

**DEVELOPMENT OF A YAJ26
FOR DISABLED PEOPLE
UNDER CIRCUMSTANCE OF THE OCEAN**

Report



**YAJ26 TECHNICAL GROUP
Non-profit Organization
YACHT AID JAPAN**

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Non-profit Organization YACHT AID JAPAN

We are affiliated with the next organizations.

International **F**oundation for **D**isabled **S**ailing

Japan **S**ports **A**ssociation for the **D**isabled

Japan **P**aralympic **C**ommittee

The new start

13 years has past since we, Yacht Aid Japan, stated to give sailing opportunities for disabled people. We have now 8 branches for sailing activity in Japan and over 2000 people including the disabled and the volunteers are fascinated by the ocean. In addition, we participated in the Paralympic games. We also introduced 3 types of sailing boat, "Freedom Independence" from the U.S., the "Sonar," and the "international 2.4mR" keelboat for Paralympic games.

By a wealthy experience of our activity, we found it necessary to build the boat for disabled people, from the beginner who enjoys sailing to the professional who aims at the Paralympic games. Therefore the boat must be suitable for both a club-racing and a cruising with ability to sail in better condition in spite of a sudden change of weather around Japan. Finally, in 2001, thanks to the Social Welfare, Medical Service Corporation, and The Nippon Foundation, we built up YAJ26 (ARIAKE) as a sailing boat for disabled people which suits for the sea condition at the ocean around Japan.

The basic concept of the boat was an offshore sailing boat which is faster, stronger, lighter, more stable, unsinkable, easily operable, and comfortable of the disabled. We have executed the development forward with the belief that the realization of our concept will surely make up the highly safe boat for all the crew both disabled and able-bodied sailors.

Later, in 2002, we built up the second boat, "JOY." Many improvements were included in the design change.

We hope that these two boats will give the disabled more opportunities to sail. We also hope that not only the disabled but also able-bodied sailors enjoy sailing.

International Foundation Disabled Sailing

Recognized National Authorities

Yacht Aid Japan

President

Masaru OTSAKA

Preface

As normalization is coming to be generally accepted in Japan, the disabled are more encouraged and get to participate in society more actively. In other words, it has become much easier for the disabled to live as the able-bodied do.

But when we look at the disabled sailing, it was not common to build up a boat for the disabled even in the world. Actually there were few kinds of boats for the disabled. Therefore the only one thing that we could do was to remodel the existing boats by ourselves. Needless to say, there was not a boat for the disabled in Japan.

Then we, Yacht Aid Japan (a nonprofit organization to support the disabled in sailing in Japan), began the project called "The Development of the Boat for the Disabled in Japan" in 1998, with the subsidization of Social Welfare and Medical Service Corporation. Though it was the first time to develop the boat for the disabled in Japan, we succeeded in building up YAJ26 (ARIAKE) as a prototype in 2001 with the cooperation of many people. Because YAJ26 is the first 26 feet boat for the disabled, we sent the information of this boat to the world. Then we received many suggestions from many people, such as IFDS chairman, and take them to develop the second boat. Finally in 2002, we built up JOY as the second boat. To examine the performance of these boats, we have participated in the most famous yacht races in Japan. And we have won the prizes in many races.

However I dare to say that developing the boat for the disabled has just begun. When we consider the ability and workability of the disabled, we still have many things to improve and develop the boats. Therefore we will work on them little by little even though we need much time.

I would like to close by appreciating Nippon Foundation supporting our project.

YACHT AID JAPAN
The chairman of the committee for developing YAJ26
Nobuyuki TAKAMA

DEVELOPMENT CONCEPT

AIM OF THE DEVELOPMENT

The aim of the development is to design the safer boat, which suits for the sea condition at the ocean around Japan and promote disabled sailing. As the result we expect Japanese disabled sailors become more competitive at the international racing events such as Paralympic games.

BASIC REQUIREMENT

The boat must be designed and constructed that the category 1, first class disabled people can do all of the operating actions on board.

