West Marine/Sea Star Life Raft Test

June 25, 1994

Life Raft Study provided by West Marine, for additional information dial (800)BOATING (800)BOATING

Sponsored by:
West Marine Products
Sea Star Yachting Products
Switlik Parachute Co.
Henshaw Inflatables, Ltd.

INDEX

INTRODUCTION

This report documents a heavy weather test comparing the new Switlik MD-2 yachtsman's life raft and the Tinker Traveller life boat. The test was conducted on June 25, 1994 by West Marine Products, of Watsonville, CA, and Sea Star Yachting Products of Alameda, CA.

OBJECTIVES

This test evaluated two distinctly different types of craft reflecting two approaches to survival and rescue after abandoning ship. The Switlik MD-2 life raft is a conventional type raft designed to be stored for extended periods of time and inflated only during an abandon ship emergency. It can be readied for boarding in less than a minute, using conventional CO2/nitrogen inflation systems, and is packed with a modest inventory of survival gear. It provides environmental protection for up to six individuals. Due to its octagonal shape and lack of propulsion and steering methods, it is not maneuverable.

The Tinker Traveller is a combination inflatable dinghy and survival craft. In appearance, it is similar to an inflatable dinghy like those made by Avon, Zodiac, and West Marine. It has a segmented plywood floor, hard transom, and small dodger on the bow. It incorporates an inflatable survival canopy which encloses the occupants to reduce exposure. In addition, it is supplied with a compact sloop sailing rig with a daggerboard and rudder. This rig, plus conventional oars, allow the Tinker to be sailed or rowed reasonably well so that its crew might be able to reach land or travel to shipping lanes where the chance of rescue is greater.

LOCATION

This test was conducted in the open ocean, in an area NW of the Golden Gate of San Francisco Bay known as the Potato Patch Shoal. This area is north of the main ship channel into San Francisco Bay which is on an approximate course of 60°/240° magnetic. While the ship channel is dredged to about 10 fathoms, the shoals to the north and south of this channel are very rough due to the shallow depths of around 4 fathoms. Waves frequently break during storm conditions, especially during an ebb tide. Due to the strong currents and constricted entrance at the Golden Gate, short wavelength and steep sided chop is abundant, along with the longer Pacific swells. The characteristic "beaten egg white" chop of the Golden Gate provided a remarkably tippy surface to test the capsize resistance of the tested craft.

WEATHER

Typical summer conditions for this area prevailed during this test. Winds at the 1000 PDT launch time were from the NW at 20 knots (force 5). Over the course of the day, winds increased to a steady 25 knots with frequent gusts above 30 knots (force 6-7). Waves were about four feet at the start (sea state 3), building to 6-8 feet (sea state 4-5) at 1400. Whitecaps were present all day long.

SUPPORT VESSELS

The primary support vessel was a Garden 51 fiberglass ketch, *Sea Star*. In addition, a Tinker 10' dinghy was used to ferry participants between the life rafts and *Sea Star.*

PARTICIPANTS

Ray Thackeray provided his vessel *Sea Star*, the Tinkers, and three crew members who helped to document the event on video and slide film. West Marine provided six associates, most of whom had extensive offshore sailing experience. Due to the rough conditions, it was not possible to exchange crews as we had done in past tests. Ray Thackeray and Chuck Hawley were the primary testers, with Scott Lonsway and Pepe Parsons also spending time in the MD-2 raft.

SEASICKNESS

Conditions were perfect for inducing motion sickness, and several crew members on the large support vessel were affected by it. Both of our liferaft testers became sufficiently nauseated to vomit. This was associated with specific functions on board the rafts: orally inflating the MD-2 floor, victim recovery from the water where water was ingested, and projects requiring concentration inside the canopies. Normal methods for reducing motion sickness were effective, particularly getting outside the enclosures so that the visual equilibrium was established.

COMMUNICATIONS

A Navico Axis handheld VHF radio was used for communications between the rafts and the support

vessel . This worked well until it was immersed. We believe that the presence of water in the microphone area made the transmission excessively garbled, although the battery may have run down at that point. A Standard Communications HX-230S was also used in a protective vinyl bag, and it performed well. Since it has a relatively large PTT button, the HX-230S was quite easy to operate.

