Module 3: Situational Awareness



SUGGESTED SCRIPT: “Our third module is about situational awareness, a factor very fundamental to CRM success. When you complete this module, you should have an understanding of situational awareness and how job safety is affected by circumstances both on and off the job.”

Next slide



** Facilitator Notes*

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Situational Awareness

Specific Learning Objectives: Situational Awareness

- State the two elements of situational awareness
- Describe how a team/crew's perception of the situation is adopted
- Describe personal and team cues that indicate potential safety breakdowns

Crew Resource Management 35



OBJECTIVE OF SLIDE: *To show the specific learning objectives of the situational awareness module.*

Specific Learning Objectives: Situational Awareness



SUGGESTED SCRIPT: “When we are finished with this module, each of you should be able to....”



Click on mouse



REFER TO SLIDE: “State the two elements of situational awareness.”



Click on mouse



REFER TO SLIDE: “Describe how a team/crew’s perception of the situation is adopted.”



Click on mouse



REFER TO SLIDE: “Describe personal and team cues that indicate potential safety breakdowns.”

Next Slide



** Facilitator Notes*

Situational Awareness

Specific Learning Objectives: Situational Awareness (cont.)

- Describe the potential impact of stress and fatigue on worker perceptions of developing situations
- Explain to a co-worker why maintaining situational awareness is so important to job safety
- List four good habits that individuals can develop to maintain situational awareness on a team

Crew Resource Management 36

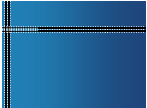


OBJECTIVE OF SLIDE: *To show more of the specific learning objectives of the situational awareness module.*

Specific Learning Objectives: Situational Awareness (cont.)



Click on mouse



REFER TO SLIDE: “Describe the potential impact of stress and fatigue on worker perceptions of developing situations.”



Click on mouse



REFER TO SLIDE: “Explain to a co-worker why maintaining situational awareness is so important to job safety.”

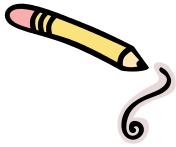


Click on mouse



REFER TO SLIDE: “List four good habits that individuals can develop to maintain situational awareness on a team.”

Next Slide



** Facilitator Notes*

Situational Awareness

Situational Awareness

1. Reality versus Perception of Situation
2. Situational Cues
3. Steps in Maintaining Situational Awareness
4. Steps in Regaining Situational Awareness
5. Maintaining and Recognizing a Loss of Situational Awareness
6. Fatigue

Crew Resource Management 37



OBJECTIVE OF SLIDE: *To show participants the outline of module 3: situational awareness.*



SUGGESTED SCRIPT: “The idea of situational awareness is at the heart of effective CRM practices. To better understand what is meant by the term situational awareness, we want to visit five aspects of the topic.”



REFER TO SLIDE:

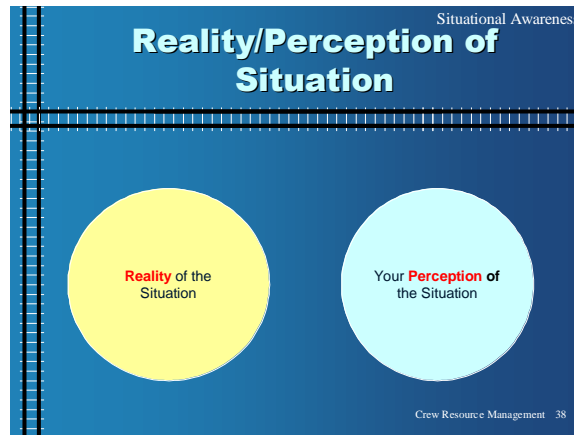
1. Reality vs. Perception of Situation
2. Situational Cues
3. Recognizing a loss of Situational Awareness
4. Regaining Situational Awareness
5. Maintaining Situational Awareness
6. Fatigue

Next Slide

** Facilitator Notes*



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OBJECTIVE OF SLIDE: *To familiarize participants with the concepts of reality of the situation and perception of the situation.*

Beginning Summary of Situational Awareness



SUGGESTED SCRIPT: “Situational awareness is knowing what is going on in your environment around you. This includes knowing where you are in your environment, as well as where others in your crew are. It is recognizing and constantly taking in cues or information from your environment. Besides simply taking in cues, it is also being constantly aware of what each cue or combination of cues is telling you about the current situation or the future situation in which you will find yourself. This is the essence of defensive driving when operating your personal vehicle. It is an understanding of how cues and environment will likely change in each future slice of time, without assuming that they are always going to act in the same way.

“There are two conceptual elements of situational awareness. An understanding of these elements and how they interact will help you understand situational awareness as a whole. The two elements of situational awareness are...”

- The reality of the situation
- Your perception of the situation

“Your goal should always be to get your perception to match reality.”

Reality of the Situation



SUGGESTED SCRIPT: “The reality of the situation is how the situation really is. It is what is actually going on around you. Unlike the perception of the situation, it is not influenced by you or your take on things.”

Perception of the Situation



SUGGESTED SCRIPT: “Your perception of the situation is exactly that—how **you perceive** the situation and the environment around you. It is your belief about what is going on, whether conscious or unconscious. You create your perception of the situation by taking in, gathering, and interpreting information and environmental cues. Of course, missing cues or misinterpreting cues can cause bad things to happen.”



ASK: “Does everyone understand the difference between these concepts?”

Grasping this concept will be important to understanding much of the rest of this module.



ASK: “Using these two concepts, how do accidents occur?”

Have class figure it out

- *Example of answer: When we do not perceive the situation correctly. When our perception of the situation is not in line with the reality of the situation.*



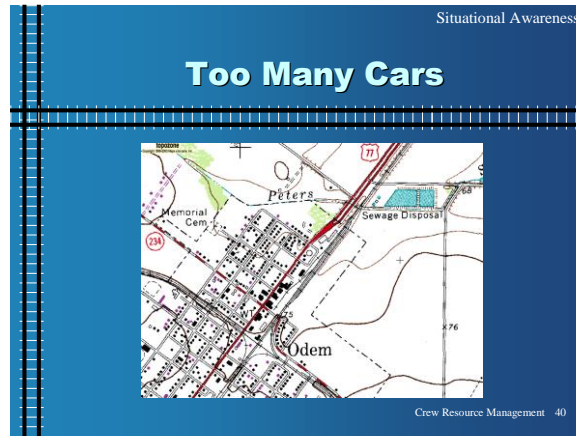
SUGGESTED SCRIPT: “Exactly, when one’s perception of the situation is not in line with the reality of the situation is when there is increased potential for accidents to occur.

“Now let’s go through a scenario/accident that was caused because a crew’s perception of the situation was not in line with the reality of the situation.”

Next slide

** Facilitator Notes*





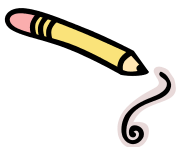
OBJECTIVE OF SLIDE: *To give participants an example of an accident caused by a loss of situational awareness.*



SCENARIO: TOO MANY CARS

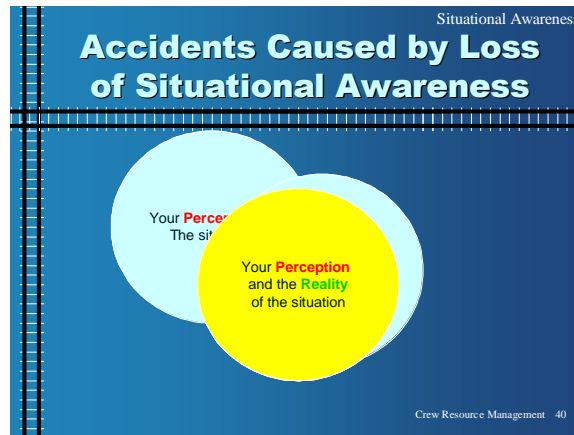
- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Too Many Cars” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Too Many Cars” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*

Next slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To explain how we have situational awareness problems when a crew's perception of the situation is not in line with the reality of the situation, which is also called a loss of situational awareness.*



SUGGESTED SCRIPT: “In the example we just talked about, here is the reality of the situation.”
Point to Reality of the Situation circle.



SUGGESTED SCRIPT: “The train is 136 cars long and extends outside the yard limits.”



Click on mouse

Point to Perception of the Situation circle.




SUGGESTED SCRIPT: “And here is the train crew's perception of the situation. The train is 64 cars long, less than half its actual length, and it is inside the yard limits.”

Point to the part of the figure that is non-overlapping in the reality circle.



SUGGESTED SCRIPT: “The non-overlapping part is the part that we have wrong. This is what contributes to an accident. Why? Because we think, behave, and make decisions based on our perception of the situation. As one's perception of a situation gets farther away from reality—this area gets bigger—and individual and team actions, because they are based on perceptions, become errors—and errors cause accidents.



“For example ( *Click on mouse*), here one's perception of the situation is fairly close to matching the reality of the situation. You are aware of most cues in the environment and that human error accidents are less likely to occur.

“However, what we are striving for is this--”



Click on mouse



SUGGESTED SCRIPT: “The goal is for our perception of the situation to perfectly overlap the reality of the situation. Crewmembers need to be aware of all environmental cues so that they can better predict what is going to occur and make better decisions. This will lead each crewmember to be cognizant of those environmental characteristics that we must be watched carefully in order to be safe in daily work activities.”

Team Situational Awareness



SUGGESTED SCRIPT: “Each individual has his/her own perception of the situation, but you are not working out there by yourself. You are working out there as a member of a team. This is important in understanding team situational awareness. There is one reality of the situation; yet there are as many perceptions of the situations as there are members of your team. Usually, each crewmember’s perception of the situation varies to a certain degree, and each covers a slightly different area of the reality of the situation (remember the circle). Thus as a team, you have a better chance of discovering the true reality of the situation than you do as an individual. However, this will not occur unless you communicate with your fellow team members your unique understanding of the situation (what is going on) and ask for their understanding of the situation. If you are working within a crew, but no one is communicating, you can fail to benefit from others’ useful knowledge and errors can occur. On the other hand, if one team member notices something that the other team members need to know to avoid error, that team member can appropriately communicate the information and prevent the error from occurring.”



SUGGESTED SCRIPT: “Let’s talk a little more in depth about cues.”

Next slide

** Facilitator Notes*

Situational Awareness

Cues

- **Environmental**
 - **Equipment**
 - **Crewmember**
- **Personal**

Crew Resource Management 41



OBJECTIVE OF SLIDE: *For participants to gain knowledge of the different types of environmental and personal cues.*

Cues



SUGGESTED SCRIPT: “So as we have just seen, human factors accidents occur when our perception of the situation does not equate with the reality of the situation. We know this sometimes happens because we are not acquiring all the cues that we need. Likewise, our perception could fail to be in line with reality because we are judging the cues incorrectly. We are getting the cues, but we are not looking at them or evaluating them correctly.

“Before we can figure out how to acquire more cues and how to read those cues appropriately, we must understand the different kinds of situational cues.

“There are cues that can be used to obtain a better understanding of the reality of a situation, and there are cues that help us to understand our own or other’s perception of situations.

“There are two main types of cues—those are the cues that happen outside of us and the ones that happen inside of us. Environmental cues are cues that happen outside of us, while personal cues are within us as a person.

“Two principal environmental cues are equipment cues and crewmember cues.”

Equipment Cues



SUGGESTED SCRIPT: “Equipment cues come from all the different pieces of equipment that you use. In the locomotive cab, a lot of the cues you get are from the equipment we use. Some examples of equipment cues that a train crew gets are train speed, mile markers, whistle boards, approaching signal, air brake pipe pressure, horn, alarm bell, torpedo detonation, and fuseses.”



Crewmember Cues

SUGGESTED SCRIPT: “Crewmember cues are the information you get from fellow crewmembers. We all know that when working as a team, fellow crewmembers are important sources of information. They are important resources. Fellow crewmembers often provide you with information you need to know in order to complete your job and complete it well. Some examples of crewmember cues are a conductor giving the engineer _____, or the engineer giving the conductor _____.”

Personal Cues



SUGGESTED SCRIPT: “The biggest personal cue that makes up our perception of the situation is our experience. Our experience leads us to have expectations about the situation. These expectations help us make prepare for a given situation.”

Next Slide



** Facilitator Notes*

Situational Awareness

Are Cues Valid?

- Are equipment, crewmember, and personal cues always correct?

Crew Resource Management 42



OBJECTIVE OF SLIDE: *To have participants question the validity of the cues they use to make up their perception of the situation.*



SUGGESTED SCRIPT: “So we use cues from our equipment (lights, indicators, and sounds), cues from our fellow crewmembers (communication information), and cues from ourselves (expectations based on our experience). We use all of these cues to make up our perception of the situation. However, we should not completely base our decisions on these cues and assume that they are always valid and correct. Often cues can be incorrect, which can cause our perception of the situation to be quite a bit off from the reality of the situation.”

Equipment



SUGGESTED SCRIPT: “For example, equipment—how do we know that the information we get from our equipment is correct? First, we should keep the equipment in good shape and make notes when there are problems. If you know a piece of equipment does not always work correctly, you should be wary of the information you get from that equipment and perhaps double check information from another source (for example, another crew member).”

Crewmembers



SUGGESTED SCRIPT: “Many times crewmembers do not give valid or correct cues. For example, sometimes there can be miscommunication between crewmembers. It is important to double check or repeat back important information to make sure you understand it correctly. We will go into more detail on crewmember cues in the next module, communication. Another reason crewmember cues or information might not be valid is that they might be complacent, fatigued, and/or under stress themselves. We will talk about some of the signs of fatigue and what to do when you or a crewmember are fatigued in a moment.”



Personal Cues

SUGGESTED SCRIPT: “As stated previously, besides environmental cues and crewmember cues, there are also personal cues that create our perception of the situation. These personal cues often involve deviations from our expectations and are based on our past experiences. These expectations are usually helpful because they allow you to plan for what is going to occur in the future. However, sometimes we rely too heavily on our expectations and become complacent. When things change from what has happened in the past, our expectations can be incorrect, and we need to be ready to regain our situational awareness. Remember, don’t rely entirely on your past experience and expectations. We all know that situations can change quickly, especially in the railroad environment.

“Next we will talk about some steps you can take to maintain situational awareness.”

Next Slide



** Facilitator Notes*

Situational Awareness

Steps in Maintaining Situational Awareness

- Planning and preparing
- Avoiding distractions
- Distributing workload
- Prioritizing your decisionmaking
- Communicating with your crewmembers
- Recognizing a deteriorating situation

Crew Resource Management 43



OBJECTIVE OF SLIDE: *To show the participants how to maintain situational awareness.*

Steps In Maintaining Situational Awareness



SUGGESTED SCRIPT: “There are several things that you can do to maintain your situational awareness.”



Click on mouse



SUGGESTED SCRIPT: “The first step in maintaining situational awareness is to plan and prepare. Your plan is the foundation on which you analyze different cues in the environment. You need to constantly update your plan as different situational cues become available.”



ASK: “What is the one thing that everyone here does every day in order to plan and prepare?”

Get answers from group.

Answer: Conduct a job briefing.



SUGGESTED SCRIPT: “Each day we have a job briefing. The job briefing is an important component of planning and preparing for the day’s work. Job briefings help define crewmembers’ responsibilities and provide a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. We will talk more about job briefings later in the day.”



Click on mouse



SUGGESTED SCRIPT: “You can also better maintain your situational awareness by avoiding distractions. When we talk about distractions, these are environmental distractions that are not relevant to the task at hand. When we become distracted by cues that are not relevant to the task, it hinders our ability to pay attention to cues that are relevant to what we are doing.

“There are several different kinds of distractions, including personal distractions, task distractions, and mechanical distractions. Personal distractions include being hungry, fatigued, or feeling ill. We can also be distracted by things in our personal or home life (for example, a family member being sick). Task distractions include radio communication, filling out paperwork, and other things you need to do as part of your job. These things need to be done as part of your job; however, do not let them distract you from some other task that you are supposed to be performing at the time. Mechanical distractions can lead to accidents. For example, suppose a small light on the operator’s console goes out. Trying to fix this small problem in the cab can cause us to lose situational awareness, for example missing a signal. Don’t get preoccupied with a single event, and forget about the big picture. Similarly, don’t mull over a past situation, and forget about the present situation.”



ASK: “If resetting an engine alarm in the cab circuit breaker cabinet causes you to miss a signal and you have a head on collision with another train—Do you think this goes down in the records as caused by mechanical failure (the alarm needing to be reset) or human error?”



SUGGESTED SCRIPT: “You had better believe it is human error, so don’t dwell on a problem.”

Other examples of distractions:

Example #1: On September 11, 2001, an engineer was listening to his radio of news coverage of the terrorist attacks. He ran a signal and collided with another train.

Example #2: In the Clarendon Head-On Collision scenario (located in the communication section of the transportation track), the engineer was distracted by a cell phone call and did not get the track warrant information, running a signal, and colliding with another train.



Click on mouse



SUGGESTED SCRIPT: “Another way to maintain situational awareness is to distribute your workload. The first step is to recognize when you are being overloaded with too many tasks at once. We can be overloaded in several ways, including mental overload and physical overload. Mental overload can occur when we are receiving too much information to be able to take it all in at once. Physical overload occurs when we try to physically do too much at one time. When we become mentally or physically overloaded, it can compromise our safety and the safety of our fellow crewmembers.

“When we are being overloaded, we need to distribute our workload. The first step in this is to admit to yourself and others when you are being overloaded. Many times we pride ourselves on taking on many tasks at once; however, this can quickly become too much. We can distribute our workload by working on just the tasks that need to be accomplished now and saving the less important tasks for later. We can also ask for help from a co-worker. If you constantly feel overloaded, you can talk to your supervisor about other ways to prevent an unsafe situation.”



Click on mouse



SUGGESTED SCRIPT: “Prioritizing your decisionmaking can also help you maintain situational awareness. You have to make many decisions every day about the course of action to take in a specific situation, and the quality and timeliness of those decisions is of the utmost importance. In order to prioritize your decisionmaking, you need to first assess the situation. This involves defining the nature of the problem, determining how much time is available for dealing with the problem, and figuring out how much risk is involved, both immediately and in the future. After assessing the situation, choose a course of action. Before choosing, you should think about the risks and perhaps consult with your other team members. Communicating with other team members can give you insights into the decision that you might have missed.”

** Later in the program we will talk about some of the benefits of team decisionmaking.*



SUGGESTED SCRIPT: “In order to maintain your situational awareness it is imperative that you communicate with your fellow crewmembers. This relates to what we talked about earlier in this module, namely team situational awareness. Communicating what you perceive in the environment, and different cues that you pick up on to other members of the team/crew increases the team’s overall situational awareness. Crews who communicate well usually make fewer errors because their assessment of the situation is more accurate. The crew has a better chance of getting their perception of the situation closer to the reality of the situation when they communicate with each other.”

“There are three questions you can ask yourself that will help you maintain situational awareness through communication. Ask...”

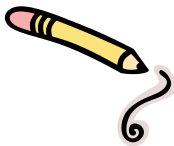
1. “What do my fellow crewmembers know that I need to know?
 - “If you realize that they know something that will help you do your job or will allow you to do it more safely, ask your team members for that information.”
2. “What do I know that they need to know?
 - “If you know something that you believe would help your fellow crewmembers perform their jobs more efficiently or safely, you need to speak up and communicate the information to them.
3. “What do none of us know that we need to know?
 - “It is good to ask yourself this question periodically during work. Sometimes we miss information or overlook something. By asking ourselves this question, it might help us determine what it is we are missing and allow us to go about getting that information.”



