Lesson Objectives

View CR Submit CR

Terminal Learning Objective - Given a root cause analysis scenario describing an event-based problem, define the problem.

Lesson 2 is divided into two parts. Part 2 has five objectives. Upon completion, you should be able to:

- Recognize the purpose and importance of defining the problem.

- Recognize the criteria of a well-defined problem.

- Recognize the process of defining a problem.

- Define the critical elements of the problem.

- Associate events to a sequence/timeline.

First, you will learn about the purpose and importance of defining a problem.

Problem Definition Introduction

I think I'm ready to take the next step with my supplier. They need to identify the problem with the fragile clamps.

I think you're ready for the first step, too. But first, I want to show you some of the theory behind problem definition. You are better prepared to face your supplier if you understand and can recognize why defining a problem is important.

D

Long Description

The mentor and a different DCMA supplier are having a conversation. The DCMA Specialist says to the mentor, "I think I'm ready to take the next step with my supplier. They need to identify the problem with the fragile clamps." The mentor replies, "I think you're ready for the first step, too. But first, I want to show you some of the theory behind problem definition. You are better prepared to face your supplier if you understand and can recognize why defining a problem is important."
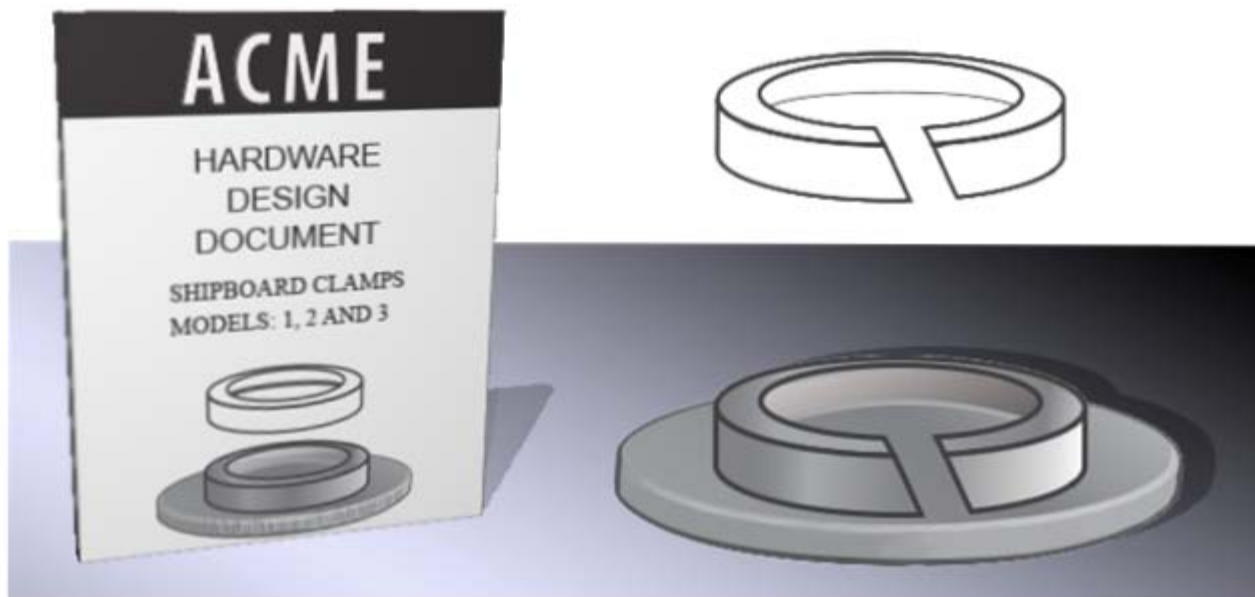
Problem Definition Purpose

View CR Submit CR

The purpose of defining a problem is twofold:

- It identifies the problem your are trying to solve.

- It describes the problem you are trying to solve.

Understanding the purpose of defining a problem gives focus to your supplier's root cause analysis and corrective action efforts.

ACME

HARDWARE
DESIGN
DOCUMENT

SHIPBOARD CLAMPS
MODELS: 1, 2 AND 3

D

Long Description

The Acme company Hardware Design Document for the clamps is pictured beside an diagram of a broken clamp.

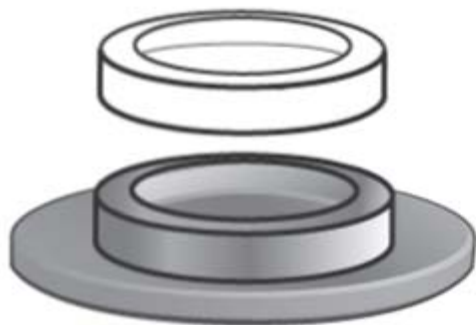## Problem Definition Conditions

For your suppliers, DCMA defines a problem as meeting one or all of the following:

- A deviation from a requirement or expectation.
- When "actual" is different than "should."
- An undesirable event, situation, or performance trend.
- The primary effect critical for a situation to occur.

GOOD PRODUCT

DEFECTIVE PRODUCT

D

Long Description

A metal clamp that is whole is pictured beneath the label "GOOD PRODUCT". Beside it is a metal clamp that is broken pictured beneath the label "DEFECTIVE PRODUCT".
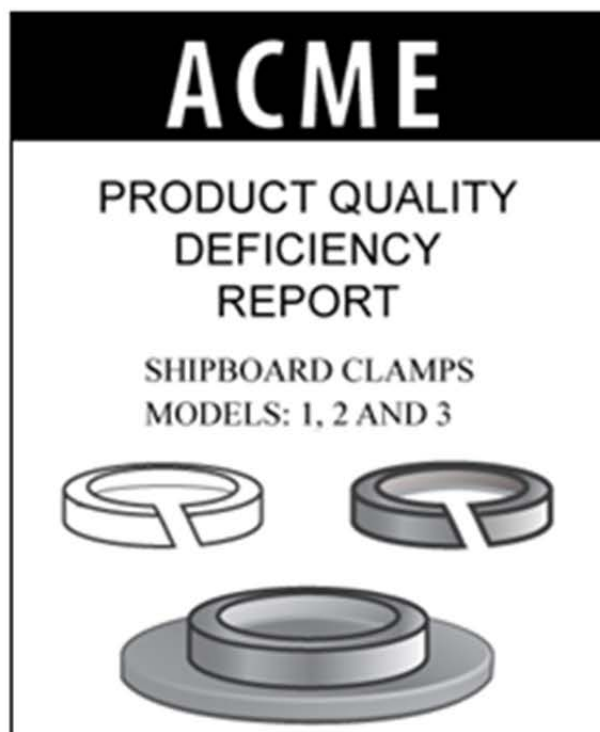
Product Quality Deficiency Reports

When the supplier receives a Product Quality Deficiency Report (PQDR) from the customer, the problem is generally accurately defined in the form of the discrepancy. PQDRs are written against hardware and software discrepancies discovered by the customer after government acceptance.

During the supplier's investigation of the returned product, it is much easier for them to determine what needs to be done to bring the product back into compliance than it is to determine the root cause of the failure.

The root cause analysis process is actually more critical in post-acceptance situations for several reasons.

- Critical hardware that the warfighter was depending on being available is not available;

- There are times when the deficiency extends beyond the single piece of hardware that requires a recall of many products leaving the stock on logistic spares below operational readiness requirements;

- The root cause of the hardware/software deficiency needs to be determined; and

- The weakness in the supplier's inspection and test processes that allowed the deficient hardware/software to be delivered to the customer must also be corrected.

As the QAS, you have your work cut out for you in evaluating the supplier's Corrective Action Plan (CAP) that addresses these concerns.

ACME

PRODUCT QUALITY
DEFICIENCY
REPORT

SHIPBOARD CLAMPS
MODELS: 1, 2 AND 3

D

Long Description

An image of the front cover page of the Acme Product Quality Deficiency Report for the metal clamps.

Problem Definition Importance

When your supplier states "what their problem is," they have found the key to problem identification and correction.

You must ensure your suppliers define an undesirable event or problem situation so that everyone involved in its solution understands it.

The importance to a defining a problem is that it:

- Focuses investigative efforts.
- Saves time.

ACME PRODUCT DEFICIENCY REPORT

D

Long Description

The supplier from Acme company stands holding the Acme Product Deficiency report for the metal clamps. He is standing beside the mentor. They both have thoughtful expressions.

