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CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1977 SEASON

FINAL REPORT

APRIL 1978

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This report covers six months of a multi-year accident investigation program. The U. S. Coast Guard's Project Officer for this report was ENS. W. M. HUNT, JR.

16. Abstract

This report details the results of seven in-depth boating accident investigations. The accidents were selected from 78 capsizing/swamping accidents reported by Coast Guard and state units. The procedures for selecting accidents for investigation are detailed. Summaries of each accident investigated are given. Each of the accident investigation reports are attached as appendices to the report.

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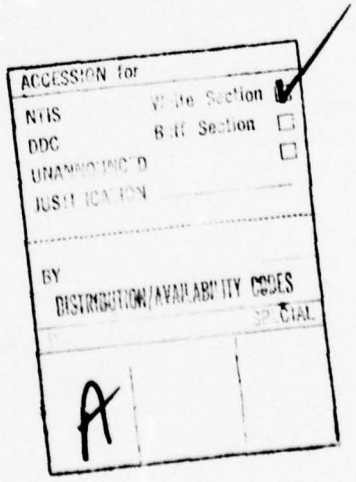


TABLE OF CONTENTS

1.	INTRODUCTORY SUMMARY	1
2.	ACCIDENTS RECEIVED FOR CONSIDERATION	1
3.	SCREENING OF ACCIDENTS	2
	3.1 Screening Criteria	2
	3.2 Screening Procedure	2
4.	DATA ACQUIRED THROUGH INVESTIGATION	3
5.	SUMMARY OF INDEPTH INVESTIGATIONS	4

APPENDICES A THROUGH G - INDIVIDUAL ACCIDENT INVESTIGATION REPORTS

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1.0 INTRODUCTORY SUMMARY

A program to conduct indepth investigations of selected boating accidents has been initiated by the Coast Guard. These investigations are conducted with two purposes in mind: to add to the Boating Accident Data file and to insure the design safety of recreational boats sold to the public. This report presents findings of accident investigations conducted between July and December of 1977. The accident investigations presented in this report deal with capsizings and swampings.

A brief summary of the accidents investigated in this report is given as well as the detailed accident investigation reports. The summary of each accident is presented as the final section of this report; and the actual reports themselves are attached as appendicies to this report. Each individual accident investigation report contains the following sections with applicable information:

- o general information
- o narrative description of accident
- o psycho/socio and human factors
- o probable causes
- o recommendation
- o attached figures and illustrations
- o accident data section

This report also explains procedures used for selecting accidents to be investigated and details the contents of the above data sections.

2.0 ACCIDENTS RECEIVED FOR CONSIDERATION

Coast Guard Headquarters has directed operating units within the 48 contiguous states of the United States to report boating accidents that met the criteria to J.J. Davis Associates, Inc. The following criteria for types of accidents to be reported was established for the 1977 season:

1. Collisions
2. Capsizings
3. Swampings
4. Cases of apparent overpowering

Accident notifiction was made by means of a WATS line maintained by J.J. Davis Associates, Inc. This WATS line is maintained soley for the purpose of receiving these boating accident reports.

During the six months covered by this report, a total of 286 accidents involving recreational boats were reported to J.J. Davis Asscoiates, Inc. During that period 78 capizing/swamping accidents were reported as well as 76 collisions. From these accidents, 7 were selected for indepth investigation concerning capsizings or swampings and 6 collisions were selected.

3.0 SCREENING OF ACCIDENTS

3.1 Screening Criteria

Of the accidents that were reported, a relatively small number met the criteria for accident investigation. A set of criteria were established to ensure the most return from every accident investigated. The following factors were considered before making the decision to investigate an accident:

- the accident involved a boat less than 26 feet in length. (In this manner, it was hoped that the accidents investigated would be representative of the vast majority of recreational boats.)
- the boat be available for further investigation.
- witnesses and/or survivors be available for questioning.
- geographic considerations (In this manner, transportation logistics and costs were optimized via multiple investigations per trip).

3.2 Screening Procedure

Coast Guard units had been instructed to report boating accidents in as timely a manner as possible. In most cases this resulted in the transmission of only partial information. When an accident notification was received by J.J. Davis Associates, Inc. that met the selection criteria, initial screening procedures were implemented. These procedures involved:

- a call back to the Coast Guard station to obtain additional information.
- calls to suvivors and witnesses to conduct a preliminary interview about the accident. During this stage the investigator is able to determine the degree of cooperation that the witness would offer as well as establishing appointments for on-the-scene interviews.

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- o review of the data collected by the program manager to determine if indepth investigation was warranted.

- o Coast Guard headquarters was notified of the accident and a message sent to the reporting unit verifying the purpose of a visit by J.J. Davis Associates, Inc.

4.0 DATA ACQUIRED THROUGH INVESTIGATION

The information contained in each of the individual accident reports is presented as follows:

- o General Information-

This section details information about the operator and the passengers of the boat. It presents such informaiton as the operator's experience and background, his general attitude about safety, and the purpose in mind for the boating activity of that day.

- o Narrative Description of Accident-

This section is sub-divided into 3 sections: pre-accident, accident, and post accident.

The Pre-Accident section sets the stage for the actual accident. It details such factors as the weather on scene, the location of the accident, and relevant environment factors. It also details any actions on the part of the operator or passengers which may have had a causal relationship to the accident.

The Accident section provides the scenario for the actual accident. This section normally commences with the initiating action which led to the accident. This section describes what the occupants of the boat were doing as the accident took place.

The Post Accident discusses the recovery phase of the accident. It details the condition of the boat and persons just after the accident and relates rescue operations, whether self-rescue by the occupants happened or rescue was through another vessel.

- o Psycho/Socio and Human Factors

This section is sub-divided into three sections: relevant operator factors, counterbalancing factors, and the interaction of the above factors.

The Relevant Operator Factors detail those conditions that played upon the operator's decision to take the courses that he did. In this section, stressors such as alcohol, fatigue, glare, etc. are detailed. Other non stressor factors such as the operator's awareness that the boat had low freeboard are also discussed in this section.

The Counterbalancing Factors section details those factors that would tend to eliminate or overcome relevant operator factors. Such factors as education and experience normally play a role in this area.

The section describing the interaction of those factors discusses in detail how each of the factors played a role in the actions of the operator.

o Probable Causes-

The precise cause of the accident is summarized in this section. In those cases where multiple causes played a role in the accident the primary cause is identified and contributing causes are also listed. Where there is insufficient evidence to show the direct cause of the accident, the investigator's opinion is presented and so labeled.

o Recommendations-

This section details recommended actions which could substantially reduce the risk of reoccurrence of a similar accident. Where applicable, recommendations are made in the fields of education, enforcement, and technical standards.

o Figures and Illustrations-

In this section pertinent information is presented in the form of illustrations and diagrams. These include loading diagrams, accident diagrams and photographs of damaged areas on boats.

o Accident Data Section-

This secton presents all of the data collected to be used as a backup for the narrative section of the report. All of the data collected during the investigation is presented in this section and is made available for review of sections of the accident investigation which are not discussed in detail in the narrative portion.

5.0 SUMMARY OF INDEPTH INVESTIGATIONS

Included on the following pages are brief narrative summaries of the accidents investigated during this report. Each summary highlights the applicable portions from each section of the report.

CAPSIZING ACCIDENT INVESTIGATION REPORT

Capsizing Number: 77-1
Date of Accident: July 13, 1977
Investigation Date: July 15, 1977
J. J. DAVIS ASSOCIATES, INC. Accident Number: 77-25

SUMMARY

This capsizing involved a 16 foot (4.8 m) Boston Whaler powered by an 85 hp outboard engine. The boat was travelling at a high speed, approximately 35 mph (56 kph), while there was a 1 to 2 foot (.3 to .6 m) chop. There was a failure of the steering cable system, causing violent rolling of the boat and eventual capsizing. The operator (sole occupant) was assisted in righting the boat by Coast Guard units. There were no injuries and property damage was valued at less than $100.00.

The primary cause of this accident was the failure of the steering system. Contributing factors were the lack of maintenance of the steering system, the improper installation of the steering system, the environmental conditions (choppy seas), and the speed at which the boat was operated. Stressors such as fatigue did not play a significant role in the causation of this accident.

The operator was a 23 year old female with some formal boating education but many years of experience boating. Her experience in boating was an important factor in the manner of operation of the boat. PFDs were available but not used.

SWAMPING ACCIDENT INVESTIGATION REPORT

Swamping Number 77-2
Date of Accident: End of July, 1977
Investigation Date: August 11, 1977
J. J. DAVIS ASSOCIATES, INC. Number: 77-67

SUMMARY

This swamping involved a 14 ft. (4.1m) Sears MFG runabout with 4 persons on board powered by a 40 horsepower Johnson outboard. There were no injuries and property damage was valued at approximately $850.00. The water was choppy (1 foot chop), due to wakes of other traffic, air temperature 80°F (26.9°c) sky clear, excellent visibility and no reported winds. The boat was drifting near the Coast Guard Station Fire Island while the occupants were fishing. Two approximately 22 ft. (6.6m) I/O drive Deep V-hull type vessels approached the runabout at a high speed. The operator of the runabout reported that as they neared they split apart to pass, one on either side, with only 10 to 15 ft. (3m to 4.5m) clearances. The wakes from these two boats swamped the runabout which sank quickly, stern first, leaving only the extreme forward section of the bow above water. Coast Guard Station Fire Island was notified by witnesses and a unit dispatched for assistance. The passengers and operator were taken to the station, and their boat towed there for dewatering.

The operator was a 19 year old male with 4 years boating experience and had taken a Coast Guard Boating Course. He was unable to avoid the accident due to the rapidity in which it occurred. PFD's were not worn by the occupants and were stowed in the relatively inaccessible forward bow locker.

SWAMPING ACCIDENT INVESTIGATION REPORT

Swamping Number: 77-3
Date of Accident: August 8, 1977
Investigation Date: August 10, 1977
J. J. Davis Associates, Inc. Accident Number: 77-78

SUMMARY

This single boat swamping involved a 22 foot (6.6m) T-Craft powered by a 115 horsepower Johnson outboard. The boat with 8 persons on board was drifting 300 to 400 yards (270-360m) off Cedar Beach, Long Island, New York. The seas were choppy and running approximately 3 ft. (.9m), the weather was clear, visibility good, with a strong wind (15-25 mph, 24-40kph). The occupants were engaged in gill netting from the stern. Upon retrieving the gill net over the stern, the operator noticed an inordinate amount of water entering the boat. He correctly deduced that this was caused by an inflow of water through the motorwell and over the transom. This was a result of two conditions. First, since the boat had not been anchored, the retrieval of the gill net caused it to act as a sea anchor bringing the boat's stern to face the oncoming wind and waves. Second, the combined weight in the stern of the operator, his wife, and father-in-law, the gill net, motor and two 20 gallon (76L) fuel tanks caused the stern to lie unusually low in the water. The situation was further aggravated by the fouling of the gill net on the motor housing thus preventing it from being further retrieved or returned overboard. The operator attempted to start the engine in order to turn the bow into the wind. Failing at this, he instructed all passengers to climb onto the bow to prevent the boat from sinking stern first. Witnesses on shore notified the Coast Guard and a unit was dispatched to the scene immediately. Upon the Unit's arrival, the operator and passengers were taken aboard and their boat which had remained upright and partially afloat was towed to CG Station Fire Island. The operator, a 36 year old male with extensive boating experience and a previous Power Squadron Safe Boating Course, prevented what could have developed into a serious accident by his quick appropriate actions. All persons on board were wearing PFDs indicating a high family safety consciousness.

Capsizing Accident Investigation Report

Capsizing Number - 77-4
Date of Accident - August 7, 1977
Date of Investigation - August 11, 1977
J. J. Davis Accident Number - #77-79

Summary

This capsizing involved a 15 ft. (4.5 m) Marquis runabout powered by a 40 hp Johnson outboard with 4 persons on board. There were no injuries and property damage was estimated at approximately $500.00. At the time of the accident it was raining, visibility was fair, water choppy (ranging from 1 to 4 feet (.3-1.2 m) due to wakes), air temperature 85 degrees F and winds eight mph (12.8 Kph). The runabout was travelling at approximately 15 mph (24 Kph) in the State Boat Channel, 1 mile (1.6 km) north of the Captree bridges, Long Island, New York. A storm was approaching the area and an extremely large number of boats were using the channel to return to their harbors and protected waters. The accident occurred as the operator of the runabout attempted to overtake a large cabin-cruiser type vessel which was travelling in the same direction at a slightly lower speed. As the runabout rode down the large wake the operator reduced the throttle in an attempt to maintain control. The reduction of the throttle further lowered the bow of the runabout which was heading downward into the trough of the wake causing it to submerge and the boat to capsize. The operator and passengers were assisted in righting and dewatering their boat by passers-by prior to the arrival of the Coast Guard unit from Coast Guard Station Fire Island. The unit towed the runabout to its launching point.

The operator, a 40 year old male, with limited boating experience and no formal boating courses, could have avoided the accident by refraining from passing the cruiser, by loading his boat with more weight in the stern, and by maintaining the outboard motor at the proper trim angle. Though PFDs were aboard, the occupants of the runabout did not use them.

CAPSIZING ACCIDENT INVESTIGATION REPORT

Capsizing Number: 77-5
Date of Accident: October 16, 1977
Investigation Date: October 20, 1977
J. J. DAVIS ASSOCIATES, INC., ACCIDENT NUMBER: 77-227

SUMMARY

This capsizing involved a 13 foot (3.9m) skiff powered by a 50 hp outboard engine. The boat was being used to ferry children from a camp site on an isolated island to a dock where cars were parked. The boat was loaded within the stated capacity but was inadequate for the sea conditions experienced. There was a 2 foot (.6m) chop in the general vicinity and 3 to 4 foot (.9 to 1.2m) swell in a passage the boat tried to navigate. The winds were strong at 20 mph (32kph).

The operator, a 38 year old male, was experienced with this boat and had received some training while in the Navy. However, he was not experienced in using his boat in adverse weather conditions. While the environmental factors led to this accident, the operator's over confidence in his boat's capabilities and his ability to handle the boat directly caused the accident.

The boat was legally equipped with PFDs: One type II and four type IV PFDs; but as the boat swamped and then capsized the operator and his two passengers could not find the PFDs and clung to floating ice chests instead. Stressors such as fatigue, glare and alcohol did not play a role in the causation of this accident.

The operator and his passengers were rescued by a passing boat and then brought to their destination. The boat washed up on the shore after it had capsized and was salvaged later that day by other members of the camping group.

CAPSIZING ACCIDENT INVESTIGATION REPORT

Capsizing Number: 77-6
Date of Accident: October 22, 1977
Investigation Date: November 1, 1977
J. J. DAVIS ASSOCIATES, INC. ACCIDENT NUMBER: 77-234

SUMMARY

This capsizing involved a 17 foot (5.1m) skiff powered by a 125 hp outboard engine. The boat was being used for an early morning fishing trip and was at anchor just before the accident. In the process of raising anchor to move to a new spot, the engine stalled and the stern swung into the waves resulting in swamping and capsizing.

The seas were estimated at between 2 and 3 feet (.6 and .9m) with the winds at 15 mph (24 kph) out of the northwest. As the boat filled with water it listed to port and the two occupants jumped overboard. As they jumped they grabbed two type III and type IV PFDs each and donned them while in the water. They were rescued by a passing boat. which also assisted in salvaging their boat.

The environmental factors were a direct cause of this accident, however, the operator's over confidence in the capabilities of his boat and the failure of the engine were contributing causes of the accident. Stressors such as fatigue or alcohol did not play a role in the causation of this accident.

The operator and his brother, the passenger, are very experienced boaters and routinely use boats for hunting and fishing trips. They have not had any formal boating education but rely heavily on their previous accident free experience.

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CAPSIZING ACCIDENT INVESTIGATION REPORT

Capsizing Number: 77-7
Date of Accident: November 18, 1977
Investigation Date: November 29, 1977
J. J. DAVIS ASSOCIATES, INC., ACCIDENT NUMBER: 77-261

SUMMARY

This capsizing involved a 19 foot (5.7m) runabout powered by two 75 hp outboard engines. The boat was operated by a 16 year old male who was accompanied by two friends (ages 15 and 17). The youths had been out fishing and were attempting to return to their dock. During one attempt at returning they momentarily ran aground on a sand bar damaging the port engine trim mechanism. When attempting to return via a different route they encountered rough seas. The operator decided to return the original way and in the process of turning around the boat swamped and capsized.

The seas on scene were between 2 and 4 feet (.6 and 1.2m) with a strong wind, 20 mph (32kph) blowing on shore. The boat was approximately 900 feet (270m) offshore at the time of the accident and there were no other boats in the area. The environmental factors were a direct cause of this accident but the operator's decision to use a boat totally unsuited to the conditions greatly contributed to that cause.

Personal flotation devices (Type II) were used by all three persons and they swam to shore after the capsizing. Fatigue and alcohol did not play a role in this accident.

The occupants swam 900 feet (270m) to shore leaving the capsized boat completely submerged. The boat was salvaged the following day by a private salvager.