SUGGESTED SCRIPT: “Recognizing a deteriorating situation as early as possible is also a way to maintain situational awareness. Acknowledging your personal limits allows you to better recognize a deteriorating situation. Communicating to fellow crewmembers when you are fatigued, under stress, complacent, confused, or not thinking ahead will help the crew as a whole recognize a deteriorating situation at its beginning stages. Many times our instinct tells them that they have lost situational awareness, even before we can consciously point out that something is wrong. Remember, if it doesn’t feel right, it probably isn’t. You need to trust your instincts.

“In the next slide, we will talk more steps you can take to regain situational awareness once you have realized you have lost it.”

Next Slide



** Facilitator Notes*

Situational Awareness

Steps in Regaining Situational Awareness

- **Communicate**
- **Resolve**
- **Monitor**

Crew Resource Management 45



OBJECTIVE OF SLIDE: *To show the participants steps to take to regain situational awareness.*



SUGGESTED SCRIPT: “So far we have talked about a variety of factors that could lead to losing situational awareness. These include failing to plan/prepare, being distracted, being mentally or physically overloaded, not prioritizing your decisionmaking, dwelling on a problem, or not communicating with your fellow crewmembers. So, how do we regain situational awareness? The first step is to admit that we have lost it. It is often difficult to admit to oneself, or to others, that we have lost situational awareness; however, it is very important that we do so.”



REFER TO SLIDE AND EXPAND: “The three steps in regaining situational awareness are (1) communicating, (2) resolving, and (3) monitoring.”

- 1) **Communicate:** “When you first realize that you have lost situational awareness, you need to communicate to your fellow crewmembers. This will allow them to help you regain it.”
- 2) **Resolve:** “You must determine exactly how you lost situational awareness and resolve the problem. You will need to then search for information and cues in the environment so that you can regain situational awareness.”
- 3) **Monitor:** “Lastly, you should monitor the issue or problem that led you to lose situational awareness and analyze why it happened. In order to prevent the same problem from happening again, you should talk to your fellow crewmembers about ideas on how to not allow it to happen again.”



SUGGESTED SCRIPT: “Now let’s talk about when we are most likely to maintain, or recognize a loss of, situational awareness.”

Next Slide



** Facilitator Notes*

Situational Awareness

Maintaining and Recognizing a Loss of Situational Awareness

- **Most likely to maintain or recognize a loss of situational awareness when we**
 - **Operate under low stress**
 - **Request and accept feedback from fellow crewmembers**
 - **Develop skills for questioning our own knowledge and experience**
 - **Are not fatigued**

Crew Resource Management 45



OBJECTIVE OF SLIDE: *To show participants when they are most likely to maintain, and recognize a loss of situational awareness.*

Maintaining or Recognizing a Loss of Situational Awareness



SUGGESTED SCRIPT: “We are most likely to maintain or recognize a loss of, situational awareness when we...”



REFER TO SLIDE AND EXPAND:

- “Operate under low stress. Stress can affect our physical and mental health. We can become fatigued, depressed, or have a variety of symptoms like headaches, digestive, and heart problems. This can cause us to lose situational awareness and not recognize that we have lost it. By working under low stress, we are more likely to maintain and recognize a loss of situational awareness. We will talk more about stress and fatigue and its effect on us in a moment.”



REFER TO SLIDE AND EXPAND:

- “Request and accept feedback from fellow crewmembers. Feedback is very important when working together as a team. It is sometimes difficult to request feedback about behaviors and decisions; however, it is essential for a high performance team. Accepting feedback can also be difficult. Nevertheless, we should take input from our fellow crewmembers into consideration when working in a high consequence industry, not just the railroad.”

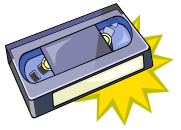


REFER TO SLIDE AND EXPAND:

- “Lastly, we are most likely to maintain or recognize a loss of situational awareness when we are not fatigued.”



SUGGESTED SCRIPT: “Let’s watch a short video related to fatigue.”



VIDEO: *Show CRM Video Clip 2–Fatigue*



ASK: “Did the worker want to admit he was fatigued?”

Possible answers: No

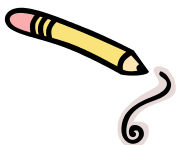


SUGGESTED SCRIPT: “The worker did not want to admit that he was fatigued, even though he was yawning and giving signs of being fatigued. The good thing was the foreman was assertive enough to take control of the situation and require that they take a break. We will go into more depth on assertiveness later in the day.”



SUGGESTED SCRIPT: “Let’s get into more detail about fatigue and its effects.”

Next slide



** Facilitator Notes*

Fatigue

- What is fatigue?
- What are some factors that lead to fatigue?
- What are some specific characteristics of railroading that could potentially lead to fatigue?
- What are some symptoms of fatigue?



OBJECTIVE OF SLIDE: *To explain the concept of fatigue.*



SUGGESTED SCRIPT: “One issue associated with recognizing a loss of situational awareness is fatigue.”



SUGGESTED SCRIPT: “Studies show that chronic fatigue affects 80 percent of all shift workers. As we stated earlier in the program, fatigue itself has been the cause of nearly one-third of human factor rail accidents since 1985, which has cost nearly \$50 million in damage since then. Fatigue cannot only cause a loss of situational awareness, but also lead one to not recognize that there is a loss of situational awareness.”



ASK: “What is fatigue?”

(Answers might include: being tired, not thinking properly, being exhausted)



SUGGESTED SCRIPT: “Cognitive fatigue is the deterioration of a person’s mental capacities or physical energy. Thus it can be both mental and physical. Mentally it affects one’s decisionmaking, reason and judgment, and the ability to remember and process contextual information. Physically it can slow down our response time.”



ASK: “What are some factors that affect fatigue?”

(Answers might include: how much you sleep, the environment, how much you eat)



SUGGESTED SCRIPT: “Some factors that affect fatigue are how much sleep or rest you get, the time of day/circadian affects, your health including any medications you might be taking, alcohol, stress, the environment, and nutrition. There are lots of factors that have an effect on fatigue. Remember that all of these factors are cumulative, meaning that they add up.”



ASK: “What are some specific characteristics of railroading that could potentially lead to fatigue?”

(Potential answers could include: shift-work, monotony, changing workloads, irregular meal times, etc.)



SUGGESTED SCRIPT: “Much of the work on the railroad is shift work. Shift work can go against the body’s natural sleep-wake cycle. This can cause difficulty falling asleep, a shorter sleep cycle, and other physical problems. Lack of quality sleep is one of the biggest fatigue factors for shift workers. Studies show that chronic sleep problems affect 60 percent to 80 percent of all shift workers (including railroaders). The workload for employees on the railroad is also constantly changing, which can increase fatigue. Similarly, when working on the railroad many times you don’t get to eat on a regular schedule. This can also cause fatigue. Work on the railroad in general is full of conditions that can lead to fatigue.”



ASK: “What are some symptoms of fatigue?”

(Potential answers could include: being tired, forgetfulness, lack of response, etc.)



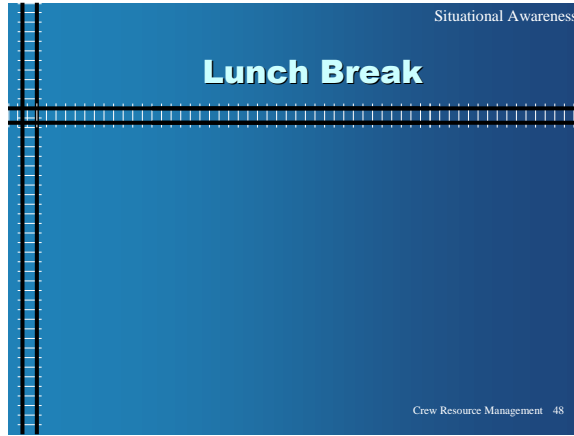
SUGGESTED SCRIPT: “Some symptoms of fatigue are forgetfulness, impaired or poor decisionmaking, slowed reaction time, poor performance and communication, being fixated, apathetic and lethargic, having a bad mood and nodding off.”

“Speaking of being fatigued, let’s take a lunch break.”



Next Slide

** Facilitator Notes*



OBJECTIVE OF SLIDE: *As a placeholder as participants eat lunch.*

Eat Lunch

Next Slide



** Facilitator Notes*

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Situational Awareness

Module 4: Communication

Objective: Know techniques and attitudes that foster effective communication within and between teams

Crew Resource Management 49



OBJECTIVE OF SLIDE: *To show participants the objectives of this module on communication.*



VIDEO: *Show CRM Video Clip 3–Bad Communication*



ASK: “Does this type of communication ever happen on the railroad? With new employees?”



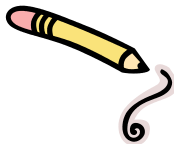
Click on mouse

Module 4: Communication



SUGGESTED SCRIPT: “The fourth module is communication. When we complete this module, we should know techniques and attitudes that foster effective communication within and between teams.”

Next slide



** Facilitator Notes*

Learning Objectives: Communication

- List six ways information should be communicated in order to be effective
- Demonstrate techniques used in two-way communication
- Explain the pros and cons of different non-face-to-face communication

Crew Resource Management 49



OBJECTIVE OF SLIDE: *To go through the specific learning objectives of the communication module.*

Specific Learning Objectives: Communication



SUGGESTED SCRIPT: “When finished with this module, you should be able to....”



Click on mouse



REFER TO SLIDE: “List six ways information should be communicated in order to be effective.”



Click on mouse



REFER TO SLIDE: “Demonstrate techniques used in two-way communication.”



Click on mouse



REFER TO SLIDE: “Explain the pros and cons of different non face-to-face communication methods.”

Next slide



** Facilitator Notes*

Communication

Learning Objectives: Communication (cont.)

- List some ways that new technologies can change communication patterns
- Illustrate good and bad techniques for communicating in a job briefing

Crew Resource Management 51



OBJECTIVE OF SLIDE: *To continue to explain to participants the specific learning objectives of the communications module.*

Specific Learning Objectives: Communication (cont.)



SUGGESTED SCRIPT: “When you are finished with this module, you should also be able to...”



Click on mouse



REFER TO SLIDE: “List some ways that new technologies can change communication patterns.”

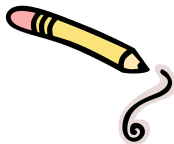


Click on mouse



REFER TO SLIDE: “Finally, illustrate good and bad techniques for communicating in a job briefing.”

Next slide



** Facilitator Notes*

Communication

Outline of Module

- Clarendon example
- Oral communication
- Two-way communication/active listening
- Other communication methods
 - Radio/written/verbal/hand signals
- Job briefing

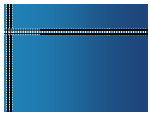
Crew Resource Management 51



OBJECTIVE OF SLIDE: *To outline module 4: communications.*



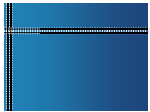
SUGGESTED SCRIPT: “In this module we will discuss...”



REFER TO SLIDE: “A train accident that occurred in Clarendon, Texas”



Click on mouse



REFER TO SLIDE: “oral communication”



Click on mouse



REFER TO SLIDE: “Two-way communication/active listening”



Click on mouse



REFER TO SLIDE: Other communication methods like radio/written/hand signals



Click on mouse

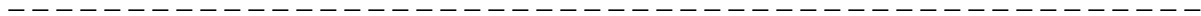


REFER TO SLIDE: Job briefing

** Note: This module is not only about communicating with other members of your crew, but also covers communication with members outside your crew where CRM and communication techniques can be helpful.*



Next slide



** Facilitator Notes*

Communication

Clarendon Head-On Collision

Amarillo Kasota Claude Malden Ashtola **Clarendon** Hedley

8876 E

0747—Dispatcher issues **TW 15** authorizing the 8876 E to move from Restricted Limits Amarillo to the East Siding Switch at Malden and to hold the track.

0749—Dispatcher issues **TW 16** authorizing the 8876 E to move from the East Siding Switch at Malden to the East Siding Switch at Ashtola **after the arrival of 9984 W** and hold the main track at Ashtola.

Crew Resource Management 52



OBJECTIVE OF SLIDE: *To go through an example of an actual train accident (Clarendon) caused by a breakdown in communications, so that participants have a better understanding of the topic.*



SUGGESTED SCRIPT: “Now let’s go over an example of how a breakdown in communications can lead to tragedy. These slides show a diagram of the actual time-based accident scenario. You will also hear the actual communication between the train crews and the dispatcher.”



SCENARIO: CLARENDON

- Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Clarendon Head-On Collision” in their **Participant’s Guide Book**. Ask them to read the scenario. Once they have finished reading the scenario, but before they answer the questions, start the Clarendon time-based slide illustrations with audio. Once the time-based graphical illustration of the accident is completed, you should have each group answer the questions as a group in the scenario titled “Clarendon Head-On Collision” in their participant’s guide.
- Read the scenario titled “Clarendon Head-On Collision” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.

* *Facilitator: There is audio attached to these next few “Clarendon Slides.” The audio will start automatically after the first mouse click on each slide. Once the audio stops for each slide, click on the mouse to advance to the next slide.*


Next Slide



** Facilitator Notes*

Communication

Clarendon Head-On Collision



0826—Dispatcher issues **TW 19** authorizing the 4385 W to move from the West Siding Switch at Hedley to the East Siding Switch at Ashtola after the **arrival of the UP 5827 E** and to clear main track at Ashtola.

Crew Resource Management 53



OBJECTIVE OF SLIDE: *To continue to develop the Clarendon accident scenario.*



ASK: “Does anyone have any questions about what has happened up to this point?”

Answer questions.

Next Slide



** Facilitator Notes*

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Communication

Clarendon Head-On Collision

0843—Dispatcher issues **TW 22** authorizing the 8876 E to move from the East Siding Switch at Ashtola to the East Siding Switch at Hedley after the arrival of the 4385 W and to hold main track at Hedley.

Crew Resource Management 54



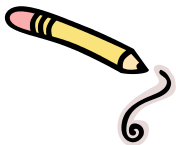
OBJECTIVE OF SLIDE: *To continue to develop the Clarendon accident scenario.*



ASK: “Does anyone have any questions about what has happened up to this point?”

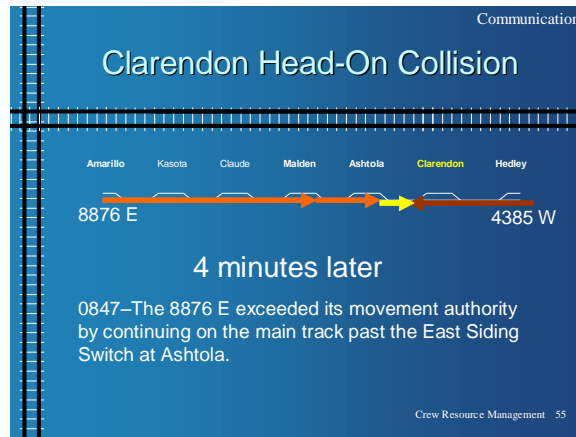
Answer questions.

Next Slide



** Facilitator Notes*

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OBJECTIVE OF SLIDE: *To continue to develop the Clarendon accident scenario.*

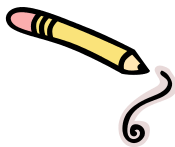


ASK: “Does anyone have any questions about what has happened up to this point?”

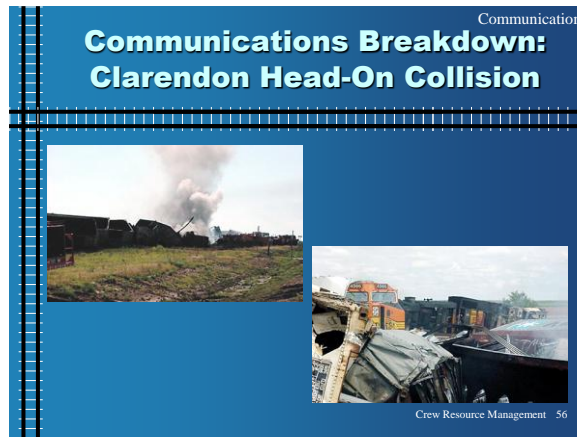
Answer questions.

Next Slide

** Facilitator Notes*



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OBJECTIVE OF SLIDE: *To wrap up the Clarendon scenario.*

This slide is displayed after the participants have gone through the Clarendon audio section.



SCENARIO: CLARENDON

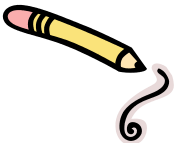
- *Participants should be in small groups of 3 to 4. Once the time-based graphical illustration of the accident is complete you should have each group answer the questions as a group in the scenario titled “Clarendon Head-On Collision” in their **Participant’s Guide Book**.*
- *When all groups have had enough time to answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “Let’s get into more detail about communication.”

Next Slide

* *Facilitator Notes*



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Communication

Oral Communication

- Clear
- Accurate
- Complete
- Organized
- Concise
- Timely



Crew Resource Management 58

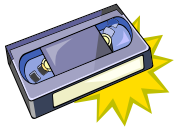


OBJECTIVE OF SLIDE: *To have participants understand oral communication.*

Oral Communication



SUGGESTED SCRIPT: “As we can see from the Clarendon Accident, when communicating with other individuals at the railroad, we must be clear, accurate, complete, organized, concise, and on time.”



VIDEO: *Show CRM Video Clip 4–Good Communication 1*

Clear



SUGGESTED SCRIPT: “First, communication must be clear. It must be understood by the receiver. Sometimes we use slang or certain words or phrases that are only understandable to our particular working group, or friends. Many times people of different cultural backgrounds use different phrases and words to describe the same things. It can help the receiver understand the message if you use phrases and words that can be understood by them. Similarly, after working within a particular crew or division, a certain language develops within the group. Remember, if there is a new employee in the group, he or she might not understand exactly what is being communicated. Also, railroad employees come from all over the country even the world and many times they have different accents, which at times can make them difficult to understand. If you do not understand someone for any reason, ask him/her to repeat what he/she said.”

Accurate



SUGGESTED SCRIPT: “Oral communication must be accurate. Misinformation can have grave consequences. Before communicating information, double check to make sure it is correct.”



Complete

SUGGESTED SCRIPT: “A message must be complete. Make sure you don’t leave out any pertinent information.”



Organized

SUGGESTED SCRIPT: “Effective communication is organized. Messages are better received if they are organized in a way that helps the receiver understand them. Many times the sender has a series of messages to send (as in a procedure)—try to organize messages so that there is some sort of logical flow, or order to it.”

** For example in CRM video clip 4—Good Communication 1, when Mike communicates the layout of the yard to Mark, he is organized. He states, “actually this yard runs from two to seven, two through seven,” then he uses his hands to illustrate and says, “two, three, four, five, six....and seven.” He then says, “this is track five,” and indicates the track they are standing next to with his hands. This is organized communication. He didn’t say, “that is track 3, and over there is track 7, and here is 5 and over there is 2,” pointing all over the place. That would be disorganized.*

Concise



SUGGESTED SCRIPT: “Communication must also be concise. We often put more words in our communication than is necessary, and this just jumbles the message. When communicating a message, try to make it as short as possible, while still being complete and clear.”

