CHAPTER 2

MISSILE HANDLING AND STOWAGE

Early in your career as a GMM you learned to handle missiles from dockside to ship to stowage area, or from ship to ship. You became familiar with standard and special handling equipment, the operation of strikedown and strikeup machinery, and the equipment or tools needed for mating and checkout of the missile. General and special rules of safety as applied to missile handling were called to your attention many times, so you wouldn't forget them. You performed operational tests on the handling equipment; lubricated, disassembled, inspected, cleaned, and reassembled mechanical, electric, pneumatic, and hydraulic handling equipment.

As you advanced in rating, you not only had to know how to operate the handling equipment, but you trained others in the use of the equipment, as individuals or teams. If your missiles required wing and fin assembly, you were expected to train the teams to do the work with the speed and accuracy required for that weapon system.

If something went wrong with the electrical or electronic parts of the handling equipment, it was your responsibility as a GMM 2 to trace the trouble to its source with the use of test equipment and the aid of wiring diagrams.

What is left for the GMM 1 and C to learn regarding the handling and stowage of missiles and missile components? Planning of the work and supervision and teaching of lower rated men are important parts of your duties. To teach others, you have to have knowledge that is broader and deeper than that of those you teach. This knowledge is also necessary for intelligent planning of handling and stowage operations. From experience and study, you should know about different missiles and different ships. Your men may have had experience with, only one or two types of missiles.

The lower rated men perform the routine preventive maintenance, and the simpler repairs. Adjustment, overhaul, and the more difficult repairs are the province of the GMMI and C. In addition to the ability to troubleshoot and repair the equipment, you must be able to plan and carry out a maintenance and repair program for the equipment.

Rules for stowage of supplies are the proper concern of the supply department or the supply officer, but the GMM must know and apply the special rules that apply to the stowage of guided missiles and their components. Because guided missiles contain explosives, the GMM needs to know the properties of explosives and the rules for handling and stowing the explosives safely. The GMM 1 and C sees to it that the weapons and their components receive the proper stowage, insisting on observance of safety regulations all through the process of handling and stowing.

LOADING AND STOWAGE PLANS

In this chapter, the loading operation discussed is that of putting the missile on the ship, whether from dockside or from another ship. Chapter 4 discusses the loading of missiles into the launcher for firing.

KNOWLEDGE REQUIRED FOR PLANNING WORK

Before you can plan a loading operation, you need to know a great deal, not only about the missile itself, but also about the ship, its handling equipment, and its stowage areas. How

much responsibility for planning will-be yours depends on the size of the ship, the personnel of the ship, and other factors. On a small ship you may be the leading petty officer in the GMM rating; prepare yourself to accept responsibility.

About Your Ship

If you have been on your ship for some time, it is assumed that you have learned the location of strikedown hatches, missile elevators, missile stowage areas, and strikedown equipment. If, however, you have not had the opportunity to become acquainted with these details, you need to make an. active effort to know your ship. When a loading operation is impending, you need to know whether the loading will be from dockside or from another ship. Missiles might be brought on deck by helicopter. This is information you must have in order to plan the handling of the missiles in getting them on the ship. Standard transfer at sea requires different handling equipment than transfer by helicopter.

Find out which of the stowage spaces are to be used for this particular load; then determine which elevator or strikedown equipment is best or most convenient to use.

STREAM - A method designed for transfer of missiles at sea is the missile/cargo STREAM transfer method, formerly known as FAST. Missile/cargo STREAM method maintains control in the movement of missile components from storage on the delivery ship through the intership transfer and through the strikedown operation on the combatant ship. Proper use of STREAM will ensure delivery of "go" missiles; will reduce alongside time, deck handling, and hazard to crew; and will increase heavy weather replenishment capability.

STREAM receivers installed in combatant ships are of two basic designs; the Tartar/Terrier receiver, and the Talos receiver. STREAM systems are installed on both the supply ship and the receiving ship. The system consists of three basic subdivisions: the strikeup/strikedown equipment on the delivery ship, the intership transfer equipment, and the strikeup/strikedown equipment on the combatant. Figure 2-1 illustrates the transfer of a missile by means of the STREAM method.

The basic principle of STREAM is to suspend a bare missile rigidly from a transfer-at-sea trolley and strongback, haul the loaded trolley between two ships on a tensioned highline, and capture the trolley at the combatant ship. The pickup arm of the elevator captures the trolley and missile, and after releasing the trolley, lowers the missile directly to the ship's strikedown elevator.

The three major components of the receiving unit are the receiving head, the elevator, and a kingpost. The receiving head catches and positions the transfer trolley and missile as it arrives on the highline from the sending ship. The elevator removes the missile from the trolley, then lowers it, and positions it oil the strikedown elevator. The kingpost supports the receiving head, elevator, and rigging. On some ships the kingpost is installed in a fixed upright position; on others it is stowed when not in use.

The receiving units of the STREAM system are the responsibility of the GMMs. You need to know enough about it so that you know where to position your men to receive the missiles, and how to release the missile and position it on the ship's elevator or on the launcher (Tartar).

About the Weapon

The planner needs to know the number of weapons of each type to be taken aboard. If only one type of weapon is being received, the matter is greatly simplified. Handling requirements may vary widely for different weapons. You need to know the configuration of the weapon (stage of assembly in which it is received), the number of containers per weapon, the size and weight of each container (shape may be important, too), the places on the containers where attachments are to be made, and the special handling equipment to be used with each. How many men will you need for each type of weapon, and what will be their specific posts and duties? These are the things that you must find out before the loading operation begins.

Safety rules for handling of explosives are applicable to guided missiles, but there are some additional rules for handling of particular missiles. What are the rules for grounding of the missile components during handling and stowage? What are the temperature and moisture

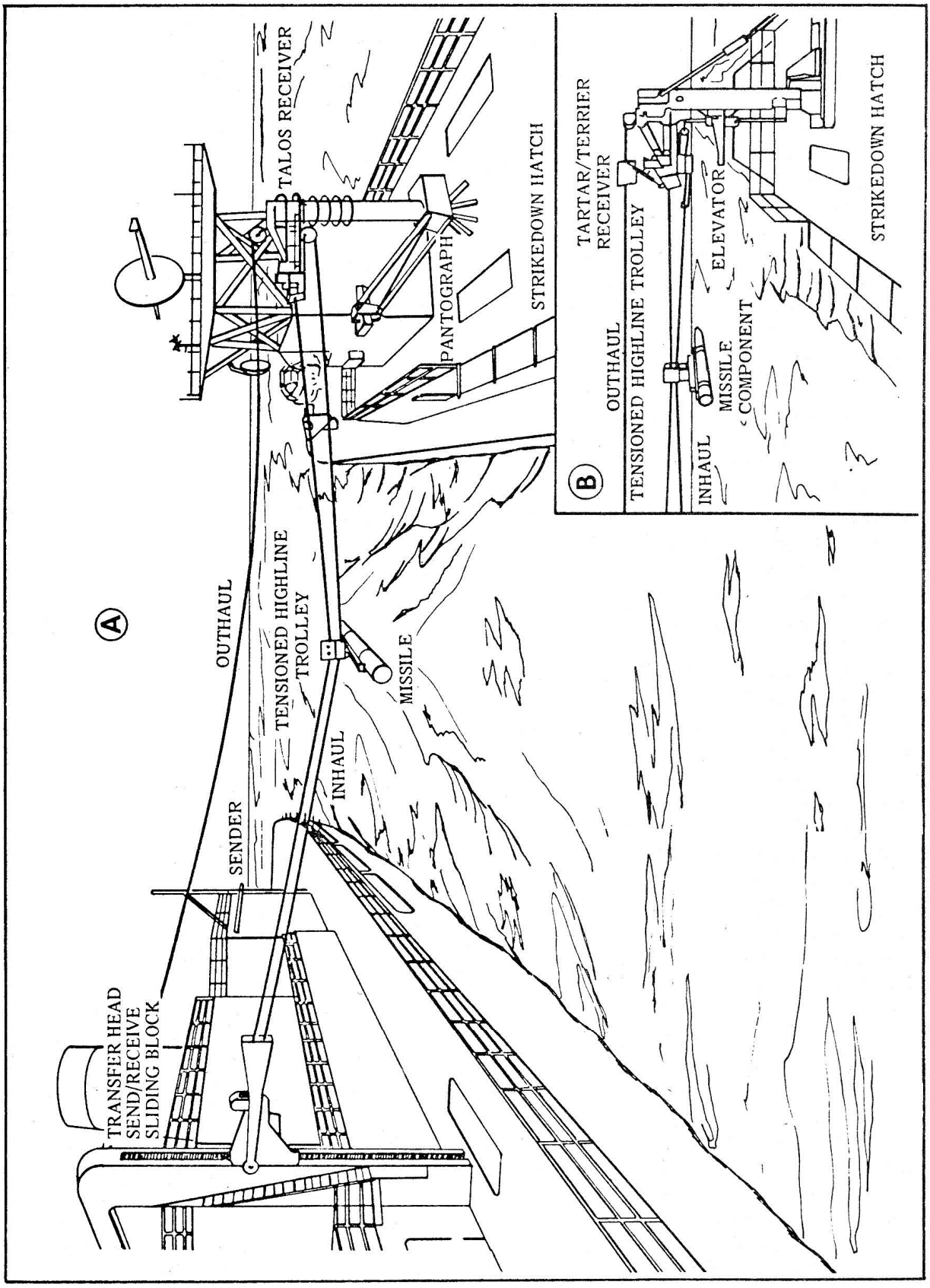

Figure 2-1.—Transfer of missiles between auxiliary and combatant.

limits of the explosive components? Do they have to be kept in the shade while waiting to be struck down?

Missiles with nuclear warheads may be delivered to the ship with the warhead installed in the missile, or the warhead and/or nuclear components may be in separate containers. Nuclear weapons in "birdcages" or other containers are the responsibility of the GMTs, but when the nuclear warhead is received installed in the missile, it is handled and stowed by GMMs. In that case, you need to know any special handling and stowage rules that apply. Consult the technical manual or OP for the missile.

Knowledge of Operation

Your experience in using handling equipment (during your years as a striker, a GMM 3, and then a GMM 2) is invaluable, and may be sufficient to enable you to manage the present situation with a high degree of efficiency. Again, it may not. A good planner does not just "hope" everything will work out all right; he checks beforehand. If there is equipment which you have not used before, find out how to operate it so you can show your men. Know the safety precautions that apply. Find out where each missile is to be stowed; this is especially necessary if you are fairly new on the ship. Considerable confusion can result, for example, if you discover after a missile has been brought down to the magazine that it belongs in a magazine at the other end of the ship. This can be particularly bad if the missiles are of the type in which the components are sent down in a specific sequence so that they will be in the correct order for assembly. If you are in charge of the handling operations, the blame for the confusion is yours. Careful pre planning prevents such mixups.

SCHEDULING OF WORK

On any ship, cooperation among divisions is necessary for a loading. or offloading operation, even though the load consists entirely of missiles. The Boatswain's Mates rig the lines and other cargo gear; the engineering department keeps the ship's elevators in operating condition; etc. When other material besides missiles is being loaded, the time for using certain of the ship's gear has to be allotted. If missile loading is scheduled, let us say, for 1000, be ready with your men to swing into action, and do your work on schedule. Loading of explosives should be done in daylight hours if at all possible, and the ship's plan for the loading will conform to this rule. Unexpected foul-ups can throw the plan off schedule. Plan your part of the work so there will not be such delays. Remember, however, that missile handling must not become a speed contest.

Usually you will have information several days in advance of the actual loading date. Have your men check the operation of the special handling equipment to be used with the missiles. If any of the equipment does not operate as it should, locate the cause of the trouble with the use of test equipment, wiring diagrams, hydraulic schematic, and trouble-shooting techniques, beginning with the simplest method. Then make the necessary repairs and adjustments. The checking of the ship's cargo handling gear is the responsibility of the Boatswain's Mates; but before you entrust any of your missile cargo to the gear, be sure it has been checked out for handling the weights required. It is the responsibility of you and your men to cycle the equipment for striking down the weapons, or the special gear for moving them to on-deck launchers. If the equipment does not operate properly, you must. repair and adjust. it so it will be ready to use on the day required. As' a GMM 2 you have had some experience in locating the trouble spots in such equipment; now you must learn to make more difficult repairs on the equipment and adjust it to working condition.

SECURITY

In addition to the safety provisions that must be observed during handling of any explosives to prevent fire or explosions, provision must also be made for the security of the weapons against theft, damage, destruction, or access to enemies. Knowledge of the transfer of the weapons, of the type and number of weapons, of the design of the weapons, etc., is information that must be concealed from enemies. Access to nuclear warheads must be especially guarded against. The

commanding officer sets the security watch on the pier and on the ship. You learned about sentry and watch duties and security of classified documents in *Seaman*, NAVTRA 10120-F, in *Basic Military Requirements*, NAVTRA 10054-C, and in *Military Requirements for Petty Officer 3&2*, NAVTRA 10056-C. You can instruct your men in their duties when they are assigned to watch duty for security, fire watch, or other watch assignment, and ensure control of classified material.

Although the stenciled information on containers conceals any classified nature of the contents, the men handling the containers usually need to be aware of what they are handling so they will use adequate precautions. If the men who handle fuzes, for example, know that is what they are handling, they will be much more careful than if they don't know.

PLANNING SEQUENCE OF OPERATION

As soon as you know your working party assignment in the loading or unloading operation, think through the work sequence as you and I your men are going to accomplish it. Roughly sketching in your plan of action on paper may be very helpful in filling in the details of the, plan. Where are you going to spot your men? How are you going to manage the handling of the missile components so they will be placed in the correct order without delay or confusion? What checkouts are necessary before the missile components are struck below? How much assembly, if any, is to be performed before stowing the components? Have your men been trained for this work or will you have to schedule a practice session before the day of loading arrives? If such a session is necessary, check to be sure the men aren't already scheduled to be doing something else during the time you want them. Consult with the training officer of the division on this.

STOWAGE AREAS

Before the loading day arrives, check the stowage areas that will be needed. All of them should be clean, with no material that shouldn't be there. The sprinkler systems must be in operating condition. Repair and adjust any parts that need it. Check all other firefighting systems or equipment in and adjacent to the magazines. Be sure the alarm systems are working. In addition to fire warning systems, continuous operation of a radiation detection device with an automatic alarm is required at shore stations and on submarines in spaces where nuclear missiles or weapons (or warheads) are stowed. In air conditioned spaces, check to be sure the system is maintaining the space at the required temperature and humidity.

Some extra checkups are needed after a magazine has been painted. The areas for attaching ground wires should be clear of paint. Make sure that the holes in the sprinkler head valves and sprinkler pipes are not clogged with paint. Hooks, latches, pins, straps, and similar gear may be made inoperable by painting. Free all such fittings so they can be used. Check openings such as ventilation ducts and outlets to be sure they can be opened. Inspect tiedown, blocking and bracing gear, chocks, and other means for stowing and holding missiles and their components. Examine the movable parts of trolley conveyors, such as switches, portable tracks, and trolleys, and make sure they operate freely.

Much of the work of checking the magazines can be delegated to your men, but you must be sure the spaces are in the best condition possible. The simpler repairs may be done by lower rated men, but you need to approve the results. Make a checklist to be sure nothing is overlooked, and that the stowage areas and stowing equipment are ready to receive the cargo of missiles and components.

Radiation Monitoring and Protection

Formerly, all areas in which nuclear weapons or nuclear warheads were stowed or were worked on had to have permanently installed radiation detection equipment, and monitoring was continuous. At present, continuous monitoring for radioactivity is required only on submarines and at shore stations. Surface ships are allotted portable monitoring equipment for use in weapon spaces. Monitoring is required before entering a space containing one or more nuclear components if the space has been unoccupied for over 24 hours. Monitoring of the spaces is not required when no personnel are in the space.

Neither is it required during replenishment at sea and during strikedown operations, or when weapons are transported on elevators or through passageways during an alert operation.

If there is an accident with a nuclear weapon or nuclear warhead, monitoring must be done immediately. The space in which the accident occurred must be closed off to prevent spread of contamination to other parts of the ship. Every effort should be made to move the weapon to a naturally ventilated place. All unnecessary personnel should be evacuated. If the space has access to the atmosphere, all such should be opened. The emergency ventilation EXHAUST should be opened, and after that, open the emergency ventilation AIR SUPPLY. Get out of the space as quickly as possible (the actions above should take very little time), and secure the space, then notify the appropriate personnel. The trained decontamination group, of which you may be a member, dressed in protective clothing, and each wearing an oxygen breathing mask (OBA), reenter the room and remove the source of contamination. The path to be followed must be cleared and the elevator ready. Afterward, the elevator used and the path followed must be decontaminated.

