CHAPTER 4

MISHAP INVESTIGATION FUNDAMENTALS

Mishaps seriously degrade operational readiness and waste tax dollars. Mishap prevention depends on hazard identification, elimination, control, and correction. We discussed these concepts in chapter 3. Despite all our best intentions to prevent mishaps, they still occur. When that happens, we must thoroughly investigate the mishap to prevent its recurrence. We must review every possible primary and contributing cause. From those causes we can learn and distribute lessons and plan corrective actions.

In this chapter, we will discuss the following information:

- Mishap investigation responsibilities
- Words and definitions associated with mishap investigations
- Privileged information
- Testimonial immunity
- Pre-mishap plans
- Investigator training
- Investigation kits
- Investigative procedures

MISHAP INVESTIGATIONS

The purpose of a mishap investigation is to determine the primary and contributing causes of the mishap. From those causes we can then plan corrective action to prevent a recurrence of the mishap. To limit mishap losses, we must analyze the frequency of potential mishaps and identify mishap causes.

Always investigate and report any mishap, near mishap, or situation that could result in a mishap; but conduct mishap investigations with care. You can use a number of investigative techniques to collect and examine evidence, take good witness statements, and determine the chain of events. Whether you are assisting a safety officer with a command or local investigation or serving as a member of a mishap investigation board, the same techniques apply.

You may be required to help conduct a safety investigation of a mishap, personal injury, or fatality. OPNAVINSTS 3750.6Q, 5100.21B, 5100.23C, and 5102.1C contain the requirements for safety investigations. *Afloat Mishap Investigation Handbook,* NAVSAFECEN 5102/30, contains the procedures the investigator should follow for afloat mishaps.

Certain mishaps are reportable to the Naval Safety Center. Chapters 6, 7, and 8 discuss mishap reporting for shore, afloat, and aviation mishaps. Each community has its own reporting requirements. All mishaps, though, require investigation, whether or not they are reported outside the command.

Investigation of mishaps is the responsibility of all levels of supervision, from the first-line supervisor to the commanding officer. Division officers, department heads, or representatives appointed by the commanding officer usually investigate serious injury or major property damage mishaps. First- and second-line supervisors investigate nondisabling injury or minor property damage mishaps.

An investigation is best conducted by the lowest level of supervision involved in the job or event that resulted in the mishap. For instance, if improper maintenance or operation of a pump causes a mishap, the immediate supervisor of the maintenance person or operator often provides the best investigation.

You should investigate mishaps that occur under your supervision for several reasons. You are close to the jobs, working conditions, and your personnel. You know the details of jobs, procedures, hazards, environmental conditions, and any unusual circumstances that might arise. You also know the experience and personal characteristics of your personnel. This knowledge provides you with a good background for conducting a thorough investigation.

Conducting mishap investigations yourself strengthens your sense of responsibility for mishap prevention. While conducting mishap investigations, you will learn about the hazards, causes, and mishap conditions that are likely to recur. You must train new personnel, check for unsafe conditions and practices, and remind personnel about hazards.

Since a supervisor has the greatest influence on mishap reporting, you must take positive steps to ensure the prompt reporting of all mishaps. Teach subordinates, especially new arrivals, to report all mishaps, including the "near mishaps" when only chance prevented a mishap. Make sure personnel understand that hazardous

conditions cannot be corrected unless they are reported. To fully support these efforts, follow up on all reported mishaps with an investigation and corrective measures,

MISHAP INVESTIGATION RESPONSIBILITIES

The commanding officer ensures all mishaps are investigated, no matter how minor. Serious mishaps will be investigated by the cognizant Echelon 2 command (ashore), a mishap investigation board (afloat), or a standing aviation mishap board (aircraft mishaps). The safety officer or manager, as principal assistant to the commanding officer, will ensure a mishap investigation is conducted for less serious mishaps. The actual informal investigation may be conducted by a safety petty officer, safety supervisor, division officer, or safety manager.

The investigator's responsibilities include answering the following questions: What? Where? When? How? and Why? Notice that you are not trying to find **WHO** caused the mishap. Your job is to make an objective inquiry to learn the circumstances and causes, not to place the blame.

Each mishap shows a failure or defect in a person's actions, a piece of equipment, an environmental condition, a procedure, or a combination of these items. You should thoroughly examine each situation to determine all causes, both primary and contributory.

An important concept for you to understand is that mishaps and injuries are two separate occurrences. An injury is not the mishap; it is the result of the mishap, The investigation of an injury or damage uncovers the cause of a mishap.

WORDS AND DEFINITIONS ASSOCIATED WITH MISHAP INVESTIGATIONS

Before continuing, let's define some of the terms with which you as an investigator need to be familiar:

Evidence— Any parts, pieces, wreckage, logs, statements, records, photographs, or other items that may provide insight into the mishap. Physical evidence consists of only tangible materials that were not staged or derived by the investigator.

JAG Manual Investigation— An official legal search to uncover facts concerning a mishap. The JAG manual investigation is conducted separately from the safety investigation and can result in punitive or administrative action.

Mishap— Any unplanned or unexpected event causing personnel injury, occupational illness, death, or material loss or damage. It also could be an explosion of any kind whether or not damage occurs.

Mishap investigation— A review of the events leading to, during, and following a mishap. The command involved conducts the investigation using the procedures outlined in OPNAVINSTS 3750.6Q, 5100.21B, 5100.23C, or 5102.1C.

Mishap Investigation Board— A formally appointed body assigned to investigate a serious mishap. Boards are appointed for shore, afloat, and aviation activity mishaps, depending upon the seriousness of the mishap. A mishap investigation board provides its findings in a Mishap Investigation Report (MIR) or a Shore Safety Investigation Report (SSIR).

Near Mishap— A hazardous or potentially risky occurrence in which injury or damage was avoided merely by chance.

Witness Statement— An oral, written, recorded, or dictated account of what the witness to a mishap saw, heard, felt, or perceived. Witness statements taken for safety investigtations are never taken under oath. They can contain opinions, beliefs, and perceptions. Statements taken by an afloat or aviation mishap investigation board may become privileged information. If a shore mishap investigation board takes witness statements, the statements are covered under testimonial immunity.

Additional definitions are given in enclosure (2) of OPNAVINST 5100.21B, *Afloat Mishap Investigation and Reporting*.

PRIVILEGED INFORMATION

Privileged information is that information voluntarily provided under a promise of confidentiality or information that would not have been discovered but for information voluntarily provided under a promise of confidentiality. The analyses of findings, conclusions, and recommendations of the afloat and aviation mishap investigation boards and any endorsements made by the board are privileged information. Also privileged are the calculations and deductions the board used in making those analyses.