Timely



SUGGESTED SCRIPT: “We must also be on time. Almost all communication here at _____ (insert name of RR) is needed now. Once you realize that something needs to be communicated, do it then. Don’t wait or it might be too late.”

“So these are good ideas for communicating, but we all know that communication should not be one way—communication is two way, and a lot depends on the listener.”

Next slide



** Facilitator Notes*

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Communication

Two-Way Communication/ Active Listening

- Ask questions
- Restating or paraphrasing
- Recording information

Crew Resource Management 58



OBJECTIVE OF SLIDE: *To show participants several methods of improving two-way communications.*



SUGGESTED SCRIPT: “One-way communication is when one person is talking and the other person is listening. We saw an example of one way communication at beginning of this module.”

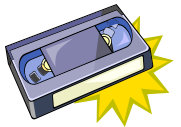


ASK: “How does this compare to two-way communication? What are some things that are present in two-way communication that are missing in one-way communication?”

Get answers from group.



SUGGESTED SCRIPT: “Let’s look at this same situation only with two way communication.”



VIDEO: *Show CRM Video Clip 5–Good Communication 2*



ASK: “What are some of the things that this new employee did which were good active listening techniques?”

Get answers from group the group—see if the participants can come up with all the behaviors that a new employee displayed when communicating actively (asking questions, restating or paraphrasing, and recording information). Once they have mentioned each of these, explain each below using the script.



SUGGESTED SCRIPT: “That is right, two way communication involves active listening, which involves asking questions.”



Click on mouse

Ask Questions



SUGGESTED SCRIPT: “Asking questions helps to make sure you understand a statement. Also, ask for any additional information that might help you understand the information better. When a new employee does not understand an acronym, he/she should ask what it means and should not be concerned about appearing dumb or ignorant. As we all know, it can be extremely noisy in the railroad environment. Sometime we don’t hear things the first time and should ask questions to make sure we understood it and heard it correctly.”



Click on mouse

Restating or Repeat in Your Own Words



SUGGESTED SCRIPT: “Another thing that the new employee did that showed an active listening technique was to confirm his understanding of the information is the same as the sender. He restated or paraphrased the message back to the sender. Paraphrasing can help not only show that you have heard the message but that you **UNDERSTAND** it.”



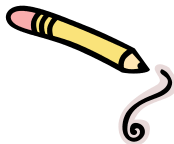
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Record Information



SUGGESTED SCRIPT: “Because we have a limited memory, we cannot remember everything, and many times throughout our work day there is information that we are given that we cannot remember unless we write it down. By writing down information, we can use the information later to remind ourselves of the communication and information.”

Next slide



** Facilitator Notes*

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Communication

Other Modes of Communication

- Radio
- Written
- Hand signals

Crew Resource Management 59



OBJECTIVE OF SLIDE: (1) For participants to understand that CRM is related to other modes of communication, (2) to understand the pros and cons of each and when to use each, and (3) to understand how different CRM factors are related to each mode.

OTHER MODES OF COMMUNICATION



SUGGESTED SCRIPT: “So far we have been discussing communication by giving examples of face-to-face, spoken communication.”



ASK: “Is this the only way we communicate with our fellow crewmembers or other members outside our crew? What are some other methods we use to communicate with our team members?”

Possible answers: (1) radio, (2) written, and (3) hand signals



Click on mouse



SUGGESTED SCRIPT: “One mode of communication we use regularly is the radio.”



Click on mouse



SUGGESTED SCRIPT: “Another mode of communication we use all the time is written communication.”



Click on mouse



SUGGESTED SCRIPT: “Another mode of communication we use is hand signals.”



Click on mouse

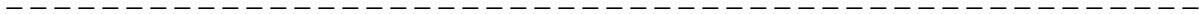


SUGGESTED SCRIPT: “Just like communicating verbally face to face, when communicating using the radio, in writing, or using hand signals, we must be clear, accurate, complete, organized, concise, and on time.”

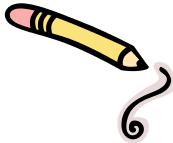


SUGGESTED SCRIPT: “Let’s look at ways computers and other technology are being used in railroading and think about some of the effects of these. Specifically, how new and emerging technology will affect CRM, communication, and safety.”

Next slide



** Facilitator Notes*



Communication

New Technology

- Remote Control
- Cell Phones
- Cell-Based Walkie-Talkie
- Electronic Authority Exchange
- Hi-Rail Limits Compliance System
- Automated Information Exchange

Crew Resource Management 60



OBJECTIVE OF SLIDE: *For participants to understand that new technologies will always be introduced in the railroad environment and to be aware of how they might change the way we communicate with our team members.*



ASK: “What are some examples of new technologies in railroading?”

Participants are likely to suggest technologies like: Remote control, cell phones, cell-based walkie-talkies, perhaps Electronic Authority Exchange track and time, etc.



Click on mouse



SUGGESTED SCRIPT: “Yes, these, as well as other new technologies including remote control, cell phones, and cell-based walkie-talkies. There is always going to be change in the technologies that we use to communicate on the railroad. When the way we do our work and the technologies we use change, it often takes some time to get up to speed. Many times there is a completely different set of cues that we must learn when technology changes or when the way we communicate with our team members changes.”

Remote Control



SUGGESTED SCRIPT: “Major changes in work procedures and technology (for example, remote control of locomotives) can change everything about the cues we take in, our environment, and how we communicate when we work.”



ASK: “What are the different cues that one takes in when they are working a remote control versus when they are in the cab?”

(Answers could be weather, cues from remote control, cues from the other person with the remote control, cues from other trains and people: engineer does not have the safety of the cab, and now has to think about where they are on the ground, other tracks and movement in the yard.)



SUGGESTED SCRIPT: “Remote control puts the engineer (or operator) on the ground, thus he or she now has to deal with weather conditions, for example the rain, snow, and wind. Weather conditions can impose physical stress on the individual, and the communication is different between a remote control team and a traditional yard crew. Because we are outside and have physical stress, we need to be conscious of communication needs.”

Cell Phones



ASK: “How are cell phones different from face-to-face communication? What are some issues we need to think about when communicating using cell phones?”
Answers could include direct contact outside official lines of communication, may help us get through to dispatcher or other personnel more easily, may be a distraction



SUGGESTED SCRIPT: “Yes, we communicate differently using cell phones. While they provide direct communication means with both work and non-work related personnel, they may also become a distraction as we saw in the Clarendon accident. They are useful tools when used properly but can affect safety when used improperly.”

Cell-Based Walkie-Talkies



SUGGESTED SCRIPT: “How about cell-based walkie-talkies? Some railroads are providing these to some of their employees in order to provide a direct and reliable means of communication between personnel.”



ASK: “How are these cell-based walkie-talkies different from face-to-face communication? Also, how are they different from communicating over the radio? What are some issues we need to think about when communicating using cell-based walkie-talkies?”



SUGGESTED SCRIPT: “When communicating with a dispatcher, train crew, or MOW crew over the radio, other employees and crews using that same channel can hear that communication. By monitoring particular radio channels, crews can stay aware of the situation around them, and they can plan ahead and prepare for future situations. However, when we communicate to another person using a cell-based walkie-talkie, no one else on the railroad can hear us as they would over the radio. Other employees and crews on the railroad can no longer use the information they get from our conversation. Sure, the radio channels are less congested improving communication, but at the cost of the other communication benefits of broadcasting intentions over a radio net.”

Electronic Authority Exchange



SUGGESTED SCRIPT: “How about an Electronic Authority Exchange System? Electronic Authority Exchange that provides Form B information over wireless signals to computer terminals in work trucks means that that information is no longer available to those listening on the radio.”



ASK: How does use of Electronic Authority Exchange system change the way we communicate? Does it change the amount of information other crew and employees on the railroad can hear?"



SUGGESTED SCRIPT: "Other workers may or may not know the limits of the Form B as a result. Foremen receiving and acknowledging electronic authority acceptance must realize that their crewmembers must be briefed on the limits and to be even more wary of trains and other work crews operating nearby or through the area since they may not be aware of their presence. Communicating the presence of a Form B area becomes even more vital for the dispatcher."

Hi-Rail Limits Compliance System



SUGGESTED SCRIPT: "How about a Hi-Rail Limits Compliance System? A Hi-Rail Limits Compliance System typically uses a global positioning system (GPS) to alert the operator of a Hi-Rail equipped vehicle when approaching the limits of the assigned authority."



ASK: "How does our use of a Hi-Rail Limits Compliance System change the way we communicate?"



SUGGESTED SCRIPT: "A Hi-Rail Limits Compliance System changes the way we communicate by increasing our dependence on outside automation to limit our movement over the track. It reduces communication error and provides real-time, direct communication between the dispatcher and the hi-rail truck's GPS system. But, once again, other personnel may not be aware of the assigned limits or Form B issuances that have been handled exclusively via computer wireless communications links."

Automated Information Exchange



SUGGESTED SCRIPT: "How about an Automated Information Exchange System? An Automated Information Exchange System allows conductors and other railroad personnel to submit reports using voice recognition technology via telephone from remote locations."



ASK: "How does our use of an Automated Information Exchange System change the way we communicate?"

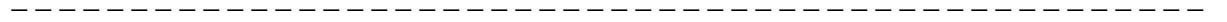


SUGGESTED SCRIPT: “Automated Information Exchange reduces the amount of paperwork by allowing voice reporting of information, but it introduces the possibility of error in misinterpretation by the voice recognition software.”



SUGGESTED SCRIPT: “While each of these new technologies has been introduced due to certain benefits that they bring to railroad operations, CRM principles teach that crews should also be mindful of the effects that they can have upon current practices and expectations regarding communications.”

Next Slide



** Facilitator Notes*

Handwriting lines for notes, consisting of a series of horizontal solid lines.



Communication

Job Briefing Guidelines

- Plan the job briefing
- Conduct the job briefing
- Brief for special conditions
- Followup by employee in charge
- Debriefing

Crew Resource Management 61



OBJECTIVE OF SLIDE: *Give participants some job briefing guidelines.*



SUGGESTED SCRIPT: “We have mentioned job briefings throughout this course. We talked about job briefings in maintaining situational awareness. The first step in maintaining situational awareness is planning and preparing. The first thing we do every day to plan and prepare is to conduct a job briefing. Job briefings help define crewmembers’ responsibilities, the tasks to be performed, and the type of protection required. It also provides a forum for crewmembers to give input into different personal or environmental situations that might be present. Similarly, it allows participants to ask questions and clarify roles and responsibilities so that everyone is working on the same plan and can be prepared for the day’s work activities. There are several job briefing guidelines that, if followed, will ensure you get the most out of job briefings.”

Plan the Job Briefing



SUGGESTED SCRIPT: “The first guideline is to plan the job briefing. A good job briefing is usually planned ahead of time. For those conducting the job briefing, you should plan the work to be performed, consider existing and potential hazards, and think about how task assignments will be made and delegated to crewmembers.

“Some accidents occur on the railroad because employees or crewmembers who should have attended the job briefing were not there. Make sure all employees who need to be present are in attendance before you begin the briefing. If an employee is not present during the first job briefing, make sure he/she is briefed first thing when he/she arrives at the work site. Also make sure that everyone at the worksite is aware that someone new is in the work area.”



Conduct the Job Briefing

SUGGESTED SCRIPT: “The next guideline is to conduct the job briefing. When conducting a job briefing, you should explain the tasks and work to be accomplished to all employees involved in the work. You should have a discussion about hazards and suggest to the crew ways to eliminate or protect themselves against them. When delegating work tasks and assignments, make sure that each crewmember knows exactly what he/she work assignment is.”

“As with all communications, when giving a job briefing, you must be clear, accurate, complete, organized, concise, and on time. The employee giving the job briefing should make sure that what he/she has said is understood by the crew. Ask questions to make sure that instructions were understood.”



Brief for Special Conditions

SUGGESTED SCRIPT: “Before ending the job briefing, make sure that you brief for special conditions. Many times special tools, material, equipment, or work methods are used during a particular work assignment. Make sure that employees involved in special work assignments know how to use the required tools and materials. Crewmembers working in the area but not using special equipment or tools should be aware of specific safety issues involved in being around such equipment. For jobs that have a high level of complexity, make sure employees know any important issues involved in the job. Because the environment where crews either drive a train, work on a track, or move equipment can change dramatically, make sure all employees are aware of any special environmental conditions that might exist in the work area.”



Followup by Employee in Charge

SUGGESTED SCRIPT: “As we all know, things change out on the railroad. When there is a substantial enough change, which can affect the crew’s work or safety, another job briefing should be performed. This way, everyone on the team stays up to date on any relevant changes in the work environment, keeping the team safe throughout the day.”



Debriefing

SUGGESTED SCRIPT: “Lastly, a debriefing is a good way to exchange information at the end of a work shift. By reflecting on work tasks that could have gone better, performance of job tasks can be improved the next time.”



ASK: “Should job briefings involve one-way or two-way communication?”

Possible Answers: will probably state that communication should be two-way; however, it is usually one-way.



SUGGESTED SCRIPT: “Just like all communication, job briefings should involve two-way communication. The employee giving the job briefing should be open to receive feedback and information from other crewmembers. This will allow the group to be more aware of the situation.”



Next Slide

** Facilitator Notes*

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Communication

Active Participation (in job briefing)

- **Contribute facts and ideas**
- **Ask questions**
- **Listen/stay focused**
- **Clarify roles and expectations**

Crew Resource Management 62



OBJECTIVE OF SLIDE: *To show the participants how to be active participants in a job briefing.*



ASK: “How do we become active participants of a job briefing?”

Get answers from group

Contribute Facts and Ideas

REFER TO SLIDE AND EXPAND: “We communicate actively by first contributing facts and ideas. One of the benefits of working together as a team or crew is that more ideas and information can be gained from a greater number of individuals. However, these benefits cannot be realized if the crew does not contribute facts and ideas.”

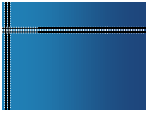
Ask Questions

REFER TO SLIDE AND EXPAND: “A job briefing is also a forum to ask questions. As in all communications, if you do not understand something, ask for clarification before the job briefing is over. Chances are many of the other attendees of the job briefing are wondering about the same thing.”

Listen/Stay Focused

REFER TO SLIDE AND EXPAND: “Likewise, in order to actively participate in a job briefing, you must listen and stay focused. It is sometimes difficult to stay focused during a job briefing; however, if you don’t, the information that you miss might be critical to your safety.”

Clarify Roles and Expectations



REFER TO SLIDE AND EXPAND: “Lastly, participants in a job briefing should clarify roles and expectations. This way there is not confusion during the workday. You should restate or paraphrase what your role and expectations are, as well as the timeframe specific work tasks are to be accomplished. Writing down or recording job briefing information is a good way to make sure you don’t forget any critical information.”



SUGGESTED SCRIPT: “Now let’s talk about teamwork.”

Next slide



** Facilitator Notes*

Teamwork

Module 5: Teamwork

- Understand that safety hinges on both individual and team actions

Crew Resource Management 64

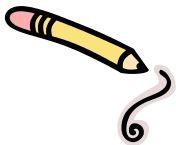


OBJECTIVE OF SLIDE: *To introduce module 5–teamwork.*



SUGGESTED SCRIPT: “The fifth module is teamwork. When you complete this module, you should understand that safety hinges on both individual and team actions.”

Next slide



** Facilitator Notes*

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Teamwork

Learning Objectives: Teamwork

- Explain why optimizing safety involves team responsibility, as well as individual responsibility
- List the benefits of improved team decisionmaking
- Be able to effectively use conflict resolution techniques

Crew Resource Management 64



OBJECTIVE OF SLIDE: *For participants to understand the specific objectives of module 5–teamwork.*

Learning Objectives: Teamwork

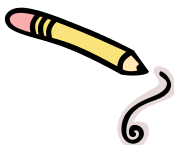


SUGGESTED SCRIPT: “The learning objectives for this module are...”



REFER TO SLIDE:

- Explain why optimizing safety involves team responsibility, as well as individual responsibility.
- List the benefits of improved team decision-making.
- Be able to effectively use conflict resolution techniques.



Next slide

** Facilitator Notes*

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Teamwork

Teamwork

- **Definition of a team-crew**
- **Team decisionmaking**
- **Conflict resolution**

Crew Resource Management 65



OBJECTIVE OF SLIDE: *For participants to understand the outline of module 5–teamwork.*



TEAMWORK

SUGGESTED SCRIPT: “In this module we will talk about...”



REFER TO SLIDE:

- Definition of a team-crew
- Team decisionmaking
- Conflict resolution skills



Next slide

** Facilitator Notes*

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Teamwork

Definition of a Team/Crew

- A crew/team is “any group of people working at tasks designed to accomplish a common mission, goal, or objective”

Crew Resource Management 66



OBJECTIVE OF SLIDE: *To restate the definition of a team/crew and explain that teamwork is important.*

Definition of Team/Crew



SUGGESTED SCRIPT: “Remember, we define CRM as “a **CREW’S** effective use of all available resources to achieve safe and efficient train operations.” It is not just how each of you as individuals use all available resource to achieve safe and efficient train operations but how the crew does.”



Click on mouse



SUGGESTED SCRIPT: “A crew is defined as....”

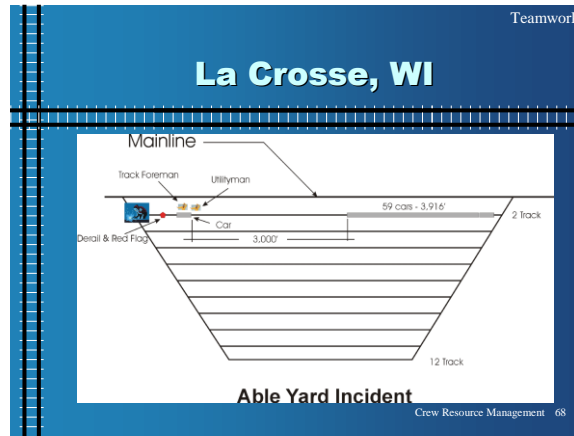


REFER TO SLIDE: “any group of people working at tasks designed to accomplish a common mission, goal, or objective.”

Next slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To go into more depth on the La Crosse, WI scenario.*



SCENARIO: LA CROSSE, WI

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “La Crosse, WI” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “La Crosse, WI” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



SUGGESTED SCRIPT: “Let’s talk about team decisionmaking.”

Next slide



** Facilitator Notes*

Teamwork

Team Decisionmaking

Advantages of team decisionmaking

1. More complete information
2. More alternatives
3. Solution is accepted by the group
4. Solutions are accepted more by individuals outside the group

Crew Resource Management 68



OBJECTIVE OF SLIDE: *To have participants understand that making a decision as a team has some advantages and disadvantages.*

TEAM DECISIONMAKING



SUGGESTED SCRIPT: “As we are all aware, each of us make decisions every day when we work. These include decisions about our work processes. It is these decisions that can lead to safe or unsafe situations. We often make decisions as individuals, and there are situations in which an individual decision is warranted; however, there are also situations when it is better to use team decisionmaking. This entails calling on the experiences of your fellow crewmembers, and asking them for advice in how to go about making the decision.

