The following 3 points indicate the necessity for a shipbuilding technology center.

1) The use of "type approval" equipment such as vessel equipment, navigation equipment and life saving equipment, etc., in ensuring safety and reliability is standard but there is no agency in the Philippines to carry out type approval.

2) There is necessity for a place to carry out basic training of the necessary staff for inspection in strengthening the vessel inspection system.

3) Because the agencies responsible for education of shipbuilding engineers do not have the necessary equipment for experiments, it is necessary for facilities to augment this system.

From the above it is preferable that this installation includes test facilities, training class rooms, laboratories, education models and experimentation water tanks, etc. With gradual expansion in the future, the center will play a role in the development of the shipping and shipbuilding industry in the Philippines in the future.

2.4.4 Evaluation

(1) Relationship between maritime accident and seaworthiness

An analysis of recent maritime accidents in Chapter 4 of Main Report repeat in brief as follows;

- Accidents occurred most frequently during typhoon season
- Maritime casualties involved small wooden vessels to a great deal. Small craft accounted for more than half of the total reported mishaps.
- "Aground", "collision" and "caught fire" were generally caused by human error.
- Against these hardships "drifted", "capsized" and "sunk" were regarded as casualties caused by seaworthiness.

Around 50% of accidents are of the "drifted", "capsized" and "sunk" type. This fact points out that the lack of seaworthiness is liable to meet with a hard casualty.

(2) Estimated damage due to lack of seaworthiness in 1990

Despite of the complicated mechanism which ends in a maritime accident, the typical distress due to lack of seaworthiness can be simplified as follows;

- Those to be occurred on calm sea

- Those to be occurred with the figures of capsize, sunk and drifting

The same method in Chapter 7.3 of Main Report is applied to the estimation of the related damage of those accidents in 1990. As a result, the amount of damage is valued at 708.1 million pesos with the following items.

- Loss of hull value	87	vessels	P567.2 mil.
- Loss of cargo	14,804	tons	P109.9 mil.
- Loss of human lives	88	person	P 31.0 mil.

Eventually the accidents caused by the lack of seaworthiness accounts for 20% of the whole ones in number and 30% in value. Therefore the upgrading of ship stability will contribute to prevention of casualties considerably.

(3) Operating Conditions

Operating reports of 171 interisland liners submitted to MARINA in 1990 indicates the following characteristics;

(Profile of Interisland Liners)

Average GRT	6,061
Average DWT	8,906
Average Year Built	1970 (newest in 1989, oldest in 1944
Average Days in Commission	224 days in 1989
Average Miles Run	31,697 in 1989
Daily Operating Cost	P93,439
Daily Running Cost	P60,181
Yearly Cost of Drydock, Repair and Maintenance	P7.6 million

Source: Interisland Liner Shipping Rate Rationalization Study (SRRS)

(4) Identified problems

Average days in commission which is a index of working ration was 224 days in 1989. It was considered to be low compared with the operation condition of Japanese fleet. Because Japanese fleet usually work almost through the year and in case of Intermediate Survey every two years and Special Survey every four years, they separate around 350 days in a year. The following reasons would be supposes in relation to the operating conditions of interisland shipping in the Philippines;

- Average age of domestic fleet is nearly 20 years. These aged vessels result in low operation and high cost of drydocking, repair and maintenance.

- Unnecessary complication of import procedure delay the necessary equipments for ship repair. Consequently spare parts are always lacking while many vessel are waiting around a shipyard.

- Prohibitive costs of ships and high rate of import duties slap on second hand vessels and spare parts and remain domestic fleet obsolete.

- Operations of domestic shipping remain hampered by tremendous bureaucracy with unnecessary clearances and poor maritime infrastructures. These function to detain domestic shipping in low operation.

(5) Conclusion

One of the immediate aims of the shipping industry must be the upgrading of all vessels belonging to the interisland shipping fleet to comply with the proposed inspection system. But the cost of equipping and reconditioning existing vessels and replacing obsolescent ships represents and additional burden on the ship operator, especially on the minor operator.

For that reason, it is afraid that enforcement of the proposed inspection enfeebles the viability of interisland shipping, while intensified inspection system will bring a great benefit from a socio-economic point of view.