The order in which the above actions are accomplished will differ with the location of the contamination, the severity of the radiation, and whether the radiation is detected immediately or upon preparing to enter a closed space. If the accident occurs on an open deck, the radiation will be carried away into the atmosphere; personnel need to be evacuated from the immediate

The T-290 portable air sampler is used to monitor the weapon space and the weapon. Instructions for operating it are given in Navy SWOP T290-2. As soon as they can be procured, the IC/T2-PA (fig. 2-2) or the battery operated IC/T2-PB will replace the T-290. Technical *Manual for Tritium Air Monitor, Portable, Type IC/T2-PA* NAVSHIPS 0969-000-6000, describes the new model, tells how to use it, and how to maintain it. The instrument is designed to detect tritium contamination in the air, but it is also sensitive to gamma radiation and to gaseous or particulate activity in the air. To use it, remove it and carry it by the carrying strap over the

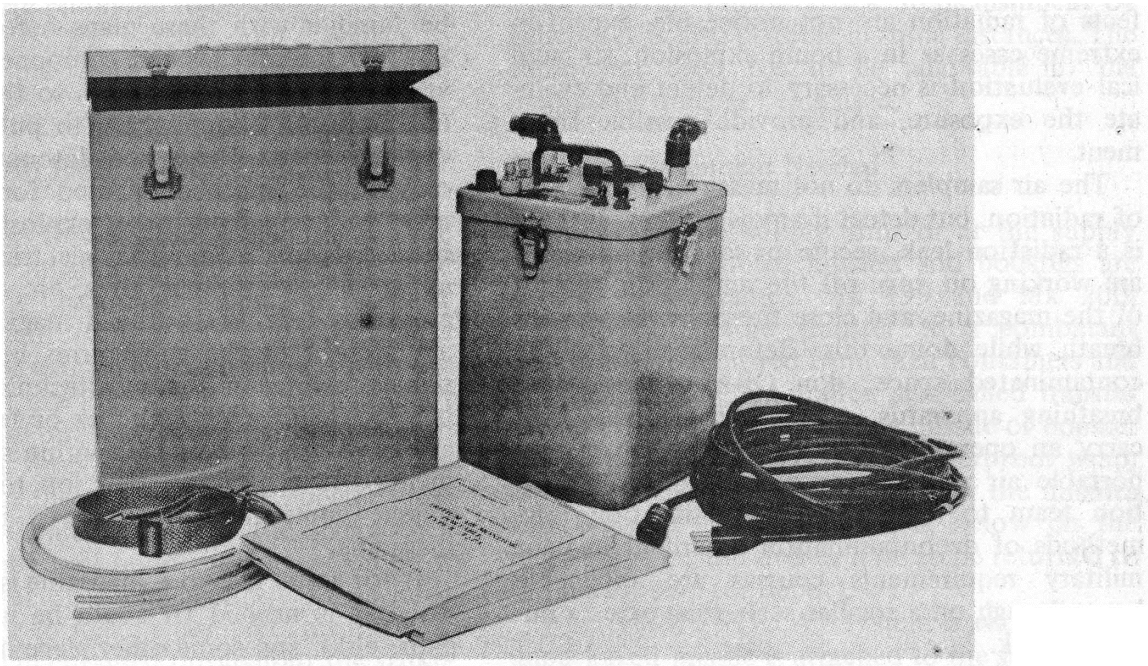

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Figure 2-2.—IC/T2-PA portable radiation monitoring instrument with accessories.

shoulder, or set it on a bench or similar place. The power cord supplied with it is 35 feet long, which allows monitoring of quite a wide area. Plug it into any 115-volt a-c 60-hertz single phase source, 3/4 ampere or greater. As air is drawn through the ion chamber of the monitor, the level of radioactivity is measured. The reading shows on the meter, and when the amount exceeds the normal setting, the alarm sounds. If you need to monitor a space without entering it, perhaps because of suspected high contamination, attach the "sniffing hose" to the instrument and insert it into the space.

The monitor is a delicate electronic instrument and should be handled with care, not dropped or abused in any way. If it becomes contaminated with radioactive particles it must be decontaminated. Careful wiping of the outside with a cloth dampened with water and detergent will remove light contamination. Be careful not to get any water on the inside.

Permanently installed continuous monitoring units formerly used in nuclear weapons spaces have been ordered removed from surface ships according to NAVSHIPS Instr 9650.5. Men who have been exposed to radiation must be sent to the medical department for evaluation. The effects of radiation are not noticeable, except in extreme cases as in a bomb explosion, so medical evaluation is necessary to detect and evaluate the exposure, and provide possible treatment.

The air samplers do not measure the amount of radiation, but detect if any is present. If there is a radiation leak, secure or safe the item you are working on, turn off the ventilation, get out of the magazine, and close the door. Hold your breath while doing this. Before reentering the contaminated space, don OBA or equivalent breathing apparatus, wear rubber gloves, and carry an operating T-290 or IC-T2-PB or -PA, portable air monitor, or call the decontamination team to take care of the situation. The methods of decontamination described in your military requirements courses are applicable here, though on a smaller scale than after a nuclear attack.

The need for extreme care to avoid inhalation or ingestion of nuclear particles should be impressed on your men. Any detectable amount of tritium is potentially dangerous. Although the chances of a leak occurring in a nuclear weapon are small, the danger is ever present and you must teach your men how to act in case it happens. The reason for turning off the ventilation on shipboard is to prevent the spread of, radioactive particles through the ventilation system. Where ventilation to the open air is possible (as at shore stations), activate ventilation systems and open windows.

The danger of unauthorized personnel gaining access to a nuclear weapon during an alarm incident makes it essential to secure the area quickly. Two technically trained men must enter the area as soon as possible to secure it.

Rules of Where to Stow

Most of our missiles are stowed completely assembled (except for wings, fins, etc,) in the magazine or ready service ring that is part of the missile launching system. The supplies of additional parts, such as extra electronic sections, warheads, or repair parts, have to be stowed in separate magazines and stowage compartments.

The ship's plans show the designated stowage for all the ammunition, missile, and missile components that are allotted to the ship. You should be familiar with these plans before attempting to stow the missiles and components. The magazine doors are also marked, so there should be no confusion about where to put the different explosive parts. Fuzes and detonators are stored only in the space designated for them, which must be away from other explosives, and specified distances away from electric or electronic apparatus, steam pipes, fires, etc. (Terrier fuzes are stowed in the warhead magazine.) Primers are stowed in the small arms magazine; flash signals belong in the pyrotechnic locker. The magazines for each launcher or launcher group are as nearby as possible (within safety requirements). It is part of your job to see that the missile components are stowed in the proper magazine.

If for some reason a magazine is not available when it is needed (it could be undergoing repairs, etc.), and some other place must be found to use instead, consult the "Chart of Permissible Stowages of Ammunition and Explosives," in OP 4, Volume 2, *Ammunition Afloat*, to determine the next best place for stowage. Study the

explanation of how to use the chart. You will not find missiles listed on this chart, but components such as boosters, JATO units, and primers are listed.

SUPPLY PRINCIPLES AND STOWAGE.- Some components have an expiration date marked on them, beyond which they are not to be used. When stowing such components, place the oldest ones nearest the front, so they will be used first. The oldest items should always be used first, even if they are not tagged with an expiration date. When a replenishment arrives, move old missile components so they will be most accessible and will be used first. Standard supply items that you might need for repairs or replacement are stored by the supply department.

TERRIER MISSILE HANDLING AND STOWAGE

Terrier missile systems are operational on DLGs, CVAs, CAGs, CLGs, and CGNs. The number and the location of the launchers, the location of the magazines, assembly areas, and checkout areas are different for each ship. That is why you were reminded to check the location of the magazines, the hatches, and elevators to be used when preparing to load Terrier missiles on the ship.

SPECIAL PROBLEMS WITH TERRIER

Although the Terrier is not the largest nor the heaviest of our missiles, its size and weight make special handling equipment necessary (fig. 2-1). The extra length of the BT-3 booster makes special handling care essential in moving it to the mating area. A crack or strain in the propellant grain can cause missile failure through uneven burning when fired. In striking down boosters and missiles to the mating area, a booster must precede every missile through the strikedown hatches, so they will be in the correct order of assembly. A set of complementary items must follow in order to make a complete missile. The order must be maintained throughout the strikedown operation.

It might seem more efficient to transfer all items that require the same handling equipment before breaking out other equipment. However, the reason for requiring transfer of all parts of a missile is obvious when you give it some thought. Suppose you transferred all the missiles and boosters first because they required the same handling equipment. Should anything occur to break off the loading operation, such as a severe storm, or the appearance of an enemy, your ship might have all the missiles and boosters and the other ship all the complementary items, all equally useless when not put together. The rule, therefore, is that for every booster a missile must be transferred, followed by all the complementary parts needed to complete the missile.

Safety rules for handling high explosives and propellants must be observed during handling and strike down. Flash units are treated as pyrotechnic items; they must not be dropped and must not be brought into areas where they will be exposed to RF energy from radars or communication transmitters, or beams from operating missile radars.

INITIAL RECEIPT

Missile components may be received from' dockside, from barges or lighters, or from another ship in transfer at sea. Replenishment by helicopter is also possible in some instances. The equipment used has to be adaptable to the method of transfer being used.

Handling Equipment Needed

On board the supply ship or at the supply depot, the assembled missiles and boosters are stowed in Containers Mk 199 and Mk 200, respectively. Before transfer to a combatant ship, they are removed from their containers and attached to handling dollies, also called transfer dollies (fig. 2-3). Sometimes a missile or booster and its dolly are sealed into a waterproof wrap, especially for transfer at sea. After the missiles and boosters have been struck below on the receiving ship, the dollies have to be returned to the supply ship (or depot).

Wherever the STREAM system is available, the unpackaged missile is attached to the strongback on the trolley, which carries the missile to the receiving ship. The missile and the booster are sent separately, to be mated on the receiving

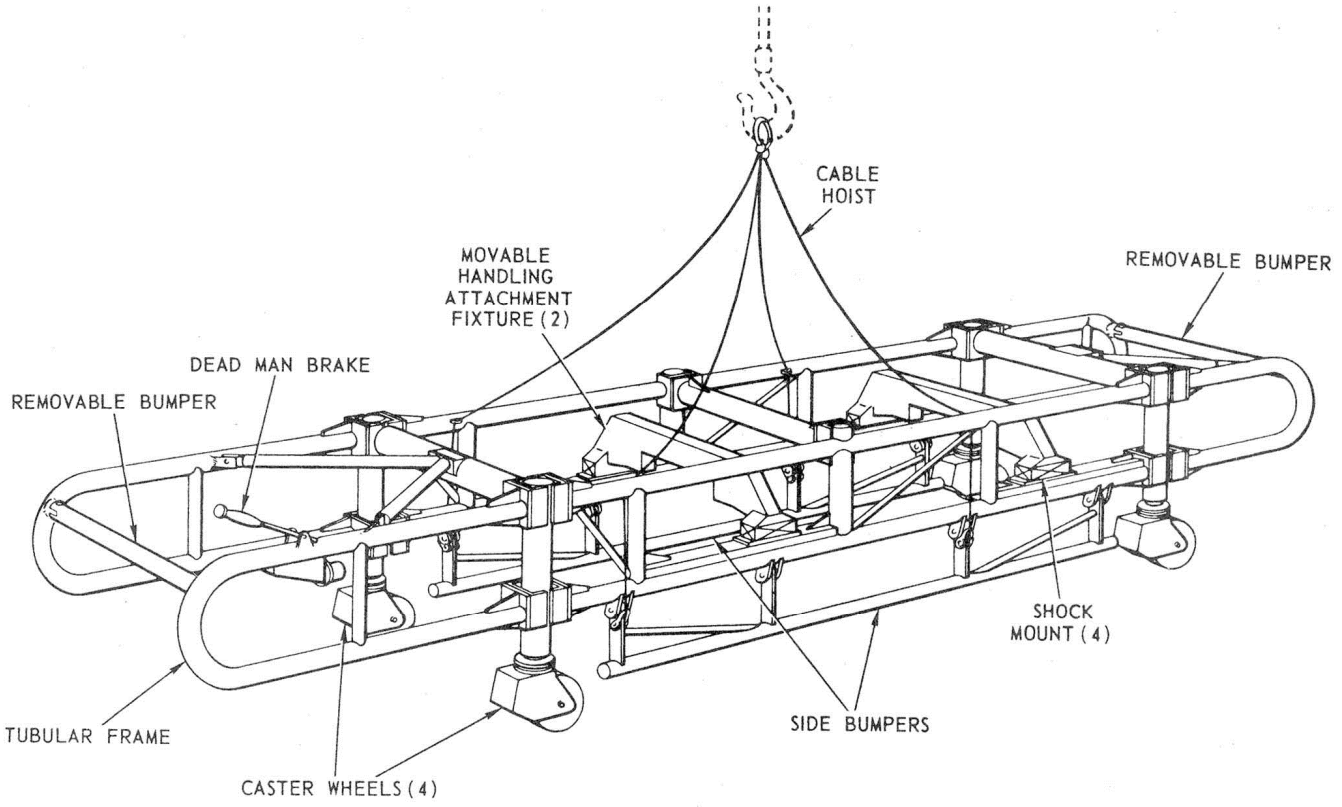

Figure 2-3.—Transfer dolly for Terrier missile.

ship. So many ships now have the STREAM system that. you may never need to use the handling dolly.

Wings and fins are packed in reusable metal containers, which have to be returned. Other complementary items, such as warheads, exercise heads, fuzes, warhead boosters, and code plugs, are transferred and stowed in their containers. They may be handled with skip boxes, or special handling cradles, but are never rolled or slid.

TRANSFER AT SEA-For underway transfer from an ammunition ship (AE), both Modified housefall (fig. 2-4) or the burtoning method, and constant-tension highline rigging (fig. 2-5) are required if the STREAM system is not installed on both ships. The modified housefall rig may be used to land the boosters and missiles on the topside replenishment area, though a tensioned highline or burtoning are preferable. The highline is used to land the complementary items in their skip boxes on the aft deck. Boosters and missiles are received at specified landing areas for subsequent strikedown through the port and starboard strikedown hatches near the after end of the 02 level (on cruisers). The lines are tended by cable winches on the ammunition ship deck. As each missile or booster on its dolly is landed on deck, it is snaked over to the strikedown elevator and is struck down. The empty dollies are returned to the ammunition ship by reversing the handling process. The only dolly with its load must be kept under control at all times. This precaution is especially necessary in rough seas.

Constant tension on the highlines wires is maintained by a winch on the ammunition ship or by a counterweight or ram tensioner. Loads are placed in a skip box hooked to a trolley block (fig. 2-5) on the wire highline. When the skip box is lowered to the ship's deck, the contents are removed, and the empty skip box is returned to the AE by the highline.

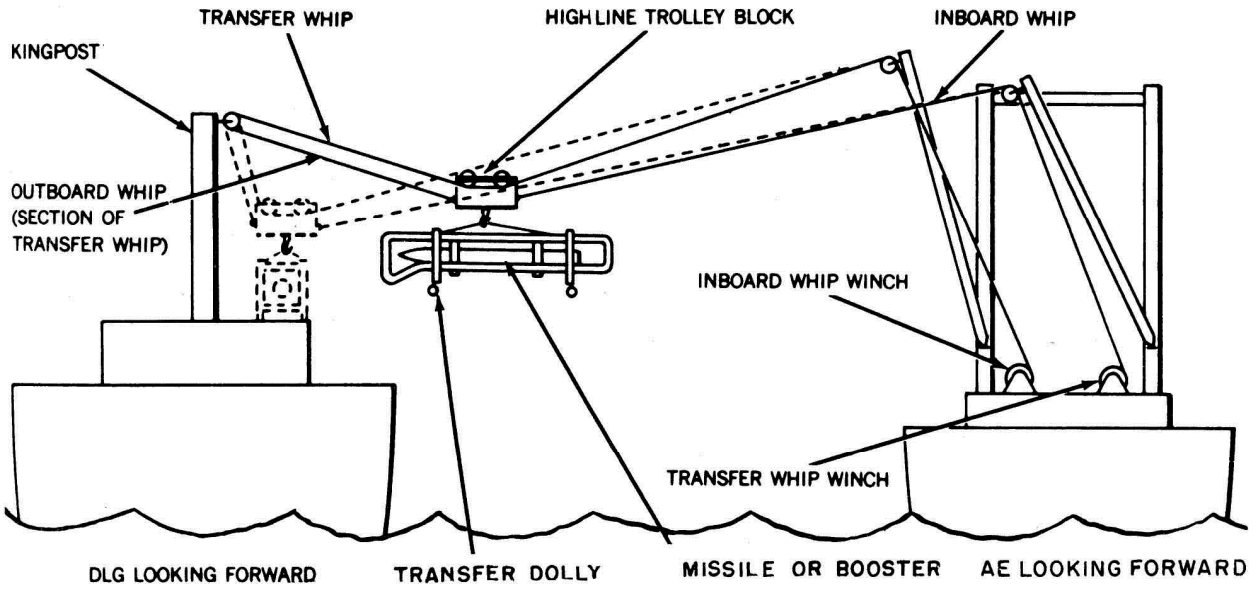

Figure 2-4.—Modified housefall transfer method.