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APPENDIX A

CAPSIZING ACCIDENT INVESTIGATION REPORT

Capsizing Number: 77-1
Date of Accident: July 13, 1977
Investigation Date: July 15, 1977
J. J. DAVIS ASSOCIATES, INC. Accident Number: 77-25

SUMMARY

This capsizing involved a 16 foot (4.8 m) Boston Whaler powered by an 85 hp outboard engine. The boat was travelling at a high speed, approximately 35 mph (56 kph), while there was a 1 to 2 foot (.3 to .6 m) chop. There was a failure of the steering cable system, causing violent rolling of the boat and eventual capsizing. The operator (sole occupant) was assisted in righting the boat by Coast Guard units. There were no injuries and property damage was valued at less than $100.00.

The primary cause of this accident was the failure of the steering system. Contributing factors were the lack of maintenance of the steering system, the improper installation of the steering system, the environmental conditions (choppy seas), and the speed at which the boat was operated. Stressors such as fatigue did not play a significant role in the causation of this accident.

The operator was a 23 year old female with some formal boating education but many years of experience boating. Her experience in boating was an important factor in the manner of operation of the boat. PFDs were available but not used.

GENERAL INFORMATION

The operator, a 23 year old female, was very experienced in boating and experienced with that particular boat, and had completed part of a power squadron course. The operator is a high school graduate, employed as a cleaning lady in a local motel and could be considered as being in a lower-middle income bracket. Her mother owns a boat yard and the operator has spent most of her life around boats. She has gone boating approximately 3 times a week for the past 7 years in this particular boat. The operator considers herself a good swimmer but does not appear to be in good physical condition (overweight).

During the interview an impression was portrayed by the operator of a very knowledgeable but sometimes reckless boat operator. During the interview the operator repeatedly made reference to the fact that she was unhappy with her job. She left the impression of a somewhat unhappy person willing to take excessive risk while boating alone. She indicated that her behavior was quite different while boating with passengers: "If I had someone with me it would never have happened, 'cause I don't run my boat wide open with people, only when I am in the boat by myself."

The operator demonstrated an awareness of boating safety principles. She said that she would frequently stay with friends on the beach if the weather deteriorated enough to make the journey back to her marina hazardous. Yet she also indicated that she had been out boating while small craft warnings were displayed. Even though her boat was equipped with more than enough PFDs, one of the two Type II PFDs was still in its plastic wrapper and stowed under the center console.

NARRATIVE DESCRIPTION OF ACCIDENT

Pre-Accident

The operator was cruising alone in the vicinity of the Great South Bay near Fire Island, Long Island for approximately 1 1/2 hours (1120-1250). During that time she travelled to many different locations. She operated the boat at full throttle between locations and then stopped the boat at each location for about 5 minutes. Visibility was poor. The water condition was choppy (1-2 foot (.3 to .6m) chop) and the wind was moderate (12 mph (19.2 kmph)) out of the southwest. The air temperature was 78° F; water temperature was 70° F.

The operator was on vacation and was cruising along the beach to "see what was happening." She was operating the boat at full-throttle or approximately 35 mph (56 kmph). The area of operation is generally very shallow, 2 to 3 feet (.6 to .9 m) in depth, with some well dredged channels clearly marked. The accident occurred in a channel of close to 12 feet (3.6 m) of water. Due to the weather conditions and it being a weekday, the area was not congested with boats.

Accident

While cruising the operator noticed white caps ahead indicating shallow water. Even though her boat would have had enough water to operate, she decided to avoid the area. She proceeded to the area of the channel and turned to port to follow the channel. (See Figure 1.) After the boat had steadied on course for about one minute, it started to rock violently. The operator's first thought was to reduce speed. She reached for the throttle control with her right hand while grasping the handrail on the port side with her left hand. At this point the rolling of the boat became more severe and ended with the boat's capsizing and throwing the operator into the water.

Post Accident

Upon surfacing the operator was temporarily disoriented but noticed the wooden seat from boat floating nearby. She started to swim toward the seat thinking that she could hold on to that until help arrived. The PFDs she carried were no where in sight. She then noticed her capsized boat nearby and swam to that to make it easier for herself to be found. By the time she reached the boat (approximately 5 minutes after capsizing) other boaters who had seen the accident arrived on scene to offer assistance. The operator refused their assistance in righting her boat saying that the Coast Guard would know how to do it better. She then requested that the Coast Guard be notified of her accident.

Approximately 15 minutes after the boat had capsized Coast Guard units arrived on scene and righted and dewatered her boat. It was then towed to a nearby harbor and moored safely.

PSYCHO-SOCIO AND HUMAN FACTORS

A. Relevant Operator Factors

1. The sea conditions consisting of 1 to 2 foot (.3 to .6 m) chop had a fatiguing influence on the operator when operating her boat at approximately 35 mph (56 kph) for 1 1/2 hours.
2. The operator's general tendency toward reckless operation of her boat when she was not carrying passengers made her more willing to take chances.
3. The operator's past accident free experiences with using this boat gave false sense of confidence in the condition of the equipment.
4. The operator's many years of boating experience gave her a casual attitude toward boating safety.

B. Counterbalancing Factors

1. The operator's experience - a lifetime spent on the water and on boats gave her a good knowledge of the boat's characteristics in many water conditions.
2. The operator's exposure to some boating education classes made her aware of the principles of boating safety but not of its practical application.
3. The operator's familiarity of the area made her aware of potential dangers.

C. Interations of A and B Factors

Two factors played important parts in the operator's decision to go boating that day. Since she was very familiar with boating and that area, she did not consider the weather conditions restrictive. Boating was as familiar a mode of transportation for this operator as driving a car is for other people. Conditions such as experienced on the day of the accident were not uncommon and had proven to be easily manageable before. Reinforcing this was the fact that she would be the only person on board. Her risk-taking threshold was much higher when operating alone. Therefore, the operator did not hesitate to go boating in those conditions.

The operator was most likely experiencing some level of fatigue from 1 1/2 hours of riding in a pounding boat at high speeds. This fatigue, however, was offset by the fact that the conditions and the duration of the stress were not an uncommon experience. She uses her boat year round (unless the Bay is frozen) and routinely experiences adverse weather conditions. Therefore, the effects of fatigue were probably minimal. Alcohol was not a factor, nor were other stressors such as glare, lack of sleep, discomfort, etc.

The operator was aware of most of the particulars of boating safety but appeared unable to transfer the lessons learned to practical application. She knew the value of PFD carriage but still had a PFD in the plastic wrapper. She said she would stay at friends' houses on the beach if the weather got bad but admitted to boating during small craft advisories. The gear in her boat was not secured but left free. This general inability to transfer knowledge to practice surfaced in the maintenance of the steering system. The cable was crossed in the initial installation and an excessive amount of cable was left on the trailing end. These conditions were allowed to go uncorrected during many seasons of use. The fact that the operator had used the boat extensively with no adverse results reinforced the false impression that the system needed no maintenance. During the interview it became obvious that the operator had no indication that the condition of the steering system could have had any effect on her accident.

PROBABLE CAUSES

During the investigation close inspection of the steering cable indicated a frayed area where the endclamp had broken free. The endclamp connection was still tight when the boat was inspected. The tail end of the steering cable was excessive in length, allowing entanglement with other objects in the boat. This entanglement in turn would increase the tension on the endclamp of the system. In addition, the cable connections on the starboard side were improperly installed causing a crossover of the cable and improper distribution of the tension. It is felt that a contributing cause of this accident was the improper installation of the mechanical cable steering system. The crossover of the steering cable on the starboard side of the system resulted in additional tensions on the cable. The frayed area on the cable near the endclamp indicated that the situation had been developing for quite some time. The excess cable on the trailing end allowed entanglement with other gear in the boat, especially in conditions such as the day of the accident, which resulted in shear tension on the endclamp. A lack of maintenance of the steering system cable allowed for a gradual deterioration to the point of endclamp failure. Therefore, the choppy water conditions, intensified by the speed with which the boat was travelling, aggrevated the pressure on the endclamp causing failure of that part. The decrease in the control of the steering system allowed the torque of the engine to swing it from side to side. The interaction of the chop and the "freer" motion of the engine caused the release of the tension clamp on the starboard side of the steering system. This in turn intensified the rocking action caused by the engine. By this time the rocking and skipping of the boat had become quite violent and it is believed that the hard chine of the whaler hull shape caught a wave capsizing the boat to starboard.

Contributing factors in the probable causes of this accident would include the operator's decision to go boating when there was a 1 to 2 foot (.3 to .6 m) chop and her operation of the boat at excessive speeds. These contributing factors were brought about by an overfamiliarity with boating without the practical application of boating safety principles and by her somewhat reckless attitude while boating alone. The primary cause of this accident is the failure of the steering system brought on by the lack of maintenance and routine inspection of the steering cable system.

RECOMMENDATIONS

It is recommended that this accident investigation be made available for consideration during the next revision of Coast Guard sponsored boating education courses. While it is not felt that a significant number of accidents can be contributed to this specific cuase, it is believed that this accident can be used as

an example of the type of cause and effect relationship associated with the lack of proper maintenance. It therefore could prove useful as an example of the results of careful routine inspection of even seemingly inconsequential parts such as the endclamp of a steering system.

It is recommended that consideration be given to a thorough evaluation of the accident causal role of steering systems. Promulgation of steering system guidelines for installation and maintenance could have played a role in reducing the probability of this accident.

While this accident was not a result of a violation of the safe powering criteria, excessive power (speed) for those environmental conditions was a contributing factor in this accident. This type of scenario should be considered in any revision of the safe powering standard.

No recommendations are made in the area of Enforcement.

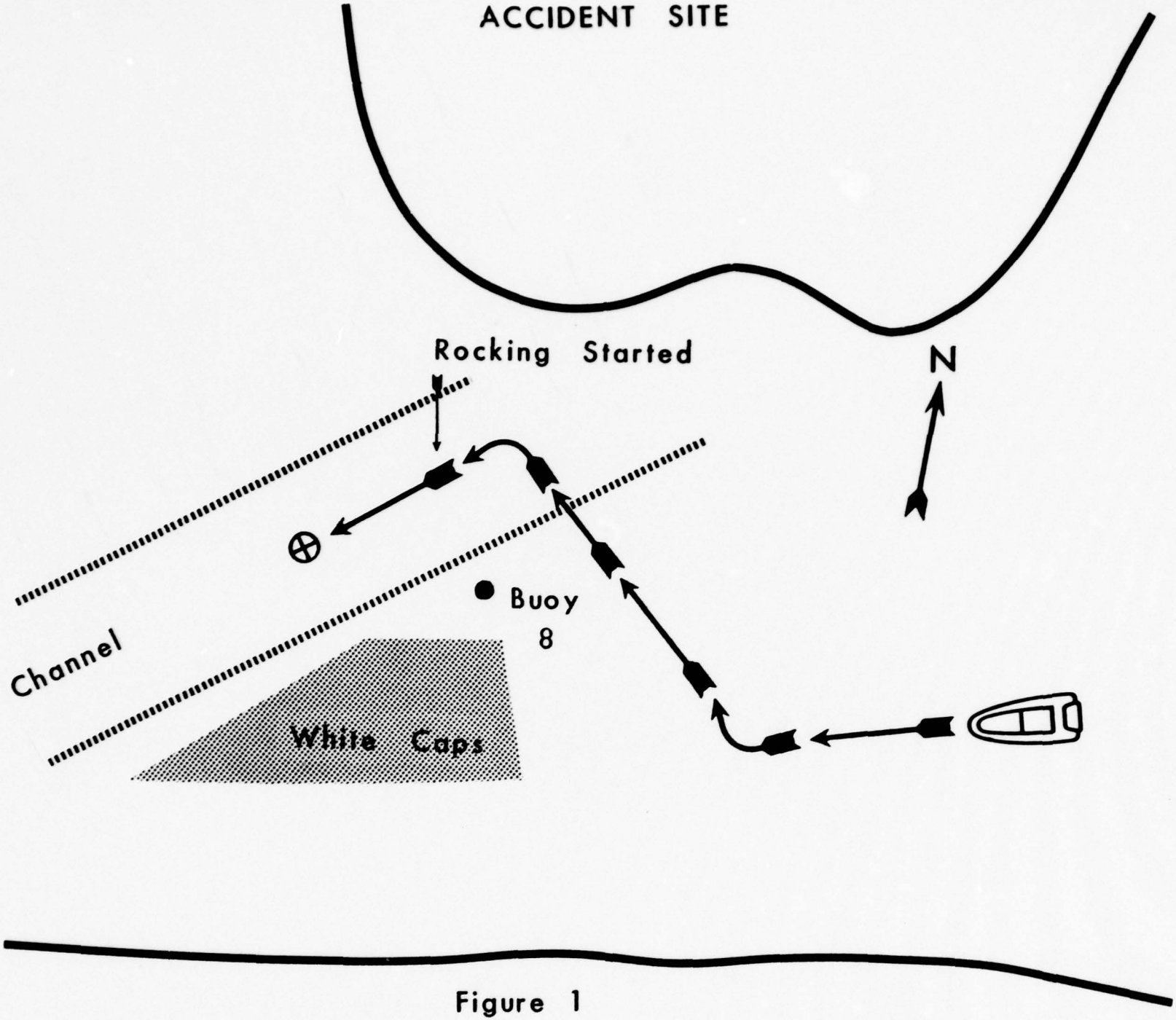


Figure 1

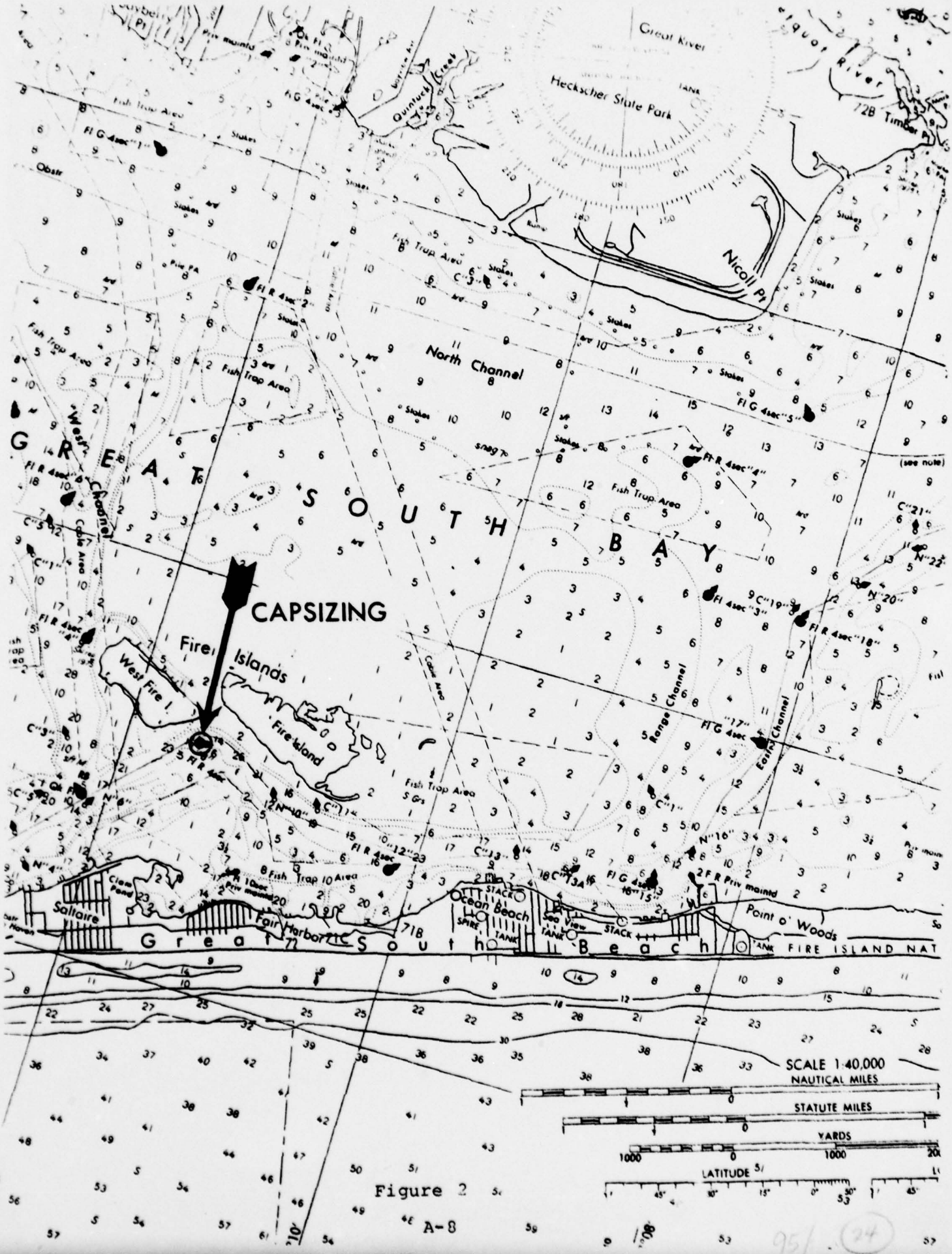
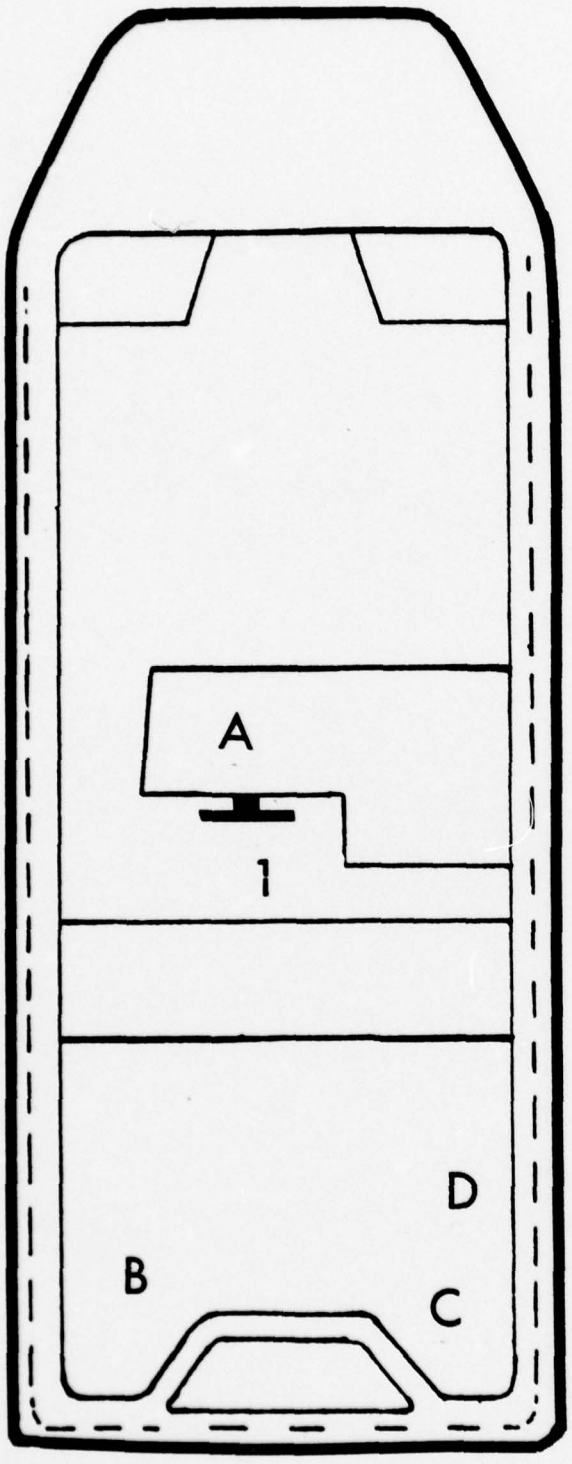

