RECOMMENDATIONS OF IMPERIAL AIRWAYS LTD.

on some

TECHNICAL ASPECTS

of the

TRANS-TASMAN AIR SERVICE.

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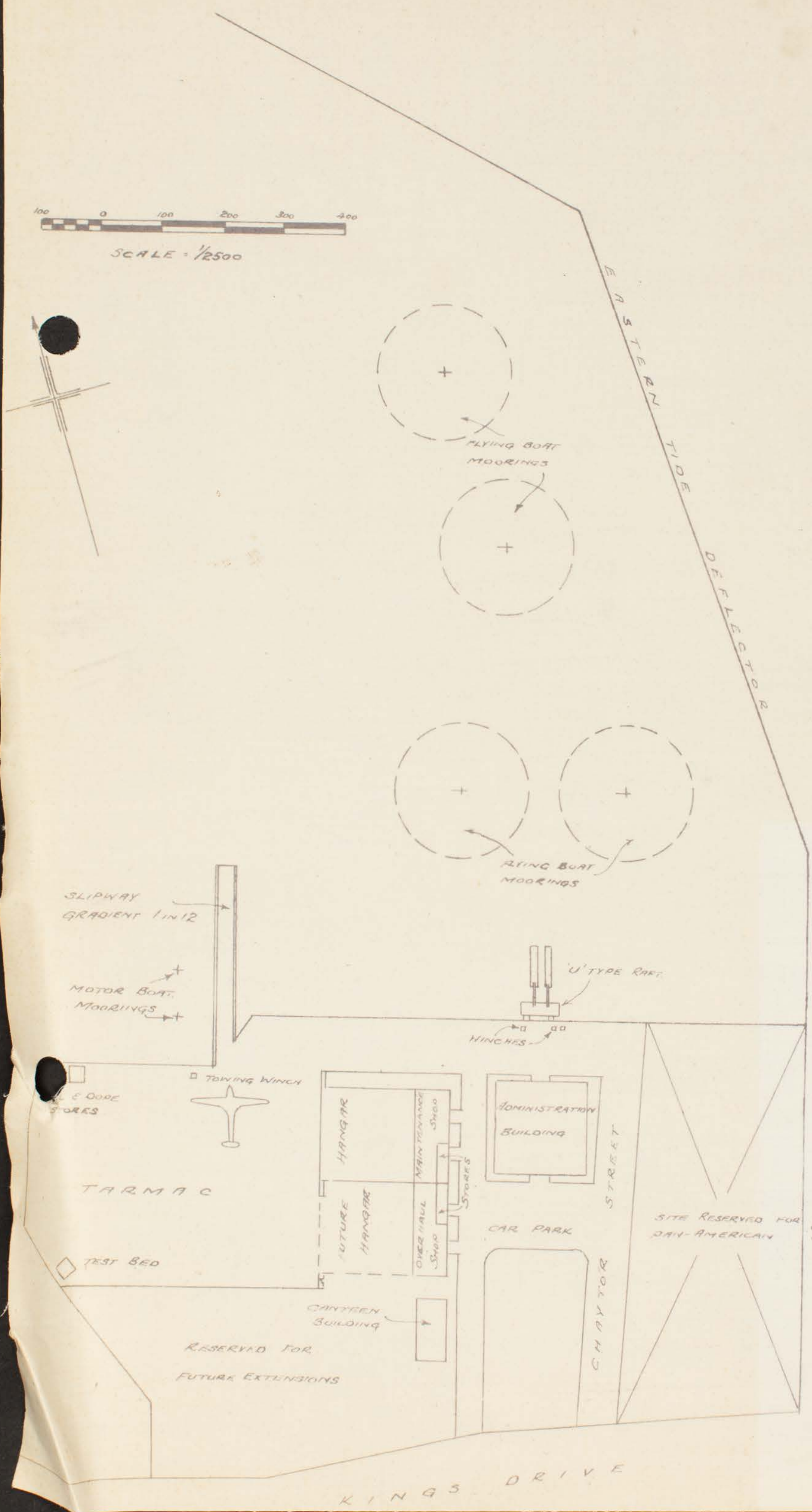

IMPERIAL AIRWAY'S PROPOSED LAYOUT OF MARINE AIRPORT AT AUCKLAND - N.Z.

RECOMMENDATIONS OF IMPERIAL AIRWAYS LTD.

ON THE

TECHNICAL ASPECTS

OF THE

TRANS-TASMAN AIR SERVICE.

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INDEX TO APPENDICES

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Selection of the Terminal Port.

From a technical point of view there appears to be little doubt that Auckland Harbour affords a more suitable area of water for a marine airport than Wellington Harbour. The alighting area is reasonably sheltered, with fairly good approaches and if the existing breakwater can be improved in accordance with what is understood to be the Harbour Board's plan, the alighting and mooring area should be satisfactory for day and night operations in almost any weather conditions.

A detailed report on the comparative merits of the two harbours from a flying boat base point of view, is dealt with herein in the report written by Captain Burgess after his survey flight over the proposed Trans-Tasman Route in December, 1937. It is understood that a definite decision has not yet been reached regarding the selection of the terminal port, and therefore the recommendations made in this report are based on the assumption that Auckland will be selected eventually.

Other matters which have been assumed in making these recommendations are:-

1. That the terminal for the Trans-Tasman Service will also be the terminal for the Trans-Pacific Service.

2. That the base should also be capable of affording the necessary facilities to Pan American Airways, although it is understood that a plot of land adjacent to the proposed site has already been leased to that Company.

3. That flying boats of much larger dimensions than those employed at present should be catered for and therefore the hangar and slipway should be designed to take a flying boat of about 150' wing span and weighing about 35 tons.

4. That bigger boats than the above will eventually be produced and therefore an adequate area of foreshore and land should be reserved for future extension.

A suggested layout of the base is attached showing the buildings, etc., considered necessary for the first regular operations from the airport, and the area of land which it is considered advisable to reserve for future development. During the first months of operation it is appreciated that hangar and slipway facilities may not be available, but it is understood that the slipway at the R.N.Z.A.F. base at Hobsonville might be used in case of emergency.

Another point to be considered during the initial stages of the service, is the provision of an emergency mooring in Islington Bay, or alternative site, which would appear to be necessary until the breakwater at Mechanics Bay is heightened.

NOTE: The disembarkation raft referred to herein is patented in the joint names of Imperial Airways Limited and Frederick Braby & Sons Ltd.

The prior consent of the British Power Boat Company is required before the design of that Company's motor launches (of which drawings are included herein) can be copied.

Captain Burgess's Report on Wellington
and Auckland Harbours.

By a careful comparison between Auckland and Wellington there is little left to doubt that Auckland has many advantages over Wellington from a flying boat base point to view, especially since the safety and regularity of an air service is of prime importance.

The Dominion already has a very efficient internal air service which connects Auckland with all the main cities. From a Mail distribution point of view, Wellington is more central than Auckland and of course is the capital of the Dominion.

The distance from Sydney to Auckland is about 1348 statute miles and the distance to Wellington is about 1412 miles; a difference of about 64 miles. The distance from Auckland to Wellington is about 312 miles, and therefore the additional mileage mails and passengers for Wellington would have to fly if the route is operated via Auckland would be 312 miles - 64 = 248 miles. In a fast aeroplane the 312 miles could be covered in under two hours.

When payload is considered, the extra mail that could be carried across the Tasman by using the shorter route, even if Wellington were desired as the base, might be more economically carried by flying via Auckland. I will endeavour to compare both cities from every possible outlook.

WELLINGTON:

Port Nicholson contains an area of about 20,000 acres surrounded by high mountains. The prevailing winds are N.N.W. and S.S.E. and the N.N.W. frequently blows hard with heavy gusts off the high land, causing vessels at anchor to sheer about considerably. For a flying boat there is little protected water except in Evans Bay, which would provide the only possible base. This bay is open to the harbour at the northern end and enclosed by flat ground to the south and high hills on both the east and west sides.

Reasonably sheltered moorings can be found near by the Patent Slip, but they are exposed to the violent gusts during a N.W'ly gale. As stated, these gales are quite frequent. In my opinion I consider that Wellington is comparable with Mirabella.

Evans Bay would provide a base which could be used under most conditions during the day, but unless the weather were extremely favourable it would be dangerous for night alightings and take-offs. For the Tasman service to operate in Winter it might be necessary to do a certain amount of night flying.

In my opinion it would be more advisable at first to take off in the early morning and to arrive always by daylight. With Wellington as a base I can foresee many delays due to adverse weather. Approaching Wellington Harbour from the Tasman in bad weather would offer many difficulties owing to the high ground which possibly might also affect the wireless bearings.

AUCKLAND:

The harbour has a total area of 77 square miles, surrounded by hills, with Rangitoto Island 854 ft. as the highest peak.

Auckland, like all other ports in New Zealand, has a treacherous wind which blows from the N.E. and reaches a force of 60 miles per hour on occasions. Shelter can be found for flying boats in Mechanics Bay, which is a large area on the south side of the harbour protected on the north, north-east and eastern sides by a rubble wall, affording a fairly safe mooring. The Auckland Harbour Board already have a scheme to extend this rubble wall and to find another anchorage for yachts and launches, and so make an ideal base for flying boats. The Harbour Board have reserved an area on the foreshore where a slipway and all necessary buildings for a base could be put up. Sheltered water for alighting and taking off can always be found.

No difficulties should be experienced in laying a flare path, and except under adverse conditions night alightings and take-offs could be made.

Until a slipway could be built, beaching facilities are already available at the R.N.Z.A.F. Base at Hobsonville (7 miles by water from Mechanics Bay.) The Hobsonville slipway should be quite strong enough to carry an Empire boat. The width of the slipway is about 50 ft. and connects with a large concrete apron in front of two hangars, which are complete with workshops. The hangars are not large enough for the boats, but there is ample space for a temporary hangar should it be decided to make the temporary repair base at Hobsonville.

In a comparison of the weather conditions at both places the New Zealand Pilot should be consulted.

With consideration for all available data, I strongly recommend that the Tasman service terminal should be Auckland, especially as Auckland appears to be the natural base for the proposed Pacific service.

Specification of Marine Airport.

The Air Ministry produced about four years ago an outline specification for an alighting area based on the assumption that it would be adequate for flying boats up to a maximum weight of 100 tons.

The dimensions of the runways in any wind direction were:

Length	2,000 yards,
Width	250 "
Minimum depth	10 feet.

Approaches and take-off from this area, to be clear of all obstructions for a distance of at least 1,000 yds.

As a result of the experience we have gained with the "C" Class flying boats, we are able to state the dimensions we consider adequate for operation with these aircraft. It is difficult to visualise the dimensions which may be necessary if flying boats reach an all-up weight of 100 tons, but it is interesting to note that the "C" Class Boat requires no greater area of water to manoeuvre in and take off than the Calcutta class, which was designed 12 years ago and is half the all-up weight.

Take-off with the "C" Class Boat in calm conditions with full load is accomplished in less than half a mile, and rate of climb from sea level in these conditions is about 1,000 feet per minute. Pull up on alighting takes considerably less than half a mile.

In view of this we consider an alighting area of the following dimensions and characteristics is satisfactory for operations with the flying boats in use at the present time, although for flying boats of the future the dimensions referred to below may be too limited.

ALIGHTING AREA:

An uncongested area of water, reasonably sheltered, affording an unobstructed run into the prevailing wind about one mile long and 200 yards wide, and not less than 9 feet deep, with one other similar run at approximately right angles to it.

"Reasonably sheltered" means that the alighting area should not be subject to a severe swell, or seas measuring more than 3' from crest to trough.