Taking into account of these complicated situations, this study recommend that the proposed inspection system should be implemented with other countermeasures to improve the operating conditions of interisland shipping such as simplification of import procedures and related clearances, incentives to taxation system and replacement of old vessel and development of shipbuilding/repair industry simultaneously.

2.4.5 Necessity for Formulation of General Shipping and Shipbuilding Policies

The Philippines are an island nation made up of in excess of 7,000 islands making the shipping industry an essential component without which the national economy would fail to exist. It can also be said in this case that the shipbuilding and repair industry is essential. However, when looking at the present state of affairs, in a state of depression with dilapidated vessels, to coming to the conclusion that shipbuilding is on the decline and the road to recovery is far off is unavoidable. Under these circumstances, it is recommended that in order to ensure maritime vessel safety, the inspection system is to be strengthened and that inspections are strictly enforced. However what is afraid of the possibility that the shipping industry could lapse into more and more of a decline by

strengthening the inspection. The Philippine government is attempting to work out the previously mentioned policies (PISDA) in order to bring about development of the shipping industry. But as stated before it cannot be conducive to improve vessel safety.

Looking back, a "10 year shipping and shipbuilding program" with the Board of Investment (BOI) as the primary figure, was formulated with the objectives of ensuring vessel safety and stimulating the shipping and shipbuilding industries in the Philippines from the mid '70s to the mid '80s, this program was implemented but is not said to have been a success. In actual fact, even though this program was completed, as before, the shipping industry still had dilapidated vessels, maritime cargo movement became stagnant and shipbuilding industry went into a destructive decline. Firstly clarification of the causes of the unsuccessful results must be made and then measures must be taken to make sure that the same mistakes are not repeated. Furthermore, as long as there is no positive move towards the development of the shipping industry and vessel modernization, regardless of the strengthening of the vessel inspection system, it will not be effective and the whole exercise will be meaningless.

Accordingly, it is necessary for an overall shipping and shipbuilding policy taking in all these points and to that effect, it is hoped that a feasibility study will be rapidly implemented.

2.5 Aids to Navigation Upgrading Reliability Project

2.5.1 Identified Problems and Issues

In summary, the problems/issues are presented in the following paragraphs.

- Based on the proposed master plan, over 300 visual aids will be constructed according to implementation schedule.

- There are, a number of the existing lights need to be rehabilitated and improved due to their poor light facilities, low luminous range, tear and wear of associated facilities, shortage of spare supplies and the like. The luminous range of a number of existing lighthouses and light beacons is insufficient.

- The monitoring of lights significantly improve the operational rehability of aids, and thus leads to safe navigation, but there is none.

- Lots of the large scale lighthouses were constructed in as early as about 100 years ago and individually have a unique appearance and a lighting equipment of

various types. It is necessary to restore and to maintain by individual approach with taking account of historical value.

- The visual aids of comparatively small scale were built up recently and seem to closely standardized for buildings and devices in use. Systematic support should be required.

- Each of the manned lighthouses is nominally posted by 1 - 3 people but many of the lights are reportedly maintained by the local staff living in a village nearest to the light, because accommodation buildings at the site are badly deteriorated or damaged by age.

- Unmanned lighthouses are visited for maintenance by the HANC personnel once or twice in a year.

- The maintenance staff at HANC are well trained for their purposes. The lighthouse keepers are, however, not so good at technical services and regard monitoring of the light and keeping of the site area and the property as their major task.

- A 350-ton lighthouse tender carries out its duty as the only service vessel but is apparently deteriorated and has no capability to handle buoys.

- No organized system/structure exists to effectively monitor lights for operational situation. Only the monitor function alive is the human-being posted at manned sites. In addition, there is no way to make communication with PCG or St. from even the manned sites, which is referred as one of the causes to bring in delays in delivering necessary information to mariners.

- Considerably less number of stored spare parts, together with technical unfamiliarity of the lighthouse keepers, has become one of the causes to prolong the repair time.

