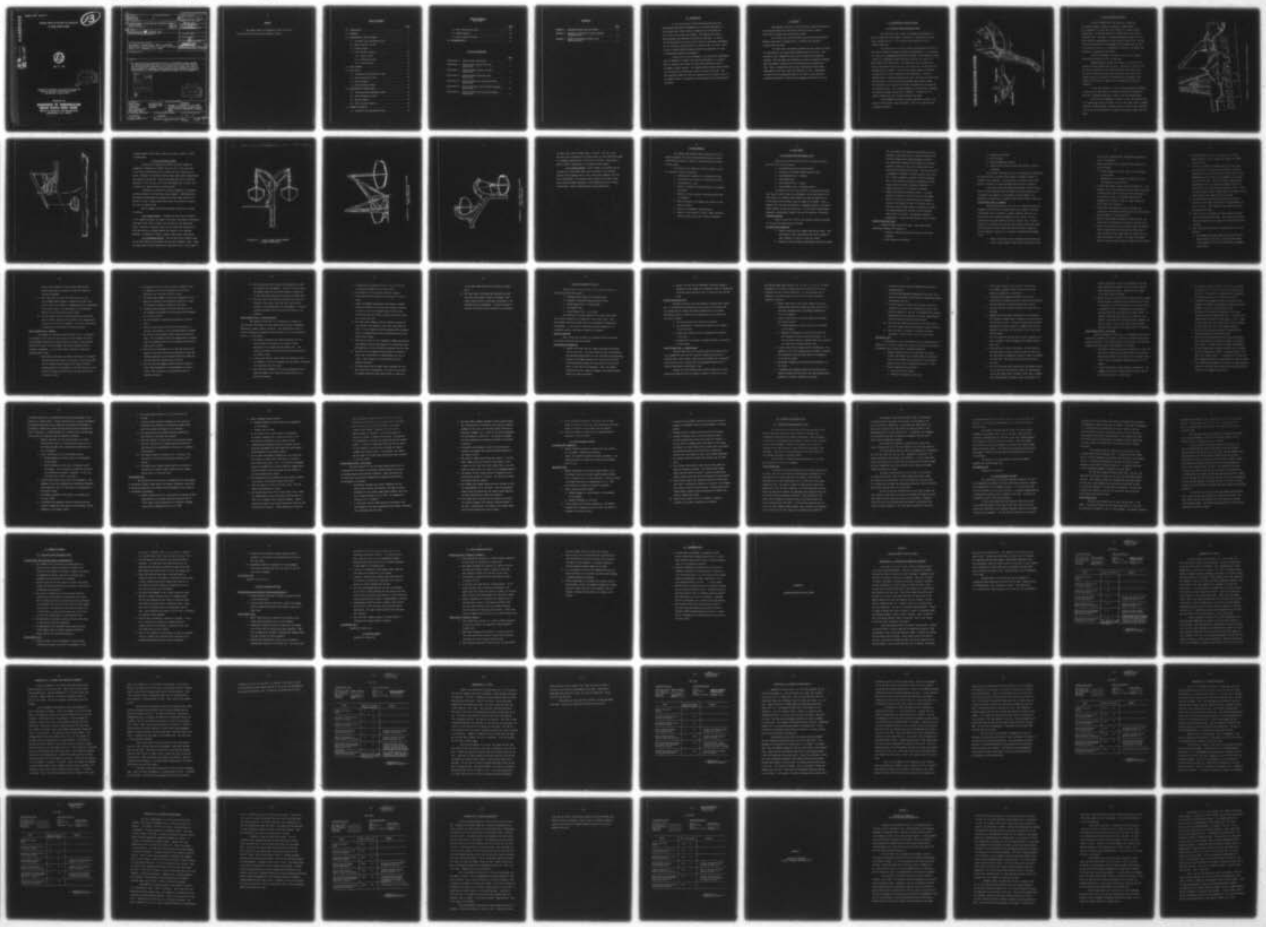
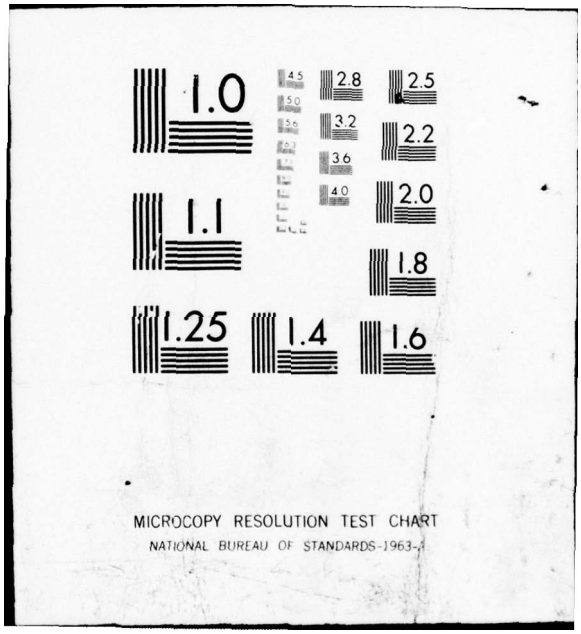
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PROGRESS REPORT ON THE TEST AND EVALUATION OF THREE ESCAPE SYSTEMS

May 31, 1974

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16. Abstract

The report describes operational trials of two shipboard escape systems: an inflatable abandonment slide and a davit-launched inflatable liferaft. The two systems were installed on Great Lakes ore carriers, the crews of which operated the equipment during simulated ship abandonment operations. Observations of a third system, originally intended, are not included.

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PREFACE

This paper reports the progress to date on the test and evaluation of three ship abandonment systems.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
2.0	APPROACH	2
3.0	DESCRIPTION OF ESCAPE SYSTEMS	3
	3.1 Inflatable Ship Abandonment Slide	3
	3.2 Davit Launched Life Raft	5
	3.3 Brucker Capsule	7
	3.4 Davit Launched Lifeboat	10
	3.4.1 Radial Davits	10
	3.4.2 Mechanical Davits	10
	3.4.3 Gravity Davits	14
4.0	TEST CRITERIA	15
5.0	TEST PLANS	16
	5.1 Inflatable Ship Abandonment Slide	16
	5.2 Davit Launched Life Raft	28
	5.3 Brucker Capsule	35
	5.4 Davit Launched Lifeboat	42
6.0	DESCRIPTION OF ACTUAL TESTS	44
	6.1 Inflatable Ship Abandonment Slide	44
	6.2 Davit Launched Life Raft	46
	6.3 Brucker Capsule	49
	6.4 Davit Launched Lifeboat	49
7.0	SUMMARY OF RESULTS	51
	7.1 Inflatable Ship Abandonment Slide	51

TABLE OF CONTENTS
(Continued)

	Page
7.2 Davit Launched Life Raft	53
7.3 Brucker Capsule	54
7.4 Davit Launched Lifeboat	55
8.0 RECOMMENDATIONS	57

LIST OF ILLUSTRATIONS

		Page
Illustration 1.	Typical Slide Installation	4
Illustration 2.	Typical Davit Launched Life Raft Installation	6
Illustration 3.	Typical Brucker Capsule "A Frame" Installation	8
Illustration 4.	Typical Brucker Telescopic Boom Installation	9
Illustration 5.	Typical Radial Davit Launched Lifeboat Installation	11
Illustration 6.	Typical Mechanical Davit Launched Lifeboat Installation	12
Illustration 7.	Typical Gravity Davit Launched Lifeboat Installation	13

APPENDIXES

		Page
APPENDIX A.	OBSERVERS REPORTS AND DATA SHEETS	A-1
APPENDIX B.	BRIEFING ON OPERATION OF DAVIT LAUNCHED INFLATABLE RAFT	B-1
APPENDIX C.	REPORT ON ADDITIONAL TESTING USING INFLATABLE RAFTS	C-1

1.0 INTRODUCTION

At the Sixth Session of the Intergovernmental Maritime Consultative Organization Subcommittee on Lifesaving Appliances, it was decided that a total rewrite of Chapter III of the Safety of Life at Sea Treaty would be necessary. This rewrite will take a much different form from what is presently being used. In effect, the revised chapter will be written in terms of functional requirements and not limited to specifications for lifeboats and life rafts. Thus, a need to assess shipboard escape systems become apparent as a step in developing functional requirements.

Another step in the development of the functional requirements was the analysis of casualty data and the development of a computer model to simulate the network of events which determine survival following a vessel casualty. The computer model handles times involved for activities and probabilistic values for events occurring. The times obtained during the test and evaluation will be used as input to the computer model to determine the effectiveness of each system under evaluation.

2.0 APPROACH

The approach used was to install the three evacuation systems on various Great Lakes Ore Carriers and utilize the crews on board each vessel to operate the systems being tested.

As a first step, the Coast Guard contracted with The Battelle Memorial Institute of Columbus, Ohio, to develop the evaluation criteria and test plans.

The Coast Guard subsequently modified the test plans to include the exercising of the escape system normally used by the ship. This was done so that comparative data could be obtained for evaluation purposes. The test plans were followed as closely as possible, although specified weather conditions are not available for long periods of time. This, in conjunction with a major coordination effort being undertaken for each test, made life difficult for all. Considering the extent of the coordination effort, all tests to date have been considered successful in that we have completed what we set out to do.

3.0 DESCRIPTION OF ESCAPE SYSTEMS

3.1 Inflatable Ship Abandonment Slide

The inflatable slide concept was originally developed as a mode for removing a large number of persons in a short period of time from a downed aircraft. It has recently been adapted for use on offshore platforms.

The installation of the test slide was accomplished on the U. S. Ore Carrier Enders M. Voorhees as shown on Illustration 1. It is mounted on a deck just overhanging the hull stern plating. The stowage containers consist of a fiberglass reinforced plastic drum for the slide and a metal case for the gas bottles. The fiberglass drum is supported by half a cradle which causes the drum to fall away from the ship when the holding strap is released. The inflation system consists of 2000 psi nitrogen which is used to separate six air aspirators. After the holding strap is released by pulling one lever, the drum falls away from the ship which in turn activates the nitrogen and inflation begins. A raft attached to the bottom of the slide is automatically activated by the inflating slide. This inflation system is also aspirated, although the separate nitrogen bottles are at 3000 psi. A simple pull of a lanyard releases the raft from the bottom of the slide.

Two outriggers are used to steady guidelines attached to the slide at various points along its length. This is to give the slide transverse stability.

MARINE EVACUATION SYSTEM

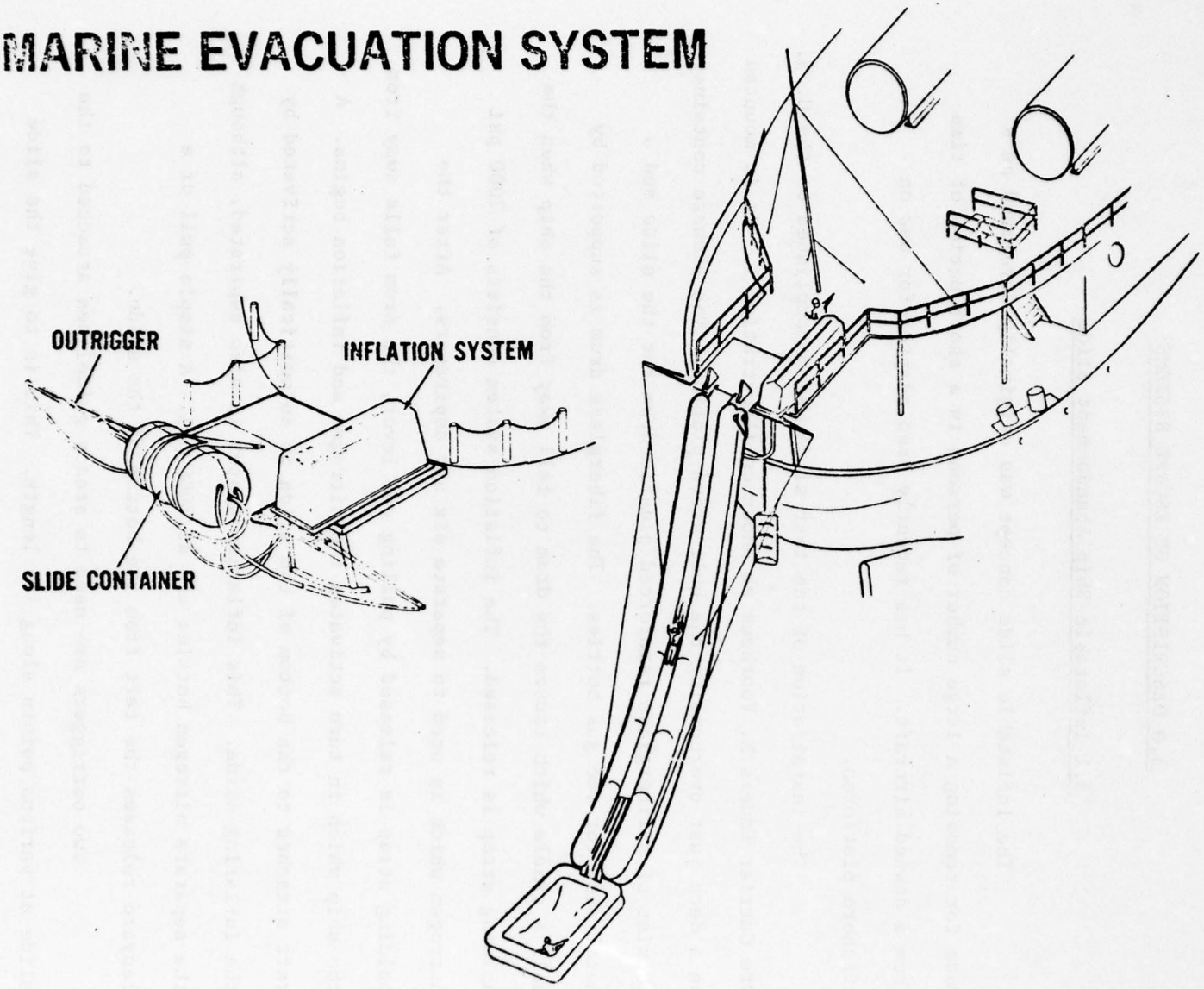


ILLUSTRATION 1. TYPICAL SLIDE INSTALLATION

3.2 Davit Launched Life Raft

The davit launched raft was installed on board the Ore Carrier Joseph H. Frantz as portrayed in Illustration 2. It is mounted on the port side, aft in place of a normal lifeboat installation. The system consists of a shatts davit and a 25-man inflatable raft. The davit is a manually operated, single fall unit which swings out approximately 10 feet from the ship's side. Two hand cranks are provided; one for swinging the arm outboard and the other for retrieval of the fall. The release of the fall is by gravity and actuated by raising the brake handle.