EMERGENCY ALIGHTING AREA:

The establishment of an emergency alighting area to the North-West of Auckland is considered necessary to provide an alternative should Auckland become closed down by adverse weather and also to decrease the sector mileage across the Tasman Sea: this also applies to the projected Trans-Pacific service. The relative merits of Parenga-Renga, Russell, or any other sheltered creek in the neighbourhood should be determined by a detailed survey, but it would appear that Parenga-Renga is better situated from a commercial operating point of view for both the Tasman and Pacific crossings.

Whichever site is selected, skeleton ground services will have to be laid down in the form of one mooring and a small refuelling plant. It is suggested that the mooring should be in the form of an orthodox single unit comprising one sinker and two anchors with a suitably fendered metal buoy - rubber buoys are not recommended for isolated places where inspection facilities are likely to be spasmodic. Refuelling could be carried out by the trough system as described in Appendix "F".

MOORING AREA:

Moorings should be laid in sheltered water clear of the shipping fairway, and preferably adjacent to the point of disembarkation. A minimum swinging RADIUS of 150 feet should be allowed for a flying boat riding at moorings.

The proposed layout of the marine base at Auckland shows 4 moorings in position, two in the lee of the breakwater for standby aircraft, or service aircraft unable to use the embarkation raft, and two more in front of the raft for normal conditions. At a later date, should it become necessary to use two rafts, only one more mooring will be necessary to supplement those already laid. It is considered that the arrangement under review will prove satisfactory and should not interfere with other traffic.

Until the mooring area is completely protected by the breakwater and since it is unlikely that this work will be completed by the time services commence, it is recommended that an emergency mooring should be laid somewhere in the immediate neighbourhood, possibly Islington Bay.

For further details of moorings see attached specification and Appendix "A" sketch.

SHORE FACILITIES:

Facilities for handling passengers, mails and freight, from the flying boat to the shore should be provided. In sheltered water loads can be handled from the flying boats on to a floating raft connected to the shore, pier or jetty, by means of a floating gangway. It appears that shore facilities at Auckland are similar to those at Southampton, and therefore full particulars Appendix "B" of the system employed at Southampton are attached. Where no pier or jetty exists, some form of steps leading up the bank should be provided. The minimum depth of water at the pierhead or steps is dependent on the draft of the largest surface craft employed, but it should not be less than 4'.

TRANSPORT:

Means of transport should be provided from the Airport to the town capable of carrying passengers and crews with their baggage.

AIRPORT BUILDINGS:

Buildings should be provided adjacent to the point of disembarkation, containing Customs, Immigration, Health Examination rooms, Sorting rooms, passengers' waiting rooms, lavatories and Air Companies' Booking Offices. Accommodation should also be provided for marine and aircraft stores, launch shelters, etc., but these are usually situated away from the main Airport Buildings in the most convenient site.

A canteen is also necessary for the Airport staff, and on occasion, means for providing passengers with light refreshments. It is suggested that this building should be of portable construction so as not to interfere with possible future expansion schemes - such a canteen may possibly be shared with Pan American Airways.

A proposed layout of the Marine Airport is attached.

HANGAR AND SLIPWAY:

It is recommended that a hangar and slipway should be provided generally in accordance with the dimensions and particulars set out in the attached diagram of the Auckland Base. Provision has been made for future expansion both in operating schedules and type of aircraft employed on the route. So far as the one proposed hangar is concerned, doubtless another could be erected at a later date alongside with a common dividing wall and common power driven doors. The span and depth of the hangar allows for the housing of two Modified "C" Class boats and would be large enough for one "C" Class Development boat. It is anticipated that aircraft larger than the "C" Class Development type will be operated on the Trans-Tasman route eventually, but to make provision for such aircraft at this stage would be based on guesswork, and even if a much larger hangar were recommend it might prove to be just too small when the aircraft are produced. The dimensions and gradient of the slipway suggested are considered to be ample to meet known requirements providing there is sufficient depth of water at low water spring tides to attach the beaching chassis.

Appendix "C". Further details are attached to this report.

WORKSHOPS FOR MAINTENANCE:

For an ordinary maintenance depot an annexe along one side of the hangar should be adequate.

ENGINE OVERHAUL SHOPS:

It is difficult to advise on the size of such shops until the probably maximum output is known. For the present, the complete overhaul shops could doubtless be housed in the one hangar alongside the maintenance shops, but provision for future requirements has been incorporated in the attached plan. It is not recommended that the test bed should be in the vicinity of the Administration Buildings or hangars, it has been sited, therefore, on the remote side of the tarmac. The equipment should consist of a complete test bed of approved type capable of handling engines of 2,000 h.p. and housed in a suitably sound-proofed building.

STORES:

These should be housed as conveniently as possible for easy access of both the maintenance and overhaul workshops. The suggested position is shown in the attached plan.

CONTROL:

In a recognised harbour where all shipping comes under the control of a Harbour Board, the movements of flying boats usually come under this authority, but are in most cases controlled by a separately appointed control officer with experience of flying boat operation. Alighting Areas used only for the operation of flying boats are normally controlled by an Airport official. Detailed information regarding control and methods of

Appendix "D". day and night operations are attached.

RADIO COMMUNICATION:

M.W., S.W., and Adcock Direction Finding facilities should be available and means of communication between the Radio Station and the Control Office should be provided either by land line or ultra-short wave radio equipment. W/T should also be provided on the control launch at stations having alternative alighting areas which are out of sight or signalling range of the ground station, or at a station situated at the end of a long sea crossing, where the control launch may have to put out to sea. These typical cases apply particularly to stations where night landings may be scheduled. A small medium and short wave set suitable for these conditio can be obtained. Means should be incorporated, when installing the aerials such a set, for them to be readily retractable in order that the launch may

Appendix "E". come alongside an aircraft without danger of fouling the wings.

METEOROLOGICAL FACILITIES:

Full meteorological facilities should be available, either obtained locally according to the geographical situation of the Marine Airport, or by direct communication with the nearest First Order Meteorological Station. Meteorological stations come under three categories; a first order station is one where synoptic charts are plotted and forecasting facilities are available, a second order station observes and records upper winds, cloud formations and heights, surface winds, barometic pressures and rainfall; a third order station observes surface conditions only. The facilities at present available are not considered to be entirely adequate for the Trans-Tasman or Pacific crossings. The recommendations set out in the "Report of the Proceedings of the Meteorological Conference at Wellington" dated November 29th - December 3rd, 1937, are endorsed and considered to comply with the standards on other sections of the Empire routes.

FUELLING FACILITIES:

Fuel suppliers have adopted 3 methods of refuelling on the Empire routes; one is by means of a special motor launch with a capacity of 2,000 glns., replenished as necessary from a shore installation; two only applies to stations where the aircraft can be brought close in to shore, and fuel is delivered direct from the shore installation; three is the trough system where fuel is pumped manually from troughs into which tins are emptied 4 at a time. The launch system is almost universal, a standard mobile installation, which can proceed under its own power at short notice to emergency alighting areas, and which is interchangeable with other units on the route, has much to recommend it. These craft are, however, extremely heavy for flying boat work and must be efficiently handled.

It is felt that the shore facilities at Auckland lend themselves to refuelling from the shore, either from the raft or while the aircraft is beached on the tarmac. Some mobile installation should, however, also be provided but this is a matter for discussion with the fuel suppliers.

The trough system can be used at remote stations where it is not convenient or ecomonical to instal costly equipment. Supplies are carried in a suitable local boat which is manoeuvred into the vicinity of the aircraft. This system is recommended for Parenga-Renga, or whichever alternative site is eventually selected.

Tail drogues are supplied to all stations where a combination of wind and tide tend to swing the aircraft at her moorings while refuelling or servicing operations are in progress. The drogue is of the orthodox type between 4 - 6 ft. diameter according to local conditions; it is attached to the tail eye of the aircraft and released by the aircraft crew in the normal way. A marker buoy must also be incorporated in the drogue to facilitate salvage after release.

Appendix "F". Recommendations for refuelling operations are attached.

CONTROL AND AUXILIARY LAUNCHES:

One of each is required at every station, but at terminal stations it may be found necessary to employ more than one auxiliary launch, depending on local conditions. The use of an embarkation raft materially reduces the use of launches, but in congested harbours, during night landing operations, at least two general purpose launches are necessary for patrolling the alighting area.

Appendix "G". Further particulars of launches are attached.

DINGHIES:

2 Dinghies about 12' long are considered suitable. These must be specially fendered and have no projecting rowlocks or thole pins.

MOORINGS AND BUOYS:

For a regular port of call two moorings are considered the minimum number that should be laid.

Although the inflated Rubber Buoy manufactured by Messrs. Short Bros. is used on the Empire routes, there are certain stations where they have not proved entirely satisfactory by reason of their rubber construction. In European ports they are satisfactory but in tropical conditions the rubber deteriorates rather quickly and they are subject to destruction by savages and crocodiles. They can be obtained in two sizes 40" and 55" diameter. The 55" buoy is used where the moorings are laid in over 6 fathoms of water or fast flowing rivers. The 40" buoy is recommended for Auckland.

GENERATING SET AND SEARCHLIGHT:

The generating set and searchlight referred to above is part of the equipment of the control launch and consists of a small petrol electric set providing current for a searchlight mounted on the cabin of the control launch.

Appendix "H". Further particulars of such equipment are attached.

ALDIS SIGNALLING LAMP:

Two of these will be required complete with red and green screens one for each launch. They are of the standard type and can be obtained from Miscellaneous Disposals Ltd., 41, St. James's Sq., W.11.

BATTERIES 24 VOLT.53A:

These are required in conjunction with the electric light set described above; they are of the Nife type and can be obtained from Batteries Limited, 172, Buckingham Palace Road, S.W.1. These batteries are recommended as they are interchangeable with those of the aircraft, and experience in the past has shown that this type has a very effective life. They are, however, prone to rapid deterioration if they are not properly maintained and they must be installed in watertight containers for launch work.

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FLARES:

A type of flare and float has been developed which is considered the most suitable for night operations. These are manufactured in quantity by Messrs. Wilcox. A description of these flares and flotation gear are attached.

Appendix "I".

APPENDIX "A"

APPENDIX "A".

DETAILED REQUIREMENTS OF FLYING BOAT MOORINGS.

1. GENERAL.

The accompanying diagrams show the layout of a trot of two and three moorings. The trot system is almost universal on the Empire routes, but suffers from the disadvantage of being difficult to relay if one end shifts. Although clump and Admiralty pattern anchors are specified, they are not universal, as the nature of sea, lake or river bottoms must be taken into consideration. Generally speaking moorings laid as single units are to be recommended providing they comply with the specifications set out below, and conform with the best local practice.