CRAFT TESTED

Below is a brief description of the craft tested:

Switlik MD-2

The Switlik MD-2 is a 6 person raft, meeting the ORC regulations for offshore sailing races. It has two buoyancy tubes with a large self-supported canopy. It is constructed of heat welded polyurethane fabric and is octagonal in shape. It was supplied with Switlik's optional inflatable floor. It was packed in the Switlik Cordura nylon valise.

The MD-2 is the newest of Switlik's yachting life rafts, and it borrows many design features from their other models. Some of these features are as follows:

1. **Materials**: Urethane coated nylon fabric using heat welded construction. The compressed gas inflation system is the same as those used on USCG approved life rafts. The canopy is an orange outside/blue inside material.

2. **Stability**: Ballast pockets are the same as those used in USCG approved rafts. Octagonal shape for stability.

3. **Access:** Two large doors for greater versatility in ventilation and visibility. Door closure via large marine grade zippers.

4. **Price:** Competitive with imported rafts with fewer features to induce customers to buy true offshore life rafts rather than inshore or coastal rafts.

Tinker Traveller

The Tinker Traveller is a dual purpose dinghy and life boat. Without its sailing rig and canopy, it resembles a conventional 12' inflatable sportboat. With its sailing rig in place, the Traveller can be sailed reasonably well upwind and down. With the inflatable canopy in place, the Traveller resembles a small covered wagon, with enough space for two or three adults and some provisions. It can also be fitted with manually operable CO2 inflation cylinders for rapid inflation of the hull chambers. The hull fabric is a Hypalon/neoprene mixture, while other components appear to be heat welded polyurethane/nylon fabric. The Traveller is a six person dinghy, although is does not have enough room for six as a life boat.

The Traveller features "hull within a hull" construction. Inflatable inner portions of the main tubes provide reserve buoyancy should the outer tubes become punctured. This capability was not tested.

The Tinker Lifeboat was designed after the Fastnet Race of 1979 in which hundreds of boats were subjected to gale conditions, and 15 yachtsmen lost their lives. The requirements were as follows:

1. **Stability:** High capsize resistance through hull design and drogue, keeping the lifeboat beam-on to the seas and wind.

2. **Capsize:** Easily righted from within, maintaining thermal protection while inverted.

3. **Navigation:** Ability to maneuver towards rescue.

4. **Comfort:** Thermal insulation from ocean and air, ability to be made dry inside, protection against "fish hits" from below.

5. **Deployment:** Ability to be kept ready for use on deck, or inflated quickly using the hand pump or CO2 inflation.

6. **Drills:** Ability to practice Abandon Ship evolutions except for CO2 inflation.

7. **Durability:** Ability to be used for many years as a working dinghy in addition to life boat duties.

8. **Cost:** Competitive with high quality inflatable dinghies and life rafts combined.

COMPARISON OF EQUIPMENT/CONSTRUCTION/SPECIFICATIONS

	Switlik MD-2	Tinker Traveller Life Boat
Price	$3,970.00	$5,361.00
Price (5 years assuming repacking)	`$5,320.00	$5,361.00
Shape	8-Sided	Sportboat
Storage	Cordura Nylon Valise	PVC Coated Polyester Valise
Tube Diameter	9-1/2" X 2	12"
Outside Dimensions	7' 0" X 7' 0"	12' 0" X 4' 9"
Inside Dimensions	5' 5" x 5' 5"	10'5" x 1' 8"[1]
Weight as Tested	65	121
Main Tube Inflation	CO2/Nitrogen	Hand Bellows/CO2 Optional
Canopy Inflation	Automatic CO2	Hand Bellows
Canopy Openings	Two Inverted V Doors	Two Drawstring Closures
Arch Tubes	One	Self Supporting
Ladders	Two	Over The Bow Boarding
Water	96 oz.	Optional
Flares	3HH/2 Para	Optional
Paddles	Yes	6' Jointed Oars
First Aid Kit	No	Optional
Repair Kit	Yes	Yes
Flashlight	Yes	Optional
Water Activated Lights	One	Optional
Sailing Rig	No	Yes, Sloop Rigged
Sailing Hardware	No	Mast, Rudder, Daggerboard, Shrouds, Sails
Seat/Transom	No	Central Wooden Thwart, Transom
Drogue	Yes	Yes

The bow dodger of the Traveller covers an area approximately 2 feet in length, which could be used for storage or leg room. It is a wedge-shaped area which tapers towards the bow.