A complete and comprehensive mishap investigation is an essential tool in identifying the cause of a mishap and thereby preventing recurrence. Traditionally, the only source of mishap information is a Judge Advocate General (JAG) investigation. This investigation detemines accountability and culpability.

The Manual of the Judge Advocate General, JAG Instruction 5800.7C, governs the JAG Manual investigation. In a JAG Manual investigation, however, the reluctance of witnesses to divulge information for fear of being punished might lead to the loss of valuable safety information. The sole purpose of the safety investigation is mishap prevention, not the determination of accountability. That is why we invoke the concept of privileged information for afloat and aviation investigations.

Individuals may be reluctant to reveal information pertinent to a mishap because they believe certain uses of the information could be embarrassing or detrimental to themselves, their fellow service members, their command, their employer, or others. They may also elect to withhold information by exercising their constitutional right to avoid self-incrimination.

Individual members of the armed forces **must be assured** that they may confide in others for the mutual benefit of fellow service members without incurring personal jeopardy in the process. Witnesses **do not** provide statements to mishap investigation boards under oath, and requiring them to do so is prohibited. Mishap investigators must advise witnesses, in writing, of the purpose for which they are providing a statement and of the limited use to be made of the statement. The witnesses' statements are not limited to matters they could testify about in court. They may be invited to express opinions and speculate on possible causes of the mishap.

Mishap investigation boards who believe their deliberations, opinions, and recommendations could be used for other than safety purposes might be reluctant to include vital safety information in their reports. Likewise, endorsers of MIRs may be reluctant to include vital safety information in their MIR endorsements (MIREs).

Should the Department of the Navy (DON) use privileged information for any purpose other than safety, it would lose the trust of its people in future assurances of privilege. To protect privileged information against unauthorized disclosure, the Navy must safeguard the entire reporting cycle. That cycle includes assurances of confidentiality given; privileged information obtained, developed, and reported; privileged information protected against misuse or public disclosure; and trust in assurances of privilege and confidentiality. If any segment of the cycle fails, we may lose vital safety information. Privileged information will not be used as follows:

- In making any determination affecting the interest of an individual involved in a mishap or making a statement under assurances of confidentiality
- As evidence, or to obtain evidence, in determining misconduct or line-of-duty status
- As evidence, or to obtain evidence, to determine the responsibility of personnel from the standpoint of discipline
- As evidence, or to obtain evidence, to assert affirmative claims on behalf of the government
- As evidence, or to obtain evidence, to determine the liability of the government for property damage caused by a mishap
- As evidence, or to obtain evidence, before administrative bodies, such as officer evaluation boards (USN) or field performance boards (USMC)
- As evidence, or to obtain evidence, in any other administrative or judicial proceeding(s) to determine misconduct or line-of-duty status, or governmental liability

Not all evidence collected by a mishap investigation board is privileged. Logs, most photographs, physical evidence, and copies of instructions are commonly available to anyone with no promises of restricted use. The source of physical evidence is privileged if divulged under the promise of confidentiality. Other privileged items include the following:

- Witness statements to an afloat or aviation mishap investigation board.
- Preplanned photographs staged or posed by the afloat or aviation mishap investigation board to illustrate a specific condition or situation. All captions or markings placed on photographs suggesting the mishap board's deliberative process are also privileged. Photographs of human injuries/remains that are not staged are not privileged, but may be exempt from disclosure under exemption b(6) of the Freedom of Information Act.
- Notes made on the board's deliberations, including personal notes made by board members.

The concept of privilege has been successfully used by the Navy aviation community and U.S. Air Force to gather vital mishap information. This concept was

applied to afloat units in OPNAVINST 5100.21B, *Afloat Mishap Investigation and Reporting.*

TESTIMONIAL IMMUNITY

Federal law requires the U.S. Navy to make available to other federal agencies copies of mishap investigations occurring ashore. Because of this potential widespread distribution, we don't use the concept of privilege to gather information for shore mishaps. Instead, we use a similar concept that promises the witnesses "testimonial immunity."

We grant testimonial immunity to gather information that might not ordinarily be volunteered. Although less encompassing than the concept of privilege used by the mishap investigation boards for afloat and aviation mishaps, testimonial immunity protects individuals from adverse action based solely on the information they provide.

As we saw with afloat and aviation mishaps, a complete and comprehensive mishap investigation is an essential tool in identifying the cause of a mishap and thereby preventing recurrence. The primary source of shore mishap information in the past was a Judge Advocate General (JAG) investigation. However, the JAGMAN investigation can be used to determine accountability and culpability.

The *Manual of the Judge Advocate General,* JAG Instruction 5800.7C, governs the JAG Manual investigation. In a JAG Manual investigation, however, the reluctance of witnesses to divulge information for fear of being punished might lead to the loss of valuable safety information. The purpose of the safety investigation is mishap prevention, not the determination of accountability. That is why we use the concept of testimonial immunity for shore mishap investigations.

Individuals may be reluctant to reveal information pertinent to a shore mishap because they believe certain uses of the information could be embarrassing or detrimental to themselves, their fellow service members, their command, their employer, or others. They may also elect to withhold information by exercising their constitutional right to avoid self-incrimination.

We must assure members of the armed forces that they may confide in others for the mutual benefit of fellow service members without incurring personal jeopardy in the process. Witnesses **do not** provide statements to shore mishap investigation boards under oath, and requiring them to do so is prohibited. Mishap investigators must advise witnesses, in writing, of the purpose for which they are providing a statement and of the limited use to be made of the statement (fig. 4-1). The witnesses' statements are not limited to matters they could testify about in court. They may be invited to express opinions and speculate on possible causes of the mishap.

The Department of the Navy will not use information gathered under the concept of testimonial immunity as follows:

- In mating any determination affecting the interest of an individual providing the information
- As evidence, or to obtain evidence, in determining misconduct or the line-of-duty status of an individual providing the information
- As evidence, or to obtain evidence, to discipline the individual providing the information
- As evidence, or to obtain evidence, to assert affirmative claims on behalf of the government against an individual providing the information
- As evidence, or to obtain evidence, before administrative bodies, such as officer evaluation boards (USN) or field performance boards, (USMC) pertaining to the individual providing the information
- As evidence, or to obtain evidence, in any other administrative or judicial proceeding affecting the individual providing the information

PRE-MISHAP PLANS

No one plans to have a mishap, but your effectiveness in conducting an investigation may depend on preplanning in case a mishap happens. Aviation squadrons have pre-mishap plans. These plans tell who to call and what actions to take when you are first notified of a mishap. Nearly every airport and large community has drills and plans to combat disasters. Pre-mishap plans are highly recommended for every ship and occupational safety and health (OSH) office.