2. MATERIALS AND MANUFACTURE:

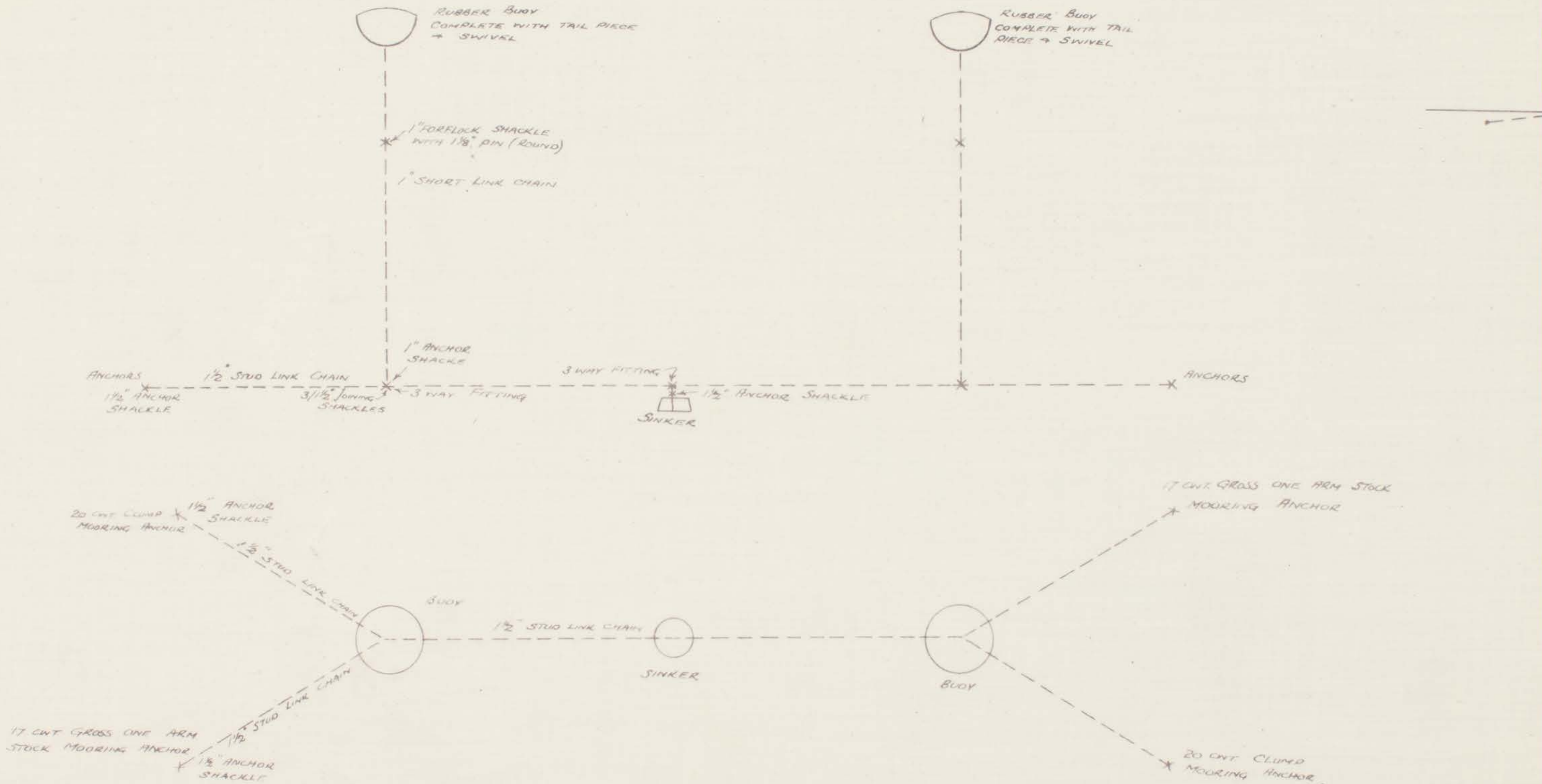
The whole of the chains, cable, shackles and links should be manufactured from wrought iron in accordance with British Standard Specification No. 51 of 1929. The three-way Plates should be made from forged steel equal to Admiralty Quality "C" Steel.

The shackles should be made from wrought iron bars, each made in one piece with the eyes turned in the direction of the grain of the bar and welded. The bolts of the shackles should be secured by tinned steel retaining pins, the steel being of 40/50 tons per square inch ultimate tensile strength, with an elongation on a length of four diameters of not less than 15%. The holes for the retaining pins in all the shackles should be made to a taper of 1 in 16. These holes should have dove-tailed chambers at their heads to receive leaden pellets. The depth of the dovetail chamber should equal one diameter of the point of the pin.

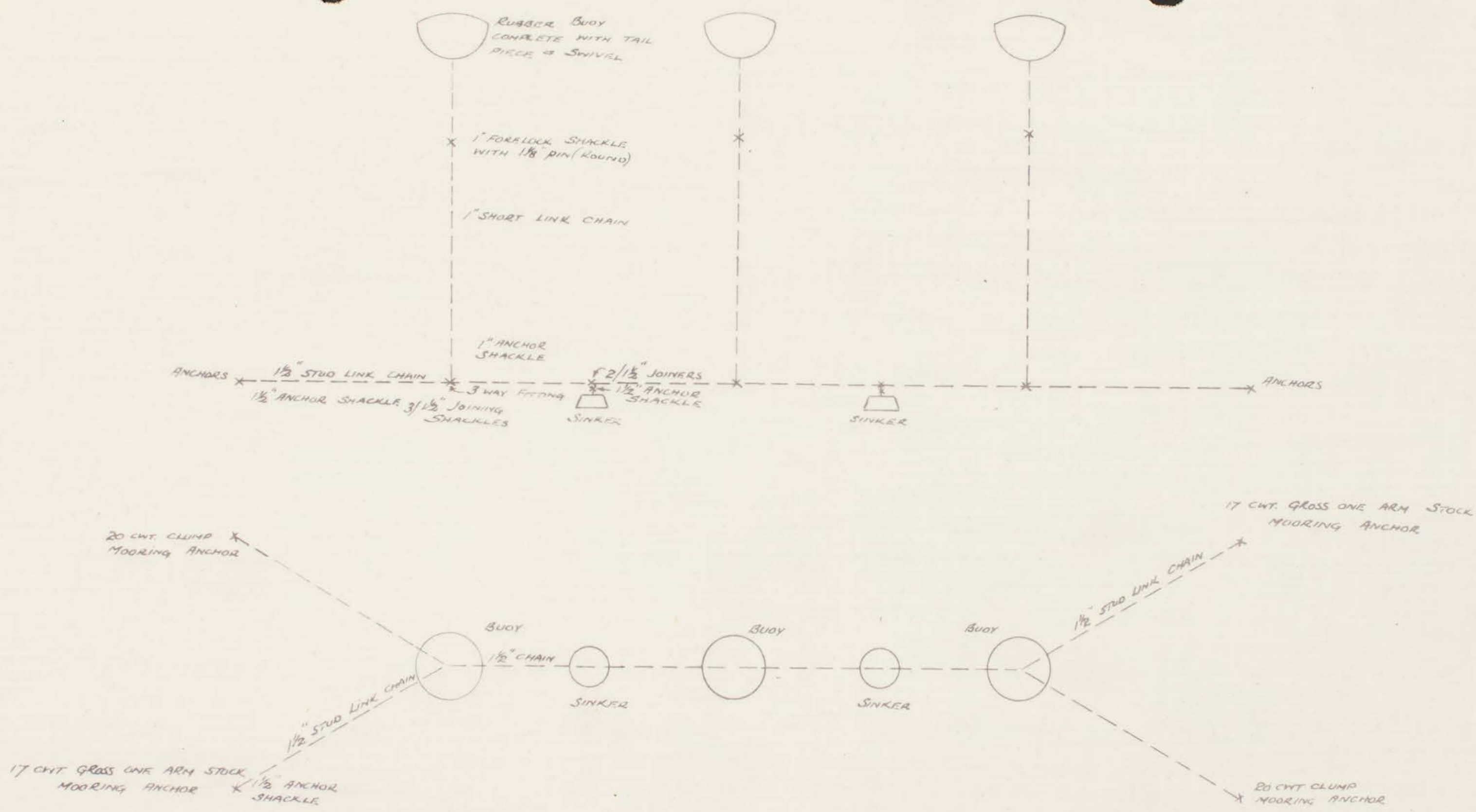
The shackles should be subjected to a preliminary load (approaching the Proof Load) at the contractors works. After the shackles have been so loaded, the holes in the shackles and shackle bolts for the retaining pins should be machined with the bolts in position, care being taken that the bolt is wedged home in its seating during machining.

3. TESTS:

All Chains, anchor shackles and joining shackles should be tested at Lloyds Proving House, to Lloyds full cable tests, and Lloyds Statutory Certificates for Chain Cable furnished.



LAYOUT OF TROT OF TWO AS FLYING BOAT MOORINGS



LAYOUT OF TROT OF THREE AS FLYING BOAT MOORINGS

APPENDIX "B"

APPENDIX "B".

EMBARKATION RAFTS.

We are only in a position at the moment to offer advice on rafts and pontoons of one specific type, namely, the heavy "U" raft and "Snake" pontoons which we use at Southampton. The other types are still in the experimental stage and have yet to be proved under the actual conditions for which they are designed.

The attached general arrangement drawing of the "U" raft shows all the salient dimensions, and gives a good idea of its layout and construction. Generally speaking this particular raft is giving excellent results at Southampton, where water and wind conditions are at times difficult.

So far as a station like Southampton is concerned some sort of embarkation raft is essential to handle efficiently the frequent and heavy loads in a short space of time. Hitherto motor launches were employed, but these, in anything but calm weather, were not capable of transferring a complete shipload of passengers, baggage, mail, freight, etc. in a manner consistent with our standards at an important terminal station.

For an aircraft arrival the aircraft makes fast to a buoy in the normal way, the buoy being placed conveniently in front of the raft in such a way as to allow the aircraft to manoeuvre in all conditions of wind without interference. The mooring line passed over the aircraft bollard runs through a pulley on the buoy and thence to a winch on shore, the purpose of which is explained in diagram 1. When the aircraft is once moored a well fendered motor dinghy proceeds from the raft and attaches to the aircraft tail release gear two 1" steel hawsers, which are controlled from the shore by means of mechanical winches. The aircraft is now secured fore and aft and capable of being moved under the direct control of the shore staff. In this way the aircraft is manoeuvred, tail first, into the raft (See photographs).

For departures a similar procedure is adopted to get the empty aircraft into the raft, where loading and servicing operations take place; as soon as these are completed the engines are started and the aircraft taxies straight out of the raft to the take-off area.

Successful operations are dependent on a number of factors, the most important of which are set out below:

PROTECTION OF AIRCRAFT:

One of the chief reasons for the development of embarkation rafts was to eliminate motor launches, refuelling barges, etc. coming alongside aircraft. It has been found that in the course of time considerable damage is done to the aircraft hulls about the water-line. It is absolutely essential therefore that the raft should be thoroughly well fendered as the aircraft is not designed to take additional outside forces except in the neighbourhood of the spar frame. In this connection it should also be pointed out that the handholds on the aircraft sides are only intended as such and should not be used for mooring the aircraft once it is in the raft. They can be used, however, for steadying purposes providing shock absorber elastic is incorporated between the aircraft and raft.

FENDERS:

It has been found that ordinary cork filled canvas fenders are inadequate. The present raft at Southampton utilises a large pneumatic fender similar to an aircraft tyre. The importance of protecting the aircraft sides cannot be over emphasised; fenders should be at least 18" square in section. Details of pneumatic and "Linotex" fenders are attached. The general arrangement drawing of the raft shows swivelling fenders at the entrance to the raft; these also must be of ample proportions, and preferably of the type recommended above.

RAFT CONTROL:

During conditions of high cross winds or tide, or a combination of both, the aircraft may tend to lie at an awkward angle to the raft. Under these conditions it is advisable to swing the whole raft through a slight angle in order that the aircraft may enter or leave without fouling her sides. The raft is controlled by means of side kedge anchors or a line to the shore. See diagram 1.

RAFT CREW:

Successful operations depend to a large extent on efficient co-operation amongst the shore staff. A foreman should be in charge of all operations, with a crew of approximately six men under his direct command. These men are employed at other times in general traffic work and maintenance of marine equipment.