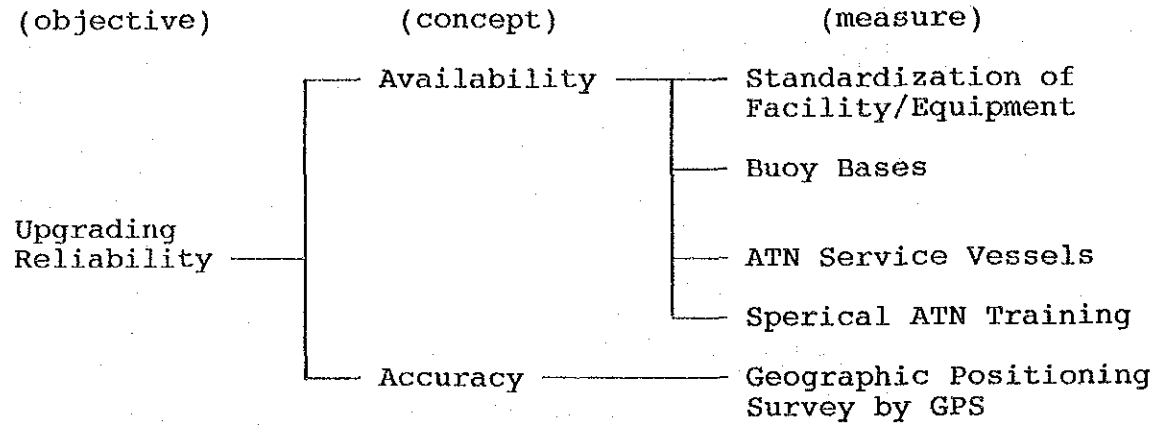
2.5.2 Proposed Measures for Upgrading Reliability

Based on above-mentioned analysis, it is turned out that upgrading reliability of aids to navigation is important as well as these development in the Philippines. The concept of reliability can be divided into the following two phases;

1. availability - to operate without trouble

2. accuracy - to inform correct position

Both two make aids to navigation work fully. Accordingly, in this study five (5) measures are selected as follows;



This section will describe the examination and proposal of each measure.

(1) Standardization of Facility/Equipment

1) Classification of Visual Aids

The type and size of the visual aids are classified as follows;

Lighthouse,
Light Beacon L (P),
Light Beacon M (S),
Light Beacon S (T),
RLB, and
Buoy,

2) Design Concept

In designing concept of buildings, either a steel reinforced concrete or a module type made up by materials of little weight such as FRP is taken up for the structure of lighthouses and light beacons, according to a limited information on the local condition which lacks critical data such as of soil. for RLBs and buoys, one of the selected 2-3 types of materials is discussed, according to the depth of the site. Equipment is assumed to have one unified instrumentation for each type and size, except power sources.

The power sources discussed here consist of the following primary power lines.

- "Commercial Power Line" + one "Emergency Engine-Generator".
- 2 or 3 "Engine-Generators".
- "Solar Batteries" (+ "Secondary Batteries").

3) Design Principals

- To have a sufficient structural strength in order to withstand the frequent hits of tropical cyclone.
- To properly function in higher ambient temperatures.
- To adopt lamps having a higher efficiency. This enables to save capacity of the power source.
- To focus on to facilitate maintenance of equipment but not to pursue development of a smaller sized one.
- To install a solar battery power system as many as possible.

(2) Buoy Base

A complete package of buoy removed from sea will be thoroughly checked at a buoy base, and necessary repair work will be carried out. The process of buoy maintenance works at a base is shown in Figure III.5.

1) Buoy Body

Light and power devices and other parts should be dismantled from a buoy, and if necessary, the tower should also be removed for clearing up.

Any damages, tear and wear and malfunction parts found after overall checkings shall be repaired together with rust clearing by sand blast and painting thereafter.

Careful painting should be carried out including antirust process according to the buoy painting procedures pre-established in terms of number of times and drying up period.

2) Mooring

Any damages and torn and worn should be replaced through overall checking, and also necessary quantity of chains should be retained for immediate use.

3) Equipment

Equipment for maintenance and repairs of buoys, chains are to be stored.

4) Heavy Duty Machines

Truck cranes, fork lifts and such are to be used for carriage of heavy machines like sinkers.