Improper Problem Definition Consequences

An honest effort by your suppliers to carefully define their problems avoids "ready, fire, aim" approach that is so common in problem-solving.

A problem that is not properly defined may result in failure to reach the proper resolution.

D

Long Description

The supplier from Acme company smiles, triumphantly holding the Acme Product Solutions Report for the metal clamps. The mentor stands beside him looking pleased and proud.

Case Study

The supplier was able to successfully identify the problem with the clamps for the U.S. Navy. It seems a fabricator grabbed his delivery clamps from the Army bin instead of the Navy bin while Acme company was in a shift between the services.

So, we can see now that the supplier's claim of snow days and the inconsistency of specifications no longer applies to their true problem definition.

Acme company is now putting a corrective action plan into place. Everyone on the shop floor has been informed of the root cause of the problem. Also, a foreman is now required to be on-site during all future shifts between Acme's DoD customers and their clamps.

Case Study Knowledge Review

Which statement from the Acme supplier suggests that Acme Company has properly defined the clamp problem?

☐ "Everyone on the shop floor has been made aware of the problem."

☑ "Our fabricator grabbed his delivery clamps from the wrong bin."

☐ "Our shop foreman will be on-site for all future shifts between customers."

Check Answer

By specifically acknowledging that **the fabricator grabbed his clamps from the wrong bin**, it is clear that Acme Company has properly defined the clamp problem. The other two disclosures are important to the problem, but do not define the true nature of the problem.

Problem Definition Summary

You have just learned about the purpose and importance of defining a problem.

Next, you will learn about a well-defined problem and its criteria.

Well-Defined Problem Criteria Introduction

We seem to be spending a lot of time on defining a problem. It's not like having a problem with your car.

Be careful. A problem with your car may seem small, but you still need your car to get to work. And if you don't get to work, you may have bigger problems. And to build off of that comparison, imagine your mechanic telling you that he thinks the problem with your car was electrical, and his costs are twice the estimate. Most people would check their bill and want a more defined description than 'electrical.'

Let's take a look at well-defined problems in 'our' industry.

D

Long Description

The mentor and the DCMA Specialist continue their conversation. The DCMA Specialist says to the mentor, "We seem to be spending a lot of time on defining a problem. It's not like having a problem with your car." The mentor replies, "Be careful. A problem with your car may seem small, but you still need your car to get to work. And if you don't get to work, you may have bigger problems. And to build off of that comparison, imagine your mechanic telling you that he thinks the problem with your car was electrical, and his costs are twice the estimate. Most people would check their bill and want a more defined description than 'electrical'. Let's take a look at well-defined problems in 'our' industry."

Well-Defined Problem Criteria

Look for two things when checking to ensure your supplier has a well defined problem:

- It must focus on the gap between what is and what should be
- It states the effect – what is wrong, not why it is wrong

Click on each folder tab to learn more about the criteria for a well-defined problem.

| Criteria 1 | Criteria 2 | Criteria 3 | Criteria 4 |

Criteria 1

A well-defined problem is measurable.

It tells you how often, how much, and when.

It avoids broad and ambiguous categories like "morale", "productivity", and "communication."

Criteria 2

A well-defined problem is stated in a positive manner and describes the symptoms.

Look for your supplier to state "the valve leaks."

Criteria 3

A well-defined problem avoids "lack of" and "no" statements. These types of statements imply solutions instead of definition.

An example of a poorly defined problem statements - "lack of food" or "no food" implies food as the solution, while the problem is hunger.

Criteria 4

A well-defined problem highlights the significance of effects. It may state areas of discomfort, hurt, or annoyance, or how people are affected.

Well-Defined Problem Examples

A well-defined problem can meet its criteria with as few as two simple statements.

Click on each folder tab to see examples of well-defined problems from suppliers.

Example 1	Example 2	Example 3

Example 1

The auxiliary equipment operator spilled ten gallons of sulfuric acid on the cement pad of the water treatment plant while performing a regeneration. This action violated EPA requirements and necessitated a report to environmental regulators.

Example 2

The auxiliary equipment operator spilled ten gallons of sulfuric acid on the cement pad of the water treatment plant while performing a regeneration. This action violated EPA requirements and necessitated a report to environmental regulators.

Example 3

Over the past three weeks, 83 work orders were returned to the Maintenance Department for required signatures resulting in a 30% increase in processing time.

Case Study

I remember in the last topic that Acme Company told us what their problem was. That was to ensure they recognized the importance of problem definition.

You are correct.

We determined that Acme did understand the importance of defining the problem with their clamps. But do you think their problem was well-defined? Select the Next button to re-visit their problem statement again.

D

Long Description

The mentor and the DCMA specialist continue their conversation. The DCMA specialist says to the mentor, "I remember in the last topic that Acme Company told us what their problem was. That was to ensure they recognized the importance of problem definition." The mentor replies, "You are correct. We determined that Acme did understand the importance of defining the problem with their clamps. But do you think their problem was well-defined? Select the Next button to re-visit their problem statement again."

Case Study Knowledge Review

View CR Submit CR

> It seems a fabricator grabbed his delivery clamps from the Army bin while we were in a shift between services.

Although Acme Company recognized the importance in defining the problem with the clamps, they did not define the problem well-enough. Which criteria were not met in Acme Company's problem definition? (Select all that apply)

☑ A well-defined problem highlights the significance of the event.

☑ A well-defined problem describes the symptoms.

☑ A well-defined problem is measurable.

Check Answer

Acme Company's problem definition **was not measurable**, it **did not describe the symptoms**, and it **did not highlight the significance of the event.**

Well-Defined Problem Summary

Suppliers have problems. Ensure they are well-defined.

Next, we will explore the process of defining a problem.

Problem Definition Process Introduction
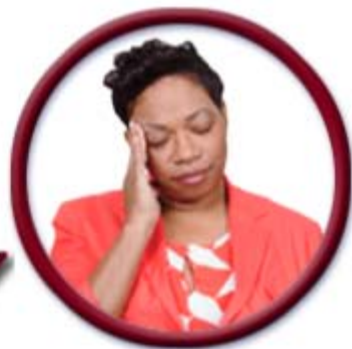
Ugh. Acme Company needs to pay more attention to quality assurance. Now they have a problem with their seat belts, too!

Well, that is both bad and good.

It is bad for any company to deliver products to their customers that fail to meet specifications and requirements. But, it is good for our training because their problems help us focus on the details we need to discuss to meet our objectives.

For example, let me show you the process of defining a problem in the Quality Assurance industry and then we can apply it to the seat belt problem at Acme Company.

D

Long Description

The mentor and the DCMA Specialist continue their conversation. The DCMA Specialist is frustrated and exclaims to the mentor, "Ugh. Acme Company needs to pay more attention to quality assurance. Now they have a problem with their seat belts, too!" The mentor replies, "Well, that is both bad and good. It is bad for any company to deliver products to their customers that fail to meet specifications and requirements. But, it is good for our training because their problems help us focus on the details we need to discuss to meet our objectives. For example, let me show you the process of defining a problem in the Quality Assurance industry and then we can apply it to the seat belt problem at Acme Company."

Problem Definition Process

When suppliers learn of a defect with their products, they typically define their problems with a process that follows a series of steps.

Click on each step below to learn more about a typical problem definition process.

1. Organize the initial information

2. Assess the magnitude of the problem

3. Act immediately (if required)

4. Gather additional information

5. Assemble data points

6. Evaluate data points

7. Define the problem

Organize
Assess
Act
Gather
Assemble
Evaluate
Define

D

1. Organize the initial information

Organize the initial information around the defect and answer what, who, when, where, how much, and how many. Many suppliers use production records, spreadsheets, operational test results, etc., to sort their initial information.

2. Assess the magnitude of the problem

Assess the magnitude of the problematic situation. Many suppliers answer these questions to determine magnitude:

How much of the product is affected by the defect?
Where are the defective products (in stores, already in use by end users, etc.)?
What is the extent of the defect?
What is the importance of the defect?

3. Act immediately (if required)

Many of your suppliers will move this step to the top of their process to define a problem. They determine if an immediate action is required in order to prevent the situation from getting worse.

4. Gather additional information

Identify any additional information needed to clearly define the problem so you can focus your root cause analysis efforts. This is especially relevant to the supplier that may use several vendors for parts to manufacture their products. They may need to gather this additional information from other sources.