TOWING GEAR:

As previously mentioned, the aircraft is towed into the raft by means of mechanical winches. These consist of 5 h.p. Lister petrol engines, coupled by twin friction drives on to a winch drum. The whole gear is specially designed to give a wide variation in reeving speed, and no greater pull than 10 cwt. can be applied. Both tail towing winches are under the direct control of one man.

MOORINGS:

The raft is moored forward by means of a bridle connected to a one inch ground chain, the length of which is dependent on the depth of water; a 1½ ton anchor is used. Aft, the raft is moored direct to the shore. See diagram 11.

COMMUNICATION:

In the original layout at Southampton communication between the two sides of the raft and with the shore was by means of Snake pontoons (see photographs). These are light in weight and cheap to produce, but cannot be expected to weather heavy seas, owing to their shallow draught. They have, however, given excellent service, and are only being abandoned on account of the occasional severe storms which are encountered in the comparatively exposed water of Southampton docks. In calm waters these Snake pontoons are entirely successful.

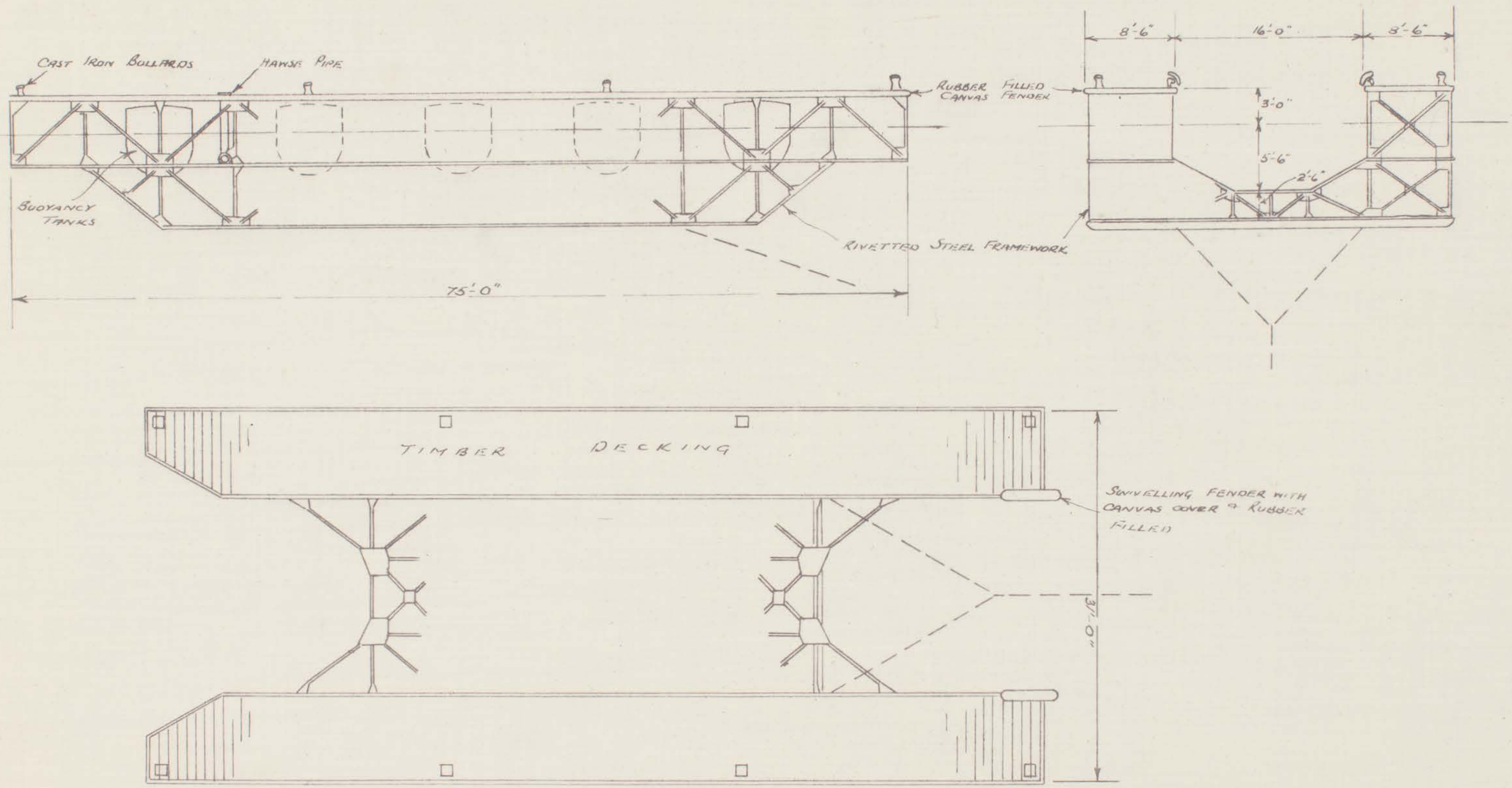
The scheme now adopted for operations in disturbed waters is to use a well ballasted 65' x 20' lighter as a base for the raft. From this lighter two gang planks are run on to the raft, so affording easy means of inter-communication between the two sides; a third gangway leads direct to the shore. Such an arrangement provides, in effect, a double "U" raft both in plan and section. Diagrams 1 and 11 show this scheme in operation.

Reference to the photographs will show that a crane is also used in conjunction with the gangways for ferrying loads to and from the aircraft. In practice all dead load is handled in this way; a crane is almost essential when dealing with terminal loads which exceed two tons. The radius of the crane should reach at least as far as the trailing edge of the wing root, the design of the mail hatch does not permit direct loading and unloading taking place on the aircraft upper deck. The scheme adopted for unloading mail is to drop the bags down a chute on to a rope net laid out on the raft behind the wing; from this position the crane picks up its load.

Comparing the present facilities for handling heavy terminal loads at Southampton with those of the past, where motor launches were used, there is no doubt that a raft, if efficiently handled in conjunction with a crane, is superior to any other method so far evolved for the quick and efficient handling of aircraft loads.

SERVICING OF AIRCRAFT:

At stations where a slipway is not available for beaching the aircraft for servicing and maintenance work on shore, it is suggested that this raft might be used for the purpose. The aircraft would have to be brought in bow first and securely moored in the raft at bow and tail. A platform could be built around the bow, supported on both sides of the raft, on which special platforms and rostrums could be mounted. It is considered that the layout shown in Diagrams 1 and 11 would best suit this arrangement, the lighter would form an excellent stable base on which to build out an extension for this purpose.



FLYING BOAT PONTOON

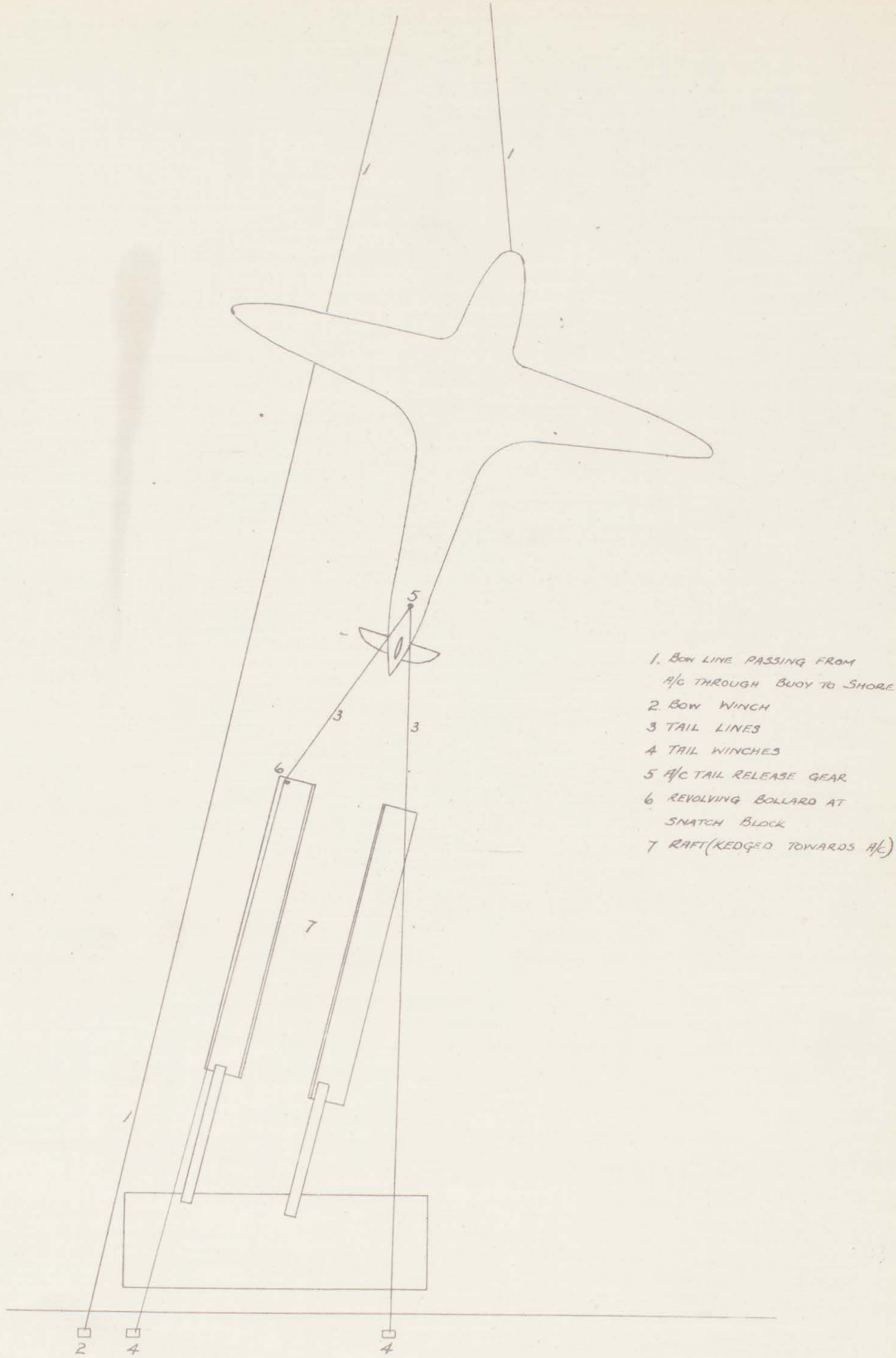
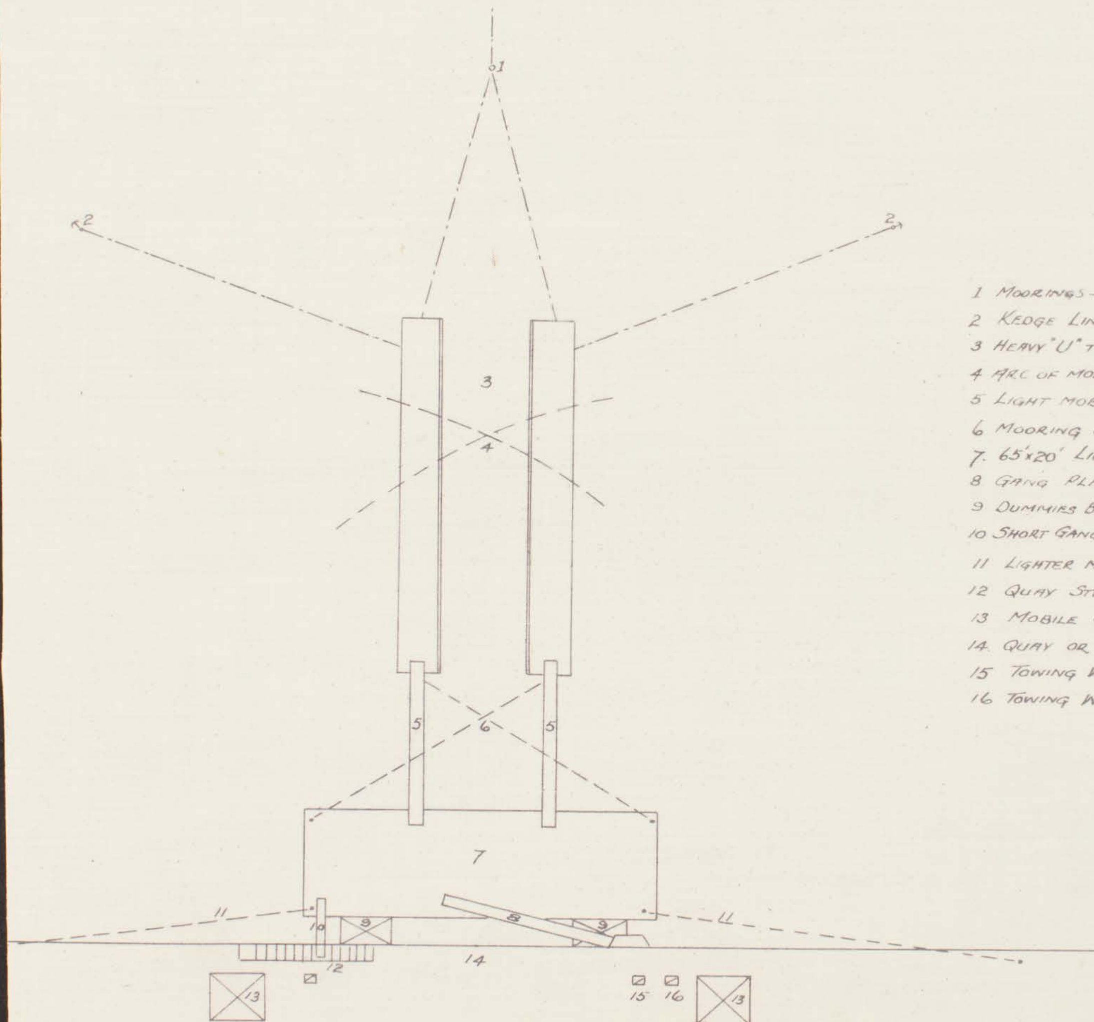