CAPSIZING
Great River
Heckscher State Park
Nicoll Pt
North Channel
GREAT SOUTH BAY
West Channel
Fire Islands
West Fire I
Fire Island
Range Channel
East Channel
Fish Trap Area
Saltaire
Fair Harbor
Great South Beach
Ocean Beach
Sea View
Point o' Woods
FIRE ISLAND NAT
SCALE 1:40,000
NAUTICAL MILES
STATUTE MILES
YARDS
LATITUDE

Figure 2

LOAD DISTRIBUTION



1) Operator 135 lbs. (60.8 kg)

A) Gas Tank (full 6 gal.) 38 lbs. (17.1 kg)

B) Gas Tank (3 gal.) 20 lbs. (9 kg)

C) Battery - 45 lbs. (20.3 kg)

D) Anchor - 10 lbs. (4.5 kg)

Figure 3

25



Figure 4
GENERAL STOWAGE SCHEME OF EQUIPMENT

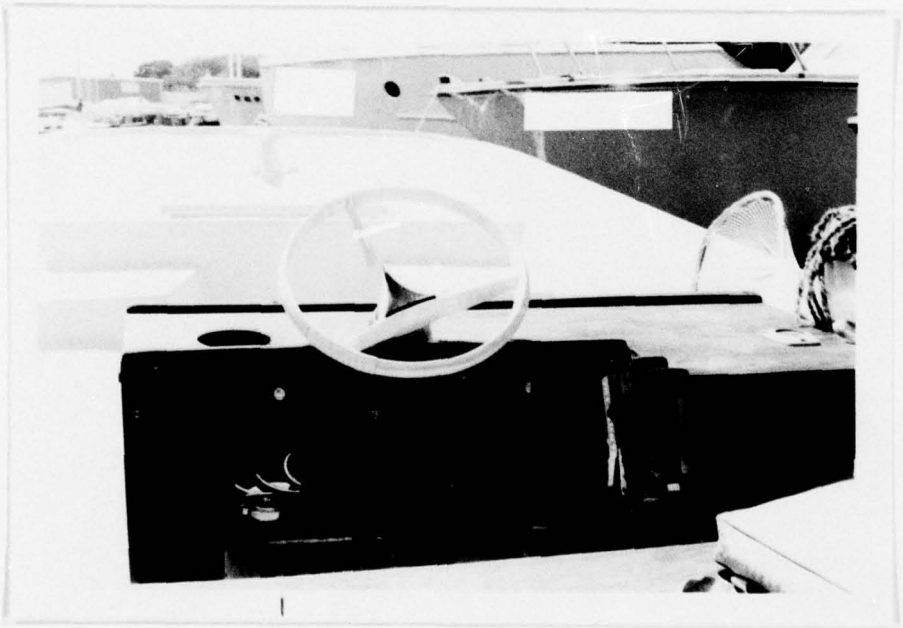


Figure 5
CONTROL STATION

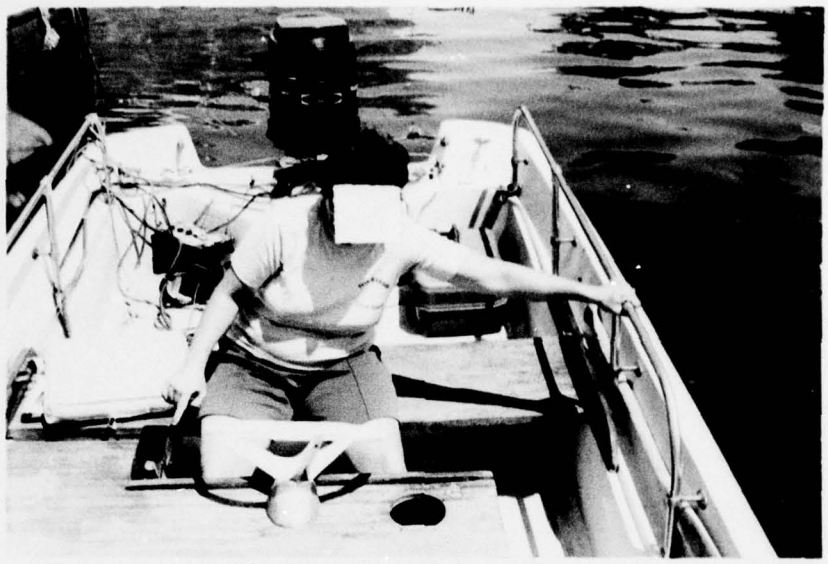


Figure 6
OPERATOR POSITION IMMEDIATELY PRIOR TO CAPSIZING

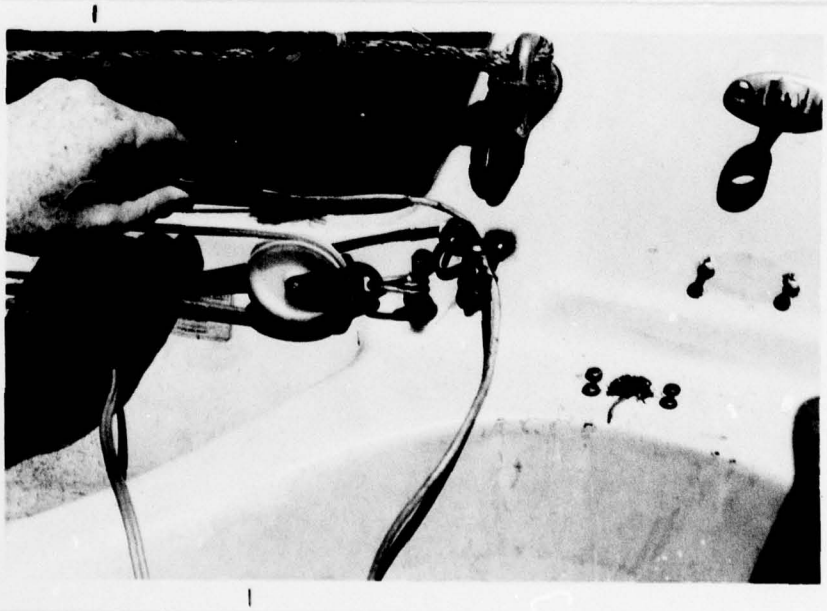


Figure 7
FRAYED PORTION
OF STEERING CABLE FROM WHICH END CLAMP WAS RIPPED

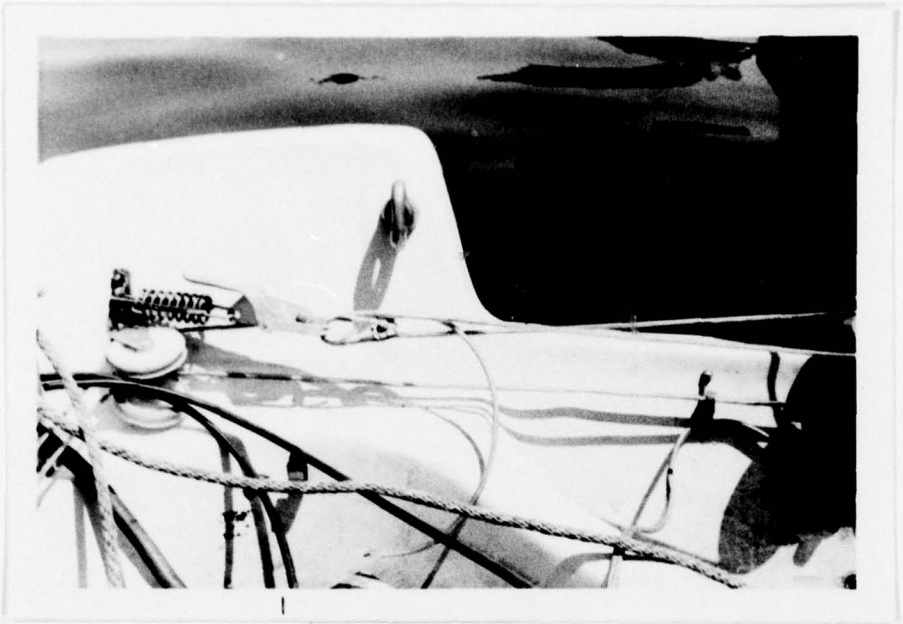


Figure 8
TENSION CLAMP CLOSED
NOTE CROSS OVER OF CABLES

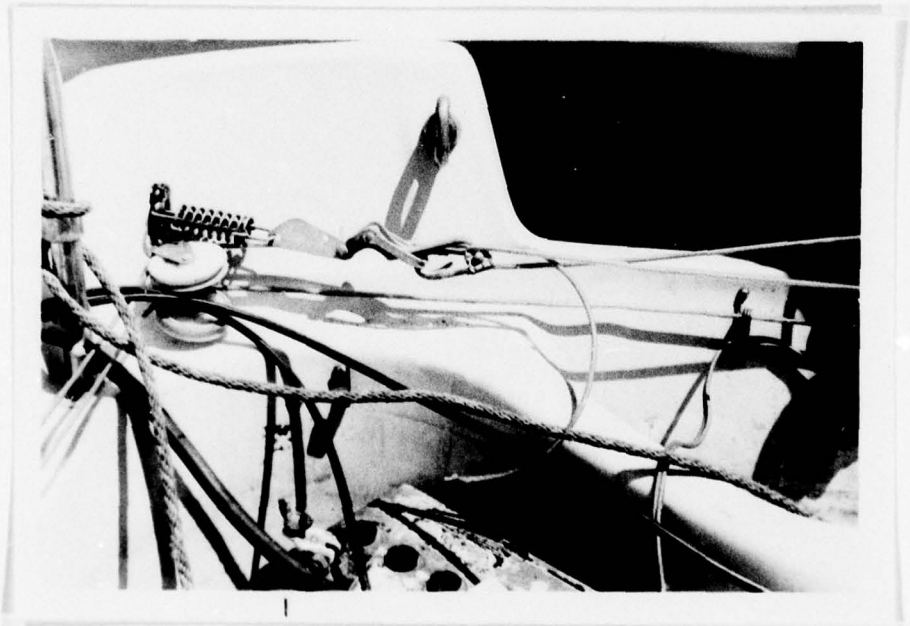


Figure 9
TENSION CLAMP OPENED

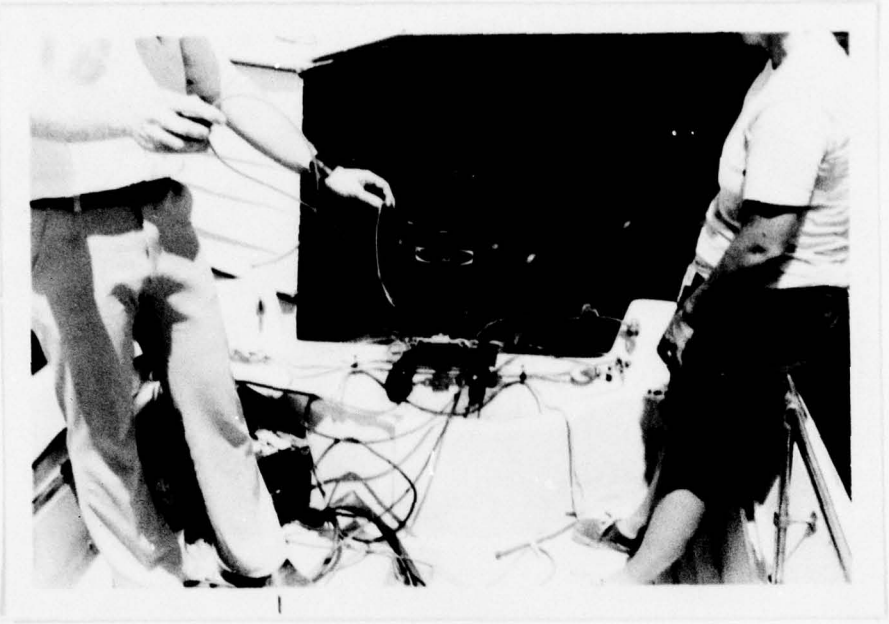


Figure 10
EXCESS CABLE AFTER END CLAMP

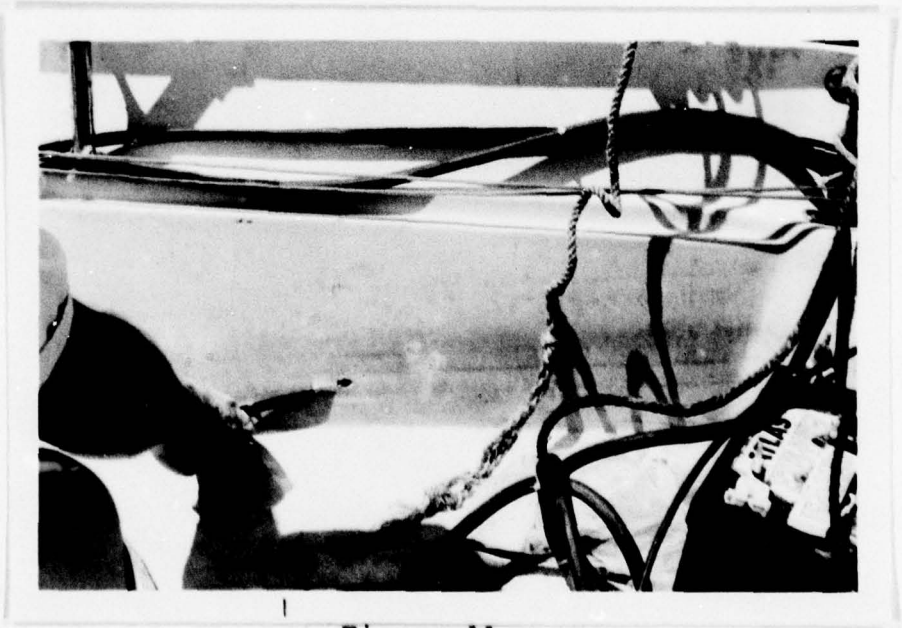


Figure 11
PUNCTURE INCURRED DURING CAPSIZING

ACCIDENT DATA SECTION

Case Number 77-1

J.J.D.A. Number 77 / 25

Date of Accident 7 /13/77 (mo/day/year)

Date of Investigation 7/15/77 (mo/day/year)

State (Use postal codes) NY

Jurisdiction (Circle one digit)
1 State
(2) Joint/Federal
3 High Seas

More than one vessel involved? (Circle one)
1 Yes
(2) No
9 Unknown

NOTE: If more than one vessel was involved, complete a separate booklet for each vessel.

