INDEX NO. A-11

AERONAUTICS TARGETS

AIRCRAFT ARRANGEMENTS AND HANDLING FACILITIES IN JAPANESE NAVAL VESSELS

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1. Subject report, covering Targets A-11 and A-12 of Fascicle A-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Comdr. N. Hancock, RCNC, assisted by Lt. Comdr. (A) S. Edgecumbe, RNVR, on operational matters and by Lt.(jg) G. R. Clauson, USNR, as interpreter and translator.

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"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE A-1, TARGETS A-11 AND A-12

JANUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

AERONAUTICS TARGETS

AIRCRAFT ARRANGEMENTS AND HANDLING FACILITIES IN JAPANESE NAVAL VESSELS

For the purpose of clarity this report is divided into two parts. Part I deals exclusively with Japanese aircraft carriers, three distinct types of which were in operation or building at the end of the war. They were: (1) large fleet carriers for operation with the Battle Fleet, (2) light fleet carriers for operation with cruiser task forces, and (3) small escort carriers with merchant ship hulls. Japanese carrier design had therefore reached the same stage as that in Allied navies.

In general, the Japanese possessed soundly designed carriers fitted with most of the aircraft facilities available in Allied ships, although development of these facilities lagged somewhat behind.

In Part II, the method of stowing and launching aircraft from seaplane carriers and other Japanese warships is reviewed. The arrangements resembled those in Allied ships of similar size and type. Notable exceptions, however, were the battleships ISE and HYUGA, the cruisers TONE and OYODO, and the submarines of the I-401 class. In all of these, aircraft handling facilities were given far more emphasis than in similar Allied types.

Well-designed seaplane carriers were constructed in recent years to fulfill a need for long distance reconnaissance over broad ocean areas. Dissatisfaction with this type and an urgent need for escort carriers led to the conversion of two of them to aircraft carriers.

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REFERENCES

Location of Target:

Navy Technical Department and Navy Aeronautics Department of Japanese Navy Ministry, TOKYO.
Navy Yards at KURE. YOKOSUKA, SASEBO and MAIZURU.
Navy Airfields at YOKOSUKA AND KISARAZU.
Aircraft Carriers at KURE and SASEBO.

Japanese Personnel Who Assisted in Gathering Documents:

E. CHIBA, Tech. Comdr., IJN, Navy Aeronautics Department, and First Naval Technical Arsenal, YOKOSUKA.
I. UCHIDA, Tech. Lt. Comdr., IJN, of Section Four, Navy Technical Department and Yokosuka Navy Yard, Construction Department.
G. YAMAMOTO, Civilian Naval Architect of Section Four of Navy Technical Department.

Japanese Personnel Interviewed:

M. YAMAOKA, Captain, IJN, of Operations and Plans Division of Navy General Staff.
M. NAGAISHI, Captain (Air), IJN, of Crash Barrier and Arresting Gear Section of Navy Aeronautics Department.
E. CHIBA, Tech. Comdr., IJN, of Crash Barrier and Arresting Gear Section of Navy Aeronautics Department.
T. INAGAWA, Tech. Captain, IJN, Section Four, Navy Technical Department.
K. MATSUMOTO, Tech. Captain, IJN, Section Four, Navy Technical Department and later head of Construction Department Kure Navy Yard.
G. YAMAMOTO, Civilian Naval Architect, Section Four, Navy Technical Department.

Related Air Technical Intelligence Group Reports:

ATIG No. 5 - Japanese Aircraft Barriers, Arresting Gear and Catapults.
ATIG No. 7 - Japanese Catapults.
ATIG No. 8 - Japanese Submarine Catapult
ATIG No. 19 - Summary of Information on Japanese Catapults and Arresting Gear.
ATIG No. 34 - Inspection of Japanese Aircraft Carriers.

INTRODUCTION

Part I of this report is intended to serve as a link between the ATIG and NavTechJap reports which relate to the design and construction of Japanese aircraft carriers and other aircraft carrying vessels. The aim of the investigation has been to avoid duplication of work previously reported and to fill in any gaps which existed due to the differing viewpoints from which those reports were written.

The following report, therefore, is intentionally incomplete in some respects, but it is hoped that sufficient references to ATIG and NavTechJap reports are given to enable the reader to obtain a complete picture of the aircraft facilities in Japanese naval vessels.

This investigation was attacked by ascertaining what systems and facilities, peculiar to aircraft carrying vessels, had been in use by the Japanese. Sufficient drawings and other documentary information were obtained (mainly from the library of drawings at Yokosuka Navy Yard) to enable the investigator to interrogate the referenced personnel. Copies of relevant ATIG reports were also obtained and studied with a view to deriving the greatest benefit from the excellent work of the ATIG investigators and avoiding possible duplication.