5. Assemble data points

After all the information, like spreadsheets, assembly records, or supporting specification, is gathered, your supplier will comb through the information, looking only for the design specifications that are relevant to the defect. This information will be organized into data points.

6. Evaluate data points

The evaluation step of the process is the point where subject matter experts and managers are most beneficial. Your suppliers look at each assembled data point and compare it to the defect. They make value judgments based on their history, experience, knowledge of design, and prior agreements.

7. Define the problem
[Graphic only]

Long Description

The same clipboard from before is pictured, but now all of the checkboxes are checked. The checkboxes are: Organize, Assess, Act, Gather, Assemble, Evaluate, and Define.

Seat Belt Scenario Introduction

Can there be more than seven steps in the problem definition process?

Yes! There can be seven, seventeen, or seven-hundred steps in a supplier's process. Remember, DCMA is responsible for inspection and acceptance of non-complex and complex systems and products from a variety of large, medium, and small size suppliers.

Since Acme Company is an average size supplier, we will use the seven steps as a training tool.

Tell me more about Acme Company's problem with their seat belts.

D

Long Description

The mentor and the DCMA Specialist continue their conversation. The DCMA Specialist asks the mentor, "Can there be more than seven steps in the problem definition process?" The mentor exclaims, "Yes! There can be seven, seventeen, or seven-hundred steps in a supplier's process. Remember, DCMA is responsible for inspection and acceptance of non-complex and complex systems and products from a variety of large, medium, and small size suppliers. Since Acme Company is an average size supplier, we will use the seven steps as a training tool. Tell me more about Acme Company's problem with their seat belts."

Seat Belt Defect

The shipboard Human Restraint System (HRS) is a seat belt. Acme Company includes a restraint with each shipboard seat they deliver to their U.S. Navy customer. During product examination, DCMA identified a defect and rejected the shipment.

USN SHIPBOARD
HUMAN RESTRAINT
SYSTEM (HRS)
for Model 1 Seat

ACME
Acme Company
4016 Cleveland Ave
St. Louis, MO 63110
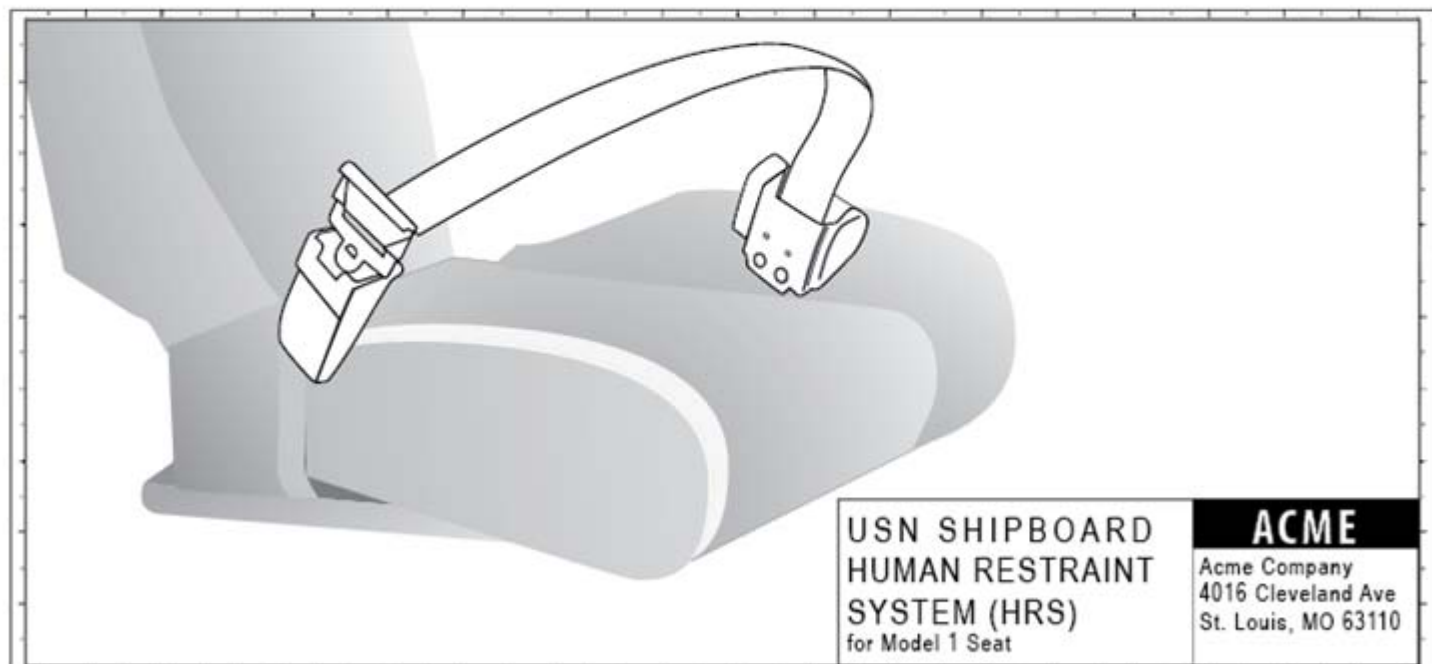
Seat Belt Problem Definition Scenario

View CR Submit CR

Acme Company has defined the problem with their restraints. Max, a Quality Assurance Specialist at Acme Company conducted the investigation.

Click on each tab to read how Max used that process step to define Acme Company's problem.

| **Organize** | **Assess** | **Assemble** | **Evaluate** |

Organize the initial information

Here is our list of initial information:

- Contract
- Statement of Work
- Technical Drawings
- Work Instructions
- Design Specifications
- Assembly Records
- Test Records
- Inspection Records

Organize the initial information

Here is our list of initial information:
- Contract
- Statement of Work
- Technical Drawings
- Work Instructions
- Design Specifications
- Assembly Records
- Test Records
- Inspection Records

Assess the magnitude of the problem

Here is our assessment of the magnitude of the problem:
- The defect was present on 15 of the 100 restraints in the inspected lot (including the 1 found by DCMA).
- There was Work in Progress (WIP) in 2 lots.
- Both lots have been stopped until the defect is resolved.
- There were no products in stores and no product has been delivered to the customer as this is the first production lot.
- The defect only impacts customers with a waist over 44 inches in seas above ten feet.
- The risk to users is a fall of 24 inches to the deck of the ship.

Assemble data points

From our source data, we established the following data points for evaluation:
- Strength of Leather Belt
- Quality of Hexagon Screws (2)
- Quality of Flange Screw (2)
- Quality of Plastic Washer (2)
- Operational Belt Buckle (Male End)
- Operational Belt Buckle (Female End)
- Quality of End Fixtures (2)
- Length of Leather Belt

Evaluate data points

In evaluating our data points, we found all points to be satisfactory, except for one. The length of the leather belt was found to be outside the specification.

Problem Definition Knowledge Review

View CR Submit CR

In which step in the "defining a problem" process does the supplier answer the questions what, who, when, where, how much, and how many about their defect?

☐ Gather additional information

☐ Assemble data points

☑ Organize the initial information

☐ Assess the magnitude of the problem

Check Answer

The best answer is that suppliers should answer those questions while they are **organizing their initial information**.

Problem Definition Summary

I think Acme Company did an adequate job with their process to define their problem.

Training scenarios cannot replace the real-world interaction between DCMA and suppliers. And your takeaway from the process could be to ensure the supplier actually solves their problems with a series of steps.

If they do not have a process, then they have bigger problems than the length of their seat belts.

Let's take a look at a scenario and determine if you can define the problem.

D

Long Description

The mentor and the DCMA specialist continue their conversation. The DCMA specialist comments, "I think Acme Company did an adequate job with their process to define their problem." The mentor responds, "Training scenarios cannot replace the real-world interaction between DCMA and suppliers. And your takeaway from the process could be to ensure the supplier actually solves their problems with a series of steps. If they do not have a process, then they have bigger problems than the length of their seat belts. Let's take a look at a scenario and determine if you can define the problem."

Case Study Introduction

Acme Company delivers user panels to a prime defense supplier for their U.S. Navy shipboard warfighter consoles. The user panel is illustrated below.

Case Study

View CR Submit CR

Review the supplier provided artifacts for the Shipboard Warfighter Console User Panel by clicking on each tab. At the end of this series, you will be asked to define the critical elements of a non-working speaker by reviewing differences between the delivery and comparing it against the contractual specifications.