Commercial vessel involved? (Circle one)
1 Yes
(2) No
9 Unknown

Was there at least one fatality? (Circle one)
1 Yes
(2) No
9 Unknown

EXPLANATORY NOTES :

DATA SOURCE:

ENVIRONMENT:

Time of day of accident (when accident occurred, began, to the nearest hour on a 24 hr. clock; i.e., 2 p.m. = 1400): 1300 — OPERATOR

Body of Water: (Circle appropriate code)

1 Ocean or Gulf of Mexico
2 Great Lakes
(3) Tidal Waters (Rivers)
4 Lake, Pond, Dam, Reservoir
5 River, Stream, Creek
6 Harbor, Marina

Condition of Water: (Circle appropriate code)

1 Calm
(2) Choppy
3 Rough
4 Very Rough
5 Fast Water, but flat (such as flooded river)
6 White Water, down river

Depth of water at accident site	12 ft.	3.6 m.	CHART
Relative Humidity		78 %	COAST GUARD
Air Temperature	78 °F	25.8 °C	
Water Temperature	70 °F	21.3 °C	

If precise temperature is unknown, then check one:

Warm (greater than 73°F)(41°C) ____
Cold (60° - 73°F)(34° - 40°C) ____
Very Cold (below 60°F)(34°C) ____

EXPLANATORY NOTES:

DATA SOURCE:

Sky Conditions: (Circle one) COAST GUARD

1 Clear
(2) Cloudy
3 Hazy
4 Rain
5 Snow

Wind: (Circle one)

1 None
2 Light (0-6 mph) (0-10 kph)
(3) Moderate (7-14 mph) (11-22 kph)
4 Strong (15-25 mph) (23-40 kph)
5 Storm (over 25 mph) (41 kph)

Wind Direction:

From the Southwest

Was weather a factor (i.e., did it contribute to causing the accident or did it hamper recovery efforts)? (Circle one) OPERATOR

1 Yes (2) No 9 Unknown

Was weather forecast obtained prior to departure? (Circle one)

1 Yes (2) No 9 Unknown

Was weather as forecast? (Circle one)

1 Yes 2 No (9) Unknown

If not, describe change _____

_____

EXPLANATORY NOTES:

(32)

DATA SOURCE:

Was weather warning issued at point of departure? (Circle one)

1 Yes 2 No (9) Unknown

Visibility: (Circle the appropriate codes, one on each list):

(1) Day	1 Good
2 Dusk/Dawn	2 Fair
3 Night	(3) Poor

This boat's distance from shore, pier, etc.
(Fill out one)

_____ miles, or 1500 feet

_____ kilometers, or 450 meters

This boat's distance from nearest boat.
(Fill out one)

_____ miles, or 1800 feet

_____ kilometers, or 540 meters

Was the accident in a congested area?
(Circle one)

1 Yes (2) No 9 Unknown

Environmental Contributors:

Were any of the following contributors to the accident? (Check one column for each row)

	Yes	No	Unknown
Familiar waters	___	X	___
Unfamiliar waters	___	X	___
Hazardous waters	___	X	___
Undetectable hazard (submerged object)	___	X	___

EXPLANATORY NOTES:

(33)

DATA SOURCE:

Environmental Contributors (cont.):

	Yes	No	Unknown
Undetectable hazard (not visible in this type of light)	_____	X	_____
Traffic, congested area	_____	X	_____
Abrupt change in weather	_____	X	_____
Change in water brought about by floods	_____	X	_____
Improper/Inadequate boat for type of water	_____	X	_____

NOTE: If any of the environmental contributors are checked "Yes", be sure to include these in the narrative.

BOAT IDENTIFICATION:

Manufacturer Name BOSTON WHALER

Model Name --

Year of Manufacture 1970

Does the boat have a Courtesy Motorboat Examination (CME) decal affixed? (Circle one)

1 Yes (2) No 9 Unknown

If yes, what year? _____

CAPACITY INFORMATION:

If no capacity information is available, check here ___, otherwise code as follows:

Maximum Horsepower 100 hp

Maximum Person Capacity -- lb (-- kg) (10 Persons)

Maximum Weight Capacity 2,400 lb (1080 kg)

Weight Capacity stated as: (Circle one)

(1) Persons, motor, and gear

2 Persons and gear

EXPLANATORY NOTES:

(34)

DATA SOURCE:

Does the boat have a BIA plate? (Circle one)

1 Yes (2) No 3 Not Applicable 9 Unknown

If not a BIA plate, sketch the general layout of the capacity plate in this space:

. Length 16 ft. 7 in.
. Normal operating maximum of 10 persons or 2,400 lbs. (Includes engines and accessories)
. Maximum horsepower 100

"This boat meets recommendations for flotation as set forth in the Outboard Boating Club of America Engine Manual. This hull is equipped with specially designed steering and control equipment. DO NOT SUBSTITUTE. For replacement parts refer only to your dealer or the factory."

BOAT TYPE: (Circle the appropriate code)

10 Johnboat (flatbottomed)
(11) Open lightweight motorboat - not johnboat
12 Skiff (heavy open motorboat)
13 Dinghy (under 10 ft.)
14 Rowboat (manually propelled)
15 Bowrider runabout
16 Runabout (decked forward)
17 Bass boat
20 Cuddy cabin boat (limited accommodations under raised forward deck)
21 Cabin motorboat (cabin constructed forward, bulkhead with doors or hatches enclose cabin)
22 Houseboat
23 Pontoon boat
30 Canoe
31 Kayak
32 Inflatable boat
33 Inflatable raft
34 Non-inflatable raft
40 Sail only
41 Auxiliary sail (inboard engine)
42 Sail with outboard kicker
50 Other (hydroplane, airboat, any category not listed above. Specify:_____)

EXPLANATORY NOTES:

DATA SOURCE:

HULL MATERIAL: (Circle the appropriate code)

1 Wood (includes wooden construction sheathed by fiberglass or metal)
2 Aluminum
3 Steel and Steel Alloys
(4) Fiberglass, Reinforced Plastic(rigid construction)
5 Non-Reinforced Plastic(rigid construction)
6 "Rubber" (plastic inflatable)
7 Other (Specify :_____)

HULL SHAPE: (Circle the appropriate code)

1 Deep-V(ø greater than 18^{o})
(2) Semi-V(ø less than 18^{o})
3 Cathedral or Tri-Hull
4 Flatbottom
5 Roundbottom
6 Other (Specify:_____)

WEIGHTS:

Weight of Boat (inboard only)	-- lbs.	-- kg.
Weight of Hull (without gear and engine) (outboard only)	900 lbs.	405 kg.
Weight of Engine(s) (outboard only)	244 lbs.	109.8 kg.

PROPULSION SYSTEM:

Total Horsepower	85
If twin engine, port engine horsepower	____
starboard engine horsepower	____

EXPLANATORY NOTES :

DATA SOURCE:

Engine attached by: (Circle one)
1 Clamp (2) Bolts

Engine attached at: (Circle one)
(1) Transom 2 Other (Specify: _____)

Engine Manufacturer Name Mercury

Primary Propulsion System: (Circle one code)

1	Inboard	4	Sail
(2)	Outboard	5	Manual
3	Inboard/Outdrive	6	Other

Primary Propulsor: (Circle one)
(1) Propeller 2 Water Jet 3 Other

Number of Propulsors in Primary System 1

Secondary Means of Propulsion: (Circle one code)

1	Outboard	4	Other
2	Sail	5	None
(3)	Manual		

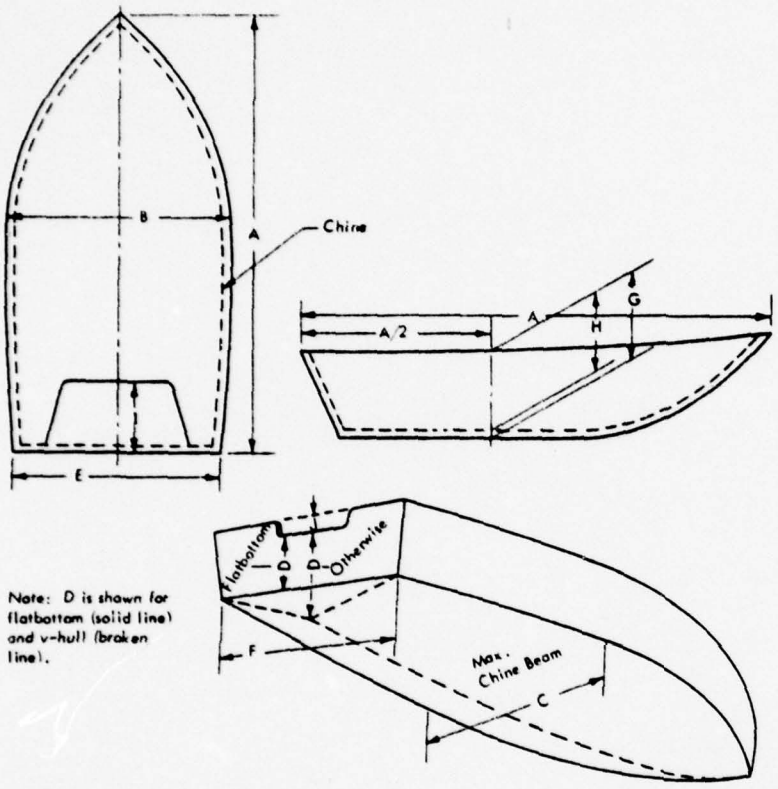
CONTROLS:
Location of control station: (Circle one code)

1	Engine Mounted	(4)	Center Console
2	Starboard	5	Other
3	Port		

EXPLANATORY NOTES:

(37)

DATA SOURCE:



Note: D is shown for flatbottom (solid line) and v-hull (broken line).

MEASUREMENT:

A	Length Overall	16	ft.	7	in.	4.8	m.	17.5 cm.
B	Maximum Beam at Gunwale	6	ft.	1.5	in.	1.8	m.	3.8 cm.
C	Maximum Beam at Chine	5	ft.	8	in.	1.5	m.	20 cm.
D	Transom Height at Centerline	-	ft.	21.5	in.	-	m.	53.8 cm.
E	Transom Width at Gunwale	6	ft.	1.5	in.	1.8	m.	3.8 cm.
F	Transom Width at Chine	5	ft.	8	in.	1.5	m.	20 cm.
G	Depth Amidships, Keel to Top of Gunwale	UK	ft.		in.		m.	cm.
H	Depth Amidships, Gunwale to Cockpit Sole	UK	ft.		in.		m.	cm.
I	Length of Motorwell		ft.	14.5	in.		m.	36.3 cm.
J	Height of Motorwell below Transom		ft.	5	in.		m.	12.5 cm.

EXPLANATORY NOTES:

DATA SOURCE:

Steering controls: (Circle one code)

1 Controlled from engine 3 Tiller
(2) Remote steering wheel 4 Not applicable

Shift/Throttle controls: (Circle one code)

1 Manual 3 Hydraulic
2 Electric (4) Mechanical

Throttle and shift controlled by same lever: (Circle one)

(1) Yes 2 No 9 Unknown

BILGE/COMMUNICATIONS:

Bilge: (Circle one code)

(1) Open
2 Partially decked
3 Completely decked
4 Tunnel
5 Other (Specify:_____)

Bilge pump installed: (Circle one)

1 Yes (2) No 9 Unknown

Sound amplifying device (loudhailer): (Circle one)

1 Yes (2) No
9 Unknown (Specify:_____)

Electronic communication device: (Circle one code)

1 AM broadcast receiver only
2 FM broadcast receiver only
3 FM marine weather receiver
4 CG radiotelephone
5 VHF radiotelephone
6 SSB radiotelephone
7 Other

EXPLANATORY NOTES

DATA SOURCE:

ADDITIONAL SAFETY EQUIPMENT:

Navigational aids aboard (charts, compasses, etc.) (Circle one)

1 Yes (2) No 9 Unknown

Specify_____

Navigation lights: (Circle one code)

Meet legal standards-

(1) Inland 3 Some, but don't meet standards

2 International 4 None

Anchor/Anchor line on board: (Circle one)

(1) Yes 2 No 9 Unknown

LIFE SAVING AIDS:

Deck hardware (grab rails, life lines):

(Circle one)

(1) Yes 2 No 9 Unknown

Specify_____

Level Flotation Equipped

1 Air chamber (2) Poured foam compartments

3 Foam blocks 4 Other

Number of personal flotation devices aboard:
(Enter two numbers for each PFD type)

	Number	Number Serviceable
Number of Type I	_____	_____
Number of Type II	2	2
Number of Type III	_____	_____
Number of Type IV	1	1
Number of non-approved PFDs aboard	_____	_____

Describe non-approved PFDs _____

Additional life preservation aids (dinghies, rafts, etc.):

(Circle one)

1 Yes (2) No 9 Unknown (Describe_____)

EXPLANATORY NOTES:

DATA SOURCE:

DESCRIPTION OF ACCIDENT PARTICIPANTS (complete every row for each person)	OPERATOR	PASS. 1	PASS. 2	PASS. 3	PASS. 4
Age	23				
Weight	135				
Height	5'2"				
Sex: 1 Male 2 Female	2				
Indicate highest grade completed in school (See instructions)	12				

FORMAL BOATING SAFETY INSTRUCTION:

(Circle one digit for each person)

1	USCG Auxiliary	1	1	1	1	1
2	U. S. Power Squadron	(2)*	2	2	2	2
3	American Red Cross	3	3	3	3	3
4	State sponsored boating inst.	4	4	4	4	4
5	Other (Specify _____).	5	5	5	5	5
6	None	6	6	6	6	6
Last two digits of year when the individual's most recent course was completed		__				

TOTAL EXPERIENCE/EXPERIENCE ON THIS BOAT:	5/5	_/_	_/_	_/_	_/_

1 Less than 5 hrs
2 5 - 20 hrs
3 20 - 100 hrs
4 100 - 500 hrs
5 Greater than 500 hrs

(Enter 2 digits for each person)

EXPLANATORY NOTES:

*Partially completed the course

DATA SOURCE:

POOR PHYSICAL CONDITION WAS A FACTOR IN THIS ACCIDENT: (See Instruction)

1	Yes	1	1	1	1	1
2	No	2	(2)	2	2	2
9	Unknown	9	9	9	9	9

WEARS PRESCRIPTIVE LENSES (INCLUDE SUNGLASSES IF PRESCRIPTION):

(Circle one digit for each person)

1	Yes, worn at time of accident	1	1	1	1	1
2	No	2	(2)	2	2	2
3	Yes, but not at time of accident	3	3	3	3	3

SWIMMING ABILITY:
(Circle one digit for each person)

1	Above Average	1	(1)	1	1	1
2	Average	2	2	2	2	2
3	Below Average	3	3	3	3	3
4	Non-Swimmer	4	4	4	4	4

HOW OFTEN DID THIS PERSON SWIM DURING THE PAST YEAR? (Enter one digit per person)

1	0-6 times	3	—	—	—	—
2	0-12 times					
3	12-24 times					
4	More					
9	Unknown					

EXPLANATORY NOTES:

DATA SOURCE:

ACCIDENT TYPE:

Grounding	1	Primary	2
Capsizing	(2)	Secondary	6
Flooding/Swamping	3		
Sinking	4	Tertiary (third)	
Collision	5		
Falls Overboard	(6)		
Other	7		
Specify			

ACCIDENT DESCRIPTORS:
(Circle the codes of all that are relevant)

Collisions, Groundings

01 Two boats head on
02 Bow/Side
03 Bow/Transom
04 Side/Side
05 Ran aground
06 Hit fixed object (submerged)
07 Hit floating object other than boat

Capsizing, Flooding, Sinking

09 Wave over bow
10 Wave over stern
11 Wave over gunwale
- Another boat's wake
12 Over bow
13 Over stern
14 Over gunwale
- Boats's own wake

EXPLANATORY NOTES:

(42)

DATA SOURCE:

15 Over bow

16 Over stern

17 Over gunwale

18 Passenger movement

19 Load shift (other than passenger)

- Water through hull via drains, vents, holes

(20) Control cables

21 Water through damaged hull

Others

(22) Falls overboard

23 Falls within boat

24 Material failure

25 Other (Specify: _____)

Using the codings as shown, list the three major descriptors of this accident; i.e., the three major causes, by number:

1. 20

2. 22

3. _____

EXPLANATORY NOTES:

(114)

DATA SOURCE:

NOTE: N/A stands for Not Applicable; UNK stands for Unknown

Were any of the following accident contributors related to this boat? (Every row should have a check-mark in it.)

	YES	NO	N/A	UNK
Peculiarities in handling characteristics	X			
View obstruction attributed to boat design		X		
Inefficient control station layout		X		
Structural failure		X		
Steering failure	X			
Other equipment failure		X		
Steering or throttle out of adjustment		X		
Were this boat's navigation lights adequate?			X	
Were this boat's navigation lights on?			X	
Loss of stability during high speed maneuver		X		
Loss of stability due to wave or wake	X			
Loss of stability in strong current, rapids, rough water		X		
Ran out of fuel		X		
Blower inadequate due to malfunction			X	
Bilge pump inadequate due to malfunction			X	
Slippery deck			X	
Lack of hand or grab rails		X		
Failure of anchor; other anchor related factors			X	

Other: (Explain)_____

EXPLANATORY NOTES:

(45)

DATA SOURCE:

SIGNALLING:

Every row should have two check-marks, one for each question for each row. N/A stands for Not Applicable; UNK stands for Unknown. If a type of signal was not on board, use N/A for "Was it used?"

	Was this type of signal on board?			Was this type of signal used?		
	YES	NO	UNK	YES	NO	UNK
Flares	___	X	___	___	X	___
Flags	___	X	___	___	X	___
Signalling lights (flashlight, etc.)	___	X	___	___	X	___
Electronic	___	X	___	___	X	___

Other:
(Specify)_____

EXPLANATORY NOTES:

(46)

DATA SOURCE:

NOTE: N/A stands for Not Applicable and UNK stands for Unknown.