The raft is packaged in a fabric bag with a tab exposed indicating the position of the lifting ring.

System operation requires the removal of the raft from a stowage container located near the davit. The hook at the end of the fall is then attached to the lifting ring while two bowsing lines are tied to cleats on the deck near the ship's side. The fall is cranked up past a point where the bowsing lines are taught. This tension on the raft will activate the conventional CO_2 inflation mechanism.

As the raft inflates, it will be swung outboard by cranking the davit arm so that upon full inflation the raft is alongside the ship with a boarding apron held in place by the two bowsing lines.

After all crew members are aboard the raft, the bowsing lines are released and a man at the davit will lift the brake lever to commence lowering. During lowering, a release lanyard is pulled from onboard the raft to set the release hook for automatic release upon impact with the water.

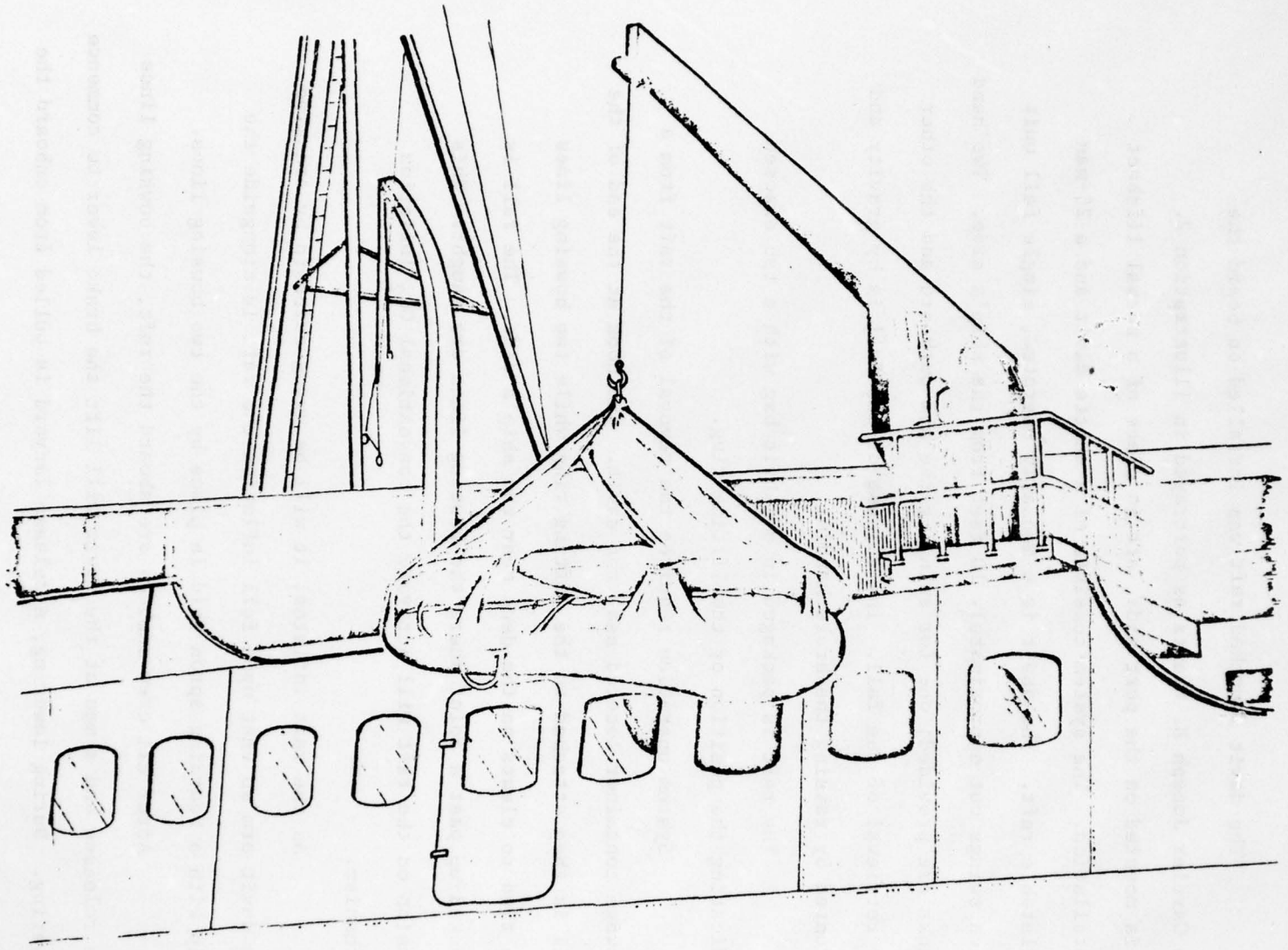


ILLUSTRATION 2. TYPICAL DAVIT LAUNCHED LIFE RAFT INSTALLATION

The raft is constructed of a fabric reinforced neoprene material. The outside diameter of the raft is just under 14 feet. There are two inflatable tubes which form the exterior shape of the raft. An inflatable floor is provided which is inflated by use of a hand pump once water borne. The automatically inflated center post holds the canopy in place and provides for a conial shaped canopy.

3.3 Brucker Capsule

The capsule was developed for use on offshore drilling rigs and is launched by means of a single fall suspended from an "A frame" extending over the side of the vessel. This particular system has not been installed as of this date, as a smaller version of the capsule as well as a telescopic boom davit are nearing the completion stage. The new davit system is considered more applicable to shipboard use primarily because its stowage condition would not require anything extending over the side of the ship. Installation arrangements are shown in Illustrations 3 and 4.

Operation of the system is accomplished by all crew members entering the capsule through the hatch doors, then pulling the release lever inside the capsule to begin lowering by gravity. When the capsule has reached the water, a crew member must release the cable by pulling a lever on the capsule.

The capsule has a circular plan which is 13 feet, 6 inches in diameter. The lower part of the capsule is bowl shaped with a conial flaring for stability. The structure of the capsule is fiberglass

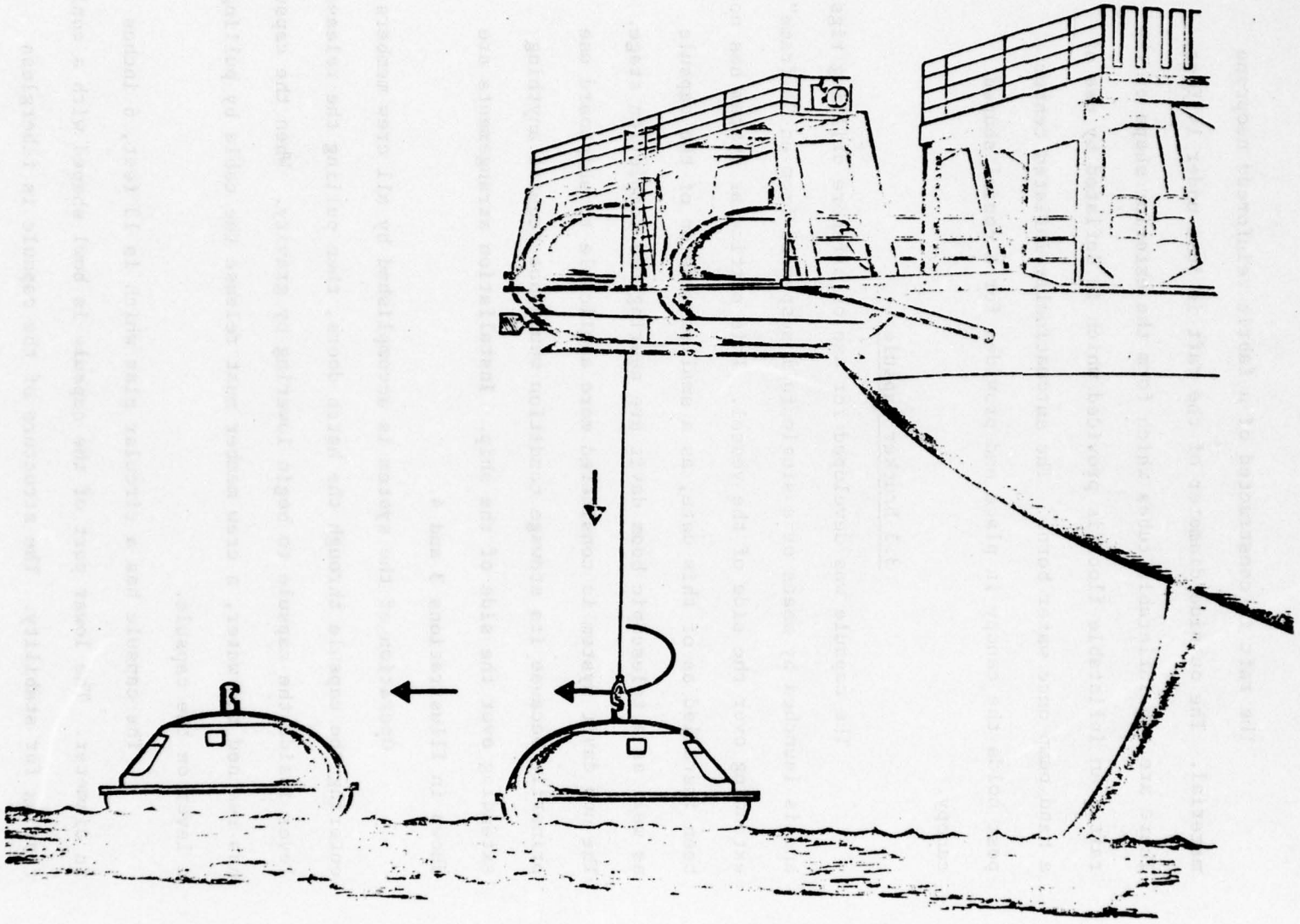


ILLUSTRATION 3. TYPICAL BRUCKER CAPSULE "A FRAME" INSTALLATION

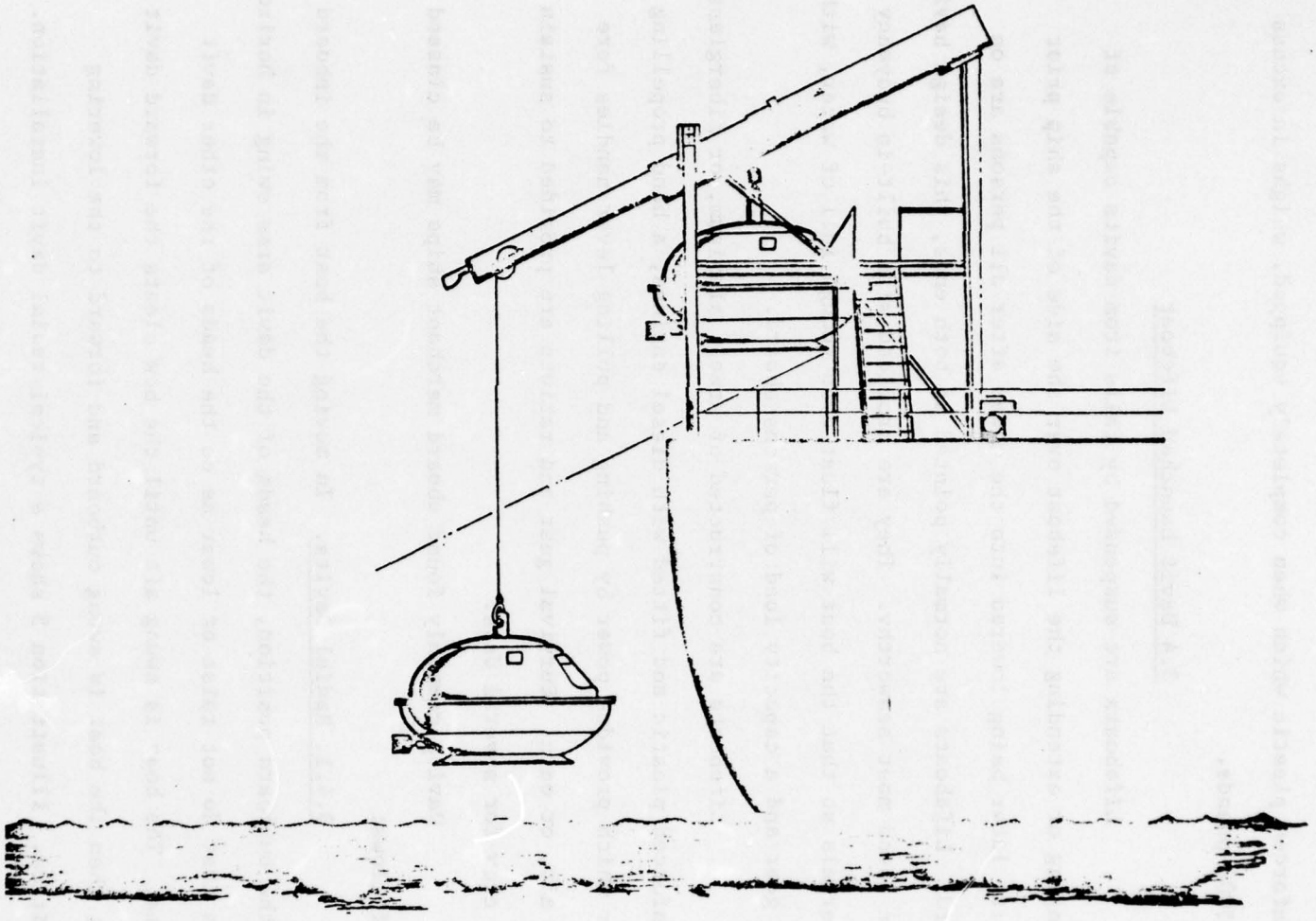


ILLUSTRATION 4. TYPICAL BRUCKER TELESCOPIC BOOM INSTALLATION

reinforced plastic which when completely equipped, weighs in excess of 5000 pounds.

3.4 Davit Launched Lifeboat

Lifeboats are suspended by falls from davits capable of swinging or extending the lifeboat over the side of the ship prior to its later being lowered into the water after all persons are on board. Lifeboats are normally pointed at both ends, this design having been found most seaworthy. They are provided with built-in buoyancy materials so that the boat will float even though full of water, with all gear and a capacity load of persons aboard.