Pre-mishap plans can range from one page to volumes. They may consist of checklists for each type of mishap. They must provide clear, concise instructions on what to do and when to do it. They should provide for

- saving and maintaining an alarm system or method,
- saving lives,
- protecting lives and property from more loss, and

ADVICE TO WITNESSES

THIS IS PART OF A LIMITED USE MISHAP INVESTIGATION REPORT.
LIMITED DISTRIBUTION AND SPECIAL HANDLING ARE REQUIRED
AS PROVIDED FOR IN OPNAVINST 5100.21B.

THIS STATEMENT IS PRIVILEGED AND IS EXEMPT FROM DISCLOSURE UNDER FOIA.

DO NOT FILE THIS STATEMENT IN A SYSTEM OF RECORDS SUBJECT TO THE PRIVACY ACT. FOR EXAMPLE, THIS STATEMENT MUST NOT BE RETRIEVABLE BY NAME, SOCIAL SECURITY NUMBER, DATE OF BIRTH, OR OTHER UNIQUE IDENTIFIER ASSOCIATED WITH AN INDIVIDUAL.

Authority: 10 U.S.C. 5031

Principal Purposes: To determine the cause of the mishap so the U.S. Navy can improve equipment design, safety, and warning devices; operating and maintenance procedures and training; administrative and engineering controls; and personal protective devices to prevent or reduce to a minimum the accidental loss of naval personnel and materials.

Official Use(s): The information requested will be used by the mishap investigation board, officials and employees of the Naval Safety Center, and other DOD officials to prevent mishaps and to promote and monitor safety and safety programs. Collective or individual mishap investigation reports form the basis for safety advisories to the fleet, for material for safety publications, and for recommendations to higher authority involving human factors and equipment design to prevent mishaps.

Mandatory or Voluntary Disclosure: The information being requested is voluntary. However, your failure to provide the requested information will diminish the overall understanding of the causes of the mishap.

PLEASE READ THIS STATEMENT CAREFULLY.
CERTIFY YOUR UNDERSTANDING BY SIGNING AT THE BOTTOM.

I understand:

a. I have been requested to provide information to a mishap investigation board.
b. My statement will not be under oath or affirmation.
c. Disclosure of information is voluntary; my election or refusal to provide such information will have no adverse effect upon me.
d. The mishap investigation board and the Department of Defense will use the information I provide solely to determine the cause(s) of the mishap and to make safety evaluations for future prevention of loss of life/material.
e. The information I provide shall not be used as evidence or to obtain evidence in any other administrative or judicial proceeding(s) to determine misconduct or line-of-duty status, or governmental liability.
f. Examples of situations where the information provided by me shall NOT be used include:
(1) In any determination affecting me.
(2) As evidence in determining misconduct or line-of-duty status of other personnel.
(3) As evidence in any disciplinary proceedings.
(4) To assert affirmative claims by the government or to defend the government against claims.
(5) Before any administrative boards, such as officer evaluation boards (USN) or field performance boards (USMC).

1. PRINTED NAME		2. SIGNATURE	
3. DATE	4. RANK/RATE	5. SERVICE	6. TELEPHONE NO.
7. YOUR ADDRESS			
8. PRINTED NAME OF BOARD MEMBER		9. SIGNATURE	
10. STATEMENT (Continue on reverse or attach separate sheets)			

Figure 4-1.—Advice to witnesses form.

- assuring a timely investigation.

The pre-mishap plan should also provide for protecting the mishap scene as much as possible. For example, if a ship spills a hazardous substance into the harbor, what local agency or office do personnel from the ship report that spill to? Is there assistance available from a shore command? Can the local medical clinic accept personnel contaminated with a chemical? All of these questions can be answered with a pre-mishap plan.

Vital evidence can be lost if steps are not taken quickly to secure the area. If feasible, the plan should include phone numbers and points of contact for each type of emergency. Pre-mishap plans are usually part of the Command Duty or Staff Duty Officer's Notebook.

INVESTIGATOR TRAINING

Whether a safety petty officer (SPO) or an experienced safety manager, mishap investigators need some training to ensure they can conduct a useful investigation. Aviation safety officers receive extensive formal training in aircraft mishap investigation techniques. The Afloat Safety Officer Course currently devotes 3 days to mishap investigation and training. The Naval Safety School provides a mishap investigation course for shore activities.

Most investigator training is done in house or on board by a trained safety manager or safety officer. Good training is the key to a good investigation; a good investigation is the key to preventing mishaps. The following example demonstrates the importance of a good investigation:

> A Seaman fell down a ladder and broke his ankle. He lost more than 5 work days, so his divisional safety petty officer (SPO) had to do an investigation and prepare a report. The SPO talked to one person who saw the SN fall. That person said the SN was hurrying to get to chow and slipped on the middle step. The SPO listed the cause of the mishap as inattention and rushing. The resulting mishap report was three sentences long. The next week another sailor fell down that same ladder and died.

What is wrong with this story? Perhaps the SPO was not trained in conducting a mishap investigation. Perhaps the SPO didn't realize the importance of the mishap investigator's job. When a formal mishap investigation board investigated the second mishap, it found the following evidence:

- Worn ladder treads
- No nonskid at either end of the ladder
- Dirty ladder treads and greasy hand rails
- A burned out light at the top of the ladder
- Missing pins from the bottom handrail attachment
- The routine practice of requiring personnel who used that ladder to work until chow was nearly over resulted in personnel hurrying to the mess decks

A thorough investigation of the first mishap may have prevented the fatality. The training of that investigator may have saved a life.

INVESTIGATION KITS

In the movies we see civilian investigators with their cameras, fingerprint kits, and magnifying glasses. Although you may not investigate enough mishaps to justify having a professional kit, you may find the following equipment useful during evidence collection and mishap scene evaluation. Most of the equipment is common and will be available on board ship or at your activity.