“Several advantages of making decisions as a team are listed here.”

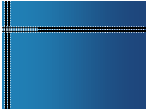
More Complete Information

REFER TO SLIDE AND EXPAND: “As we have talked about throughout this program, a group brings different experiences and perspectives to a situation. Each member of a crew has his/her own perception of the situation; by communicating those perceptions in a group decisionmaking forum, more complete and valid information can be gathered.”

More Alternatives

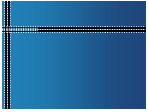
REFER TO SLIDE AND EXPAND: “Because crewmembers have different perceptions and experiences, they also can come up with different alternatives to problem solving. Thus as a group, there is a more, and a greater diversity of information. This means more alternatives for solving a problem can be communicated. The more alternatives a crew has, the more likely they will decide on the best and safest decision.”

Solution Is Accepted by the Group



REFER TO SLIDE AND EXPAND: “Most decisions made by an employee out on the railroad will somehow affect their fellow crewmembers. Everyone likes to participate in decision that affects him/her personally. So by making a decision as a team and getting crew input, that final decision is more likely to be accepted by the crew.”

Solutions Are Accepted More by Individuals Outside the Group



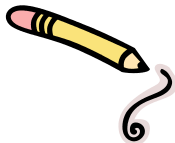
REFER TO SLIDE AND EXPAND: “Finally, just like their acceptance with members of the crew themselves, when explaining to someone outside the group why a certain decision was made, it is more likely to be accepted if it was made by a team compared to an individual.”



SUGGESTED SCRIPT: “Of course there are disadvantages as well. Usually individuals can make decisions faster than a team or group. So there are times when an individual decision is warranted. However, in the right circumstances, team decision are usually better decisions.”

Next slide

** Facilitator Notes*



Teamwork

Conflict Resolution

- Causes of conflict
- Effects of conflict
- Win-Win solution
- Conflict resolution techniques

Crew Resource Management 70



OBJECTIVE OF SLIDE: *To have participants understand the causes and effects of conflict and how to resolve conflicts so that there is a win-win solution.*

Conflict Resolution



VIDEO: *Show CRM Video Clip 6–Poor Conflict Resolution*



ASK: “Have any of you had a conflict like this? Do you think these workers will work together safely?”

Get answers from group.



SUGGESTED SCRIPT: “These two will probably not work together very well as a crew because of their conflict. That is why we need to resolve conflicts as soon as possible. Conflict within a crew occurs when there is disagreement over a decision or course of action.”

Causes of Conflict

REFER TO SLIDE AND EXPAND: “There are different causes of conflict. Conflict can be caused by personality differences, stress, poor communication, aggression, confusion over roles and responsibilities, loss of authority, or incompatible goals.”

Effects of Conflict

REFER TO SLIDE AND EXPAND: “Conflict can negatively affect many aspects of work because it can lead to mental fatigue. Conflict can thus shift attention away from important aspects of a work task, and it can lead to a loss of situational awareness. If resolved properly, conflict can lead to positive outcomes. These include the correction or prevention of mistakes by the crew and improved performance. A resolved conflict can also increase workers’ interest in work issues. It can also lead to an understanding between crewmembers. Thus, if handled properly, conflict can have positive effects in the long run.”

Win-Win Solution

REFER TO SLIDE AND EXPAND: “There are three different types of outcomes to a conflict. First there is a lose-lose outcome. This is when the parties either don’t deal with the problem or conflict, and there was a poor decision or compromise made. A win-lose outcome is when one person’s view is dominant and the other person’s concerns are not addressed. This usually leads to more conflict further down the line. What we are striving for is a win-win solution. This occurs when a solution is reached in which all parties’ concerns are reflected in the decision. You always want to work toward a solution where all parties feel that the solution appropriately addresses the situation.”

Conflict Resolution Techniques

REFER TO SLIDE AND EXPAND: “So, when a conflict exists, how do we go about solving it? First, we need to be physically and mentally prepared to deal with the conflict. Trying to resolve a conflict when you are fatigued, hungry, under stress, or thinking about something else is a bad idea. You should not respond to a conflict until after you are physically and mentally prepared. Similarly, you should delay responding to a conflict until you know what you would like to say or do. Take at least a moment to gather your thoughts before trying to resolve a conflict.

“One of the most important steps to resolving a conflict is to define the conflict. That is determining what is at the root of the conflict. Often other issues and conflicts are actually the result of some disagreement or event that occurred previously. Just by clarifying what the conflict is about, can clear up confusion by both parties and resolve the conflict itself. By figuring out exactly what the root conflict is, you can use your resources to resolve that conflict.

“When resolving conflicts, use some of the effective communication techniques we discussed earlier in the communication module, including being clear, accurate, complete, organized, concise, and on time. Also, use some of the techniques discussed previously about two-way communication, including asking questions and restating/paraphrasing to check for understanding. If miscommunication occurs, it can make the conflict worse off. When resolving a conflict, each party should be assertive, yet not aggressive or passive. Many conflicts can be emotional; however, it is best to control emotions.”

SUGGESTED SCRIPT: “Now let’s revisit that conflicting engineer and conductor, and see if there is a better way to deal with conflict.”

VIDEO: *Show CRM Video Clip 7–Good Conflict Resolution*

SUGGESTED SCRIPT: “This is the proper way to deal with conflict. Discuss the reasons for conflict, and seek solutions that are acceptable to both parties.”



Next slide

** Facilitator Notes*

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Assertiveness

Module 6: Assertiveness

Objective: Understand the proper use of assertive communication

Crew Resource Management 71



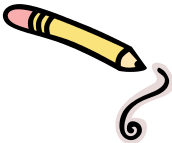
OBJECTIVE OF SLIDE: *To have participants understand the overall objective of module 6: assertiveness.*



Assertiveness

SUGGESTED SCRIPT: “The objective of this module is that you understand the proper use of assertive communication.”

Next slide



** Facilitator Notes*

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Assertiveness

Assertiveness/Proper Challenges of Authority

- **Proper assertiveness**
 - Asking questions
 - Do not attack the individual
 - Controlling of emotions
- **Corporate safety culture**
- **Taking other people's communication styles into account while being assertive/proactive**

Crew Resource Management 71



OBJECTIVE OF SLIDE: *To have participants understand the proper way to be assertive and challenge authority.*



SUGGESTED SCRIPT: “Teamwork and communication are important; however, sometimes there are still disagreements as to the best course of action. Authority, roles, seniority, or job functional areas make it hard for ideas, communication, and understanding to flow between crewmembers. In order to reap the benefits of working together in a team, team members must be assertive, especially in relation to safety. When being assertive, crewmembers should make sure they communicate their ideas or opinions, particularly when the safety of the crew depends on it, meaning that some situations might require being more or less assertive than others.”



SUGGESTED SCRIPT: “Some techniques used in being assertive are to...”

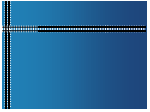
Ask Questions

REFER TO SLIDE AND EXPAND: “It is difficult sometimes to challenge another person’s actions or views without offending him or her. A good way to get around this is to ask questions. This allows you to gain information to make sure you understand the situation correctly and is less threatening to the other crewmember. For example, if you think a fellow crewmember has forgotten about a 15 mph curve up ahead you might be tempted to say ‘Hey, don’t forget we have a 15 mile per hour curve up ahead.’ Your fellow crewmember might take this as you not trusting them. A more effective way to be assertive in this situation might be to ask, ‘How far up is that 15 mile per hour curve?’”

Do Not Attack the Individual

REFER TO SLIDE AND EXPAND: Don’t attack the individual personally. One technique to do this is to begin with the objections with the word ‘I.’ For example, if you are a conductor and you think the engineer missed a yellow signal, you should first ask something like, ‘What was that last signal?’ If the engineer does not respond to that, you can say, ‘I think that last signal was yellow.’ This is more effective than saying, ‘That last signal was yellow. You always miss signals.’”

Controlling of Emotions



REFER TO SLIDE AND EXPAND: “Lastly, just like resolving conflict, when being assertive you should control your emotions. Expressing yourself in a calm and collected manner and not challenging a crewmember’s action directly is better than being aggressive and using an angry or threatening tone.”



SUGGESTED SCRIPT: “Let’s see an example of someone attempting to use these techniques.”



Video: *Show CRM Video 8–Assertive-less*



ASK: “Was the engineer using assertive techniques?”



SUGGESTED SCRIPT: “The engineer was using proper assertiveness techniques. He began questions with ‘I’ for example, ‘I sure wish we got some more air before we started,’ and he asked questions to address his issues, ‘Are you sure that switch is lined up?’”



ASK: “Did it help?”



SUGGESTED SCRIPT: “Not really. The conductor just was not listening. In this case, crewmembers must use increased levels of assertiveness to maintain safe operations. Ultimately, you are responsible for your own safety and your need to ensure that you are safe out there on the job. If, after using the various assertive techniques discussed, your fellow crewmember still does not ‘get it,’ you should state an objection clearly and take appropriate actions to divert an accident or injury.”

“That is the end of module 6, assertiveness; let’s review what we talked about today.”

Next Slide



** Facilitator Notes*

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Review

Review of Each Module

- **Introduction**
- **Technical Proficiency**
- **Situational Awareness**
- **Communication**
- **Teamwork**
- **Assertiveness**

Crew Resource Management 73



OBJECTIVE OF SLIDE: *To review each module.*



Introduction

SUGGESTED SCRIPT: “So let’s take a moment and review each module. The first module was the **Introduction** where we defined what we mean by CRM. We defined CRM as ‘a crew’s effective use of all available resources to achieve safe and efficient train operations.’ We broke this definition out and talked about what we mean by a crew. We defined crew as, ‘any group of people working at tasks designed to accomplish a common mission, goal, or objective.’ We talked about how a crew is not just your immediate work group or elemental team, but it can also be an interactive team, which occurs when two or more elemental teams work together. An example is when a train crew, an MOW crew, and a dispatcher have to work together to move a train through a work area safely.

“We talked about how CRM started in the airline industry and has since moved into other high consequence team industries. We then talked about the Butler, IN accident that caused NTSB to recommend CRM for the rail industry. We then looked at some accident statistics and talked about how, for the last 10 years, human error has been the number one cause of accidents in the rail industry. We then saw that transportation and engine has had the greatest number of fatalities in the railroad every year. We then talked about the Swiss cheese model of accident prevention and saw that although there are many factors that contribute to an accident, each of you, working together as a team and practicing good CRM techniques is the last line of defense in accident prevention.”

Technical Proficiency



SUGGESTED SCRIPT: “The second module was technical proficiency. This module was short, and we discussed the three elements of technical proficiency, including knowing your equipment, knowing your procedures, and skilled performance. We then talked about the importance of evaluating the technical proficiency of your fellow crewmembers because there are always new employees and new rules and procedures.”



Situational Awareness

SUGGESTED SCRIPT: “The third module was situational awareness. Here we talked about our perceptions of the situation and how this might differ from the reality of the situation. We talked about how by communicating with our fellow crewmembers we can come up with a team perception of the situation, which is usually closer to the reality of the situation than any individual crewmember’s perception. We talked about different environmental and personal cues, and questioning the validity of those cues. We talked about some steps you can take to maintain situational awareness, as well as steps to regain situational awareness if it is lost. In this module we also talked about fatigue and how it affects our situational awareness. By practicing good CRM techniques and working together as a team, we can often counteract the effects of fatigue.”



Communication

SUGGESTED SCRIPT: “The fourth module was communication. We talked about one-way versus two-way communication and how communication should be two-way whenever possible to ensure understanding. We talked about other modes of communication and how new technologies, although they might be advantageous for some tasks, may affect the amount of information that is communicated. Lastly, we talked about steps to take when conducting a job briefing, as well as how to be an active participant in a job briefing.”



Teamwork

SUGGESTED SCRIPT: “Module five was teamwork. Here we talked about the advantages of team decisionmaking, as well as how to deal with and resolve conflict. We talked about the causes and effects of conflict, as well as some conflict resolution techniques that will allow you to strive for a win-win solution.”



Assertiveness

SUGGESTED SCRIPT: “The last module was assertiveness. Here we talked about how to be assertive by asking questions, not attacking the individual, and controlling your emotions.”



SUGGESTED SCRIPT: “Let’s look at some of the benefits some other industries have seen from CRM training.”

Next Slide



** Facilitator Notes*

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Review

CRM Benefits

- **Continental Airlines** (trained approximately 2/3 of maintenance workforce in CRM)
 - 66% decrease in ground damage costs
 - 27% fewer occupational injuries
- **Maersk** (after 4 years of CRM and human factors training)
 - 33% reduction in accidents
 - 15% decrease in insurance premiums as a result

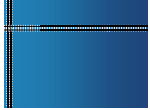
Crew Resource Management 73



OBJECTIVE OF SLIDE: *To show participants some results of CRM training from other industries.*



SUGGESTED SCRIPT: “Does practicing CRM techniques make the workplace safer? Well, it has in other industries that are similar to the railroad industry.”

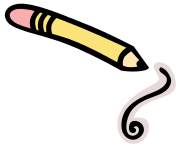


REFER TO SLIDE AND EXPAND: “Continental Airlines trained approximately 2/3 of its maintenance workforce in CRM. Afterwards, there was a 66 percent decrease in ground damage costs and 27 percent fewer occupational injuries within that workforce. Similarly, Maersk, a shipping company, trained its employees in CRM. After 4 years of CRM and human factors training, they saw a 33 percent reduction in accidents, which resulted in a 15 percent decrease in insurance premiums.”



SUGGESTED SCRIPT: “We’ve already discussed how airline safety and other fields have used CRM to improve their safety by reducing human factors errors. CRM works. It does create a safer work environment.”

Next Slide



** Facilitator Notes*

Review

CRM Benefits

- **Benefits**
 - Increased worker safety (saved lives, reduced lost work injuries, fewer equipment failures, reduced fatigue-related accidents)
 - Improved performance (avoid costly errors)
- **Costs**
 - Will require changes in the railroad culture
 - On-going training and evaluation program
 - Organizational commitment to see as many errors as possible eliminated

Crew Resource Management 74



OBJECTIVE OF SLIDE: *To have participants see some real-life results of CRM.*



SUGGESTED SCRIPT: “Again, CRM is about safety. The main **benefit** is increased worker safety. It can save lives, reduce lost work injuries, lead to fewer equipment failures, and reduce fatigue-related accidents.”

“There are however **costs**. First, it will require changes in the railroad culture. For a long time, workers have thought about their jobs as individuals rather than as team functions. Additionally, management, labor, and regulators have often been at odds, resulting in conflict and miscommunication at work. This needs to be improved if CRM is to be fully effective.”

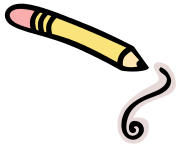
“Second, it will require an ongoing training and evaluation program. I mentioned at the beginning of the program that CRM is not a short-term accident-reduction program, and it is not just this course today. CRM has to be part of the ongoing training here, including the evaluation program. It will take some time to implement, as well as have an effect on safety and accidents.”

“Lastly, it will take an organizational commitment to see as many errors as possible eliminated. The organization has to support it, and it does.”

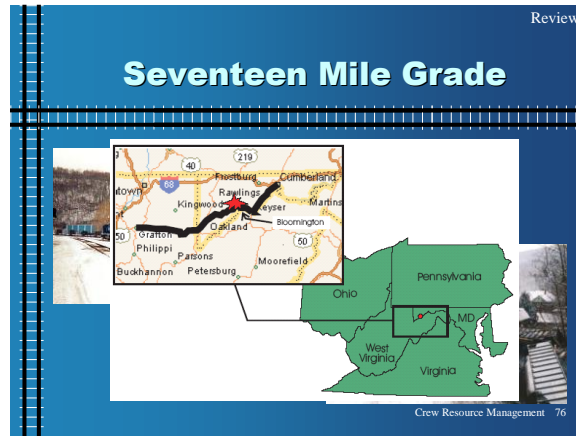


SUGGESTED SCRIPT: “Let’s examine one final scenario in which you will identify the CRM skills failures.”

Next Slide



** Facilitator Notes*



OBJECTIVE OF SLIDE: *To give participants a final scenario that involves all of the elements of CRM discussed during the training.*



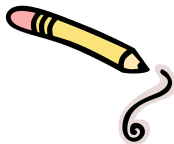
SCENARIO: SEVENTEEN MILE GRADE

- *Break participants into small groups of 3 to 4. Have participants turn to the scenario titled “Seventeen Mile Grade” in their **Participant’s Guide**. Ask them to read the scenario and answer the questions at the end as a small group. Have one group member write down the group’s answers to the questions.*
- *Read the scenario titled “Seventeen Mile Grade” in the **Facilitator’s Scenario Guide** to re-familiarize yourself with the scenario and questions.*
- *When all groups have had enough time to read through the scenario and answer the questions, go through and discuss the questions as a class, asking each small group to give you an answer(s) to particular questions.*



Click on mouse during discussion to show several more pictures, including on of the accident scene.

End of Presentation



** Facilitator Notes*



Rail Crew Resource Management

Transportation Track Facilitator's Scenario Guide

Includes possible answers and discussion notes for Rail CRM Pilot Course.

Scenarios Presented During Pilot Rail CRM Testing

Transportation Track

Introduction

NS Student Engineer at Butler, Indiana
Runaway Lumber Cars
Split Switch Derailment

Technical Proficiency

Unfamiliarity with Equipment Leads to Crash

Situational Awareness

Too Many Cars

Communication

Clarendon

Teamwork

La Crosse, WI

Assertiveness

(None)

Final

Seventeen Mile Grade

NS Student Engineer at Butler, Indiana

Source:	NTSB Report: NTSB NTSB/RAR-99/02 (Full NTSB report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Transportation–Introduction to CRM
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Technical Proficiency • Organizational Pressures • Communication
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer; NS & Conrail • Conductor; NS & Conrail • Student Engineer; NS
Railroad:	Norfolk Southern Corporation and Consolidated Rail Corporation
Train:	NS - 255L5; Conrail - TV 220
Location:	Butler, IN
Accident Date and Time:	March 25, 1998, about 4:48 AM CST
Type of Accident:	Collision
Fatalities/Injuries:	NS conductor killed, NS engineer, and student engineer sustained minor injuries
Property Damage:	NS damages - \$187,000 to equipment, \$18,000 to track and signals, and \$59,000 to cargo Conrail damages - \$314,000 to equipment, \$33,500 to track and signals, and \$4,700 to cargo

Facilitator Notes:

This accident can be used to depict all the various elements of CRM, technical proficiency, situational awareness, communications, teamwork and assertiveness.

The Incident

The accident occurred just before 5:00 in the morning. The weather was cold, about 35 °, the visibility was unrestricted at about 10 miles, and there was a slight wind out of the NW that had no effect on the accident.

The southbound Norfolk Southern Corporation (Norfolk Southern)² train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio. The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple, stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

Conrail

The Conrail train proceeded into the interlocking according to the signal system and with the authority of the controlling dispatcher.