The investigation reported in Part II was complementary to that of Part I and was made for the same reason, viz, to serve as a link between the NavTechJap and ATIG reports.

Various types of ships carrying seaplanes were inspected during a field trip to MAIZURU, KURE and SASEBO. On return to TOKYO, copies of the relevant ATIG reports were obtained and studied. A preliminary survey of the field was then made and copies of plans required for a more detailed study were obtained. The subject was then discussed with personnel of Gun Reibu (Naval Staff), Koku Hombu (Navy Air Headquarters) and Konsei Hombu (Navy Technical Department).

In the years immediately before the war, the Japanese Naval Staff asked for aircraft on all ships displacing more than about 4000 tons, for reconnaissance and anti-submarine duties. Thus there were many types of ships carrying seaplanes, including special seaplane carriers which were intended to fill the role now filled by escort carriers and to serve at advanced bases for reconnaissance.

The Japanese attitude towards the carriage of aircraft in warships was therefore similar to that of the Allied navies during the same period, but they went further in combining the functions of the cruiser and battleship with that of the seaplane carrier, and in building special seaplane carriers in addition to aircraft carriers.

THE REPORT

Part I
AIRCRAFT CARRIERS

A. Japanese Naval Staff Requirements for Aircraft Carriers

The Japanese Navy took an active interest in the subject of operating aircraft from ships since its inception and Japan was the second naval power to build a carrier de novo. (HOSHO, completed in 1922). During the 1920's, in common with that of other major naval powers, the further construction of carriers by the Japanese was prohibited by treaty, but experience was gained with carriers converted from a battleship (KAGA) and a battle cruiser (AKAGI), and as a result the small carrier RYUJO was designed in 1930 and completed in 1933.

Further carrier building was limited by treaty, but the art of aircraft carrier design progressed and SORYU, an 18,000 ton ship, was completed by the end of 1937. Less than two years later, in mid-1939, HIRYU, an improved SORYU displacing 20,000 tons, was delivered to the Japanese Fleet. At about this time carrier construction increased in tempo and two sister ships, SHOKAKU and ZUIKAKU, displacing 28,000 tons, were delivered in 1942.

Experience during the early days of the late war demonstrated the weakness of these ships and necessary improvements were embodied in a large ship, TAIHO, of 34,000 tons. This ship had an amoured flight deck and improved torpedo protection and was completed by the spring of 1944. Meanwhile an improved HIRYU type of carrier, UNRYU class, was put into large scale production (fifteen ships of this type were projected), the name ship being delivered in mid-1944. In all, three ships of this class had been completed by the end of the war and two more had been launched.

A very urgent need for carriers induced the Japanese to convert two other potentially valuable ships, SHINANO, (designed as a battleship of YAMATO class and IBUKI designed as a heavy cruiser) to aircraft carriers. Those, however, do not appear to have any significant place in the trend of carrier design. There appears to have been some truth in the suggestion that SHINANO's special function was to serve as a well-defended floating airfield in advance of the main carrier squadron from which she was to be supplied with aircraft.

Conversion of various types of apparently innocuous ships to carriers during the war years provides an interesting example of the ways in which treaty conditions can be circumvented by an enterprising power. ZUIHO and SHOHO, two small escort carriers of 13,000 tons, were converted from tankers which had been built in about 1934 with a definite view to conversion in the event of war. (Note their high speed - 29 knots). CHITOSE and CHIYODA were similar ships converted from seaplane carriers. RYUHO was a somewhat larger ship converted from a submarine tender and TAIYO, UNYO and CHUYO, of about 22,000 tons from passenger liners. JUNYO and HIRO were converted to fleet carriers of 28,000 tons from ships which were to have been large passenger liners. These ships, all designed for rapid conversion to carriers in the event of war, proved an extremely valuable addition to the Japanese Fleet.

Table I lists the main classes of ships built as or converted to carriers since 1920. From it the trend towards larger carriers with large flight decks, larger hangars, larger aircraft capacity, better protection, higher top speed, greater range and higher cruising speed is evident. "Shadow" carrier construction (i.e. ships readily converted to useful carriers with approximately the same speed as current naval carriers) clearly follows the same trend. By the middle of the war, construction had settled down to three main types, a large fleet type with armoured flight deck and good underwater protection