- Blank labels or tags
- A camera with flash (black and white/color film)
- China marking pencils (red and black)
- Manila envelopes
- Felt-tip markers (red and black)
- A two-cell, explosion-proof flashlight (with spare batteries)
- Graph paper
- A hacksaw (frame and blades)
- A 2 1/4-inch adjustable inspection mirror
- A notebook
- Plastic envelopes or small plastic bags with scalable openings
- Pliers (regular, needle nose, and wire cutters)
- A pocket knife
- Polyethylene rope (yellow)

- A magnetic retrieving tool
- A 12-inch wooden ruler
- A screwdriver (flat and Phillips head)
- Steel measuring tapes (12-foot and 100-foot)
- A video camera (optional)
- A voltage tester
- Adjustable wrenches (6-inch and 8-inch)
- A yellow lumber crayon

Investigating a mishap scene could expose you to health hazards such as soot, sharp metal, toxic chemicals, or asbestos fibers in torn lagging. In such cases, you need to wear at least the following protective equipment:

- Disposable coveralls
- Protective gloves
- Adequate respiratory protection
- Safety glasses and goggles
- Safety shoes

If a respirator is necessary, your respiratory protection officer or shore Respiratory Protection Program manager can help you get fit-tested and ensure you receive the required medical screening.

INVESTIGATIVE PROCEDURES

A mishap has occurred! The worst that could happen has happened! What are your priorities? There is no question about the first priority at a mishap site—save lives and prevent more injury and property loss. Aboard ship, damage control takes priority over preserving the scene of the mishap for investigators.

Begin your investigation as soon as possible after the mishap. The sooner you begin, the better your investigation will be. Witnesses will be present. You can gather more accurate facts because the damage and materials involved will be in the same relative position as when the mishap occurred.

The mishap investigator is seldom the first to arrive at the scene of a mishap. An activity with a pre-mishap plan will have a supervisor on the scene who knows how to protect the site, detain witnesses, and provide observations. Protecting and preserving the mishap site is important. However, it may be necessary to disturb the scene for damage control purposes.

Your first overall observation and analysis on arrival at the scene is critical. Slow your approach to the scene so that you can observe the overall big picture.

Start your investigation the minute you arrive, but don't hinder damage control or first-aid efforts. Don't become part of the mishap! Once people have calmed down, victims have been removed, and the area is safe, your priorities are as follows:

- Preserve the evidence
- Protect the mishap site
- Secure the evidence

You will have little time to plan your investigation. Always be ready to begin collecting facts and evaluating the situation with little prior notification.

Preserving Evidence

Mishaps gather crowds! People forget their work and begin running in all directions as they rush in for a look. Too often, many more people arrive on the scene than need to be there. Preserving evidence and controlling activities under these conditions is almost hopeless. Evidence gets washed away, trampled on, thrown over the side, picked up as a souvenir, or scooped up in initial clean-up efforts.

When a mishap occurs, especially aboard ship, everyone's first thought is to get the site back to normal. That must be discouraged if it doesn't impact on operational readiness. Anything that can be left in place should not be touched.

As a safety supervisor, you may be a key player in preserving evidence until a mishap investigation board arrives. Take the following steps (which should be included in your pre-mishap plan) to preserve evidence:

- Cord off or secure the mishap scene. Post a guard if you must!
- Get a photographer on the scene as soon as possible to take photographs—takes lots of photos of everything. Use a video camera, if available, as well.
- Cover the scene with a tarp if the scene is outdoors or if the scene may be disturbing to passersby.
- Prevent witnesses from leaving the area. Keep them from conversing with each other, if possible. Get their names and a phone number

where you can reach them, If time allows, have them start writing down what they saw.

- Ensure the medical department representative or emergency medical technician preserves any transitory evidence, such as blood samples, for drug and alcohol tests (if warranted and authorized).
- Minimize moving or disturbing any physical evidence. Other investigators may be using this same evidence, so protect it as a courtesy to all who may need that evidence.
- Before any evidence is moved, photograph it from several angles. If you don't have a camera, make a quick sketch or diagram.

Collecting Evidence

You may have seen investigators on television in surgical gloves placing little bits of debris in plastic bags. They handle such evidence gingerly to prevent damage to it.

You may want to collect parts, pieces, debris, and other items from the site to prevent their loss and to examine later. Carefully wrap them in protective material or place them in plastic bags, envelopes, or small glass or plastic containers. Accurately label each item with the following types of information:

- Who gathered the item (You may want to question the person later about the position or location in which it was found.)
- The identification of the item, if known
- The time and date it was gathered
- The location of the item when removed

When labeling evidence, make sure you do not put any information on the label that might be privileged. In other words, do not indicate the source leading to your finding the item or any deliberative comments. You must share physical evidence with other investigators, since it, in itself, is not privileged.

You may also collect records such as logs, operating procedures, or time cards as evidence. Even though you review the original record, make a copy of it to retain as evidence. Mark on the back who made the copy and when. A copy of a log made a week after the mishap may have given someone the chance to rewrite or "correct" it. Check for erasures and added lines.

PHOTOGRAPHING.— Photographs are perhaps the most valuable piece of evidence you will have besides an eye witness. You can't just go in to a mishap scene and start shooting photographs at random! You or your photographer needs to plan your shots to make the best use of limited time and still not miss critical information.

Some safety officers and safety managers keep a disposable 35-mm camera or self-developing camera readily available. If they arrive early at the scene, having a camera on hand may be vital. If you intend to use the base or ship's photographer, arrange ahead of time for a review of investigation and photographic techniques with the photographer.

Self-developing photographs are acceptable but lack fine detail and are difficult to enlarge. Black and white photographs are not as helpful as color photos, but some ships and laboratories can only develop black and white film. Using color film may delay developing services. If you are using base or commercial photo laboratory services, color developing may be available and faster. Color, 35-mm, 400-speed film used with a high-speed flash will do a good job. Otherwise, make do with what is available.

Color photography is especially helpful in fire investigations. The color of the smoke and flames can provide valuable information on what is burning and how hot the fire may be. A yellowish to white flame indicates a hot flame of about 1500 degrees Celsius, while a reddish color indicates a cooler flame of about 500 degrees Celsius. Red or running flames on water indicate the burning of petroleum products. Heavy black smoke usually means a burning petroleum product or burning rubber or paint. Light white smoke occurs from the burning of combustibles such as wood or paper. An aura of brilliance around the base of the smoke indicates burning metal.

Take care to avoid underexposure when taking photos of fire scenes after the fire is out. Charred and sooty material may absorb the light from your flash.

Be sensitive to photographs that show bodies or body parts, especially if the victim can be identified. If the mishap was controversial or has high public interest, be careful about using commercial photo developing services. We don't want to tempt a technician to send one of your photos to the local newspaper.

If you use Navy developing services, ask for the negatives, proof sheets, and all prints. Get proof sheets and decide which photos you want printed. You should overshoot but underprint—take duplicate photos with

Figure 4-2.—Investigation photograph with ruler to show scale.

different light, exposures, or angle; but only print the good shots.