Lifeboats are constructed of steel, aluminum, or fiberglass reinforced plastic and fitted with diesel engines, a hand propelling gear which provides power by pushing and pulling lever handles fore and aft, or oars. Survival gear and rations are provided to sustain the crew for several days.

Davits commonly found aboard merchant ships may be classed as follows:

3.4.1. Radial Davits. In moving the boat from the inboard to the outboard position, the heads of the davit arms swing in horizontal arcs that do not raise or lower as do the heads of the other davit types. The boat is swung aft until the bow clears the forward davit arm; then the boat is swung outboard and forward to the lowering position. Illustration 5 shows a typical radial davit installation.

3.4.2. Mechanical Davits. The two davits most commonly found on the Great Lakes are the sheath screw and the quadrantal types. These two types may be further described by terms which refer to the shape of

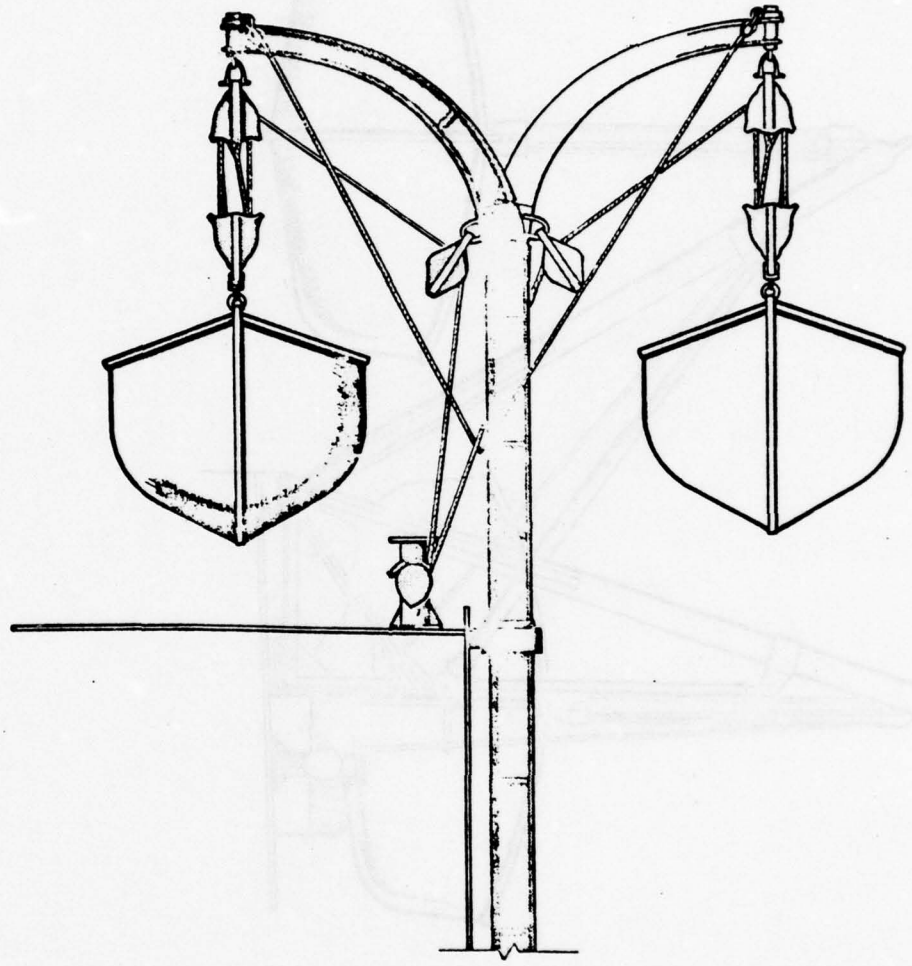


ILLUSTRATION 5. TYPICAL RADIAL DAVIT LAUNCHED LIFEBOAT INSTALLATION

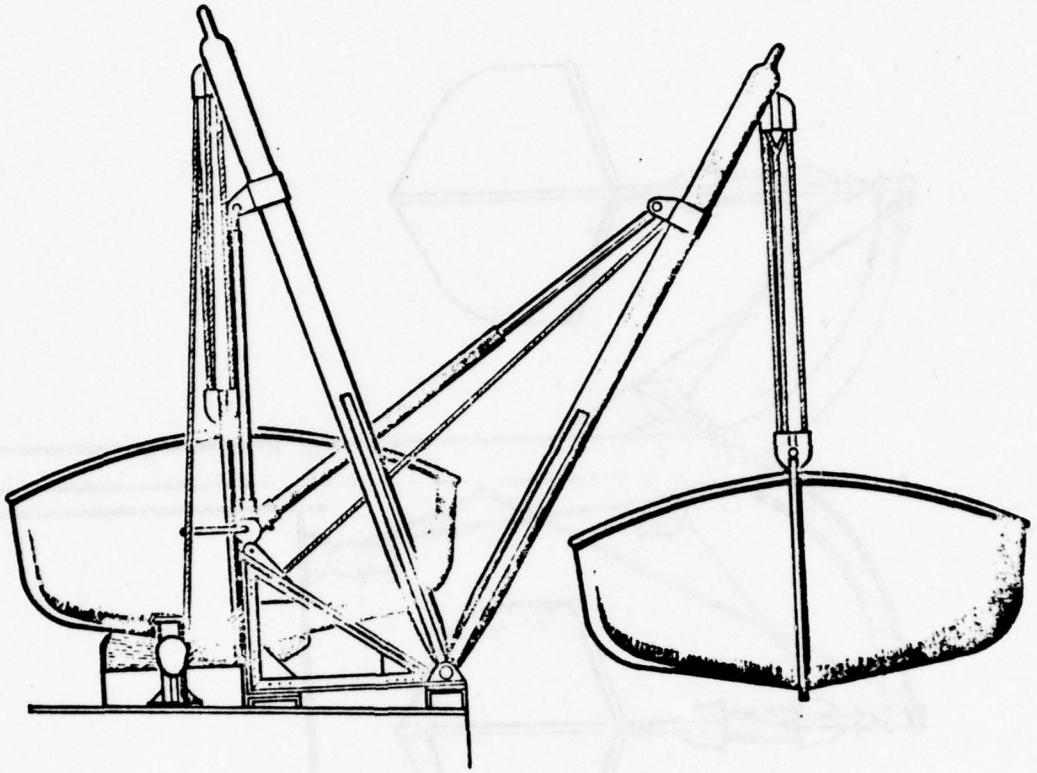


ILLUSTRATION 6. TYPICAL MECHANICAL DAVIT LAUNCHED LIFEBOAT INSTALLATION

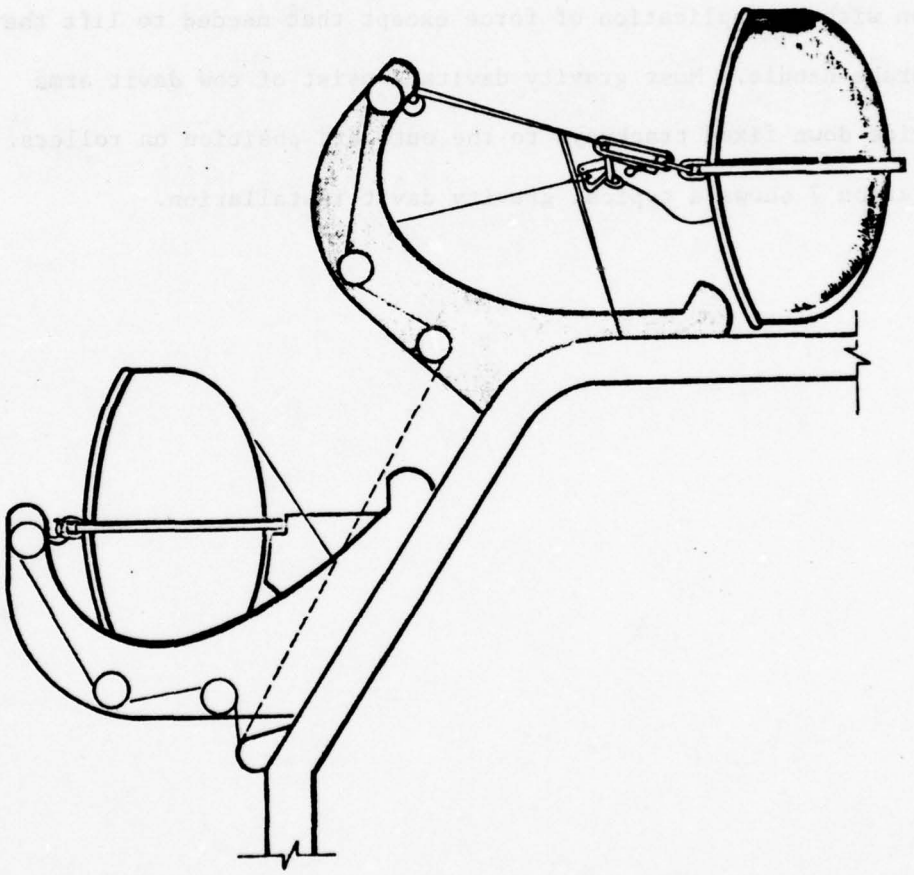


ILLUSTRATION 7. TYPICAL GRAVITY DAVIT LAUNCHED LIFEBOAT INSTALLATION

the davit arm, either straight boom or crescent. For both types, the davit arm is cranked out by screws, gears, or other mechanical means in a movement perpendicular to the side of the ship. Illustration 6 shows a typical installation of a mechanical davit system.

3.4.3. Gravity Davits. After release of the gripes and the locking bars, these davits move from the inboard to the outboard position with no application of force except that needed to lift the winch brake handle. Most gravity davits consist of tow davit arms which ride down fixed trackways to the outboard position on rollers. Illustration 7 shows a typical gravity davit installation.

4.0 TEST CRITERIA

The abandon ship concepts under evaluation are to be evaluated against all factors associated with getting a person safely from the deck of a vessel to the water level and a place of safe refuge.

The factors to be taken into account include, but are not limited to, those listed below:

1. Maintenance of pressure in an inflatable system.
2. Susceptibility of system to accidental activation.
3. Accessibility to crew.
4. Ability of system to withstand abusive environmental conditions.
5. Notation of times involved in getting system ready for boarding.
6. Safety with which crew members are lowered to safe place of refuge.
7. Ability to accommodate injured persons.
8. Number of crew needed for launch, number remaining aboard stricken vessel after system is launched.

5.0 TEST PLANS

5.1 Inflatable Ship Abandonment Slide

There are five test activities that constitute the total test plan for the slide system:

1. Pre-operational Tests and Observations
2. Dockside or Functional System Check-out Tests
3. Severe Weather Test -- unmanned
4. Cold Weather Test
5. Severe Weather Test -- manned
6. Severe Weather Test -- alternate method

The sequence for the tests should be as listed above except that Items (4) and (5) may be interchanged. At the discretion of the Coast Guard, the unmanned severe weather test may be completed only to the extent that personnel risks are shown to be minimal. Then to minimize test time and inconvenience to shipping schedules, the manned severe weather test may be carried out. In the event of questionable response or inconclusive results, tests may be repeated if necessary.

Personnel Briefing

Prior to each test activity, all personnel should be briefed on the test activities that are outlined.

Pre-Operational Inspection

1. Inspect access path for crewmen entering the slide. This path should be free from obstructions and be capable of crew traverse at a rate up to one per second.
2. Inspect the slide inflation (deployment) initiation system.

The latch handle that releases the container should be examined to determine that it is easily accessible and obviously marked as the slide deployment initiator. The lanyard that connects with the gas valve should be examined to make sure there are no obstructions that would prevent opening the gas valve. Both devices should be examined to determine if normal exposure (ice, snow, etc.) would be expected to prevent or deter operation. Note: Care should be exercised in examining the slide release latch to prevent inadvertent deployment. A nominal 10-pound force is required to release.

3. Inspect the inflation system gas supply. A nominal pressure of 2000 psi should be read on the gas gages.
4. Inspect the system for general structural integrity. A general check should be made to be assured that the cover over the gas supply system is adequately secured, the slide guidelines are secured, and the container tether lines are secured. Any apparent structural inadequacies or suspected problem areas should be noted.

Dockside Functional Tests

Perform dockside functional tests. These tests should demonstrate adequacy with respect to:

1. Container release and retention and apron structural integrity
2. Slide release and inflation

3. Guideline positioning
4. Raft inflation
5. Slide configuration (slope)
6. Slide and raft trial use under fair weather, calm sea conditions

The dockside tests should be used to determine the feasibility of slide and raft retrieval and the number of crewmen necessary to accomplish the retrieval. The possibility of using the ship's main deck as a platform for slide repacking should also be considered.

Coast Guard activities during the dockside functional tests should include observation and recording of the slide operation and recording of any aspects of the operation that may appear to be precursors of difficulty in operation under adverse weather conditions.

Severe Weather Test -- unmanned

The main objective for this test is to demonstrate that the equipment will function as intended under severe weather conditions with minimum risk to personnel. Another important objective is to obtain data on the operating parameters of the system. The data collected would include details of time to deploy, time to inflate, dimensions of deployed slide system, deflections of slide under load, and deflections of slide system under load and weather conditions. Another important objective is to identify operational shortcomings if any.

1. Weather conditions for the unmanned severe weather test should include winds at least 30 mph and waves at least

10 feet high, daylight hours and moderate temperatures of 45 to 70 degrees.

2. Vessel conditions for the unmanned severe weather test should include:
   a. Minimum headway for vessel safety to be determined by the Captain
   b. Headings both at 90 degrees to wind direction and 180 degrees to wind direction
3. A Coast Guard service vessel should be standing by. Four swimmers in wet suits equipped with face masks, inflatable life preservers, and life lines should be standing by on the service vessel. One swimmer should also be equipped with a 100-foot length of light towing line with a small float attached.
4. A simulated ship emergency should be declared and preselected crew members and Coast Guard test participants should assemble at the slide station.
5. With the ship headed 180 degrees to wind direction, the slide should be deployed by operating the release lever.
6. After the slide and raft are inflated, dummy crew members (plastic bags loaded with approximately 180 pounds of water enclosed in cloth bags) should be loaded into the slide and allowed to descend. Two dummy crew members should be used to check the general response of the system.