Table I
MAIN CLASSES OF JAPANESE WARSHIPS BUILT AS, OR CONVERTED TO, AIRCRAFT CARRIERS

		Characteristics							Flight Deck				Elevators		
		WL Length (m)	Beam (m)	Displacement (tons)	SHP	Top Speed (kt)	Cruising Speed (kt)	Range (Miles)	Length (m)	Breadth Ø (m)	Breadth Fwd. (m)	Breadth Aft (m)	Forward (m x m)	Ø (m x m)	Aft (m x m)
Originally Designed as Carriers	HOSHO	176.6	17.6	10,000	30,000	26.0	14	8,000	160.8	22.7	10.0	14.0	12.8 x 8.5	-----------	13.7 x 7.0
	RYUJO	165.5	20.8	11,000	55,000	29.0	14	10,000	156.5	23.0	17.0	23.0	11.1 x 15.7	-----------	10.7 x 7.0
	SORYU	222.5	21.3	18,000	140,000	34.0	18	8,000	216.9	26.0	16.0	26.0	11.5 x 16.0	11.5 x 12.0	11.8 x 10.0
	HIRYU	222.9	22.0	20,000	150,000	34.0	18	8,000	216.9	27.0	16.0	26.0	13.0 x 16.0	13.0 x 12.0	11.8 x 13.0
	SHOKAKU	250.0	26.0	28,000	160,000	34.0	18	10,000	242.2	29.0	18.0	26.0	13.0 x 16.0	-----------	13.0 x 12.0
	TAIHO	253.0	27.7	33,800	160,000	33.5	18	10,000	257.0	30.0	18.0	27.0	14.0 x 13.6	-----------	14.0 x 14.0
	UNRYU	223.0	22.0	20,000	152,000	34.0	18	8,000	216.9	27.0	16.0	26.0	14.0 x 14.0	-----------	14.0 x 13.6
Conversions	ZUIHO	201.3	18.1	13,000	52,000	28	18	9,200	180.0	12.0	12.0	16.0	13.0 x 12.0	-----------	12.0 x 10.8
	CHITOSE	182.0	21.0	13,500	?	29	18	12,000	180.0	23.0	12.0	16.0	13.0 x 12.0	-----------	12.5 x 12.0
	TAIYO	173.7	22.5	20,000	?	21	18	6,500	172.0	23.6	18.0	23.5	12.0 x 13.0	-----------	13.0 x 12.0
	JUNYO	215.5	26.7	27,500	56,000	25.5	18	10,000	210.3	27.3	16.0	25.0	14.0 x 13.0	-----------	14.0 x 14.0
	SHINANO	256.0	38.9	65,000	150,000	27	18	10,000	256.0	40.0	22.0	30.0	15.0 x 14.0	-----------	13.0 x 13.0
	IBUKI	198.0	20.8	?	?	?	?	?	205.0	23.0	13.0	14.0	13.0 x 11.6	-----------	13.0 x 11.6

(five improved TAIHO's were to be built), a lighter fleet type for operating the smaller types of aircraft (fifteen UNRYU's were being built) with less adequate protection and reduced range, and light escort carriers with merchant ship hulls. This trend was confirmed by Captain YAMAOKA of the Naval Staff (Gun Reibu) who admitted that experience had shown HIRYU type to be too small for operation with the battle fleet, and that SHOKAKU, although large enough to operate the heavier and more powerful types of aircraft, proved to be inadequately protected for this service. TAIHO design was regarded as satisfactory for this type of work. Carriers of UNRYU class, produced by progressive improvement of SORYU design, were regarded as suitable for strikes against convoys protected by cruisers and escort carriers. Here the lighter types of plane would suffice, and this type had the advantages of simplicity and rapidity of construction. The smaller carriers were intended for escort duties.

Thus, in the main, the trends were the same as in the Allied Navies, with a strong tendency towards larger flight decks and hangers in the heavy fleet type.

B <u>Aircraft Stowage</u>

Aircraft were normally stowed in hangars of conventional type having an unobstructed height of from 13.5 feet to 15 feet. The lower hangers were 13.5 feet, upper hangars 14 feet, and on SHINANO 15 feet. Few of the Japanese carrier-borne aircraft had wings which folded completely, consequently, considerable ingenuity was required to achieve close stowage of aircraft in the hangars. Some indication of the type of stowage employed is given by the upper and lower hangar deck plans of TAIHO (NavTechJap Documents No. ND50-1406 and -1408, see Enclosure (A)). It will be seen that fighters in the forward portion of the upper hangar had to be stowed slant-wise to get in two rows in the hangar width. Planes stowed in the hangar were lashed to rings welded to the deck, chains and screw strainers being used for wheels with rope lashings for the after end and for the wing tips.

During operations the number of aircraft carried was increased by about twelve planes carried on the flight deck. These were lashed to securing points, consisting of flush bars set in hemispherical recesses, in the flight deck. Sufficient lashing points were provided to enable planes to be secured in almost any portion of the flight deck.