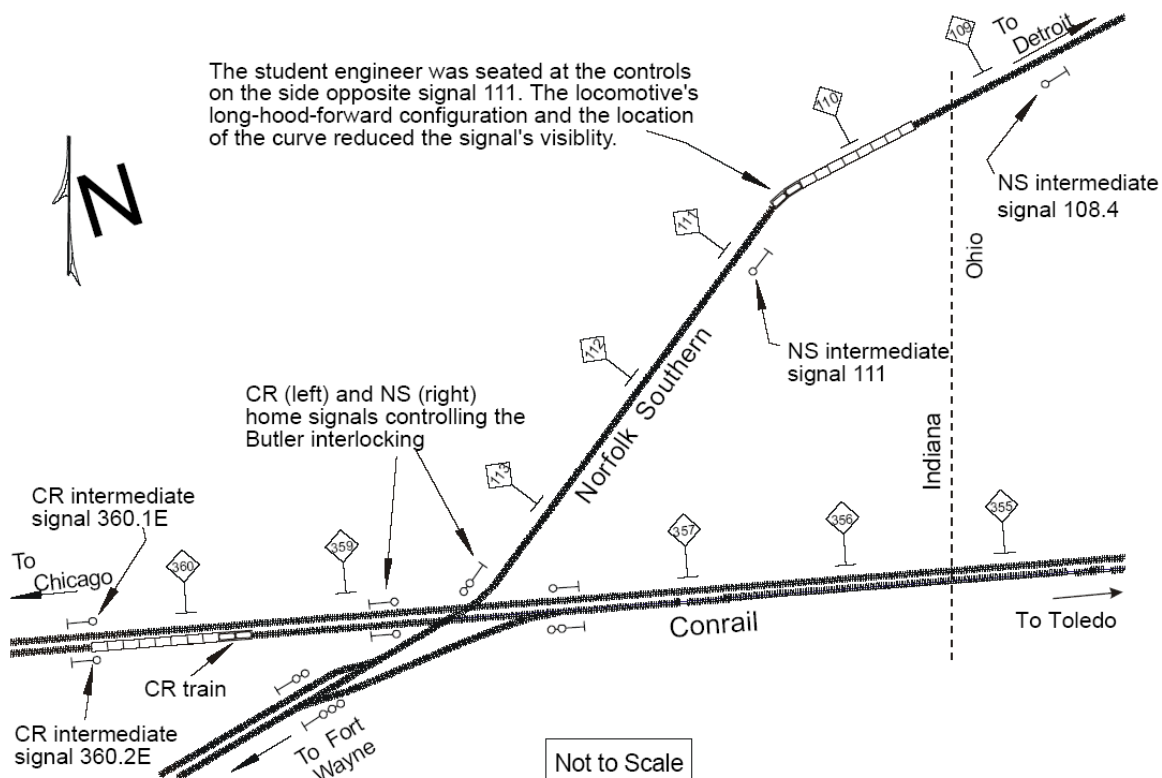


Figure 1 Conrail (CR) and Norfolk Southern (NS) signals in area of Butler interlocking

Norfolk Southern

On an uneventful trip from Peru to Detroit, two days previous, the conductor of the crew instructed the student engineer that it was the practice of the (*this*) crew not to call clear signals (a Norfolk Southern Rules violation, Rule 34 requires all signals to be clearly called.)

On the night prior to the accident, at 11:35 p.m., the Norfolk Southern crewmembers, an engineer, a student engineer, and a conductor, reported for duty at the Detroit Terminal. After reading their orders and clearing them with the train dispatcher, the crewmembers boarded the two-unit locomotive consist at the round house and proceeded to their train in the Triple Crown facility. The train, consisting of 85 loaded road-railer type cars, departed the facility about 2:30 a.m., after crewmembers had performed the required air brake tests.

After leaving the terminal area, about 2:35 a.m. and about 114 miles northeast of the accident, the engineer turned over the train's operation to the student engineer. The train continued southwest toward Fort Wayne. The student engineer reported nothing unusual about the train's handling before the accident.

The locomotive was being operated with the long hood forward, with the student engineer seated at the controls on the right side of the lead locomotive; the conductor and engineer were seated on left side, with the engineer in the forward seat and the conductor directly behind him in the rear seat. The engineers operating position visibility to the left side of the locomotive is limited when it is being operated in this mode. The student said that he had never been formally trained in long-hood-forward operation and had operated in this mode only once before, on the trip with the same crew from Peru, Indiana, to Detroit, Michigan, that concluded the day before the accident.

The student engineer said that the conductor and engineer did not call clear signals. The engineer agreed that the conductor had told the student upon going on duty at Peru that it was the practice of the crew not to call clear signals. Norfolk Southern operating rule 34 requires that crewmembers "call," or orally communicate, all signals encountered.

The student engineer said that the engineer and conductor both started reading what he thought were paperback books shortly after 3:00 a.m., about 30 minutes after departing Detroit. Two paperback books were found on the floor of the lead locomotive after the accident. The student engineer also said that about 30 minutes to an hour before the collision, the conductor or the engineer turned off the overhead light on the left side of the control compartment. The student said that he left the light on above his position to better observe the controls. The student was unsure how long the light was out on the other side of the cab, stating "It could have been a half-hour, it could have been an hour. I don't know." He said that during the time the light was off, he did not talk to the engineer or the conductor or hear them talking to each other. He was unable to state with certainty whether the engineer or the conductor was asleep while the light was out, only that no communication occurred between himself and the other crewmembers during that time.

The student engineer said that as he approached Butler, intermediate signal 108.4 was displaying a clear indication, which he radioed over the road channel. He did not see signal 111, the next intermediate signal on the left side of the track and the last intermediate signal before the home signal at MP 113.9, Butler interlocking. Locomotive event recorder data indicated that the train was traveling approximately 60 mph (the maximum speed) as it passed signal 111. According to the student engineer, when it seemed the train had gone too far without encountering signal 111, he asked the conductor and engineer about the signal location. He said that he began slowing the train as the stop signal at Butler interlocking became visible and that

“...Howard [the conductor] was coming across, and we saw it together; actually, and he said it [the home signal] was all red.”

The student engineer said he was already in dynamic braking and was applying more air brake when he heard the air brakes go into emergency. He said that he thought the engineer had applied the emergency brake using the valve on the left side of the cab. The student then placed the automatic brake valve handle in the emergency position.

The Accident

As the Norfolk Southern train approached Butler interlocking, the student engineer stated that he realized a collision was imminent when he saw the other train going across the crossing. He said he shouted, “We’ve got to get out of here” twice and turned to leave by the door behind his position. The conductor was the first to exit, followed by the student. The engineer stated that he saw both the conductor and student exit before he exited behind them.

The student stated that as he went down the locomotive stairwell and saw the proximity of the oncoming train, he jumped, landing in some water. The student could not recall whether the conductor jumped but did recall him being on the platform. The engineer stated the conductor was out of sight when he exited the cab and jumped from the locomotive.

Tasks

1. What are some of the factors that led up to this accident?

Possible Answers:

- The conductor’s instructions at Peru, circumventing Rule 34, “Call all signals.”
- When the engineer turned over the train’s operation to the student after departure of the Detroit area.
- When the student was assigned to a new territory without any previous training in the equipment to be used.

Discussion: Organizational and peer pressure resulted in the student engineer not being assertive to call into question the stated practice of not calling “Clear” signals in this crew. Organizational because this is a qualified and experienced conductor being trained as an engineer. He is fully aware that you go where you are assigned.

Peer because this student knows that you do not make friends in the labor union by pointing out rule violators without a substantial backing from other employees.

After the engineer turned over the train to the student, several points occurred where a loss of situational awareness appears to be evident. When the student observes the conductor's side overhead light turned off, he accepts the situation without comment and loses awareness that he may not have any back-up for signals that are not clear.

When he passes intermediate 108.3 showing a clear, the student is unaware that intermediate 111 is ahead on the left just past the left-hand curve. Furthermore, he is unaware that this signal has had some problems in the recent past and has a reported trouble code against it.

2. What was the fatal error that caused this accident?

Possible Answers:

- Missed the intermediate signal at MP 111.
- Long-hood-forward operation causing limited visibility of signals on the left side of the track.

Discussion: The fact that the student was unfamiliar with both the territory and the operation of long hood forward leads to a conclusion that lack of technical proficiency exists with regard to the student in this accident.

The fact that the intermediate signal for the critical interlocking is located on the left side of the track, past a left-hand curve, on territory where long-hood-forward equipment is operated brings into question the technical proficiency of the signal engineering departments placement.

Assigning a student to an unfamiliar territory on equipment he has not had any formal training with leads to questioning the technical proficiency of the crew callers in this instance.

3. What action(s) could the student engineer have taken to avoid this accident situation?

Possible Answers:

- He could have insisted on complying with NS Rule 34 (i.e., call all signals).
- He could have engaged the engineer in conversation while operating the locomotive on the run from Detroit to Fort Wayne.

Discussion: What are some issues that may have inhibited the student from taking assertive action discussed?

4. What do you think should be done to protect the employee from being unduly exposed to this type of situation in the future?

Possible Answers:

- Have the rest of the crewmembers agree to work together as a team to ensure that the signals are read (interpreted) correctly. This will support the teamwork concept already trained for.

- Ask for a review of the rules that the train is to be operated under for the trip. Make sure the whole team views the situation the same and that it is viewed as reality not fantasy.

Discussion: Teamwork is a vital component of several individuals working on the same job together.

Runaway Lumber Cars

Source:	NTSB Report: NTSB RAB/04-03 (Full NTSB report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Transportation • Engineering
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Teamwork • Technical Proficiency • Communications
Employees Involved in Accident:	<ul style="list-style-type: none"> • Inbound Crew Engineer • Inbound Crew Conductor • Switching Crew Engineer • Switching Crew Conductor • Trainman • Dispatcher • Chief Dispatcher • General Superintendent
Railroad:	Union Pacific Railroad
Train:	Inbound: QRVML-19 Switching: LOB32-20 31-car consist: 28 lumber cars, 2 paper cars, and 1 empty
Location:	City of Commerce, CA
Accident Date and Time:	June 20, 2003 11:58 AM
Type of Accident:	Derailment of runaway cars at approximately 95 mph
Fatalities/Injuries:	No fatalities, 13 injuries
Property Damage:	Total damages estimated at \$2.4 million

Facilitator Notes:

Following the accident, UP reviewed operating practices and emphasized the proper procedures for securing equipment. UP also reissued instructions detailing the methods that are required to secure trains, locomotives, and railcars when they are left unattended on the mainline, in yards, and when delivered to other facilities. In addition to local supervision, UP's Omaha Safety and Operating Practices Compliance Committee performed field observations of crews and supervisory audits to assess performance. UP has identified switches, such as the west switch at Montclair, which allow downgrade access to mainline tracks. To protect the main track from runaway equipment, split-point derails (devices similar to a track switch but without running rails) have been installed at Montclair Siding and on all such sidings on the UP that may be used for the storage of cars and that have a grade of 0.5 percent or greater.

UP officials told NTSB investigators that since the accident, they have published a track chart that shows the direction and magnitude of the grades of the main track for use by the train

dispatchers in the San Bernardino train dispatching office. UP has trained the dispatchers to read the chart and placed a copy on each train dispatcher's desk. In addition, UP initiated a systemwide drill program that addresses runaway cars. Each train dispatcher and member of the UP Response Management Communications Center has been issued a flowchart and written procedures that describe the steps to be taken when notified of a runaway situation. These procedures require prompt notification of local emergency response agencies in the event of runaway cars.

Probable Cause

NTSB determined that the probable cause of the derailment of the runaway cars in City of Commerce, CA, was the failure of both the inbound train crew and the switching crew to properly secure the railcars as required by UP operating rules before the airbrakes were released on the cars. Contributing to the accident was the failure of UP to enforce the application of its operating rules for securing freight equipment before locomotives are uncoupled.

The Incident

Phase 1

The crew for train QRVML-19, a mixed freight train with 3 locomotives and 69 cars, began their tour of duty in Long Beach, California, at 5:45 a.m. on the day of the accident. After a job briefing, they boarded their train, performed an air brake test, and departed the yard in East Los Angeles eastward toward Montclair Yard, about 31 miles away. The accident occurred on the Los Angeles Subdivision, which is controlled from UP's train dispatching office in San Bernardino, California. The main track(s) on this subdivision are centralized traffic control (CTC) and vary between one and three main tracks. The maximum timetable speed for trains on the Los Angeles Subdivision is 79 mph for passenger trains and 65 mph for freight trains.

After setting out 38 cars in UP's City of Industry Yard, the crew continued on to Montclair Yard with the 31 remaining cars. Of the 31 cars, all but one car were loaded. Twenty-eight cars (flatcars and boxcars) contained lumber or lumber products, and two cars contained paper. None of the cars contained hazardous materials. The 31 cars weighed 3,881 tons and had a total length of 2,281 feet. After delivering the 31 cars to Montclair Yard, the crew was to leave one locomotive on a storage track in the yard and continue eastward with the two remaining locomotives for about 20 miles to UP's West Colton Yard, where the crew was to go off duty.

As the inbound train approached Montclair Yard, the train dispatcher issued instructions to the conductor for the train to enter the siding and instructed him to communicate with road switch train (LOB32-20) for permission to jointly occupy the siding at Montclair. The conductor of the switching crew told the inbound train that they had permission and told them to "hi-ball" (to "disregard" or "skip") the brakes because "We're going to be coming up against the rear of your train." In this communication, the switching crew informed the crew of the inbound train not to set hand brakes on their train because the switching crew would couple their engine to the opposite end of the cars.

After the last car of the inbound train cleared the west switch into the siding at the west end of Montclair Yard, the conductor and brakeman of the switching crew were standing near the track and were preparing to assume responsibility for the train from the inbound crew. The switching crew engineer was with his locomotive in a yard track, making his way through several yard tracks to the west switch, preparing to enter the siding and approach the rear of the inbound train. Without setting handbrakes, the crew of the inbound train uncoupled their locomotives from the train. As intended, the separation of the cars from the locomotives caused the car's air brakes to apply in an emergency application. The crews were aware that the grade of the siding would cause cars without brakes to move downgrade. Both crews later told investigators that they expected the emergency application of the air brakes to hold the cars stationary and that because the switching crew's locomotive would quickly be attached to the opposite end of the cars, the cars would not be left standing for very long without a locomotive attached. Crews had done this before at this location, and UP supervisors acknowledged being aware of this method of exchanging cars from one crew to the other. However, UP's operating rules prohibit crews from relying on air brakes to secure cars when locomotives are detached. The rules require that a sufficient number of handbrakes be applied on the cars before detaching a locomotive. UP's *Air Brake and Train Handling Rules* also require that handbrakes be used to secure equipment.

After uncoupling the 3 locomotives and moving a short distance from the 31 cars, the inbound crew separated the lead locomotive from the other 2 locomotives, which remained on the siding a short distance from the cars of the inbound train. The crew then took the lead locomotive to the storage track, as instructed. After securing the locomotive on the storage track, the crew walked back to the two remaining locomotives as they prepared to depart the yard.

The conductor of the switching crew told investigators that he began bleeding the brakes on the cars, starting in the middle of the 31 cars and walking to the west, releasing the air brakes on each car as he walked by. As the trainman approached the middle of the train, the conductor said that he instructed the trainman to "start there [in the middle] and bleed the train eastward." When the conductor finished releasing the airbrakes of the cars on the west end, he returned to the yard to assist the engineer in bringing the locomotive from the yard track to the west end of the siding so that they could couple to the rear car and begin switching.

Meanwhile, the trainman completed his task of bleeding the cars and walked in the direction of the crew of the inbound train, who had placed the one locomotive on the storage track and were returning to their two remaining locomotives. As the trainman approached the other crew, the inbound crew noticed that the 31 cars were moving westward, downgrade, toward the switch at the west end of the siding.

The trainman ran after the cars in an attempt to climb aboard the moving cars and set handbrakes. However, the cars gained speed, and the trainman could not catch them. The conductor of the switching crew also noticed that the cars were moving, and he too began running toward the cars. The conductor also used his handheld radio to have the switching engineer alert the train dispatcher that the cars were rolling downgrade toward the main track. At other, similar, locations, a derail is in place to prevent equipment from entering the main track. At the time of this accident, no derail was in place at the end of Montclair Siding.

Phase 2

About 11:33 a.m., the switching engineer used his cell phone to contact the train dispatcher but was connected to voice mail. He then used the locomotive radio, selected "9" for an emergency radio contact with the dispatcher, and was immediately connected. The dispatcher determined that the cars were running away toward the main track. She said she immediately turned to the corridor manager to notify him of the runaway cars.

After rolling downgrade on the Montclair Siding, the 31 cars entered the main track at MP 35.1. The main track signal system recorded the runaway cars passing the west switch at Montclair and onto the main track of the Los Angeles Subdivision at 11:34 a.m. The main track was mostly on a descending grade ranging from 0.24 percent to 1.01 percent with short level sections between Montclair and Los Angeles. At the time of the initial notification about the runaway cars, personnel in the dispatcher's office were unaware of the grade of the main track. They also did not know the number of cars that were running away. Personnel in the dispatching office told investigators that they expected the cars to slowly come to a stop on the main track.

The engineer of the inbound train told investigators that he asked the dispatcher if he should take his locomotives and chase after the cars. The engineer moved his locomotives westward on the siding in pursuit of the cars but was stopped by a red signal at the west end of the siding.

Between 11:40 and 11:42 a.m. the corridor manager asked the chief dispatcher if he should send an engine after the cars. The chief dispatcher instructed him to wait for the cars to come to a stop. The chief dispatcher later told investigators he feared that an attempt to catch the cars could result in a collision. Unaware of the direction of the grade of the main track in this area, he instructed the corridor manager to re-line the Montclair Siding switch to prevent the cars from coming back into the yard and causing damage or injury. The train dispatcher contacted maintenance-of-way employees in the area and instructed them to clear the track.

During the next few minutes, a report of the movement of the runaway cars was received from the Pomona Police Department. The corridor manager notified the assistant general yard manager in the East Los Angeles Yard that the runaway cars were headed his way and for him to alert his crews and trains in the area to stop their trains and clear the main track. At this time, dispatching office personnel were uncertain if the cars would stop, reverse direction, or derail. Dispatching center supervisors told investigators that because of these uncertainties, they decided to continue evaluating the situation and gathering information; however, they did not notify local authorities about the runaway cars.

UP's mainline between Montclair Yard and City of Commerce varies between one and two main tracks. However, closer to Los Angeles there are three main tracks. The location of the derailment in City of Commerce was at a control point that contains switches that direct trains from one track to another in an area where the railroad changes from two main tracks to three. At this location, there is also a sidetrack named House Track No. 4. The entrance to House Track No. 4 was from a main track switch, which, like other main track switches in the area, was remotely controlled by the train dispatcher.

Allowing the cars to continue rolling on No. 1 main track beyond MP 7.1 would have directed the cars to roll toward Los Angeles and UP's Los Angeles Yard. UP managers were aware that a Metrolink passenger train was on this track beyond City of Commerce.