DIAGRAM OF "C" CLASS A/C BEING TOWED INTO RAFT



1 MOORINGS - BRIDLE & GROUND CHAIN
2 KEDGE LINES
3 HEAVY "U" TYPE RAFT
4 ARC OF MOBILE CRANE
5 LIGHT MOBILE GANG PLANKS
6 MOORING SPRINGS
7. 65'x20' LIGHTER
8 GANG PLANK TO SHORE
9 DUMMIES BETWEEN SHORE AND LIGHTER
10 SHORT GANG-PLANK TO QUAY STEPS (ALTERNATE 8)
11 LIGHTER MAIN MOORING SPRINGS
12 QUAY STEPS
13 MOBILE CRANE
14 QUAY OR SHORE
15 TOWING WINCHES (TAIL)
16 TOWING WINCH (BOW)

GENERAL LAYOUT OF HEAVY "U" RAFT (SOUTHAMPTON)

DESCRIPTION OF "AVON" PNEUMATIC

FENDERS AND THEIR USE.

DESCRIPTION:

A series of cylindrical rubber tubes, each 3 ft. long, and of a suitable diameter according to requirements, lie inside a continuous "P" shaped outer covering. The outer covering is manufactured in exactly the same way as a motor transport type, i.e. laminations of canvas and rubber bonded together. The cylindrical rubber tubes are retained in position within the outer container by aprons marked "A" and "B" in the attached sketch. The two aprons are laced together forming a complete cover for the inner tube to prevent wear by chafing.

Along the top and bottom edges of the outer cover a series of brass grommets are inlet by means of which the fender is attached, with brass bushed pins, to the surface requiring protection. At the lower edge of the outer cover drain-holes are incorporated to prevent water accumulating.

The inner tubes are inflated to any desired pressure (the optimum is between ½lb. and 2 - 3 lbs. per sq. in.) and for the sake of uniformity a simple "U" tube is best employed for checking:

Standard Schrader valves are fitted.

The complete fender is manufactured by the "Avon" India Rubber Co. of Melksham, Wiltshire, to the design of Imperial Airways.

PURPOSE OF THE FENDER:

To protect the thin metal skins of the "C" Class flying boats from damage caused by contact with hard unresisting surfaces. This type of fender may be adapted to fit quaysides, rafts, motor launches, refuelling barges, pontoons, dinghies, metal buoys etc.

METHOD OF ACTION:

The object of a fender is to distribute side loads evenly over as large an area of the aircraft frames as possible. With the old cork or sawdust filled type this is not achieved as efficiently as a pneumatic fender which tends to spread under load and can never become "solid" as there is always a cushion of air between the aircraft and the fender base.

COMMENTS:

Comparatively little experience has been gained so far with the pneumatic fenders on the raft at Southampton; after various teething troubles have been overcome the fender is proving to be a great advance over previous types. The effective life of the material used requires further observation, but the manufacturers are prepared to guarantee against faults in material, or deterioration in salt or fresh water for a period of five years.

FINISH:

The outer cover can be supplied in any desired colour without additional cost but all pneumatic fenders suffer from an inherent disadvantage where rubbing loads have to be contended with. As the rubber is compressed the pores of the material open and tend to adhere to the aircraft side; this can be overcome by soaping the fender in strategic positions, the efficiency of the fender is thus greatly increased; oil should on no account be used.

USE WITH LAUNCHES:

Various sizes of fenders can be made up to suit launches which, when so fitted, have a greatly increased buoyancy factor. In an emergency such a fender of suitable dimensions would prevent a launch from foundering if it became water-logged.

"LINATEX"RUBBER FENDERING.

The general characteristics and functions of the Linatex fender are similar to those of the pneumatic "Avon" type but differ insofar as this type is semi-pneumatic, non-abrasive or corrosive, and is manufactured by a patent process.

The cost is considerably higher than other types of fender in use but it is recommended on the score of experience gained under service conditions.

An auxiliary launch at Southampton has been fitted with this fendering for over a year, it has given excellent results and shows no signs of deterioration.

Details of construction are attached.

This material is manufactured by:

Wilkinson Rubber Linatex Ltd.,
124, Great Tower Street,
London, E.C.3.

APPENDIX "C"

APPENDIX "C".

OUTLINE REQUIREMENTS OF HANGAR AND SLIPWAY.

Size of Hangar should be such that aircraft of the following dimensions can be housed, and some margin should be allowed for future larger aircraft.

	"C" Class Boat.	Development Boat.
Wing Span	114 ft.	134 ft.
Overall length	88 ft.	103 ft.
Height when on Beaching Chassis.	27 ft. 9 in.	40 ft.
Ground Clearance of Hull when on Beaching Chassis	6 in.	6 in.
Ground Clearance of wing tip float on beaching chassis.	6 ft.	6 ft.

DIMENSIONS OF SLIPWAY:

	"C" Class Boat.	Development Boat.
1. Gradient of slipway should not be less than	1 in 18	1 in 18
2. not to be greater than	1 in 10	1 in 10
3. Overall width of slipway	not less than 30 ft.	30 ft.
4. Distance between wheels of beaching chassis: Track: 16' 3.86" (centre line to centre line)		13 ft.
5. With the aircraft loaded to 17½ tons, - all four tyres level and pumped to 90 lbs. to the square inch - the contact area per tyre is 78 sq.ins. and the contact pressure 126 lbs. per square inch.		The corresponding figures:- 32½ tons all up weight. Tyre pressure 90 lbs. per sq.in. Contact pressure 115 lbs. over an area of 145 sq. in.

Note.

A minimum of 9 feet of water is required for attaching the beaching chassis of the Development Class Boat.

WINCH:

We recommend a winch of about 20 HP. with a hawser capable of taking a strain of at least 2,500 to 3,000 lbs. But both of these depend largely on the quality and condition of the surface of the slipway and the speed of haul.

With as small a slope as 1 in 18, it is also essential for the pulleys and hawser to be arranged for hauling the aircraft down as well as up the slipway.

Alternatively, a tractor can be used with similar characteristics. The choice of the two is governed by local conditions; a tractor has a variety of used at an airport, but does not possess such a high safety factor as a winch when handling large aircraft. The use of both winch and tractor is recommended.

A point to be borne in mind when considering the layout of a slipway and hangar is ground and tail clearance. If the gradient of the slipway commences at the hangar doors there is danger of the keel grounding on the apex of the slope and the tail fouling the top of the doors.

APPENDIX "D"

APPENDIX "D".

IMPERIAL AIRWAYS GROUND ORGANISATION FOR CONTROL OF ALIGHTING AND TAKE-OFF AREAS DURING DAY AND NIGHT.

GENERAL:

The regulations set out hereafter have been drawn up in the light of experience gained in operating flying boats under a variety of conditions throughout the Empire Routes. They are designed to comply with the International Air Traffic Regulations but suitably modified to meet certain special conditions and needs of the Company.

DAY OPERATIONS:

The duties of Control are similar to those outlined in the night operations for keeping the alighting area cleared and escorting the aircraft whilst on the water.

Permission to alight or take off is signalled to the aircraft by means of flags which are laid out on the canopy roof of the control launch during an arrival and flown on a suitable mast, held by a member of the launch crew, during a take off. It has been found by experience that a red-white chequered pennant and a green-white quartered pennant are the most suitable. The dimensions of the pennant are approximately 5 feet at the base and 13 feet from base to apex.

During the time that an aircraft is running on the water during alighting or take off it is the duty of the control launch to be in such a position that, in the event of emergency, immediate aid can be rendered to the aircraft. The recommended procedure is for the launch to stand-off half distance along the Port side of the alighting or take off run, making due allowance for possible interference with the aircraft's menoeuvres. From this position the launch will be able to observe the approach and follow the aircraft during the latter stages of its run.

NIGHT FLYING OF FLYING BOATS

GROUND ORGANISATION.

1. RESPONSIBILITY:

(a) At established Civil Airports under official control the responsibility rests entirely with the authorities and is outside the jurisdiction of Imperial Airways Ltd.

It is recommended, however, that the general principles outlined in this memorandum, which follows closely the "International Convention, relating to the Regulation of Aerial Navigation" as laid down in the edition April 1937, be as far as practicable adopted.

(b) The necessary organisation affecting surface craft in or near the alighting area shall be agreed between the Area Manager and the local authorities.

(c) At airports for which Imperial Airways Ltd. is responsible the Area Manager will advise in writing the official who is to be in charge of Night Flying Ground Organisation. Normally this official will be the Station Superintendent.

The Area Manager is required to satisfy himself that the official appointed has knowledge of his responsibilities or has the assistance of a person with the necessary intimate experience required.

2. CONTROL:

The official in charge of night flying ground organisation at a station will detail an experienced member of his staff to undertake the duties of "Control".

(At stations where only emergency landings are likely the official in charge may have himself to undertake the duties of "Control")

THE DUTIES OF "CONTROL" ARE:-

1. To take complete charge of the flare path prior to, during and after a take-off or alighting of aircraft.

2. To "control" all aircraft on the water and in the air for a take-off or alighting between sunset and sunrise, or in times of low visibility when a flare path is employed.

Motor launches detailed for control purposes come under the orders of "Control".

3. FLARE PATH:

The flare path is to be laid on all occasions when a night landing or take-off is expected, or in conditions of low visibility or at the request of a commander of an aircraft.