ORC SPECIFICATIONS

One of the strongest motivators for equipping a yacht with a life raft is that it is required if the boat is to participate in offshore races. The **Recommendations for Offshore Sailing**, published in the US by US SAILING, describes in detail the attributes which a life raft must have to be approved for use while racing. The following is taken from Appendix II of the 1994 **Special Regulations**:

Requirement	Switlik MD-2	Tinker Traveller
1.a Stowage	Yes	Yes
1.b Only Saving of Life at Sea	Yes	No
1.c Stable	Yes	Yes
1.d Canopy, Highly Visible, Can Collect Rain	Yes	Yes[2]
1.e Painter, Outer Lifeline, Inner Lifeline	Yes	No[3]
1.f Capable of being righted by a single person if inverted	Yes	Yes
1.g Fitted at each opening with an efficient method to board	Yes	No
1.h Buoyant and Rugged Valise	Yes	Yes
1.i Buoyancy divided into separate compartments	Yes[4]	Yes
1.j.1 Capacity, based on buoyancy of tubes	6	6
1.j.2 Capacity, based on floor area	6	3
1.k Floor Design	Yes	Yes
2.a Rescue Quoit	Yes	No
2.b Knife and Bailer	Yes	No
2.c Two Sponges	Yes	No
2.d Sea Anchor or Drogue	Yes	Yes
2.e Two Paddles	Yes	Yes
2.f Repair Outfit	Yes	Yes
2.g Topping Off Pump	Yes	Yes
2.h Electric Torch	Yes	No
2.i Three Handheld Flares	Yes	No
2.j Six Sea Sickness Pills/Person	Yes	No
2.k Waterproof Survival Instructions	Yes	Yes
2.l Non-toxic gas, auto inflation, able to be topped off	Yes	Yes

[2] While the Traveller canopy can collect rain, the rules require that "means shall be provided for collecting rain". It is not obvious if this has to be a special apparatus, or whether a method is sufficient.
[3] The Traveller has an outer lifeline along about 60% of its length and no interior lifeline.
[4] With stacked tube rafts, the floor is left unsupported if the bottom tube deflates, while the canopy is unsupported if the upper tubes deflates and the arch tube is not independent.

DEPLOYMENT/INFLATION

Crew members Hawley and Thackeray simulated an abandon ship evolution for each craft. An abandon ship bag was prepared in advance for each raft. Due to the different design concept of each raft, a different launch methods were used.

The MD-2 is a conventional raft which should only be deployed when it is clear that the primary vessel is sinking, since it cannot be re-used or stored after inflation. In fact, there is a chance of damaging the raft if it is kept alongside a damaged vessel.

With the painter secured to the support vessel, the MD-2 was tossed to leeward and its inflation line was pulled. The raft inflated quickly (approximately 20 seconds), in the upright position, and with the canopy doors in the down position. After the raft inflated, the over pressure valves released excess gas causing the raft to "hiss" for about four minutes. The testers lowered themselves through the canopy door (with some difficulty owing to the rolling of the support vessel and its high freeboard), accepted the prepared "grab bag" from one of the support crew, and cut the painter free.

Deployment of the Traveller requires a different approach. It is stowed on deck like an inflatable sportboat, with its sailing rig stored separately in a 6' x 1' zippered duffel. As with the MD-2, a separate grab bag was used to store the majority of the survival equipment. To deploy the Traveller, its valise was removed, and it was unfolded on the stern deck. One crewmember reached inside the transom and turned on two valves which controlled the flow of CO2 to the right and left hull tubes. The CO2 supplied was enough to inflate the hull tubes about half way. Apparently, the soft nature of the boat makes it more stable initially, since it effectively "sticks" to the water alongside the mother vessel which reduces the chance that the raft will "skip away" in high winds. The boat was put over the lifelines in this partially inflated state. At this point, the sailing rig was slid inside the deflated canopy so that it would be available for use after boarding.

The flaccid nature of the boat made launching without damage challenging, since it sort of draped over the lifelines and stanchions. Two scenarios would have made launching easier: the raft could have been more fully inflated while on deck before launching, and launching from the boat as it sank would have reduced the substantial freeboard.

Alternatively, the Traveller can be kept inflated on deck, as with any inflatable dinghy. This would eliminate the need for the CO2 inflation cylinders. Optionally, *additional* cylinders might be installed which would inflate the life boat more fully. Henshaw believes that pressure release valves are unreliable and expensive and has therefore elected not to use them on the Traveller. This accounts for the partial inflation with CO2 followed by topping off by hand.