7. The two swimmers from the Coast Guard service vessel should board the raft to position the dummy crew members around the raft.
8. A total of 18 dummy crew members should then be loaded into the slide. An attempt should be made to sustain a loading rate of one per second for a brief period of time, depending upon the ability of the swimmers to distribute the load in the raft. Part of the slide loading (using approximately 1/2 of the dummy crew members) should be conducted with the ship headed 180 degrees to wind. Then, the ship should be slowly brought about to 90 degrees to the wind direction for completion of the loading.
9. The loaded raft should be detached from the slide and allowed to drift under surveillance for approximately 1/2 hour to 1 hour. Raft response to sea conditions should be observed and noted.
10. After the raft is detached the slide should be deflated and hauled aboard the Voorhees. The retrieval operations should be observed and any significant difficulties should be noted.
11. Raft retrieval should then be accomplished by one of two methods:
    a. The swimmers would discharge water ballast from the dummy crewmen on the raft. The Coast Guard vessel would approach the raft and take aboard the swimmers and the raft.

b. The swimmers would attach a towing line to the raft and then board the Coast Guard vessel. The raft would be slowly towed to a protected harbor area for unloading and retrieval.

After the raft and slide are deflated and retrieved, both should be returned to the manufacturer for repacking and then replaced on the Voorhees for further tests.

Cold Weather Test

The objective for the cold weather test is to demonstrate the capability of the slide and raft to function as intended in a cold weather environment. The effect of the cold weather on raft occupants will be of particular interest. A further objective is to obtain data on operating parameters under cold weather conditions. Time to deploy, time to inflate, and relative rigidity of the slide are examples of parameters that are significant.

1. Weather conditions for the cold weather test should include light winds (up to 10 mph), light sea conditions (up to 3-foot waves), daylight hours and air temperatures from 0 to -20°F, and floating ice if available.
2. Vessel conditions should include:
   a. Minimum headway for vessel safety to be determined by the Captain
   b. Heading at 90 degrees to the wind direction.
3. A Coast Guard service vessel should be standing by. One swimmer equipped with a wet suit and a life line should be standing by on the service vessel.

4. A simulated ship emergency should be declared and preselected participants and Coast Guard test participants should assemble at the slide station.
5. The slide should be deployed by operating the release lever.
6. After the slide and raft are inflated, several participants equipped with life preservers and dressed in normal winter clothing or in exposure suits, should slide down the slide to the raft. At least one participant should be supplied with a two-way radio for communication with the Captain of the Voorhees and the Captain of the Coast Guard service vessel.
7. After the participants are in the raft, the raft should be released from the slide. The Coast Guard swimmer shall be the first to enter the raft.
8. After the slide is free from the raft it may be deflated and retrieved aboard the service vessel.
9. Participants in the raft should then transport the raft away from the Voorhees (using the paddles supplied in the raft) toward the Coast Guard service vessel.
10. The raft should lay off the Coast Guard service vessel for approximately two hours and checks should be made on drift rate, transport rate (using paddles), tendency toward sea sickness, and relative protection from the cold (if any) provided by the sides of the raft. Checks should also be

made on raft visibility from the Coast Guard service vessel particularly to discover if the raft light can be seen in daylight.

11. After two hours, but not more than four hours, the raft crewmen should attempt to approach the Coast Guard service vessel for boarding. Boarding should be accomplished by the safest means to be determined by the Commanding Officer of the Coast Guard service vessel.

12. The raft should then be retreived aboard the Coast Guard service vessel, deflated, and returned to the manufacturer along with the slide for repacking. Then both items should be replaced on the Voorhees for further testing.

Severe Weather Test -- manned

The purpose of the manned severe weather test is to determine the response of the slide and raft system to severe weather when used by crew members simulating a vessel casualty situation. The procedure described includes two well-equipped Coast Guard representatives to simulate crew members. At the Coast Guard's discretion, additional personnel may be used.

1. The weather conditions and vessel conditions for the manned severe weather test should be the same as listed previously for the unmanned severe weather test except the ship's heading should be at 90 degrees to the wind direction, wind should not exceed 50 miles per hour and the waves should not exceed 12 feet.

2. A Coast Guard service vessel should be standing by with two swimmers in wet suits equipped with face masks, inflatable life preservers and life lines.
3. Two Coast Guard swimmers in wet suits equipped with face masks and inflatable life preservers should be on board the Voorhees to simulate crewmen for this test.
4. A simulated ship emergency should be declared and the two simulated crew members plus observers should assemble at the slide station.
5. The slide should be deployed by operating the release lever.
6. After the slide and the rafts are fully inflated, if possible, the propeller on the Voorhees should be stopped.
7. The selected "crew members" should then slide down the slide. One crew member should be equipped with a portable radio for communications with the Voorhees and the Coast Guard service vessel.
8. After the two crew members are in the raft and the raft appears to be riding the waves satisfactorily, very slow forward propulsion of the Voorhees should be resumed and the raft should be detached from the slide.
9. The raft with crew members aboard should be allowed to drift under surveillance for approximately 1/2 hour to 1 hour. Raft response to sea conditions should be observed and noted.

10. The Coast Guard service vessel should approach the raft and retrieve the crew members. The raft can then either be brought aboard the Coast Guard vessel or towed back to the Coast Guard station for retrieval in calmer water.
11. The slide would be deflated and retrieved on board the Voorhees. Both items, slide and raft, would then be returned to the manufacturer for repackaging. If further testing is planned, both would then be returned to the Voorhees.

Severe Weather Test -- alternate method

The purpose of this test is to determine the response of the slide and raft system to severe weather when used by crew members simulating a vessel casualty situation. This method may be used in lieu of the manned and unmanned severe weather tests at the descretion of the U. S. Coast Guard.

1. The weather conditions and vessel conditions for this severe weather test should be the same as listed previously for the manned severe weather test. Wind should not exceed 50 miles per hour and the waves should not exceed 12 feet.
2. A Coast Guard service vessel should be standing by with two swimmers in wet suits equipped with face masks, inflatable life preservers and life lines.
3. Two Coast Guard swimmers in wet suits equipped with face masks and snap-on life lines with harness should be on board the Voorhees.

4. A simulated ship emergency should be declared and the participants assemble at the slide station.
5. The propeller on the Voorhees should be stopped.
6. The slide should be deployed by operating the release lever.
7. Dummy crew members approximately 180 pounds in weight should be loaded into the slide and allowed to descend. As soon as it can be determined that the slide raft system is secure and creates no safety hazard for those yet to enter the raft.
8. Two Coast Guard swimmers from the Voorhees followed by the selected "crew members" should then slide down the slide. One crew member should be equipped with a protable radio for communications with the Voorhees and the Coast Guard service vessel.
9. After the raft has its full compliment (dummy and selected crew members) and the raft appears to be riding the waves satisfactorily, the raft should be detached from the slide.
10. The raft with crew members aboard should be allowed to drift under surveillance for approximately 1/2 hour to 1 hour. Raft response to sea conditions should be observed and noted.
11. The Coast Guard service vessel should approach the raft and retrieve the crew members. The raft can then either be brought aboard the Coast Guard vessel or towed back

to the Coast Guard station for retrieval in calmer water.

12. The slide would be deflated and retrieved on board the Coast Guard service vessel or Voorhees. Both items, slide and raft, would then be returned to the manufacturer for repackaging. If further testing is planned, both would then be returned to the Voorhees.

5.2 Davit Launched Life Raft

There are five test activities in the total test plan for the davit launched raft system:

1. Pre-operational Inspection and Observations
2. Dockside or Functional System Check-out Tests
3. Severe Weather Test -- limited usage
4. Cold Weather Test
5. Severe Weather Test -- full usage

The sequence of the tests should be as listed above except Item 3 may be deleted at the descretion of the Coast Guard. Also, the dockside functional system check-out has apparently already been accomplished. In the event of questionable system response or inconclusive results, tests may be repeated if necessary.

Personnel Briefing

Prior to each test activity all personnel should be briefed on the test activities that are outlined.

Pre-operational Inspection

1. Inspect the access path for crewmen entering the boarding area for the raft. This path should be free of obstructions and provide handling space for raft inflation and positioning.
2. Inspect the storage provisions for the raft and the davit. Provisions should be made for easy access to the raft and davit in the event of an emergency. Also, the stowage should protect both items of equipment from adverse weather (wind, ice, snow, and waves).

3. Inspect the raft and its deployment initiation system to determine if there might be a reasonable chance of inadvertent inflation before the davit fall is attached to the lifting ring.

Dockside Functional Tests

Dockside functional tests have apparently already been carried out. It is expected that these tests will verify that the particular installation did not negate the design capabilities of the system. Information should be sought from the manufacturer on the results of the tests to assure:

1. The raft and davit will function as expected.
2. The installation is structurally sound and will support a full load crew.
3. Loaded raft retrieval can be accomplished by operation of the davit.
4. Recognition of any known or suspected hazards in operation of the system.

Severe Weather Test -- limited usage

The main objective of the limited usage severe weather test is to demonstrate that the raft and davit system will function as intended under severe weather conditions with minimum risk to personnel. Other objectives are to obtain data on operating parameters and to identify operational shortcomings if any.

Because the davit launched raft has been subjected to prior testing and usage and the raft design is similar to rafts now in use,

the limited usage severe weather test is aimed at obtaining confirming information on the davit handling system and identification of any potential for use in rescue operations. To obtain maximum use of resources, the limited usage test and the full usage test may be combined in sequence.

1. Weather conditions for the severe weather test should include winds from 30 to 50 mph and waves from 10 to 12 feet high, daylight hours, and moderate temperatures of 45 to 70 degrees.
2. Vessel conditions for the limited usage severe weather test should include:
   a. Minimum headway for vessel safety to be determined by the Captain.
   b. Heading at 90 degrees to wind direction with the wind blowing on board of the raft and davit. If raft and davit cannot be launched under this condition, the vessel may be headed into the wind.
3. A Coast Guard service vessel should be standing by. Two swimmers in wet suits equipped with face masks, inflatable life preservers, and life lines should be standing by on the service vessel.
4. One swimmer equipped as above should be standing by on the Frantz.
5. A simulated ship emergency should be declared and pre-selected crewmen and Coast Guard test participants should assemble at the davit launched raft station.

6. The davit and raft should be deployed and secured in loading position.
7. Two Coast Guard swimmers equipped with wet suits, face masks, and inflatable life preservers (simulating crewmen) should board the raft.
8. The raft should be released from the deck restraints, lowered to the water, and released from the davit fall.
9. Using the paddles in the raft, the crewmen should attempt maneuvering the raft away from the Frantz (approximately 50 yards) and then returning for retrieval.
10. The davit fall should be resecured to the raft and the raft with crewmen should be retrieved on board the Frantz.
11. After the raft is on board, it should be deflated, repackaged, and made ready for use in future tests.

Cold Weather Test

The objective of the cold weather test is to demonstrate the capability of the davit launched raft system to function as intended in cold weather and to obtain data on operating parameters.

1. Weather conditions for the cold weather test should include light winds (up to 10 mph) light sea conditions (up to 3-foot waves) broken floating ice if available, daylight hours, and air temperatures from 0 to -20°F.
2. Vessel conditions should include:
   a. Screw will not be turning.
   b. Heading is 90 degrees to the wind.

3. A Coast Guard service vessel should be standing by. Two swimmers equipped with wet suits and life lines should be standing by on the Frantz.
4. A simulated ship emergency should be declared and preselected crew members and Coast Guard test participants should assemble at the davit launched raft station.
5. The davit and raft should be deployed and made ready for boarding.
6. Swimmers and participants equipped with life preservers and dressed in normal winter clothing or in survival suits should board the raft. At least one participant should be equipped with a two-way radio for communication with the Captain of the Frantz and the Captain of the Coast Guard service vessel.
7. The raft should be released from the deck, lowered to the water, automatic release triggered and released from the davit fall.
8. After the raft is free of the Frantz, the raft shall be retrieved by use of fall on Frantz, raised to boat deck, any crew members disembarked, lowered to water and released a second time. The Frantz shall be free to proceed at this time.
9. The raft with Coast Guard participants and swimmers should lay off the Coast Guard service vessel for approximately 2 hours and checks should be made on drift rate, transport rate (using paddles), tendency toward sea sickness, and

relative protection from the cold provided by the raft. Checks should also be made on raft visibility from the Coast Guard service vessel. Operation of the lights on the raft should be checked.

10. After 2 hours, but not more than 4 hours, the raft crewmen should attempt to approach the Coast Guard service vessel for boarding. It may be necessary for the service vessel to approach the raft. Boarding may be accomplished by hoisting the entire raft aboard with crewmen inside. If desired, crewmen may board the service vessel by rope ladders to the deck after securing the raft alongside the service vessel. Then the raft may be hoisted aboard, deflated, and returned to the manufacturer for repacking.

Severe Weather Test -- full usage

The main objective of this test is to demonstrate the ability of the davit launched raft system to function as intended during severe weather conditions. Other objectives are to obtain data on operational parameters and identify any shortcomings of the system.

1. The weather conditions and vessel conditions for this test should be the same as listed previously for the limited usage severe weather test, winds from 30 to 50 mph, waves 10 to 12 feet, and moderate temperatures from 45 to 70 degrees.
2. A Coast Guard service vessel should be standing by. Two swimmers in wet suits equipped with face masks, harness and life lines will be on the Frantz.

3. At the Coast Guard's and owner's descretion, additional participants up to a total of 25 may be designated for this test. All should be equipped with life preservers and dressed according to the weather conditions.
4. A simulated ship emergency should be declared and the selected crew members, participants and observers should assemble at the davit launched raft station.
5. The davit and raft should be deployed by the ship's crew and secured for boarding the raft. A two-way radio communication set should be taken aboard. Also, a light tow line (100 feet) with a small float on one end should be taken aboard the raft as an emergency measure.
6. The raft and participants should be lowered from the Frantz and released from the davit fall.
7. After the raft has drifted from the Frantz and floated free, participants will attempt to paddle to the Frantz for retrieval. Relaunch shall be without crew members.
8. The participants may be removed from the raft by securing the raft alongside and climbing a boarding ladder to the deck of the service vessel. Alternatively the entire raft with crewmen inside may be hoisted aboard the service vessel.
9. As an alternative procedure, the raft may be towed using the towline to the Coast Guard station and protected waters for removal of the crewmen from the raft.

10. After the participants are retrieved and the raft is aboard the service vessel, the raft should be deflated and returned to the manufacturer for repacking and reuse.