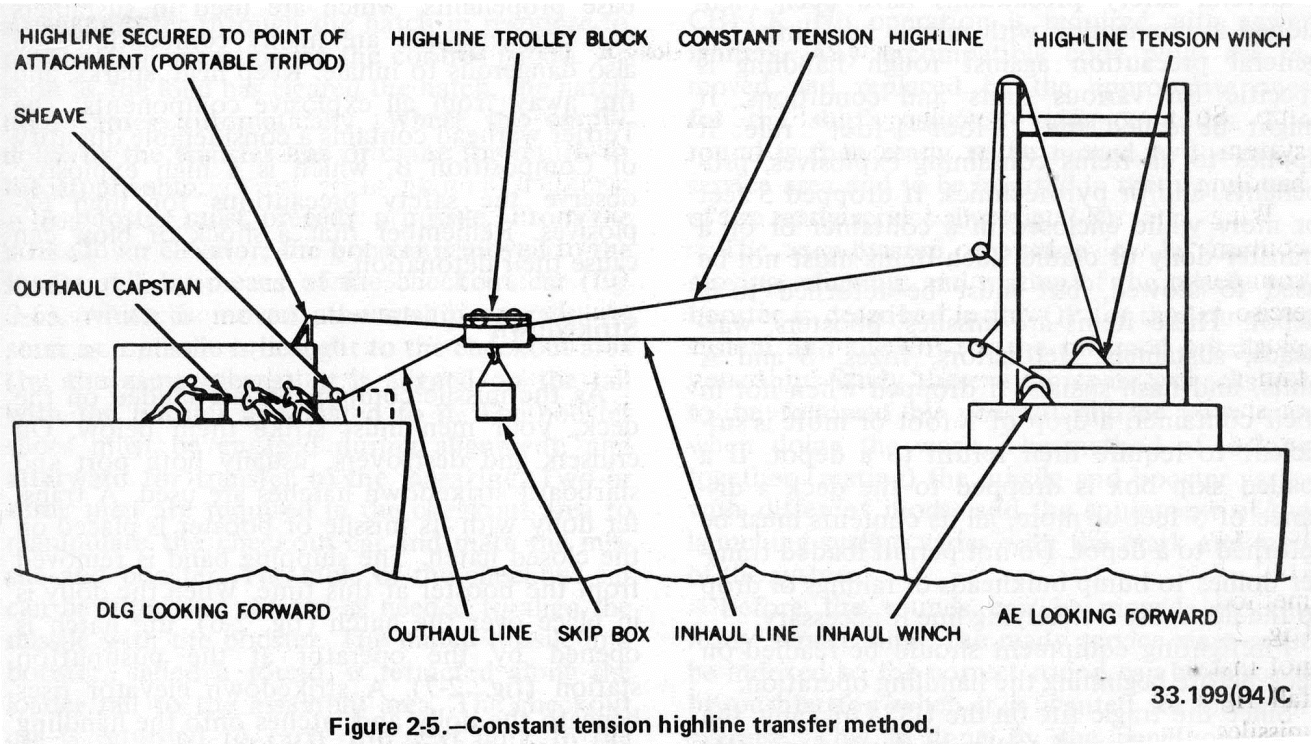

Figure 2-5.—Constant tension highline transfer method.

The work of handling the lines and winch may all be done by the boatswain's crew, but a trained and experienced GMM needs to be at hand to ensure that the explosive components will be handled with proper care. Skip boxes and dollies must be lowered gently to the deck. No smoking is permitted while any ammunition is being handled. The PO in charge should have all his men leave their smoking materials, including lights and matches, at a specific check point before coming to the loading area. Lead the way by putting yours there first.

TRANSFER FROM DOCKSIDE LIGHTER, OR BARGE.-A dockside or floating crane is used to transfer boosters and missiles on their transfer dollies. The complementary items may be carried aboard manually or landed aboard by crane. Subsequent handling is the same as in transfer at sea. While handling explosives on a pier or in a building, ship's personnel are under the authority of the commanding officer of the ordnance facility.

Safety Precautions in Handling

Several safety precautions have been mentioned in connection with missile handling. The general precaution against rough handling is specific for various units and conditions. It might be called the "5-foot-l-foot" rule; it applies to all items containing explosives, propellants, and/or' pyrotechnics. If dropped 5 feet or more while enclosed in a container or on a transfer dolly or cradle, such items must not be used to stowed, but must be returned to a depot. These items are missiles, boosters, warheads, sustainers, detonators, fuzes, S and A units, and flash signals. .If dropped when not in their container, a drop of 1 foot or more is sufficient to require their return to a depot. If a loaded skip box is dropped to the deck a distance of 5 feet or more, all its contents must be returned to a depot. Do not permit loaded transfer dollies to bump bulkheads or railings or drop to the deck; use a steadying line if necessary.

Firefighting equipment should be readied on deck before beginning the handling operation.

Since the tragic fire on the USS Oriskany, the rules for handling of explosive items, especially pyrotechnics, have been reexamined. New, stricter and more comprehensive rules have ~ I promulgated to help prevent such catastrophes in the future. Adding new rules, however, will not prevent accidents. Only strict adherence to the rules will achieve that. You not only need to observe that your men obey the rules, but you need to strive constantly to get your men to believe in the need for the rules.

When planning movement of missiles and components on deck, plot the movements to avoid RF radiation. The beams from radars and other electronic transmitting equipment can cause detonation of some components, and they are also harmful to people. The commanding officer will order inactivation of all possible radar and electronic equipment during ammunition handling, but usually some units have to be kept operating at all times. Flash units are very susceptible to detonation by RF radiation.

The RAD HAZ and HERO programs on the effects of radiation from electronic equipment are discussed in chapter 8.

In the magazines and stowage spaces or ready service rings, if you detect any odor of ether or nitroglycerine, report it immediately to the officer in charge. These fumes exude from double-base propellants, which are used in sustainers and boosters, and are highly combustible and also dangerous to inhale. Keep heat, sparks, and, fire away from all explosive components. The Terrier warhead contains a considerable quantity of Composition B, which is a high explosive; observe the safety precautions for high explosives. Remember that a shock or blow can cause their detonation.

Strikedown

As the missile components are landed on the deck, your men must strike them below. On cruisers and destroyers, usually both port and starboard strikedown hatches are used. A transfer dolly with its missile or booster is placed on the closed hatch. The shipping band is removed from the booster at this time. When the dolly is in place over the hatch (fig. 2-6), the hatch is opened by the operator at the pushbutton station (fig. 2-7). A strikedown elevator rises beneath the dolly and latches onto the handling attachments on the missile or booster. The handling attachments are then manually released

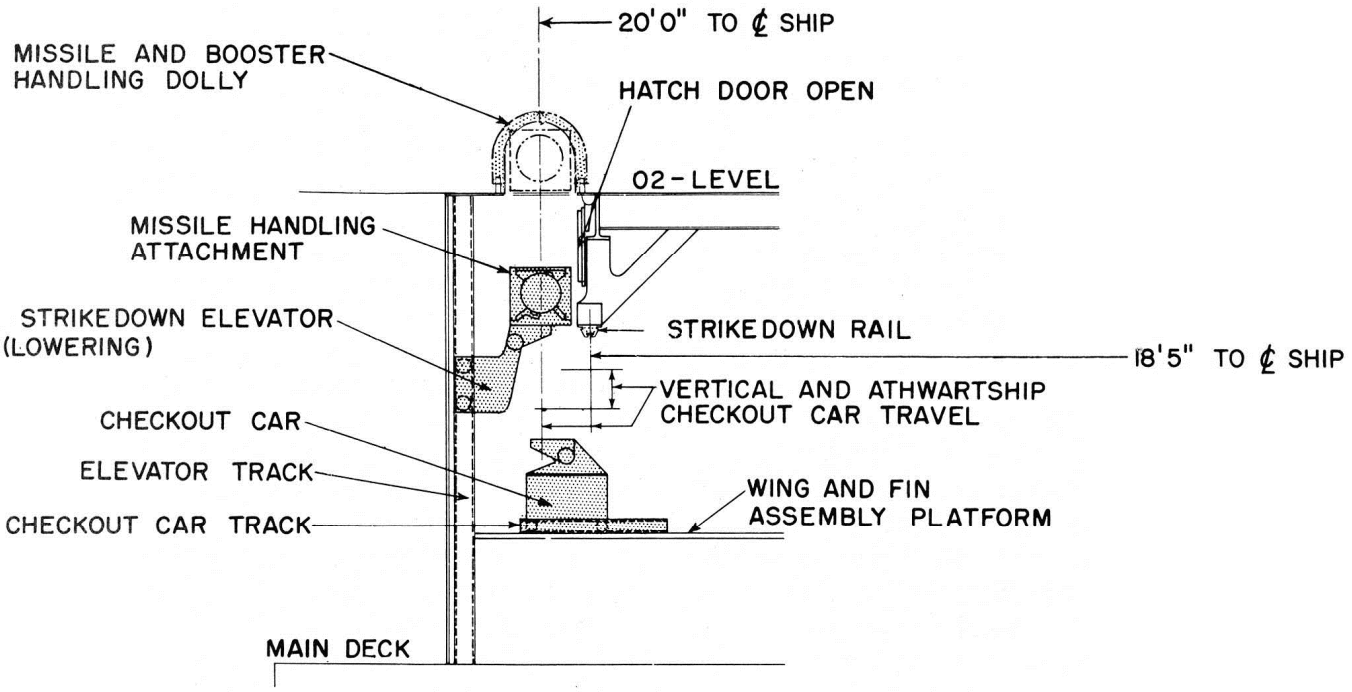

Figure 2-6.—CLG (Terrier). Strikedown and checkout missile handling equipment. (Elevation).

from the dolly and the elevator lowers the missile or booster through the hatch in response to pushbutton operation at the control panels. As soon as the load has cleared the hatch, the hatch door closes automatically. Wheel the empty dolly to the transfer line or crane for return to ,the supply ship.

A booster must precede a missile. From the strikedown elevator, the booster is 'moved to the loader rail by means of the checkout car (fig. 2-6), which is moved athwartship on rails. As soon as a missile is brought to the checkout area (by the same means), it is aligned on the rail with the booster and mated to it. The booster shoes must be engaged during alignment, and afterward for transfer to the magazine. Two or three men are required in the checkout area to manipulate the checkout car and mate the missile and booster. The table of the checkout car can be tilted and rotated as needed to align the missile with the booster. The mated missile and booster, called a round, is retracted along the loader rail to the assembly area. The checkout car is returned to carry the next unit. In the assembly area, the code plug is inserted and the sustainer on the BW-1 is mechanically armed; the sustainer arming switch of the BT-3 is set on CHECK. No operation is required with newer igniters. Any incompatible code plugs are removed and replaced by the appropriate ones for the ship's assigned guidance codes. The round is then ready to be moved to the ready service area and to be inserted in the proper tray of the ready service ring (fig. 2-8).

The step-by-step operation to be used in moving, aligning, and mating of the missile and booster is described in the OP for the launching system and the OP for the mk/mod missile on your ship. Study these and prepare a checksheet to be followed by yourself and/or your men when doing the work. The method of locking together (mating) the missile and booster varies with different mods, and the equipment of the launching system varies with the mark and mod of the system.

Before the rounds can be moved into the ready service rings, the ready service rings must be indexed so the correct round can be selected by pushbutton when it is wanted for firing or exercise. This is done by the panel operator setting the pushbuttons according to the plan. The actual arrangement of the weapons in the

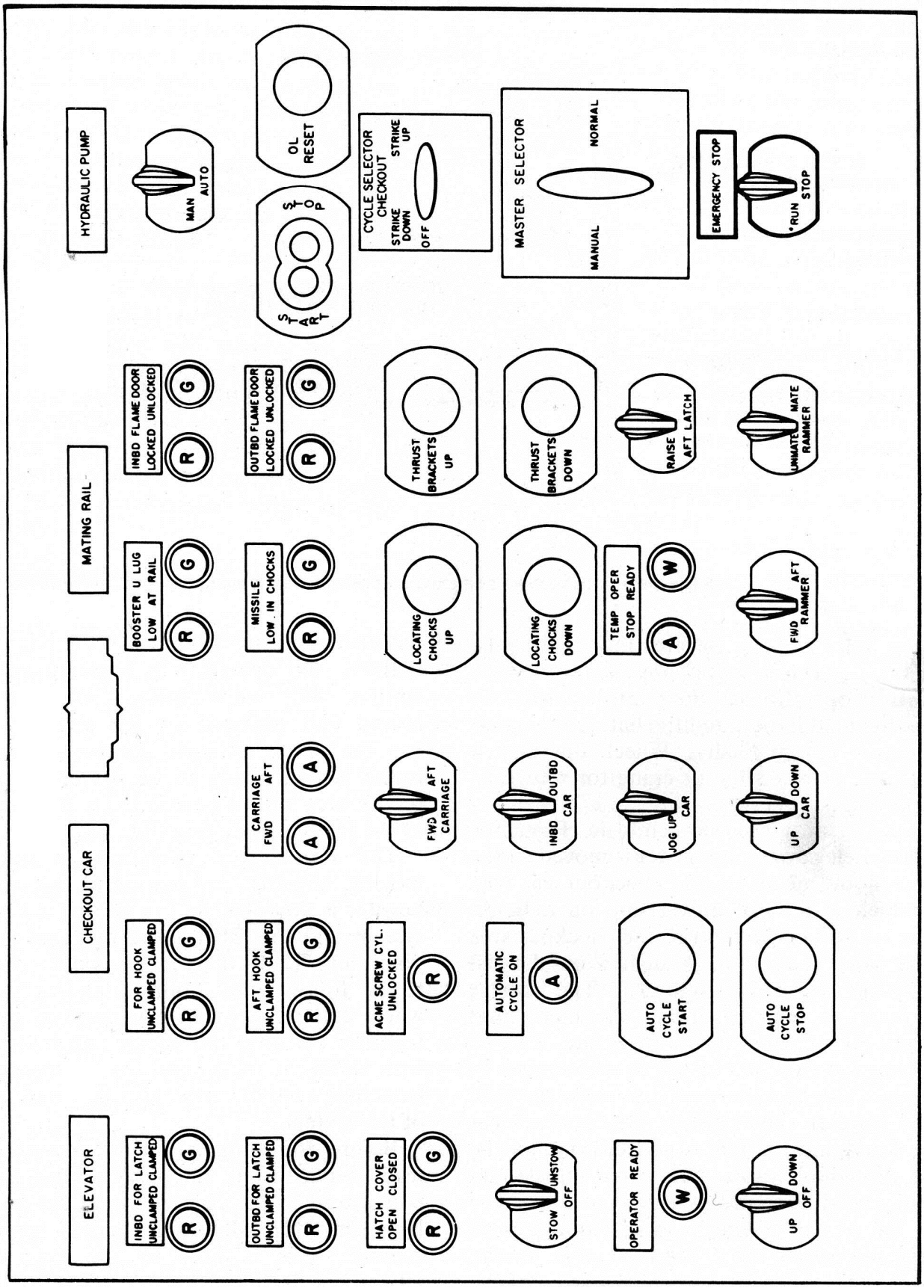

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Figure 2-7.—Strikedown panel, GMLS Mk 9.