Four choices for diverting the runaway cars were available to the dispatchers:

- Divert them from the main track to a branch line that crosses two tracks of the Burlington Northern Santa Fe Railway over which high-speed freight trains and Amtrak and Metrolink passenger trains operate.
- Lining the switch from No. 1 main track to No. 2 main track which would have caused a head-on collision with a 93-car train carrying hazardous materials, including several cars of liquefied petroleum gas and chlorine residue.
- Lining the switch from No. 1 main track to No. 3 main track which would have caused a head-on collision with a UP switching crew. Had the switching crew not been occupying track 3, the runaway cars would have posed a risk to a fuel storage facility in Los Angeles near track 3.
- Lining the switch from No. 1 main track to House Track No. 4. Because the maximum speed of the turnout from the main track to House Track No. 4 was 15 mph, the managers knew that the speed of the cars would likely cause them to derail as they passed over the turnout.

At 11:47 a.m., the chief dispatcher inquired as to whether there were cars on House Track No. 4 and was informed that House Track No. 4 was clear of locomotives and cars. At 11:50 a.m., after considering all of the information that was available at the time, the chief dispatcher decided to have the dispatcher line the main track switch to direct the cars in the direction of House Track No. 4 because the tracks in the area presented a wide section of railroad right-of-way within which the cars could derail.

At 11:51 a.m., the chief dispatcher called the general superintendent of the territory and informed him of the situation. The superintendent, after being briefed by the chief dispatcher, agreed to route the cars toward House Track No. 4.

At 11:52 a.m., a maintenance-of-way employee who had been earlier instructed to clear the main track because of the runaway cars called the dispatcher's office and reported that the cars had been observed. When asked about the speed of the cars, the employee estimated that the cars were moving at "50 or 60" mph.

At 11:54 a.m., a voice radio transmission from a wayside defect detector at MP 14.8 broadcast the speed of the cars as 86 mph. (Based on time and distance measurements between control points, the runaway cars reached a calculated maximum speed of 95 mph.)

At 11:58 a.m., 28 of the 31 cars derailed due to excessive speed as they passed over the turnout into House Track No. 4. Cars 1 through 6 derailed but stayed on the right-of-way. Cars 7, 8, 11, and 13 departed the right-of-way and struck neighborhood residences. Cars 29, 30, and 31, the rearmost cars as the 31 cars rolled downgrade, did not derail. The runaway cars had traveled

about 28 miles from Montclair Yard to the switch at House Track No. 4 in City of Commerce. Before derailing, the cars had traversed 25 highway rail crossings, 24 of which were equipped with active warning devices.

Tasks

1. What was the primary cause of the runaway cars in this scenario?

Possible Answers:

- Failure to follow rules for setting hand brakes on cars.
- Failure in teamwork resulted in all the brakes being released before switch locomotive attached to cars.
- Lack of split-point derail at switch entering yard.
- Lack of situational awareness of track grade at dispatch center.
- Dispatcher did not quickly let engineer chase, couple, and slow down runaway cars.
- Dispatching center's lack of familiarity with grade of the tracks at that location.

Discussion (for facilitator's notes):

2. Once the cars exited the yard, what were some barriers to communication that prevented the dispatchers from realizing the potential for them to accelerate as quickly as they did?

Possible Answers:

- Not knowing the grade and direction of slope in the runaway area.
- Did not verify the number of cars when speaking with engineer on first report of runaways.
- Lack of communication with local law enforcement.

Discussion (for facilitator's notes):

3. What could have prevented this accident?

Possible Answers:

- Following procedures and setting the hand brakes before decoupling by the road crew.
- Installation of a split-point derail at the siding switch.
- The crews not having developed a dependence upon emergency air brake application to hold the cars in place on a sloped siding.
- Better communication between the switching conductor and trainman regarding release of the air brakes on the cars in the siding.

- Better leadership by management to ensure that crews complied with proper procedures.
- Improved dispatcher knowledge/situational awareness of runaway area.
- Improved situational awareness (e.g., since switching engine was delayed in yard, conductor and trainman should have waited longer to release the brakes or road crew should have waited to decouple from the cars until the switching locomotive was on the track). (Mental model of what the exchange was supposed to entail was not changed once the switching locomotive was delayed.)

Discussion (for facilitator's notes):

4. Did the road and yard crew's realize the potential implications of their normal exchange of cars on the siding?

Possible Answers:

- No.
- Yes, but they did it anyway thinking that the odds were low that something bad could happen as a result of their variance from the proper procedures.

Discussion (for facilitator's notes):

5. Identify other CRM principles that were violated in this scenario.

<i>CRM PRINCIPLES</i>
Technical Proficiency
Situational Awareness
Communications
Assertiveness
Teamwork

Split Switch Derailment

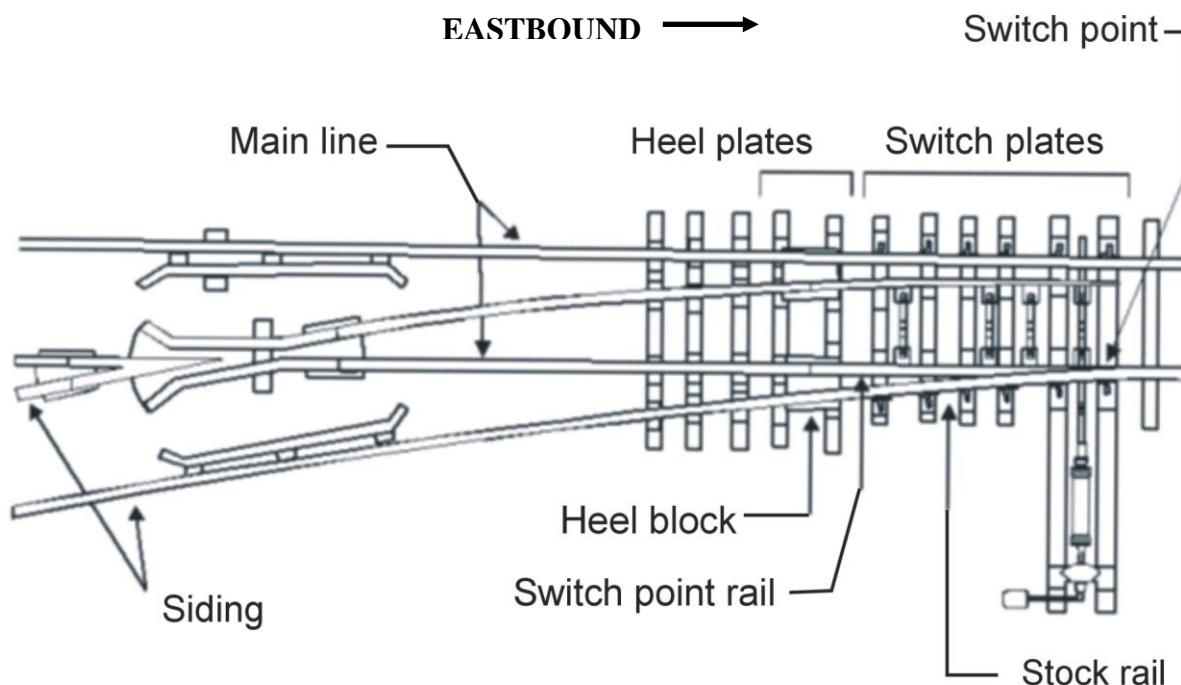
Source:	NTSB/RAB-03/05; September, 2002 (Full NTSB report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Transportation (covered in the introduction before participants are introduced to CRM modules) • Engineering (covered in the introduction before participants are introduced to CRM modules)
CRM Principles Covered:	<ul style="list-style-type: none"> • Communication • Teamwork • Technical Proficiency • Organizational Pressure • Situational Awareness • Leadership
Employees Involved in Accident:	<ul style="list-style-type: none"> • Conductors • Engineers • Dispatcher • Signal Maintainer
Railroad:	Norfolk Southern Railway
Train:	15T
Location:	Farragut, Tennessee
Accident Date and Time:	September 15, 2002, 11:20 a.m. eastern daylight time
Type of Accident:	Derailment
Fatalities/Injuries:	No fatalities or serious injuries
Property Damage:	\$1.02 million

Facilitator Notes:

The Incident

At 8:30 a.m., eastbound NS train No. 721, en route to Knoxville, Tennessee, passed over a spring switch from the Boyd Siding onto the main track. About an hour later, eastbound train No. 703, traveling on the main track, received an unexpected restricting signal indication at the west end of Boyd Siding, which is about 2 miles from the east end of Boyd Siding. This signal indication required that the crew slow the train from the normal track speed of 50 mph to a speed, not to exceed 20 mph, that would allow the train to stop within half the visual range and short of any obstructions. The train crew reduced the train's speed and reported the signal indication to the train dispatcher, as the operating rules required.

At the east end of the siding, the crew of train 703 stopped short of the spring switch so the conductor could look at the switch before proceeding. He found that the left switch point (when facing west) was not seated tightly against the stock rail but instead had a 1/4-inch gap. After operating the spring switch through its motion several times, the conductor found that the left switch point still failed to close completely, leaving about a 1/8-inch gap between the switch point and the stock rail.



The engineer of train 703 radioed the train dispatcher and reported that the switch points had not lined “back all the way to line up for the main line; you might need somebody to look at it.” The dispatcher replied, “Alright, I’ll get somebody headed that way.” Because an eastbound train movement was a trailing movement that would tend to force the switch points back into the correct position, train 703 proceeded through the switch at restricted speed without incident.

About 9:45 a.m., just after train 703 had cleared the switch, the train dispatcher called a signal maintainer to inspect the spring switch. The dispatcher advised the signal maintainer that he did not have to hurry because no trains were due to arrive at the switch soon. The maintainer

ate breakfast and departed his home at about 10:20 a.m., arriving at the switch at about 11:00 a.m. The signal maintainer said that as he approached the switch, he could see the signal controlling westbound train movements and noted that it was showing a clear aspect, indicating that the switch gap had closed after train 703's movement over it.

The signal maintainer said that when he arrived at the switch, he noted that the points appeared to be properly positioned. He said that he visually inspected the switch and noticed that the switch plates, while not really dry, "looked like they could use a little oil." He said that he put oil on each switch plate. He walked from the heel block to the switch point and did not see anything unusual.

In order to make an internal inspection of the switch to determine why the spring switch had gapped, the signal maintainer was required to get a track warrant to occupy the track and inspect the mechanical movement of the switch. The signal maintainer called the train dispatcher and told him that the switch appeared to be aligned properly and asked about a track warrant and any expected train traffic. The dispatcher told the signal maintainer that a freight train (train 15T) and a coal train were en route westbound toward the switch. The signal maintainer replied, "Okay, all right, I will wait till these two [trains] get by [the switch] and holler at you."

The signal maintainer, while waiting on the north side of the main line adjacent to the switch, heard the crew of train 15T call out the clear signal at east Boyd. According to event recorder data, train 15T approached the switch at about 38 mph. The engineer stated that as the locomotives moved over the switch, he felt a slight "tug," and he, along with the conductor, looked back and saw the train starting to derail. The train went into emergency braking at that time. The engineer said he immediately saw what appeared to be a smoke cloud coming from the train. The engineer radioed the train dispatcher by using the emergency 911 radio tone and advised him of the derailment and of the smoke. The signal maintainer also called the dispatcher, about 11:20 a.m., to report the derailment.

Examination of the switch during the post accident investigation showed that a bolt was missing from the No. 4 throw rod. A piece of the missing bolt was wedged between the south spring point and the stock rail, keeping the point from properly contacting the stock rail.

Tasks

1. Determine who comprised the crew assigned to safely accomplish the task of safely moving trains through the switch?

Possible Answers:

- Engineer and conductor of the all the trains going through the switch
- Dispatcher
- Signal maintainer

*Discussion: Each of these employees had responsibilities relating to the safe accomplishment of the task. Part of those responsibilities, which are often overlooked and act to maintain the error chain, is working together effectively as a team. In this example, the crew is an **interactive** team.*

2. What was the first thing that went wrong (or the critical event)?

Possible Answer:

- Equipment failure

Discussion: Many times equipment failure is the critical event in an error chain. Equipment failure happens all the time; however, procedures are in place, as well as CRM skills that can break the error chain, so that the critical event does not cause an accident. Thinking back to the Swiss Cheese Model, this is an example of how the second CRM filter (after the critical event) failed to prevent an accident.

3. What do you see as some errors after the critical event?

Possible Answers:

- Decision of the signal maintainer and the dispatcher to allow trains to pass over the switch without an operating test.
- Communication: The write up states that the “train dispatcher called a signal maintainer to inspect the spring switch;” however, we are unsure how much information about the problem the dispatcher communicated to the signal maintainer. It can be assumed that the dispatcher was vague in his/her description of the problem. A different decision might have been made had the dispatcher given the signal maintainer the background of the problem. For example, if the dispatcher would have communicated to the signal maintainer that before a train’s trailing movement, the train crew found that the switch point was not seated tightly against the stock rail but instead had a 1/4-inch gap, even after operating the spring switch through its motion several times. The signal maintainer could have then reasoned that the trailing movement would tend to force the switch points back into the correct position, making it look like the switch was aligned and functioning properly, when in fact there was a malfunction. This might have led the signal maintainer to be more assertive and take the switch out of operation (get a track warrant).
- Not walking opposing movement trains. Perhaps putting a slow order on the switch or walking the train through might have minimized the damage from a derailment.

Discussion: There is no argument that the beginning of the error chain occurred when the bolt came out of the No. 4 throw rod and became wedged between the south spring point and the stock rail, keeping the point from properly contacting the stock rail. However, a case could be made that the accident could have been prevented if the team involved used the proper CRM techniques.

4. What might be some other factors involved in the accident besides the factors already discussed?

Possible Answers:

- Lack of clear company procedures to stop or take cautionary action for all trains from unrestricted proceeding after a main track problem was reported. However, making more rules does not always solve the problem; teams are always going to have to make decisions in one form or another.
- Assertiveness: Perhaps the dispatcher or the signal maintainer felt that he/she should

- do an operational test yet was not assertive enough to voice his/her opinion.
- Operational pressure.
 - Reliance on indicators (equipment cues) that say something is working correctly when other cues give you info that it is not (person cues).

Discussion (for facilitator's notes):

4. Determine how operational testing can be used to break error chains such as the one that caused this incident.

Possible Answers:

- The probable cause of the accident was determined to be the decision of the maintainer and the dispatcher to allow trains to pass over the switch without an operating test

Facilitator: Before leaving the scenario, make sure that you have mentioned these specific CRM principles that were violated in this scenario. This will help with the lead in to the introduction to the main CRM elements.

CRM PRINCIPLES
Communication
Teamwork
Technical Proficiency
Assertiveness
Situational Awareness

Unfamiliarity with Equipment Leads to Crash

Source:	NTSB Report: NTSB RAB/03-01 (Full NTSB report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Transportation
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer • Conductor
Railroad:	National Railroad Passenger Corporation (Amtrak)
Train:	Amtrak train No. 90 “The Palmetto”
Location:	Baltimore, MD
Accident Date and Time:	June 17, 2002 About 5:42 PM
Type of Accident:	Collision/sideswipe and subsequent derailment
Fatalities/Injuries:	Six minor injuries—all treated and released
Property Damage:	\$740,000

Facilitator Notes:

From NTSB report:

The circumstances of the accident are consistent with evidence that the engineer lost situational awareness as her train traveled through the tunnel toward Penn Station. When people fixate on or become preoccupied with a certain task, their ability to detect and respond appropriately to other important information can be degraded or lost. The engineer said that as her train traveled through the tunnel, she focused on the speed of the train. The fact that the engineer was not comfortable with P-42 equipment likely exacerbated her excessive focus on regulating her train's speed through the tunnel, to the exclusion of more significant stimuli, such as responding appropriately to a change in cab signals governing the movement of her train.

The Incident

The engineer of the Amtrak train was an extra-board employee based in New York City. On the day of the accident, the engineer had deadheaded from New York to Washington, D.C., to operate Amtrak Train No. 90 on a trip from Washington back to New York. When she arrived in Washington, she was surprised to learn that the train she was to operate was being pulled by two diesel-electric P-42 locomotives. She said she expected to operate electric equipment on this run, as she had on other occasions. She said her experience in operating P-42s was limited to training and operating in a yard environment and that she had never operated P-42s in revenue service. (Amtrak records stated that the engineer had operated a train with 2 P-42 locomotives on passenger run between Philadelphia and Washington under the observation of a designated supervisor of locomotive engineers about six months prior to the accident.)

Train No. 90 departed Union Station on time at 4:45 p.m. with the engineer as the only person in the locomotive cab. (Normal procedure for Amtrak trains as the conductor and other crewmembers are often busy taking care of passengers.) As the train proceeded out of the station and began to enter the main line, upon reaching 20 mph it experienced a penalty air brake application which stopped the train due to the territory switch being improperly positioned. The engineer stated that the electric locomotives she normally operated within the Northeast Corridor always had cab signals activated and thus did not require that the territory switch be repositioned. (The engineer had experienced a similar penalty brake application on an earlier occasion when locomotive cab signals of an electric Acela train set were not properly configured when she departed Washington, D.C., for New York City.) The engineer said that after she reported the penalty stop, as required, the trip north toward Baltimore was generally uneventful.

As the train approached the tunnel in Baltimore, the engineer received an approach medium signal indication, which required a speed reduction to 45 mph. The signal was followed by an approach signal indication, which authorized her to proceed through the tunnel at not more than 30 mph. The engineer said that while traversing the tunnel, she concentrated on maintaining a train speed of 30 mph. The engineer recalled that the brake system for train No. 90 was configured in the direct-release position, as opposed to the graduated-release air brake setup with which she said she was more familiar. She also said she normally engaged the dynamic brakes in electric locomotives but that she "...was not familiar with how to...control the train using the dynamic on those P-42s." Rather, she said she used the automatic brake to slow the train's speed through the tunnel. The engineer said that the track was on a descending grade as it approached the end of the tunnel and that as she traversed this section, her throttle was off and that the train pushed her along. She recalled that she initially used the independent brake (applying to the locomotives only) to slow the train but worried about causing flat spots on the locomotive wheels.

Locomotive event recorder data showed that after receiving the approach signal, the train received a restricting signal indication requiring that the train slow to below 20 mph and operate in a manner that would permit stopping within half the range of vision short of a stop signal. Although the engineer said she did not recall receiving the restricting signal indication, the event recorder showed that she acknowledged receipt of the signal and that she did slow the train below 20 mph.

The engineer said she continued to operate on an approach signal until she exited the tunnel, and that "...to my recollection, the only other signal, the only thing I had in the cab was an approach." She said she was not distracted while traversing the tunnel and that she was "just trying to control these two motors. My concentration was on keeping the speed down."

Two main tracks, track No. 2 to the east and track No. 3 to the west, are in the vicinity of the accident. The two main tracks diverge into the station tracks for Baltimore's Penn Station. Train No. 90 was operating on track No. 2 through the tunnel. Meanwhile, southbound MARC train No. 437 was operating on a permissive diverging aspect at the interlocking signal outside the station. The route lined through the Charles Interlocking was a crossover route from station platform track No. 5 to the No. 2 main track, continuing through the crossover to the No. 3 main track. While train No. 437 was traversing the interlocking, the signal governing the movement of train No. 90 on No. 2 main track was displaying a stop indication.

The train No. 90 engineer said that as her train rounded a curve after leaving the tunnel, she saw the MARC train crossing over in front of her. She said that she "went for the brake" but that she could not recall if she "put it in emergency all the way or what." According to event recorder data, train No. 90 was traveling about 15 mph when the engineer put the train into emergency braking. The left leading corner of the lead Amtrak locomotive struck the 4th car from the head-end of the MARC train. The 5th and 6th cars on the MARC train derailed upright, and the lead truck of the Amtrak locomotive derailed. The collision occurred about 330 feet north of the red signal governing train No. 90's movement.