PQDR	**Technical Drawing**	**Photographs**	**Design Specification**

PRODUCT QUALITY DEFICIENCY REPORT

1. REPORT CONTROL NUMBER	2. DATE (YYMMDD)	3. ORIGINATING ACTIVITY
USN 1440	**140321**	**CVN-76**

4 STOCK NUMBER	5. PART NUMBER	6. SERIAL NUMBER
6240-00-027-2060	7671C2640-405X3	BZ05Z3-01 THRU 18

7. REMARKS	8. DEFECT DESCRIPTION
18 OF 18 USER PANEL ALARM SPEAKERS ARE INOPERATIVE. OPERATOR HAS NO AUDIO ALARM FOR ALERTMENT.	SPEAKERS EMIT NO SOUND OR CRACKLE DURING ALERTS

9. ORIGINATOR NAME	10. ORIGINATOR PHONE
CAPT., JOHN V. SMITH SUPPLY OFFICER CVN-76	(555) - 555 - 1212

DD FORM 2332 JUL13

D

PQDR

[Graphic Only]

Long Description

An example of a product quality deficiency report is displayed. The following note is written under the "Remarks" section: "18 of 18 user panel alarm speakers are inoperative. Operator has no audio alarm for alertment." Under the "Defect Description" section, the following note is written: "Speakers emit no sound or crackle during alerts."

Technical Drawing

[Graphic Only]

Long Description

The Acme wiring diagram of the Shipboard User Panel Alarm Speaker Connection is displayed. The two pieces of equipment in the diagram are the Amplifier and the Speaker. The rear of the Speaker has a plus symbol at the top and a minus symbol at the bottom. The Amplifier has symbols R plus and R minus. However, the R plus symbol is next to a larger minus symbol, and the R minus symbol is next to a larger plus symbol. A red line goes from the plus symbol at the back of the Speaker to the minus symbol next to the R plus symbol on the Amplifier. A black line goes from the minus symbol at the back of the Speaker to the plus symbol next to the R minus symbol on the Amplifier.

Photographs

[Graphic Only]

Long Description

Two photographs are displayed. The left photograph is a close-up of the amplifier user panel audio jacks. The right photograph shows the entire amplifier user panel. Some of the cables connected to the audio jacks are red and some are black.

Design Specification

[Graphic Only]

Long Description

The Hardware Description Document, or HDD, for the CVN 76 Shipboard Warfighter Consoles is displayed. A particular paragraph is called into focus. The paragraph says, "USN Shipboard Warfighter Console Alert Speaker Connections - User Panel. Alert speaker connections on the WFC User Panel shall use industry standard connections - positive to positive, negative to negative. Speaker cables and connectors shall be red/positive, and black/negative for ease of maintenance and troubleshooting."

Case Study Knowledge Review 1

You have completed your review of supplier artifacts. Define a critical element of the problem by answering the question: "What is the problem?"

- [ ] Based on the PDQR, the connections are bad.

- [ ] Based on the Technical Drawing, the connections are bad.

- [ ] Based on the Photographs, the connections are bad.

- [✓] Based on the Design Specification, the drawing has errors.

Check Answer

The best answer is that the **design specification** requires specific connections and color-coded cables. **The drawing has errors.** It does not meet the specification.

Case Study Knowledge Review 2

Further define a critical element of the speaker problem by answering this question: "How did the problem most likely occur?"

☐ The Navy accepted inoperative consoles.

☑ The supplier erred when creating the drawing.

☐ The connections were reversed.

☐ The specification left out important detail.

Check Answer

The supplier created the drawing with errors in it.

Case Study Knowledge Review 3

Further define a critical element of the speaker problem by answering the question: "Who is overall responsible for the problem?"

☐ The prime supplier

☐ The hardware integrator

☑ The sub-tier supplier – Acme Company

☐ The Navy design architects

Check Answer

Because the drawing failed to meet the design specification, **the sub-tier supplier who submitted the technical drawing is at fault**. But since Acme Company is a sub-tier supplier, DCMA typically deals with the prime supplier when seeking corrective actions.

Problem Definition Job Aid

View CR Submit CR

A step by step guide may have been helpful to Acme Company to use as a quick reference when defining the critical elements of their manufacturing problems.

A Job Aid is provided here as a guide. Use the list of questions in the Job Aid as a starting point to identifying critical elements in problem definition.

Be sure to compare the Job Aid from this training to the one your manager prescribes in your DCMA office.

Click here to access the Critical Elements in Problem Definition Job Aid for this training.

DAU CMQ220 Root Cause Analysis

Job Aid – Critical Elements in Problem Definition

A. INTRODUCTION: The recommended method of defining the critical elements of a problem is a basic question and answer session with stakeholders. Use the table below as a guideline during this process. Rank the criticality of the answers based on team consensus.

Category	Questions
What	1. What equipment, machine, or tool had the problem?
	2. What is wrong, what is the complaint?
	3. What undesired behavior is involved?
Who	1. Who is involved?
	a. Internal - Employee, bystanders, etc.
	b. External –
	2. Who is a stakeholder
When	1. When does it, day, date, time?
	2. What shift, time of operation?
	3. What part of equipment life cycle
	4. What time period is involved?
Where	1. Which unit, department
	2. Where is the location of defect
How	1. How is the "what" affected?
	a. Injury, death, damage, etc.
How Much (How Many)	1. How much were components
	2. How many times was the product affected
	3. How much of an item was affected?
	4. How many defects per item?

CLICK TO OPEN

D

Long Description

A thumbnail of the Critical Elements in Problem Definition Job Aid. The image has a magnifying glass superimposed over it that says "CLICK TO OPEN".

Case Study Summary

View CR   Submit CR

Do suppliers often miss the specifics on drawings?

I hope not. But a QA Specialist must be prepared to spend a lot of time at that level of detail. That is our job.

Your supervisor in your office will tell you that no two problems are alike among suppliers. It is DCMA's responsibility to drive their problems to resolution

Let's take a look at a different problem solving tool in Root Cause Analysis. Next, you will learn about Event Sequence/Timelines.
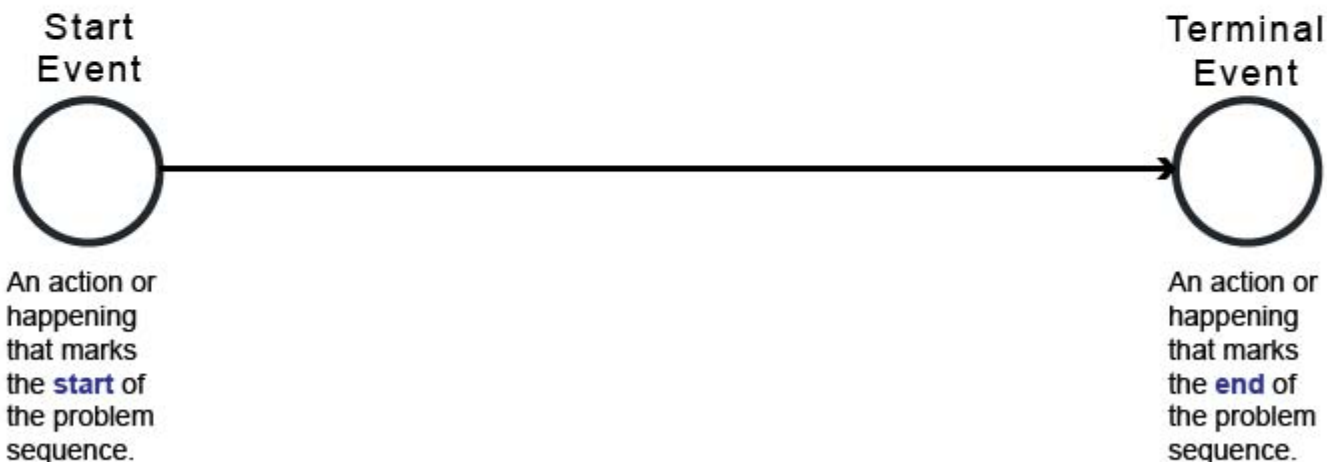
D

Long Description

The mentor and the DCMA Specialist continue their conversation. The DCMA Specialist asks the mentor, "Do suppliers often miss the specifics on drawings?" The mentor answers, "I hope not. But a QA Representative must be prepared to spend a lot of time at that level of detail. That is our job. Your supervisor in your office will tell you that no two problems are alike among suppliers. They miss design specifications and it is DCMA to drive their problems to resolution. Let's take a look at a different problem solving tool in Root Cause Analysis. Next, you will learn about Event Sequence Timelines."