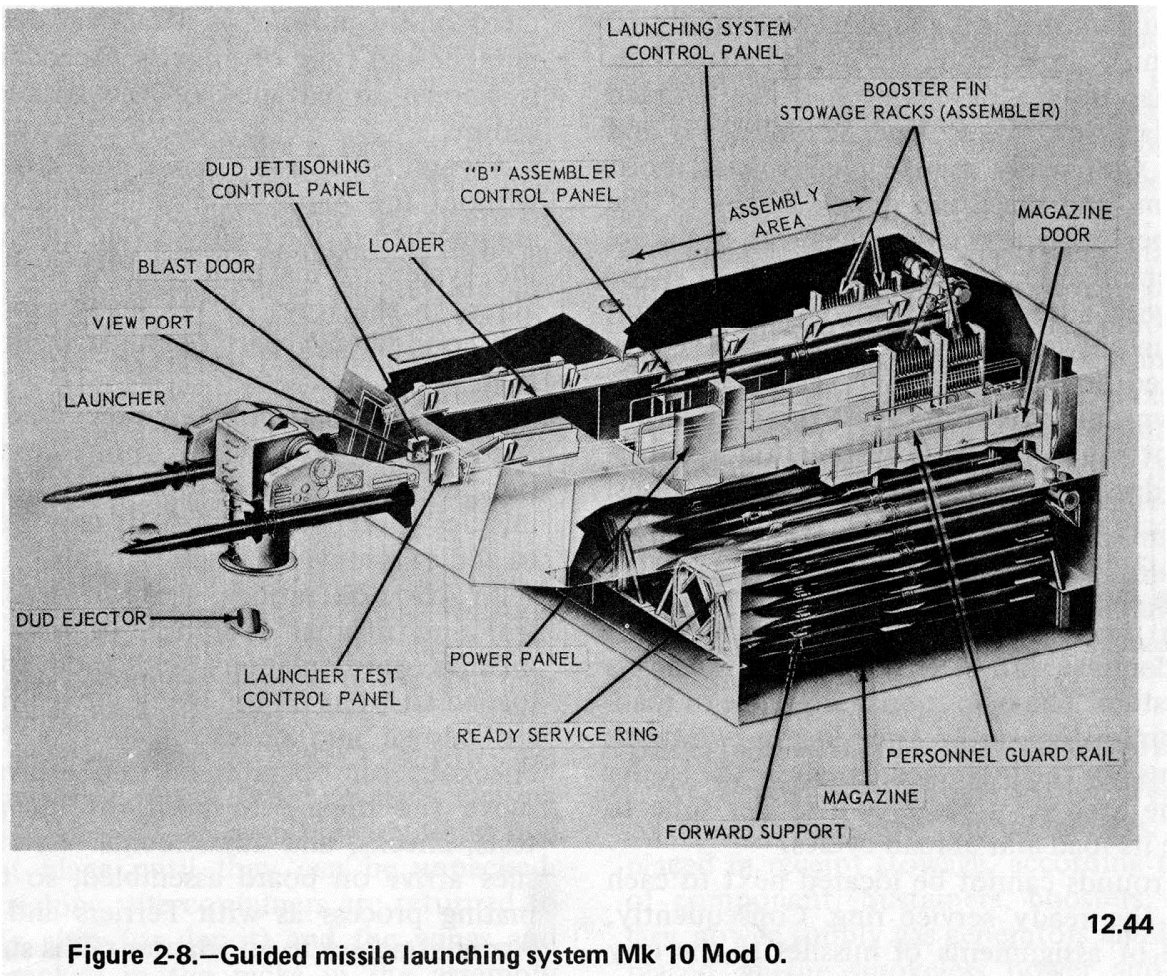

Figure 2-8.—Guided missile launching system Mk 10 Mod 0.

service ring is a tactical decision. A Terrier missile ship may carry one or two or even three types of Terrier missiles. The BW-1 type has a smaller booster, and therefore the service ring trays that are to hold BW-1 type missiles must have inserts added to them. This is considered a maintenance operation, which must be done before missiles are stowed. Make a sketch of the service ring and indicate the positions of the various weapons as planned. Then add the inserts to the trays indicated for BW-1 missiles. (There are very few BW-1 missiles left, and those are used for practice runs.)

The Assembler Panel (fig. 2-8) has a light for each tray, with colors and lettering to indicate what is loaded into the tray. The operator of the panel can select the weapon required by pushing the correct button for the tray wanted. When the round is ready to put into the ready service ring, it can be done automatically or step-controlled. Step control requires operation of pushbuttons for each step. Automatic operation is initiated by pushbuttons on the EP-2 panel. The tray with the code designation of the round in the assembly area moves to the hoist position, the magazine doors open, and the hoist raises to the loader rail. The loader chain pawl moves the round from the loader rail' onto the hoist. The hoist lowers the round into the ready service ring tray; the tray shifts the round free of the hoist; the booster shoes engage in the ready service ring structure and the magazine doors close. As each round in unloaded to the ready service ring, the lamp (on the control panel) associated with the tray goes out. The magazine for Terrier rounds is in the deckhouse (fig. 2-8) or below deck, depending on the ship installation. Each weapon must be identified by a serial number and recorded in a missile log for each missile on board. The number of the tray in which it is stored is not sufficient identification as it may be put into another similar tray when it is returned after having been taken out for checkout, maintenance, or exercise.

STRIKEDOWN OF ASROC MISSILES.- The Terrier Guided Missile Launching System Mk 10 Mods 7 and 8 stows both Terrier and Asroc missiles. It has three stowage mechanisms: Guided Missile Magazine Mk 5 Mod 12, Mod 13, and Mod 14, with ready service mechanisms, hoist mechanism, and magazine doors. Either of the two upper ready service mechanisms can store 20 Terrier missiles, or 10 Terrier and 10 Asroc missiles with adapters. The lower, or auxiliary, mechanism stows only Terrier missiles. The missile strikedown equipment is located in the strike down and checkout area. The strikedown equipment is a NAVSHIPS installation; its operation is described. in NAVSHIPS publications. *Gunner's Mate M (Missiles) 3&2*, NAVTRA 10199-B contains an illustration of the Mod 7 launching system, showing Terriers and Asrocs placed in the ready service rings. The Mod 8 is almost identical, but it has no tilting rail in its feeder system. The operational sequence of loading and unloading is the same in the two mods but because of the increased length of the loader rail in the Mod 8, it requires a longer time to complete its load and unload cycles.

Asroc rounds cannot be located next to each other in the ready service ring. Consequently, the table of assignments of missiles to the tray must be followed carefully. The actual arrangement of the missiles is a tactical decision. The number and type of missiles for loading usually is known in advance of the strikedown procedure.

Figure 2-9 shows Terrier and Asroc missiles, without the Asroc adapter. The adapters often are installed in the ready service rings at the time the system is installed. Placing the Asroc adapters in the trays of the ready service rings is not considered a part of the strikedown operation.

In addition to the adapter used with the Asroc missile because it is shorter than the Terrier, an insert is used with X or Z type Asroc missiles (practice missiles). It may be necessary to add or remove an insert.

In Asroc operations, strikedown is a step control and manual operation to load assembled missiles onto adapters and then to stow the loaded adapters on the ready service rings. In the strikedown and checkout area, a NAVSHIPS checkout car operates on rails athwartships to move the missile to positions for performing tests, checks, and adjustments. The Asroc missiles arrive on board assembled, so there is no mating process as with Terriers and Talos. An Asroc attached to an adapter rail is shown in the

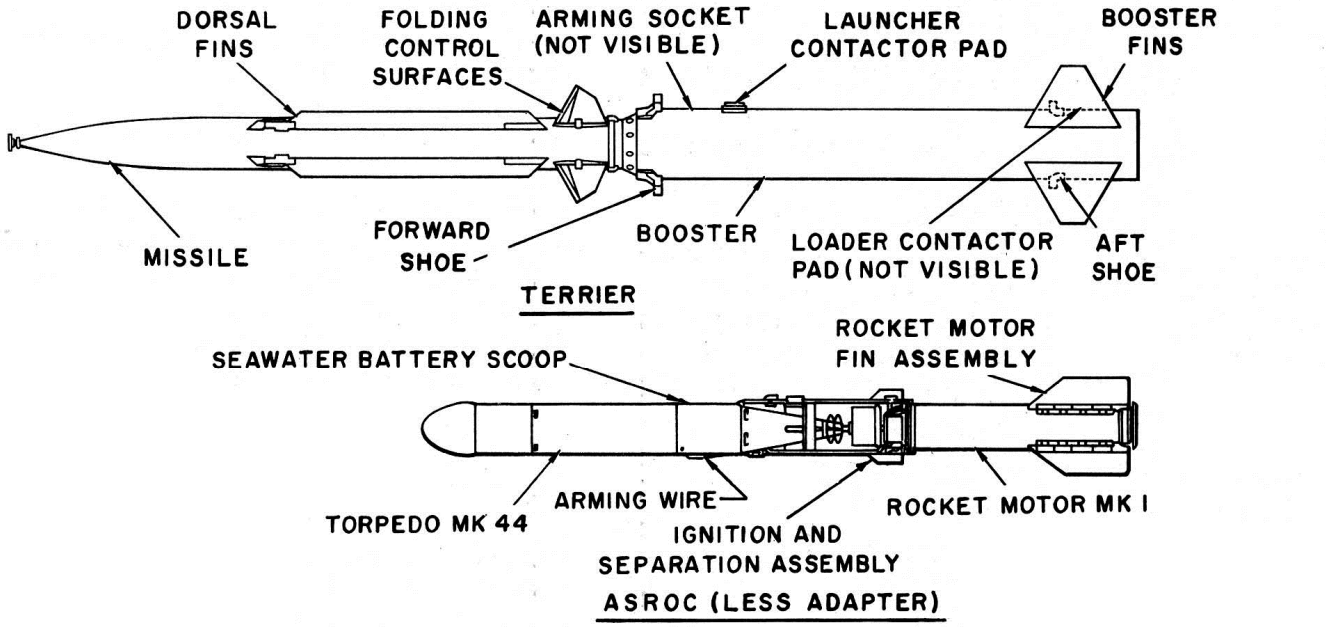

Figure 2-9.—Terrier and Asroc weapon types.

text, *Gunner's Mate M (Missiles) 3&2*, NAVTRA 10l99-B. A special Asroc adapter loader assembly is in the strikedown area for attaching the adapter to the missile before putting it on the loader. The Asroc missile is brought to the strikedown and checkout area on the strikedown car. It is aligned with the adapter by means of the adapter loading fixture, and latched into the adapter. The snubbers on the adapter are air operated, and need to be unlocked with care to avoid casualties. Everyone must be clear of the snubbers before unlocking. After the missile is attached to the adapter, the strikedown-checkout car is stowed and the missile with adapter taken to the magazine via the loader.

STRIKEDOWN OF COMPLEMENTARY ITEMS. - The complementary items include wings, fins, after control surfaces, warheads, warhead boosters, fuzes, exercise heads, and miscellaneous missile spare parts.

The WINGS and FINS or BOOSTER FINS are hand carried away from the main deck landing area and stacked in their reusable containers in a convenient place until they can be unpacked. After unpacking, the containers are returned to the supply ship (or depot) and the wings and fins are stacked in the racks in the assembly area. If the number of personnel available is sufficient, all this should be done at the time of strike down to avoid pile-up of material.

The WARHEADS or EXERCISE HEADS that are not assembled to Terrier missiles while they are stowed, are sent to the warhead magazine below decks. The strikedown elevators are used but these must have special handling cradles temporarily installed. One at a time, each warhead (or exercise head) in its container is lowered to the checkout car. The car moves within range of an overhead bridge crane, which mounts a birail trolley hoist with an attached J-bar. The J-bar adapter is attached to the upper end of the container, and the container is lifted clear of the cradle and checkout car and placed on a dolly on the component parts hoist and lowered to the warhead magazine, where it is stowed. The checkout car with the cradle on it moves back up to its position under the strikedown elevator ready for the next load.

The FUZES and WARHEAD BOOSTERS in their containers are stacked out of the way until completion of missile-booster strikedown. Then they are struck down to the warhead magazine by means of the missile component parts hoist. The fuzes are placed in fuze stowage racks in the warhead magazines; the warhead boosters and S and A devices have bins in the warhead magazine.

NONEXPLOSIVE complementary items, other than wings and fins, are stacked aside in their containers, and then struck down to the second platform and stowed in the missile component storeroom. Miscellaneons tools and parts are placed in this magazine. Normally, insert components are not stowed in the same compartment with explosive or flame-producing components. If lack of space makes mixed stowage necessary, specific approval must be obtained from the operational commander. Flammable material may not be stowed in any magazine.

DEPOT HANDLING AND STOWAGE

At depots, missile parts are received in sealed containers from the manufacturers. They are placed in receipt stowage, according to the type of component. Sustainers, boosters, and auxiliary power supply gas generators and igniters are placed in the smokeless power and projectile magazines. The warhead, destructor charge (if any), fuze booster, and the safety and arming (S & A) device are placed in a high explosive magazine. Flash signals are stored in the pyrotechnic magazine. Inert missile components are stored in the guided missile service unit checkout building.

On shipboard, the work of GMMs is focused on care and operation of the launching systems. Note, however, that one of your quals requires the E-7 to have a knowledge of methods of handling and stowing of missiles ashore. Few assignments of GMMs are made to amunition depots, but Naval Weapons of GMMs are made to ammunition depots, but Naval Weapons Stations require many GMMs.

The volumes of OP 5 are pertinent references: Volume 1, Ammunition and Explosives Ashore, Safety and Security for Handling, Storting, Production and Shipping, Volume 2, *Ammunition Ashore*, Stowage Data and Volume 3, *Ammunition Ashore, Advanced Bases*. Volume 1 contains much information on the properties of

different explosives, and how they must be stored and handled because of these properties. Numerous sketches illustrate the quantity-distance requirements for different types of ammunition. On shipboard, the quantity-distance requirements cannot be followed be cause there simply isn't room enough to stow ammunitions at the separate distances specified. At shore bases the requirements must be observed. The purpose of the requirement is to keep the quantity of ammunition per building small enough so that a fire or explosion in one building will not spread to adjacent buildings.

Guided missiles are considered a mass detonation hazard, but assembled missiles present several types of hazards. Therefore, regulations and instructions for storing, shipping, handling, and marking of guided missiles and their major components are not covered in OP 5. The OP for the particular missile must be consulted for the specific instructions. The hazard classification and storage requirements of some components are mentioned in OP 5. Solid propellant sustainers and boosters, without warheads, are classed as group 6 materials if so designated by NAVORDSYSCOM, and must be stored a minimum of 1800 feet from any inhabited dwelling, passenger railway, or public highway. Guided missile warheads are group 7, 9 or 10, unless classed otherwise by NAVORDSYSCOM. The distance requirement varies with the number stowed in the building, and the type of magazine. Other components are in other storage classifications. Fuzes, for instance, are called group 8 materials, which must be stored in special magazines, earth-covered or with equivalent protection.

The rate training manual, *Gunner's Mate M (Missiles) 3&2*, NAVTRA 10199-B mentioned in several places that a defective component, or a missile, was to be returned to a depot for repair or destruction. OP 5, volume 1, contains a chapter of instructions on how to dispose of damage or dangerous explosives of different kinds. Some are burned; some are dumped in deep water. Maintenance and surveillance instructions are given for various small components such as fuzes, but missiles and boosters (except rocket boosters) are not covered. A missile is not destroyed except as a last resort if the missile cannot be made safe. A publication available from NAVORDSYSCOM is *Safety Regulations for Guided Missile Propellants*. Request specific instructions for each missile, in the event that destruction seems to be necessary.

Rules for shipping explosive components by truck and by railroad are not given for missile components or assembled missiles, but have to be interpreted for missile shipments. Many of the rules are applicable to transportation of any type of explosive. For example, passengers are not permitted on trucks carrying explosives. In addition to giving such general rules, OP 5 lists references you will need if you have to pack and/or ship missiles and missile components. With on-land shipments, you not only have to follow Navy regulations, but also state and inter-state rules.

Security regulations, firefighting, lighting protection, static grounding, and industrial safety, health, and hygiene procedures given in OP 5 are applicable to missiles and missile components. Revisions to OP 5 added rules for quantity-distance storage of missile propellants according' to their hazard classification. The application of the rules to Navy missiles containing liquid propellant (Talos, Bullpup) is described in the OPs for the missile.