5.3 Brucker Capsule

There are five test activities in the total test plan for the Brucker Capsule:

1. Pre-operational Inspection and Observations
2. Dockside or Functional System Check-out Tests
3. Severe Weather Test -- limited usage
4. Cold Weather Test
5. Severe Weather Test -- full usage

The sequence of the tests should be as listed above except that Item 3 may be deleted at the descretion of the Coast Guard.

Personnel Briefing

Prior to each test activity all personnel should be briefed on the test activities that are outlined.

Pre-operational Inspection

1. A general inspection should be carried out of the installation of the Brucker Capsule on the vessel.
2. The access path for crewmen entering the capsule should be examined to determine that adequate space is available and that protection is provided against the possibility of a crewman falling overboard.

3. The method of securing the capsule to the launch platform and the launch platform to the ship should be examined for consideration of any apparent structural inadequacy. The possible motions of the capsule in response to ship motions should be considered.

4. The interior accessories of the capsule should be examined to assure that all expected accessories and required supplies for capsule operation are in place.

Dockside Functional Tests

It is expected that dockside functional tests will be performed by the manufacturers. These tests should demonstrate adequacy with respect to:

1. Capsule retention and release and retrieval
2. Capsule power operation
3. Capsule and launch platform structural integrity under full crew loading

Coast Guard activities during the dockside functional tests should include observation of the tests and recording of the events and the results. Any aspects of the operation that appear to be precursors of difficulty under adverse weather conditions should be recorded.

Severe Weather Test -- limited usage

The main objective of the limited usage severe weather test is to demonstrate that the capsule and lowering mechanism will function as intended under severe weather conditions with minimum risk to personnel. Also, because the capsule is equipped with a propulsion system,

a further objective is to demonstrate the potential usefulness of the capsule as a rescue vessel. Further objectives are to obtain information on operating parameters and to identify any potential shortcomings of the system. Because the capsule and associated lowering mechanism has been in field use, to obtain maximum use of resources the limited usage test and the full usage test may be combined in sequence.

1. Weather conditions for the severe weather test should include winds from 30 to 50 mph and waves from 10 to 12 feet high, daylight hours, and moderate temperatures of 45 to 70 degrees.
2. Vessel conditions for this test should include:
   a. Minimum headway for vessel safety to be determined by the Captain
   b. Vessel heading such that wind is blowing on board the capsule. If the capsule is located on the stern, the wind should be astern if possible. If not, the wind should be at 90^{o} to the vessel.
3. A Coast Guard service vessel should be standing by. Two swimmers in wet suits equipped with face masks, inflatable life preservers, and life lines should be standing by on the service vessel.
4. One swimmer equipped as above should be standing by on the test vessel.
5. A simulated ship emergency should be declared and pre-selected crewmen and Coast Guard test participants should assemble at the capsule station.

6. The capsule doors should be opened and prepared for loading.
7. Two Coast Guard personnel equipped with wet suits and inflatable life preservers as simulated crewmen should board the capsule and prepare it for lowering.
8. The capsule should be released from the platform and then lowered to the water and released.
9. After the capsule is on the water, the propulsion system should be started and the capsule should be maneuvered away from the ship approximately 100 yards on a simulated rescue mission.
10. The capsule should be returned to the vicinity of the ship and the lifting cable should be resecured to the capsule.
11. The capsule with crewmen inside should be retrieved by the ship to its normal stowed location and the crewmen should return to the ship's deck.

Cold Weather Test

The objectives of this test are to demonstrate the functioning of the Brucker Capsule system under cold weather conditions, obtain data on operating parameters, and identify any shortcomings of the system in a cold weather environment.

1. Weather conditions for the cold weather test should include light winds (up to 10 mph) light sea conditions (up to 3-foot waves) broken floating ice if available, daylight hours, and air temperatures from 0 to -20°F.

2. Vessel conditions should include:
   a. Minimum headway for vessel safety to be determined by the Captain.
   b. Heading into the wind.
3. A Coast Guard service vessel should be standing by. One swimmer equipped with a survival suit and a life line should be standing by on the service vessel.
4. A simulated ship emergency should be declared and pre-selected crew members and Coast Guard test participants should assemble at the capsule station.
5. Two or three crew members equipped with life preservers and dressed in normal winter clothing or in survival suits should board the capsule. At least one crew member should be equipped with a two-way radio for communication with the Captain of the test vessel and the Captain of the Coast Guard service vessel.
6. The capsule should be released from the platform, lowered to the water, and released from the hoist fall.
7. After the capsule is free of the test vessel, the test vessel should proceed on course.
8. The capsule should lay off the Coast Guard service vessel for approximately 2 hours and checks should be made on drift rate, transport rate (using the engine), tendency toward sea sickness, and relative protection from the cold provided by the capsule. Checks should also be made on

capsule visibility from the Coast Guard service vessel. Operation of the lights on the capsule should be checked.

9. After 2 hours but not more than 4 hours, the capsule crewmen should attempt to approach the Coast Guard service vessel for boarding. It may be necessary for the service vessel to approach the capsule. Boarding may be accomplished by hoisting the capsule aboard with crewmen inside. If desired, crewmen may board the service vessel by rope ladders to the deck after securing the capsule alongside the service vessel. If necessary, the capsule may be towed to the Coast Guard station and later returned to the test vessel.

Severe Weather Test -- full usage

The main objective of the full-usage severe weather test is to demonstrate the ability of the Brucker Capsule system to function as intended during severe weather conditions. Other objectives are to obtain data on operational parameters and identify any potential shortcomings of the system.

1. The weather conditions and vessel conditions for the manned severe weather test should be the same as listed previously for the limited usage severe weather test; wind 30 to 50 mph and waves 10 to 12 feet. Air temperature should be 45 to 70 degrees.
2. A Coast Guard service vessel should be standing by with two swimmers in wet suits equipped with face masks, inflatable life preservers and life lines.

3. Two Coast Guard swimmers equipped as above except without life lines should be on board the test vessel to simulate crewmen for this test. At the Coast Guard's discretion, additional crewmen, up to a total of 28, may be designated for participation in this test. All should be equipped with life preservers and dressed according to the weather conditions.
4. A simulated ship emergency should be declared and the selected crew members plus observers should assemble at the capsule station.
5. The selected crewmen should board the capsule. A two-way radio communication set should be taken aboard. Also, a light tow line (100 feet) with a small float on one end should be taken aboard the capsule as an emergency measure.
6. The capsule and the crewmen should be released from the platform and lowered to the water. The hoist fall should be released from the capsule.
7. The capsule with crewmen aboard should be allowed to drift for approximately one to two hours. Then the propulsion system should be started and the capsule should approach the Coast Guard service vessel for retrieval.
8. The crewmen may be removed from the capsule by securing the capsule alongside and climbing a boarding ladder to the deck. Alternatively, the capsule with crewmen inside may be hoisted aboard the service vessel.

9. As an alternative procedure, the capsule may be towed using the towline to the Coast Guard station and protected waters for removal of the crewmen from the capsule.
10. After the crewmen are retrieved, the capsule should be returned to the test vessel.

5.4 Davit Launched Lifeboat

Pre-operational Inspection

1. Inspect lifeboat and davits to assure that the system is in its normal, stowed-at-sea condition.
2. Inspect the system for general structural integrity. Any deficiency shall be brought up to Coast Guard standards prior to test.

Operational Test

1. Weather conditions for this test should compare to the cold weather test for the other systems being evaluated. Force 3 condition (i.e., 3-foot seas and 7 to 10 knot winds) in daylight hours with air temperatures of 0 to $-22^{\circ}F$, and floating ice, should be included if possible.
2. Vessel condition should include:
   a. Minimum headway for vessel safety to be determined by the Captain.
   b. Heading 90 degrees to the wind.
3. A Coast Guard service vessel standing by. One swimmer equipped with an exposure suit and a life line should be standing by on service vessel.

4. A simulated ship emergency should be declared and persons assigned to designated lifeboat should assemble at lifeboat station.
5. Lifeboat should be deployed and made ready for boarding.
6. A number of persons equal to those entering the other survival systems being tested shall board the lifeboat. A two-way radio for communication with Captain of the vessel and Captain of Coast Guard service vessel shall be provided. All persons entering the lifeboat shall be wearing an exposure suit with normal, on deck, work clothes underneath.
7. The lifeboat should be lowered and released from the davit falls.
8. The lifeboat shall maneuver away from the ship using the means of propulsion provided. The lifeboat shall remain apart from the ship for one hour. Persons on board shall remove survival suits and don life preservers for this period.
9. Persons shall remove life preservers and don survival suits just prior to hooking the lifeboat to the falls. The lifeboat shall then be raised to the boat deck. Persons shall either remain aboard lifeboat while being hoisted or reboard the ship by climbing the ladder.
10. After all are safely out of the lifeboat, it shall be secured in its normal, stowed-at-sea condition.

6.0 DESCRIPTION OF ACTUAL TESTS

6.1 Inflatable Ship Abandonment Slide

The inflatable ship abandonment slide was installed on the stern of the Great Lakes Ore Carrier, Enders M. Voorhees, and underwent an installation test shortly thereafter. After deployment of the slide, all guidelines were adjusted to assure correct stability for an at-sea deployment. During the inflation, two of the four aspirator hoses came loose and a minor modification was made to the attachment. Even with two hoses inoperative, the slide inflated to full pressure providing a functional slide.

The raft has an inflation system independent of the slide which appeared to function as designed.

Severe Weather Test

A version of the alternate method for the severe weather test was used. The test was conducted in Whitefish Bay (southeast end of Lake Superior) in 40 mph winds and a snow squall. The seas were estimated to be in the neighborhood of 6 to 8 feet with a few swells reaching 12 feet. We chose to launch the slide into the wind as we thought this to be the worst condition. As can be seen from the data sheets and observers' remarks, the deployment went smoothly except for the inflation and positioning of the raft. After inflation of the slide, the raft began to inflate but due to its surface area, the raft was blown up onto the slide. As the raft was blown up onto the chute, the lower bladder bacame crimped, thus forcing all entering gas to be vented since the full volume of the bladder was blocked off.

Not wanting to take any unnecessary risk, it was decided to bring the bow of the ship into the wind, thus providing a lee for the slide-raft combination. As the ship was coming about, the side forces acting on the slide caused the slide and raft to lift approximately 20 to 25 feet into the air. In addition, the outrigger on the windward side used for guideline attachment was bent into a shape closely resembling a pretzel.

Once around, the slide-raft combination was found to be sound, although only one of the two bladders on the raft was inflated.

Two sand bags were used as dummy crew members which successfully slid down the chute and into the raft. Immediately thereafter, four persons entered the raft without any difficulty. It was at this point that it was decided not to allow any more persons into the raft because the lower bladder was not fully inflated and we suspected the upper bladder was losing air slowly.

The plan at this point was to tie a line to the bottom of the slide and the raft, drift or paddle towards the service vessel and retrieve a line from them. This would enable us to use the raft as a shuttle boat to remove the remaining participants from the Voorhees and recover the slide after it was released.

As soon as the line was made fast and the raft released, the raft, having a slower drift rate than the Voorhees and being on the lee side, began to drift under the fantail of the Voorhees. Attempts to control the raft by the paddle were unsuccessful as they offer very little, if any, assistance. The line that was secured to the end of

the slide was used to pull the raft clear of the Voorhees rudder and propeller. The vessel then moved ahead at a slow speed until the raft was clear.

Once clear of the ship and the slide, the service vessel attempted a few passes to get a line to the raft. This would not have been a problem except for the line in the raft becoming tangled, not allowing the raft to be free of the slide. After the tangled lines were cut, all four participants in the raft were safely brought aboard the service vessel. The slide was then released from the ship and brought on board the service vessel for transportation to shore and repacking.

See Section 7.1 of this report for pertinent comments regarding the severe weather test.

Cold Weather Test

Reserved for future use

6.2 Davit Launched Life Raft

The installation of the davit launched inflatable life raft was accomplished by removal of the port after davit arm from a lifeboat davit installation on the Joseph H. Frantz. A 1 1/4 inch base plate was then attached to the aft davit arm base. A further strengthening was accomplished by welding clips to doublers on the deck. The davit was subsequently bolted to the new base plate.

The new installation was then tested by inflating the raft and loading 4600 pounds of sand bags in the raft, which is the same weight test required for davit launched lifeboats (110% of total weight of persons and equipment). The raft was then lowered over the side in

conjunction with the testing of the brake by intermittently releasing and engaging the brake as the raft was lowered. There was no deformation or structural defect noted during this test. When the raft was three feet above the water, two persons entered the raft, the hook trip lanyard pulled and the brake released. This simulated the drop test which could not be performed in accordance with the regulations for davit launched lifeboats due to the different type of release mechanism.

The functional test was conducted in the vicinity of the Cleveland Intake Crib, Cleveland, Ohio. A lifeboat drill was called and all off-watch personnel of the Frantz were directed to the lifeboat station. A step-by-step explanation was given to the crew as the preparation and launch was being carried out. A verbatim transcript of that explanation appears in Appendix B of this report.

The raft was lowered and raised three times. The first two times with four persons on board and the last time with eight persons on board. The automatic release was tripped twice with good results. The one time it was attached was to observe the difficulty involved in a retrieval operation. No difficulty was observed. The raft with occupants was allowed to drift for one hour before being retrieved by the Coast Guard service vessel.

Severe Weather Test

The test plan followed was the severe weather test -- full usage -- described previously in this report (Section 5.2). The test was conducted on November 2, 1973, in Lake Michigan. The weather conditions

were not what we needed to run a test which could give us conclusive results. The test will have to be run again, although there was much to be learned about this system, even though the weather was relatively calm.

The test began with the sounding of the abandon ship alarm after which all members of the crew not on watch reported to the lifeboat station to prepare the raft for launch.

After the first two crewmen arrived at the station, the raft was removed from the metal storage shed on deck and located beneath the davit arm by the side of the ship. The two bowsing lines were attached to the cleats provided nearby and the red tab was pulled from the valise in order to locate the ring. Another crewman was removing the release hook from the davit arm and swinging the arm to a point directly over the raft. The release hook was then attached to the ring on the raft but only after a little difficulty in assuring that the release hook had been positively latched. Without a secure closing, the raft could fall free of the fall once unsupported. The fall was then brought in, raising the raft in an effort to bring tension on the two bowsing lines which would then activate the inflation mechanism.