Were any of the following contributors to the accident with respect to this vessel? (Every row should have a check-mark in it)

	YES	NO	N/A	UNK
Sunglare				
Bright sun	___	X	___	___
Sun high	___	X	___	___
Sun low	___	X	___	___
Just prior to accident, boat was headed into sun	___	X	___	___
Visual problems (overcast, misty, foggy)	___	X	___	___
Changing sun conditions (bright to minimal sun)	___	X	___	___
Noise, Shock/Vibration				
Just prior to accident, boat achieved speeds of approximately 35 mph. 56 kph.				
If outboard motor, running at near full speed	X	___	___	___
Operator inside cabin	___	___	X	___
Full windshield in front of operator	___	X	___	___
No windshield	X	___	___	___
If inboard, equipped with mufflers	___	___	X	___
Boat pounding	X	___	___	___
Ride uncomfortable	X	___	___	___
Was operator seat padded or cushioned?	X	___	___	___

EXPLANATORY NOTES:

DATA SOURCE:

	YES	NO	N/A	UNK
Fatigue/Discomfort/Time Stress				
Vigorous activity during or prior to accident	___	X	___	___
Person uncomfortably cold	___	X	___	___
Facing into wind	X	___	___	___
Facing into spray	X	___	___	___
Person physically ill	___	X	___	___
Hurrying to achieve destination by a certain time	___	X	___	___
Time of outing prior to accident	1.5 hrs.			
Time exposed to elements	1.5 hrs.			
Time elapsed since person last slept	5 hrs.			

EXPLANATORY NOTES:

(48)

DATA SOURCE:

OTHER HUMAN FACTORS/STRESSORS CONTRIBUTORS:

NOTES: N/A stands for Not Applicable and UNK stands for Unknown. (Every row should have a check mark in it.)

	YES	NO	N/A	UNK
Drugs/Narcotics/Alcohol				
Was the operator on medication? (If yes, describe_____)	___	X	___	___
Were narcotics (controlled substances)involved?	___	X	___	___
Was alchohol involved?	___	X	___	___
Was the person(s) drunk?	___	X	___	___
Poor Judgment				
Were any of the following contributors to the accident with respect to this vessel?				
Overloading	___	X	___	___
Exceeding persons capacity	___	X	___	___
Improper load distribution	___	X	___	___
Change in load distribution (not passenger movement)	___	X	___	___
Passenger movement	___	X	___	___
Operator standing on gunwale, bow, transom	___	X	___	___
Passenger standing on gunwale, bow, transom	___	X	___	___
Excessive speed for conditions	X	___	___	___
Operator seated improperly on gunwale, seat back, bow, etc.	___	X	___	___
Passenger seated improperly on gunwale, seat back, bow, etc.	___	X	___	___
Operator unfamiliar with boat	___	X	___	___
Operator unfamiliar with water/ area	___	X	___	___

EXPLANATORY NOTES:

DATA SOURCE:

	YES	NO	N/A	UNK
Operator inattention	___	X	___	___
Failure to detect hazard	___	X	___	___
Navigational error	___	X	___	___
Violations of rules of road	___	X	___	___
Started engine in gear	___	X	___	___
Started engine in improper sequence	___	X	___	___
Did not check weather	___	___	X	___
Ignored weather warning	___	___	X	___
Operator away from helm	___	X	___	___
Operating in malicious/ reckless manner	___	X	___	___
Overconfidence in boat capabilities	___	X	___	___
Overconfidence in ability to handle boat	X	___	___	___
Lack of swimming ability	___	X	___	___
Lack of sufficient safety equipment	___	X	___	___
Did not know how to use safety equipment	___	___	X	___
Disregard for safety precautions	X	___	___	___
Lack of parental supervision for young operator	___	X	___	___

EXPLANATORY NOTES:

DATA SOURCE:

PERSON'S POST ACCIDENT BEHAVIOR WITH RESPECT TO BOAT:

(Enter at bottom of page)

RELATION TO BOAT IMMEDIATELY AFTER ACCIDENT:

1 Maintains contact with boat initially

2 Enters water unconscious

(3) Loses contact with boat initially but regains contact

4 Loses contact with boat initially and unsuccessfully attempts to regain contact

5 Loses contact with boat; does not attempt to regain contact

6 Trapped in overturned boat

7 Voluntarily leaves boat

ACTION:

1 Maintains position in boat

2 Holds onto boat

(3) Loses contact with boat

4 Under boat

RESULT OF ACTION:

1 No injury

2 Drowns

3 Dies from exposure

4 Injured (hospitalization not required)

5 Injured (hospitalization required)

6 Reaches safety

(7) Reaches safety through rescue

EXPLANATORY NOTES:

DATA SOURCE:

	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
Length of time person was in water; enter two codes, first hours, then min. (Enter 00/00 if never in water)	00/05	--/--	--/--	--/--	--/--
Post accident code from above (three digits)	3 3 1 -/-/-	-/-/-	-/-/-	-/-/-	-/-/-
If the person died and was taken from the water, the attitude of the body is best described as: (Circle one digit for each person who died)					
Completely submerged	1	1	1	1	1
Head submerged	2	2	2	2	2
Floating horizontally	3	3	3	3	3
Floating vertically, face not in water	4	4	4	4	4
Floating vertically, face in water	5	5	5	5	5

EXPLANATORY NOTES:

(52)

DATA SOURCE:

PFD AVAILABILITY AND USE	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
PFD aboard for this person's use: (Circle code for each person)					
1 Yes	(1)	1	1	1	1
2 No	2	2	2	2	2
9 Unknown	9	9	9	9	9
PFD accessible just before accident: (Circle code for each person)					
1 Yes	(1)	1	1	1	1
2 No	2	2	2	2	2
PFD accessible just after accident: (Circle code for each person)					
1 Yes	1	1	1	1	1
2 No	(2)	2	2	2	2
3 N/A	3	3	3	3	3
9 Unknown	9	9	9	9	9
Person used PFD: Circle code for each person					
1 Yes	1	1	1	1	1
2 No	(2)	2	2	2	2
3 N/A	3	3	3	3	3
9 Unknown	9	9	9	9	9
If person used PFD, then circle one of the following and the PFD type:					
1 Wore PFD at time of accident and did not remove it	1	1	1	1	1
2 Wore PFD but subsequently took it off	2	2	2	2	2
3 Wore PFD but it came off	3	3	3	3	3
4 Donned PFD after accident	4	4	4	4	4
5 Held onto PFD	5	5	5	5	5
PFD type: (Circle one for each person who used a PFD)					
1 CG approved I	1	1	1	1	1
2 CG approved II	2	2	2	2	2
3 CG approved III	3	3	3	3	3
4 CG approved IV	4	4	4	4	4
5 Non-approved	5	5	5	5	5
If non-approved, describe:					

EXPLANATORY NOTES:

DATA SOURCE:

	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
Evidence of PFD failure: (see instructions; circle one) If yes, explain:					
_____ 1 Yes	1	1	1	1	1
_____ 2 No	(2)	2	2	2	2
_____ 3 N/A	3	3	3	3	3
_____ 9 Unknown	9	9	9	9	9
_____					
_____					
Evidence of improper PFD usage:					
If yes, explain:					
_____ 1 Yes	1	1	1	1	1
_____ 2 No	(2)	2	2	2	2
_____ 3 N/A	3	3	3	3	3
_____ 9 Unknown	9	9	9	9	9
_____					
_____					

EXPLANATORY NOTES :

(54)

DATA SOURCE:

OPERATION OF BOAT AT TIME OF ACCIDENT:
(Circle the appropriate code)

01 Cruising (proceeding normally)

02 Planing

03 Proceeding slowly, but underway

04 Maneuvering (docking, mooring, emergency operations)

05 Racing (sanctioned)

06 Towing

07 Being towed

08 Adrift

09 At anchor (includes moored to buoy or dragging anchor)

10 Docked

11 Other (Specify_____)

99 Unknown

PRINCIPAL ACTIVITY OF PEOPLE AT THE TIME OF THE ACCIDENT: (Circle the appropriate code)

1 Waterskiing

2 Fishing

3 Skin diving or swimming

4 Fueling

5 Pleasure cruising, departing

6 Pleasure cruising, returning

(7) Pleasure cruising, in middle of outing

8 Other (Specify_____)

9 Unknown

ATTITUDE OF BOAT PRIOR TO ACCIDENT: (Circle the appropriate code)

(1) Level

2 Bow High

3 Stern High

4 Listing starboard

5 Listing port

9 Unknown

EXPLANATORY NOTES:

(55) 56X

APPENDIX B

SWAMPING ACCIDENT INVESTIGATION REPORT

Swamping Number 77-2
Date of Accident: End of July, 1977
Investigation Date: August 11, 1977
J. J. DAVIS ASSOCIATES, INC. Number: 77-67

SUMMARY

This swamping involved a 14 ft. (4.1m) Sears MFG runabout with 4 persons on board powered by a 40 horsepower Johnson outboard. There were no injuries and property damage was valued at approximately $850.00. The water was choppy (1 foot chop), due to wakes of other traffic, air temperature 80°F (26.9°c) sky clear, excellent visibility and no reported winds. The boat was drifting near the Coast Guard Station Fire Island while the occupants were fishing. Two approximately 22 ft. (6.6m) I/O drive Deep V-hull type vessels approached the runabout at a high speed. The operator of the runabout reported that as they neared they split apart to pass, one on either side, with only 10 to 15 ft. (3m to 4.5m) clearances. The wakes from these two boats swamped the runabout which sank quickly, stern first, leaving only the extreme forward section of the bow above water. Coast Guard Station Fire Island was notified by witnesses and a unit dispatched for assistance. The passengers and operator were taken to the station, and their boat towed there for dewatering.

The operator was a 19 year old male with 4 years boating experience and had taken a Coast Guard Boating Course. He was unable to avoid the accident due to the rapidity in which it occurred. PFD's were not worn by the occupants and were stowed in the relatively inaccessible forward bow locker.

GENERAL INFORMATION

The operator enjoys boating and uses his boat approximately three times a month during the boating season, for about 5 hours per occasion. He is a cautious boater who only uses his boat when the weather is good and water relatively calm. He attended a Coast Guard sponsored Boating Course two years prior to the accident. Due to this course and consequent boating experience, he is knowledgeable in the areas of small boat handling and safe boating practices. He is a high school graduate and is currently attending college. He is very athletic, and has mastered many athletic skills (evidenced by the trophies on display at his home, and his being a coach for youth activities in several athletic events). He lives with his parents in a middle class neighborhood, and often takes his younger brother with him when boating.

The operator is aware of what conditions brought about the accident, having taken water over the stern once before, and has indicated that the low freeboard on his boat presented some safety hazards. He knows that the positioning of the PFD's below the foredeck was inappropriate but indicated that the limited cockpit area of his boat did not provide enough space for four persons to fish and carry a large amount of gear.

NARRATIVE DESCRIPTION OF ACCIDENT

Pre-Accident

The operator and passengers had been in the boat and fishing for approximately 3 hours (from 1100 to 1400) and had just drifted under the Robert Moses causeway in a north easterly direction with incoming tide. Numerous boats were in the immediate area as was common on most summer weekend afternoons. The operator looked up and noticed 2 approximately 22 ft. (6.6m) I/O drive Deep V hull type vessels bearing down upon him from dead astern 300-400 yards (270-360 m) away. (Refer to figure 7.) The distance was such that the operator at that time felt no concern for the safety of his vessel. Accordingly, he continued fishing. The operator did not become alarmed until the boats had approached to perhaps 30 yards (27 m) away. At this time the operator pointed them out to his passengers and started to move to the forward motor controls and helm from his seat in the stern. At the last moment the two boats split apart and passed the runabout at approximately 20 knots with 10-15 ft. (3-4.5 m) clearances on each side.

Accident

The high wakes (2-3 ft., 60-90 cm) from the two boats' passage converged over the runabout's stern. The operator by this time had made it to the helm and was attempting to start the motor. He was unable to start it however, since it was already partly submerged. One passenger (210 lbs., 94.5 Kg) in the left front seat knew that swamping was imminent and felt his

additional weight would further aggravate the situation. Accordingly, he jumped overboard immediately after the passage of the two boats. (The other two passengers waited until the runabout became submerged before swimming away from it.) Within approximately 10 seconds after the wakes reached the stern of the runabout it was completely swamped with only the bow above the surface. The operator and passengers swam clear and were picked up by other boats in the immediate area who had witnessed the accident and immediately had come to their aid. The operator and passengers were in the water for approximately 30 seconds before being picked up. The Coast Guard was notified of the accident and a 20-footer from the Fire Island station was dispatched to the scene.

Post-Accident

The Fire Island 20-footer towed the runabout to the station for dewatering. This operation completed, it was noted that while the runabout was submerged its hull had been damaged and keel split as one forward seat was ripped out.

PSYCHO/SOCIO AND HUMAN FACTORS

A. Relevant Operator Factors

1. Knowledge that the freeboard at the transom was extremely limited making swamping possible.

2. Knowledge that the loading was high, although within the limits described in the capacity plate.

B. Counterbalancing Factors

1. Education - Coast Guard Sponsored Boating Course, high school diploma, currently enrolled in college.

2. Experience related to boating

- Four years boating in the runabout
- Athletic ability
- Past experience with the boat involved in the accident.
- Has taken water over the transom during rapid deceleration and not swamped.
- Wakes from passing vessels have caused water to enter over the transom and no swamping resulted.
- Has operated numerous times in the immediate vicinity of the accident and under similar sea conditions with no adverse effects.

C. Interaction of A and B Factors

No significant variables such as glare, poor visibility, or poor water conditions influenced the operator's ability to detect the rapidly approaching boats. Their presence was noted while they were at a point approximately three to four hundred yards east of his position. The operator did not perceive the approaching boats as potential threats to his safety as numerous other boats were operating in the area, none of which were causing any threatening wakes. He also assumed that the large number of boats drifting in his immediate vicinity would cause the two approaching boats to change course towards more open water north of his position. This assumption was based on his experience during his morning of fishing, which indicated that any action would not be necessary, as all of the boats entering and leaving the inlet had been using the channel north of his position.

The operator displayed poor judgment in operating his boat in areas with potentially threatening wakes, especially while loaded with four passengers. This is indicated by the operator's statement that he had taken wakes over the transom and that he was aware that a large wake over the transom might cause swamping. The factors defined in Section A were not sufficient to cause the operator to devote full attention to the potential threat of swamping but did influence him in a limited manner. Once the operator realized that the passing vessels would cause large wakes to approach his transom he then attempted to rapidly start his engine and get underway to avoid the possible swamping. This reaction shows that he was aware of the possibility of swamping. Otherwise he would have been concerned only about the possibility of a collision and would have relaxed after the two boats passed.

The counter balancing factors mentioned in Section B played a direct role in both causing the accident and in reducing its severity. These factors contributed to the accident in reducing the operators perception of the possibly severe results of a swamping. He had taken water over the stern before without severe results and would have expected the same results this time. The counter balancing factors reduced the severity of the accident in that the operator was aware that flooding from wakes was possible and that some action (i.e. starting the engine) might be required of him if the flooding got too bad. The operator's past experiences of water entering over the transom may have also influenced his casual attitude toward fishing in the inlet and caused him not to seek protected waters when boating.

The operator's educational experience and mature personality did reduce the severity of the consequences once a swamping was imminent as his actions were correct and his concern for the passengers appropriate. The operator did attempt to take positive evasive maneuvers which were correct at the time and which

would have averted the swamping had they been initiated sooner or the engine not failed to start. The operator indicated that he had learned the consequences of the operation of a boat with a very low freeboard and the need to have PFDs readily accessible. The interview with the operator indicated that his future boating activities would be conducted in a different manner as he would be more aware of the potential effects of other boats on his vessel.

It is doubtful that the alertness of the operator will be substantially changed during all boat operation in the future, as every day operation in any environment cause some lack of attention to potential threats. The operator's failure to continually monitor all boats approaching his position is understandable, as he had not had any adverse interference from any other boat during the morning and no reason to predict any that afternoon. This type of behavior is displayed by automobile drivers everyday, as they do not feel all other traffic is a threat. This acceptance of past experience as being the best prediction of future events was displayed by the operator's lack of reaction to the first observation of the approaching boats. This behavior cannot be expected to change in the future.

PROBABLE CAUSES

The investigation revealed that the accident was a direct result of the 2-3 ft. (.6 - .9 m) wakes generated by the close and rapid passage of the two V-hulled vessels. The high wakes converging on the runabout from directly astern washed over the low transom causing the boat to be swamped. Neither the clear sunny weather nor normal sea conditions for that area (1 foot chop) can be considered contributory factors. The large number of vessels in the area may have restricted the maneuverability of the 2 V-hulled vessels, but this does not account for their high speed through what was, in effect, a heavily congested area. One possible explanation for the apparent failure by the 2 V-hulled vessels to see the runabout, is that neither was cruising in a planing position. Both were riding bow high. It is quite possible that the operators could not see what was directly in front of them, only what was to the side.

The major contributory factors were the runabout's extremely low freeboard (6", 15 cm, at the transom) (refer to Figure 4), and the loading of the stern with 3 passengers, motor, partly full gas tank and tackle box. There is no doubt that the operator complied with the maximum load restrictions as set forth by the capacity plate. There is also little doubt that the runabout fits the loading requirements as set forth by the capacity test system. However, what passes as seaworthy in a laboratory might not under actual sea conditions.