The four routine missile operations at an ammunition depot are initial receipt, retest, loadout, and missile return processing. Many variations are possible in each of those operations. While initial receipt is defined as receipt of the missile components from the manufacturers, the components may be delivered by different methods of transportation (railroad car, truck, etc.). The containers are designed for particular missiles and their components; some handling equipment is designed for particular missiles and their components.

All components must pass inspection when unloaded, but the extent of testing varies. On shipboard, a booster is never tested. At a depot, the booster is unpacked, transported to the igniter test cell, where it is given an igniter squib check, then is repackaged. If it is to be shipped with a missile, it is placed in ready issue stowage until the missile is assembled and ready for shipment. If it is to be stored for some future time, it must be repackaged and sealed with desiccant.

Let us assume that you are going to assemble: a missile to be sent to a ship for tactical use, or

ready issue. Assume that each package has been given on-receipt inspection, tests when applicable, and has been repackaged, awaiting assembly. The booster remains in ready issue storage until the last, when it is to accompany the assembled missile, but not assembled to it. The sustainer is brought to the igniter test cell and is given a continuity test, then is repacked and taken to the assembly area. As each of the other components is inspected and checked out, it is brought to the assembly area to be assembled into the missile. Present type depots perform only pneumatic missile system tests (MST), which require a missile assembled without the warhead section, S&A device, and fuze booster. After the missile has successfully passed the initial MST and has been transported back to the assembly area, the nose section, the target detection device (TDD), and the tactical missile test spacer are removed to prepare the missile for tripak storage or for tactical assembly.

The tripak configuration for Terrier missiles consists of the electronic section, sustainer, and aft section assembled with dorsal fins and placed in a Mk 199 Mod 0 container (fig. 2-10). By the use of different blocking and bracing and cushioning materials, this container can be used for bipak storage (electronic section, aft section, nose section, and dorsal fins), or for a ready issue missile, or for sustainers, or for spare parts. Two handlift trucks Mk 40 Mod 0 are used to handle it on deck. A forklift truck may also be used. The tripak must be grounded and the sustainer arming device must be in SAFE position during all handling operations. The loaded container is closed with 20 latches on the container lid. Fresh desiccant is placed in the desiccant basket; the air release valve on the container is closed, the missile log and records are placed in the records receptacle on the end of the container, and security seals are placed on it and on

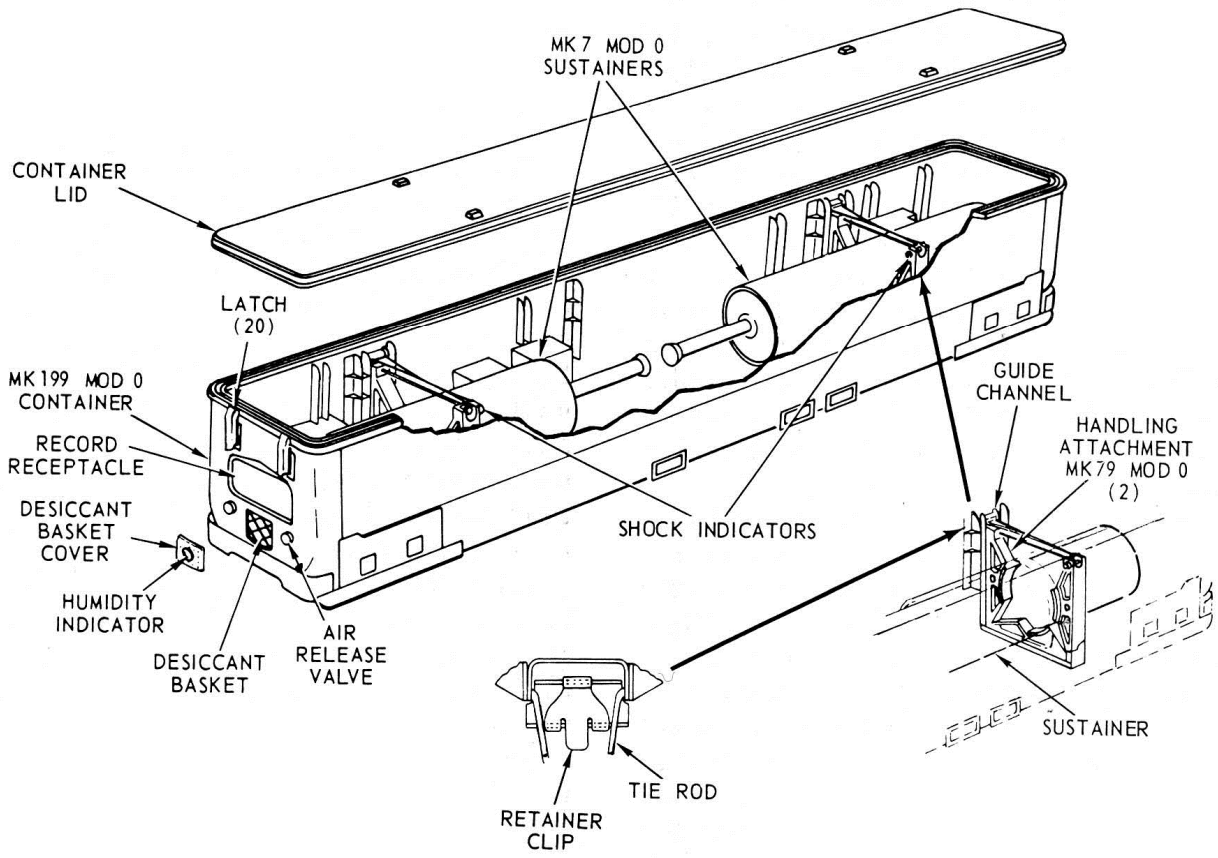

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Figure 2-10.—Container Mk 199 Mod 0, with two sustainers, and showing placement of handling attachment for lifting sustainer.

two of the latches. The container then is ready to be transported to storage.

When the missile is to be assembled for ready issue or tactical assembly, the warhead section, target detection device (TDD), and nose section are added to the already assembled tripak configuration. If a Mk 5 and 7 warhead is used, a fuze booster and an S&A device are required to complete the fuze section. All these contain high explosives and must be handled as such.

The assembled missile is shipped from the depot in a Mk 199 Mod 0 container; its booster is in container Mk 200 Mod 0, and the booster fins are in container Mk 205 Mod 0. They are moved from ready issue storage and loaded on trucks or railroad cars by means of handlift trucks or forklift trucks. The trucks or railway cars are moved to the loading dock, where the missiles are moved for ship loadout.

For loadout to an ammunition ship, the missiles are kept in their containers. If a combatant ship is loaded directly from the dock, the missiles and components are removed from their containers on the dock and transferred to the ship on a weapon component transfer dolly. On the ship, the missiles are struck down to the .magazine and the dollies are returned to the dock.

Tests and Inspection

Few tests of missile components are made aboard ship by GMMs. Boosters, S&A units, fuzes and flash signals are never tested aboard ship.

Before Stowage

As the components are brought aboard, inspect them for visual damage. Check for external dents, cracks, or other obvious physical damage to the unit. Notice the expiration date if there is one on the unit. Set aside any units that are too old to be used. Boosters must not be armed. If you find one that is armed, notify the loading officer at once. Also call the officer if there is any odor of ether or nitroglycerine. Do not strike below any items on which you have found damage or defects. When the case of any explosive, propellant, or pyrotechnic item appears dented, cracked, or bent, or if it has been dropped 5 feet or more when in its container (1 foot if out of the container), return the unit to a depot.

If an S&A unit is found in an armed condition, store the unit, without the warhead or fuze booster, in an explosive locker; request disposition instructions from NAVORDSYSCOM Headquarters. DO NOT test or disassemble any S&A unit aboard ship, or make any attempt to repair one. This rule also applies to fuzes and flash signal units.

Rough handling may damage the coupling flanges on the fore and aft ends of the warhead; inspect for such damage. Check the central tube in the warhead for rust and for damage caused by the warhead lifting tool mandrel. There should be no exudate on the warhead. At replenishment the warhead is stowed in its container; this inspection is made when the warhead is unpacked.

Check to make sure that the booster arming socket is positioned at SAFE at all times until armed on the launcher.

On the sustainer the SAFE position is not for use on board ship. Make certain that the manual tool-controlled mechanical arming device on the BW-l Mk 5 sustainer is in the ARMED position. The BT-3 Mk 7 arming device should be in the CHECK position at all times aboard ship except when the round is ready to load on the launcher. Do not disassemble, check, or tamper with any part of the sustainer units.

Checkout

As soon as possible after strikedown and stowage, the missiles must be given an initial checkout and servicing. At present, BT-3 missiles are checked upon receipt, after a 3-month interval, and at 6-month intervals thereafter. (This rule may be changed by NAVORDSYSCOM directive.) As a GMM 3 you learn to use the strikdown equipment for strikeup of the missile components to the checkout areas, and to unmate the missile and booster for the checkout tests. You learned to use the checkout handling equipment. To advance to GMM1 and C, you must be able to supervise and direct this work and to operate the control panels.

The checkout equipment consists of the guided missile test set (GMTS), the hydraulic

fluid pumping unit, the air diffuser panel, and the gas pressure actuator assembly. Other ratings may have the responsibility for the checkout tests. If you need to perform the checkout tests, study the technical publications that give the full details of how to perform the checkout on Terrier missiles. OP 2329, Vol. 2, *Terrier Guided Missile Mk 7 Mod 0 and Mk 8 Mod 0*, describes field checkout procedures for BW-1 missiles, and OP 2512, Vol. 2, *Guided Missile Complete Round Mk 1 Mod 0 and Mk 2 Mod 0 (Terrier BT-3)*, describes depot and checkout procedures for BT-3 missiles. OP 2898 covers BT-3A missile checkout, and OP 3051 is for the BT-3B missile, while OP 3043 is for HT-3 and HT-3A's. Check OP 0, *Index of Ordnance Publications*, to be sure you have the latest revision of these instructions. Also, keep abreast of instructions and directives as they are issued.

The checkout equipment is in the checkout areas which are in the main deckhouse. The checkout areas are separated from the magazine by flametight magazine doors. Compressed air is supplied by the ship's compressed air system at 4500 psi which can be reduced to 3250 psi with the aid of a reducer. A stream of such high pressure air can be fatal if directed at a person. A 500-psi nitrogen source is provided for the hydraulic fluid pumping unit. Figure 2-11 shows the checkout area portside, and depicts the checkout equipment and checkout station. The starboard checkout area is identical, but the test sets are used by both areas. The missile to be checked out is brought from the magazine by the reverse of the strikedown process, but in step-control only, not automatic. It is attached to the checkout car by means of a set of handling attachments. The blowout pipe and blowout pipe adapter are for the purpose of conducting away any dangerous gases in case of an accidental ignition. Connect the adapter to the missile (fig. 2-11). The booster is returned to the magazine while the missile is being given the checkout tests. The warhead, warhead booster, and fuze are placed in temporary storage lockers during maintenance on the missile. After successful completion of the tests, the booster is again mated to the missile and the complete round is stowed in the ready service ring. If the tests indicate NO GO, the round may be stored in the magazine to await repairs to the missile.

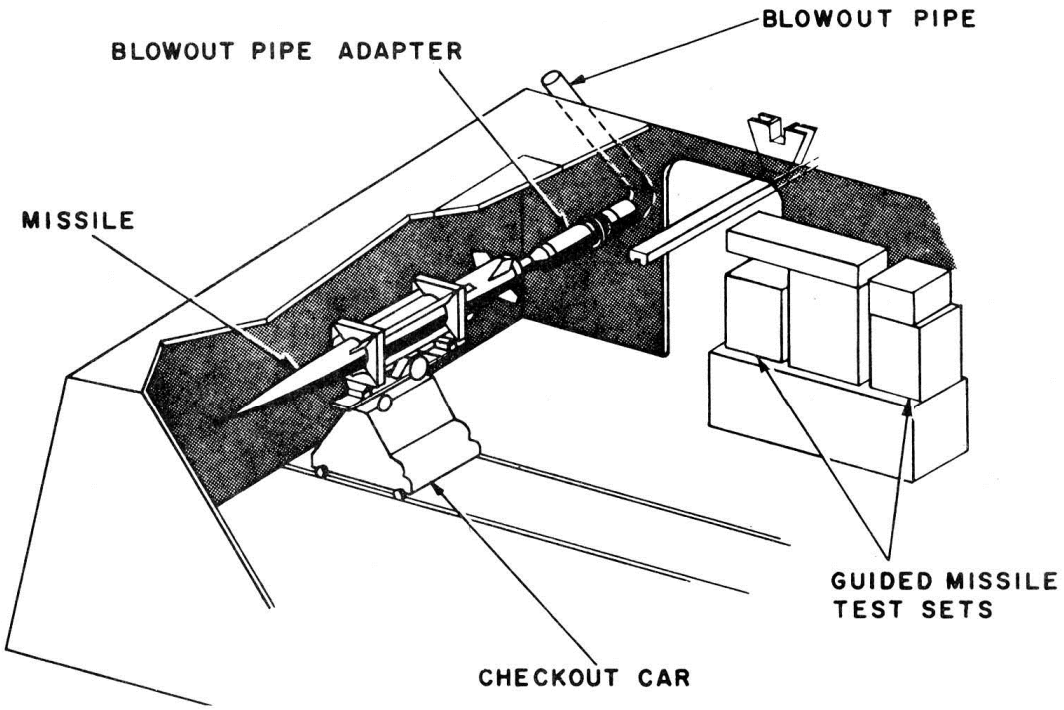

Figure 2-11.—Terrier missile checkout area on a cruiser.

When the booster is received above ship, the torque screw will be fully loosened and the adjustment nut will be fully tightened. This should again be the condition when missile and booster are separate for the checkout. When the missile is mated to the booster, the suitcase latch is closed, and the torque screw is tightened with 480 in-lb of torque. The clamp links should make contact with the ends of the pivot pin to ensure that the latch will not accidentally spring open under torque conditions, and possibly cause injury to personnel. Do not release the latch without first removing all torque from the torque screw. Keep the missile supported on the checkout car during the entire time. Do not use the locking ring to pull the sections together.

The missile-booster release mechanism is illustrated in *Gunner's Mate M (Missiles) 3&2*. NAVTRA 10199-B, where the suitcase latch is shown fully closed and fully opened.

Only the men necessary to perform the tests are permitted in the checkout area during the tests. During the charging of the missile air flask, only one man is permitted in the area, and he must remain behind a protective shield (if there is one) during the charging and for 5 minutes afterward.

REVISED RULES FOR CHECKOUT.- The trend is toward reduction in the number and complexity of tests for missiles and their components, especially after they have been tested at a depot and assembled. The interval between inspections and test has been greatly increased. Some missiles such as Tartar and Terrier are under a No-test program. This program requires no shipboard testing of a number of designated missiles. There are missile service records for each missile aboard ship. There service records indicate either a test or No-test program for each missile. A great deal of dependence is placed on careful inspections, careful handling, and controlled stowage temperatures and humidity requirements for No-test missiles.

ASSEMBLY AND DISASSEMBLY

The mating of the missile to the booster before stowing of the round, and the unmating for the checkout tests, are assembly and disassembly processes already mentioned. Wings and fins are assembled to the round prior to loading onto the launcher. Any additional assembly or disassembly or the missile is usually done at a repair activity. Assembly or disassembly of the handling and launching equipment is done as part of the maintenance and overhaul program, and will be discussed in another chapter.

Maintenance procedures are discussed in later chapters, especially in chapter 10.

If the Mk 22 Mod 0 warhead section of the Terrier BT-3A missile is received in a warhead container, it must be unpacked, given receipt inspection, and given a monitor test before it is assembled into the missile, and the missile is mated to the booster before stowing in the magazine. Spare' warheads are repackaged with desiccant and stored in the special warhead magazine.

Present practice is not to install the battery power supply until ordered by the commander. This practice may be changed in the future. In anticipation of such a change, OP 2898 gives the instructions for installing the battery power supply and giving it a monitor test before the complete missile round is stowed in the magazine on shipboard.

TALOS MISSILE HANDLING AND STOWAGE (GMLS MK 12)

The handling procedures for Talos missiles include:

1. Transfer to ship, at sea transfer, or dock-side transfer, and depot or weapons station handling.
2. Strikedown of missiles, boosters, and complementary items
3. Checkout of missiles stowed in magazine and ready service areas
4. Ready service replenishment
5. Athwartship transfer

The methods of transfer are very similar to those for Terrier missiles. Areas of difference will be pointed out. An important difference between the Mk 7 and Mod 0 and Mk 12 Mod 0 Talos launching systems is the location of the magazines.