(a) Night Landing. The flare path is to be ready in all respects at least 30 minutes before the expected time of arrival of the aircraft.

When the ETA is less than one hour before sunset, the flare path is to be ready in all respects 15 minutes before sunset if the aircraft has not already safely landed.

(b) Night Take-off. The flare path is to be ready in all respects 30 minutes before departure time.

It is to remain lit and ready after a departure to accept the aircraft returning for a night landing for one hour (or until daylight, whichever is the less) or as much longer as may be necessary at the request of an aircraft commander.

(c) At intermediate alighting areas at which a regular call is not scheduled or at which the Captain has advised he will not be landing, a flare path is to be laid, lit and be ready in all respects when an aircraft is expected to pass over or near to it during darkness. The flare path will be ready one hour before the aircraft is expected to pass until one hour after its passage (or until daylight, whichever is the less) or as much longer as may be necessary at the request of an aircraft commander.

4. LAY-OUT OF FLARE PATH:

This will be in accordance with Figure 1.

At certain stations it will be necessary to make certain modifications due to local geographical or congested conditions, and Area Managers are requested to issue the appropriate instructions, notifying the Air Superintendent, who will embody them in the Route Book issued to all commanders.

Examples include:-

(a) The use of corner boats on the flare path to aid the Control where water traffic makes this advisable, as at Alexandria.

(b) The alternative positioning of the Auxiliary Launch, as may be necessary under certain conditions at Brindisi.

(c) The reduction in the length of the flare path.

5. CONTROL ZONES:

Control Zones are necessary when more than one aircraft is liable to arrive and/or depart within a short period of time.

(a) When the space available in the alighting area permits, two zones will be employed as shown in Figure 2.

(b) When the plan of Control Zones outlined in (a) is impracticable owing to narrowness of the channel, the Area Manager, having regard to local conditions, will lay down a Control Zone plan to suit the particular requirement.

As a guide to Area Managers, a possible Control Zone scheme of this description is shown in Figure 3. The same channel is shown in Figure 3a with the wind in the opposite direction.

When an Area Manager is issuing instructions under this paragraph the situation of the moorings to which the flying boat arriving is proceeding must be borne in mind. When the moorings are actually situated within the Waiting Zone, the arriving aircraft can proceed direct to its moorings, keeping clear, of course, of aircraft waiting in that zone to take-off.

Where the moorings are situated up-wind of the Arrival and Departure Zone and are relatively close to that zone, e.g. within 700 or 800 yards, it may be desirable for the aircraft which has just landed first to proceed to the Waiting Zone and remain there until the aircraft which is departing has left the water.

In paragraph 9 signals are given for the purpose of instructing the flying boat as to its procedure.

6. COMMUNICATIONS:

It is essential that the Control has immediate information regarding aircraft in flight. This may be achieved in the following ways:-

(a) The Control Launch may be fitted with wireless for direct communication with the aircraft. (It is hoped to make this the standard practice).

(b) The Control Launch and the shore base (which is in close communication with the main wireless station) may be in communication by wireless telephony.

(c) By Aldis lamp visual signalling. (At such stations staff have to have the necessary training).

(d) By the use of an additional motor boat carrying the necessary messages (in this instance all messages to and from Control must be written and a proper form of receipt maintained; on no account should verbal messages be sent.)

7. CONTROL LAUNCH:

It is hoped that Control Launches will be all fitted with W/T for two-way communication with aircraft. It is also desired to get the 'signal pan' wired for use with green and red lights, and a key arranged to permit morse signals being used. The Control launch will also carry an Aldis lamp with green and red screens and Verey Light Pistol with cartridges.

It is intended that once the flares are properly positioned and lit the Control launch should remain stationary in the position on the flare path as indicated. It can employ its searchlight for sweeping the alighting area as required prior to the arrival or departure of an aircraft, but during the actual take-off or landing the searchlight should be pointed up-wind and kept steady.

8. AUXILIARY LAUNCH:

The Auxiliary launch is intended essentially for warning off vessels likely to be approaching or entering either the Arrival and Departure Zone or the Waiting Zone. Prior to an actual arrival or departure it will patrol the Arrival and Departure Zone, reporting all clear to the Control Launch. For the signals to be employed please see paragraph 9.

9. SIGNALS Employed between Aircraft and Control and Control and Auxiliary Launches:

(1) Urgency Signals.

When an aircraft wishes to give notice of difficulties which compel it to land without requiring immediate assistance, the following signals shall be used :-

(a) By Radiotelegraphy:
The group PAN, the letters of which must be well separated so that the signals AN may not be transformed into one signal P.

(b) By visual signalling (when working "Control" not fitted with W/T). A succession of WHITE pyrotechnical lights, or a succession of short and intermittent flashes with the navigation lights.

(ii) Normal Requests for Landing.

(a) An aircraft wishing to land at night, without being compelled to do so, shall, before landing, ask permission by a signal made by radio-telegraphy or by means of an Aldis lamp, the use of the navigation lights for this purpose not being permissible.

The visual signal, sent by International Morse Code, shall be composed of the last three letters of the registration group of the aircraft; this signal shall be repeated for as long as may be necessary.

(b) When the request to land has been sent by radiotelegraphy the reply will be by the same method. In addition, the reply will be repeated by visual signal. The visual signal shall consist of a repetition of the same three-letter sign made by a GREEN light to give permission to land, and a RED light to prohibit landing.

(NOTE. Where a 'signal pan' is employed, the coloured light last used will continue to be shown).

(c) The firing of a RED pyrotechnical light or the display of a RED flare or light from the ground or RED light from signal pan, and notwithstanding any previous permission, shall be taken as an instruction to aircraft in flight that they are not to land for the moment, and to aircraft manoeuvring in the Arrival and Departure Zone that they are not to proceed.

(iii) Special Requests to Aircraft to Land.

To require an aircraft to land, the following signals shall be used:-

A series of WHITE Verey lights.

In addition, if it is necessary to distinguish amongst several aircraft which is to land, a series of WHITE flashes from an Aldis lamp shall be directed at that aircraft.

Where wireless communication with the aircraft has been established by the Control launch, the necessary order may be given by radiotelegraphy.

(iv) Signals to Aircraft for Normal Departure.

(a) The Control authorises the aircraft to enter the Landing and Departure Zone by a series of WHITE flashes from an Aldis lamp. This does not authorise the aircraft to take-off.

(b) Permission to take-off is given by Control directing his Aldis lamp at the aircraft and showing a continuous WHITE beam of a few seconds duration.

(c) To prohibit taking off he shall direct at the aircraft his Aldis lamp showing a series of RED flashes.

NOTE: Where more than one aircraft is waiting to depart, the signals described in (a), (b) and (c) above must be preceeded by the last three letters of the registration group of the aircraft to which the signal is addressed, by Morse Code, using the same colour as the signal which is to be sent.

(V) Signals from Auxiliary Launch to Control.

These signals will be given by Aldis Lamp:

(a) Landing area clear - steady GREEN light maintained until Control acknowledges with letter "A".

(b) Landing area obstructed - a steady RED light maintained until Control acknowledges with the letter "A".

(Vi) Signal to Flying Boat to return to or proceed to Waiting Zone.

This signal will be given by Aldis lamp:

Return to or proceed to Waiting Zone - a steady RED light directed at the aircraft. Where more than one aircraft is manoeuvring, this will be preceeded by the last three letters of its registration by Morse Code, using the RED screen.

IMPORTANT NOTE:

With Controls not operated by Imperial Airways Ltd., but conforming strictly to International procedure :-

(1) Permission to land will be given either by radiotelegraphy or by visual signal , it being understood that when permission has been asked by visual signal the reply shall always be by visual signal.

(2) A continuous light is not employed by Control following either permission or refusal to permit a landing.

10. MOORINGS:

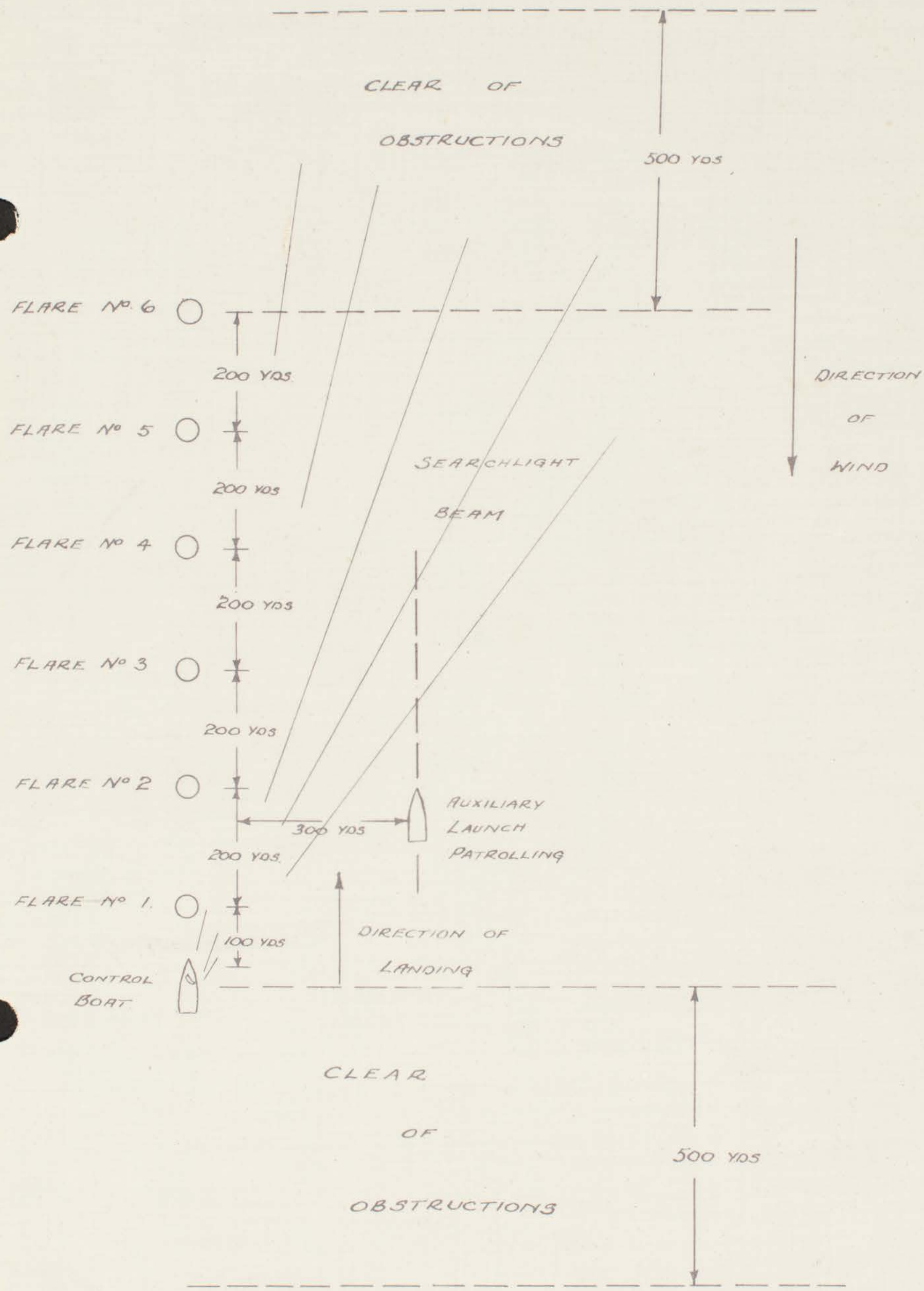
The position of the flying boat's moorings will be indicated by a dinghy being moored up to the buoy and a member of its crew will move vertically through about three feet a WHITE hurricane lamp. The same dinghy will normally hand up to the bows of the flying boat the mooring rope.