BOARDING

Switlik believes that life rafts should be as easy to board as possible. To this end, their rafts are packed with the doors in the canopies as open as possible. The MD-2 has two large triangular-shaped doors which we found easy to enter.

The partially inflated Traveller was difficult to board, since it filled with water from waves and the added weight of the two crew members. The canopy was deflated, and lying on top of the sailing rig duffel, which made it difficult to figure out where to sit. Interestingly, the canopy covers the entire interior of the raft, necessitating entering the canopy by crawling into the fore and aft openings.

When the painter was cut free, one crewmember set to work bailing about 8" of water out of the boat, while the other began to top off the inflation chambers. This proved difficult due to three factors: the valves were located several inches underwater, the pump was designed to be used on a hard surface, and the inflation hose tended to kink if not held in a smooth arc.

After approximately 10 minutes of steady manual inflation, the tubes became firm to the touch, and the crew began to inflate the canopy. Bailing continued via a dinghy style piston-type pump, which proved tiring and ineffective. A standard scoop bailer would have worked infinitely better, being faster and less tiring. Had the Traveller been inflated firmly before launch, it would no doubt have remained drier and would have been easier to board.

DROGUE DEPLOYMENT

Each craft was supplied with a conical drogue measuring approximately 24" in diameter by 36" long. The MD-2's drogue was tethered to one "end" of the raft, so that the doors face across the wind. The valise, which was attached to the raft near the port side door, created substantial drag which caused the raft to yaw about 45° away from the wind. The attachment point of the drogue could be moved from side to side along a section of one of the perimeter lifelines, allowing some variation in drift orientation. It appeared that the attachment point of the drogue to the raft would chafe over time, possibly causing either the lifeline or drogue line to part.

The Traveller's drogue is deployed off the starboard beam, which increases the stability of the raft in heavy conditions according to tests run by the National Maritime Institute Limited. The drogue is made from a brilliant orange mesh that is easy to see from rescue craft due to its distinctive color. It uses a substantially longer rode of approximately 75' as compared to the MD-2's 35'. The Traveller has a length of plastic tubing to protect the line and the tube fabric where the line passes over the inflation tube.

Both drogues would occasionally cavitate on the surface as large waves hit the rafts. The Switlik drogue actually broke the surface several times, although it rapidly sank back into the water. Neither appeared unstable, and neither fouled. While we did not experiment with different drogue line lengths, it would be interesting to compare the rate of drift and the effect on comfort in the raft using different line lengths. In our opinion, both drogues would benefit from additional weighting.

CANOPY DESIGN

The Switlik MD-2 has a single canopy support tube which is placed outboard of the upper inflation chamber. The height and location of the canopy support creates sitting headroom for at least four of the occupants: two at each end under the vertical portion of the tube. The other two crew members would be adjacent to the door, and would have headroom if the doors were open. As with other Switlik rafts, the canopy is bright orange on the outside, and blue on the inside. The blue color is intended to reduce motion sickness orange canopies often seem to induce. The primary effect is to dramatically darken the interior since the combination of the orange and blue colors effectively block most of the light.

The two doors zip from bottom to top, allowing the crew members to trade off freeboard for ventilation and visibility as conditions dictate. There is no designated viewing port. Since the doors zip up, there is a large variation in how much protection vs. ventilation is available. In the conditions which we encountered, it was possible to stand in the raft and grab the arch tube for stability, so that one's height of eye and visibility was increased.

As expected, it was claustrophobic with both doors shut tightly, and neither crew member desired to remain in that state for more than a minute. Light streamed in through the stitching holes along the zipper and it appeared that water might leak in, although none did during our test. The 9 o'clock canopy door had a small rain collection tube, although there was no trough for guiding the rain to the tube.

Fabric tape zipper pulls were located on the outside of the raft, with only the standard zipper pulls on the inside. This seemed odd, since the need is greatest on the inside of the raft.

The Traveller's canopy is made from a bright orange heat welded vinyl fabric that has multiple lengthwise tubes. It is inflated using the hand inflation pump, and forms a lengthwise arched tube which covers the hull from the transom to the aft edge of the covered bow.

The Traveller 's canopy can be completely removed, or removed from one side to open the raft to the elements, as when sailing. The ends of the canopy serve as viewing and ventilation ports, and their openings can be adjusted with the light line which is provided. To stand watch, it is necessary to sit on the transom or forward on one of the tubes, as the canopy effectively covers the entire interior of the boat.