Tasks

1. What were the engineer's options when she arrived in Washington and realized that she was being assigned to equipment with which she was relatively unfamiliar?

Possible Answers:

- Admit that she felt uncomfortable on P-42 procedures and discuss it with a supervisor or the conductor.
- Speak up during the crew briefing saying that it had been at least 6 months since she had been in a P-42 locomotive.
- Call crew schedulers to see if another engineer was available or see if the DC roadmaster/trainmaster could assign someone for a ride-along or an additional engineer.

Discussion (for facilitator's notes):

2. What were some of the outside pressures that made her take the train anyway?

Possible Answers:

- She had deadheaded down to take the train back, indicating that there were no other available qualified engineers to operate the train back to New York.
- Operational pressures of a passenger train—no time to find a replacement.

- Hesitant to admit lack of proficiency/knowledge on P-42s.
- Job and reputation consequences of not taking the train (official from Amtrak and non-official from other engineers/employees).

Discussion (for facilitator's notes):

3. What were some of the clues that other crewmembers should have noticed indicating that something was lacking in her technical proficiency to operate the train?

Possible Answers:

- Penalty brake application coming out of the station. Conductor questions?
- Not stated, but potentially her actions in the crew brief should have been evaluated by the conductor. Should have been asked by the conductor if P-42s were that uncommonly used on this run.

Discussion (for facilitator's notes):

4. What was the primary error that caused the crash?

Possible Answers:

- Missed signal(s)
- Did not know brake systems on P-42.
- Not paying attention to outside due to task fixation/overload.

Discussion (for facilitator's notes):

5. What could the engineer have done to prevent this accident?

Possible Answers:

- Be better prepared.
- Get a better briefing from crew assignment regarding equipment that she is expected to operate.
- Identify the problem earlier.
- Know all potential locomotive and train systems better.
- Speak up and state lack of technical proficiency.

Discussion (for facilitator's notes):

6. Identify other CRM principles that were violated in this scenario.

CRM PRINCIPLES
Technical Proficiency <ul style="list-style-type: none">• Familiarity with equipment• Skilled performance
Situational Awareness <ul style="list-style-type: none">• Loss of situational awareness• Task fixation or preoccupation

Too Many Cars

Source:	NTSB Report: NTSB RAB/98-02 (Full NTSB report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Transportation (Situational Awareness) • Engineering (Situational Awareness)
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Technical Proficiency • Organizational Pressures • Communication
Employees Involved in Accident:	<ul style="list-style-type: none"> • Clerk • Dispatcher • Engineer • Conductor
Railroad:	Union Pacific Railroad
Train:	BVFW-20, EM-20
Location:	Odem, Texas
Accident Date and Time:	February 21, 1997, about 2:08 a.m., central standard time
Type of Accident:	Collision, Derailment
Fatalities/Injuries:	2 crewmembers of striking train received "non-life threatening" injuries
Property Damage:	\$31,000

Facilitator Notes:

* Could add some technical proficiency questions. Example: Was the clerk technically proficient? (Did not perform his/her job correctly) Was the train crew technically proficient? (Did not realize that they were hauling twice as many cars.)

The Incident

Train 1, a northbound Union Pacific freight train (BVFW-20), arrived at Kingsville, Texas to switch crews. The inbound crew informed the clerk at UP's National Customer Service Center (NCSC) that the train consisted of 136 cars. The clerk at the NCSC improperly entered in the computer that the train had only 64 cars. As a result, the outbound crew received an incorrect computer-generated car count. The crew departed Kingsville and arrived in Odem, Texas. It was early in the morning and foggy out when upon arrival, the train dispatcher (who had information that the train was carrying 136 cars) informed the crew that they had cars to set out. The train crew advised the train dispatcher that they only had 64 cars in their train and that they were all through cars. With this new (incorrect) information, the train dispatcher instructed the crew to pick up 30 cars destined for Fort Worth, Texas. At 1:28 a.m., the crew, thinking that they had 64 cars, reported to the train dispatcher that their train was clear of the yard limits at MP 153. The crew uncoupled the locomotives and the first 5 cars from the train and proceeded onto the yard track that had the 30 cars. After the crew of train BVFW-20 reported their train clear of the main track, the train dispatcher gave another train, Train 2 (EM-20) permission to proceed to MP 153.0. No one knew that the uncoupling of the 136 car BVFW-20, left the rear portion of their train approximately 2,100 feet south of the yard limit sign, which was located at MP 153.

Train 2 operating at 45 mph, approached the yard limits in Odem, Texas. The engineer made an initial brake pipe reduction with the train brakes in preparation for entering the yard limits. As the train proceeded, the crew observed the marker light flashing on the rear car of Train 1. The engineer placed the train into emergency braking 1,046 feet from the rear end of Train 1. The crew of Train 2 jumped from their train at approximately 20-25 mph. Train 2 collided into back of Train 1 on the mainline track just south of the Odem Yard. Both crewmembers who jumped from train 2 received non-life threatening injuries. The crew of train 1 was not injured.

Tasks

1. Determine who comprised the crew assigned to accomplish the task of safely moving into the yard.

Possible Answers:

- Clerk
- Dispatcher
- Engineer
- Conductor

Discussion: It is everyone in the crew's responsibility to safely move trains into the yard. This is an example of an interactive team.

2. Determine when the error chain began.

Possible Answers:

- When the clerk incorrectly entered 64 instead on 136.

Discussion: The error chain began when the clerk incorrectly entered 64 instead of 136; however, this human error could have been prevented if others in the team were more situationally aware.

3. What was the crew of train #1's perception of the situation?

Possible Answers

- They had 64 cars.
- Their train was inside the yard limits.

Discussion (for facilitator's notes):

4. What was the reality of situation?

Possible Answers:

- They had 136 cars.
- Their train extended beyond the yard limits.

Discussion (for facilitator's notes):

5. How was the team's incorrect perception of the situation developed?

Possible Answers:

- By the Clerk.
- Overdependence on the computer generated car count.

Discussion: It was developed first by the clerk incorrectly entering in the car count. However, it was reinforced by a lack of questioning discrepancies by the crew.

6. If the key to team situational awareness is communication between team members, what should be done when there are discrepancies between team members' understanding of the situation?

Possible Answers:

- When discrepancies exist, stop and discuss the discrepancies.

Clarendon

Source:	NTSB Report: NTSB/RAR-03/01 (Full NTSB report can be found on "CRM disk 1 ...")
Training Track Application:	<ul style="list-style-type: none"> • Transportation (Communication) • Engineering (Communication)
CRM Principles Covered:	<ul style="list-style-type: none"> • Communication • Situational Awareness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer (Coal Train) • Conductor (Coal Train) • Engineer (Intermodal Train) • Conductor (Intermodal Train) • Dispatcher
Railroad:	Burlington Northern Santa Fe Railroad
Train:	BNSF 8876, BNSF 4385
Location:	Clarendon, Texas
Accident Date and Time:	May 28, 2002
Type of Accident:	Collision, Derailment
Fatalities/Injuries:	1 Fatality (Engineer of I.M. Train 4385)
Property Damage:	Equipment \$6,401,192 Lading 427,000 Track 331,189 Environmental cleanup 202,765 Wreck clearing 763,506 Total \$8,125,652

Facilitator Notes:

The Incident

The engineer and conductor of the intermodal train went on duty at 6:45 a.m. in Childress, Texas, about 60 miles east of the accident location. The engineer and conductor of the coal train went on duty at 6:00 a.m. in Amarillo, Texas, about 55 miles west of the accident location. The coal train, with 116 cars of coal and headed by lead locomotive BNSF 8876, departed Amarillo at 7:40 a.m. The train operated eastward, entering track warrant control (TWC) territory several miles east of the yard area. The coal train crew's first track warrant was quickly followed by a second one at 7:49 a.m. The second track warrant was an after-arrival warrant, stipulating that the coal train was to wait at Malden Siding for the arrival of a specified train before proceeding beyond that point. As was common BNSF practice when heavy coal trains were to meet other, lighter, trains on this portion of the railroad, the coal train was to remain on the main track while the lighter train was diverted onto the siding. The coal train met the opposing westbound train at Malden Siding, as required. At 8:05 a.m., the engineer of the coal train called a family member on his cell phone. The call was ended 23 minutes later at 8:28 a.m. The meet between the coal train and the specified train took place two minutes later at 8:30 and lasted till 8:35, after which, in accordance with its track warrant, the coal train proceeded toward the east end of Ashtola Siding.

Meanwhile, the westbound intermodal train (Engine BNSF 4385 West) was granted track warrant authority at 8:26 a.m. This track warrant was also an after-arrival warrant. The train was to proceed to Hedley Siding (see figure 2) where it was to await the arrival of Engine UP 5827 East. Once that train had passed on the adjacent track, the intermodal train's track warrant authorized it to move on the main track from Hedley Siding to Ashtola Siding. At Ashtola, the intermodal train was to divert onto the siding to allow the coal train to pass on the main track. As instructed by the track warrant, the intermodal train waited for the passage of Engine UP 5827 East, after which the requirement of the track warrant was complete, and the intermodal train began moving westward toward Ashtola.

As the coal train neared Ashtola, at 8:43 a.m., the final track warrant, Track Warrant 22, was issued. At the exact time Track Warrant 22 was issued, and 16 minutes since getting off the phone earlier, the engineer used his cell phone to call his family again. As the engineer was controlling the train and talking on his cell phone, the after-arrival track warrant that covered the coal train's movement between Ashtola Siding and Hedley Siding, about 25 miles away was being repeated by the conductor. This track warrant specified that the coal train was to hold short of the east end of Ashtola Siding until the arrival in the siding of Engine BNSF 4385 West (the intermodal train). The track warrant would become effective at that point. A review of the audiotapes of the dispatcher's radio communications confirmed the content of the track warrant, which the conductor read back accurately to the dispatcher, including the stipulation that the track warrant was not in effect until after the arrival of Engine BNSF 4385 West at Ashtola. At the time this warrant was issued, the coal train was approximately 3.2 miles from the point at which it was to stop and wait and was traveling, according to event recorder data, about 48 mph.

The engineer was still on this call several minutes later as his train passed the east end of Ashtola Siding. The train should have stopped at this point to await the arrival of the intermodal

train, in accordance with the train's track warrant. Event recorder data indicated that the train was traveling about 48 mph at that time. After the coal train had traveled for about 9 1/2 minutes after passing the east end of the siding, the train's conductor saw and alerted the engineer to the oncoming train as the intermodal train rounded the curve ahead. The engineer exited the rear door of the locomotive, followed by the conductor, and jumped from the rear steps. The conductor and engineer of the intermodal train also exited their locomotive and jumped from the walkway.

Event recorder information indicates that both trains' brakes were placed in emergency before the collision. At the time the coal train was placed in emergency, it was moving at 49 mph. The intermodal train was placed in emergency as it was moving at 42 mph with the throttle in the 8th notch (maximum power). An engineering survey commissioned by the BNSF indicates that the coal train went into emergency 1,093 feet before the collision point and that the intermodal train went into emergency 1,064 feet before the collision point. At the point of the collision, the coal train had traveled for almost 10 minutes and about 7.8 miles from the point where it should have waited for the arrival of the intermodal train.

The coal train engineer received critical injuries. The conductor of the coal train was struck by the debris of the derauling equipment of his train and partially buried in coal. He received critical injuries and required extensive hospitalization and rehabilitation. Although the intermodal train conductor received minor injuries, the engineer of the intermodal train was fatally injured when he was struck by the derauling equipment.

Tasks

1. Determine who comprised the crew assigned to accomplish the task of moving the two trains.

Possible Answers:

- Engineer and Conductor of BNSF 8876
- Engineer and Conductor of BNSF 4385
- Dispatcher

Discussion: It is everyone in the interactive crew's responsibility to safely move the two trains to their destinations.

2. What was the first error?

Possible Answers:

- When BNSF 8876, passed the east end of Ashtola siding.

Discussion: The error chain began when BNSF 8876 passed the east end of Ashtola siding.

3. What were some of the breakdowns in communication?

Possible Answers:

- The conductor failed to inform the engineer of the track warrant information.

4. Were there any distractions to communication?

Possible Answers:

- Telephone conversation.
- Hot box detector.

La Crosse, WI

Source:	BLET/FRA Officials
Training Track Application:	<ul style="list-style-type: none"> • Engineering (Teamwork) • Transportation (Teamwork)
CRM Principles Covered:	<ul style="list-style-type: none"> • Situational Awareness • Communication • Teamwork • Assertiveness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer • Conductor • Utility Man • Train Master • Yardmaster
Railroad:	BNSF
Train:	Yard Train
Location:	La Crosse, WI
Accident Date and Time:	February 6, 2004
Type of Accident:	Run over Red flag, Yard Derailment
Fatalities/Injuries:	None
Property Damage:	Unknown

Facilitator Notes:

The Incident

At approximately 0745, A Track Maintenance Foreman reported to the Yard office and informed the Yardmaster that he would be working at the west end of the yard with a contractor constructing a highway overpass. He further informed the Yardmaster that he would be working on Tracks 2 and 12. Subsequently, the Foreman asked for permission to take the west end of Track 2 out-of-service. The Yardmaster granted permission and the west end of Track 2 was taken out-of-service. Per the Safety Rules, the Foreman erected a red flag and installed a portable derail to the track. While the Yardmaster assumed that the foreman had put up a flag and derail, there was no communication between the foreman and Yardmaster to confirm that fact.

Later in the morning the Yardmaster decided to place a car at the west end of Track 2. He contacted the foreman and asked if there was room at the west end for the car and still provide MOW protection. The Foreman confirmed that there was room for the car. He then moved his flag and derail approximately 70 feet west to accommodate the single freight car. He did not communicate to the Yardmaster that he had to move his flag and derail to accommodate this move.

Shortly thereafter, a switch crew placed a single freight car at the west end of Track 2. This resulted in the freight car resting approximately one car length (or less) from the red flag and derail.

An Engineer and Conductor reported for duty at 1201 on February 6, 200 at the yard. This crew was assigned to operate a freight train from Able Yard to Chico Yard, a distance of approximately 100 miles. The 3916 feet long train consisted of 59 cars, 43 loads, 16 empties weighing 5359 tons, with approximately 90.8 tons per operative brake. The train was sitting at the east end of Track 2.

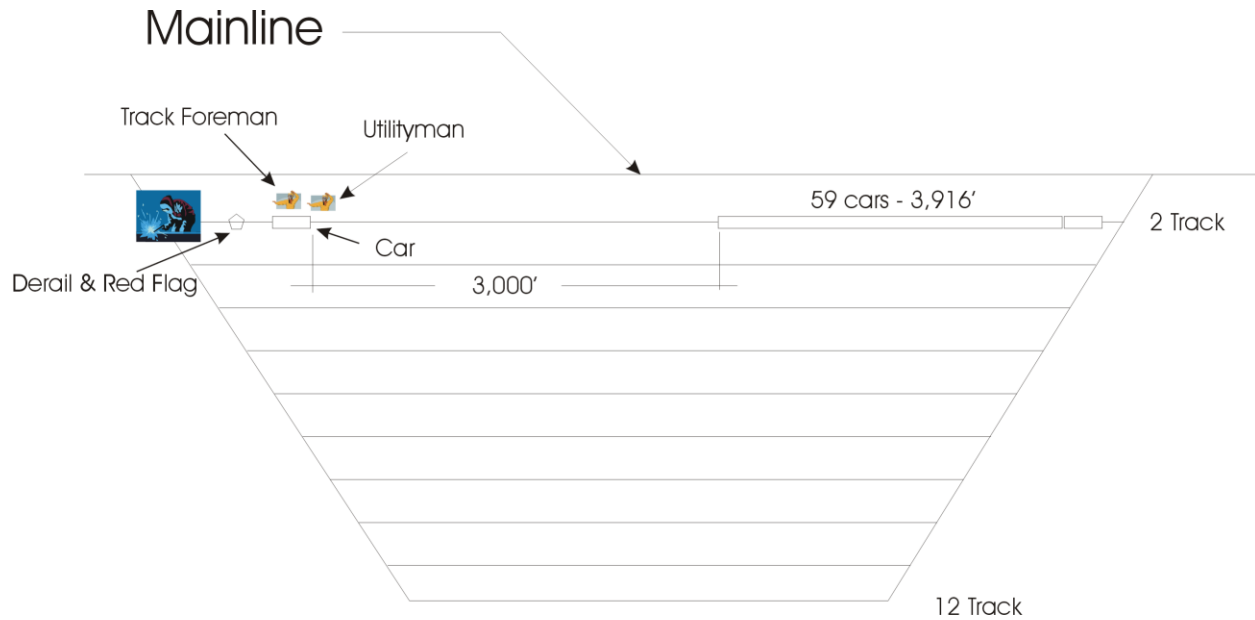
Before departing Able Yard the crew was instructed by the Yardmaster to pick up an additional car that was sitting at the west end of Track 2. The Yardmaster also informed the crew that a utility man would be assigned to their crew to facilitate the pick up.

A safety briefing was conducted between the conductor and the utility man concerning the pick up. The facts that the train had approximately 60 cars and had to shove a considerable distance (approximately 3000 feet) were discussed. The conductor returned to his train and briefed the Engineer on the work to be done.

The Utility Man arrived at the location of the single car to be picked up and began the shoving movement by instructing the Engineer to shove back 40 car lengths. He did this knowing that there were more than 40 car lengths available for the movement. He also met the Foreman at this location and noticed the red flag. He did not notice the derail.

The utility man stated he gave the following instructions to the engineer, a second 40 car call, "20 cars," "10 cars," "5 cars," "3 cars," "1 long car." The train was moving at approximately 4-6 mph when at a distance of approximately 25 to 35 feet from the single car to be picked up, the utility man radioed the crew saying, "That will do."

The train coupled to the signal car showing it down Track 2, running over the Foreman's red flag, striking a derail, and derailing the single car into the maintenance of way work area at approximately 1250. There were no injuries.



Able Yard Incident

Tasks

1. Determine who comprised the team assigned to safely accomplish the task of picking up the single freight car.

Possible Answers:

- Engineer
- Conductor
- Yardmaster
- Utility Man
- Foreman
- MOW Crew

Discussion: Each of these employees had responsibilities relating to the safe accomplishment of the task. Part of those responsibilities, which are often overlooked and act to maintain the error chain, is working together effectively as a team.

2. What were some of the human errors that contributed to this incident?

Possible Answers:

- The yardmaster failed to inform the utility man, engineer, and conductor of the presence of the work being conducted at the west end of Track 2.
- The foreman, in an attempt to accommodate operational needs, compromised the safety of the task by relocating the flag and derail.
- Technical proficiency: The utility-man did not recognize the approaching distance-speed combination during closure for the train as it approached the subject car and failed to appropriately announce the closure distance and required speed reduction needed to prevent a hard couple to the engine crew.
- When the foreman met the utility man at the single car, the foreman failed to inform the utility man of the presence of the derail.
- When conditions changed (the utility man noticed the flag), he failed to conduct a job briefing with the engineer and conductor.