Figure III.4
Drawing Example of Standardization

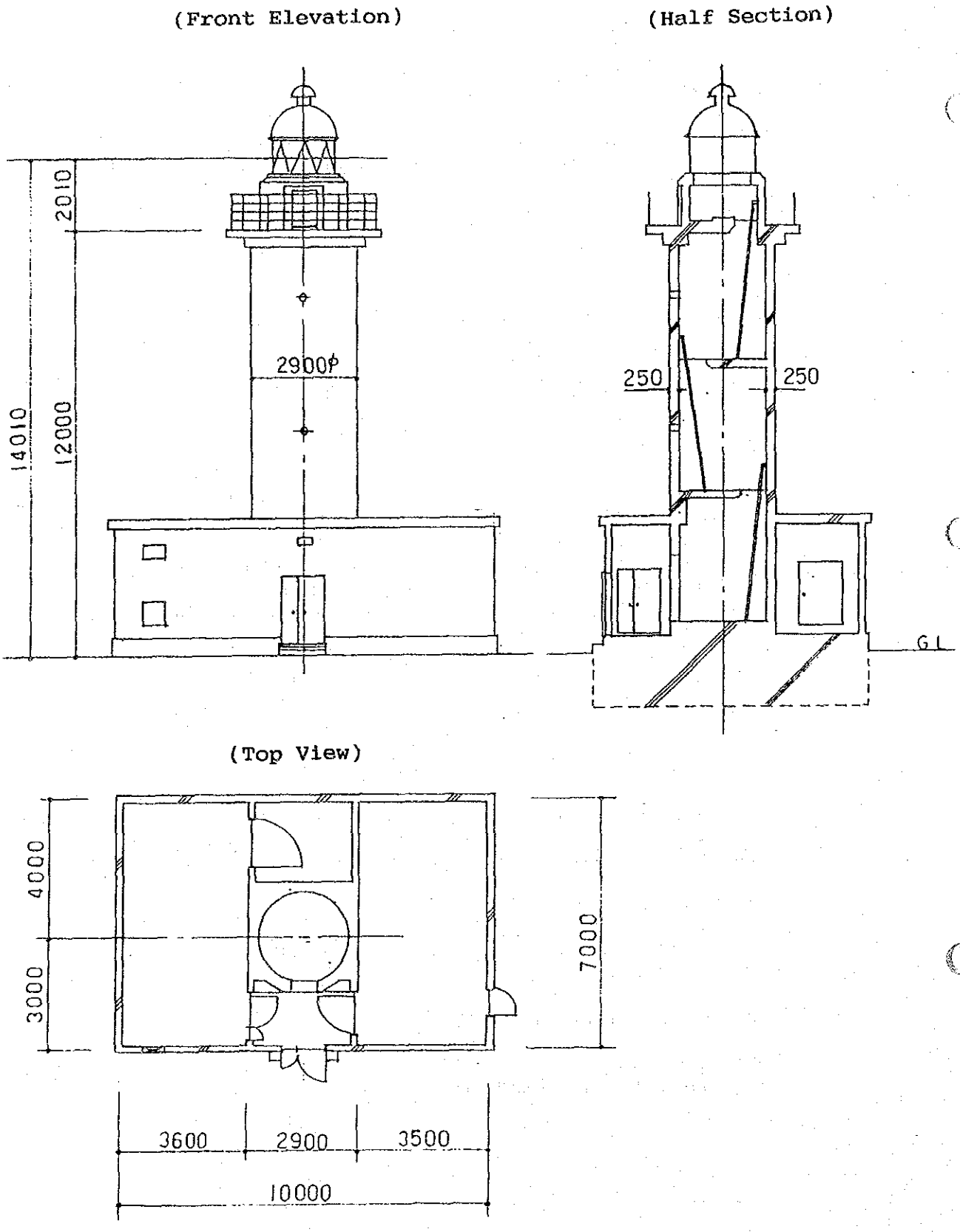
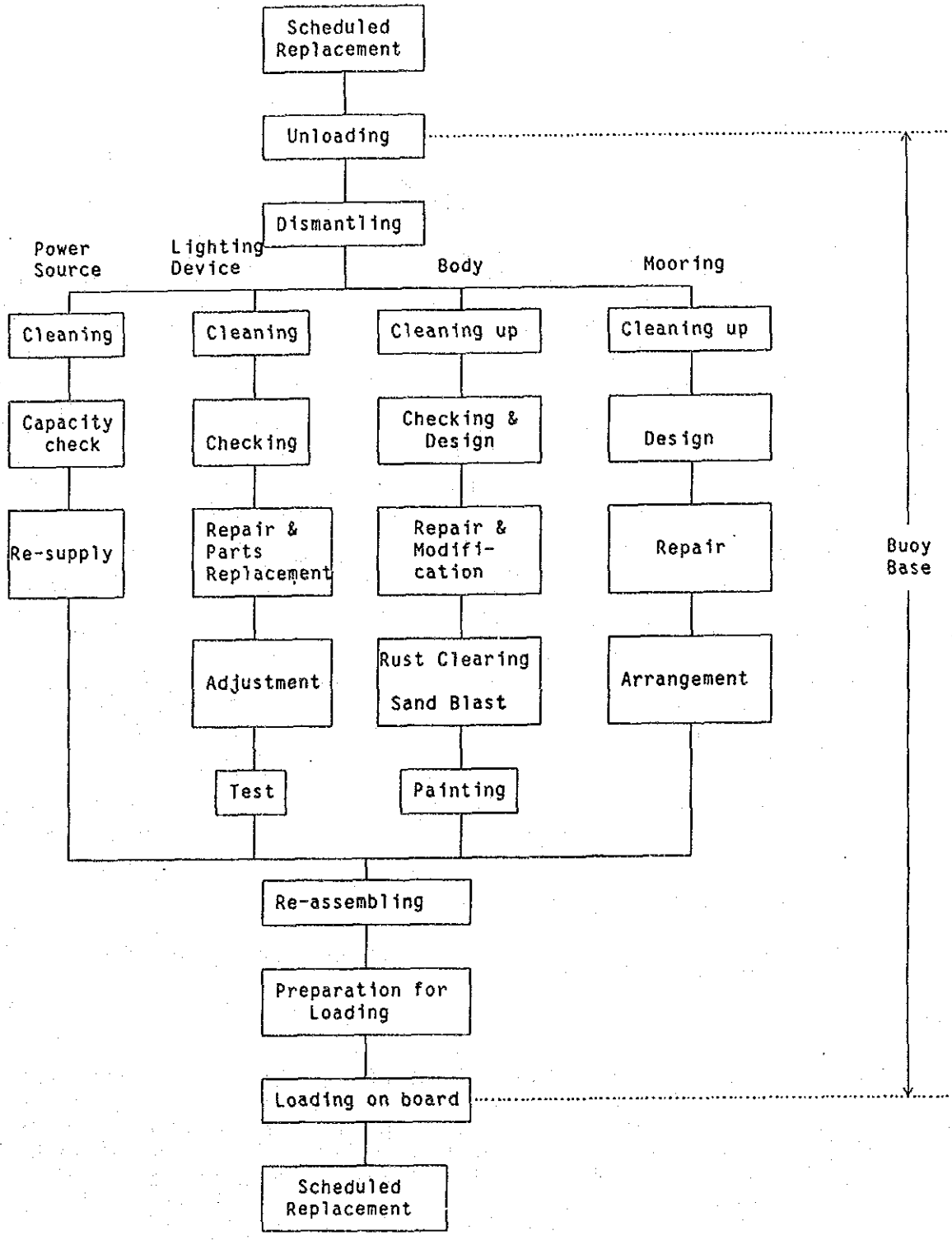