The canopy is laced in place with light line using a chain stitch that can be removed in less than a minute. It is far slower to install, but can be done with the boat in the water. Normally the boat would be stored with the canopy in place, so that it would only have to be inflated to be ready for use. A system for compressed gas inflation of the canopy is available as an option.

The thickness of the inflated canopy provides both insulation in cold weather and flotation in the event of a capsize. Each end of the canopy can be drawn down tightly with lines to seal the interior.

Headroom is limited, although there is enough if the occupants sit on the Traveller's sole. If the sailing rig is fitted, the canopy can be partially deflated and pulled back so that the mast has clearance.

The Traveller canopy can be partially deflated to form a rain water collection pocket, and the sails make effective "catchers" as well.

FLOOR DESIGN

The MD-2 was supplied with an optional inflatable floor, which is made from a light heat welded fabric in two halves. These are inflated orally using a tube similar to those found on inflatable lifejackets. The "tufted" type floor used C-shaped welds to hold the floor in a more or less even thickness. This was comfortable, but not as effective as the drop-stitch floor of the Switlik Coastal raft we tested in 1991 which has a practically flat surface which did not collect water.

We managed to tear off one of the tie-down straps for the floor when we re-boarded the raft from the water, but this did not puncture the air chamber. It is not obvious why the floor is supplied in two halves, but it does complicate the installation and leaves a seam in the center which seems unnecessary.

The Traveller has a plywood floor glued into the fabric of the hull. This makes it somewhat effective for insulation, and also makes it difficult to lose items since there are no intermediate layers. It is quite solid under foot. One area where the plywood floor is clearly superior to inflatable floors is that many survivors have mentioned "fish hits" where large fish (including sharks) have bumped against the bottom of the raft's occupants, resulting in painful bruises.

EASE OF FAMILIARIZATION

Once the inflation lanyard/painter ion the MD-2 s pulled , there is little need for further instructions (a good thing since there are almost no instructions in evidence). The floor must be blown up and attached, and the contents of the survival pack need to be inspected, but for the most part the occupants are left to their own devices. The survival pack is tied to the interior of the raft and is packed in bright yellow fabric to make it easy to find. The knife is in the standard location by one door, along with a water activated light. The drogue was deployed by yanking it free and allowing it to stream upwind. The knife was a collapsible design.

The Traveller was equally devoid of instructions, although anyone familiar with assembling an inflatable sportboat or a sailing dinghy should have no trouble during the day. At night we suspect that it might be very difficult, since the boat needs to have its buoyancy chambers topped off, be supplied with additional gear including the sailing rig, have its canopy inflated, and be launched. This challenge would be reduced if the boat were kept fully inflated.

If the Traveller is launched before the canopy is inflated, it becomes challenging to complete the process since it is necessary to duck under the unsupported canopy to find the pump, bailers, sailing rig, etc. This

proved very nauseating for at least one participant (but there wasn't much during the day of testing that wasn't nauseating). It would be very difficult to complete the process of readying the boat for survival either on deck in the dark, or in the water in the dark.

One advantage, however, is that the Traveller can be inflated manually and deflated any number of times before the actual emergency. In fact, it is likely to be been used many times as a dinghy, so that the location of valves and other equipment would be known to the users. Also, depending on the safety orientation of the ship's crew, mock drills could be carried out with the exception of the CO2 inflation which would simulate the process of abandoning ship. While this is possible with a life raft, it is impractical to actually inflate the raft since it must be professionally re-packed each time, and repeated inflation has a tendency to gradually weaken the fabric.

AIR HOLDING/EASE OF REPAIR

The MD-2 has the traditional stacked independent buoyancy tubes. The canopy arch tube is an integral part of the upper tube. In other words, if the upper tube is violated, the arch tube deflates. Other rafts have a one-way valve connecting the arch tube to the upper buoyancy tube so that the arch tube remains inflated separately.

The urethane based MD-2 fabric is light and strong, and is unlikely to be punctured except at the time of launching. It comes with several clamp-type leak stoppers in its equipment bag. No air loss was noticed during the test.

The Traveller uses a heavier Hypalon/neoprene fabric as befits an inflatable dinghy which might be used on beaches and other rough surfaces. Its patch kit consists of a container with patches, glue, and sandpaper. While not tested, this is probably more suitable to land-based repairs, and would be difficult to use at sea. The twin chambers of each side of the Traveller provide redundant air holding if one tube is somehow damaged. No air loss was noticed during the test.