11. IDENTIFICATION LIGHTING of Imperial Airways' Motor Launches used in conjunction with Flare Path:

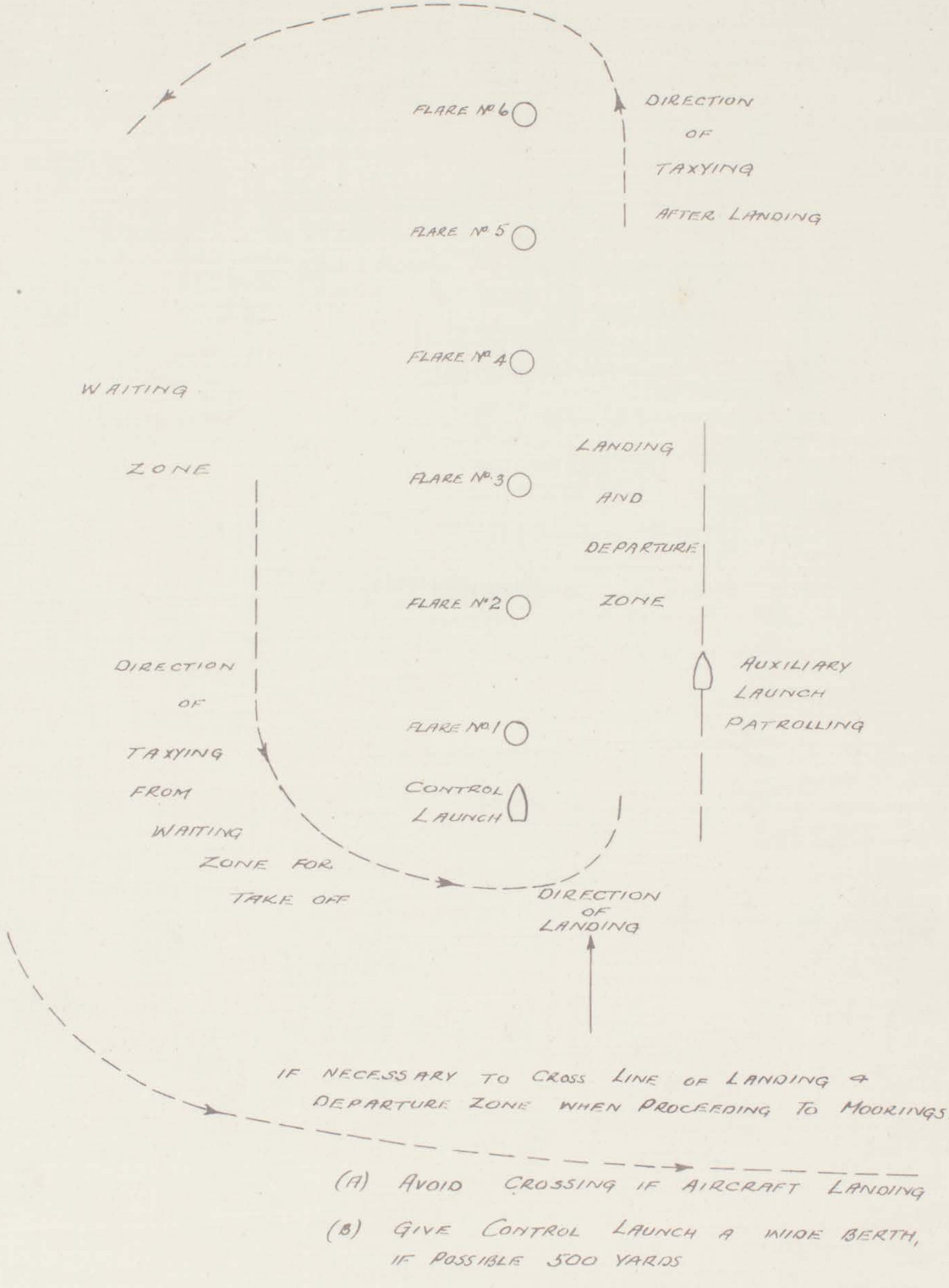
At certain ports where heavy traffic exists it may be necessary to introduce identification lights on each motor launch to distinguish it from other boats which may be in the area. The local authorities should be in each instance approached and asked to agree to the following:-

Auxiliary launches - one BLUE light visible in all directions mounted approximately three feet above water level.

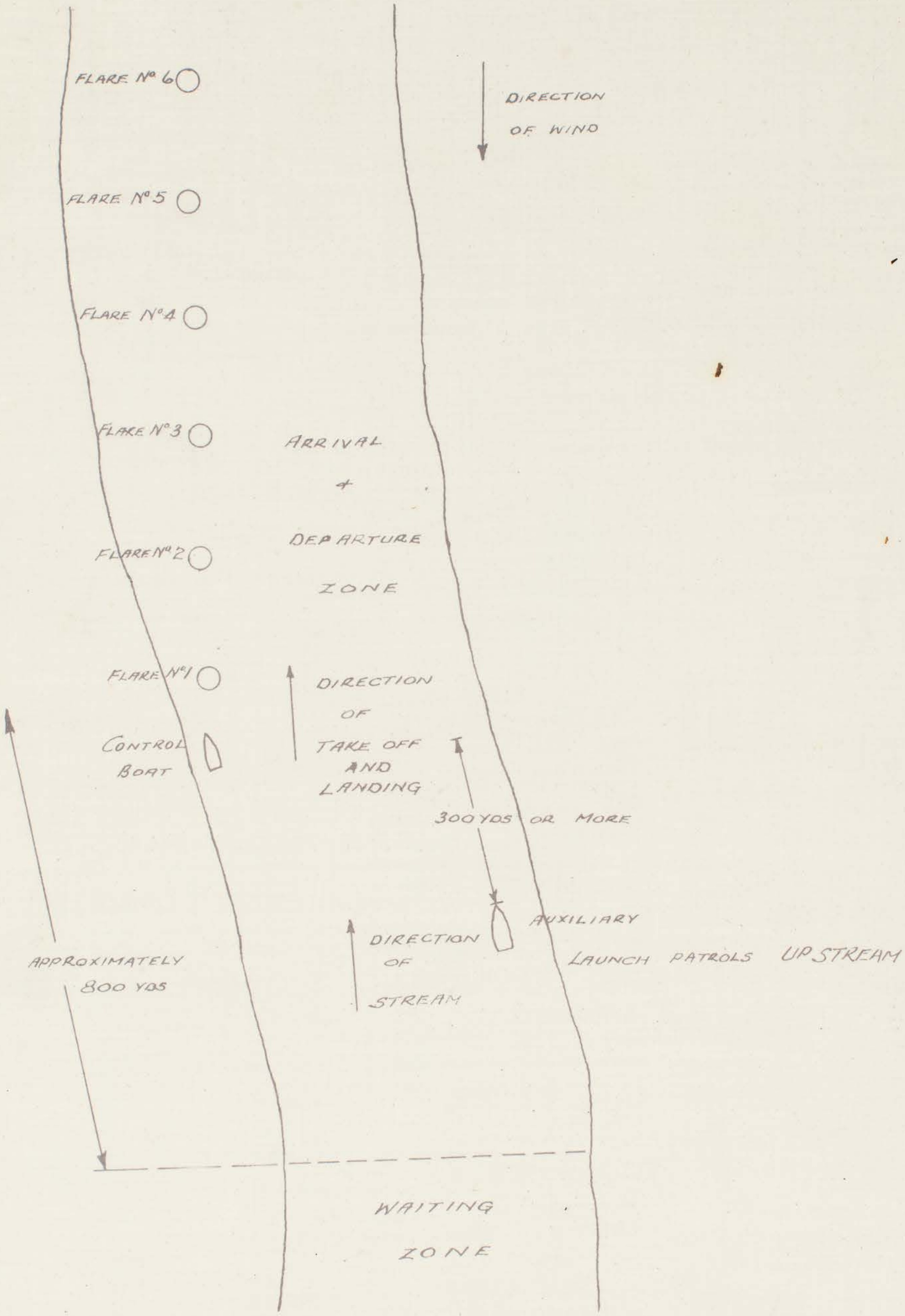
Any other launches employed, e.g. to carry messages to the shore or for guiding flying boats to their moorings where floating obstructions such as buoys are prevalent - two BLUE lights visible in all directions arranged vertically one above the other, two feet apart, the lower one being at least three feet above water level.



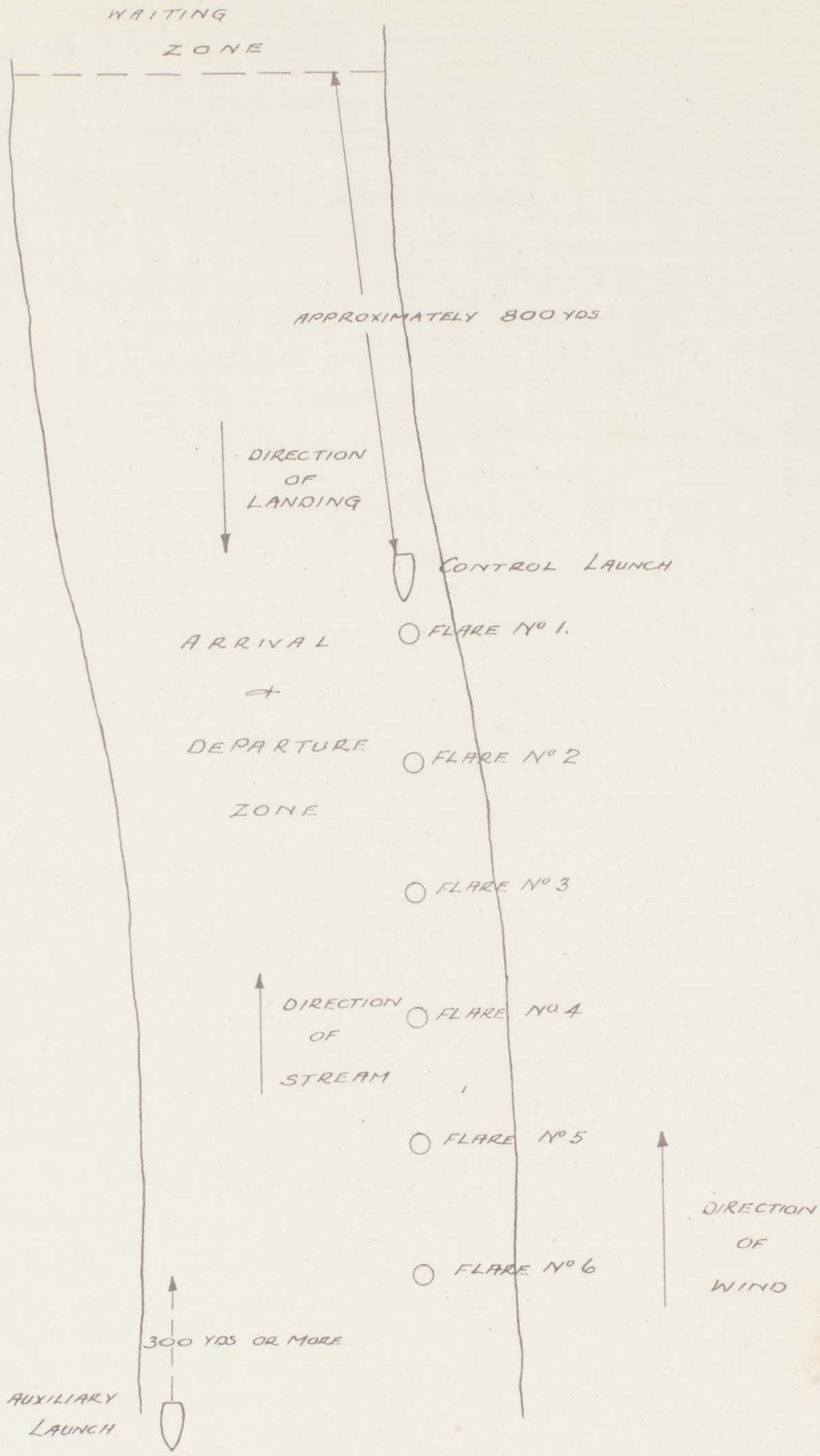
LAYOUT OF FLAREPATH



ARRANGEMENT OF FLAREPATH AND CONTROL ZONES



FLARE Nº 6
DIRECTION OF WIND
FLARE Nº 5
FLARE Nº 4
FLARE Nº 3
ARRIVAL + DEPARTURE ZONE
FLARE Nº 2
FLARE Nº 1
DIRECTION OF TAKE OFF AND LANDING
CONTROL BOAT
300 YDS OR MORE
AUXILIARY LAUNCH PATROLS UP STREAM
DIRECTION OF STREAM
APPROXIMATELY 800 YDS
WAITING ZONE



FLAREPATH IN RIVER -(ALTERNATE WIND DIRECTIONS)

APPENDIX "E"

APPENDIX "E".