Event Sequence Timeline Introduction

One of the many tools used in Root Cause Analysis when defining a problem is the Event Sequence/Timeline. Suppliers and vendors create timelines in response to a problem or product defect. By re-tracing their steps, they may be able to identify the undesirable event and better define their problem. Note the Start and Terminal events on the sample timeline.

Start Event

An action or happening that marks the **start** of the problem sequence.

Terminal Event

An action or happening that marks the **end** of the problem sequence.

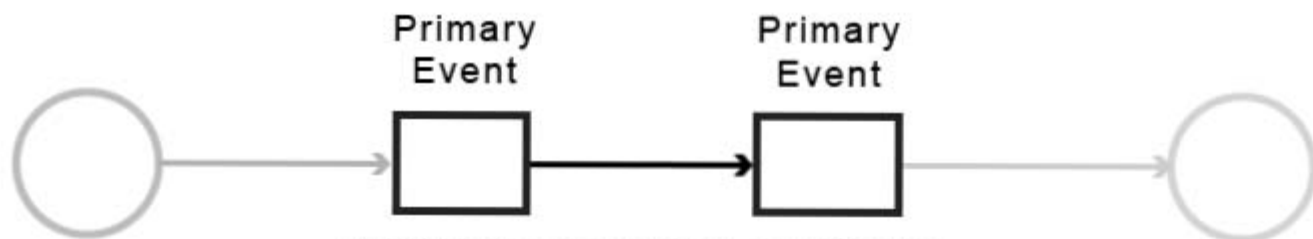**EVENT SEQUENCE/TIMELINE**

D

Long Description

The graphic is titled EVENT SEQUENCE/TIMELINE. The graphic is comprised of the following elements. A circle on the left is labeled Start Event. A circle on the right is labeled Terminal Event. A long, thick horizontal arrow comes out of the Start event circle and points to the right to the Terminal Event circle. The Start Event circle is described in a caption as "An action or happening that marks the start of the problem sequence." The word "start" is emphasized. The Terminal Event circle is described in a caption as "An action or happening that marks the end of the problem sequence." The word "end" is emphasized.

Primary Events

Suppliers and vendors will mark the primary events in their problem Event Sequence/Timeline by creating a rectangle for every major step in the problem sequence.

Note how bold arrowheads are used to connect the Start Event to each Primary Event. The bold line and arrowhead add emphasis to the importance of the step.

Primary
Event

Primary
Event

A Primary Event is any action or happening that marks a **major** step in the problem sequence.

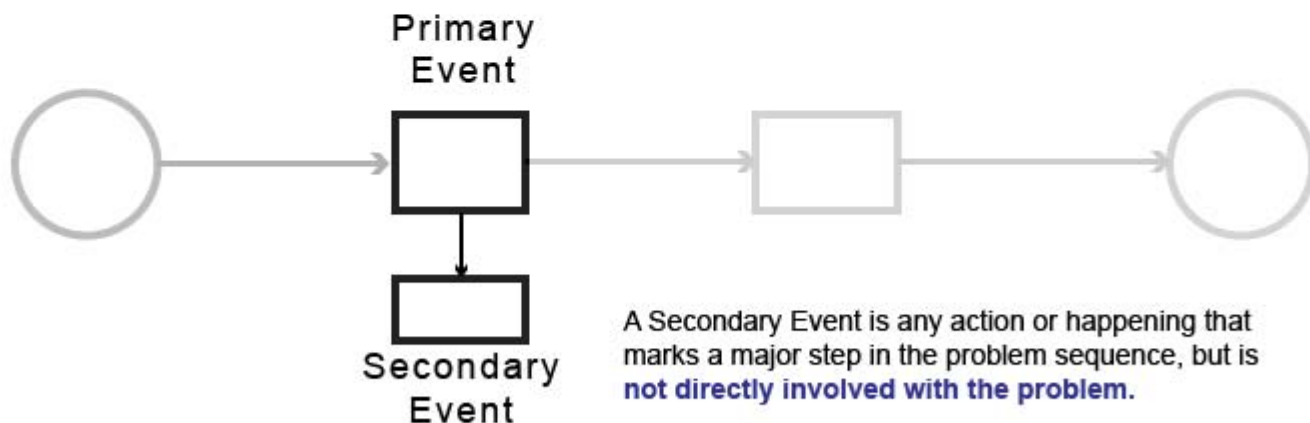## EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted, but with two additions to it. Two rectangles have been inserted between the Start Event circle and the Terminal Event circle. They are connected by thick horizontal arrows. The two rectangles that have been inserted are each labeled "Primary Event". These two rectangles are described in a caption as "A Primary Event is any action or happening that marks a major step in the problem sequence." The word "major" is emphasized.

Secondary Events

Secondary events on an Event Sequence/Timeline are rectangles, too, but they are drawn above or below the timeline and are connected to their parent Primary Event by vertical arrows.

Note the difference between the thickness of the arrows that connect Primary Events to the thickness of the arrow that connects the Secondary Event. The arrow that connects the Secondary Event to its parent Primary Event is not bold, which signals its less important status on the timeline. Also note the direction of the arrow. The arrow originates from the Primary Event and points to the Secondary Event.

Primary
Event

A Secondary Event is any action or happening that marks a major step in the problem sequence, but is **not directly involved with the problem.**

Secondary
Event

EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted here, but with one more element added to the timeline. A rectangle has been added below the first Primary Event rectangle. This new rectangle is labeled "Secondary Event". A thin vertical arrow originates from the Primary Event rectangle and points down to the Secondary Event rectangle. This vertical arrow is thinner than the horizontal arrows that connect the Primary Event rectangles to one another. The Secondary Event rectangle is described in a caption as "A Secondary Event is any action or happening that marks a major step in the problem sequence, but is not directly involved with the problem." The phrase "not directly involved with the problem" is emphasized.
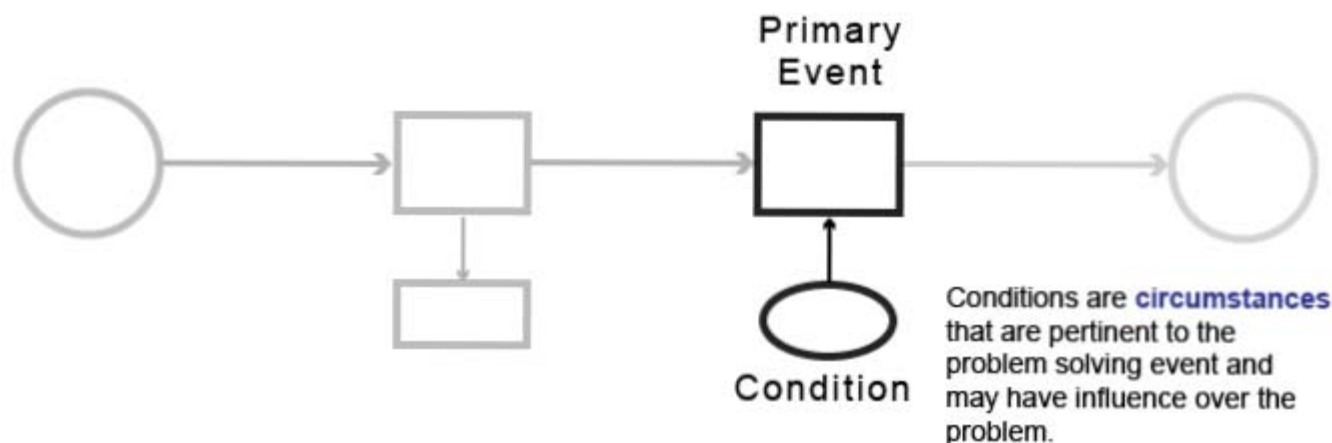
Conditions

View CR   Submit CR

Ovals on an Event Sequence/Timeline depict an action or happening that influences an event on the timeline. They focus on the condition that is pertinent to solving this problem or event.

Note the fact that the arrow points from the condition to the parent Primary Event indicates the condition may have an influence on the Primary Event above it.

Primary
Event

Conditions are **circumstances** that are pertinent to the problem solving event and may have influence over the problem.

Condition

EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted here with one more item added. An oval has been added beneath the second Primary Event. This oval is labeled "Condition". A thin, vertical arrow points from the Condition oval up to the Primary Event rectangle. The Condition oval is described in a caption as "Conditions are circumstances that are pertinent to the problem solving event and may have influence over the problem."