SHIPBOARD EQUIPMENT

Although some handling equipment is especially designed for the Talos missile, the method of use is very similar to that for Terrier handling equipment. The following shipboard equipment is used during transfer, strikedown, and prefiring operations.

1. Burtoning or automatic tension highline and highline gear
2. Strikedown elevators
3. Ready service cranes
4. Missile and booster carts (instead of checkout car)
5. Component handling hoist and associated gear
6. Warhead hoists
7. Component elevator and birail trolley hoists
8. Warhead magazine bridge crane
9. Receiving stand
10. Ready service magazine hoists
11. Ready service magazine trays
12. Magazine tray transfer mechanism.

Handling Equipment-Similarities and Differences

Missiles and boosters are received aboard ship, each in assembled condition, attached to the handling dollies by which they are transferred. Boosters and missiles are transferred by the constant-tension highline or burtoning, and the components are transferred by the housefall method. A floating crane is used for dock-side transfer. New construction ships may have a missile/Cargo Stream system installed for transfer at sea

As with the Terrier, Talos missiles and boosters must be transferred and struck down in sequence so they will arrive at the mating area in correct order. The sequence differs on CLGs and GGs. (Talos missiles and boosters may be stowed unmated.) On CLG 4 and 5, the order of transfer and strikedown for other components is not specified. Transfer dollies, innerbody, and wing and fin containers must be returned to the supply ship or depot if you do not have storage space. Other components are stowed in their containers, which are disposable.

A CLG has two missile strikedown elevators, one each, port and starboard of the deckhouse, which are used simultaneously during replenishment. The strikedown operation is the same on A and B sides of the deckhouse. Strike down on a CLG is described. Figure 2-12 shows the relative location of the areas used in strikedown and stowage.

Instead of a checkout car below the elevator, a missile cart or a booster cart is located on the elevator, and the missile or booster is attached to the cart. When the elevator has lowered, the cart can be rolled off onto tracks on the deck and moved to the station where it is needed for mating, stowage, or checkout. The carts differ principally in the method of securing and supporting the load.

Two warhead hoists travel on overhead birail tracks from the checkout areas in the deckhouse to the warhead strikedown hatch on the main deck. With adapters, the hoists are used to handle warheads, exercise heads, and innerbodies, which are stowed in the warhead magazine. These are the spares, which are not assembled in the round.

For the missiles and boosters that are to be mated into rounds, the after lenses, packaged and stored within the missile after section, must be removed prior to mating. The ready service crane is positioned over the mating station. The missile and the booster carts are brought on tracks to the mating area and are positioned. The missile cart is attached to the ram cylinder which produces the movements necessary for the mating, and the booster cart is secured to the handling track. After the missile and booster are mated, the ready service crane is used to raise the weapon, and the carts are returned. The operator at the pushbutton-station opens a magazine door, positions the crane over the magazine, and raises the hoist containing an empty magazine tray. He then lowers the round into the tray, and orders the hoist to a level in the magazine for stowing the tray and missile. When this is done, the magazine door is closed. As a GMM2 you were required to be able to man all stations; as a GMM1 and C, you need to be able to train individuals and teams in the operation of the system. The operator at the pushbutton station must be constantly alert so the missile' components will move smoothly to their destination in the proper magazine.

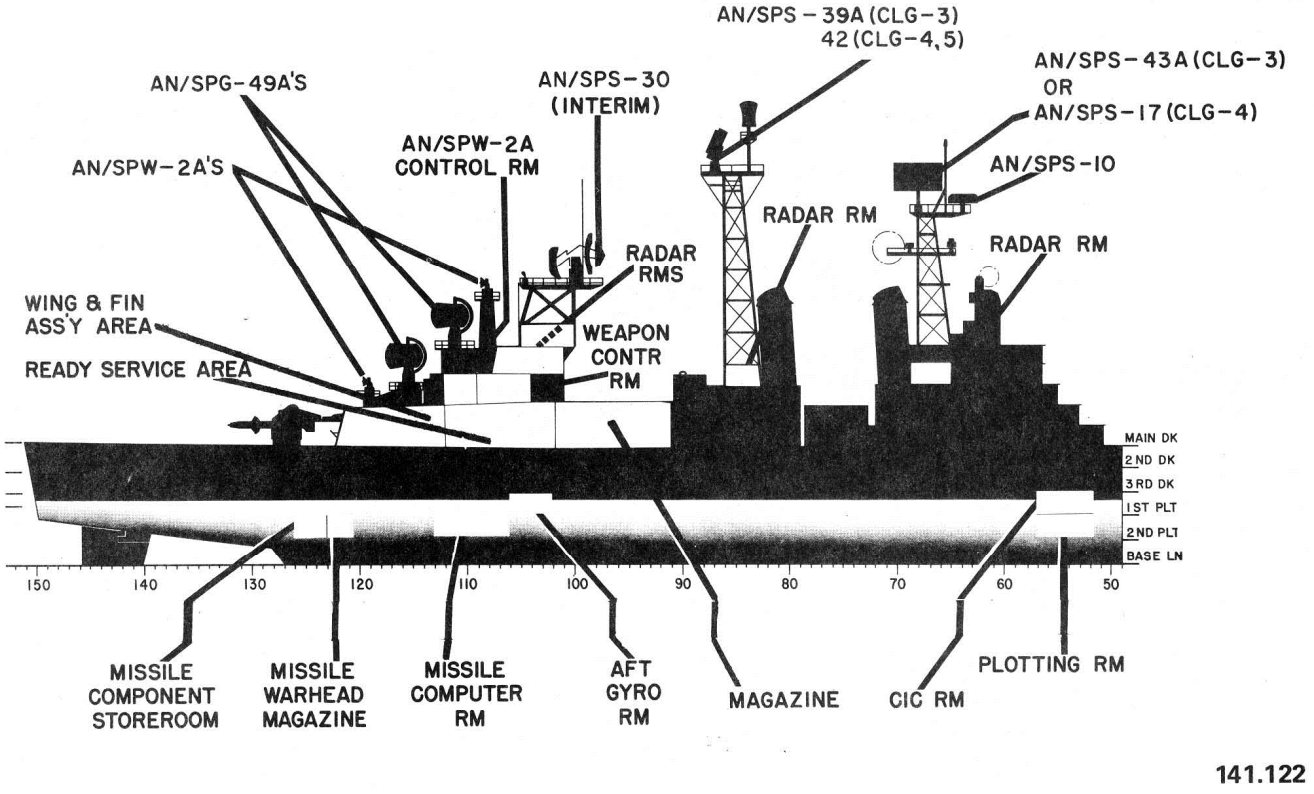

Figure 2-12.—Profile view showing location of missile handling and stowage areas.

The location of many of the equipments used in transfer and strikedown of Talos missiles on a CLG may be seen in figure 2-13. Locate the missile strikedown elevator, ready service crane, power cart, check out fixture, warhead hoist, and overhead crane.

The spare innerbody, which contains the warhead when assembled for tactical use, or a dummy warhead for exercises, is brought aboard in a container. It is struck below from the 02 level by means of the warhead strikedown hatch. Then the bottom part of the container is removed and the innerbody, supported in the upper part. of the container, is lowered in a vertical position to the second level by the component handling hoist. There it is placed on the receiving stand and secured to it. The container is returned to the 02 level. The receiving stand (there are two of them) is pneumatic-powered and has a built-in tilting mechanism so the innerbody can be rotated from vertical to horizontal position. The receiving stand moves inboard until it is adjacent to the elevator and-from there the innerbody is moved by the birail trolley hoist to the component elevator, which lowers it to the warhead magazine. Within the warhead magazine, a bridge crane is used to move the innerbody into position over the stowage chock, where it is positioned and fastened down. The receiving stand must be in position before the innerbody is lowered.

Different methods of stowing and securing warheads and innerbodies are used on different classes of ships.

Stowage Spaces

The spaces for stowing Talos missile components are very similar to those of the Terrier. If the ship has two sets of launchers, separate stowage facilities are provided for each. Replenishment is carried on simultaneously at both places. Whoever is in charge must make sure that the correct items are landed on the deck near the fore and aft strikedown elevators. The essential difference in handling and strike down between the Mk 12 launching system and the Mk 7 system (fig. 2-13) is that of location of the equipment and the stowage spaces.

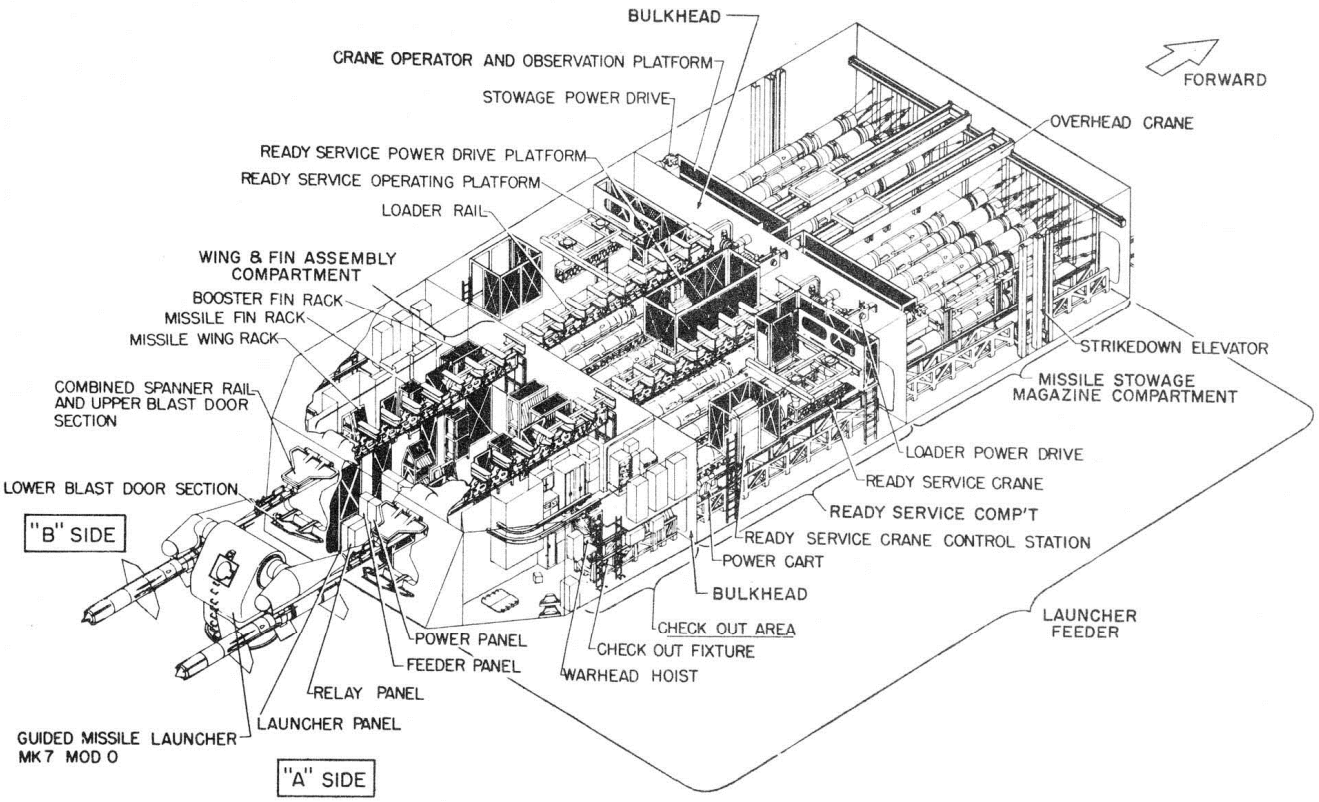

Figure 2-13.—Cutaway view of deckhouse on a CLG, showing location of components of Talos launching system, Mk 7 Mod 0.

On a ship with forward and aft (Mk 12 Mod 0 and/or Mk 12 Mod 1) launching system installations, there are four strike down elevators, two for each installation. *Gunner's Mate M (Missiles) 3&2*, NAVTRA 10199-B has illustrations of the Mk 12 launching system, as does chapter 3 of this text. The deckhouse of the Mk 12 launching system is divided into area 1 and area 2. Area 1 is the assembler area, where the missile wings and missile and booster fins are stowed at strikedown and assembled preparatory to firing. It also contains some of the panels of the Missile Launching System Control-the power panels, the launcher control panel, assembly panels, and relay panel. Area 2 is directly over the belowdecks magazines. The remainder of the control panels are located here, and the mating area for mating missiles and boosters is here. The missile-booster combination is lowered to the magazine on the magazine hoist through the magazine door. Figure 2-14 shows the general location of the areas with respect to each other.

The A and B sides of the launcher are served from the A and B sides of the magazine, called the Mk 7 Mod 0 and Mk 7 Mod 1 magazines. Each magazine has a loader trunk, which passes through both area 1 and area 2 of the deckhouse, moving the missile-booster combination to the launcher when loading.

Complete descriptions of strikedown operations on particular ships are given in NAVSHIPS publications. For example: NAVSHIPS 378-0351, *Talos Handling and Stowage (Aboard USS Albany (CG-10), USS Chicago (CG-11), and USS Columbus (CG-12))*. Figure 2-12 shows the location of the various parts and areas of the Mk 7 launching system.

The Talos Mk 12 launching system does not have a ready service ring, nor does it have a second magazine to stow unmated missiles as does the Mk 7 system. The mated rounds are

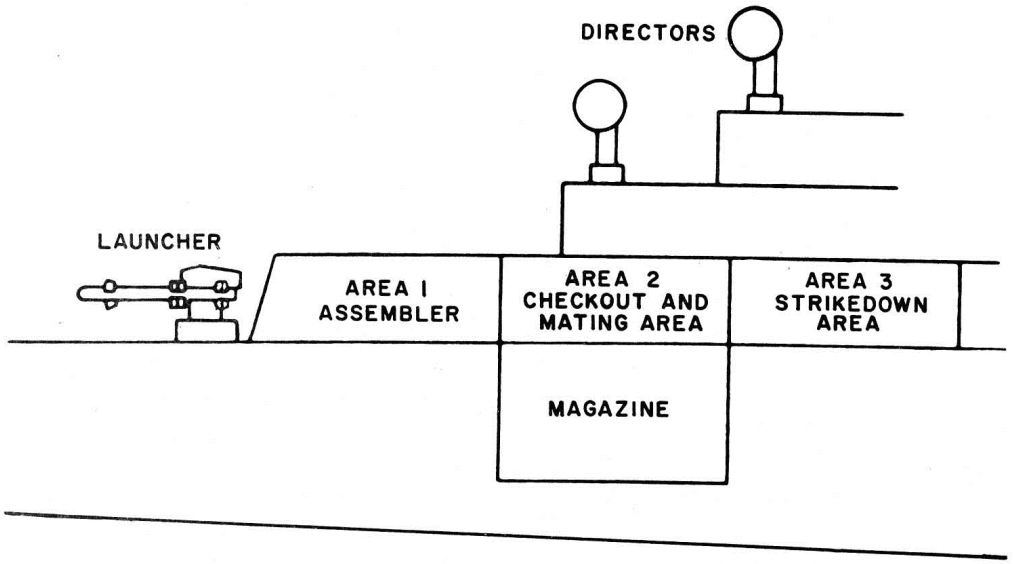

Figure 2-14.—Location of areas occupied by GMLS Mk 12, with relation to each other.

stowed in trays in the magazine. Any unmated spares must be placed in magazine spaces designed for them.

MAGAZINES.-In the Mk 7 Mod 0 launching system the missile and booster and booster magazines are in the deckhouse, but the warhead" magazine and the components magazine are below decks, below the waterline of the ship. Each mating and checkout area (in the deckhouse) will hold one completely assembled weapon.

As you saw in figures 2-12, 2-13, and 2-14, the magazines may be located differently on different ships and for different missiles, and launching systems.

Blowout Patch or Vent.-Near the forward end of each magazine is a blowout plug or vent. Its purpose is to allow escape of gases in case of accidental ignition of the round, and thus prevent the terrific buildup of pressures that would otherwise result.

Wings, Fins, and Arming Plugs.- The wings and fins are removed from their containers and are stowed in racks in the wing and fin assembly area. Spare missile modules are stowed in the same area, as are the arming plugs (in locked boxes).