The number and disposition of aircraft carried varied with the type of operation contemplated. A typical complement for a fleet carrier was seventy-two planes stowed in twin hangars, made up of twenty-seven fighters, twenty-seven bombers, and eighteen torpedo and planes or torpedo bombers. Similar figures for a light fleet carrier were eighteen fighters, eighteen bombers and nine torpedo planes, totaling forty-five planes. The complement of both types could be augmented by twelve planes on the flight deck, the type depending upon the intended operation.

When a balanced complement of planes was carried, it was usual to stow the fighters in the middle to forward portions of the upper hangars, the torpedo planes in the after section of the lower hangar, and bombers in the after end of the upper hangar and forward end of the lower hangar. This enabled a choice of planes to be made at will, the fighters being in the most favorable position for rapid handling.

All fleet carriers had double hangars, except SHINANO which was converted too late during her construction to permit the incorporation of this feature. Also with the exception of the forward section of SHINANO, all hangars were of closed type. Open hangars had been tried, but were not liked on account of the difficulty of keeping out green seas and weather, and keeping hangars light tight at night. This had the disadvantage that engines could not be warmed up in the hangars, but the carrying of planes on the flight deck during operations somewhat offset this difficulty. It was considered that SHINANO had sufficient freeboard to make the open hangar worth-while, but, as has been indicated previously, she was intended to serve as an advanced floating airfield rather than a regular fleet carrier. Also due to her early demise, no operational experience with her was obtained.

C. Aviation Gasoline System

The fundamentals of the system used in recent Japanese carriers are illustrated by system used in UNRYU class carriers (Figure 1). The aviation gasoline was carried in two groups of tanks, one forward and the other abaft the machinery spaces. (See general arrangement drawings of TAIHO, NavTechJap Document No. ND50-1403 to 1415, Enclosure (A).) Each group of tanks was divided into two sections, one section containing high octane fuel (for starting up and for high bursts of speed), the other containing a lower octane fuel for cruising.

Each tank was fitted with a fixed suction pipe reaching to within 100mm of the bottom, having a float-operated hinged toe piece 600mm long, which ensured that the suction was never from the bottom of the tank unless the latter was empty. The tanks were also fitted with sumps 100mm deep, to which all water and sullage drained and might be pumped out of the sump (see Figure 2), and also an air escape pipe.

The aviation gasoline pumping space was situated either just above or alongside the tanks and contained three separate pumps, one for high octane fuel, one for low octane fuel, and the third for dirty water and sullage. Each of the two clean fuel pumps was connected through a strainer to the suction pipes of the appropriate tanks and delivered through a rising main to the main gasoline line. The sullage pump was connected to the sullage suctions of all tanks and to a small sullage tank, in the pump compartment, into which all water or condensate from the air escape pipes drained.

The sullage pump discharged overboard. All three pumps were fitted with spring-loaded by-pass valves, arranged to lift at 3 kgm/cm^2, so that the pump could be run continuously with supply valves closed. Suitable cross connections were provided to use the high octane pump to pump lower grade fuel and vice versa should the other pump break down. The hangar and flight deck filling positions were supplied by two main gasoline lines, one for the A type (high octane) fuel and the other for the B type fuel. These mains were situated in the middle section of the lower hangar and in the end sections of the upper hangar, with rises to the middle section of the upper hangar and to the flight deck. Sufficient fixed A type filling positions were provided to ensure that any position, in either hangars or flight deck, could be reached with a 25 meter flexible hose. Twice as many filling positions were provided for B type fuel.

Due to copper shortage, the use of flexible metal hose was discontinued and it was replaced by hoses made of two layers of cellophane separated by a helical wire insert and covered with canvas. These are stated to have proved satisfactory in service. Hoses were fitted with pistol type filling valves.

In the larger carriers, unwanted fuel was returned to the main tanks by a separate system, but in the smaller carriers, fuel return was by the gasoline supply system, the pumps being by-passed by additional pipes for this purpose. The return gasoline system was then connected to deck filling connections for fueling from a tanker. Planes were defueled by hose to hoppers at convenient points in the hangar.

The gasoline supply and sullage pumps were all of "gear wheel" type, driven by electric motors in the compartment above. In UNRYU their capacity was 40 kiloliters/hour. The gear type was apparently adopted to minimize the difficulty of keeping packings gasoline-tight. The single gland in this type of pump utilized metallic packings.