SURVIVAL KITS

The survival kits packed in most liferafts, as has been documented in numerous articles on survival in the past, are meager in their contents. Depending on the degree of completeness supplied by the manufacturer, and purchased by the customer, life rafts may or may not contain water, flares, fishing kits, first aid kits, repair kits, etc. Life raft buyers are extremely resistant to paying for more complete kits when buying the raft; however at sea, they believe that every kit is woefully inadequate.

Every life raft owner should know what his/her raft contains. If unknown, it should be documented at the raft’s next repack. No one, in our opinion, should rely solely on the equipment supplied in even the highest specification life raft, but should rather augment it with a separate kit.

This separate kit, often referred to as an Abandon Ship Bag, should contain an EPIRB, a water maker, and additional SOLAS-grade flares at a minimum. Although these items can be packed within the raft, there are numerous stories of needing these items without needing to launch the raft. Therefore, we believe that they should be in the raft only if there are similar items carried on board outside of the raft.

PERSONAL VOLUME/FLOOR SPACE

The MD-2 meets Ocean Racing Council specifications, which require 4 sq. ft. per person, and minimum equipment inventories. We only attempted to put four men inside, and while crowded, it was not horribly cramped. The octagonal shape provides fewer places to get out of each other's way, compared to the oval shape of the Switlik Coastal. he use of a vertical canopy arch tube, which is set outboard of the upper tube, provided excellent headroom reminiscent of the Plastimo Offshore raft we found most comfortable in our last test.

The Traveller's interior beam is only about 20" across. Since the canopy attaches to the center of the top of each hull tube, it is possible for three persons to sit on top of the buoyancy tubes on each side, with one's head bowed toward the center and with one's knees against those on the opposite side. With only two aboard, the Traveller's space seemed cramped but adequate. Three or more would have been pretty horrible. The daggerboard trunk/thwart and the bow dodger take up a lot of interior space that might be used for reclining, although one's legs can be extended underneath both items if seated on the floor. If the person on watch were to sit forward, while the person asleep were to lie aft, it might be possible to rest on board.

In general, the Traveller felt too small to spend an appreciable time aboard, and it would benefit by being taller and beamier before we would consider it comfortable at sea.

The ORC regulations require 4 sq. ft. of floor area per person, which the MD-2 achieves with its 24 sq. ft. The Traveller has 15.75 sq. ft., so it barely misses the requirement for a four person life raft.

CAPSIZE RESISTANCE AND RIGHTING

An important part of the test was to purposely capsize the rafts and then attempt to right them and re-board them. While we purposely held the test in rough conditions, neither raft felt unstable when inflated, bailed, and with the drogue deployed.

We tried to establish the relative capsize resistance by loading the rafts with all the weight on one side. In the case of the MD-2, two crewmembers sat in the starboard side gunwale, which caused the port side to lift rapidly. It took a short time for the water to drain from the ballast pockets, whereupon a wave hit the raft and it capsized quickly. Observers reported that the pockets appeared to be 1/3 full of water, at most, at the time of capsize, although the raft had been deployed for 30 minutes or so. We were frankly surprised at how easy it was to capsize the raft.

The raft floated at about a 135° angle of inclination, supported by the arch tube. One crewman was able to climb aboard the overturned raft, pull the righting strap free of its snaps, and pull the raft over easily.

Both crew members boarded without assistance through the doors by means of the webbing ladders. Like all such ladders, they tended to swing under the raft and it took several tries to use the ladder correctly. At night it was felt that the ladders would have been hard to find and use, particularly if the victim were hypothermic.

The MD-2 was capsized a second time to check our observations. In this case, the raft was capsized with three persons on board, and it was only necessary to get them on one side of the raft to initiate the capsize. Righting was accomplished by reaching up to the webbing and pulling the raft over while still in the water.

When righted, the MD-2 had 40 gallons of water inside after the first capsize, and perhaps 10 gallons after the second capsize. The difference was due to the method of righting. Since we did not stand on the raft during the second righting, there seemed to be less chance of scooping water as it came over.

To find out why the MD-2 capsized reasonably easily, we examined the ballast bags while the raft was upright. Even though ballasted with chain, the bags tended to collapse and not hold their "bread box" shape. We are of the opinion that stiff stainless steel wire or the equivalent might be used to force the bags into the shape resulting in the maximum volume.