Photographs are physical evidence. They can be shared among investigators. The only exception is if the mishap investigation board deliberately stages a photograph. Based on its deliberations, the board may want a photograph staged to prove or disprove a point. For example, the board may decide that a worker was electrocuted by touching a light switch over a metal sink. To prove that could have happened, the board may have a worker of the same height stand in the same spot to try to reenact touching the switch. Staging the photograph to show that the victim could reach the switch makes that photograph and its negative privileged information. Also, if a mishap board member writes or draws something on a photograph based on board deliberations, the photograph then becomes privileged. The negative to that photograph, without the writing, is not privileged.

When taking photographs for your investigation, keep the following tips in mind:

- Take a few shots while approaching the mishap. Follow the path of travel of the victim.
- Photograph anything that may get moved or collected.
- If you get there while the mishap is in progress, take photos of the onlookers and emergency response personnel. That may provide identification of witnesses to the mishap and where they were standing.
- Get photos from all sides, if possible.
- Photograph the debris so that you can see details—get close but keep some background in the photo to show a relationship with other evidence.
- Show a scale of the item by photographing a person, a hand, a ruler, or a clipboard next to the item (fig. 4-2).

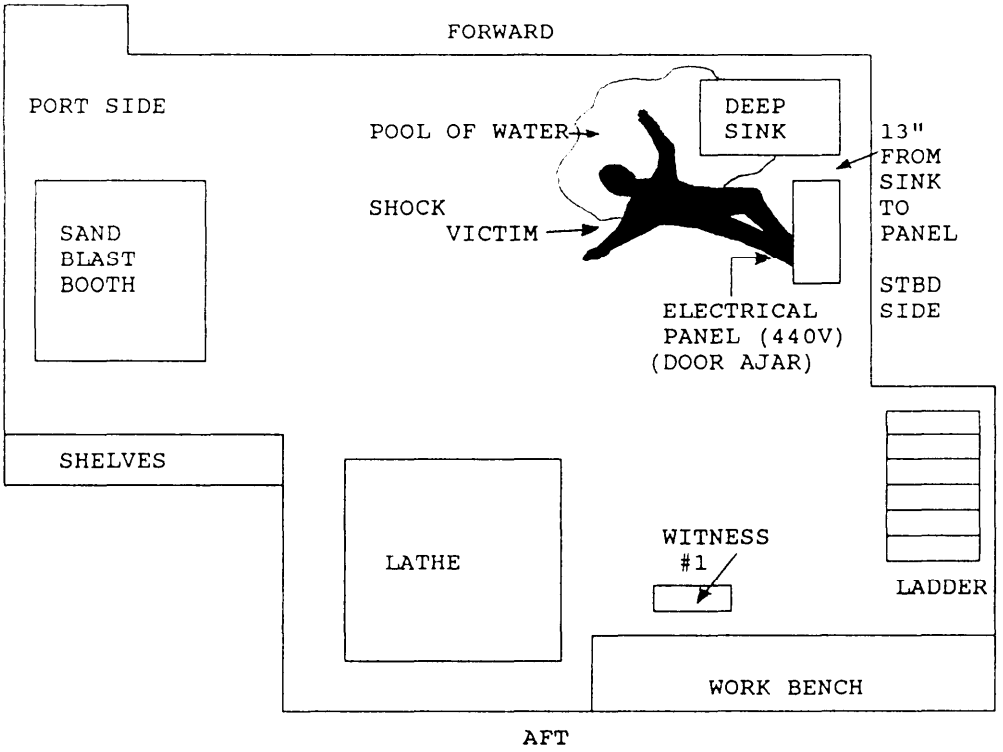

Figure 4-3.—Sketch of mishap scene.

- Use a pen or pencil to draw arrows to parts of the photograph you wish to draw attention to.
- Take wide-angle shots as well as close-ups.
- Identify your photo by including a photo log, slate, or card in the photo with a code or number or some other method of identification.

Label each photo according to your log or record, telling when it was taken, who took it, under what conditions it was taken, where it was taken from, and what it shows. Otherwise, you may end up with a photo of a jumble of wires and twisted metal with no clue as to what the photo is of. It is embarrassing to leaf through a stack of photographs and not even know which angle is up!

VIDEOTAPING.— Videotaping is a valuable method of recording a mishap scene, but it is not a substitute for still photography. A video tape shows responders in action and shows movement and color; but it cannot be studied as well as a photo.

Recording a reenactment of the chain of events leading to a mishap can serve as a valuable supplement to still photography. A videotape made by an afloat or aviation mishap investigation board to reenact a mishap is privileged, since the tape reflects the board's deliberations. Other video tapes made by reporters, passersby, or a single investigator are not privileged since they are physical evidence.

SKETCHING, DIAGRAMING, AND CHARTING.— A sketch is a drawing made at a mishap site. It is usually a rough, stylized drawing that can be smoothed up later into a more accurate diagram. Charts are usually tables of information, measurements, or statistics used to clarify certain points. You may also have charts of speeds, instrument readings, and temperatures.

The same rules that apply to the labeling of photographs apply to the labeling of sketches and diagrams (fig. 4-3). Carefully label sketches and diagrams as you would a photograph. The advantage that a diagram has over a photograph is that it is less cluttered. A diagram can show movement with arrows, angles, positions of people and parts, and key distances. Drawn closely to scale, it can emphasize certain aspects of a photograph to clarify a point. Sketches may be the only evidence you have from a mishap scene if photographs were not available before evidence was moved.

With a sketch or diagram, you can add information like temperatures, air flow, plots of noise, and lighting.

Use grid or graph paper, if available, to help draw to scale. Mark sketches or diagrams aboard ships showing forward and aft, port and starboard, compartment number, or frame number. Ashore, mark magnetic north or place north in the upper left corner. Use key landmarks or features to orient your drawing. Mark key points, distances, and movement on a spare navigation chart or map. Remember to be as accurate as possible. Some items to record and measure include the following:

- Location of injured and dead personnel
- Machines and equipment affected by the mishap
- Parts broken off or detached from the equipment
- Objects damaged, marked, or struck against
- Gouges, scratches, dents, or paint smears
- Tracks or similar indications of movement
- Defects or irregularities
- Accumulations of stains or fluids
- Spilled or contaminated substances
- Areas of debris
- Sources of possible distractions or adverse environmental conditions
- Safety devices and equipment
- Positions of people and witnesses
- Possible movement of people, before, during, or after a mishap

Look for things that are obviously missing. A key part of a machine may not have been replaced during maintenance.