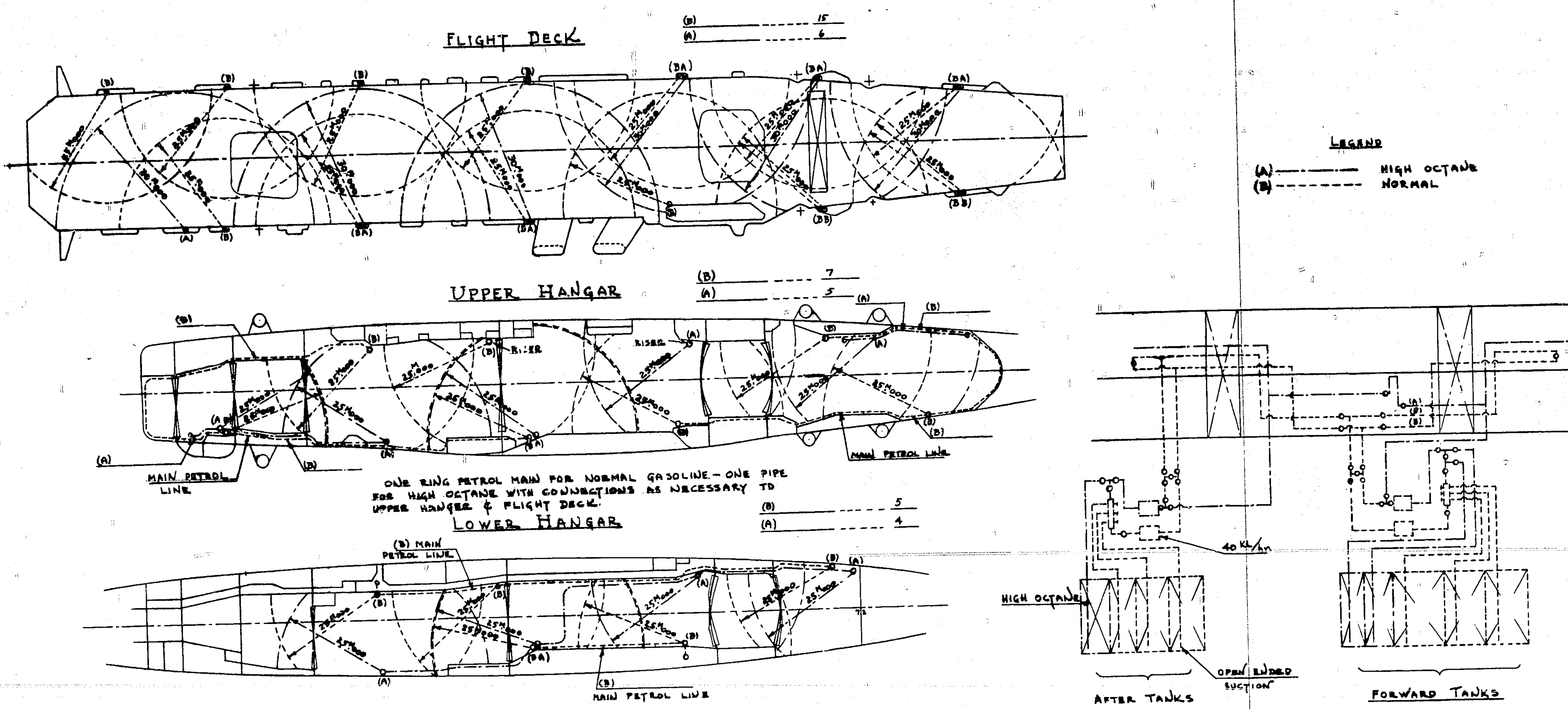


Figure 1

TYPICAL DIAGRAMMATIC SKETCH OF GASOLINE SUPPLY ARRANGEMENTS IN "UNRYU" CLASS

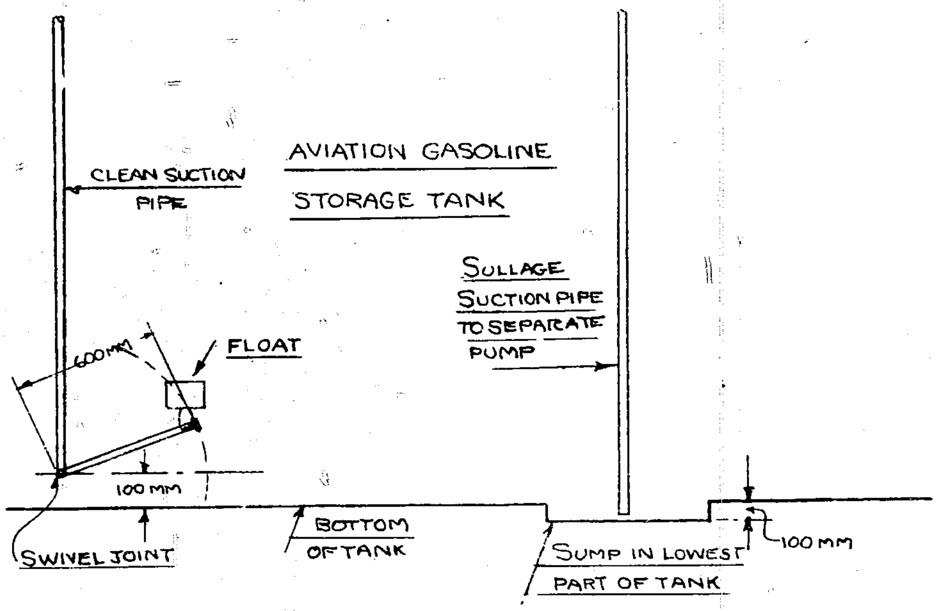


Figure 2

DIAGRAMMATIC ARRANGEMENT OF SUCTION PIPES IN AVIATION GASOLINE TANKS

Hose connections from fire main fresh water systems were provided near the pumping space for connection by hose to a hose connection from the suction side of the sullage system. These were for flushing and cleaning out the tanks and/or sullage system as necessary.

Gasoline piping which was originally made of copper had been replaced by unlined steel piping. Towards the end of the war gun metal valves were replaced by copper seated valves.

Before the war, gasoline tanks, which in Japanese ships form part of the ship's structure, were surrounded by an air space which was kept full of an inert gas (CO_2). Arrangements were also provided for filling, in an emergency, the space above the aviation gasoline in the tanks, and spaces around the pump, valve and working compartments, with the same gas.

These precautions were found to be inadequate in the early stages of the war, and as a result, the top and side air spaces were filled with concrete as a further protection against bomb damage.

D. Hangar Ventilation

The hangar ventilation installations in the older carriers were based on fan supply and fan exhaust, clean air being supplied on one side of the hangar at a height of 4 to 5 feet above the deck and exhaust from the other side at just above deck level. Fan capacities were based on a complete renewal of the air in the hangar in 10 minutes.

Most of the older Japanese carriers expelled their funnel gases downwards through curved funnels on the starboard side. All the supply intakes were kept on the port side and all exhausts on the starboard side, to avoid drawing funnel gases into the hangar. A disadvantage of this fan supply exhaust system