- The people who can reach the boat by themselves who have the disability level of category 1, first class are the assumed users of the boat. (Mainly wheelchairs)
- The boat should be designed to easily attach the adaptation equipments to compensate individual disability.
- All of the operating equipment must be handled without anybody's assistance.
- The boat shall be both operated by the disabled only and the combination of the disabled and able-bodied.

CONSIDERATIONS AT THE DEVELOPMENT

SAFETY

- Compatibility of high level sailing / motoring performance
- Hull design verification by the tank test
- Powerful engine against the changeable Japanese weather
- Unsinkable hull structure

OPERABILITY

- Proper boat size easily operable by less powerful disabled crews
- Simpler deck and cabin layout for the ease of moving around
- Reducing the needs of moving for the balancing by higher stability
- Comfortable cabin
- Preparations for attachment of adaptation equipments to compensate individual disability

PREPARATION FOR THE PROMOTING ACTIVITIES

- Proper boat size and structure for easy transportation to the campaign sites without the needs of special trucks in the Japanese traffic environment

1. DEVELOPMENT ACTIVITIES

Design committee consists of experienced sailors both disabled and able-bodied, yacht designers and a hydrodynamics researcher. The committee gave the specifications to the designers and required them to meet its specifications. After the required calculations such as structural intensity, stability and resistance curves, it designed the boat and made up a set of drawings. The aim of the design was verified by the tank test with the cooperation of Kinoshita Lab., Institute of Industrial Science, The University of Tokyo.



1/10 scale canoe body models for tank test



The tank test in IIS of YAJ26 1/10 scale models

YAJ26

Yacht Aid Japan, a Japanese disabled sailing organization, designed and built a brand-new accessible sailboat, YAJ26, in the spring of 2001.

She was designed aiming disabled crew can easily and safely sails with or without able-bodied assistance. Photographs 1 show pictures of a development committee.



Photos. 1. Pictures in the Meeting

Principal specifications are, LOA: 8.0m, LWL: 7.6m, Beam: 2.75m, Draft: 1.8m, Displacement: 1.92ton, Ballast: 0.87ton, 128degree stability, 18ps diesel engine, unsinkable hull construction, 24.3m² Mainsail, 14.5 m² Furling Jib. She can carry 8 crew members. Figure 1 shows the sail plan of YAJ26.

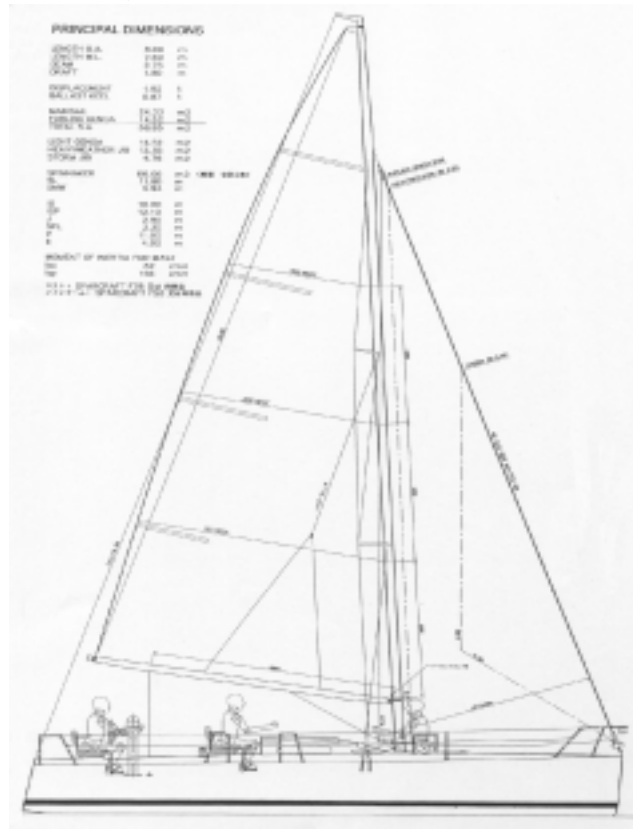


Figure 1. Sail Plan

The combination of rather bigger mainsail and smaller furling jib minimizes the need of bow work while sailing. The boom end is lifted high to prevent boom punch when able-bodied person stands at stern.