Presumptive Events

Presumptive Events are dotted rectangles and are used by suppliers and vendors to mark an event on the timeline that cannot be proven, but is still logical to the sequence of problem solving.

Presumptive
Event

A Presumptive Event is any action or happening that is **assumed**. It is logical in the sequence but cannot be proven.

EVENT SEQUENCE/TIMELINE
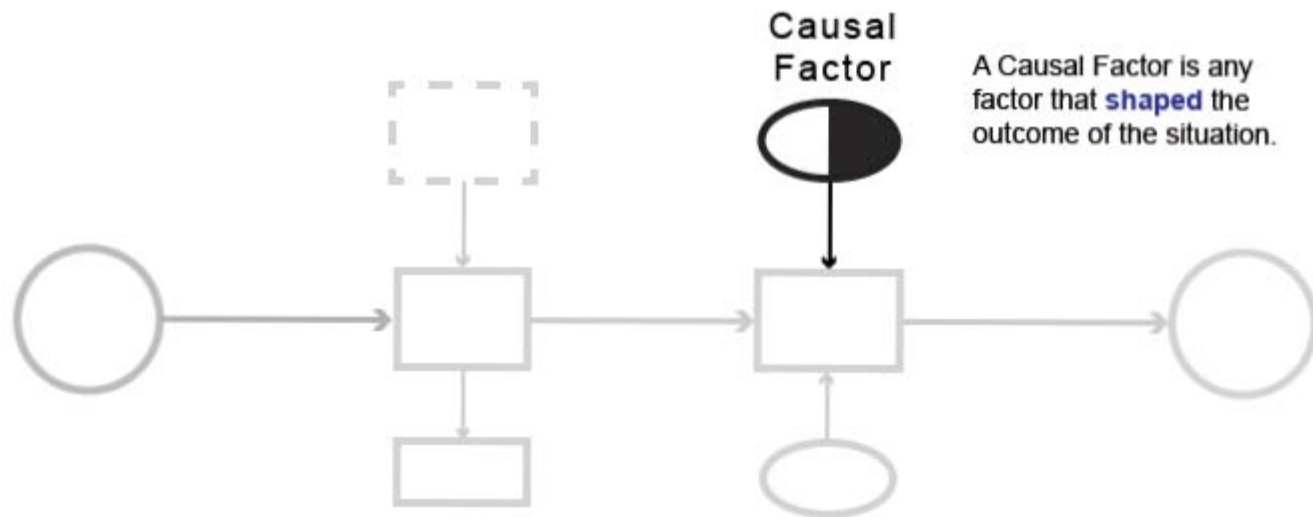
D
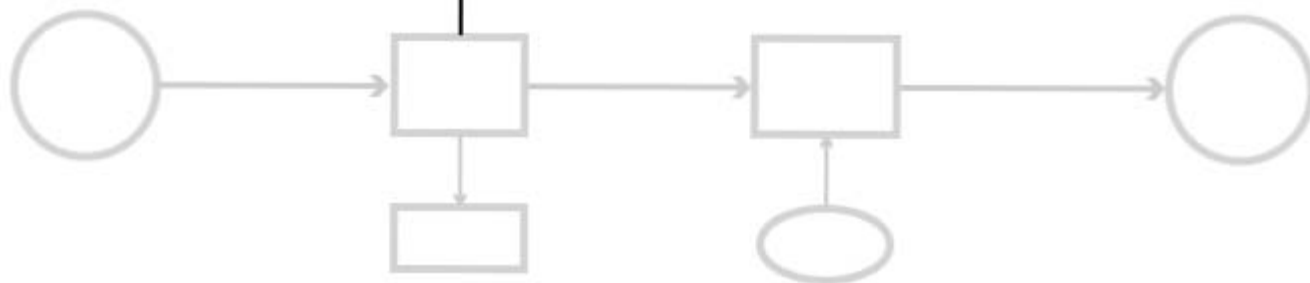
Long Description

The same Event Sequence Timeline from the previous page is depicted here with one more item added. A dotted rectangle has been added above the first Primary Event rectangle. This dotted rectangle is labeled "Presumptive Event". A thin, vertical arrow points from the Presumptive Event dotted rectangle down to the Primary Event rectangle. The Presumptive Event dotted rectangle is described in a caption as "A Presumptive Event is any action or happening that is assumed. It is logical in the sequence but cannot be proven." The word "assumed" is emphasized.

Causal Factor

Your suppliers and vendors will denote Causal Factors with ovals above or below the timeline. The right side of the Causal Factor oval is shaded. If the Causal Factor is presumptive, then the it will appear as a dotted oval.

Also note the direction of the arrow. It originates from the Causal Factor oval and points to the parent Primary Event.

Causal Factor

A Causal Factor is any factor that **shaped** the outcome of the situation.

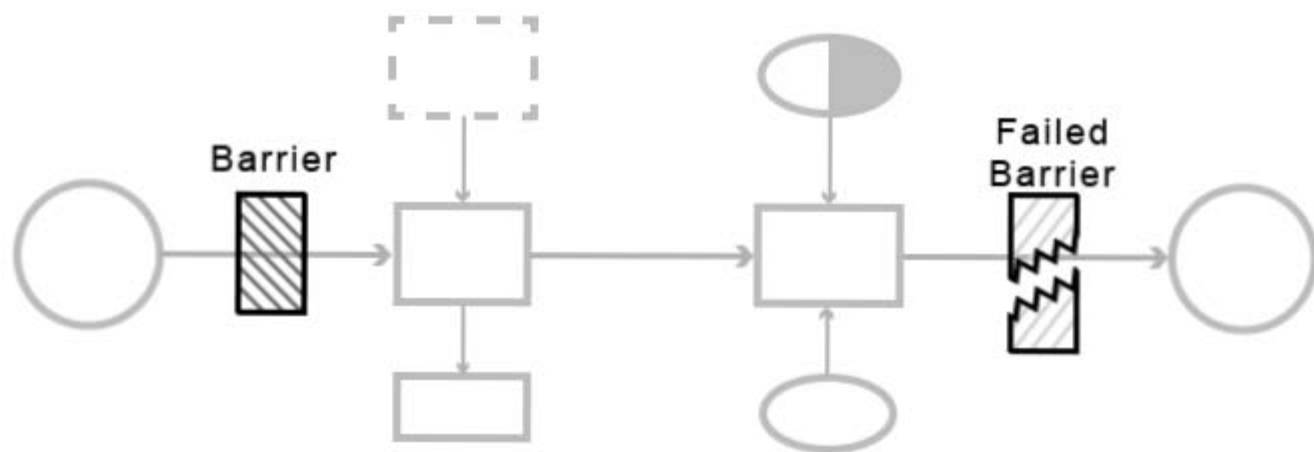## EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted here with one more item added. An oval has been added above the second Primary Event rectangle. The right half of this oval is shaded. This half-shaded oval is labeled "Causal Factor". A thin, vertical arrow points from the Causal Factor half-shaded oval down to the second Primary Event rectangle. The Causal Factor half-shaded oval is described in a caption as "A Causal Factor is any factor that shaped the outcome of the situation." The word "shaped" is emphasized.

Barriers

Barriers are used on the Event Sequence/Timeline to mark obstacles. Barriers are not necessarily detrimental to a sequence. Some barriers proved suppliers deliberate stop points. When the deliberate stop point fails, then the timeline uses a Failed Barrier to mark the event.