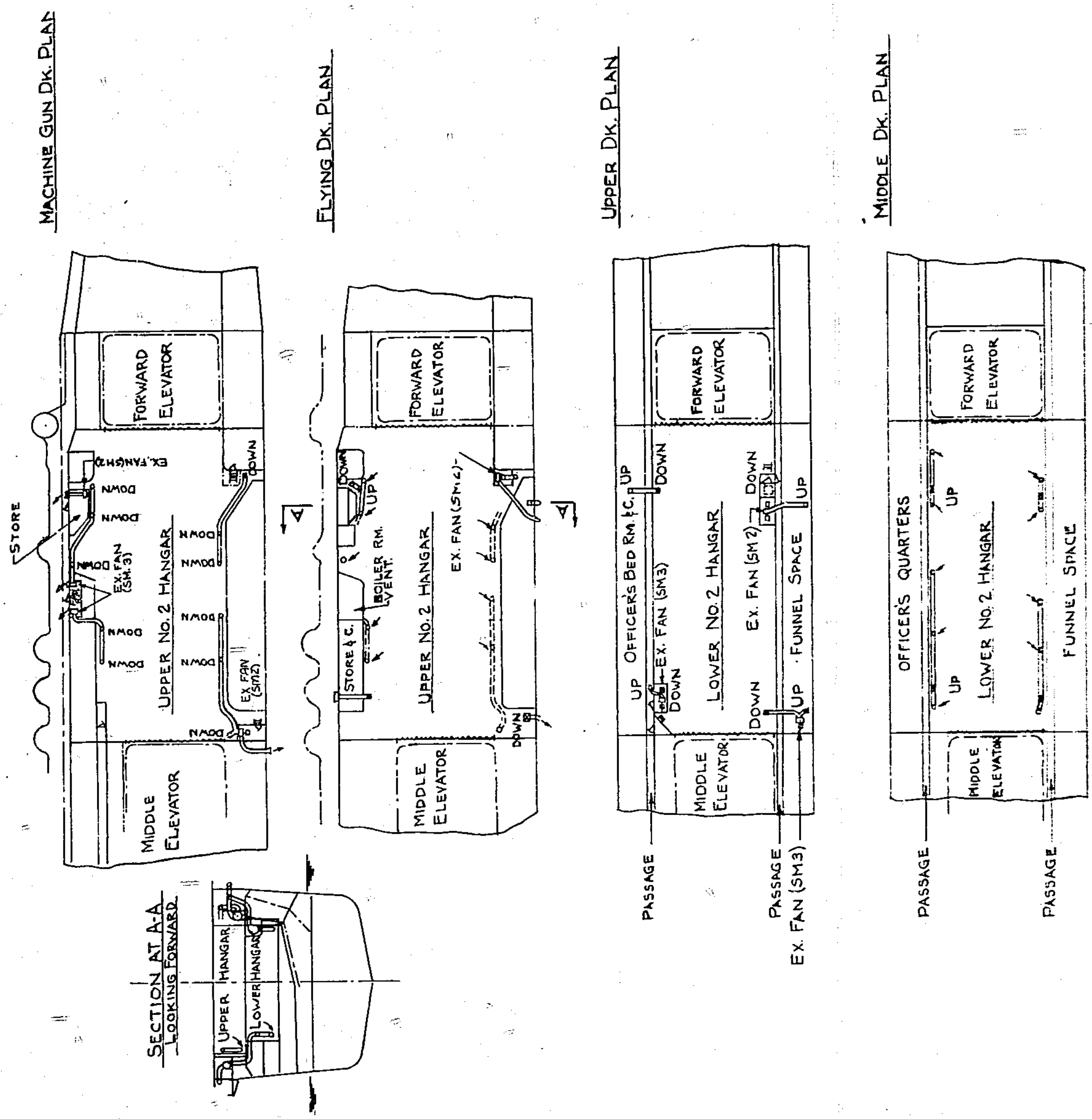


Figure 9
SHOKAKU HANGAR VENTILATION ARRANGEMENT

would appear to be a tendency to set up a circulation in the hangar about a longitudinal axis. This produced an undesirable mechanical mixing of air and petrol vapors which opposed the natural tendency of the vapor to form a blanket on the bottom of the hangar.

In more recent ships, hangar ventilation was based on fan exhausts on both sides of the hangar drawing vitiated air from just above deck level. No natural supply trunks were fitted, experience having shown that sufficient air leaked into the hangar through the elevator shafts and other openings, even when the elevators were in the flight deck position. When planes were fueling the elevators were kept in their lowest position to ensure a good current through the hangars.

With the exhaust-only system, the fan capacity was on the same basis as the old system with complete renewal in 10 minutes. A typical layout for a section of SHOKAKU class hangars is shown on Figure 3 and detailed arrangements for CHITOSE in NavTechJap Documents No. ND50-1423 to -1426, Enclosure (B). Where possible, fan compartments were placed outside hangar bulkheads but other requirements, e.g. funnel uptakes, boiler room downtakes and passageways, sometimes necessitated placing them inside the hangar. As a measure against flash, the mouths of all exhaust trunks were covered with fine mesh copper gauze, the latter being protected by expanded metal coverings.

E. Method of Operating Aircraft

1. Elevators

As has been indicated previously, the wings of most Japanese carrier aircraft were only partially folding if at all. Although this feature permitted the most rapid handling, it reduced the number of aircraft stowed in the hangar and also necessitated very large elevators (13 to 14 meters wide in the latest carriers). Combined with double hangars this presented a difficult structural problem, since both flight and upper hangar decks were perforated by holes of this