Figure III.5
Process of Buoy Maintenance Work



5) Winches

Winches are to be used for stretching chairs out for their checking at the open storage.

6) Jetty for Buoy Base

(3) ATN Service Vessels

There are presently only three buoy tenders in service for the maintenance and repair of lights throughout the country, and also some other small ships are in service such as motor banca for simple maintenance and checking.

The number of ATN service vessels required will b decided taking into account not only the maintenance policy but also the calculation result of work load. The calculation of work load of ATN service vessels involves a number of complex factors such as number and types of navaids, their locations, maintenance intervals and so forth.

Different types for ATN service vessels are required for efficient execution of the maintenance services.

1) Buoy tender

Installation and replacement of buoys. Maintenance of lighted beacons, RLB's lighted buoys and radar beacons.

2) Supply Vessel

Shift of lighthouse keepers, supply of goods to lighthouses, supply of gas cylinders, batteries, etc.

3) Aids Tender

Assisting buoy tender and supply vessel in performing maintenance of aids to navigation which are situated close to the base.

4) Inspection boat

Inspection of visual aids to navigation and repair of minor damages.

5) Survey vessel

Measurement of the light illuminating power. Evaluation and tests of radar beacons. Engineering survey for construction/installation of aids to navigation. Survey of sea banks, sea lanes where the depth is still in doubt, in connection with the planning of installing aids to navigation.

6) Survey

To perform navigational survey works in limited coastal area and assist survey vessel.

(4) Special ATN Training

Proper training of ATN personnel is time consuming and expensive but never wasted. It is ideal to establish the training facilities to be exclusively used for training of ATN personnel. However, in view of the present situations, in which there have been no such training establishments in the Philippines, a realistic approach is to make the plan a outlined below:

1) Overseas Special ATN training course

The overseas special ATN training is to be carried out for the senior staff to confine the specialized tasks of aids to navigation.

Period of course :	three months
Curriculum :	see curriculum (1)
Instructors:	maritime safety and ATN experts
Place of training:	overseas training facilities/institute

2) Domestic special ATN training course

The domestic special ATN training course is to be carried out primarily for the technician level personnel of first recruitment.

Period of course :	two months
Curriculum :	see curriculum (2)
Instructors:	Foreign...ATN expert from overseas
	Local.....ATN experts who received the overseas special ATN training
Place of training:	existing maritime training facilities

3) ATN Re-training course

The ATN re-training is a refresher or up dating course to train already experienced personnel on the front line in order for them to update new technology and equipment. This course may be arranged upon necessity in a form of factory training at the time of new procurement.

(5) Geographical Survey of Aids to Navigation

Traditional geographical surveys employ such a method to determine triangular points with a means of an optical tools such as transit, or to obtain positions with a celestial measurement by sextant in case of remote islands where any connection from the main land is not available. These methods are essentially associated with a large

scale sub-work for setting up complementary triangular points, cutting down lots of trees to get a clear range in sight or building up a watch tower to keep good visibility.

The GPS (Global Positioning System) drew our attention to be the alternative surveying method as it is used in some geographical surveys these days. Practicability and validity of the system in fixing/checking the points of aids to navigation were discussed.

The buildings of aids to navigation are generally located at a rural, remote site such as the head of a cape, which may cause troubles to shipping of the receiving equipment, availability of the electric power source, etc. Our discussions on this matter brought us a prospect that it should enable us to make position-fixing much more easily than the traditional way and to obtain better results.

It should be noted that;

- the GPS uses WGS-84 as the geodetic datum so that the positions obtained by GPS must be converted to the ones of the Luzon-datum, and

- the newly measured positions will require a study of an approach which enables them to be coordinated with the ones obtained through the traditional techniques.

For preparation of this report, some of the existing ATN site positions were checked through the GPS by obtaining GPS fixes and comparing them to the published ones. The results show GPS can provide almost perfectly satisfied outputs, indicating that the difference in the comparison of the 2 types of data ranges within 30 m.

Regarding the positions of aids to navigation on remote islands, however, the survey work conducted in the days of initial construction of the aids should be restricted to a considerable extent in tools, method, etc. Thus, the positions of these sites require to be corrected by using modern technologies. It is expected that the positions of the sites, either new or existing, are obtained, checked or corrected through the validated GPS or other recent techniques at the opportunity of initial construction, rehabilitation, etc.

2.5.3 Evaluation

(1) Analysis of Availability

1) Definition

The availability is defined as follows:

Availability = MTBF / (MTBF + MTTR)

where, MTBF = Mean Time Between Failure (an averaged period of time which elapsed from the time a failure recovered till the time a failure occurred again.)

MTTR = Mean Time to Repair (an averaged period of time which elapsed from the time a failure occurred till the time the failure recovered.)
= ("Total Operation time" - MTTR) / "Total Operation Time"

IALA, firstly in the history of aids to navigation, presented the current status and the future target of the availability of aids to navigation at the 12th IALA conference in 1990, approving criteria defined in an IALA publication "NAVGUIDE", which reads as the table below shows.

		Current Status	Future Target
Major Lighthouses, etc.	(Category 1)	99.8% and more	99.8%
General Light Beacon	(Category 2)	99% and more	99 %
Buoy, etc.	(Category 3)	97 to 99.7%	97 %

2) Availability of Aids to Navigation in the Philippines

Operational data of aids to navigation are extremely scarce in the Philippines. This fact disables a quantitative presentation of the availability. An assumption, however, provides us a total availability in order of 80% (82~85%), including the sites which are out of service for a long period.