Using Various Types of Witnesses

We usually think of witnesses as being people who were at or near the mishap scene who can provide helpful information. But witnesses need not be human. A witness can be anything or anyone who provides insight into a mishap. A witness may not have even been near the mishap but can provide information about events leading up to the mishap. Some mishap investigation courses identify four types of witnesses, known as the four "P's": people, parts, position, and paper.

- **People.** People can include others besides eyewitnesses, participants, and victims. They can be your friends, supervisors, or anyone who can provide information about the mishap. They can also be technical representatives for equipment or aircraft involved in the mishap.
- **Parts.** Parts include debris, wreckage, charred wood, failed machinery, support equipment, or stressed metals found at the mishap site.
- **Position.** Position includes the mishap location, patterns of movement, where victims were found, and where the wreckage was found or was resting after the mishap.
- **Paper.** Paper, such as logs, records, reports, drawings, and recordings, provides witnessing information. Although we may not think of them as paper-type products, floppy disks also fall into this category.

All of these items "testify" about the mishap. But by far the most valuable information about "how" the mishap occurred comes from the human witness.

In a JAG Manual investigation or any other legal investigation, the investigator is interested in the truth. Witnesses must swear under oath that their testimony is true. The written testimony of witnesses, which can be used against them, must stand up in court.

Witnesses are sometimes reluctant to fully cooperate in legal investigations because they fear retribution. That inhibits investigators from getting all the pertinent information.

A safety investigation cannot risk the withholding of information! Therefore, witness testimony in a safety investigation is NEVER TAKEN UNDER OATH! The safety investigator and witness must share a free and open flow of truthful information. Witnesses must be confident that what they say will not be used against them in any disciplinary or administrative proceeding. Witnesses must feel free to share rumors; their opinions, thoughts, or recommendations; or any other information about the mishap. They must understand that the only purpose for the information is SAFETY and that investigators need to know everything about the mishap to prevent recurrence.

Safety officers, safety petty officers, or safety supervisors who conduct an informal investigation may take oral testimony. Although you may take notes, be careful to avoid documenting any information that may be used to harm witnesses or their command. For a

command or local investigation, *assure* witnesses that you will not use the information against them, but let them know the report is releasable under the Freedom of Information Act (FOIA).

In a command or local investigation, information and evidence are not privileged. That is because junior supervisors may lack the ability to properly protect that information from release or misuse. Information becomes privileged only when gathered through an afloat or aviation mishap investigation board. To avoid problems, avoid taking written statements for locally conducted investigations.

A mishap investigation board that writes a limited-use mishap report can promise that the information witnesses provide will not be used against them. The board provides that promise in writing. An Advice to Witness form (fig. 4-1) is provided to all witnesses in an afloat mishap so that they understand just how their testimony will be used by the board. Similar forms are used in both aviation and afloat mishap investigations. These witness statements are privileged. Shore mishap investigation boards use a different form giving the witness testimonial immunity.

Remember, all testimony is VOLUNTARY in a safety investigation. Witnesses can refuse to cooperate. You must explain your purpose and request their assistance. You cannot force a person to provide information.

Interviewing Witnesses

Witnesses should be interviewed as soon as practical after the mishap to ensure the integrity of the information. Witnesses provide better information when the mishap is fresh in their minds. Waiting days, or even hours, to conduct an interview can be detrimental.

- Witnesses are strongly influenced by each other and the news media. Given time to talk among themselves and compare stories, witnesses may add to or change their story. Seeing the mishap on the news can influence their own account.
- Witnesses can forget. They forget minor details. If the witnesses didn't understand what they saw, they may use their imagination to fill in the blanks; therefore, their story may change.
- Some witnesses are hostile, and, given time, may develop a grudge. They may find out information that influences them to protect a friend or to try to hurt their supervisor.
- Witnesses may go out and tell all their friends about the exciting mishap. Each time they tell the story, it gets better. Without knowing it, the witnesses are embellishing the information.

Try to keep witnesses apart by giving them separate tasks at different locations. Put them to work drawing a sketch of the scene, listing participants, or writing down what they saw. Having a dozen sailors waiting together on the mess deck will ensure homogenized testimony.

An investigator must also consider the personality of the witness:

- Extrovert or braggart
- Timid or self-conscious
- Suspicious
- Excitable
- Intentionally misleading
- Traumatized
- Untruthful

SIGNS OF UNTRUTHFULNESS
Hang-dog appearance
Repeats the questions asked
Inaudible speech
Defensive smile
Nervous laugh
Unnatural emphasis on details
Excessive detail

The interviewer determines witness reliability. Witnesses may not be intentionally misleading, but you must compare their information to that of other witnesses. For example, six sailors responded to a fire aboard ship. Three said they heard the word passed and then heard the general quarters alarm. The fourth did not hear the word passed at all. The other two heard the word passed after the alarm. The interviewer must determine the credibility of each witness, compare testimony, and then decide which account was more accurate. The first

three may have compared stories. The fourth may have been too far from a 1MC speaker.

Interviewers who have the following types of personalities can also influence a witness:

- Commanding-type-overbearing
- Proud, overconfident ("COLUMBO complex")
- Overly eager
- Timid, insecure, insincere
- Prejudiced
- Manipulative

The interviewer's body language can intimidate witnesses or set them at ease. When interviewing, sit on the same level as the witness, not above. Offer the witness a soft drink or cup of coffee. Use a quiet place, such as an office or stateroom, to conduct the interview, not a crowded lunchroom. If a male is interviewing a female (or vice versa), the interviewer should ensure the door remains open and the place is not secluded. Make sure you are not interrupted during the interview. Interview one-on-one—avoid ganging up on a witness with two or three investigators.

INTERVIEW-DO NOT INTERROGATE!

Be sincere and friendly to your witnesses. Provide a phone number where you can be reached if they wish to add something they forgot to their testimony. Explain the purpose of your investigation. Do not argue with your witnesses.

Before your interviews, you should preplan a few common questions. Asking each witness a few similar questions can help determine if the witness's account is believable. Write down pertinent questions about which a particular witness may have information. Have a basic understanding of the equipment, material, and procedures surrounding the mishap. If you are not familiar with how a band saw works, you may not be able to ask pertinent questions about how the victim used the saw.