In this case, more awareness and safety consciousness on the part of the 2 V-hulled vessels might have caused them to slow down in that congested area and avoid the runabout by more than the 15 foot (4.5 m) clearances. More safety consciousness on the operator's part might have warned him that a 6" (15 cm) water clearance is not very seaworthy except in flat calm sea conditions. Sensing this, he might have loaded his boat with 2 instead of 3 passengers.

Neither alcohol nor fatigue were factors in the performances of the operator or his passengers.

RECOMMENDATIONS

Education

We recommend that this accident investigation be made available for consideration during the next revision of Coast Guard sponsored Boating Education courses. We believe that this accident can be used as an example of how important awareness and safety consciousness are in boating.

Technical Standards

We recommend that the maximum safe loading criteria as outlined by the runabout's capacity plate be reviewed as to its utility in sea conditions where waves range from 1-4 ft. (.3 - 1.2 m) in height. A transom height of 6" (15 cm) resulting from the loading of the runabout up to maximum capacity is not safe under sea conditions such as these.

(62)

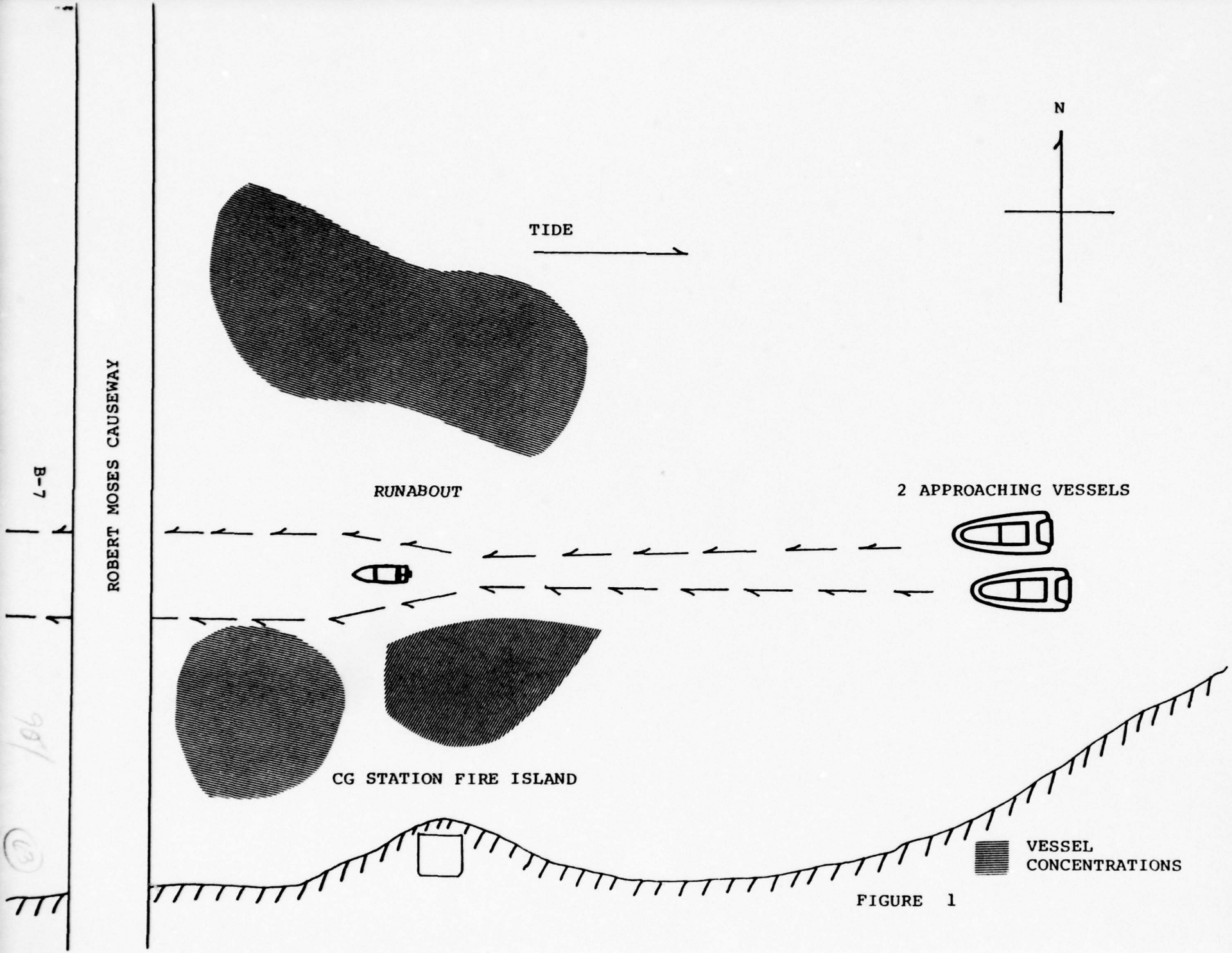

N
TIDE
B-7
ROBERT MOSES CAUSEWAY
RUNABOUT
2 APPROACHING VESSELS
CG STATION FIRE ISLAND
VESSEL
CONCENTRATIONS

FIGURE 1

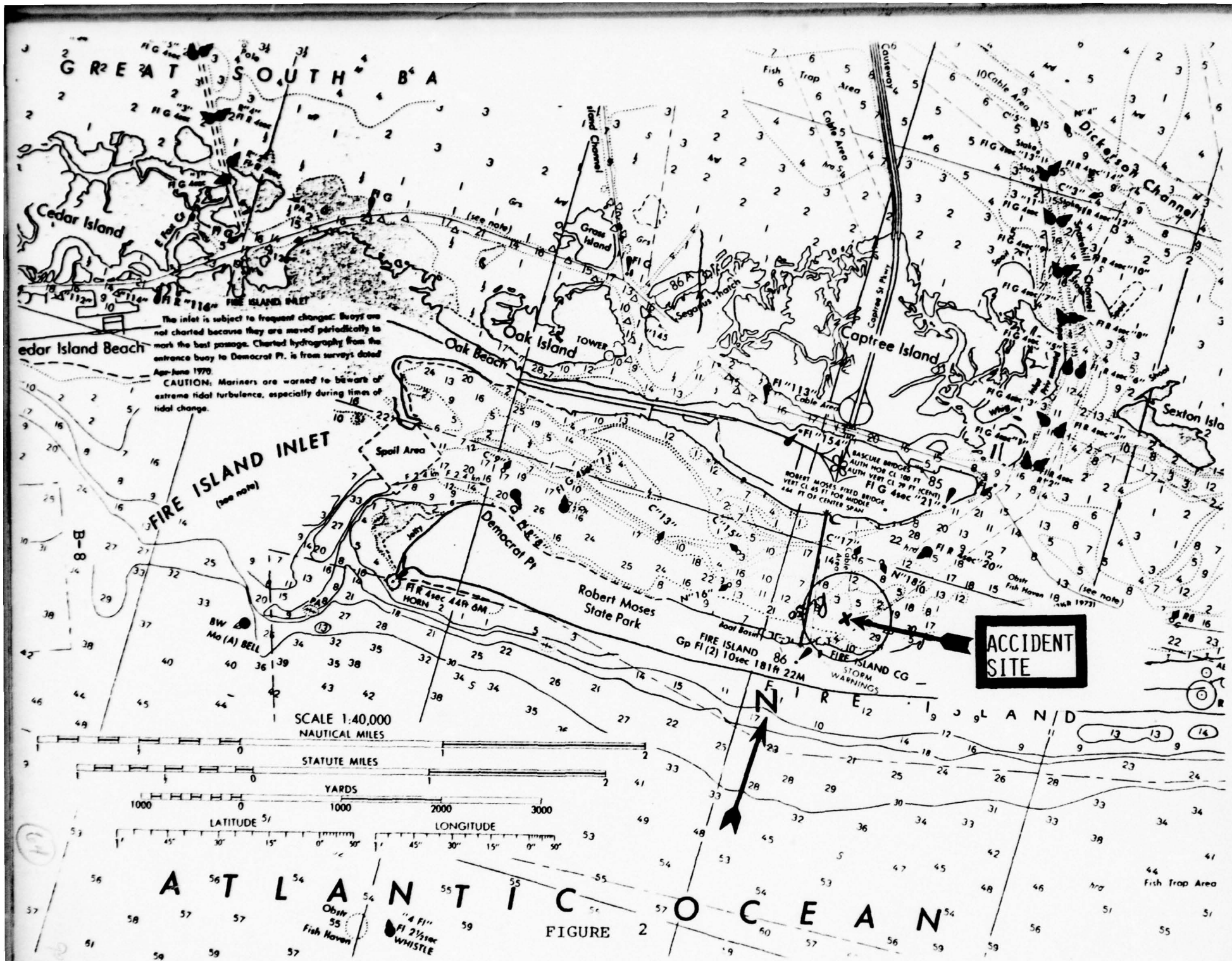
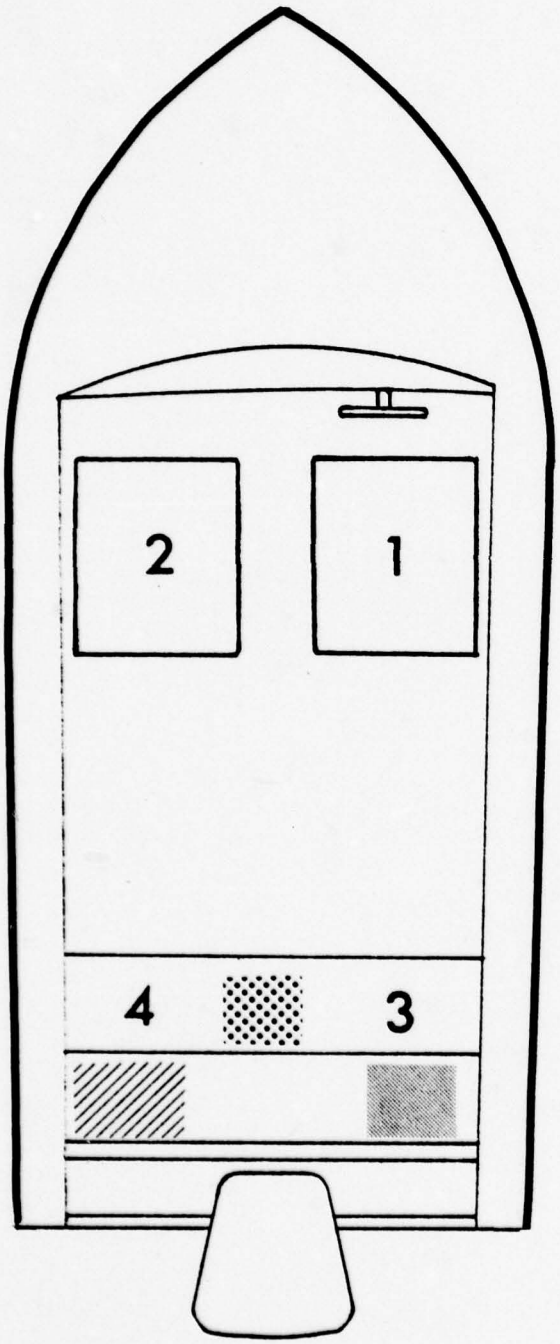

GREAT SOUTH BAY
Cedar Island
Cedar Island Beach
FIRE ISLAND INLET
(see note)
The inlet is subject to frequent changes. Buoys are not charted because they are moved periodically to mark the best passage. Charted hydrography from the entrance buoy to Democrat Pt. is from surveys dated Apr-June 1970.
CAUTION: Mariners are warned to beware of extreme tidal turbulence, especially during times of tidal change.
Oak Island
Oak Beach
Spoil Area
Democrat Pt
Robert Moses State Park
Captree Island
Dickerson Channel
Island Channel
Grass Island
Sexton Isla
Fish Trap Area
Cable Area
Causeway
Captree St Pkwy
Segovius Thatch
Jetty
Boat Basin
FIRE ISLAND
Gp Fl (2) 10sec 181ft 22M
FIRE ISLAND CG
STORM WARNINGS
ROBERT MOSES FIXED BRIDGE
BASCULE BRIDGE
ACCIDENT SITE
FIRE ISLAND
ATLANTIC OCEAN
SCALE 1:40,000
NAUTICAL MILES
STATUTE MILES
YARDS
LATITUDE
LONGITUDE

FIGURE 2

FIGURE 3

14' SEARS MFG RUNABOUT - LOAD DIAGRAM

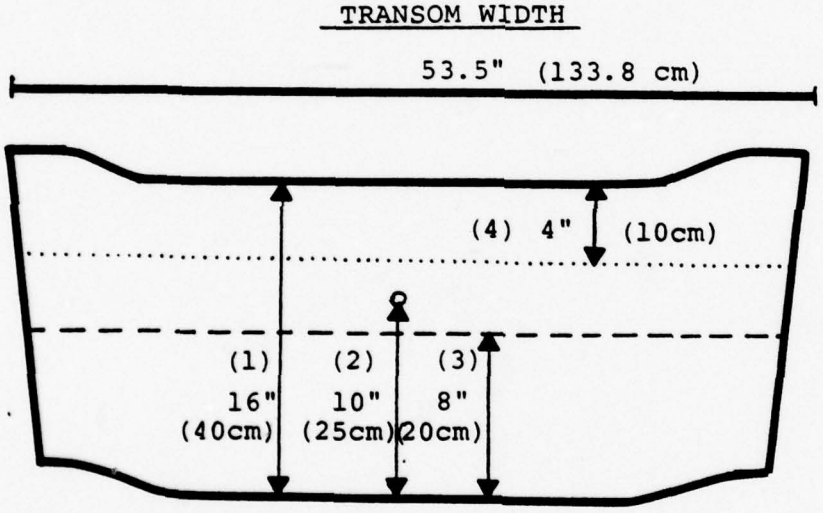


BATTERY (45 LBS., 20.4 KG)
FUEL TANK (35 LBS., 15.8 KG)
TACKLE BOX (4.5 LBS., 2 KG)

1 - OPERATOR (170 LBS., 76.5 KG)
2 - ADULT MALE (210 LBS., 94.5 KG)
3 - ADULT MALE (160 LBS., 72 KG)
4 - CHILD MALE (90 LBS., 40.5 KG)

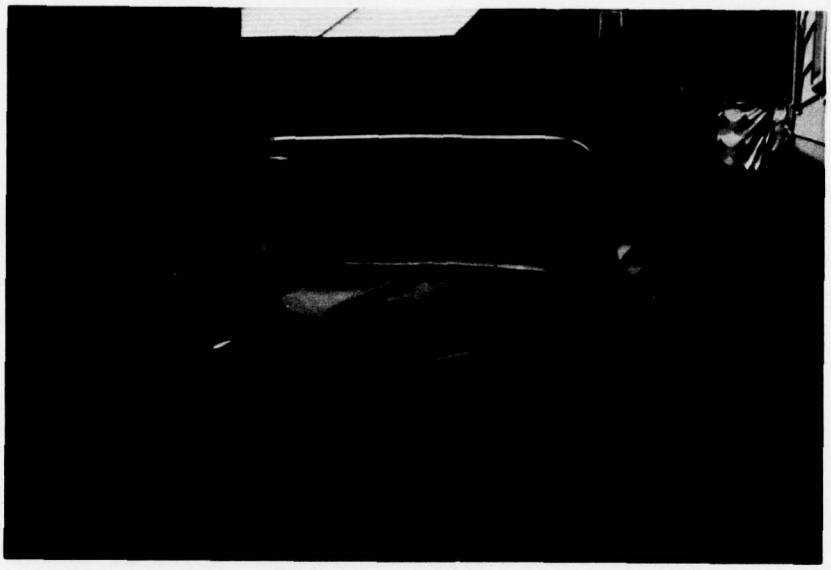
FIGURE 4

VIEW OF TRANSOM FROM STERN



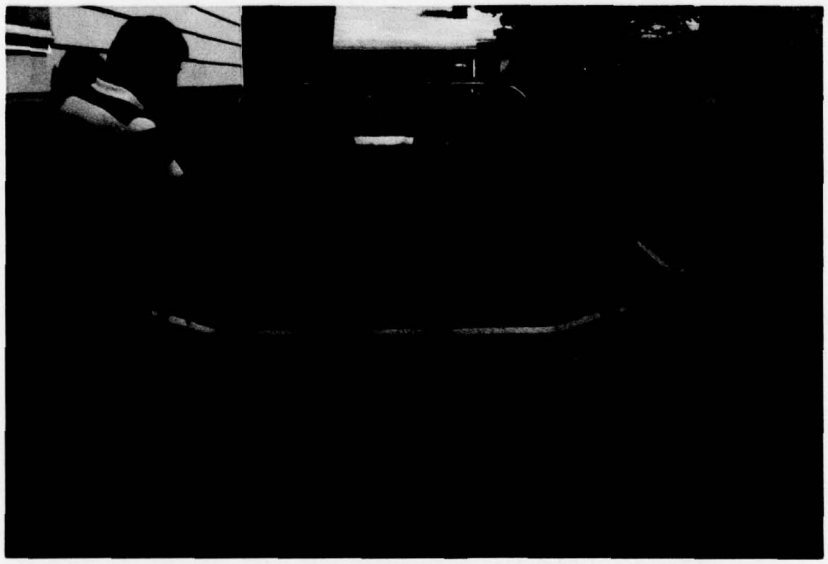
1. TOTAL TRANSOM HEIGHT.
2. HEIGHT TO DRAIN COCK
3. HEIGHT TO UNLOADED WATERLINE
4. TRANSOM FREEBOARD (LOADED)