3) Improvement of Availability

Improvement of availability, is one of the urgent subjects to be taken into account in the Philippines. To upgrade the availability, efforts must be put on to make MTBF be longer and MTTR be shorter.

MTBF becomes longer when the rate of failure occurrence decreases by practice;

a) to increase the frequency and to upgrade the level of checking/testing at the field, and

b) to make the failure rate of components/devices lower.

MTTR becomes shorter by;

c) shortening the access time to aids to navigation, and

d) lessening the time required for repair work.
Another factor to be accounted in improvement of the availability is time elapsed from the moment a failure

occurred till the time the maintenance personnel could detect the occurrence. Thus, it is also necessary for the improvement;

e) to make the occurrence of failures recognized in a shorter of time.

4) Practical Approaches

In management of aids to navigation, each practice of a) to e) is achievable by the following arrangement.

For a);

- to give a good mobility to the maintenance personnel by providing servicing vessels and/or landcraft, and
- to increase the number of the operation personnel.

For b);

- to improve and standardize equipment, buildings, etc.
- to install solar batteries as the primary power source, and
- to construct workshops, buoy bases, etc.

For c);

- to give a good and speedy movability, and
- to construct piers, access roads, etc.

For d);

- to store sufficient spare parts,
- to upgrade technical skills of the maintenance personnel (through training), and
- (aspects for b) above)

For e);

- to development a monitor system of aids to navigation, and
- to establish a communication data link,
- (Notice to Mariner may follow as a consequence.)

To take these practical approaches, buoy bases, service vessels and specialized personnel should be deployed with good coordination.

The standardization can provide the following merits;

- to facilitate the work of planning up to finishing processes of buildings at initial constructions and also at repairs in later, and

- to make the maintenance personnel be more familiar with the equipment. this leads to an expectation

that the repair time may be shortened.

- to have test equipment and tools be usable at every site as a common support device.

Then, the development of aids to navigation with a certain standard can be considered to improve these availability. The commonness and compatibility for spare parts should be sought in line with this standardization.

The four (4) proposed measures will be expected to improve the availability of aids to navigation from the existing poor conditions to the future target in "NAVGUIDE".

(2) Analysis of Accuracy

Information to the mariner is important because they anticipates that the aids to navigation on a route will be functioning in accordance with the advertised characteristics laid down in nautical information and on charts. But current situation is insufficient. Old-fashioned nautical charts are the serious problems which confront maritime transportation in the Philippines.

GPS is a position-fixing system which will be used for general navigation on land, sea and air. The preliminary assessment in this study indicates that GPS is practicable and valid to fix the positions of aids to navigation rather than conventional methods. Taking account of cost and term, GPS should be introduced to fulfill requirements about the accurate information of aids to navigation from the mariner.

(3) Conclusion

AS already noted, it is obvious that the five (5) proposed measures will contribute to upgrading reliability of aids to navigation to great extent. The four (4) proposed measures related to availability, standardization of facility/equipment, buoy base, service vessel and special training are described rich in substance in this study. Regarding to the accurate information, GPS is recommended to use for the completion of position data based on the supplemental survey for testing its capability.

With the complete implementation of the proposed master plan, however, a lot of operation and maintenance work will produce in line with development of aids to navigation. This will be liable to reduce in reliability of existing and new aids to navigation due to the limitation of budget, personnel and facilities. Therefore the proposed measures should be implemented in view of cost-effectiveness, time saving and the responsibility to the mariners.

Appendix-2
CONCEPT PAPER ON HYDROGRAPHIC SURVEY OF NATIONAL PORT

I. INTRODUCTION

The National Mapping and Resource Information Authority (NAMRIA) is mandated as the principal charting agency of the government. Being so, one of its major functions is hydrographic survey which is the gathering of all relevant data and information needed in the preparation of nautical charts.

The publication of the nautical chart for the use of mariners, port & coastal planners and developers, marines scientists, researchers and other related groups is one of several public services NAMRIA is tasked to offer. This function is being undertaken by one of NAMRIA's department - the Coastal & Geodetic Survey Department (CGSD).