Ask neutral questions. Ask questions that require explanations, not just a yes or no answer. Listen, and permit silent periods. Do not rush your witness. Keep the interview on track. Solicit a witness's assistance and recommendations to prevent recurrence of the mishap. Always start with the same question: **WHAT FIRST ATTRACTED YOUR ATTENTION TO THE MIHSHAP?**

You may want to use a visual orientation to jog the witness's memory. If not too traumatic, take the witness to the mishap scene. Let the witness explain what happened, who was standing where, and what his or her actions were. First refresh the witness's memory at the scene; then conduct the interview. Be sensitive to your witness. A witness who saw a friend injured or killed may be too upset to provide much testimony.

If you want to interview a victim in the hospital, check with the physician first to see if an interview would harm the victim. Go to the hospital sometime other than regular visiting hours. Relatives of the victim may be hostile, press for information, or upset the victim. Relatives may try to blame you or your command for hurting their loved one.

In an informal interview you listen to the witness and take notes. Although a witness may draw a scene or write down a sequence of events, a local or command mishap investigation does not use Advice to Witnesses forms or take written statements.

A mishap investigation board does use the Advice to Witnesses form and can ask for a written statement. A witness who is reluctant to write a statement may record or dictate the statement. Review dictated statements with the witness. Have a recorded statement transcribed; then review it with the witness.

Let witnesses know that you may call them in later to reinterview them or ask them more questions. Encourage witnesses to add to their testimony later, as well.

An interview has four phases:

- First phase—Free narrative
- Second phase—Repeat the story
- Third phase—Review the information
- Fourth phase—Clear up inconsistencies

Once you have interviewed and reinterviewed your witnesses, then you must analyze their information.

Table 4-1.—Witness Information Chart

WITNESS	LOCATION	ACTIVITY	OBSERVATION
MMC on watch as EOOW	Engine Room mid-level	Reviewing readings	Called by MM3 about hearing someone call for help. Went to switchboard after a moment and saw MM2 doing CPR on FN; called OOD.
MM3 on watch as throttleman	Control board	Talking with MMFN	Heard someone yell, so called EOOW. Told MMFN (throttleman under instruction) to investigate noise.
MMFN on watch as throttleman (under instruction)	Control board	Observing MM3 on watch	Heard nothing, but was told by MM3 to look near switchboard. Saw FN rigid against panel door; ran to phone and called OOD.
MM2 at SSTG doing repair work	SSTG #2A	Repairing lube oil strainer	Saw MMFN run by saying someone was being shocked; went to see. Knocked FN away with mop handle; started CPR.

WITNESS	HEARD FN YELL	SAW VICTIM	NOTIFIED OOD
MMC	no	yes	yes
MM3	maybe	no	no
MMFN	no	yes	yes
MM2	no	yes	no

Sometimes developing a chart of your witness information (table 4-1) is helpful.

Determining the Sequence of Events

Now that you have your sketches, evidence, photographs, video tapes, and witness statements, you can determine your sequence of events. That is the most difficult part of investigating a mishap, especially a complex mishap. You must take all the events surrounding the mishap and put the jigsaw puzzle together.

In some mishaps you have logs and records that aid you in pinning down times and people. Start with the times you do have; then fill in the blanks with testimony and your "best guess." Some investigators write the sequence of events on small pieces of paper and arrange them into different sequences until a possible chain of events appears.

Your chain of events can start days or weeks before the mishap even occurred. Look as far back as needed to find a cause that could prevent recurrence. Maintenance done on an aircraft 6 weeks ago could be a contributing cause to an aircraft crash. Disconnecting a backup warning bell on a forklift last year may have contributed to a worker's being run over last week. All of these may be part of your sequence of events.

Your sequence of events may also be extremely short. A welding spark touching off a pyrotechnic device that detonates other ammunition that blows out

the wall of a building may happen in a matter of seconds. The sequence of events is the investigator's best estimate of what could have happened.

Reconstructing the Mishap

Sometimes you will find that reconstructing the mishap will help you get a clear picture of how the mishap occurred. Using your best guess of the sequence of events, walk through the mishap.

Have those who take part in recreating the mishap proceed up to the point of the mishap. Use original players if they are not too upset to revisit the scene. Go through the events slowly; then stop and discuss the events.

Be careful not to repeat the unsafe act. You don't need to have another mishap on your hands! Beyond the point of the mishap, talk about the action taken and walk through it again. Try other possibilities to see if they could have been contributing causes. Videotape the reconstruction and view the tape. Many times you will discover the cause of the mishap through the reconstruction.

Checking Precedence

During your investigations you should also check to see if this same type of mishap has happened before. Based on the precept that there are "no new causes," a previous mishap could provide clues to this mishap. The Naval Safety Center, systems commands, and type commanders have information on previous mishaps, near-mishaps, and systems/equipment problems that may provide insight. Reviewing this type of information also aids in formulating corrective actions.

Determining Criminal Evidence

A mishap is an unplanned event. A criminal act is an intentional or planned event. A deliberate act is not a mishap. The criminal act may not be readily obvious until the mishap investigation is started. Arson, for example, may not be determined until most of the mishap investigation is completed.

When doing an investigation, if you find criminal evidence, stop the investigation and inform your chain of command. A mishap investigation board that finds a possible criminal act will stop its investigation, and the senior member will inform the chain of command. Nonprivileged physical evidence can be turned over to criminal investigators. The sources of the evidence and privileged information are never revealed or turned over. If directed, a mishap investigation may continue, depending on the mishap. For example, if an arson fire occurred, but investigators found several hydrants out of commission and several hoses missing, a mishap investigation might look into those problems.

Analyzing Mishaps

A variety of analytical techniques are used in mishap investigations. Some are simple, while others derived from civilian investigators are quite sophisticated. In this section we will define and discuss a few of the more common analytical techniques used by DOD personnel.

An analysis of a mishap involves many methods and techniques of arranging facts. The facts can be used for the following purposes:

- To help determine what additional information is needed
- To establish consistency, validity, and logic
- To establish sufficient and necessary causes
- To help guide and support judgments and opinions

Some methods of analysis are used both to prevent mishaps and investigate them. Systems safety and failure mode analysis are detailed methods used when investigating systems involving complex, interrelated components. The Navy may use these methods for aircraft and weapons systems investigations. Some of the results of these analyses can also be used to predict mishaps or the possibilities that certain mishaps will occur.

The following techniques are used by some Navy mishap investigators, depending on their training and the extent of the investigation. Training is available in the techniques through the Naval Safety School and local colleges and universities.