The Traveller was capsized twice with the canopy in place. Since there are no openings athwartships, the two crewmembers had to lean against the inside of canopy, opposite of the drogue. The life boat rolled reluctantly, and the crew ended up lying inside the inflatable canopy. This attitude could have been

maintained for some time without discomfort; in fact, the Traveller was arguably more comfortable upside down than right side up.

To right the Traveller, the crew simply rolled their bodies in the opposite direction, which caused the boat to resume its upright position. The boat was practically dry when righted, with only a gallon or so left in the hull. This proved to be a much more efficient method of bailing than the pump.

We also tried to use the catamaran righting method of using a line on the high side of the boat (in this case the drogue rode) to pull the boat over. This worked well. Crew members in the water could either slide inside the canopy, or right the boat from the outside. If they elected to use the "inside" method, they would avoid the need to re-board the raft over the bow.

EASE OF CREW RECOVERY

Most yachtsman's rafts are equipped with a throwing quoit and line to assist in making contact with a person in the water. We threw the MD-2 quoit (the Traveller was not so equipped) using a variety of different techniques, and were able to throw it about 25-40 feet. The weighted rubber ring was effective against the wind as well as downwind.

To simulate the recovery of a disabled crew member, one person in the water was pulled aboard by a crewman in the raft. We used a surf rescue technique where the victim faces away from the raft, and the rescuer lifts the victim' by the armpits while falling backwards into the raft. This worked reasonably well , although we were of equal size and not hypothermic. We did not attempt to deflate the MD-2 top tube to lower the freeboard, which is apparently a technique that can be used to make the process easier for rescuers who are of smaller stature.

The method for the Traveller is somewhat different: the low bow area is used as a boarding ramp, and the reduced buoyancy there makes for much lower freeboard. This reduced freeboard made recovering the person in the water much easier.

WATER SHIPPED AT SEA/BAILING

The MD-2 was almost entirely dry when initially inflated, and took on water only as wet crew members climbed in and out, and as it was righted after capsize. The high sides of the raft seemed unlikely to allow water in except when struck by breaking waves. The whitecaps that were prevalent during our trails did not cause water to come aboard.

Once it had been bailed dry initially, the Traveller remained dry as well . Some water leaked in through the grommets in the dodger where the sailing control lines passed through the fabric. In severe conditions, it is possible that water might leak under the canopy along the top of each buoyancy tube, but we did not notice any during the test.

Once again, a bailer with a flat bottom would have been far superior to the dinghy-style piston pump we used.

RATE OF DRIFT/MANEUVERABILITY/ABILITY

While it was difficult to determine the rate of drift of the rafts with any certainty due to the strong currents in the vicinity of the test, we estimate that, in 25 knots of wind, the rafts drifted at about one knot.

The MD-2's drift rate could have been increased by retrieving the drogue and/or collapsing the ballast pockets with a line under the raft. Otherwise, it was not obvious how to affect its course.

While testing the stability of the Tinker, a large container ship was noted approaching the ship channel, and about four miles to seaward. Judging this to be an opportune time to get out of the ship channel, we elected to erect the sailing rig immediately.

The Traveller 's sailing rig consists of a three-piece jointed mast, shrouds with adjusters, boom, two sails, and some running rigging. The kit also includes a kick-up rudder and a daggerboard. After striking the canopy, the crew of two were able to assemble the sailing rig in about 10 minutes. With about 20 knots of wind, only the jib was used, and it propelled the boat at 3-4 knots. There was some trouble with the kick-up rudder, but that was remedied and the boat remained under control. Total distance sailed was probably four miles in very rough water.

The sailing kit, while effective, consists of numerous small items, the loss of any one of which would have rendered the sailing rig inoperable. For example, the shackles were the loose pin type. The mast sections were not joined with shock cord like tent poles. Because this was also the first time that the rig had been stepped, we would anticipate that tricks could be employed by an experienced crew to make it easier in successive attempts.

This is really where the two craft differed the most: the MD-2 is designed to be a stable, practically immobile, survival platform in which the occupants can safely wait for rescue, assuming the rescue agencies have been alerted due to an EPIRB signal or visual sighting. The Traveller provides the option of sailing to a place where a rescue is more likely, or conceivably to land. Several accounts exist of survival in Tinker dinghies where the crew has been able to sail to a higher traffic area and be rescued.