It was found at this point that the bowsing lines had been tied, leaving too much slack between the cleats and the raft. For this reason, the fall was raised to its limit without the bowsing lines becoming taught. One crewman then pulled down on the raft which activated the inflation system.

As the raft inflated, it became apparent that the bowsing lines had been secured in a reverse manner, as the raft could not swing outboard freely upon inflation. One crewman then reversed the bowsing lines and the raft swung outboard to its boarding location.

Two men entered the raft and the brake handle was released to begin lowering the raft to the water. As lowering began, the failure of the crew to release the bowsing lines caused the raft to turn on its side. The brake was engaged, bowsing lines released and lowering continued.

The raft was then cranked up to the boarding deck, the remaining participants boarded the raft and the raft was lowered, this time tripping the release hook. The raft was set free upon impact with the water, allowed to drift for a while and then retrieved by the Coast Guard service vessel.

Cold Weather Test

Reserved for future use

6.3 Brucker Capsule

Reserved for future use

6.4 Davit Launched Lifeboat

General

There were two types of davit launched lifeboat systems tested as of the writing of this report.

The first was a radial davit launched lifeboat having rope falls without a winch to aid in the lowering process. The second was a mechanical davit launched lifeboat with a winch and wire falls.

The tests were conducted under severe weather test conditions, although the test plan calls for the same conditions required for the cold weather test. The Coast Guard felt, however, that more was to be learned by exercising the system in severe weather rather than cold.

The test consisted of sounding the ship's abandon ship alarm and noting times involved as the ship's crew proceeded to launch a lifeboat. There was no instruction given to the crew beforehand or during the launching, as the system being used is standard ship's equipment and the crew had been trained previously as part of the licensing procedure.

The crew members involved were the same ones used for the severe weather test of the escape system installed on their particular vessel. The running account of the test by two observers, as well as times of pertinent events in the preparation and launch operation, are a part of Appendix A.

Since the purpose of this test was only to obtain comparative times for the vessel's escape system and the test installation, this report will not go into detail regarding the description of the test.

Remarks which are considered pertinent are summarized in Section 7.4 of this report.

7.0 SUMMARY OR RESULTS

7.1 Inflatable Ship Abandonment Slide

Pre-operational and Functional Tests and Observations

1. An "A-Frame" had to be added at the last minute so there would be a means of raising the canister into location on the fantail of the ship. Because the canister is supported off center, some sort of hoisting rig is necessary for installation of the canister.
2. With the slide at its worst angle of incline (ship fully loaded) the slide could provide a walk way or crawl way for abandoning the ship quickly.
3. The type of clothing worn by those persons using the slide and the actual angle of inclination of the slide have a bearing upon how much surface area must be provided at the bottom of the slide for collection of those coming off the slide. The particular raft used was found to be a little short, in that one man almost went off the end of the after sliding down in a nylon exposure suit.
4. The ship does not provide a sufficient free surface area to retrieve the slide for repacking.
5. An improvement on the aspirator hose connection may be needed unless there is enough redundancy provided to accept 50% loss of functional aspirators.

Severe Weather Test

1. Using the ship's crew for deployment, the total time involved from abandon ship alarm to detachment of raft

from vessel, assuming 25 men in raft, would be 2 minutes, 42.5 seconds based on the times recorded by observer no. 1.

2. A better means of detaching the raft from the slide is necessary. In rough seas, the relative motion of the slide and the raft make it difficult to insert your hand down between the slide and raft to pull the release cord.
3. Unless the slide is restrained to the point where it cannot be lifted off the surface of the water by side winds, a ship's survival system will require more than one of the slides so one will always be available for use on a lee side or directly into the weather.
4. The slide alone appears to be a sound concept for rapid removal of persons from the deck of a burdened vessel. The raft used during the test offers no protection from the weather and unless used in conjunction with a rescue boat, has no effective means of getting away from the ship. Minor modifications appear to be all that is necessary to circumvent these problems.
5. Only one man is necessary to operate the system. A lever has to be pulled to activate the system and then a release cord has to be pulled to release the raft from the slide after all are on board.
6. There is no necessity to leave anyone on board the burdened vessel to operate the system who would then have to be provided with another means of escape for himself.

7. A means must be provided to assure that the raft or platform at the bottom of the slide does not blow back onto the slide.
8. Attachments should be considered for raft equipment other than lines which end up on the floor of the raft and can get entangled.

Cold Weather Test

Reserved for future use

7.2 Davit Launched Life Raft

Pre-operational and Functional Tests and Observations

1. A means should be provided to assure a positive closure of the release hook.
2. A better means should be provided to assure the bowsing lines are properly attached to the cleats, right line to right cleat.

Severe Weather Test

1. Better identification is needed on the outside of the valise indicating which side is to be outboard.
2. Consideration should be given to using only one bowsing line so that raft can swing freely upon inflation. This will circumvent the problem of assuring that bowsing lines have been secured in correct sequence.
3. Bowsing lines should have a loop on the end giving a predetermined length to the bowsing line. This will avoid

the problem of the line not becoming taught so the inflation system would activate. In conjunction with this, there will have to be an arrangement drawing giving the specified position of the cleat(s) dependent on the length of the bowsing line.

4. A method of releasing the brake handle from inside the raft should be incorporated in the design.
5. A means of releasing the bowsing lines from inside the raft should be incorporated, especially if the raft is modified to allow lowering from the raft.
6. Even with the mistakes made by the crew in launching, due to lack of familiarization with the system, the time involved from the abandon ship alarm to a full 25 man raft being released from the vessel, is approximately 6 minutes.
7. Consideration should be given to having a quick return for the fall so that one davit can be used for multi-deployments. No single launching should take more than the 6 minutes.
8. This raft has a canopy, however, an easier method of closing up the canopy should be provided.

Cold Weather Test

Reserved for future use

7.3 Brucker Capsule

Reserved for future use

7.4 Davit Launched Lifeboat

Mechanical Davit (Enders M. Voorhees)

1. This installation consists of a 25-man lifeboat supported by wire falls and assisted by a power winch.
2. Work began preparing the lifeboat for launch as soon as the first man arrived, however, as many as seven men were working to remove the boat cover at one time.
3. This operation requires that one man remain on board to launch the boat.
4. As the boat was being lowered, it swung freely. If the vessel had been side to the sea, the rolling of the vessel would have caused even more of a swing, to the point where the boat could slam against the side of the vessel.
5. Using a compliment of 25 persons and a descent rate of 120 feet/minute, which is the maximum allowable rate, the total time involved to get the lifeboat released from the ship was 10 minutes and 20 seconds. Actual time would be somewhat more than this due to slower descent rate.

Radial Davit (Joseph H. Frantz)

1. This installation consists of a 25-man lifeboat supported by rope falls without any assistance being provided by a power winch.
2. Work began preparing the lifeboat for launch as soon as the first man arrived, however, as many as ten men were working at one time to remove the boat cover.
3. This operation requires at least two men, but more likely

four men remain on deck to launch the lifeboat.

4. The two falls are not interconnected, thus making the rate of descent for the bow and stern of the lifeboat the same, is very unlikely. A potential tipping of the boat during launching appears to be high.
5. It is necessary to place an oar between the falls just above the block so as to prevent the block from twisting or jamming during the lowering.
6. Using a compliment of 25 persons and a descent rate of 80 feet/minute, which is considered average for a manual rope fall launch, the total time involved to get the lifeboat released from the ship is 12 minutes and 45 seconds.

8.0 RECOMMENDATIONS

1. Continue with test program to determine if there are any difficulties arising from the use of a slide, davit launched rigid craft or davit launched inflatable craft in a cold weather situation.
2. Entertain submissions of inflatable slide and davit launched inflatable raft installations as equivalents on an individual basis. Any plan review process should consider incorporation of those improvements to the test systems alluded to in Section 7 of this report.
3. Specifications or guidelines should be drafted covering the two systems evaluated to date. Standards presently governing similar items of equipment should be applied where appropriate for sake of uniformity. Standards should be performance, not construction specifications.
4. Data obtained during this testing series should be evaluated using the Graphical Evaluation and Review Technique (GERT) program developed as part of a report titled, "Assessment of the Requirements for Survival on the Great Lakes."

APPENDIX A

OBSERVERS REPORTS AND DATA SHEETS

APPENDIX A

OBSERVERS REPORTS AND DATA SHEETS

Observer No. 1 - Lifeboat Test (Enders M. Voorhees)

Sea state is four to six feet, winds are gusting from 32 to 44 knots from the Northwest. The drill is being held in White Fish Bay just north of Saulte Ste. Marie, Michigan. Emergency alarm (whistle) (0 minutes, 0 seconds) is sounding. First guy to arrive (1 minute, 8 seconds). Two men have arrived (1 minute, 8 seconds), one man is working on the boat trying to untie the cover. First two men arrive, quickly three more in here right now. We have three men working on the cover now. Seven men working on the boat cover. Two more just arrived, that makes nine men, the boat cover is off. Wooden supports have just been removed from the lifeboat. Two men ready to swing the boat out. Having a little bit of trouble with the last turnbuckle. The boat is now being cranked outboard. Painter is swung up forward and tied in position. Ladder is being made ready for boarding lifeboat. Boat is almost outboard. Boat is outboard and is now being lowered, ready for boarding. Boat is now lowered to the boat deck (4 minutes, 15 seconds).

This boat has wire falls, the Frantz had rope falls. Because it has wire falls, it has a winch and is lowering the amount of time considerably. Part of the man ropes got caught. The wind just brings the man rope around the pulley. There should really be two men in the boat. They will be holding the man rope and that would not be a problem anymore. Boat is about half way down (6 minutes, 10 seconds).

That will be the timing for it. Get timing off of the tape for the entire drill. The man rope held them up for about 30 or 45 seconds, but apparently the wire fall makes a considerable difference, even for retrieving it does not involve 15 men on each line, it only involves two or three men on a hand crank and an air hammer could have been used to retrieve the boat as well. Waterfalls make all the difference in the world.

Getting ready for the slide test now, the Captain is bringing the ship around with the stern into the wind. Again the seas are running about 4 feet, occasional 6 footer. The winds are at 32 to 40 knots with occasional gusts of 45 knots out of the Northwest.

A-3

Lifeboat
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph)	Gusts - 40 mph
Air Temperature	
Water Temperature	
Sea State	4 to 6 feet
Visibility	Poor

TEST IDENTIFICATION:

Vessel	Enders M. Voorhees
Test Location	White Fish Bay
Date	
Freeboard of Vessel	41 feet

EVENT	TIME (24 HR CLOCK)	REMARKS
Abandon Ship Alarm Sounds	0 0	
First Man (Crewman) Arrives At Test Boat Station	1 08	
Second Man (Crewman) Arrives At Test Boat Station	1 08	
Time At Which Work Began In Activating System	1 08	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	4 15	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	4 45	Indicate How Many Persons On Board Survival System (2) Lowering speed was 40 feet/min. loaded (1) man every 15 seconds, used required lowering speed, freeboard of vessel and time to halfway down side of vessel.
Time At Which Survival System Is Separated From Vessel	5 45 (This takes into account lost time due to man rope hang-up)	

Observer No. 1

Signature of Observer

Observer No. 1 - Slide

Getting ready to pull the lever now. Four, three, two, one, cotter pin is pulled, she's inflating. The raft is pulled back up on top, but the raft is inflating. She is inflated, she's being pulled back in, we'll have to check it out. Raft is inflated though. Slide is inflated, there is something to get down on. The whole thing inflated in about 4 1/2 seconds. Bottom chamber of the raft apparently got crimped a little bit and did not inflate completely because of the wind, however, this still appears to be seaworthy if you get the people into it. The raft itself was flipped back on top of the slide, the slide is out there completely inflated. None of the aspirators broke, appears to have worked pretty well. Right now we're coming around, there is no sense putting people into the water with the stern to the wind. So we're coming about to the wind to see what happens. Starboard outrig has bent all the way around, 90 degrees to the wind, took care of it. Apparently you can't get 90 degrees to the wind and its only about 34 or 35 knots right now. Pretty stiff wind.

There is nobody in the slide or the raft coming about now. Slide and raft combination is blown up in the air about 10 feet up, from the wind. Still holding on now. Coming about, bow into the wind now. The raft-slide combination is coming up about 25 feet in the air, from the wind. Right now we've got the bow into the wind, again the lower bladder of the raft is not inflated whatsoever, we only have one bladder inflated so we have half the buoyancy. Stand out pretty well, one of the outriggers is completely bent around so that it is of no use

whatsoever, holding it stable. But the other one is holding it pretty well.

Dropping the sand bags down now. The second sand bag going down now. It made it all of the way in. Apparently we are stable enough. There goes the first man down. Jack Deck went down. All right, first man down. Second man is in. Trying to get rid of the sand bags right now. The wind is pulling up a little bit throwing that raft around.

Slide
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) 40 mph - Gusts
Air Temperature
Water Temperature
Sea State 6 to 8 feet
Visibility Poor

TEST IDENTIFICATION:

Vessel Enders M. Voorhees
Test Location White Fish Bay
Date
Freeboard of Vessel 41 feet

EVENT	TIME (24 HR CLOCK) Minutes & Seconds		REMARKS
Abandon Ship Alarm Sounds	0	0	
First Man (Crewman) Arrives At Test Boat Station	1	08	
Second Man (Crewman) Arrives At Test Boat Station	1	08	
Time At Which Work Began In Activating System	1	08	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	1	12.5	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	1	24.5	Indicate How Many Persons On Board Survival System (4) (1) person down every 3 seconds
Time At Which Survival System Is Separated From Vessel	1	39.5	takes 15 seconds to release raft from slide

Observer No.1
Signature of Observer

Observer No. 2 - Lifeboat Test (Enders M. Voorhees)

Okay, the weather is not exactly what most people wanted. Winds gusting up to 40 miles an hour. Seas pretty nice and rough. Crew getting ready. Seas are estimated at 4 to 6 feet, white caps on the top. Signal sounds at 14 minutes, 20 seconds. Okay, 14 minutes, 30 seconds. And we are underway, winds blowing nice and briskly.