FIGURE 5



14' SEARS MFG RUNABOUT

FIGURE 6



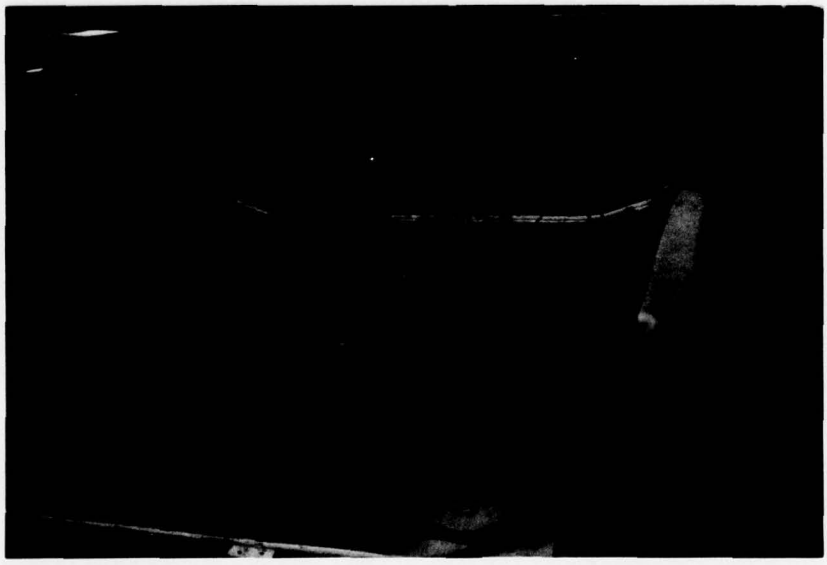
NOTE CRAMPED COCKPIT AND LOW TRANSOM HEIGHT

FIGURE 7



NOTE TRANSOM WATERLINE ABOVE MOTORWELL DRAIN

FIGURE 8



VIEW OF LOW TRANSOM FROM COCKPIT

ACCIDENT DATA SECTION

Case Number 77-2

J.J.D.A. Number 77 / 67

Date of Accident 7 / 29 / 77 (mo/day/year)

Date of Investigation 8 / 11 / 77 (mo/day/year)

State (Use postal codes) NY

Jurisdiction (Circle one digit)
1 State
(2) Joint/Federal
3 High Seas

More than one vessel involved? (Circle one)
1 Yes
(2) No
9 Unknown

NOTE: If more than one vessel was involved, complete a separate booklet for each vessel.

Commercial vessel involved? (Circle one)
1 Yes
(2) No
9 Unknown

Was there at least one fatality? (Circle one)
1 Yes
(2) No
9 Unknown

EXPLANATORY NOTES :

DATA SOURCE:

ENVIRONMENT:

OPERATOR

Time of day of accident (when accident occurred, began, to the nearest hour on a 24 hr. clock; i.e., 2 p.m. = 1400): 1400

Body of Water: (Circle appropriate code)

1 Ocean or Gulf of Mexico
2 Great Lakes
3 Tidal Waters (Rivers)
4 Lake, Pond, Dam, Reservoir
(5) River, Stream, Creek
6 Harbor, Marina

Condition of Water: (Circle appropriate code)

1 Calm
(2) Choppy
3 Rough
4 Very Rough
5 Fast Water, but flat (such as flooded river)
6 White Water, down river

COAST GUARD

Depth of water at accident site 23 ft. 6.9 m.
Relative Humidity 63 %
Air Temperature 80 °F 26.9°C
Water Temperature 71 °F 21.8°C

If precise temperature is unknown, then check one:

Warm (greater than 73°F)(41°C) ____
Cold (60° - 73°F)(34° - 40°C) ____
Very Cold (below 60°F)(34°C) ____

EXPLANATORY NOTES:

DATA SOURCE:

Sky Conditions: (Circle one)

(1) Clear
2 Cloudy
3 Hazy
4 Rain
5 Snow

Wind: (Circle one)

(1) None
2 Light (0-6 mph) (0-10 kph)
3 Moderate (7-14 mph) (11-22 kph)
4 Strong (15-25 mph) (23-40 kph)
5 Storm (over 25 mph) (41 kph)

Wind Direction:

From the N/A

OPERATOR

Was weather a factor (i.e., did it contribute to causing the accident or did it hamper recovery efforts)? (Circle one)

1 Yes (2) No 9 Unknown

Was weather forecast obtained prior to departure? (Circle one)

1 Yes (2) No 9 Unknown

Was weather as forecast? (Circle one)

(1) Yes 2 No 9 Unknown

If not, describe change _____

_____

EXPLANATORY NOTES:

DATA SOURCE:

Was weather warning issued at point of departure? (Circle one)

1 Yes 2 No (9) Unknown

Visibility: (Circle the appropriate codes, one on each list):

(1) Day	(1) Good
2 Dusk/Dawn	2 Fair
3 Night	3 Poor

This boat's distance from shore, pier, etc.
(Fill out one)

_____ miles, or 450 feet
_____ kilometers, or 135 meters

This boat's distance from nearest boat.
(Fill out one)

_____ miles, or 100 feet
_____ kilometers, or 30 meters

Was the accident in a congested area?
(Circle one)

(1) Yes 2 No 9 Unknown

Environmental Contributors:
Were any of the following contributors to the accident? (Check one column for each row)

	Yes	No	Unknown
Familiar waters	____	X	____
Unfamiliar waters	____	X	____
Hazardous waters	____	X	____
Undetectable hazard (submerged object)	____	X	____

EXPLANATORY NOTES:

DATA SOURCE:

Environmental Contributors (cont.):

	Yes	No	Unknown
Undetectable hazard (not visible in this type of light)		X	
Traffic, congested area		X	
Abrupt change in weather		X	
Change in water brought about by floods		X	
Improper/Inadequate boat for type of water		X	

NOTE: If any of the environmental contributors are checked "Yes", be sure to include these in the narrative.

BOAT IDENTIFICATION:

Manufacturer Name Sears

Model Name MFG Runabout

Year of Manufacture 19 73

Does the boat have a Courtesy Motorboat Examination (CME) decal affixed? (Circle one)

1 Yes (2) No 9 Unknown

If yes, what year? _____

CAPACITY INFORMATION:

If no capacity information is available, check here ___, otherwise code as follows:

Maximum Horsepower 45 hp

Maximum Person Capacity 600 lb (270 kg) (4 Persons)

Maximum Weight Capacity 946 lb (425.7 kg)

Weight Capacity stated as: (Circle one)

(1) Persons, motor, and gear

2 Persons and gear

EXPLANATORY NOTES:

(73)

DATA SOURCE:

Does the boat have a BIA plate? (Circle one)

1 Yes 2 No 3 Not Applicable (9) Unknown

If not a BIA plate, sketch the general layout of the capacity plate in this space:

Maximum Horsepower - 45

Maximum number of passengers - 4 persons at 150 lbs. ea.

Maximum load - 946 lbs. total weight with motor.

BOAT TYPE: (Circle the appropriate code)

10 Johnboat (flatbottomed)
11 Open lightweight motorboat - not johnboat
12 Skiff (heavy open motorboat)
13 Dinghy (under 10 ft.)
14 Rowboat (manually propelled)
15 Bowrider runabout
(16) Runabout (decked forward)
17 Bass boat
20 Cuddy cabin boat (limited accommodations under raised forward deck)
21 Cabin motorboat (cabin constructed forward, bulkhead with doors or hatches enclose cabin)
22 Houseboat
23 Pontoon boat
30 Canoe
31 Kayak
32 Inflatable boat
33 Inflatable raft
34 Non-inflatable raft
40 Sail only
41 Auxiliary sail (inboard engine)
42 Sail with outboard kicker
50 Other (hydroplane, airboat, any category not listed above. Specify:_____)

EXPLANATORY NOTES:

(74)

DATA SOURCE:

HULL MATERIAL: (Circle the appropriate code)

1 Wood (includes wooden construction sheathed by fiberglass or metal)
2 Aluminum
3 Steel and Steel Alloys
(4) Fiberglass, Reinforced Plastic(rigid construction)
5 Non-Reinforced Plastic(rigid construction)
6 "Rubber" (plastic inflatable)
7 Other (Specify :_____)

HULL SHAPE: (Circle the appropriate code)

(1) Deep-V(ø greater than 18^{o})
2 Semi-V(ø less than 18^{o})
3 Cathedral or Tri-Hull
4 Flatbottom
5 Roundbottom
6 Other (Specify:_____)

WEIGHTS:

Weight of Boat (inboard only)	____lbs.	____kg.
Weight of Hull (without gear and engine) (outboard only)	1000lbs.	450 kg.
Weight of Engine(s) (outboard only)	210 lbs.	94.5kg.

PROPULSION SYSTEM:

Total Horsepower	40
If twin engine, port engine horsepower	____
starboard engine horsepower	____

EXPLANATORY NOTES :

(75)

DATA SOURCE:

Engine attached by: (Circle one)
① Clamp 2 Bolts

Engine attached at: (Circle one)
① Transom 2 Other (Specify:_____)

Engine Manufacturer Name Johnson

Primary Propulsion System: (Circle one code)

1	Inboard	4	Sail
②	Outboard	5	Manual
3	Inboard/Outdrive	6	Other

Primary Propulsor: (Circle one)
① Propeller 2 Water Jet 3 Other

Number of Propulsors in Primary System 1

Secondary Means of Propulsion: (Circle one code)

1	Outboard	4	Other
2	Sail	5	None
③	Manual		

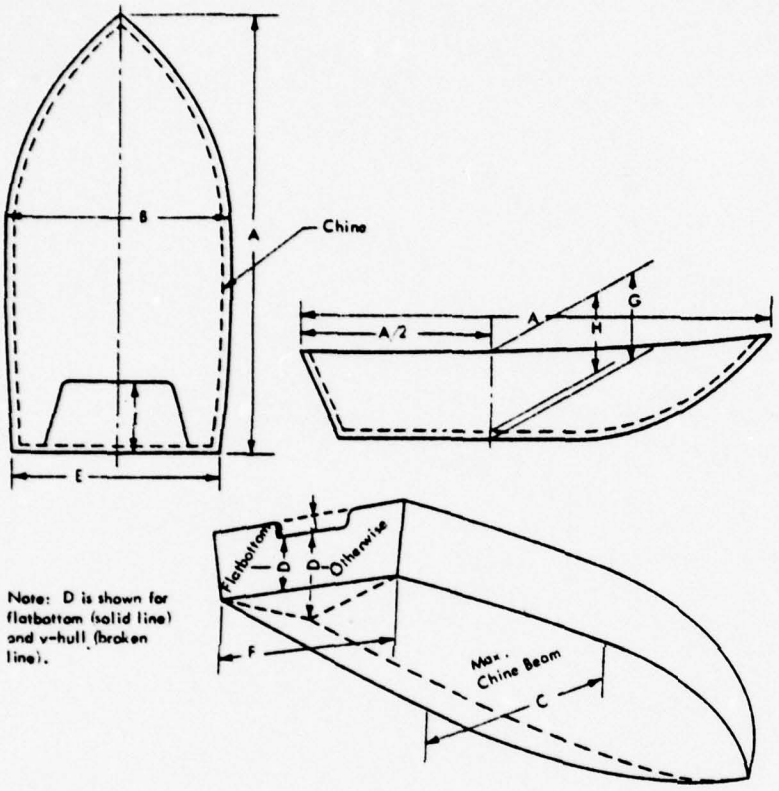
CONTROLS:
Location of control station: (Circle one code)

1	Engine Mounted	4	Center Console
②	Starboard	5	Other
3	Port		

EXPLANATORY NOTES:

(76)

DATA SOURCE:



Note: D is shown for flatbottom (solid line) and v-hull (broken line).

MEASUREMENT:

A	Length Overall	14	ft.		in.	4.1	m.	cm.
B	Maximum Beam at Gunwale		ft.	63	in.		m.	157.5 cm.
C	Maximum Beam at Chine		ft.	50	in.		m.	125 cm.
D	Transom Height at Centerline		ft.	16	in.		m.	40 cm.
E	Transom Width at Gunwale		ft.	53.5	in.		m.	133.8 cm.
F	Transom Width at Chine		ft.	47	in.		m.	117.5 cm.
G	Depth Amidships, Keel to Top of Gunwale	uk	ft.		in.		m.	cm.
H	Depth Amidships, Gunwale to Cockpit Sole	uk	ft.		in.		m.	cm.
I	Length of Motorwell		ft.	8	in.		m.	20 cm.
J	Height of Motorwell below Transom		ft.	3	in.		m.	7.5 cm.

EXPLANATORY NOTES:

DATA SOURCE:

Steering controls: (Circle one code)

1 Controlled from engine 3 Tiller
(2) Remote steering wheel 4 Not applicable

Shift/Throttle controls: (Circle one code)

1 Manual (3) Hydraulic
2 Electric 4 Other

Throttle and shift controlled by same lever: (Circle one)

(1) Yes 2 No 9 Unknown

BILGE/COMMUNICATIONS:

Bilge: (Circle one code)

(1) Open
2 Partially decked
3 Completely decked
4 Tunnel
5 Other (Specify:_____)

Bilge pump installed: (Circle one)

1 Yes (2) No 9 Unknown

Sound amplifying device (loudhailer): (Circle one)

1 Yes (2) No
9 Unknown (Specify:_____)

Electronic communication device: (Circle one code)

1 AM broadcast receiver only
2 FM broadcast receiver only
3 FM marine weather receiver
4 CG radiotelephone
5 VHF radiotelephone
6 SSB radiotelephone
7 Other

EXPLANATORY NOTES

(28)

DATA SOURCE:

ADDITIONAL SAFETY EQUIPMENT:

Navigational aids aboard (charts, compasses, etc.) (Circle one)

1 Yes (2) No 9 Unknown

Specify_____

Navigation lights: (Circle one code)

Meet legal standards-

(1) Inland
2 International
3 Some, but don't meet standards
4 None

Anchor/Anchor line on board: (Circle one)

(1) Yes 2 No 9 Unknown

LIFE SAVING AIDS:

Deck hardware (grab rails, life lines):

(Circle one)

1 Yes (2) No 9 Unknown

Specify_____

Floatation Equipped

1 Air chamber
(2) Poured foam compartments
3 Foam blocks
4 Other

Number of personal flotation devices aboard: (Enter two numbers for each PFD type)

	Number	Number Serviceable
Number of Type I	_____	_____
Number of Type II	4	4
Number of Type III	_____	_____
Number of Type IV	_____	_____
Number of non-approved PFDs aboard	_____	_____

Describe non-approved PFDs _____

Additional life preservation aids (dinghies, rafts, etc.):

(Circle one)

1 Yes (2) No 9 Unknown (Describe_____)

EXPLANATORY NOTES:

(79)

DATA SOURCE:

DESCRIPTION OF ACCIDENT PARTICIPANTS (complete every row for each person)	OPERATOR	PASS. 1	PASS. 2	PASS. 3	PASS. 4
Age	19	19	17	13	
Weight	170	210	160	90	
Height	6'	6'	5'8"	5'3"	
Sex: 1 Male 2 Female	1	1	1	1	
Indicate highest grade completed in school (See instructions)	12	12	11	7	

FORMAL BOATING SAFETY INSTRUCTION:

(Circle one digit for each person)

1	USCG Auxiliary	(1)	1	1	1	1
2	U. S. Power Squadron	2	2	2	2	2
3	American Red Cross	3	3	3	3	3
4	State sponsored boating inst.	4	4	4	4	4
5	Other (Specify _____).	5	5	5	5	5
6	None	6	(6)	(6)	(6)	6
Last two digits of year when the individual's most recent course was completed		76				

TOTAL EXPERIENCE/EXPERIENCE ON THIS BOAT:	4/4	3/3	3/3	3/2	/_

1 Less than 5 hrs
2 5 - 20 hrs
3 20 - 100 hrs
4 100 - 500 hrs
5 Greater than 500 hrs

(Enter 2 digits for each person)

EXPLANATORY NOTES:

	Operator	Pass. 1	Pass. 2.	Pass. 3.		DATA SOURCE:
POOR PHYSICAL CONDITION WAS A FACTOR IN THIS ACCIDENT: (See Instruction)						
1 Yes	1	1	1	1	1	
2 No	(2)	(2)	(2)	(2)	2	
9 Unknown	9	9	9	9	9	
WEARS PRESCRIPTIVE LENSES (INCLUDE SUNGLASSES IF PRESCRIPTION): (Circle one digit for each person)						
1 Yes, worn at time of accident	1	1	1	1	1	
2 No	(2)	2	(2)	(2)	2	
3 Yes, but not at time of accident	3	(3)	3	3	3	
SWIMMING ABILITY: (Circle one digit for each person)						
1 Above Average	(1)	1	1	1	1	
2 Average	2	(2)	(2)	2	2	
3 Below Average	3	3	3	(3)	3	
4 Non-Swimmer	4	4	4	4	4	
HOW OFTEN DID THIS PERSON SWIM DURING THE PAST YEAR? (Enter one digit per person)						
1 0-6 times	3	2	2	3		
2 0-12 times						
3 12-24 times						
4 More						
9 Unknown						

EXPLANATORY NOTES:

(81)

DATA SOURCE:

ACCIDENT TYPE:

Grounding	1	Primary 3
Capsizing	2	Secondary 4
Flooding/Swamping	(3)	
Sinking	(4)	Tertiary (third) _____
Collision	5	
Falls Overboard	6	
Other	7	
Specify_____		

ACCIDENT DESCRIPTORS:
(Circle the codes of all that are relevant)

Collisions, Groundings

01 Two boats head on
02 Bow/Side
03 Bow/Transom
04 Side/Side
05 Ran aground
06 Hit fixed object (submerged)
07 Hit floating object other than boat

Capsizing, Flooding, Sinking

09 Wave over bow
10 Wave over stern
11 Wave over gunwale
- Another boat's wake
12 Over bow
(13) Over stern
14 Over gunwale
- Boats's own wake

EXPLANATORY NOTES:

(82)

DATA SOURCE:

15 Over bow

16 Over stern

17 Over gunwale

18 Passenger movement

19 Load shift (other than passenger)

- Water through hull via drains, vents, holes

20 Control cables

21 Water through damaged hull

Others

22 Falls overboard

23 Falls within boat

24 Material failure

25 Other (Specify: _____)

Using the codings as shown, list the three major descriptors of this accident; i.e., the three major causes, by number:

1. 13 _____

2. _____

3. _____

EXPLANATORY NOTES:

(83)

DATA SOURCE:

NOTE: N/A stands for Not Applicable; UNK stands for Unknown

Were any of the following accident contributors related to this boat? (Every row should have a check-mark in it.)