In line with this function, CGSD had laid its plan on resuming the developmental aspect of this function which through the pass years, had been interrupted by economic problems and unfavorable political conditions. Vital to national development, the re-survey of the country's major ports had been marked by the CGSD as one of its priorities, aimed also at trying to catch up with other developing countries.

II. CONCEPT/RATIONALE

The main objects of the activity are the national ports of the country as identified and enumerated in the attached sheet (Appendix A). The purpose is to collect new data and update all informations concerning the ports and subsequently publish an updated and revised nautical chart of the harbor primarily for the safety of navigation in that area.

While it is a normal practice especially in developed countries to resurvey a primary port at a frequently of at least once in every 5 years or even less, this Agency had not been able to duplicate that feat as we were economically and logistically handicapped to conduct such surveys as frequent as is necessary. Except for a new important ports such as Manila and Cebu, the latest revisions of charts for the other primary ports ranges from about 10 to 33 years ago, rendering most of these chart including other related publications such as Coast Pilot and Sailing Directions shall be revised into a reliable and dependable working tool and in an internationally accepted standard.

III. BENEFITS OF THE PROJECT

Benefits expected to be derived from the projects are as follows:

1. Publications of large scale nautical charts for each of the listed national ports depicting, among others, new and updated topographic and hydrographic informations for the use of the following:

   a) Mariners entering or leaving the port

      - for their safe navigation

   b) Port Authority

      - for their operational activity and developmental planning and design such as dredging operations and expansion projects.

   c) Port Operators

      - for reference in their operations.

   d) Port Pilots

      - for navigational safety in their operations.

   e) Designers and Contractors of Port Construction Activities

      - The chart serves as a basic materials in their design and construction activities.

   f) Scientist and Researchers

      - for the invaluable scientific informations contained on the chart.

   g) Students

      - as their study reference.

   h) General Public

      - as an informational material.

2. Timely revision of the Coast Pilot books containing relevant informations about Philippine ports/harbors which are of great interest to the maritime public.

3. The project would give this Agency the chance to make up for the backlog of previous years.

4. It would provide an on-the-job and ideal training module for the new offices and crew of this Agency.

5. It would also allow full utilization of this Agency's capabilities.

IV. RESPONSIBLE AGENCY

The Coast & Geodetic Survey Department (CGSD) of the National Mapping and Resource Information Authority (NAMRIA), with its three (3) survey vessels adequately equipped for hydrographic survey shall be responsible for the execution of the project. Mandated to undertake hydrographic survey of all water area within the Exclusive Economic Zone (EEZ). NAMRIA has the full capability to undertake the project.

V. PLATFORMS/INSTRUMENTS

1. Survey ships and boats.

2. Angle measuring devices such as Theodolites, Sextants and Three-Arms Protractors.

3. Distance measuring devices such as Electronic Distance Meters (EDMs) and Tapes.

4. Electronic Positioning equipment such as Sextants and Pelorous.

5. Other positioning equipment such as Sextants and Pelorous.

6. Depth measuring equipment such as the Electronic Echo Sounder.

7. Tide measuring and recording equipments such as Automatic Tide Gauges, and Tide Staffs.

8. Water-current measuring devices such as the submersible Automatic Current Meter.

9. Bottom sampling equipment.

10. Computers for data processing.

11. Cartographic instruments for chart complication.

12. Printing equipment for final chart printing.

13. Radio Transceivers

VI. SCOPE

The Coast & Geodetic Survey Department (CGSD) of NAMRIA has initially identified seven (7) national ports for resurvey as reflected in its 3-year plan. The conduct of the project includes the following field and office activities.

1.	Control Survey	- Triangulation, Traverse and Leveling.
2.	Topographic Survey	- Delineation of Shoreline, fronts & features.
3.	Tide Observations	- Measurement and recording of tidal height changes.
4.	Sounding	- Water depth measurement.
5.	Current Observations	- Measurement of the cyclic velocity and direction of water current.
6.	Bottom Sampling	- Determination of sea bottom physical character.
7.	Coast Pilot	- Gathering of port informations which are of importance to the maritime public.
8.	Data Processing	- Computer-aided processing and hydrographic smooth sheet plotting.
9.	Chart Compilation	- Cartographic work and conversion of all processed data and records into chart form.
10.	Printing	- Preparation of plates and final printing and re-production.