Figure 2 shows the deck plan of YAJ26. Completely flat deck layout makes disabled person very easy to move/slide one end of the boat to the other end. Handrails are fixed to the gunwales and cabin top to provide hand holds while moving along the deck.

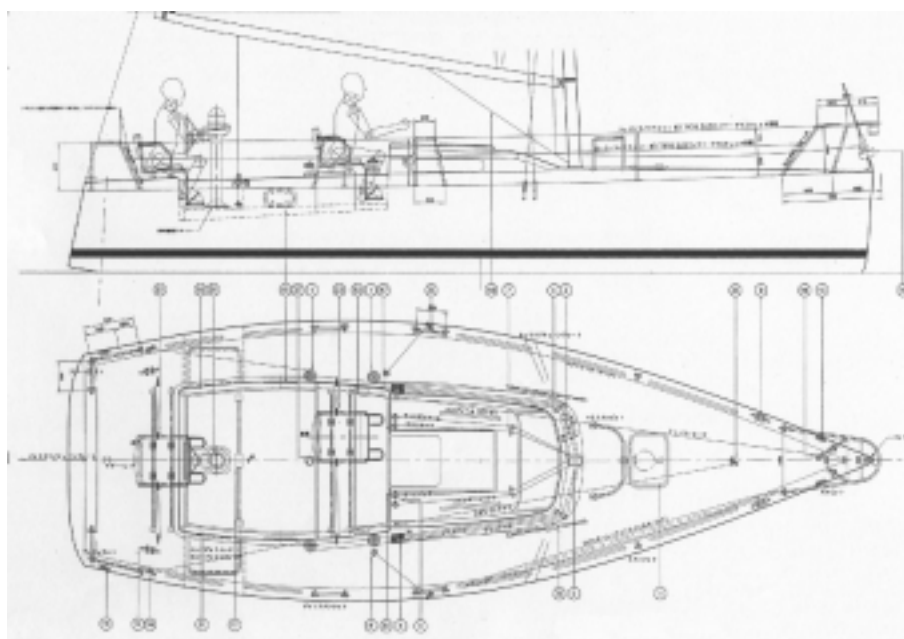
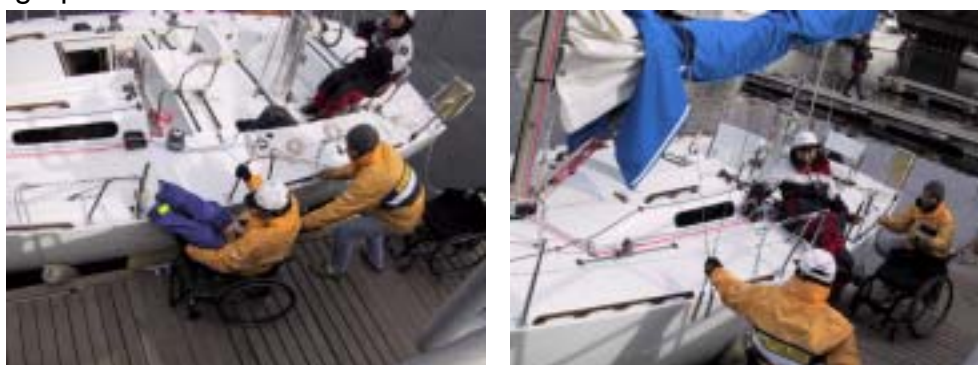


Figure 2. Deck Plan

For the safety of the crew, narrow spaced two lifelines are provided. At both side of the boat, open spaces are provided which are called gate stanchions where lifelines are temporarily removable for the ease of getting on and off board. Photographs 2 show embarkation on YAJ26.



Photos. 2. Embarkation on YAJ26

Photographs 3 show a panorama of the deck of the boat. All control lines are led to the cockpit for the ease of and safety operation.