All crew members from forward on port side walking aft. Okay, 15 minutes, 20 seconds. 15:25, two crewmen are aft on the boat deck. One crewman has started to take the stowage cover off the port lifeboat. Coast Guard cutter is standing by. Second crewman has started to take off the cover, third crewman taking off the cover. Time 15:55. There are now three crewmen working on the boat cover, four crewmen on the boat cover, five crewmen removing the stowed boat cover. It is now 16:10. The lifeboat cover has been removed. The stowage brackets have been removed, two, four, six, ten crewmen on the boat, they are releasing the tie down shackles. 16:25 they are pulling the Jacobs ladder out of the boat, the boat has been released. One turn buckle on one turn buckle still off. Time 16 minutes, 40 seconds. They are now releasing the second turn buckle. One crewman is standing by *each of the slewing winches.* Second turn buckle has been released. The Jacobs ladder is only attached at one point. Okay, they are slewing out the lifeboat, 17 minutes, 17 seconds. Okay, two crewmen are hanging onto the Jacobs ladder and they figures out that it's not working. Two crewmen on each of the screws, slewing out the lifeboat. 17 minutes, 40 seconds. Okay, the Jacobs ladder has now been fastened to the loose

point. Two crewmen are on each winch, Jacobs ladder is in position. The boat is slewed out in the air but not completely slewed out forward, there is only one man working forward and two men working aft. Time 17:50, the after side is completely slewed out, the forward side is still screwing. 18 minutes past the hour. Okay, stop for the forward section.

Okay, they are releasing the brake on the gravity drop, brake has been released, nice and windy cold, they just released the pony brake and down goes the boat. 18 minutes, 20 seconds. The boat is dropping,the boat is lowering, the brake is in release and the boat is lowering. The keel is below the deck level, the boat is still going down. 18:33. Okay, the boat has now become at deck level. This boat is wire falls, both falls leaving to a center brake drum arrangement. There is a winch, actually two winch drums here, both sides lead to one point. A monckey line got caught on the forward hook. Now this type of boat goes down uniformly.

Okay, now the boat is now well below the deck level about a foot and a half and there are two men standing. Time 20:30, halfway down at this point. The davits on this side of the boat are vertical arms that pull out and is a gear screw it looks like, that let her go over the side. Wind is blowing very stiffly, very stiffly. They are cranking up the lifeboat, it is a much better system than on the Frantz, particularly when the boat lowers.

The boat is now back at deck level and they are still cranking away. Okay, the boat is coming up. 22 minutes past the hour. 22 minutes and 40 seconds. The boat has been cranked up fully and now they are

screwing it back up onto the ship. 24 minutes, 25 seconds, the crew is now fixing the cover support setting in the braces and now grabbing the cover and bringing it up. 25 minutes, 10 seconds past the hour.

A-10

Lifeboat
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) Gusts - 40 mph
Air Temperature
Water Temperature
Sea State 4 to 6 feet
Visibility Poor

TEST IDENTIFICATION:

Vessel Enders M. Voorhees
Test Location White Fish Bay
Date
Freeboard of Vessel

EVENT	TIME (24 HR CLOCK) Minutes & Seconds		REMARKS
Abandon Ship Alarm Sounds	0	0	
First Man (Crewman) Arrives At Test Boat Station	1	05	
Second Man (Crewman) Arrives At Test Boat Station	1	05	
Time At Which Work Began In Activating System	1	05	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	4	13	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	4	43	Indicate How Many Persons On Board Survival System (2) Loaded 1 man every 15 seconds Lowering speed was 40 feet/min.
(Estimated) Time At Which Survival System Is Separated From Vessel	5 (This takes into account lost time due to man rope hang-up.)	43	used required lowering speed, freeboard of vessel and time to halfway down side of vessel

Observer No. 2
Signature of Observer

Observer No. 2 - Slide

There is one man and he is pulling the cord. It's a success. The raft is released, the raft is inflating. There she goes, the raft is inflating. The raft is inflated, but she's blown up into the slide. She's down into the water. She's in the slide. Now we have some dummies who are suppose to go down. The wind has got the life raft itself blown up to the slide. The slide was a beautiful inflation. The wind is very stiff and blowing pretty strong, blowing right at us now. The slide is holding very nicely but the wind is blowing the raft up against the ship. Waiting for the decision. There are a bunch of people standing on the platform. We are directly into the wind, the stern is to the wind and we are taking it pretty good. The raft is still doubled over, the slide is staying aft pretty much, she's standing in her position. Imagine if somebody were to go down there she might get the raft down, however, the raft is wobbling. If the wind shifts, the raft will sit down right.

Now we are 90 degrees to the wind, the slide and raft have been picked up and the bottom of the slide is flapping 15 feet off the water. Camera crew should be getting some pretty good pictures out of this. This wind is really picking up both the slide and the raft and the guideline is pretty tight up here on the boat deck where she is fastened. The raft and the slide are really floating up there nicely. She's floating up high. The bottom bladder of the raft is definitely deflated; hardly any air to speak of in it. She looks pretty good; it's still kind of bad, we are still taking winds about 90 degrees.

Winds 25 miles an hour; gusts to 30. Okay, the wind is almost on the bow, we are about now 180 degrees to the wind. Something is going down the slide very nicely, the raft is laying flat. We are into the wind directly.

There goes our first man down the slide. Second man going down, what a nice slide, second man is down and in the raft.

A-13

Slide
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) Gusts - 40 mph
Air Temperature
Water Temperature
Sea State 6 to 8 feet
Visibility Poor

TEST IDENTIFICATION:

Vessel Enders M. Voorhees
Test Location White Fish Bay
Date
Freeboard of Vessel 41 feet

EVENT	TIME (24 HR CLOCK) Minutes & Seconds		REMARKS
Abandon Ship Alarm Sounds	0	0	
First Man (Crewman) Arrives At Test Boat Station	1	05	
Second Man (Crewman) Arrives At Test Boat Station	1	05	
Time At Which Work Began In Activating System	1	05	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	1	09.5	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	1	21.5	Indicate How Many Persons On Board Survival System (4) (1) person down every 3 seconds
Time At Which Survival System Is Separated From Vessel	1	36.5	Takes 15 seconds to release raft from slide

Observer No. 2

Signature of Observer

Observer No. 1 - Lifeboat (Joseph Frantz)

Separation starting time -- two are being prepared and the other one is coming in. Like the medium rain, light rain, whatever you like to call it, coming down. Seas are what some call calm, not really much white cap, breaking is what you would call about 1 or 1 1/2 foot. Seas a little bit rolling; chap two is getting prepared the skip is off too. The engine is turned off for the safety of the operation. A bit of a chop out there. Winds are 15 miles an hour, nothing really bad. I'm back on the boat deck, all quiet? Boat deck is clean. The like raft is presently stowed in the steel container of on the deck. The lifeboat is presently secured, cover on. Everything seems to be in the secured status stowed on the upper deck. I'm up on the top of the engine house here by the stack so I can get a pretty good view of the entire deck operation.

20 seconds after the minute, 30 seconds after the Captain has just completed sounding boat and fire drill, boat drill, I am showing 52 on my watch and 20 seconds past; a 40 seconds. 45 seconds past, four crew members coming down the port side, which is the lifeboat side. There are four crew members coming down on the starboard side. I have 60 seconds past the initial bell. I have 70 seconds past initial bell, one crew member standing at the lifeboat awaiting instructions. The mate has arrived on the boat deck (75 seconds) giving instructions to the crew. 80 seconds, 85 seconds. Crew is starting to release the turnbuckle on the boat. There are two crew members presently working on the lifeboat. 110 seconds. The third crew member has arrived and is

releasing I guess it's the tie down buckle. Now four crew members are on the boat, two are starting on either end of the lifeboat uncovering the lashing using the hook. There are two members working underneath the boat to finish releasing the cover. I have 2 minutes. Two, four to help, we have five men now working on the lifeboat removing the cover and the rest of the line. He has the cover tied underneath the boat, one man still unable to finish untying it.

The lifeboat is ready and there are now 25 persons in lifeboat station No. 1 -- 2 1/2 minutes down. I assume that the painter is being paid out from one end of the lifeboat. The crew is standing by at the life raft station and releasing the side chains, but no other action occurring there at the moment. Over here one man is still releasing the cover at the tie point on one end of the boat. They still have not released the cover from underneath the lifeboat, one end is still tied. Okay, both ends of the cover released and one tie point is still held below it. On my watch I have 55 minutes and 30 seconds past the hour. Another mate has gone to help them release that one tie point underneath the lifeboat of the cover. There are presently three to six crew members standing by the life raft station. There are two, four, six, seven crew; eight crew actually operating the lifeboat and more coming. That's ten crewmen on the boat and two mates.

Okay, one crew member is now climbing into the lifeboat. They are removing the lifeboat cover, pulling it off of the lifeboat and showing 56 minutes and 30 seconds. The lifeboat cover center support has been removed and they are pulling off the stowage cover

supports are now being removed from the lifeboat. Two crew members are presently in the lifeboat, I'm showing 57 minutes and 0 seconds past starting points. Okay, two crew members are on the after end of the boat, starting to crank, nobody has touched the bow end of the boat. The lifeboat is presently being slewed out overboard, this is a radial type davit and they are cranking the lifeboat out over the side. Coast Guard cutter is directly aft of us. The lifeboat is presently going over the side, the mate has secured the lifeboat chain ladder. It is secured to the deck and he has laid it out so that it is in position. Two crew members in the boat, they are placing an oar between the falls so that the block won't twist or jam once he goes down. All the crew is standing by. 58 minutes and 40 seconds from starting point on my watch.

The crew is not too sure what is happening and they are watching for directions from the mate. He is standing in the center of the station and is giving instructions. Two crew members are going down and I am showing 59 minutes and 30 seconds from starting point. They are abaft of the lifeboat. The lifeboat is now approximately 3 feet below the ship's deck edge; I'm not sure exactly what point we are going to stop this operation.

Lifeboat
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) _____
Air Temperature _____
Water Temperature _____
Sea State _____
Visibility _____

TEST IDENTIFICATION:

Vessel Joseph Frantz
Test Location _____
Date _____
Freeboard of Vessel 40 feet

EVENT	TIME (24 HR CLOCK)		REMARKS
Abandon Ship Alarm Sounds	10:52	10	
First Man (Crewman) Arrives At Test Boat Station	10:53	20	
Second Man (Crewman) Arrives At Test Boat Station	10:53	25	
Time At Which Work Began In Activating System	10:53	25	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	10:58	40	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	11:00	25	Indicate How Many Persons On Board Survival System (1) man every 15 seconds
Time At Which Survival System Is Separated From Vessel	11:01	25	used lowering rate of 40 feet/min.

Observer No. 1
Signature of Observer

Observer No. 1 - Davit Launched Raft

Okay, I'm now showing 17 minutes, 0 seconds past the hour. They've opened the box, the raft is being rolled out and over to the boat station. I'm trying to get a good view. All the crew is present, one man has gone to grab the davit wire and release the brake, the mate releases the brake. Two of the crew members are pulling up the rail. They are still trying to pull out some of the wire to release the hook, the hook is in a stowed position and I don't think these guys know exactly how to get the hook out of the box. They need some instructions. Okay, pull the cord which releases the hooks out of the stowage valise. The hook is now being carried over. They are now ripping open the valise, they have found the ring. They are putting the hook over the ring and they have closed the ring and hook combination. The snap is now being snapped shut. 18 minutes, 30 seconds past the hour.

Okay, the hook is now attached. Crew is standing by. The mate is cranking up the arm and he is taking up on the line of the hoist. The bowsing lines are attached to the deck cleats.

All the crew, of course, is over here now standing by, as well as all of our participants. Coast Guard cutter is standing directly along side of us. Photographers are shooting away. The mate is still pulling up on the raft, the raft is hanging, it is in the air fully and it has not tripped. He is still up straight, he is not slewing out. He should start the davit out. There goes the inflation, it has just started to inflate. They are fooling with the bowsing line -- apparently the raft is inverted. It is twisted around and it seems to be backwards.

I'm trying to observe further. The raft is inflating, it is inflating outboard. The raft is out, however, we apparently are inside out, no we're not, there we go over the edge. The forward bowsing line has been released and are being retied to the cleats, 20 minutes, 30 seconds past the hour.

Okay, one man is in the raft, two men are in the raft. Bowsing lines are now being released, I think, no the bowsing lines are not released. Two men are in the raft, and we are standing by while the raft is lowered by the brake. The brake is stopped. The bowsing lines are still affixed. Instructions begin to release the bowsing lines. Lines are free.

Okay, the brake has been released, pushed up and the raft is descending. It is on its way down, it is in half descent, it's descending. All right that 21 minutes, 40 seconds past start. The raft is almost beginning to touch. The raft has touched the water and the line is slack. Two men are down, the fall is free or is loose -- it is not free, it is just whipping. Two men are in the raft. They are signaling to come on up. The raft is now being cranked up, what do you call it, the davit is out about 80 degrees, I guess that's close enough, 75 degrees to 80 degrees and they are holding up the raft. The mate is on the crank and they are holding it up. Okay, one man is now cranking. With a bit of effort he has to work, he is holding the raft up with two men in it, he is working and the raft is coming up. Okay, 22 minutes, 34 seconds; 37 seconds past the start and it is coming up. Seas are a little bit choppy, sort of rolling out there, not heavy, not smooth, it's still moving. The raft is now more than 2/3 of the way up. Still

cranking, I'm showing 24 minutes exactly past the hour. Two men are now working to crank and a little faster, they're cranking away and the raft is coming up. The raft is bouncing very nicely, two men aboard, raft is wet, water battery is hanging, everything seems to be quite normal. The raft is in a stand-up position; looks very good. Our cutter is standing by, two men are cranking the raft, it's about a foot from the rail. Okay, the raft is about the right height. I have 20, let's see 24 minutes, 45 seconds past the start.