CONCLUSIONS

Nearly all boaters who travel out of sight of land should have some sort of survival raft in our opinion. The numerous documented cases of vessels sinking, due to known causes or unknown, and the short time that a person can survive without protection makes life rafts a necessary part of offshore survival gear.

The craft tested in this test represent two of the best examples of their type: a stable, commodious, unmaneuverable life raft capable of sheltering six occupants; and a multipurpose, maneuverable life boat that can hold five as a dinghy, and 2-3 as a life boat. The Traveller proved that is indeed sailable, and stable, under our test conditions.

We have summarized our conclusions by listing the outstanding features and shortcomings of each type of craft tested. Note that these comments are specifically aimed at the craft tested: there are life rafts and dinghies which are far worse than our samples, and which may have additional shortcomings.

LIFE RAFT ADVANTAGES:

1. Life raft contains minimum survival inventory even without additional gear bag.
2. Rapid deployment technique does not require much practice technique. Most life rafts are identical in operation, and require only general familiarization.
3. Optional "automatic" hydrostatic deployment available.
4. Reasonable area per person when loaded to capacity. Good headroom.
5. High stability when loaded evenly.
6. Good environmental protection.
7. Large search target.
8. Rugged construction and reliability.[5]
9. High freeboard reduces water shipped in heavy seas.

LIFE RAFT DISADVANTAGES:

1. If capsized, occupants will likely have to right it from the outside, exposing them to heat loss.
2. High freeboard makes it difficult to board from the water.
3. Stability of the raft depends on the use of a drogue; if the drogue is lost, the raft is more likely to capsize.
4. Annual re-packing expense expected to cost $200 over the life of the raft. Risk of deterioration if raft is not re-packed, and possible deterioration between repack dates.

5. Single floor life rafts promote heat loss and are very uncomfortable in cold water.
6. Maneuverability, even using paddles, is practically nil.
7. Canopy deterioration has been reported which makes collected water unpalatable.
8. Inability to practice MOB drills without re-packing raft.

LIFE BOAT ADVANTAGES:

1. Can be sailed or rowed to land or to somewhere where the chance of rescue is increased.
2. Multiple opportunities to collect rain water, using sails or canopy, which will have less tendency to pollute the water.
3. Boarding is relatively easy over the bow.
4. Canopy provides buoyancy when inverted, and hypothermia protection when upright and inverted.
5. Can be righted from inside the craft, with less heat loss.
6. Heavy construction using Hypalon fabric.
7. Wooden floor protects against fish impacts.
8. Wooden floor offers some hypothermia protection and cannot deflate with a loss of properties.
9. Redundant air holding in each "side" of the boat.
10. Opportunity for Abandon Ship Drills due to re-packable design.
11. No annual maintenance.

LIFE BOAT DISADVANTAGES:

1. Low freeboard makes water intrusion more likely.
2. Less comfortable, especially when loaded with more than two or three individuals.
3. Does not meet ORC size specifications for more than 3 persons, and fails ORC standards in many areas.
4. Weight of complete craft is heavier than many cruisers will be able to launch easily.
5. More owner responsibility in making sure that craft is ready for use at sea.[6]
6. More incremental processes prior to launch.
7. Color of canopy is nauseating while inside during the day.
8. Likelihood of launching boat with substantial water aboard if not done correctly.

PARTICIPANTS:

Sea Star

Capt. Ray Thackeray, Sea Star Yachting Products, Skipper and "Victim"
Amy Ewing, Masterworks, Documentation
Tim Schaaf, Masterworks, Video crew
Dan Spradlin, Deckhand
Chuck Hawley, West Marine, "Victim"
Paul "Pepe" Parsons, West Marine, Deckhand
Howard Wright, West Marine, Helmsman
Scott Lonsway, West Marine, Photographer
Chris Smith, West Marine, Deckhand
Linda Day, West Marine, Deckhand

Vendors:

Switlik Parachute Company, Trenton, NJ
Henshaw Inflatables Limited, Somerset, England
Navico Navigation and Communications Systems

[5] This is primarily an attribute of Switlik rafts which use polyurethane coated nylon and heat welded seams. Other rafts employ different fabrics, which may not have the same properties. Other

manufacturer also seal the raft in a vacuum bag to protect it against the elements.
[6] This is arguably an advantage, and is consistent with the life boat "participatory" survival philosophy.