	YES	NO	N/A	UNK
Peculiarities in handling characteristics	___	___	X	___
View obstruction attributed to boat design	___	___	X	___
Inefficient control station layout	___	___	X	___
Structural failure	___	___	X	___
Steering failure	___	___	X	___
Other equipment failure	___	X	___	___
Steering or throttle out of adjustment	___	X	___	___
Were this boat's navigation lights adequate?	___	___	X	___
Were this boat's navigation lights on?	___	X	___	___
Loss of stability during high speed maneuver	___	___	X	___
Loss of stability due to wave or wake	X	___	___	___
Loss of stability in strong current, rapids, rough water	___	___	X	___
Ran out of fuel	___	___	X	___
Blower inadequate due to malfunction	___	___	X	___
Bilge pump inadequate due to malfunction	___	___	X	___
Slippery deck	___	___	X	___
Lack of hand or grab rails	X	___	___	___
Failure of anchor; other anchor related factors	___	___	X	___

Other: (Explain)_____

EXPLANATORY NOTES:

DATA SOURCE:

SIGNALLING:

Every row should have two check-marks, one for each question for each row. N/A stands for Not Applicable; UNK stands for Unknown. If a type of signal was not on board, use N/A for "Was it used?"

	Was this type of signal on board?			Was this type of signal used?		
	YES	NO	UNK	YES	NO	UNK
Flares	___	X	___	___	X	___
Flags	___	X	___	___	X	___
Signalling lights (flashlight, etc.)	___	X	___	___	X	___
Electronic	___	X	___	___	X	___

Other:
(Specify) _____

EXPLANATORY NOTES:

(83)

DATA SOURCE:

NOTE: N/A stands for Not Applicable and UNK stands for Unknown.

Were any of the following contributors to the accident with respect to this vessel? (Every row should have a check-mark in it)

	YES	NO	N/A	UNK
Sunglare				
Bright sun —	X			
Sun high	X			
Sun low		X		
Just prior to accident, boat was headed into sun			X	
Visual problems (overcast, misty, foggy)		X		
Changing sun conditions (bright to minimal sun)		X		
Noise, Shock/Vibration				
Just prior to accident, boat achieved speeds of approximately 0 mph. 0 kph.				
If outboard motor, running at near full speed			X	
Operator inside cabin			X	
Full windshield in front of operator	X			
No windshield			X	
If inboard, equipped with mufflers			X	
Boat pounding			X	
Ride uncomfortable			X	
Was operator seat padded or cushioned?	X			

EXPLANATORY NOTES:

(86)

DATA SOURCE:

	YES	NO	N/A	UNK
Fatigue/Discomfort/Time Stress				
Vigorous activity during or prior to accident	___	X	___	___
Person uncomfortably cold	___	X	___	___
Facing into wind	___	X	___	___
Facing into spray	___	X	___	___
Person physically ill	___	X	___	___
Hurrying to achieve destination by a certain time	___	X	___	___
Time of outing prior to accident	3 hrs.			
Time exposed to elements	3 hrs.			
Time elapsed since person last slept	6 hrs.			

EXPLANATORY NOTES:

(87)

DATA SOURCE:

OTHER HUMAN FACTORS/STRESSORS CONTRIBUTORS:

NOTES: N/A stands for Not Applicable and UNK stands for Unknown. (Every row should have a check mark in it.)

	YES	NO	N/A	UNK
Drugs/Narcotics/Alcohol				
Was the operator on medication? (If yes, describe_____)	___	X	___	___
Were narcotics (controlled substances)involved?	___	X	___	___
Was alchohol involved?	___	X	___	___
Was the person(s) drunk?	___	X	___	___
Poor Judgment				
Were any of the following contributors to the accident with respect to this vessel?				
Overloading	___	X*	___	___
Exceeding persons capacity	___	X*	___	___
Improper load distribution	___	X	___	___
Change in load distribution (not passenger movement)	___	X	___	___
Passenger movement	___	X	___	___
Operator standing on gunwale, bow, transom	___	X	___	___
Passenger standing on gunwale, bow, transom	___	X	___	___
Excessive speed for conditions	___	___	X	___
Operator seated improperly on gunwale, seat back, bow, etc.	___	X	___	___
Passenger seated improperly on gunwale, seat back, bow, etc.	___	X	___	___
Operator unfamiliar with boat	___	X	___	___
Operator unfamiliar with water/ area	___	X	___	___

EXPLANATORY NOTES:

* See narrative re: Capacity test criteria.

DATA SOURCE:

	YES	NO	N/A	UNK
Operator inattention	___	X	___	___
Failure to detect hazard	X	___	___	___
Navigational error	___	X	___	___
Violations of rules of road	___	X	___	___
Started engine in gear	___	X	___	___
Started engine in improper sequence	___	X	___	___
Did not check weather	___	___	X	___
Ignored weather warning	___	___	X	___
Operator away from helm	X	___	___	___
Operating in malicious/ reckless manner	___	X	___	___
Overconfidence in boat capabilities	X	___	___	___
Overconfidence in ability to handle boat	___	X	___	___
Lack of swimming ability	___	X	___	___
Lack of sufficient safety equipment	___	X	___	___
Did not know how to use safety equipment	___	X	___	___
Disregard for safety precautions	___	X	___	___
Lack of parental supervision for young operator	___	___	X	___

EXPLANATORY NOTES:

DATA SOURCE:

PERSON'S POST ACCIDENT BEHAVIOR WITH RESPECT TO BOAT:

(Enter at bottom of page)

RELATION TO BOAT IMMEDIATELY AFTER ACCIDENT:

(1) Maintains contact with boat initially
2 Enters water unconscious
3 Loses contact with boat initially but regains contact
4 Loses contact with boat initially and unsuccessfully attempts to regain contact
5 Loses contact with boat; does not attempt to regain contact
6 Trapped in overturned boat
7 Voluntarily leaves boat

ACTION:

1 Maintains position in boat
(2) Holds onto boat
3 Loses contact with boat
4 Under boat

RESULT OF ACTION:

1 No injury
2 Drowns
3 Dies from exposure
4 Injured (hospitalization not required)
5 Injured (hospitalization required)
6 Reaches safety
(7) Reaches safety through rescue

EXPLANATORY NOTES:

(90)

DATA SOURCE:

	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
Length of time person was in water; enter two codes, first hours, then min. (Enter 00/00 if never in water)	00/02	00/02	00/02	00/02	--/--
Post accident code from above (three digits)	1/2/7	1/2/7	1/2/7	1/2/7	-/-/-
If the person died and was taken from the water, the attitude of the body is best described as: (Circle one digit for each person who died)					
Completely submerged	1	1	1	1	1
Head submerged	2	2	2	2	2
Floating horizontally	3	3	3	3	3
Floating vertically, face not in water	4	4	4	4	4
Floating vertically, face in water	5	5	5	5	5

EXPLANATORY NOTES:

DATA SOURCE:

PFD AVAILABILITY AND USE	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
PFD aboard for this person's use: (Circle code for each person)					
1 Yes	(1)	(1)	(1)	(1)	1
2 No	2	2	2	2	2
9 Unknown	9	9	9	9	9
PFD accessible just before accident: (Circle code for each person)					
1 Yes	1	1	1	1	1
2 No	(2)	(2)	(2)	(2)	2
PFD accessible just after accident: (Circle code for each person)					
1 Yes	1	1	1	1	1
2 No	(2)	(2)	(2)	(2)	2
3 N/A	3	3	3	3	3
9 Unknown	9	9	9	9	9
Person used PFD: Circle code for each person					
1 Yes	1	1	1	1	1
2 No	(2)	(2)	(2)	(2)	2
3 N/A	3	3	3	3	3
9 Unknown	9	9	9	9	9
If person used PFD, then circle one of the following and the PFD type:					
1 Wore PFD at time of accident and did not remove it	1	1	1	1	1
2 Wore PFD but subsequently took it off	2	2	2	2	2
3 Wore PFD but it came off	3	3	3	3	3
4 Donned PFD after accident	4	4	4	4	4
5 Held onto PFD	5	5	5	5	5
PFD type: (Circle one for each person who used a PFD)					
1 CG approved I	1	1	1	1	1
2 CG approved II	2	2	2	2	2
3 CG approved III	3	3	3	3	3
4 CG approved IV	4	4	4	4	4
5 Non-approved	5	5	5	5	5
If non-approved, describe:					

EXPLANATORY NOTES:

DATA SOURCE:

	OPERATOR	PASS 1	PASS 2	PASS 3	PASS 4
Evidence of PFD failure: (see instructions; circle one) If yes, explain:					
_____ 1 Yes	1	1	1	1	1
_____ 2 No	2	2	2	2	2
_____ 3 N/A	(3)	(3)	(3)	(3)	3
_____ 9 Unknown	9	9	9	9	9
_____					
_____					
Evidence of improper PFD usage:					
If yes, explain:					
_____ 1 Yes	1	1	1	1	1
_____ 2 No	2	2	2	2	2
_____ 3 N/A	(3)	(3)	(3)	(3)	3
_____ 9 Unknown	9	9	9	9	9
_____					
_____					

EXPLANATORY NOTES :

(93)

DATA SOURCE:

OPERATION OF BOAT AT TIME OF ACCIDENT:
(Circle the appropriate code)

01 Cruising (proceeding normally)

02 Planing

03 Proceeding slowly, but underway

04 Maneuvering (docking, mooring, emergency operations)

05 Racing (sanctioned)

06 Towing

07 Being towed

(08) Adrift

09 At anchor (includes moored to buoy or dragging anchor)

10 Docked

11 Other (Specify_____)

99 Unknown

PRINCIPAL ACTIVITY OF PEOPLE AT THE TIME OF THE ACCIDENT: (Circle the appropriate code)

1 Waterskiing

(2) Fishing

3 Skin diving or swimming

4 Fueling

5 Pleasure cruising, departing

6 Pleasure cruising, returning

7 Pleasure cruising, in middle of outing

8 Other (Specify_____)

9 Unknown

ATTITUDE OF BOAT PRIOR TO ACCIDENT: (Circle the appropriate code)

1 Level

(2) Bow High

3 Stern High

4 Listing starboard

5 Listing port

9 Unknown

EXPLANATORY NOTES:

(94)

APPENDIX C

SWAMPING ACCIDENT INVESTIGATION REPORT

Swamping Number: 77-3
Date of Accident: August 8, 1977
Investigation Date: August 10, 1977
J. J. Davis Associates, Inc. Accident Number: 77-78

SUMMARY

This single boat swamping involved a 22 foot (6.6m) T-Craft powered by a 115 horsepower Johnson outboard. The boat with 8 persons on board was drifting 300 to 400 yards (270-360m) off Cedar Beach, Long Island, New York. The seas were choppy and running approximately 3 ft. (.9m), the weather was clear, visibility good, with a strong wind (15-25 mph, 24-40kph). The occupants were engaged in gill netting from the stern. Upon retrieving the gill net over the stern, the operator noticed an inordinate amount of water entering the boat. He correctly deduced that this was caused by an inflow of water through the motorwell and over the transom. This was a result of two conditions. First, since the boat had not been anchored, the retrieval of the gill net caused it to act as a sea anchor bringing the boat's stern to face the oncoming wind and waves. Second, the combined weight in the stern of the operator, his wife, and father-in-law, the gill net, motor and two 20 gallon (76L) fuel tanks caused the stern to lie unusually low in the water. The situation was further aggravated by the fouling of the gill net on the motor housing thus preventing it from being further retrieved or returned overboard. The operator attempted to start the engine in order to turn the bow into the wind. Failing at this, he instructed all passengers to climb onto the bow to prevent the boat from sinking stern first. Witnesses on shore notified the Coast Guard and a unit was dispatched to the scene immediately. Upon the Unit's arrival, the operator and passengers were taken aboard and their boat which had remained upright and partially afloat was towed to CG Station Fire Island. The operator, a 36 year old male with extensive boating experience and a previous Power Squadron Safe Boating Course, prevented what could have developed into a serious accident by his quick appropriate actions. All persons on board were wearing PFDs indicating a high family safety consciousness.

GENERAL INFORMATION

The operator displays considerable knowledge of safe boating practices and regulations though he took the Power Squadron course 2 years previous to the accident. He is a high school graduate in good health and is a licensed boiler operator. He works for the State of New York as a boiler operator and as such he is in the middle class income bracket. He and his family live in a middle class housing area. His boat , house and cars show excellent maintenance. The family participates in their recreational activities as a group and the operator shows considerable concern for their safety. They do not use the boat when the weather is poor but they do like to use it at every favorable opportunity. All members of the family can swim but they have type II PFDs immediately accessible if not worn while boating. Besides the PFDs the operator has insured that all other appropriate safety devices are on board.

The operator now realizes what conditions led to this accident and how to avoid its recurrence. He indicated that the incident was not entirely due to the boat's design but that his method of operation showed design weaknesses which contributed to its occurrence. He stated he would continue to use the boat for its present purpose but that his method of operations would change as a result of his experience .

NARRATIVE DESCRIPTION OF ACCIDENT

Pre-Accident

The operator, his family and in-laws were out for a pleasure ride and fishing trip in the area of Cedar Beach just off the Fire Island inlet. The seas were choppy and running approximately 3 ft. (.9m). The weather was clear, visibility good with a strong wind 15-25 mph, (24-40kph). The air temperature was 80°F (26.9° C), water temperature 71°F (21.8° C) and sea depth 10-17 feet (3-5.1m).

The operator had proceeded directly from the launching area to the scene of the swamping and had set the gill net upon arrival. This net was 100 feet (30m) long and had 20lbs. (9kg) of lead weights attached. The trip from the dock to the accident scene had taken approximately 35 minutes and no difficulties were encountered during this period. After the gill net had been set and in the water for a few minutes, the operator shut off his engine and began retrieving the net and his catch. The operator did not anchor the boat as he retrieved the net, but allowed it to act as a sea anchor. He retrieved the net over the transom with some assistance from his wife. The other adult male, the father-in-law, was also in the stern, watching and helping place the net in the boat. During this time the motorwell cover was in place but the seal around it was poor and not watertight.

Accident

After approximately half the net had been retrieved it became fouled on the outboard engine cover. The operator immediately attempted to free it but while in the process he noticed an unusual amount of water in the boat, and realized that the weight of the net and persons in the stern were causing water to enter through the motorwell. At this point the additional weight of the gill net, and its effects as a sea anchor held the stern very low in the water and waves began to clear the transom and motorwell cover. The operator had attempted to free the net with a knife, but was unsuccessful up to this time. He didn't use the electric bilge pump because his first thought was to start the engine in order to move the boat around into the wind and waves and force the water toward the stern. The small bilge pump could not have handled the rapid inwash of waves over the stern. He then attempted to start the engine but was again unsuccessful as it drowned immediately after starting. The operator then instructed all passengers to put on PFDs and move onto the forward deck in an attempt to balance the boat as best as possible. He then signalled his predicament to people on the beach by waving a piece of plastic back and forth. (He could not use his radio since, by this time, it was submerged.) Coast Guard Station Fire Island was notified and a unit sent to the scene. The unit took all passengers on board and towed the boat to Coast Guard Station Fire Island.

Post Accident

The boat was dewatered at the station, towed to its trailer and taken home by the operator. The only injury occurring during the accident was a slight cut to the operator's hand as he gripped the windshield frame in the area of the running light mast.

PSYCHO-SOCIO AND HUMAN FACTORS

A. Relevant Operator Factors

1. An unusually large number of persons on board (8).
2. Three foot (.9m) waves and strong winds (24-40kph).
3. The unusual occurrence of the gill net fouling on the outboard engine cover, holding the transom down and facing the incoming seas.

B. Counterbalancing Factors

1. Education-the operator had completed a Power Squadron boating course and was a high school graduate.