Batteries.- The missile batteries are of the nickel-cadmium type. The spare batteries are stored and charged or discharged in the missile battery shop, not in the ship's battery room. Some types of batteries are placed in locked storage and the key placed in the custody of the officer.

Antenna Lenses.-Missiles in ready service stowage have the antenna lenses assembled into them. They are removed during missile checkout and are stowed in a locker provided for them. This locker is also used to stow spare guidance, homing, and beacon antenna lenses.

Ready Service.-Missile-booster combinations that have been checked out are moved into the ready service spaces. They do not have the wings, fins, or arming plugs installed.

HANDLING AND STOWAGE AT DEPOTS

At a depot, the weapon components may be received directly from the manufacturers, packaged in separate containers. Fork-lift trucks and other trucks can be used for much of the handling and moving of components. Missile components are assembled to form missiles, and: booster components are assembled into boosters The missiles and boosters are then packaged for stowage at the depot or for shipment. The

components not assembled to form missiles and boosters (warheads, innerbodies, wings and fins, safing and arming plugs) are packaged separately. If not shipped to using activities, they are stored in different buildings. The buildings must meet the requirements set fourth in OP 5, Volume 1, *Ammunition and Explosives Ashore* for the stowage of ammunition of various kinds. You will need to check the condition of the buildings for compliance with the requirements. Nuclear warheads, for example, should be placed in air-conditioned buildings, with radiation and security alarms installed. They must be in buildings that can be adequately guarded. . If you have duty at a shore base, study OP 5 for the regulations that apply to the different explosive components of the weapons. OP 2540, *Containers and Association Handling Equipment for Talos Missile Mk 11, Mod 3, 4, and 5; Description, Operation, and Maintenance* (U), has the newest information on Talos containers and handling equipment.

As with Terrier missiles, most Talos missiles and components are handled at Naval Weapons Stations, of which there are six, rather than at depots.

TARTAR MISSILE HANDLING AND STOWAGE

Strikedown operation of Tartar missiles is the process of either onloading or offloading a missile. Onloading transfers a missile into the launching system; offloading transfers a missile out of the launching system. These operations involve not only launching system personnel and other crewmembers but also dockside crews, crewmembers of a second ship, or a helicopter crew.

The Tartar missile is brought aboard ship as a complete weapon. When transferred from dockside or from a barge, the missile is mounted in a transfer dolly. Instead of being struck below on an elevator as with Talos and Terrier, the missile is transferred from the transfer dolly to the launcher guide arm rail, figure 2-15. It is then struckdown (stowed) in a vertical position in the missile magazine beneath the launcher. When

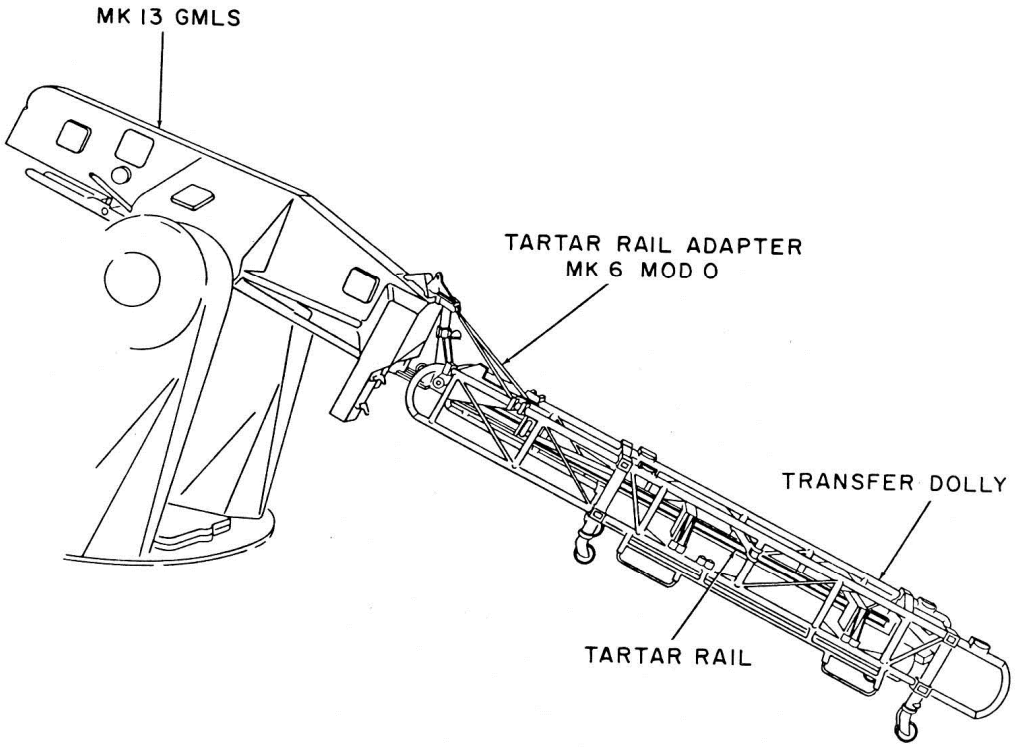

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Figure 2-15.—Transfer dolly alined with Mk 13 GMLS.

handling Tartar missiles, particular care must be taken to avoid damage to the missile radome, to the target detection devices (TDD), and to the missile control surfaces.

When transferring Tartar missiles at sea by the Missile/Stream system, special deck handling equipment designed to contain and control the missile from sending ship to receiving ship has been installed on most Tartar missile ships. Deck handling is accomplished by either a Tartar Transfer Fixture, figure 2-16, or by Dolly/Loadbeam equipment Figure 2-17.

DECK HANDLING EQUIPMENT

The Tartar transfer fixture used on DEG's is a hydraulically powered portable unit bolted to the weather deck and is capable of onloading or offloading a Tartar missile from the receiver unit to the launcher, Fig. 2-16.

The combination dolly/loadbeam fixture used on DDG's is a track-guided, manually-powered handling system capable of onloading or offloading a missile from the receiver unit to the dolly, from the dolly to the loadbeam, and from the load beam to the launcher rail, fig. 2-17.

Strikedown Operation

For the launching system, strikedown operation begins with the crewmembers attaching the strike down equipment consisting of a chain drive fixture, a deck control box, and a manual air control valve and air supply lines. The chain drive fixture is attached to the front of the launcher guide arm, figure 2-17, whenever a transfer dolly or combination dolly/loadbeam deck handling equipment is used. The purpose of the chain drive fixture is to move a missile from the deck handling equipment onto or off the launcher guide arm. The chain drive fixture is a pneumatically operated unit controlled by a manually operated control valve. A crewmember operates the pneumatic control valve which determines the direction of chain drive movement for either on load or off load operations.

A portable electrical control box (figure 2-18), called the deck control box, is plugged into the launcher control system and is operated by personnel on deck (missile handling area) to control the movements of the launcher when mating the launcher with the deck handling equipment during strikedown operations. The deck control box is a manually operated switching unit contained in a metal box which has two handles, indicating lamps, and toggle switches, a cable attached to one end of the control box is plugged into a receptacle on the launcher stand or bulkhead. For training and elevating the launcher to a strikedown position, an operator uses the toggle switches on the deck control box which connect fixed position synchros in the launcher control system to position the launcher to a fixed load position for either port or starboard strikedown operations. For transferring the missile between the launcher rail and missile magazine, and operator at the EP-2 panel (Launcher System Control Panel) operates switches in either the step load or step unload mode of operation on orders from the launcher captain. The launcher captain operates the deck control box and orders missile movement for onload or offload operations whenever the launcher is in a position to transfer a missile between the launcher rail and missile magazine. The launcher captain is in charge of all strikedown operations.

The chain drive fixture is not used with launchers that employ the Tartar transfer fixture shown in figure 2-16. A built-in rammer chain unit which is a component of the transfer fixture is used to move the missile from the deck handling equipment to the launcher guide arm and serves the same purpose as the chain drive fixture. The location of the strikedown equipment in relation to the launcher is illustrated in Chapter 7 of this text. Chapter 7 illustrates and describes how the pneumatic chain drive fixture is used to transfer the missile during strikedown operations.

Tartar Missile-No-test Program

A technical evaluation project for the Improved Tartar missiles indicated that those Tartar missiles not tested by ships were in better condition and had a higher success rate than those that were tested aboard ship. In view of the foregoing all activities concerned have suspended shipboard testing of Improved Tartar missiles and all Tartar missile spare parts and test equipment is being deleted from. shipboard

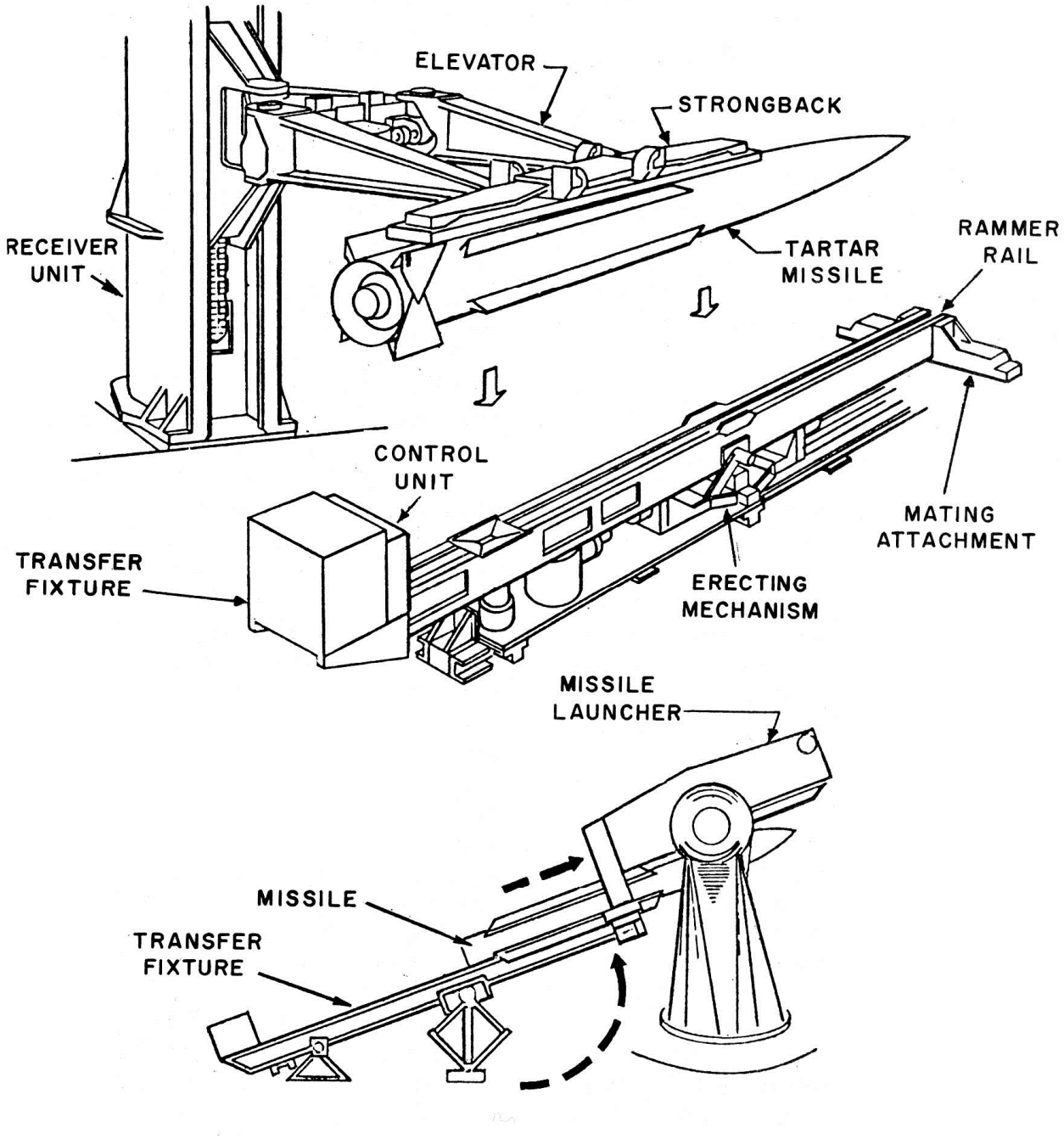

Figure 2-16.—Tartar transfer fixture.

allowance lists. Current NAVORD instructions limit shipboard testing of Tartar missiles to periodic external missile inspection. All missiles received aboard ship are now certified as reliable and require no test after being issued by a Naval Weapons Station.

It must be emphasized that the No-test concept places certified missiles in the magazine. They are to be fired, returned to a supply source, or jettisoned; the missiles are not to be taken apart, or repaired aboard a combatant ship.

Tartar Missile Safety Precautions

The Dual Thrust Rocket Motor (DTRM) is considered a class B explosive and should be handled accordingly. The DTRM produces an extremely hot exhaust blast and noxious gases. It is relatively safe when handled properly, but a

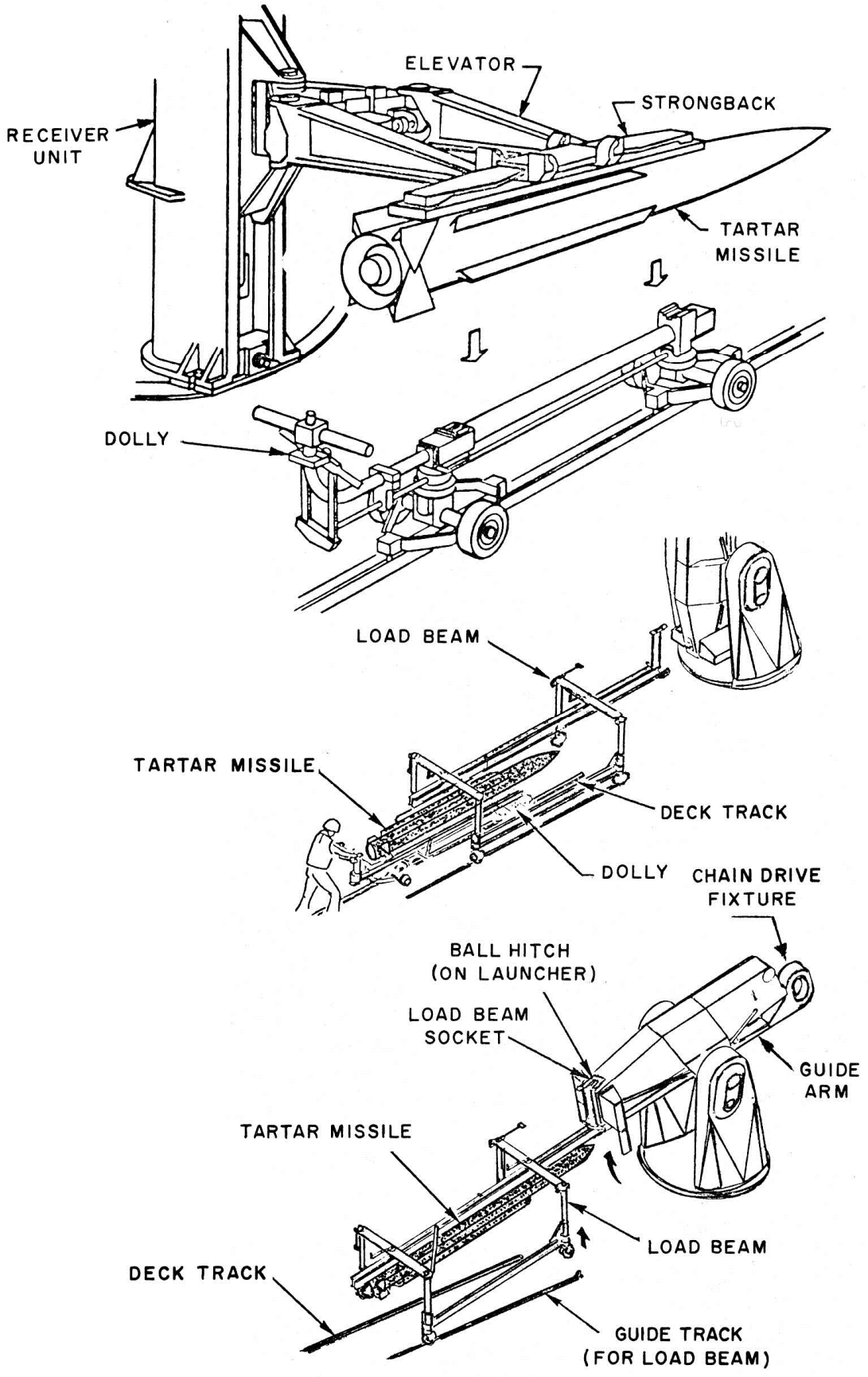

Figure 2-17.—Load beam and dolly.