Note the difference in the rectangles that mark a Barrier and Failed Barrier.
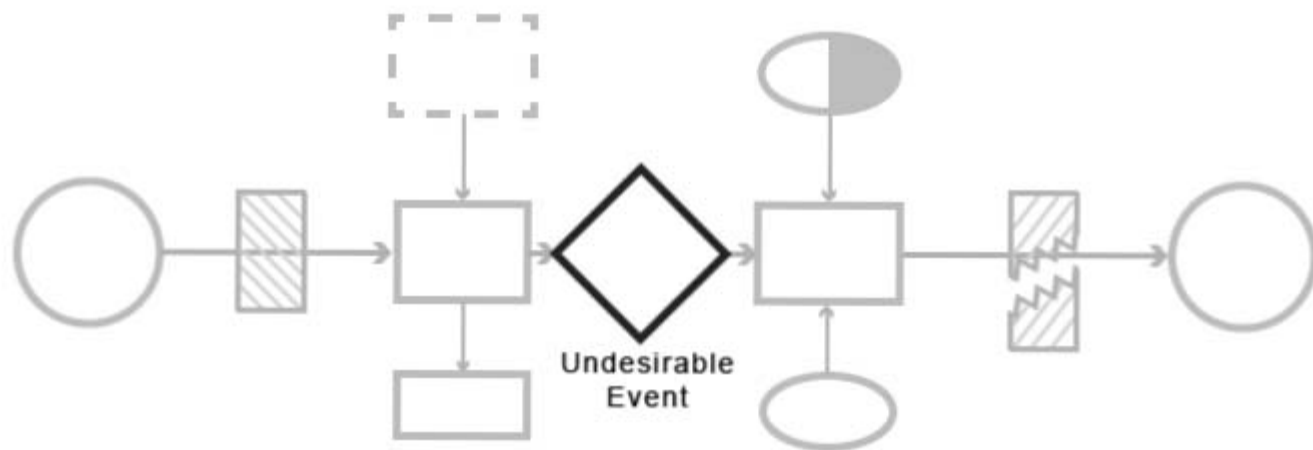

EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted here with two more items added. Immediately after the Start Event circle, a tall rectangle with diagonal stripes has been inserted. This rectangle is labeled "Barrier". Immediately after the second Primary Event rectangle, a similar tall rectangle with diagonal stripes has been inserted, except this rectangle is broken in half, indicated by jagged lines. This broken rectangle is labeled "Failed Barrier". The diagonal lines in the Barrier rectangle are perpendicular to the diagonal lines in the Failed Barrier rectangle.

Undesirable Events

An Undesirable Event can be an equipment failure or condition or an inappropriate action. These events are critical for the situation being analyzed to occur. They are shown as a diamond.

Undesirable
Event

EVENT SEQUENCE/TIMELINE

D

Long Description

The same Event Sequence Timeline from the previous page is depicted here with one more item added. A diamond has been added between the first and second Primary Event rectangles. This diamond is labeled "Undesirable Event".

Event Sequence Summary

Suppliers begin developing an event sequence as soon as they have been notified of a problem or an undesirable event. Timelines can appear on walls or whiteboards using self-stick removable notes, taped index cards, or printed from a specialized computer program.

The Event Sequence/Timeline provides your vendors and suppliers with a method to collect and analyze information from a baseline of focused facts.

This sequence can be used as a starting point for a more comprehensive Event and Causal Factor Chart. Which tools to use in Root Cause Analysis often depends on the problem.

Next, you will see how Acme Company mapped a sequence of events from a supervisor's log book to an Event Sequence/Timeline.

Case Study Introduction

View CR Submit CR

Compare the Supervisor's Log Book on the left with the Timeline on the right. It is a simple start and stop timeline because there were no problems or undesirable events on the 2nd shift.

An Event Sequence/Timeline needs to chart a problem.

ACME

Supervisor's Log Book - Seat Belt Line

Date	Time	Event
3/14	1500	Bell Starts 2nd shift
	1504	Electrician Starts Line 1 Belt Mach.
	1510	Line crew 1 brief on shift quota 150
	1600	Counter at 10
	1700	Counter at 25
	1800	Counter at 42
	1900	Counter at 58
	2000	Counter at 68
	2100	Counter at 83
	2200	Counter at 99
	2300	Counter at 113
	2345	Counter at 126
	2350	Counter at 139
	2351	Counter at 155
	2359	2nd Shift Over
3/15	0815	Quality Rejects 5 Belts: Quota met

ACME

Event Sequence / Timeline

Start 2nd Shift

↓

Stop 2nd Shift

D

Long Description

Two documents are depicted side-by-side. They each say "ACME" in the header. The document on the left is entitled Supervisor's Log Book - Seat Belt Line. It is a table containing entries of events along with the date and time of the event. On March 14th, the events were: At time 1500, the event was "Bell starts second shift". At time 1504, the event was "Electrician Starts Line 1 Belt Machine". At time 1510, the event was "Line Crew 1 Briefed on Shift Quota 150". At time 1600, the event was "Counter at 10". At time 1700, the event was "Counter at 25". For the next nine hours, on the hour, the counter incremented culminating in the event "Counter at 155" at time 2351. At time 2359, the event was "Second Shift Over". The next entry is for the following day, March fifteenth. At time 0815, the event was "Quality Rejects 5 Belts - Quota Met 150". The document on the right is the corresponding Event Sequence Timeline. It contains only a Start Event circle and an End Event circle. The Start Event circle is labeled "Start second shift". The Terminal Event circle is labeled "Stop second shift".

Case Study Knowledge Review 1

View CR Submit CR

Based on this Supervisor's Log Book, which statement best describes the problem with the product on this shift?
Click here to open the Log Book.

☐ Electrician Downs Line 1 for Parts at 1900.

☑ Twenty Four Seat Belts were Rejected from the Lot.

☐ Shop Secured for Repairs at End of Shift.

☐ A Power Surge was Logged at 1822.

Check Answer

The problem is that **24 of 85 seat belts were rejected from the lot**.

ACME		
Supervisor's Log Book - Seat Belt Line		

Date	Time	Event
3/14	1500	Bell Starts 2nd shift
	1504	Electrician Starts Line 1 Belt Mach.
	1510	Line crew 1 Briefed on Shift Quota
	1515	Employee Sick, Apprentice on Ruler
	1600	Counter at 10
	1700	Counter at 25
	1800	Counter at 4
	1822	Shop Lights
	1834	Electrician
	1850	Line crew switched to manual
	1900	Electrician halts Line pending pa
	1900	Manual S Count
	2000	Manual S Count 50
	2100	Manual Shi Cou
	2200	Manual Shif unt - 70
	2300	Manual Shift
	2345	Bell stops 2nd Shi
	2350	Belts in 2nd Shift bir 5
	2351	Line 1 Belt Mach. par ecieved
	2359	2nd Shift Over- Shop cured
3/15	0815	Quality Rejects 24 B of 3/14 lot
		a not met.

D

Long Description

A document with "ACME" in the header is entitled "Supervisor's Log Book - Seat Belt Line". The image has a magnifying glass superimposed over it that says "CLICK TO OPEN". The document contains entries of events along with the date and time of the event. On March fourteenth at time 1500, the event was "Bell starts second shift". At time 1504, the event was "Electrician Starts Line 1 Belt Machine". At time 1510, the event was "Line Crew 1 Briefed on Shift Quota." At time 1515, the event was "Employee Sick, Apprentice on Ruler". At time 1600, the event was "Counter at 10". At time 1700, the event was "Counter at 25". At time 1800, the event was "Counter at 42". At time 1822, the event was "Shop Lights Flicker - Power surge?" At time 1834, the event was "Electrician Halts Line 1 Belt Machine". At time 1850, the event was "Line crew 1 switched to manual". At time 1900, the event was "Electrician halts Line 1 pending parts". Also at time 1900 was the event "Manual Shift Count equals 48". For the next four hours, on the hour, the manual shift count increases, until at time 2300, the event was "Manual Shift Count equals 80". At time 2345, the event was "Bell stops second shift". At time 2350, the event was "Belts in second shift bin equals 85". At time 2351, the event was "Line 1 Belt Machine parts received". At time 2359, the event was "Second shift over - Shop Secured". The next day, on March fifteenth, at time 0815, the event was "Quality Rejects 24 Belts of March fourteenth lot. Quota not met."

Case Study Knowledge Review 2

View CR   Submit CR

The Seat Belts were rejected for not meeting length specifications. Based on the Supervisor's Log Book, determine the event that should be placed in the diamond in the Event Sequence/Timeline. Click here for the Log Book.

ACME

Event Sequence / Timeline

- [ ] Time 1900: Electrician halts Line 1 pending parts

- [ ] Time 1515: Employee Sick, Apprentice on Ruler

- [ ] Time 2351: Line 1 Belt Machine parts received

- [✓] Time 1822: Shop Lights Flicker - Power surge?

Check Answer

The item that should go in the diamond is the Undesirable Event, which occurred at time **1822 when the shop lights flickered**.