Photos. 3. Panorama of the deck of the boat

Photographs 4 show the sliding seats. Two sliding seats are fixed on the rails at skipper and jib trimmer position. Disabled sailors can move themselves from one side of the boat to the other using control sheets attached to the sliding seats.



Photos. 4. Sliding seats

Photograph 5 shows the compact steering wheel. A small diameter hydraulic assisted steering wheel is provided in front of the rear-sliding seat.



Photo. 5. Compact steering wheel

Figure 3 shows the general layout and elevator system. Instead of conventional companionway steps a hydraulically operated elevator seat is installed to enable a disabled person to access the cabin. Photographs 6 show the hydraulically operated elevator system.

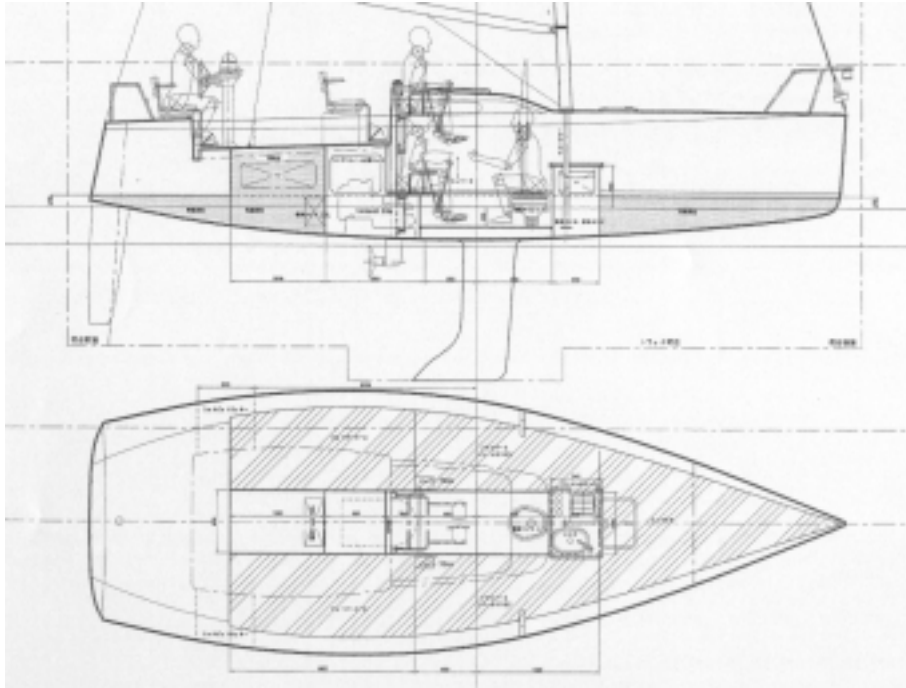


Figure 3. General Layout and elevator system



Photos. 6. Hydraulically operated elevator system

Cabin layout is simple and flat. In the cabin, small toilet, compact basin and cartridge gas stove. (Photographs 7)



Photos. 7. Small toilet, compact basin and cartridge gas stove

The main theme of the boat is Safety. For the better stability, the mass of the ballast is concentrated to the lower portion of the keel. Styrene foam is injected into the major portion of the hull for the buoyancy so the boat is unsinkable if the hull is hardly damaged.

Powerful engine is used to have safety margin to the weather change or crew health condition problems.

The second boat was launched in the spring of 2002. Many improvements, which were found at the trial sailing with the first boat, were included in the design change. Many of the suggestions given by Ian Harrison at his June 2001 boat observation (attachment) were also included in the improvement list. Photograph 8 shows the trial sailing with Ian Harrison.



Photo. 8. Trial Sailing with Ian Harrison

With these boats, Yacht Aid Japan will expand its activity for more range of disability and more way of joy of the sailing.

Attachment

Yacht Aid26 first impressions

1) Observations made by Ian Harrison - Chairman of IFDS during a visit to the Project on the 9th and 10th June 2001.