width. Thus, although a three elevator arrangement was preferred, (it was adopted in SORYU and HIRYU), the high stress concentrations caused by such a large hole in the strength deck of the amidship portion of the ship, forced the Japanese designers to revert to the two lift systems. The arrangement of elevators, shown in TAIHO drawings (NavTechJap Documents No. ND50-1403 to -1415, Enclosure(A), is typical of that in recent ships.

Elevators were unarmored, except in the case of TAIHO, which had an armored flight deck, and were capable of lifting a maximum load of 5 tons. The elevators in TAIHO and SHINANO were designed to lift 7.5 tons. The time to raise or lower elevators from lower to flight deck was 15 seconds. Elevators were operated by wire cables wound on motor operated drums and were guided by heavy vertical stiffeners on the hangar bulkheads, the spaces between the stiffeners being occupied by balance weights. The cable drums were fitted with friction brakes, which came into operation immediately after the current was shut off, held the elevator in position at the upper hangar and served as a precaution against failure of power. Positive detents, hinged about vertical axes at the four corners of the aperture in the flight deck, were swung into position when the elevator was brought to rest at flight deck level and thus relieved the cables of shock due to touching down on the elevator platform.

The elevator machinery was stowed in a pit between the lower hangar deck and the next lower deck. In older two-hangar ships a second platform was suspended beneath the main elevator by means of chains and came into operation when the elevator reached the upper hangar on its upward path. This idea was abandoned in later ships, portable gangways being provided at lower hangar level to bridge the elevator pits.

A more detailed description of elevator machinery is given in NavTechJap Report, "Characteristics of Japanese Naval Vessels, Article 3 - Surface Warship Hull Design", Index No. S-01-3.