Davit Launched Raft
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) _____
Air Temperature _____
Water Temperature _____
Sea State _____
Visibility _____

TEST IDENTIFICATION:

Vessel Joseph Frantz
Test Location _____
Date _____
Freeboard of Vessel 40 feet

EVENT	TIME (24 HR CLOCK) Minutes & Seconds		REMARKS
Abandon Ship Alarm Sounds	15	50	
First Man (Crewman) Arrives At Test Boat Station	17	0	
Second Man (Crewman) Arrives At Test Boat Station	17	05	
Time At Which Work Began In Activating System	17	05	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	20	30	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	21	30	Indicate How Many Persons On Board Survival System (1) person per (2) seconds
Time At Which Survival System Is Separated From Vessel	21	50	

Observer No. 1
Signature of Observer

Observer No. 2 - Lifeboat (Joseph Frantz)

The test is beginning, it's 10:54 at this point and 30 seconds. The alarm has sounded at 10:55. This is the test of a lifeboat. 15 seconds. 10:55 and 15 seconds. Not much better in an emergency. Not much quicker in an emergency either. First man arrived at 10:55, 45 seconds. Second and third man arrived at 10:56. Both of the men beginning to ready the lifeboat for launch. At 1 minute, 30 seconds after signal sounded. Lifeboat has cover completely intact; cover has to be taken off. This is the normal at sea condition. At 10:56 and 45 seconds there are six men working to launch the lifeboat. At present there are nine people at the boat station. Seven of them actively engaged in launching the lifeboat. Cover is still intact. Time is 10:57 and 15 seconds. Four men laying out the painter right now. 10:57, all persons at boat station. Crew is able to start launching the lifeboat as soon as the first person got there. 10:58 and 30 seconds. Cover is just being taken off of the lifeboat. 10:59 and 15 seconds. Lifeboat cover is finally removed from lifeboat. All boarding is being removed from the lifeboat; boarding supporting the cover. Time is 10:59 and 45 seconds.

Approximately 12 people working on the lifeboat to launch it at this point in time. Time is 11:00 even. Part of the boat crew showed up with foul weather gear, it's raining out, everybody has life preservers; all wearing them properly. They all have some sort of head cover. Swinging out the boat now, it's 11:00 and 45 seconds. The boat is swung out, at 11:01. Boat is now being lowered to boarding deck.

Boat is completely swung out at 11:01 and 25 seconds. Only two men in the boat, the boat is lowered. The boat could be boarded about one every 10 seconds. The rate of descent is not continuous, it's done by individuals manning two lines. This means that two men have to stay on board the vessel in order to lower the lifeboat. Boat was lowered half way down at 11 minutes and 3 seconds.

Starting to bring the boat back up again. The only problems I saw, basically was the fact that the crew of course, since this was a drill, did not operate as quickly as they might have. Also, the fact that it does involve two men to lower the boat, there is no way around that, you must have two men on the boat all times. We are retrieving the boat, it involves manually pulling the boat back up to the deck. There are no winches available for this maneuver. Pulling has the factor of four. Two pulley block. All of about 15 men on each line to retrieve the lifeboat. Lifeboat itself is uncovered and, of course, enough cold protection for the persons in the boat. Mechanical davits are in good operating conditions. With no difficulty whatsoever in utilizing the system as designed. Timing sequence for the test is over. Necessary to put an oar between the line on the block so that the lines don't cross. Only a qualified seaman would know to do this.

A-24

Lifeboat
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) _____
Air Temperature _____
Water Temperature _____
Sea State _____
Visibility _____

TEST IDENTIFICATION:

Vessel Joseph Frantz
Test Location _____
Date _____
Freeboard of Vessel 40 feet

EVENT	TIME (24 HR CLOCK)		REMARKS
Abandon Ship Alarm Sounds	10:55	00	
First Man (Crewman) Arrives At Test Boat Station	10:55	45	
Second Man (Crewman) Arrives At Test Boat Station	10:56	00	
Time At Which Work Began In Activating System	10:55	45	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	11:01	25	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	11:03	05	Indicate How Many Persons On Board Survival System (1) man every 15 seconds can board boat
Time At Which Survival System Is Separated From Vessel	11:04	05	used lowering rate of 40 feet/min.

Observer No. 2
Signature of Observer

Observer No. 2 - Davit Launched Raft

We've two people observing. They have the raft out of the box. Pulling out the cable right now. One man is pulling out the cord so that he can find the hook on the inflatable raft. Taking down the chain and one of the side rails so that there is room to inflate the raft itself. The people working on deployment of the raft itself involves about three or four people. Both bowsing lines are attached. They are pulling out the red webbing right now so that they can find the hook. Attaching the hook to the raft itself. The time right now is 11:21 and 50 seconds. They are raising the raft with the davit now. They have stopped raising so that they could pull out another railing. It's now 11:22 and 20 seconds. Two of the bowsing lines are a little bit loose, but they will tighten those up later. Right now only one man is operating the system, he's swinging the davit out. Raft is up in the air. Bowsing lines are not taught yet.

Raft is starting to inflate, it's 11:23 and 05 seconds, raft has begun to inflate. Raft is approximately halfway inflated at 11:23 and 20 seconds. Raft is fully inflated at 11:23 and 40 seconds. Raft is ready for boarding at 11:23 and 50 seconds. 11:24 raft is ready for boarding, first person is in the raft, second person is in the raft; it takes about a second a person. 11:24 and 20 seconds. Starting to lower the raft. All right 11:24 and 30 seconds, bowsing lines are detached, raft is lowered. 11:24 and 50 seconds. Begin descent. Raft at the water in 20 seconds.

The only problems I saw were that the bowsing lines were not detached. Involved one person to lower the raft. This was the first

time that the ship's crew actually operated the davit launched raft. Right now they are cranking it back up, got an automatic release on the hook, but we did not trigger because we wanted to put 8 more people on the raft.

Davit Launched Raft
Survival System
Identification

DATA SHEET

CLIMATOLOGICAL DATA:

Wind (Kts or mph) _____
Air Temperature _____
Water Temperature _____
Sea State _____
Visibility _____

TEST IDENTIFICATION:

Vessel Joseph Frantz
Test Location _____
Date _____
Freeboard of Vessel 40 feet

EVENT	TIME (24 HR CLOCK)	REMARKS
Abandon Ship Alarm Sounds	11:19 30	
First Man (Crewman) Arrives At Test Boat Station	11:20 15	
Second Man (Crewman) Arrives At Test Boat Station	11:20 30	
Time At Which Work Began In Activating System	11:20 25	Indicate How Many Men Needed To Begin This Work (1)
Time At Which Survival System is Ready for Boarding	11:23 50	Indicate How Many Men Were Needed As Minimum (1)
Time At Which Lowering Begins (For Slide, This is When All Persons are in Raft)	11:24 50	Indicate How Many Persons On Board Survival System (2) (1) person per second
Time At Which Survival System Is Separated From Vessel	11:25 10	

Observer No. 2
Signature of Observer

APPENDIX B

BRIEFING ON OPERATION OF DAVIT LAUNCHED INFLATABLE RAFT

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BRIEFING ON OPERATION
OF DAVIT LAUNCHED INFLATABLE RAFT

My name is Dave Edwards of R.F.I., the manufacturers of the raft, and we are going to have a launching drill in slow motion. Normally it would take about 3 minutes to launch the raft with 20 or 25 people on board, if the thing is done quickly. It will probably take us 10 minutes or maybe even 15 minutes. We're not trying to prove speed, we're trying to get the drill really understood by ourselves and by you, and see just exactly how the davit works, how the raft works and what the drill is.

Now the drill that I am going to go through is a drill that has been developed in the past and is the present existing drill on a number of ships. It's not necessarily the one that we will end up with; I personally think we're going to be able to improve it a bit, and after you've seen it you can comment about it or what you want to know about them -- any improvements in the drill or equipment.

The principal of the thing is that the raft is inflated outboard, not on deck, it's inflated slung out suspended from the davit which is already slewed. Boarding is done out through here with the raft suspended, and when boarding is complete, then the davit has a gravity brake which is lifted and the raft is lowered to the water and release is automatic; the release gear automatically disengages the raft and it's floating free. Now in some ships the davit can be used to launch more than one raft; on some it launches as many as six rafts

and the fold can be recovered on a quick recovery hoist two inches or more, and the whole procedure can be repeated; we're not going to do that. On a ship of this type it would never arise, it would be only one raft per davit, I expect. Now the drill basically is removing the guard rail, getting the raft in position, tying the raft to the deck cleat; at the same time the davit can be slewed out, the release gear can be unhooked from its stowage which is on the end of the fall. The release gear is brought onto the raft and attached to a ring, which at the moment is buried under the canvas release, and then the davit inflates the raft by going into the hoisting process and that actually is connected to the inflation mechanism. The raft is pulled outboard as it inflates, so we're going to start with the davit slewed, and it ends up in the boarding position, already bowsed. So it's not going to get thrown around in a gale. It's under control from the davit, under control from these two cleats which are bowsed in and then immediately it's fully inflated which would be the job of the deck officer that determines when it's hard and when the safety valves are singing; then it is capable of taking a full load.

Boarding starts, just walk into the raft, spread out and sit on the floor around the outside of the raft, that's improtant and it really can get 25 people in it, it's the only place you can go. Sit right here on the outside of the raft. And then the bowsing lines are detached, thrown into the raft; they don't have to be they'll follow it down and the davit operator releases the brake and away she goes. Now if there are any questions at this point, I think we can

have them. But we don't want to go into detailed discussions because we'll start right in on the launchings. If you have any questions we can have them now.

Now we want one person to upright the davit so we need a volunteer for that; I believe Bob, you're going to do that. Okay this operation can be done with two men; one, the person in charge of the boarding station and second, the davit operator. It really could be done by one person; the davit operator could do the whole thing on his own. We'll do it with two people, and I think we need another volunteer to take the position of station officer, deck officer in charge of this boarding station. So let's have a volunteer for that, or a nominee.

We're going to get the davit operator working the davit right from the word go and I'll tell him what to do in a second; you should start getting the raft into position right from the word go; the two would be working independently to begin with, although you've given him instructions normally. I'll give them for the moment. And you'll need to get someone to help you, anyone of the crew, to help you to get the raft out or detail two people to get the raft out, probably better still, so let's get out with that, let's get the raft from its position there right down on this position here.

Now that shows up to be a little bit of a time consuming operation there, this is an item that needs practice of boat drills. You have to get the hanger closing that release drill gear, once it's closed and staying closed, it's locked closed.

For though it is a no load release at the moment a positively closed release. It becomes a no load release only once we start getting on the way down by pulling this lanyard. This lanyard pops it and turns it into a no load release; so that moment once it's closed, once that you've established that it is closed, it's safe. If it's not safe, we could lose the raft during inflation. Now at this point we can start slewing the davit. Everything else should be okay. You may have to adjust it during inflation. Now you have to put the brake on before you can start winding. When it starts cranking we should commence inflation. During inflation we may need to adjust these two bowsing lines to make sure that it does lay in nice and snug in the right position. Okay, let's start it in inflation now. Let's have this one a little slacker. The boy is going up too high with the davit. You can always raise it, it's more difficult to drop it. Now we want to get the raft pushed off the edge of the deck, so that this is level with the deck. Okay, you can tighten up again. Bring the davit this way abit. Down a little bit.

Okay...now at this stage we're ready for boarding. Before we actually start boarding, let's see if there are any questions at this stage. And also a couple of other things I want to go over again. First, are there any questions? Okay, the hissing sound that you hear is the safety valve in the raft inflation system. This is necessary because there's enough gas to inflate in cold weather. In other words, there's gas than necessary to inflate at this temperature. It has to have safety valves, that hissing noise is the sound of things, not a leak.

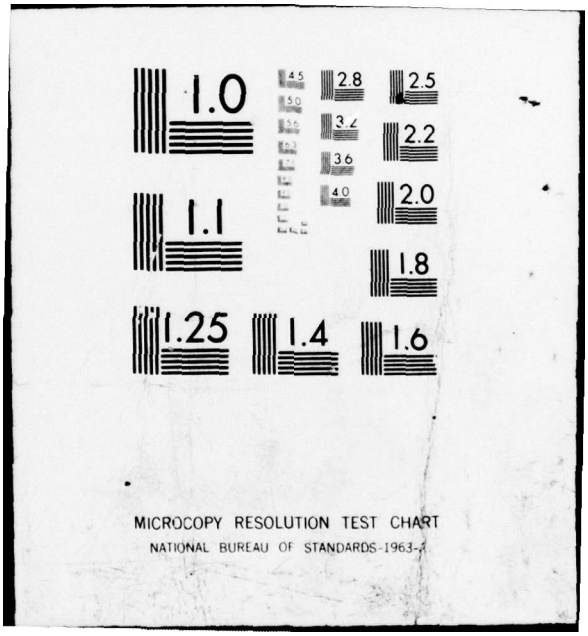
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PROGRESS REPORT ON THE TEST AND EVALUATION OF THREE ESCAPE SYST--ETC(U)
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Now I understand that we're going to get three people in it at this stage. Two or three. So we're going to need two or three volunteers. Do you want to go this time or do you want to go next time? Okay, here we are. Okay there expendable. Where's the third? We want one more. Okay...if you would stand up in that door way for a moment you'll see that there's a wire coming out of that relief gear and a rope attached to it. That's the tripping lanyard. Now you can actually, it's down here, you can actually trip that lanyard at any stage between now and the water, but it's probably better to leave it until you're halfway down or approaching the water, you can even leave it until you've touched the water.

APPENDIX C

REPORT ON ADDITIONAL TESTING USING INFLATABLE RAFTS

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REPORT ON ADDITIONAL TESTING USING INFLATABLE RAFTS

This is a summary of a detection enhancement exercise conducted by the U. S. Coast Guard on January 24, 1974, in Grand Traverse Bay. The two survival craft were modifications of the davit launched inflatable raft and the raft from the inflatable slide.

The davit launched raft was modified by replacing the existing canopy with one made of a gold foil mylar. The raft from the slide was modified by inclusion of a standard canopy.

The weather was clear, visibility of 35 miles, scattered clouds at 3500 feet, wind 17 to 21 knots with 2 to 3 foot seas. Air temperature was 31 to 35 degrees F. with the water being 33 to 38 degrees F.

Raft From Slide-Raft Combination

1. When the raft was inflated, it was found that one of the aspirators had frozen allowing for only a partial inflation of the raft. The raft had been stored on deck of a Coast Guard buoy tender without protection from the environment. This would not be the case when it is a part of the slide-raft system, although it is a factor to consider.
2. The canopy could be closed using strips of Velcro which made the task much easier in the cold weather.

Davit Launched Inflatable Raft

1. This raft was successfully inflated but turned upside down when deployed over the side.
2. The canopy support will not raise to inflation pressure alone when it is not hung from an attachment such as the fall on the davit. This should be considered when considering the "float-free" capabilities of an inflatable raft.
3. The draw pulls to secure the inner and outer canopy access, were very difficult to operate with ice encrustment.
4. This raft was retrieved by the buoy boom on the Coast Guard buoy tender. This capability should be possible with any davit launched, single point suspension system. If this means of retrieval is to become common practice, a vacuum breaker of some sort may be necessary to reduce the additional load on the retrieval boom when the raft has a full compliment of people.