WIRELESS AND D/F REQUIREMENTS.

According to reports the medium wave (333 Kc/s) radio communication organisation existing throughout New Zealand appears to be satisfactory. With regard to short wave and direction finding facilities, however, it is recommended that some improvement might be made on the lines set out below.

SHORT WAVE RADIO:

It is suggested that Short Wave Radio should be provided at both Sydney and Auckland, capable of two-way communication in all conditions, and of sufficient power to ensure easy working with aircraft at both ends of the sector.

DIRECTION FINDING:

This would appear to call for the installation of Marconi Adcock D/F equipment at Sydney and Auckland.

"HOMING":

It is considered advisable that omni-directional radio navigational beacons should be supplied at strategic points - to enable aircraft to use their own W/T installations for navigational direction finding in case of breakdown of either the aircraft transmitter or the ground station and its direction finders. To this end it would appear advisable to instal at least one high power radio navigational beacon with sufficient range to cover not less than 700 miles. Lord Howe Island is suggested as a sight for this beacon, while one of slightly lower powef capable of 500 miles range might be installed at Sydney.

In conjunction with the above radio beacons, provision should be made to augment the existing marine beacons at Tiritiri, Cape Maria and Stephens Islands, all working on their normal frequency, so that aircraft might make use of these facilities when flying in the Eastern Sector of the route.

AIRCRAFT INSTALLATION:

The radio apparatus installed in the aircraft which will operate on the Tasman Route is as follows:-

Transmitter. Marconi A.D.67A with normal aerial power of 66 watts, Medium Wave continuous working, and 60 watts on Short Wave continuous working. The frequencies worked range between 15 and 100 metres, 183 metres spot frequency and 550 - 1000 metres.

Receiver. Superheterodyne Marconi type 6872 covering the above frequencies and also working in conjunction with a rotating loop D/F attachment on medium and long wave bands.

EMERGENCY WORKING:

The complete wireless installation can be worked while the aircraft is afloat by means of a small auxiliary engine carried on board for the purpose.

APPENDIX "F".

APPENDIX "F".

REFUELLING PROCEDURE.

The importance of keeping heavy surface craft away from the aircraft has already been emphasised; this particularly applies to the refuelling launch, which, by virtue of its design and weight is always a latent source of danger unless carefully handled. The actual procedure is as follows during calm conditions.

The aircraft is moored in the normal way and tail drogue attached, if necessary.

Once the aircraft is steady the refuelling launch is signalled forward and takes up a position approximately 50 yards forward of the aircraft facing in the same direction. The launch drops anchor and approaches the aircraft by paying out the anchor line; in this way the coxswain has very effective lateral control in all directions.

When in position the refuelling launch makes fast forward to the aircraft buoy and bollard. The ties between launch and aircraft aft are most important as there are no stressed members of the aircraft available for this purpose. The hand holds can be used but only when insulated from snatch loads by suitable lengths of rubber or shock-absorber elastic.

Needles to say, the fendering of the refuelling launch must be of ample dimensions. (See Appendix "B").

Unless weather and water conditions are favourable the launch must not make contact with the aircraft; the launch approaches the aircraft in the normal way but stands off and passes the refuelling hose over a dinghy.

Refuelling has been carried out by the launch making fast to the tail release eye of the aircraft, thus taking the place of the drogue. This method is effective under certain conditions but is not to be recommended as a general practice owing to the difficulty of handling the long connecting hose necessary with this scheme and also the danger of seriously straining the aircraft tail eye and its fittings.

The same remarks apply to the trough system of refuelling; usually, when this method is adopted the lighter is manoeuvred into position by means of a launch.

APPENDIX "G".

OUTLINE SPECIFICATION OF CONTROL LAUNCH.

GENERAL.

The main duties of a Control Launch are outlined in Appendix "G", which deals specifically with the ground organisation for day and night operations. The principal functions of these boats are as follows:

(a) To patrol and search the alighting area for all obstructions during day or night operations, working in conjunction with a second or auxiliary launch.

(b) To carry signal apparatus (both W/T as necessary and/or visual) for communication with the aircraft direct, or a shore station.

(c) To lay and collect a flare path; carry out duties as "Control" during a night landing or take-off and illuminate the flarepath and/or obstructions with its searchlight.

(d) To be capable of rendering assistance to aircraft in distress. This capacity involves a high cruising speed, good seaworthy properties and a reasonable endurance.

(e) To be able to take an aircraft in tow at a moment's notice. For this a removable Samson post is necessary situated approximately amidships.

OPERATING CONDITIONS.

The boats used throughout the Empire Routes at present are designed for use in harbours, seas, rivers and lakes, under varying operational and climatic conditions. Where the purchase of a single launch is contemplated for operation in a particular climate, such stringent conditions need not necessarily be complied with and a launch suited to the particular conditions might be built.

Seaworthiness and easy manoeuvrability at all speeds are essential features. The boats should be sufficiently seaworthy to work in any sea in which a large flying boat may be expected to weather; this condition particularly applies to sectors of the route involving long sea crossings.

For reliability, endurance, manoeuvrability and economy, twin engines and rudders are an advantage. Compression ignition engines are preferred but are not considered essential, and the initial cost is much higher than a petrol engine of equivalent power.

If the boats are to be handled by native labour they should be simple to operate and require a minimum amount of straightforward maintenance.

Although control launches are primarily intended for the duties outlined, they should nevertheless have a disposable load of at least 1½ - 2 tons and be fitted with accommodation for 16 passengers or more.

RECOMMENDED GENERAL SPECIFICATION.

Dimensions.

The overall length of the present "Power" launches range between 37'6" and 40', other dimensions and general layout are shown in the accompanying drawings.

CONTROLS.

The boat and machinery should be contollable from the starboard side of the wheelhouse and it is suggested that the wheelhouse should be at the bow end of the boat. The port side should be available for housing the W/T apparatus and operator, or alternatively the W/T may be sited in the after cabin. Provision should also be made for the coxswain to be able to control the boat with his head and shoulders outside the top or starboard side of the wheelhouse.

SUPERSTRUCTURE.

The covered accommodation for passengers can be a portable canopy with drop curtains, which should be quickly detachable.

The height of the wheelhouse, or any other fixed piece of equipment, should not exceed 5 ft. above the water line when the boat is light, while still giving reasonable head-room for a man of normal height.

The after portion of the boat should not exceed 3 ft. above the water line when light, as it may be desirable in an emergency to place the stern of the launch under the wing or other portion of the flying boat.

GUARANTEED FULL SPEED.

The control boats now in operation were designed to have a full speed of not less than 18 knots with full load, all equipment and full tanks; their speed is actually 24 knots.

ENDURANCE.

Approximately 200 sea miles at full speed and full load is recommended but this is governed entirely by local conditions. For a control launch based at Auckland this figure is considered the minimum.

MACHINERY.

With the exception of boats constructed in Europe by foreign governments, all launches on the Empire routes are of British Empire manufactured machinery. Auxiliary machinery includes charging plant, hand and electric starting, electric light and 24 volt batteries of the nickel iron plate type.

UNDERWATER GEAR.

Tungum is recommended for propellers, shafting, and propeller brackets, the latter being fitted with cutlass rubber bearings. All parts should be interchangeable if possible, port and starboard.

FUEL TANKS.

If petrol engines are to be used the greatest care should be taken with the fuel system, especially the ventilation and draining of the tank compartments.

FIRE-FIGHTING EQUIPMENT.

The stocks recommended to be carried on board are 9 one quart Methyl Bromide extinguishers, two of which should be connected to the engine carburettors by piping, and two one quart Pyrene Tetrachloride type. Experience with the Methyl Bromide extinguishers, has shown the fumes after use to be slightly toxic and therefore dangerous to personnel working in the vicinity especially if they are smoking.

INSTRUMENTS.

The usual complement of engine instruments should be incorporated such as revolution indications, oil pressure, and water temperature gauges. A compass is also considered necessary.

W/T. SCREENING AND BONDING.

If W/T is fitted the boat should be suitably screened and bonded.

BILGES.

It is recommended that at least three watertight compartments should be fitted between bilges, which in turn should be drained automatically when the boat is under way. If self bailers are fitted an anti-syphoning device should be incorporated to prevent flooding of the boat whilst at anchor. An efficient hand operated bilge pump should also be carried.

CRASH EQUIPMENT.

The design of the launch should allow sufficient space for carrying the following equipment:

2 Light collapsible ladders,
1 12'6" crash platform,
1 Neil Robertson folding Admiralty pattern stretcher,
2 Fireman's axes.
1 3 pronged Grapnel with 40' 3/16" chain,
2 Boat Hooks,
1 First aid outfit c.w. full instructions for use.

Outline Specification for Auxiliary Launch.

The 23'6" Power "Sea Rover" launch has proved to be so successful on the Empire Routes that little more can be recommended for such a craft of this type.

For the sake of interchangeability of spares, the same engines are used in these craft as the Power "Control" boats. If another type of engine is contenplated it should be as compact as possible, preferable of a "V" cylinder lay-out.

APPENDIX "H".

APPENDIX "H".

THE MARINE SEARCHLIGHT.

Outline Specification, Essential Characteristics and Principal Requirements.

As a general guide to the requirements, a brief specification of searchlight suitable for use of control launches is as follows.

A flat twin $2\frac{3}{4}$ h.p. balanced engine is mounted in the well of the launch coupled to a 1.5 k.w. generator. This unit charges the 24 volt Nife batteries which supply the necessary current to the searchlight via a switchboard containing moving coil ammeter, volt meter, D.F. switch, fuse, shunt regulator and nipphon water-proof plugs.

The switchboard is mounted in the cockpit of the launch. The whole of the generating plant is designed for operation on launches in rivers, lakes and seas, in Europe, and also under tropical conditions.

The searchlight is simple to operate and controlled by hand. It is designed to conform to the following requirements.

A. The searchlight is capable of rotation through 360° in Azimuth and through a vertical angle of 90° for use as a beacon.

B. The searchlight is fitted with a beam spread device to enable the operator to change from a brilliant spotlight for long range use to a diffused light for flarepath lighting purposes, without losing time or distracting his attention from the illuminated objects. The beam for this purpose, is diffusable through a minimum horizontal angle of 20°.

APPENDIX "I".