Yacht Aid26 Suggestions

2) Suggestions for future consideration arising from the visit of Ian and Pauline Harrison to Tokyo on 9th 10th and 11th June 2001.

Attachment 1

(Yacht Aid26 first impressions)

Yacht Aid 26

Observations made by Ian Harrison - Chairman of IFDS during a visit to the Project on the 9th and 10th June 2001.

The first impression of the yacht was that it had not been especially designed for disabled people and would be recognised as an exciting, modern and fast cruiser / racer by the able bodied sailing community. I felt that this was extremely important as sailing is one of the few sports where effective integration is really possible

It was obvious that she had been built to high standards and the finish was excellent. Fittings were of good quality and every thing had been designed for ease of operation.

Great care had been taken in the design of the deck layout and it is possible for a disabled person to move/slide from one end of the boat to the other without having to negotiate obstacles such as winches and cleats etc.

Handrails had been fixed to the gunwales and cabin top to provide excellent hand holds while moving along the deck. A "pulpit" had been fixed in front of the mast to provide security for someone sitting on the deck while working at the foot of the mast. The spinnaker boom track fixed to the mast ran down to deck level to enable to boom to be secured by a sitting disabled person.

A large shallow cockpit had been included to which all running lines were led.

At the aft end of the cockpit two Harken tracks had been fitted onto which a seat fitted with hinged arms had been secured. Lines were attached to each side of the seat and by using these a disabled sailor could move himself from one side of the boat to the other. A small diameter wheel had been provided just in front of the sliding seat by which the boat could be steered. The seat allowed the

sailor to choose whether he steered from the windward or leeward side or some where in between.

The main sheet was also accessible from the sliding seat.

A bridge had been fitted in the cockpit approximately 50 CMS aft of the cabin bulkhead to which another seat running on Harken tracks had been secured and could be operated in the same way as the seat provided for the helm. This provided easy access to the two winches and jamming cleats used for operating halyards sheets and other running lines.

Instead of conventional companionway steps a hydraulically operated seat had been installed to enable a disabled person to access the cabin. A valve had been fitted to the right hand side of the seat to enable the operator to lower himself into the cabin and the seat could be raised to cockpit level by operating a lever situated between the operator's legs.

Bunks were situated immediately either side of the hydraulic seat to provide easy transfer from where a person could slide forward to a small toilet, immediately ahead of which, was a console housing a camping stove and wash basin.

Although six berths were provided this would be very cramped and but four people could be accommodated in reasonable comfort for a short overnight cruise.

Over a period of two days we sailed the yacht in smooth seas with winds varying from 4 to 15 knots and found her easy to handle, responsive and a pleasure to sail. She was fast for her size and the boat worked extremely well on all points of the wind.

In my opinion the yacht could be sailed safely in reasonable conditions with two disabled sailors and one less disabled sailor or an able-bodied crewmember.

My first and final impression is that an enormous amount of thought and care had been involved in the design of what I would consider to be an excellent boat

that could be used by people with a moderate degree of disability.

However, with some additional features and relatively minor alterations the boat could accommodate and provide a memorable and enjoyable sailing experience to people with a much wider range of disabilities. Such alterations would enable even greater participation in the sailing of the boat by disabled people.

Details of the various suggestions arising from our observations of the yacht are attached.

Ian Harrison
Chairman IFDS
19th June 2001

Attachment 2
(Yacht Aid26 Suggestions)

Yacht Aid 26

Suggestions for future consideration arising from the visit of Ian and Pauline Harrison to Tokyo on 9th 10th and 11th June 2001.

General

A great deal of very careful thought had clearly gone into the design of the yacht and had resulted in the creation of a very effective boat capable of being sailed by a mixed disabled and able bodied crew.

The following are suggestions, which in our opinion, would improve on an already very cleverly designed boat.

Wherever possible all protrusions should be removed to avoid injury to people with paraplegia or similar disabilities.

Specific

- 1) The bridge on which the crew seat is secured could be improved if it were lowered by approximately 10cms.