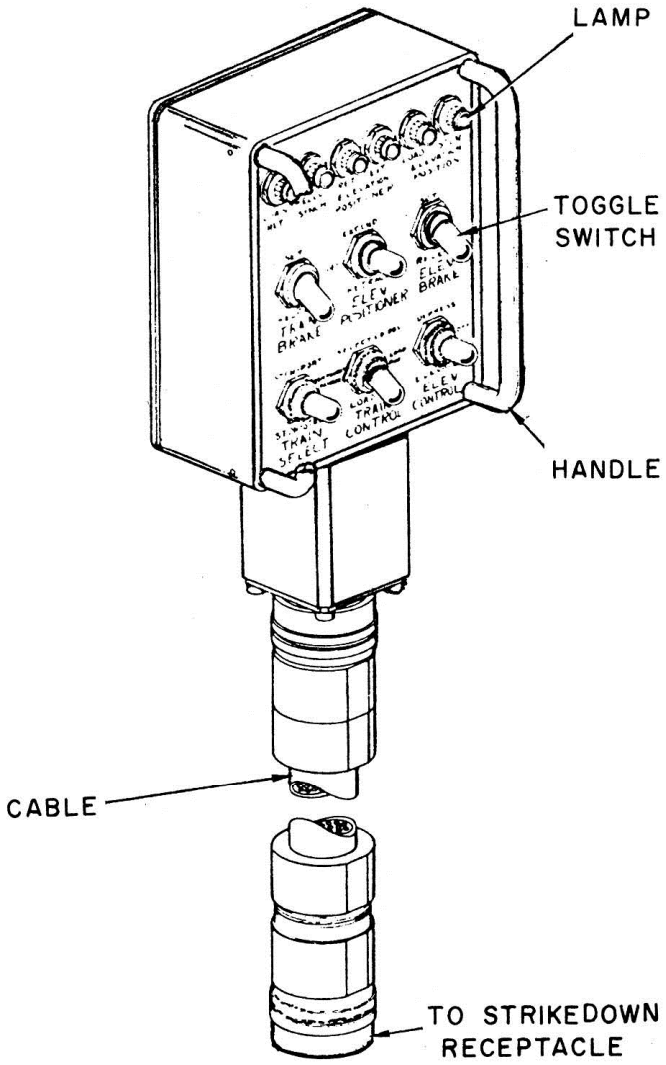

Figure 2-18.—Deck control box and cable.

sharp blow could crack the propellant grain resulting in an explosion when the missile is fired. If the DTRM is found to be armed, manually move the arming lever to the SAFE position and request disposition and instructions from NAVORDSYSCOM.

Personnel shall keep clear of the area aft of the missile (DTRM area) at all times.

Because the missile contains electro-explosive devices (EEDS), observation of currently prescribed Hazards of Electro-magnetic Radiation to Ordnance (HERO) safety precautions during handling is mandatory.

Take all possible steps to protect all missiles from extremes of temperature, humidity, vibrations, electrical or magnetic fields, and radiological exposure. Exposure to any of these conditions, when excessive, may require disposal of the missile.

Upon receipt of the missile, a visual inspection shall be made to ensure that no physical damage has occurred during handling. This inspection is to determine if all sections are free of rust and corrosion, that all covers, plugs, tape, and decals are in place and secure, and that safety devices are in the SAFE position. When any abnormal conditions are indicated, the defective missile shall not be struck down, but shall be returned to the replenishing source.

Interlocks and warning bells are built into the handling system as safety features and are not to be bypassed or disregarded at any time except

under emergency conditions. In the event that such devices are disabled or bypassed, adequate warning signs shall be posted to indicate that such a condition exists. Also, all applicable safety precautions shall be posted at each operating station of the handling system. Regular handling drills employing dummy or training missiles shall be held to ensure safe operations and improved individual proficiency. During drills, the officer-in-charge and leading chief shall carefully observe all operations which might create hazardous conditions and shall take the necessary corrective steps to alleviate them.

NUCLEAR WEAPONS HANDLING AND STOWAGE

Nuclear weapons used by the Navy may be bombs, torpedoes, missiles, depth charges, and projectiles. Rules for peacetime operation of nuclear weapon systems issued by the Chief of Naval Operations, along with official Naval Ordnance System Command special weapons checklists, are mandatory directives which must be followed.

The operation of each type of nuclear weapon is described in the applicable Special Weapons Ordnance Publications (Navy SWOPS). Nuclear weapons will be handled and stored in accordance with Navy SWOP 50-1 and SWOP's of the 20 series. No ammunition assemblies or components shall be disassembled or modified unless authorized by applicable technical instructions. Detailed safety precautions and considerations are prescribed in Navy SWOP 50-1.

Missiles that have nuclear warheads are stowed in a ready service condition in the same missile magazine as those with conventional warheads and require no special handling or testing. The GMM that deals with any weapon must ensure that a proper storage condition is maintained. This ensures the reliability of the weapon and also guarantees personnel safety. As a leading GMM, it is essential that you have a thorough knowledge of the hazards concerned and the restrictions imposed on nuclear weapons. For this reason your main concern when dealing with a nuclear weapon is their security and protection.

Safeguarding Nuclear Weapons

Nuclear weapons require special protection because of their political and military importance, their destructiveness, and the attendant consequences of an unauthorized nuclear detonation. Procedures and responsibilities for the establishment of effective security measures are set forth in DOD directives and implemented by the using agencies. The Navy's security program is outlined in OPNAV Instruction 05510.83B, Criteria and Standards for Safeguarding Nuclear Weapons. This instruction is the basis for determining the minimum necessary requirements for all nuclear weapons in Navy custody. It may be augmented by additional security measures as deemed necessary by local commanders.

This section outlines the basic requirements for safeguarding nuclear weapons in the Navy, and is not intended to include all of the local area commander's requirements. .It is your responsibility as a senior petty officer to keep informed of the security requirements of your activity.

Definitions

The definitions that follow are used throughout the Navy in conjunction with nuclear weapons. Navy SWOP 4-1 is the approved source for definitions other than those in OPNAVINST 05510.83B.

Access: As applied to nuclear weapons, access means physical proximity in such a manner as to allow the opportunity to cause a nuclear detonation. (Whenever the word access appears in the nuclear weapons program, only this meaning will apply.) Access should not be confused with entrance.

Technical Knowledge: That knowledge, however obtained, required to cause a nuclear detonation.

Critical Position: One in which the incumbent has (1) technical knowledge of nuclear weapons, and (2) access to nuclear weapons.

Limited Position: One in which the incumbent could acquire both knowledge and access.

Controlled Position: One in which the incumbent is performing duties physically associated with nuclear weapons, but does not require

technical knowledge of, nor access to, nuclear weapons.

Exclusion area: The designated area containing one or more nuclear weapons.

Limited Area: The designated area surrounding one or more exclusion areas.

Two-Man Rule

No other single area identifies more with the spirit and intent of the nuclear safety and security program than the two-man rule. All personnel working with nuclear weapons should read and understand this rule, which is explained in GMM 3&2, NAVTRA 10l99.

Entry and Access Control

Entry control to limited and/or exclusion areas is formalized and maintained to ensure positive identification of personnel prior to admission. An exchange badge system, entry control rosters, visitor escorts, and a duress system are employed.

Unauthorized actions by persons with approved access to nuclear weapons is one of the threats to nuclear weapons. Therefore, entrance to exclusion areas containing nuclear weapons is restricted to properly cleared personnel who have a positive need for access, or to personnel who have to enter a space containing nuclear weapons during the course of their duties. Only persons authorized by the commanding officer can be admitted to exclusion areas. Limited area access may be authorized by the commanding officer's designated representative.

When projects in a limited and/or exclusion area require the presence of personnel not cleared for normal entry, such persons are kept under constant escort by the security force or supplementary personnel. Their movements are limited to only those necessary for the performance of assigned tasks. A log of persons entering and leaving exclusion areas is kept and maintained locally for a period of at least 2 years.

In those spaces in which nuclear weapons are stored and manned by only two men, all openings and entrances to those spaces (other than those in use) must be locked and alarmed. The unlocked entrance(s) are guarded by an armed guard who also controls entrance to the spaces.

When transporting nuclear weapons from one area aboard ship to another, an appropriately armed guard accompanies the personnel loading, handling, or transporting the weapon.

Once working hours commence and the exclusion area is entered by two authorized persons, the responsibility for maintaining the two rule rests with the senior man present. No one individual is allowed to remain in the exclusion area alone.

SAFETY STANDARDS

Safety rules are issued for every nuclear weapon system. These rules are to be followed in peacetime and wartime, when possible. All safety rules are applied against the four safety standards.

All hands must take positive measures to prevent weapons involved in accidents or incidents, or jettisoned weapons, from producing a nuclear yield.

Also take positive measures to prevent deliberate arming, launching, firing, or releasing except upon lawful orders.

Positive measures must be taken to prevent inadvertent arming, launching, firing, or releasing, and provide adequate security.

Handling Precautions

The best handling equipment designed is only as good and as safe as the personnel who operate it. With nuclear weapons, it is imperative that you know the type material you are handling and its hazards; further, you must know the capabilities and limitations of the equipment you are using when handling the weapons.

When using hoisting equipment in handling nuclear weapons, it should never be loaded in excess of its rated capacity. No piece of handling equipment should be used for other than its intended purposes. When elevated loads are moved horizontally on a monorail, sudden stops or starts must be avoided. Remove any obstructions from the path of the load.. Never raise weapons higher or let them remain suspended longer than is absolutely necessary to complete the required handling operation.

PERSONNEL

All personnel assigned to work with nuclear weapons must receive special training in the handling, storage, and, a accounting methods of nuclear weapons. Prior to such training they must possess at least a secret clearance based on a background investigation. Only properly cleared personnel who have need for access to spaces containing nuclear weapons will be allowed entry to these spaces. Only personnel of demonstrated reliability and stability as outlined in BUPERINST 5510.11 A, Criteria and Standards for Personnel Assigned to Duties Involving Nuclear Weapons, will be assigned to this type duty.

Human Reliability Program

The human reliability program is aimed at all personnel who control, handle, have access to, or control access to nuclear weapons or nuclear weapons systems. The program covers selection, screening, and continuous evaluation of the personnel assigned to various nuclear duties. The program seeks to ensure that personnel coming under its purview are mentally and emotionally stable and reliable.

Alarm and Warning Systems

Numerous alarm and warning signals are installed on ships with nuclear weapon spaces. Some are audible alarms, such as bells and buzzers; others are warning lights. Some are connected to all parts of the ship, and others only to certain spaces. The nuclear weapons stowage spaces have warning signals for high temperature and security.

The operation of security alarms and warning signals can be mechanically operated switches or pushbuttons activated by the opening of access doors and/or hatches to nuclear weapons spaces. Alarm panels used for security alarm systems are located in ship's areas that normally are manned at sea and in port such as quarter deck areas and damage control central. When the alarm panels include entry into a nuclear weapons space, special security forces are alerted to safe-guard nuclear weapons and components.

Ventilation In Nuclear Weapons Spaces

On most ships with nuclear weapons spaces, the ventilation system for those spaces is not connected to the system that services other parts of the ship. The reason for this arrangement is that, in the event of a nuclear accident, radioactive particles will not be carried from nuclear weapons spaces through the ventilation system into other living or working spaces.

Circulation of air in nuclear weapon spaces is provided by distribution ducts and fans. Stale air is taken out through exhaust ducts. It is necessary to keep exhaust systems running at all times, even though areas are not occupied. The ventilation weather openings should be kept open as long as possible, even in rough weather, to permit ventilation with outside air.

HANDLING AND STOWAGE OF OTHER MISSILES

Missile magazines in aircraft carriers generally are located below the water line and within the ship's armor belt. For ease in handling of missile components, these magazines contain power operated handling equipment such as electrical, hydraulic, or pneumatic hoists, trolleys, etc. To provide adequate and continuous surveillance in magazines containing certain missiles, and to provide assurance that a specific hazard is not actively present, these magazines are equipped with special detection equipment.

Aboard most aircraft carriers the handling, stowage, and assembly of aircraft launched missiles is the responsibility of personnel in the Aviation Ordnancemen rate. Some carriers split this responsibility and utilize personnel in GMG and GMM rates for the maintenance of storage magazines and some missile handling equipment.

The movements of aircraft ammunition and explosives between the magazine areas and aircraft involve specific handling and assembling functions that are controlled by areas designed for a specific purpose. Two of these areas, the magazine or stowage area and the delivery assembly area, are of interest to personnel of the GMM rating assigned to the ship's armory aboard a carrier.

Handling Areas

The magazine, or stowage area, is the location with fixed installations designed for stowage of all the various types of aircraft ammunition.

The delivery assembly area is the location aboard carriers where the various components of ammunition are delivered for assembly into complete weapons for use on aircraft.

Since the assembly, testing, and arming of aircraft launched missiles are the duties of the Aviation Ordnanceman, the GMM assigned to the ship's armory has the primary duties of ensuring that all components of aircraft launched missiles are properly stowed and maintained in a state of readiness at all times. He may also be called upon to supply the various components of aircraft launched missiles to personnel in the delivery assembly area where the missiles are assembled for use or transfer to ready service areas. If you are charged with the responsibility of stowage magazines and the transfer of rocket and missile components, you should thoroughly familiarize yourself with the practical methods or safe handling and stowage of such items. Listed below are some safety precautions to be observed when handling rockets and guided missiles.

Firing temperature limits specified for each missile must be observed for safe operation. If a missile is exposed outside of temperature limits stenciled on the unit, it should be set aside and handled in accordance with current instructions.

Continued exposure to abnormal stowage temperatures which may cause the propellant to deteriorate, with attendant hazards of possible explosion when the rocket is fired.

Rough handling or blows which may break the propellant grain thus exposing too much surface to burning and leading to possible excessive pressure in the motor. Excessive pressures may cause the motor to explode when fired.

STANDARD MISSILE

Standard Missiles, RIM-66A, RIM-66B, and RIM-67A, are surface launched, supersonic guided missiles which may be used against surface or airborne targets. RIM-66A and RIM-66B are medium range (MR) missiles employed aboard guided missile ships having Tartar Fire Control Systems. RIM-67A is an extended range (ER) missile employed aboard guided missile ships having Terrier Fire Control Systems.

The MR missile is propelled by a solid fuel dual-thrust rocket motor (DTRM) which provides short duration high thrust for the initial or boost flight period, and long duration low thrust for the remainder of the propelled flight.

The ER missile is propelled from a launcher by a solid fuel booster rocket which provides short duration high thrust for a boost flight period. Separation of the booster results in ignition of a solid-fuel sustainer rocket which supplies long duration long thrust energy for the remainder of the flight.

Standard Missile Handling

The Standard MR missile and its components are shipped and stowed in the same type containers as the Tartar missile. The handling equipment and procedures for loadout, offload, underway replenishment, and stowage are identical for the Standard MR and Tartar missiles.

The Standard ER missile and its components are shipped and stowed in the same type containers as the Terrier missile. The handling equipment and procedures for loadout, offload, underway replenishment, and stowage are identical for the Standard ER and Terrier missile.

Special Handling Procedures for Standard

Power for the Standard Missile is supplied by a squib activated primary battery. This battery will generate gas, when activated, requiring the following special handling procedure whenever the battery is activated or a misfire occurs:

Allow approximately four hours for battery temperature to return to normal.

Inspect the battery vent port (forward of the dorsal fin) to determine if temperature has cooled sufficiently to work safely.

Clean up any vented electrolyte (potassium hydroxide, a caustic alkali). Do not allow the electrolyte to contact body or clothing. If it does, immediately flush the contaminated area with large quantities of vinegar and water or fresh water.

After cooling and cleanup, replace the missile battery vent port plug and return the missile to the magazine for future offloading.

If, during missile handling or firing exercises, black smoke appears from the battery vent port, the missile should be jettisoned immediately. Black smoke indicates a missile battery fire. The appearance of white steam from the missile vent port is due to the battery venting and should not be mistaken for a battery fire within the missile.

Make sure that the DTRM igniter arming level (Standard MR) and the sustainer arming indicator (Standard ER) are in the SAFE position prior to and during handling operations.