FAULT TREE ANALYSIS.— The Navy uses fault tree analysis to determine if a particular system, component, or equipment requires planned maintenance. It asks questions such as, If maintenance is not done, will the system fail? If the system fails, what is the result? Will personnel get injured? Will operational readiness be damaged? The fault tree is a

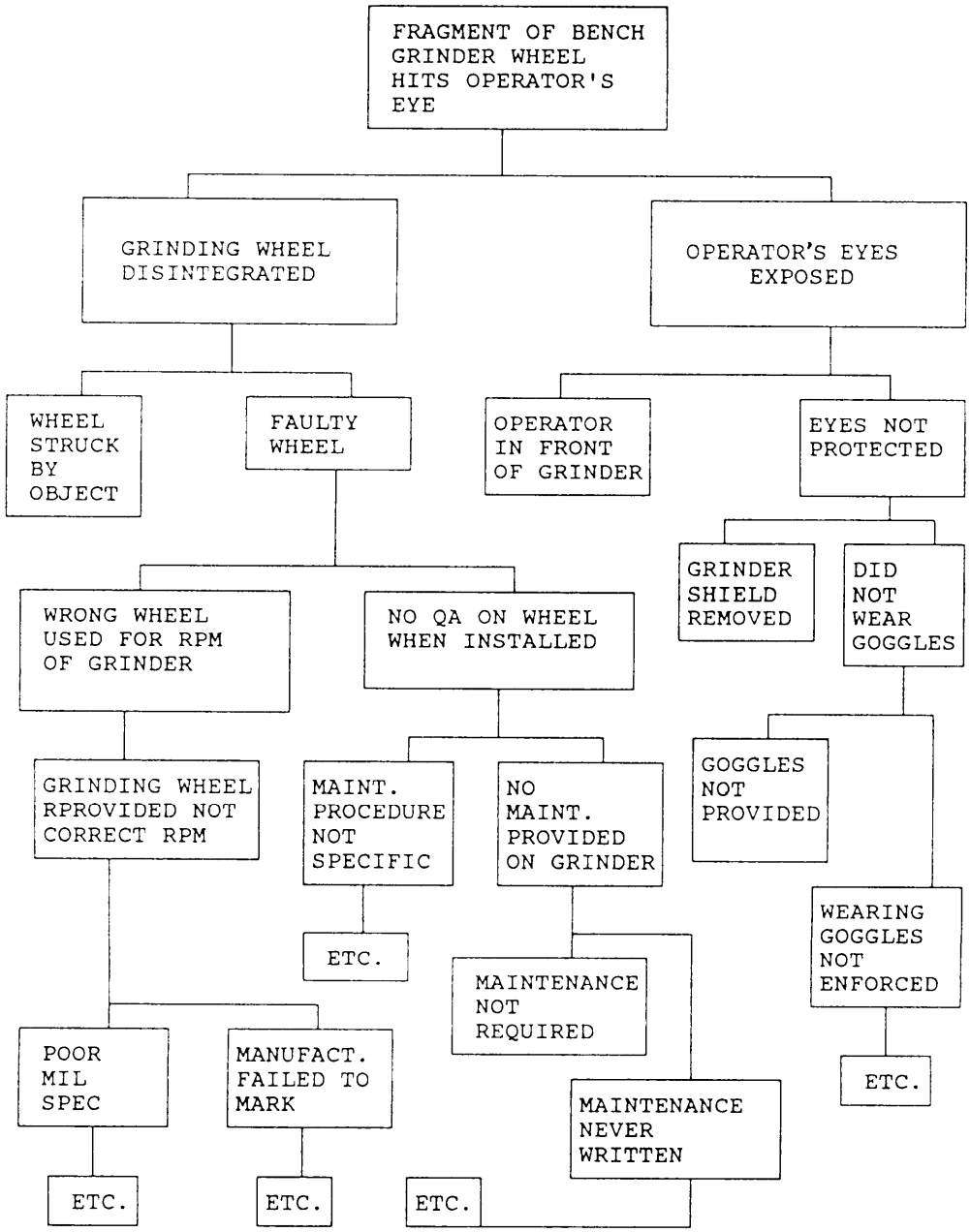

Figure 4-4.—Sample fault tree diagram.

symbolic diagram on paper showing "what if "problems (fig. 4-4). It also branches off into other components affected by the failure. Analyzing mishap investigation information works backwards from the final failure to the original component. It shows the cause-and-effect relationship of systems.

CHANGE ANALYSIS.— Change signals trouble. A change in the steering of the ship or a change in the sound of an engine may signal trouble. Departures from the norm may be an element in the chain of events leading to a mishap. Changes interact with subsequent changes. A change in a Maintenance Requirement Card (MRC) could cause a change in frequency of the maintenance. The change in frequency could change the adequacy of the maintenance. The change in adequacy of maintenance could change the reliability of the equipment. The change in reliability could lead to a mishap. Analyzing the changes that affected a system or procedure may provide mishap causes. In a change analysis, we compare a mishap situation with a similar but mishap-free situation. We determine the differences

and analyze them. These differences may be the cause factors.

MANAGEMENT OVERSIGHT AND RISK TREE.— The management oversight and risk tree (MORT) technique uses a logic tree format as a guide to seeking facts in mishap investigations. It involves a long series of interrelated questions and the use of diagrams, symbols, and charts. It is similar to a fault tree but adds in more supervisory and human factors. Once completed, it provides a visible trail of facts and investigative steps.

MORT is based on the concept that all accidental losses arise from two sources: (1) specific job oversights and omissions, and (2) the management system factors that control the job. Within the MORT system, a mishap means an unwanted transfer of energy that produces injury, damage, and loss.

Mishaps are prevented by using energy barriers or controls. For example, the energy of a piece of broken grinding wheel causes the loss of an eye. The appropriate energy barrier would have been a guard on the grinder or eye protection on the worker.

TECHNIQUE OF OPERATIONS REVIEW.— The technique of operations review (TOR) method is used in mishap prevention and as an investigative tool. It is directed more at management than at hardware. TOR is a step-by-step process whose goal is the efficient operation of a system. Analyzing the operation using TOR after a mishap defines weaknesses in the operation. TOR usually uses a group discussion method of defining all possible and probable causes and then tracing the events. As causes are accepted or rejected, the primary cause eventually becomes clear. TOR does not propose solutions but does expose problems.

SUMMARY

In this chapter you have been given some mishap investigation fundamentals concerning investigative techniques, collection of evidence, interviewing witnesses, and analyzing information. These procedures can be applied to any type of investigation, whether ashore, afloat, or involving aviation. The results of these investigations provide you with the information to complete mishap reports. Chapters 6, 7, and 8 deal with their respective areas of mishap reporting.