This would give the following advantages: -

- a) It would bring the seat down to same level as the companion way hoist facilitating an easier transfer. Some moveable transfer board between the seat and the hoist along which a person could slide forward or backwards would be very helpful.
- b) It would enable a level and easier transfer from the deck to the seat.
- c) At present the crewmember is pulling the sheets in an upward angle. Lowering the bridge would enable a straighter and more efficient pull to be made.

- 2) The Harken track fixed to the top of the bridge should be let into the surface as the protruding edges of the track could cause injury.
- 3) The bridge itself should be moved aft by at least 30cms. as the space between the bridge and the cabin top bulkhead was extremely restricted. This was uncomfortable if the crew member were to remain seated for any length of time and access would be difficult if they had anything but very small feet. Injury could also occur if the crew person were to experience a spasm while seated. We do not feel that by moving the seat aft any difficulty would be experienced in reaching the running lines such as sheets etc.
- 4) The lines controlling the movement of the crew seat from side to side should be extended to the gunwale, as this would provide additional purchase and better control.
- 5) A broad strap should be fitted to the seat to give security for those with poor balance. This could also improve their ability to pull on the sheets etc. Such a strap would have to be fitted with a quick release mechanism i.e. similar to an aircraft/car seat belt or Velcro fastening.
- 6) The forward part of the arms of the seat should be extended to form a right angle rather than angled at present, as this does not give sufficient support especially when the boat is heeling. The arms should have some form of padding, as the present thin tubing does become uncomfortable when leaned on, for even a relatively short time.
- 7) It would be a great advantage to curve the base of the seat to assist comfort and stability when the boat is heeling.
- 8) If possible, within Japanese maritime regulations, a slightly larger hatchway would provide easier access to the companion way hoist. This could be achieved by raising the cabin top or by extending the hatchway in a forward direction.
- 9) The tubes locating the arms of the companionway hoist are dangerous as they extend above the seat level and have sharp edges.

- 10) The hydraulic lever operating the companionway hoist could be shortened, as it is difficult to operate when the seat is raised to its maximum height. However this would not be necessary if the cabin top could be raised or the hatchway extended.
- 11) Removable, padded rails should be provided on either side of the toilet.
- 12) The view of the instruments indicating speed, wind direction and strength etc. is often obscured from the helmsman's seated position, by the crewmember and relocation could be considered. Possibly on the steering console.
- 13) The location of the spinnaker winch causes an obstruction when moving about the deck and transferring to the bridge seat.
- 14) The pulpit forward of the mast is an excellent idea but does need to be less curved and or moved forward as it is difficult to get into.
- 15) Exactly the same alterations to the helmsman's seat should be considered as for the crew person's seat.
- 16) The space between the footrests on the helmsman's seat the base of the steering column was very restricted and difficulty was experienced when using the seat to move from side to side. Moving the column approximately 20 CMS forward and extending the shaft of the steering wheel would remove this problem. We feel that people with anything but the very small feet would experience similar problems.
- 17) A wide range of audio equipment is now available that can be used in conjunction with navigational aids. If possible, consideration should be given to fitting the yacht with this type of equipment to enable full participation by sailors with a visual disability.
- 18) Consideration could be given to the fitting of wheel chair clamps in a fore and aft position to either side of the floor of the cockpit. However, it

would have to be acknowledged that such users would be limited in their ability to fully participate in the sailing of the yacht.

19) Some people would find the fixing of some handholds inside the cabin useful similar to those fitted to the deck and gunwales of the boat.

20) Some form of curtain to provide some privacy while using the heads (toilet) might avoid some embarrassment although it is recognised that this could be difficult.

Ian Harrison
Chairman IFDS
19th June 2001

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Publications Manager: Masaru Otsuka
3-18-13 Shiratori, Katsushika-ku, 125-0063 Tokyo, Japan
Tel: +81-3-3690-8633 Fax: +81-3-3690-8733
URL: <http://www.yacht-aid.jp>