Discussion: This is a case where each individual did their jobs properly as they saw it, but they failed to ensure that the other team members had the information that they needed to make proper decisions.

3. When did the error chain begin?

Possible Answers:

- While arguments could be made for many starting points, the first breakdown in the process appears to be when the yardmaster gave the foreman permission to take Track 2 out of service, and the foreman did not inform the yardmaster specifically that he was going to provide protection by using a flag and derail. While this is the rule, and the yardmaster may have subconsciously understood what foreman was going to do, the verbalization of that fact may have influenced the yardmaster's decisionmaking process.

4. Identify specific CRM principles that were violated in this scenario.

<i>CRM PRINCIPLES</i>
Technical Proficiency: The lack of technical proficiency displayed by the yardmaster, MOW crew, and utility man. All contributed to this incident.
Situational Awareness: A lack of situational awareness was displayed by the engine crew, the utility man, and the MOW crew.
Communication: Communication vital to carrying out a proper job briefing is also in evidence. General lack of communication or making assumptions is apparent.
Assertiveness: The scenario states that the utility man met the foreman at the location when giving direction to the engineer. If the foreman was watching, did he not think that the train was going too fast? If he did, perhaps he was not assertive enough to say something to the utility man.

Seventeen Mile Grade

Source:	NTSB Report: NTSB RAR/02-02 (Full NTSB report can be found on “CRM disk 1 ...”)
Training Track Application:	<ul style="list-style-type: none"> • Transportation
CRM Principles Covered:	<ul style="list-style-type: none"> • Technical Proficiency • Situational Awareness • Communications • Teamwork • Assertiveness
Employees Involved in Accident:	<ul style="list-style-type: none"> • Engineer • Conductor • Trainman Trainee • Helper Engineer • Dispatcher • Crew Callers • Road Foreman
Railroad:	CSX Transportation
Train:	Coal Train V986-26
Location:	Bloomington, MD
Accident Date and Time:	January 30, 2000 About 7:00 AM
Type of Accident:	Derailment on long descending grade in mountainous territory
Fatalities/Injuries:	1 fatality - 15yr old boy in house destroyed by derailed cars; 3 other residents were injured- 1 seriously; Crew escaped without injury
Property Damage:	Total damages in excess of \$3.2 million.

Facilitator Notes:

Probable Cause

NTSB determined that the probable cause of the January 30, 2000, derailment of CSX Transportation train V986-26 near Bloomington, MD, was the railroad's practice of including dynamic braking in determining maximum authorized speed without providing the engineer with real-time information on the status of the dynamic braking system.

The Incident

Crew background

Engineer:

The locomotive engineer assigned to this train was considered one of the most senior and experienced engineers in the Grafton area. He had qualified as an engineer in 1976 and stated that he had taken trains from Grafton to Cumberland “thousands of times;” however, he had recently been in yard service for 4 years and returned to road service on January 9, approximately three weeks prior to the accident.

Upon returning to road service, he had requested several trips accompanied by a pilot to re-familiarize himself with the route and any new or special procedures that had been put in place. The road foreman stated that he could have 2 round-trip pilot runs, but, due to scheduling, he had only received one pilot run in the direction opposite the accident run. He had completed a total of 20 trips along the accident route, 12 westbound and 8 eastbound in the three weeks he had been back on road service. Upon being assigned to this run, he reminded the crew callers that he still was “due” for more pilot runs but the crew callers said that they would decide if he needed one and, if so, there would be one there. Upon reporting there was not one there. The engineer knew that the road foreman was out of town and unavailable.

Conductor:

The conductor had been well rested upon reporting. He had been off duty for 11 hours and 30 minutes. He was qualified and experienced on this route.

Trainman trainee:

Trainman trainee had been on the railroad for about a month, most of which had been spent in initial classroom training. At the time of the accident, he was sitting in the second locomotive cab because the engineer was smoking in the lead locomotive and he did not like the smell.

Consist Information

CSXT train V986-26 originated at the CSXT Grafton Yard in Grafton, West Virginia, and was destined for the Potomac Electric Power Company's Bennings power plant in Washington, D.C. The 80 loaded coal cars of the accident train were coupled with a three-locomotive consist with a former Conrail locomotive as the lead unit at about 11:30 p.m. on January 29 by a yard crew under the direction of the dispatcher. All applicable brake tests were conducted and passed. The yard crewmembers were instructed to move the accident train down track No. 3 to the scale house, where they secured the train and were relieved at about midnight.

Route before the Incident

The accident train crewmembers (an engineer, a conductor, and a trainman trainee) arrived at Grafton about 2 hours later, at 2:00 a.m. on January 30. After receiving their orders and conducting a job briefing, the accident train crewmembers went to the train. The Federal Railroad Administration (FRA) air brakes test was completed by the engineer and a utility employee. The train line pressure was set for 90 psi, and according to both the engineer and the

utility employee, the EOT indicated a pressure of 81 psi at the rear of the train. The engineer and the utility employee also successfully tested the EOT emergency brake application feature. The crew then checked that the locomotive hand brakes were off and that the control console of each trailing locomotive unit was set up in the proper configuration. About 2:30 a.m., the train, upon receiving the signal from the dispatcher, departed Grafton Yard. The utility employee said that he observed the last 30 to 35 cars of the train as it departed and that he noted no problems.

When the train reached Newburg at MP 267.2, it stopped so a helper locomotive could be added. The engineer later said that up to that point, he had not needed to use either the air brakes or the dynamic brakes to control the train. When the helper arrived and was coupled onto the rear of the coal train, the helper flagman (brakeman) disconnected the train line from the coal train EOT and connected it to the helper. The helper engineer told the train engineer that there were 82 pounds of pressure and asked him to do a set-and-release brake test. After successful completion of the test, the train proceeded east with a clear signal. From then on, except at Blaser (MP 258.9), until the helper was uncoupled at Terra Alta, the train engineer did not communicate with the helper engineer except to call signals. When the train reached the top of the hill at Blaser, the helper engineer radioed the train crew that the air on the rear of the train was adequate to go down the hill. The train proceeded down the hill at the authorized speed of 25 mph; however, the helper engineer thought something was unusual:

“I think we used 17 pounds of air coming down the first hill. Which was kind of [unusual]. Generally, 10 to 11 [pounds of] air will hold a train off there. But [the coal train engineer] controlled the train at the speed limit.”

The helper engineer said later that he did not say anything to the train engineer about the heavier air brake application, even though he thought it was unusual, because the train was under control and not exceeding the authorized speed. The train reached the bottom of the grade at Rowlesburg and began the uphill climb to Terra Alta. The train reached the top of the grade at Terra Alta without difficulty, where it stopped to cut off the helper.

As the train draped the crest of the grade at Terra Alta, the helper was uncoupled. The helper brakeman reconnected the flashing EOT to the train line, but the EOT would not register train line pressure. The helper brakeman replaced the EOT with a spare unit carried aboard the helper, and he and the train engineer were then able to establish telemetry and successfully performed an air test and an EOT emergency feature test. About 5:43 a.m., the train continued east, and the helper returned to Rowlesburg.

The portion of railroad from Terra Alta to Altamont was undulating over 18.6 miles, and the maximum authorized speed for coal trains was 30 mph. The eastbound route had a brief down grade, from Terra Alta to Snowy Creek, during which the engineer maintained a speed of 28 to 29 mph by using dynamic braking and a short and limited application of the air brakes. The engineer then went to full throttle (throttle control in the 8th notch) and ascended the grade to Edgewood, east of the Maryland State line. Then he descended the shallow down grade to Skipnish Fill, while he again made a short, 1-minute, minimum 8-pound application of the air brakes, supplemented by dynamic braking. (The engineer was unaware that the lead locomotive was the only unit on which dynamic braking was actually being applied because of a defective multiple-unit cable connecting the lead locomotive with the first trailing unit.)

After that, the grade dropped off rather sharply down into the Youghcogheny River Valley through Macking's Hollow, just west of Oakland, Maryland. The engineer used a brief minimum brake application of 10 pounds for about a minute and a half while continuously using heavy dynamic braking. The railroad was relatively level through Oakland and then gently ascended to Mountain Lake Park, where the grade increased and the railroad climbed up through Deer Park, Maryland, about 2.8 miles from the grade at Altamont. When the train reached Oakland, the engineer came out of dynamic braking and increased the throttle, eventually accelerating to 40 mph in order to build enough momentum to ascend to Altamont. He maintained maximum throttle (notch 8) on the climb to Altamont, but the speed slowly dropped to 15 mph as the lead locomotive unit crossed the summit, about 6:22 a.m. About a minute later, the speed dropped to 13 mph, and the engineer made a minimum brake application while in throttle notch 7. He proceeded to drag the train over the crest of the Altamont summit while progressively reducing the throttle as more of the train crested and began the descent. During this time, the train's speed dropped to 9 mph and then climbed to 13 mph.

Descent of 17-Mile Grade

As it began its descent at Altamont, down 17-mile grade, the train had been running for more than 4 hours and had traveled about 58 miles. Until the train had reached Newburg, where the helper was added, the engineer had not used either the air brakes or dynamic brakes. Between Newburg and Altamont (about 25 miles), the engineer made four applications of the air brakes, totaling 43 minutes and 18 miles. One of the four applications was the 17-pound reduction at Blaser that was noted by the helper engineer.

The train started down 17-mile grade (an average grade of 2.4 percent) at 13 mph in throttle notch 7 with a 6-pound reduction of the train line. The maximum authorized speed from Altamont to Swanton Flats was 30 mph. Over the next 3 minutes, as more of the train crested the summit and began to descend, the engineer increased the train line reduction to 10 psi, which increased the brake application. During this time, he also went from pulling (throttle) to dynamic braking, which he increased to the near maximum according to the event recorder on the lead locomotive unit. For the next 7 minutes, he maintained heavy dynamic braking (which was affecting only the lead locomotive because of the defective cable) and continued to increase air braking by making incremental 1-pound reductions in train line pressure about every 30 seconds until he had a 17-pound reduction.

About 10 minutes down the grade from Altamont, near "Swanton Flats," the engineer deactivated dynamic braking and began to apply traction power while still maintaining a 17-pound reduction in train line pressure. The maximum authorized speed from Swanton Flats to Bloomington was 25 mph. The engineer then powered against the train brakes for about the next 2 miles (5 minutes) while keeping the speed between 21 and 24 mph. When asked later if the reason he powered against the brakes was that he was afraid of stalling out at Swanton Flats, the engineer stated that it was and that he knew if a stall occurred it could take up to two and one half hours or more to reset the brakes and continue down the hill. *CSXT Train Handling Rules*

When necessary to apply power descending long heavy grades, trains must not be pulled for a distance greater than 2 miles if the brake pipe reduction is 18 pounds [psi] or greater.

According to FRA inspectors who have ridden trains down 17-mile grade and to CSXT operating officers and CSXT engineers who regularly operate trains through the accident area, it is possible to control a loaded coal train headed by three modern locomotive units with a 12-pound or less brake pipe reduction and light throttle or dynamic brake modulation. The accident engineer stated several times that he attributed his use of more air brake than usual to the wet snow and icy rail.

About 16 minutes down 17-mile grade, the engineer went from power to heavy dynamic braking with the 17-pound reduction still applied. The train was moving at 24 mph. Several minutes after reaching full or near-full dynamic braking (on the lead unit only), the train's speed reached 28 mph, and the engineer increased the train line reduction to 18 pounds. Over the next 2 minutes, he steadily increased the train line reduction to 26 pounds, or "full service," in response to the train's steadily increasing speed.

The train failed to slow, and about 30 seconds later, while moving at 34 mph, the engineer put the train brakes in "emergency" which eliminated any effect from the dynamic braking. The train briefly slowed to 30 mph and then began to accelerate. Despite the emergency application of the air brakes, the train's speed steadily increased over the next 6 minutes to 59 mph. When the engineer placed the train in emergency, he used the automatic brake valve handle. He did not use the switch in the cab that would have activated an emergency application from the two-way EOT on the rear of the train. He said that he noted the EOT was indicating a train line pressure of 0 psi about a minute and a half after he had made the emergency application and that he therefore felt no need to activate the switch. He said that he was taught to activate the switch only if the emergency application did not apply on the rear. The conductor said that he noted on his display screen that the train line had depleted to 0 psi and that he, therefore, knew that the emergency brake application had propagated all the way to the end of the train.

When it became apparent that the train was uncontrollable, the engineer attempted to radio the dispatcher on the locomotive radio but was unable to do so. According to the engineer:

I could not contact the dispatcher. I tried the emergency button, the code 9 and applied on channel 14, but [this was] a Conrail radio, and evidently they're not compatible with ours [CSXT].

The conductor said:

We tried to contact the dispatcher with the engine radio, but the engine radio is a Conrail radio, and it will not contact our dispatchers, the equipment is not compatible. Radios are locked-in and not changeable by crews.

The trainman trainee was in the second locomotive unit cab. He said:

The first suspicion I had that anything was amiss was that the brake shoes were burning and there was acrid smoke coming into the cabin of the second locomotive. I opened the window, and it was even worse. I shut it quickly. Five minutes later, the engineer came on the radio, and said, "Go to channel 14 and get the dispatcher on the radio." He said there was a button that I should press, number 5. Well, the second radio is different from

what he had, and I didn't know how to operate it, so I went to channel 14, but I was still on channel 8. I broadcast the emergency, but I was unable to get the dispatcher.

During post accident interviews, the trainman trainee was asked if he had been trained in making an emergency radio transmission. He said:

Yes, but getting the dispatcher on the radio here is something different. You have to press certain buttons and I wasn't still sure he gave me some instructions over the radio, but the second radio was different from his, and it had no key pad, so I did not know how to operate the second radio.

The trainman trainee stated that he had seen as many as five different styles of radios on various locomotives but that the instructions he had been given on their use were generic and were not specific to any particular type of radio.

Near Bond, MP 212.6, the trainman trainee inadvertently contacted the operator at West Keyser. The operator responded and said that the train was "lit up," or cleared for continued movement. The conductor told the operator that the train was going through Big Curve at 50 mph and was in "real trouble." The conductor told the engineer that he did not believe the train would get to the bottom of the hill at all. The conductor said that he and the engineer discussed jumping but .figured we were going to land in a ditch someplace with the engine on top of us. I figured our chance of survival was about zero.

The train ultimately reached a speed of 59 mph. The train broke apart and derailed at curves in three separate segments, starting from the rear end. At MP 210.6, the first group of 20 cars separated, and 17 of the 20 cars derailed. At MP 209.8, another 18 cars separated and derailed. Finally, at MP 208.2, the remaining 42 cars separated, and 41 of the 42 derailed in a general pileup. Some of the 41 derailed cars struck a nearby occupied residence, destroying the house and killing a 15-year-old boy and seriously injuring his mother. Three other occupants of the house escaped with minor or no injuries. Some of the 41 cars also broke a gas pipeline inside a transfer building near the track; as a result, about 101 customers of Columbia Gas of Maryland temporarily lost natural gas service.

The three locomotive units finally came to rest more than 2 miles down the track, at MP 206.5, just west of Piedmont Road Crossing, where the crew was subsequently picked up and taken to Cumberland for toxicology testing and interviews.

Damages

Damages to railroad equipment totaled about \$1.8 million (67 of the 76 cars that derailed had to be scrapped). Other damages included: Lading of coal: \$182,753; Track and signal: \$275,000; Private property: \$288,963; and Clean up: \$14,297. Total damages were in excess of \$3.2 million.

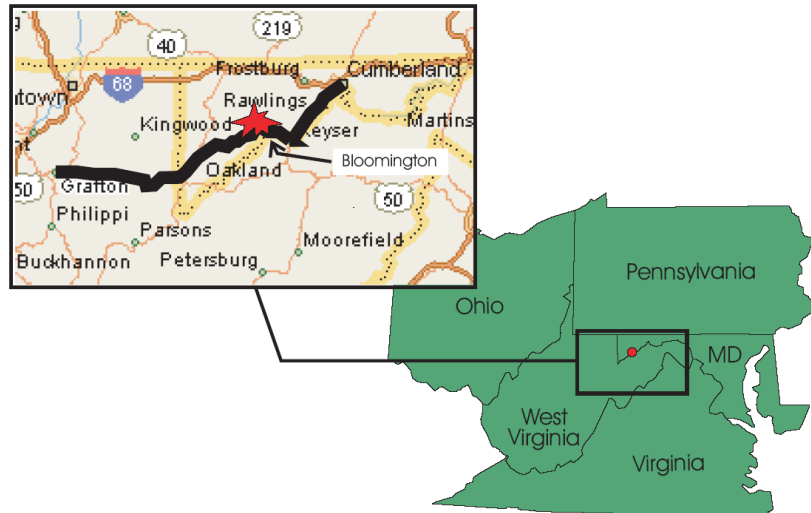


Figure 1. Accident location.

Tasks

Since this scenario is generally used as a final review, the questions will allow you to identify instances where CRM principles were either practiced or could have been practiced better.

1. What are some parts of this scenario that exhibit the need for improved technical proficiency by the crewmembers?

Possible Answers:

- Engineer's unfamiliarity with operations over this route and down the seventeen mile grade.
- Inability of the crew to use the radios in the lead locomotive during the critical phase of this accident.
- Engineer's failure to use EOTD switch.

Discussion (for facilitator's notes):

2. What are some parts of this scenario that show a loss of situational awareness?

Possible Answers:

- Engineer did not realize that he was using higher than normal brake pipe reductions, therefore he had no reason to suspect faulty dynamic braking. Had he been more familiar with the normal route settings, he might have been more suspicious that something was wrong.
- Helper engineer did not realize the implications of his not speaking up about a problem he saw.
- Trainman trainee saw smoke and did nothing (other than close the window) for about 5 minutes.
- Crew callers did not realize the importance of assigning a pilot to the run.
- Road foreman did not verify that two round-trip pilot runs were completed before allowing engineer to operate over the territory.

Discussion (for facilitator's notes):

3. What parts of this scenario relate to the need for improved communications?

Possible Answers:

- Engineer did not talk to the helper engineer except to call signals.
- Trainman trainee did not communicate with other crew when he saw and smelled smoke.
- Crew did not know how to effectively use radios to communicate with dispatcher.

Discussion (for facilitator's notes):

4. What parts of this scenario could have been improved by increased assertiveness?

Possible Answers:

- Helper engineer was hesitant to speak up when noticing larger than normal brake pipe reduction while he was coupled to the train.
- Trainman trainee speaking up when he saw and smelled smoke.
- What role did the conductor play in this scenario? Very little about him in the NTSB report. Should he have noticed something and questioned the engineer?
- Engineer could have spoken up during the crew brief or brake checks or at any time during the run if he felt that something was not right with the train's performance.

Discussion (for facilitator's notes):

5. What are some parts of this scenario that relate to the need for improved teamwork?

Possible Answers:

- Helper engineer did not speak up when he was a part of the team.
- Lack of communication between crewmembers throughout the scenario.
- Need to better coordinate and understand crew assignment, pilot runs, etc.
- How much training was the trainman trainee receiving while in the second locomotive?

Discussion: Remember to state that NTSB found CSX rules allowing use of full dynamic braking in determination of maximum speeds in mountainous territories as the probable cause of the accident.