Start 2nd Shift

↓

Electrician Starts Line 1

↓

◇

↓

Electrician Stops Line 1

↓

Stop 2nd Shift

D
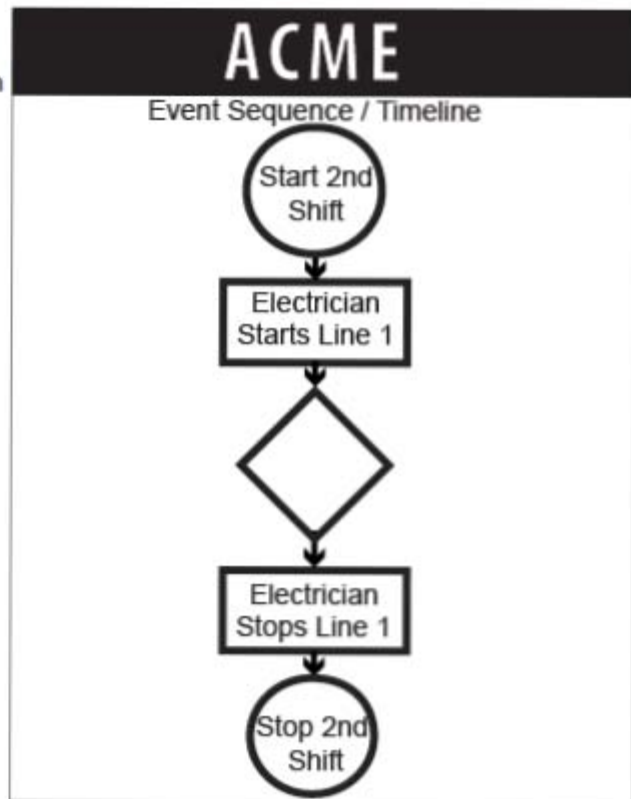
Long Description

An Acme Company Event Sequence Timeline is shown. It starts with a circle that contains the words "Start Second Shift". This points to a rectangle that contains the words "Electrician Starts Line 1". This points to a diamond with no words in it. This points to a rectangle that contains the words "Electrician Stops Line 1". This finally points to a circle that contains the words "Stop Second Shift".
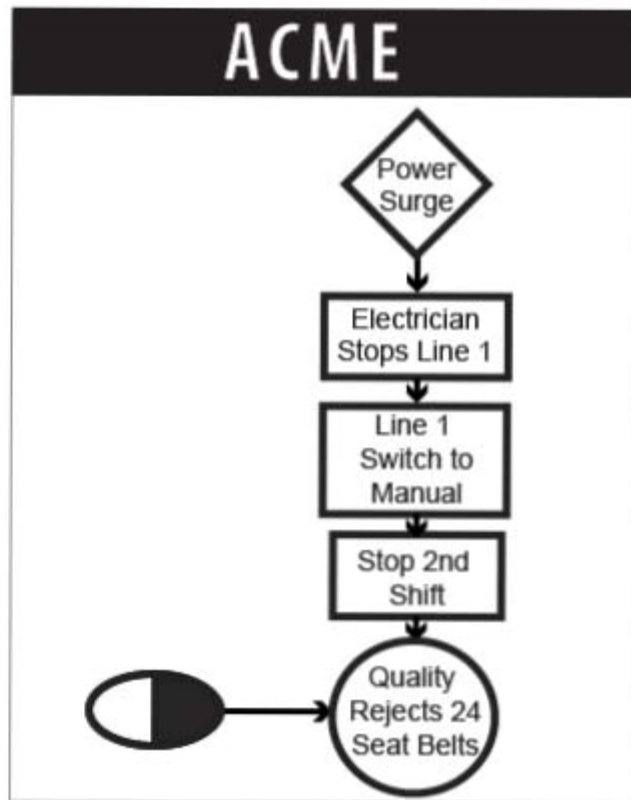
Case Study Knowledge Review 3

View CR Submit CR

Based on this same Supervisor's Log Book, determine the event that should be used to label the half-shaded oval.
Click here for the log book.

✅ Time 1515: Employee Sick, Apprentice on Ruler

☐ Time 1850: Line crew 1 switched to manual

☐ Time 1504: Electrician Starts Line 1 Belt Machine

☐ Time 1822: Shop Lights Flicker - Power surge?

Check Answer

The item that should go in the half-shaded oval is the Causal Event, which occurred at time **1515, Employee Sick, Apprentice on Ruler**.

ACME

```
      Power
      Surge
        |
        v
    Electrician
    Stops Line 1
        |
        v
      Line 1
     Switch to
      Manual
        |
        v
     Stop 2nd
      Shift
        |
        v
      Quality
    Rejects 24
    Seat Belts
```

D

Long Description

A continuation of the same Acme Company Event Sequence Timeline is shown. It starts with the diamond labeled "Power Surge". A thick arrow connects from the diamond to a rectangle labeled "Electrician Stops Line 1". A thick arrow then connects from that rectangle to another rectangle labeled "Line 1 Switch to Manual". A thick arrow then connects from that rectangle to another rectangle labeled "Stop Second Shift". A thick arrow then connects from that rectangle to a circle that is labeled "Quality Rejects 24 Seat Belts". Finally, a thin arrow points from a half-shaded oval to the circle labeled "Quality Rejects 24 Seat Belts". The half-shaded oval is not labeled.

Event Sequence Timeline Job Aid

View CR Submit CR

Job Aids are used as quick references in training. Many are used in DCMA offices worldwide.
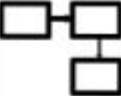
An Event Sequence/Timeline Job Aid has been included with this training to assist you on the job. Access and print this document. With your DCMA supervisor's approval, use it as a starting point to chart a sequence or timeline of events.

Click here to access the Event Sequence/Timeline Job Aid for this training.

DAU CMQ220 Root Cause Analysis

Job Aid - Event Sequence / Timeline

Shape	Use
→	**Timeline** An arrowed line (horizontal or vertical) that depicts a linear path for actions or happenings in problem solving.
▭	**Event** An action or happening that occurs during some activity. Enclose all events (actions or happenings) in rectangles.
▭–▭	**Primary Event (on Timeline)** The action or happening directly leading up to or following the primary effect; shown as a rectangle on the primary event timeline. The primary sequence of events is depicted in a straight horizontal line with the primary events connected with a heavy arrow. Relative time sequence is generally left to right.
◇	**Undesirable Event** An undesirable event (equipment failure or inappropriate action) that was critical for the situation being analyzed to occur; shown as a diamond. e.g., component failures, system malfunctions.
▭–▭	**Secondary Event (Above or Below Timeline)** An action or happening that impacts the primary event but is not directly involved in the situation; shown as a rectangle below or above the primary event; connect secondary events by small arrows.
○	**Terminal Event** The end point of the analysis; shown as a circle at the end of the primary event line.

CLICK TO OPEN

D

Long Description

Thumbnail of the Event Sequence/Timeline Job Aid. The image has a magnifying glass superimposed over it that says "CLICK TO OPEN".

Case Study Summary

The Event Sequence/Timeline helped Acme Company determine a possible casual factor for their rejected seat belts. The apprentice did not correctly measure the length of the belts.

Yes. There may be other tools in use during Root Cause Analysis that might have helped your supplier find the cause. DCMA specialist must know the fundamentals of these tools to properly review their Corrective Action Plans.

D

Lesson Summary

This lesson focused on the concepts of problem solving.

You now understand that suppliers and vendors to DCMA have several methods of "getting to the bottom" of a defect or undesirable event.

Maintain an awareness of problem definition concepts when assessing your supplier Corrective Action Plans. Approach each plan with an understanding of these problem solving concepts:

- Activities may vary from supplier to supplier.

- Expect your supplier to face challenges.

- Check to ensure your supplier avoids pitfalls.

- Problem solving takes skills and attitude.

- Defining a problem is important to RCA.

- Ensure you supplier's problems are well-defined.

- Isolate the critical elements of problems.

- Begin with a timeline to sequence events.

Long Description

The mentor and the DCMA Specialist conclude their conversation. The DCMA Specialist comments, "The Event Sequence/Timeline helped Acme Company determine a possible casual factor for their rejected seat belts. The apprentice did not correctly measure the length of the belts." The mentor agrees, "Yes. There may be other tools in use during Root Cause Analysis that might have helped your supplier find the cause. DCMA representatives must know the fundamentals of these tools to properly review their Corrective Action Plans."

Lesson Completion

You have completed the content for this lesson.

To continue, select another lesson from the Table of Contents on the left.

If you have closed or hidden the Table of Contents, click the Show TOC
button at the top in the Atlas navigation bar.