2. Bomb and Torpedo Handling Arrangements

Bombs and torpedoes were stowed in separate compartments in the hold. Both types of fleet carriers had bomb rooms forward and aft, the torpedo stowage being adjacent to the after bomb room. With this arrangement, there was a combined bomb and torpedo hoist aft to serve both hangars and a smaller bomb hoist forward, serving the lower hangar only, (the forward portion of the upper hangar being used exclusively for fighters; which were supplied with ammunition by small hoists direct from the magazines to the upper hangar). Bombs and torpedoes were lifted from their stowage bins on to light trolleys by means of hydraulic hoists, and the trolleys were wheeled out on to a platform raised about one meter above the deck level. This arrangement was adopted to allow a coaming of this depth to be worked around the bomb lifts, thereby preventing aviation gasoline vapor from pouring into the bomb room. Hoists, fitted over the raised platforms, enabled the bombs or torpedoes to be lifted onto special dollies, which were used for transport about the hangars or from the upper hangar to the flight deck by means of the after elevator.

Loading bombs or torpedoes onto planes was normally carried out on the flight deck (but occasionally in the hangars), the dollies being provided with screwjacks to raise the store for this purpose. Dollies were manually operated and were of two types, a light type for bombs of 250 kg or less and a heavy type for bombs of 500 kg and greater, and torpedoes. The heavier type of dolly weighed 800 kg.

3. Assisted Take-Off

In the years immediately before the war, the increased wing loading of carrier-borne aircraft, particularly bombers and torpedo bombers, and the consequent longer take-off required to make the planes airborne, had laid emphasis on the desirability of fitting assisted take-off gear in Japanese aircraft carriers. In consequence, determined efforts were made to design efficient apparatus similar in principle to those employed in aircraft catapults. Major difficulties included a way of overcoming the lack of rigidity in the flight decks (which have expansion joints), the excessive weight (30 tons per unit) and space required by the apparatus, an inexplicable retention of a heavy landing carriage and rail, (which although essential to a catapult are not to an accelerator) and the excessive time required to load an aircraft onto the landing carriage by means of a crane.

In spite of the difficulties, the design drawings of TAIHO (NavTechJap Document No. ND50-1403 to -1415, Enclosure (A)) show two accelerators on the flight deck and only the successful development of rocket assisted take-off led to the scrapping of the accelerator project for this and other Japanese carriers.

The method of rocket-assisted take-off used was to attach two rockets to the sides of the fuselage and in a plane passing through the center of gravity of the aircraft and below the tail, to avoid blast effects. The rockets were angled outwards and aft for a similar reason. Each unit contained three 3-inch cordite tubes, weighed 38 kg and exerted a thrust of 700 kg for a period of 3 seconds.

4. Japanese Aircraft Carrier Operations

Japanese aircraft carriers were operated in pairs for preference, in which case the organization of landing circles was as shown in Figure 4. Details of the landing circle are shown in Figure 5.

Table II
JAPANESE OPERATIONAL NAVAL AIRCRAFT

		Name		Date Adopted	Wing Type	Crew	Dimensions (Meters)					Weight (kg)			Performance					
							Span								Speed (kt)			Min. Take-Off Dist. (m)		Service Ceiling (m)
		Japanese	Allied				Normal	Folded	Length	Height	Wing Area (m^2)	Empty	Normal Load	Over Load	Max*	Land-ing	Take-Off	No Wind	14m/sec Wind	
Carrier - Borne	Fighter	00-21	Zeke	Jan. 43	low	1	12.00	10-955	9.06	2.92	22.43	1680	2336	2796	275/5000	60	65	194	80	10,300
		00-52c	Zeke	Oct. 44	low	1	11.00	no	9.087	2.986	21.26	1873	2686	2952	302/6000	63	65	200	80	11,050
		00-52	Zeke	Oct. 44	low	1	11.00	no	9.237	2.986	21.26	1837	3300	3566	319/6000	68	67	257	90	11,000
	Dive Bomber	99-22	Val	Jan. 43	low	2	14.36	10-952	10.231	3.348	34.9	2618	3800	4122	231/5650	70	67	210	85	10,880
	Dive Bomber Recco	SUISEI-12	Judy	Oct. 44	Mid.	2	11.493	no	10.22	3.740	23.6	2635	3835	4353	313/5250	78	70	320	125	10,720
		-33	Judy	Oct. 44	Mid.	2	11.50	no	10.22	3.740	23.6	2501	3750	4657	310/6050	79	70	352	125	10,500
		-43	Judy	Oct. 44	Mid.	1	11.50	no	10.22	3.740	23.6	2635	4542	4733	298/2600	80	72	462	140	8,450
	Torpedo-Bomber	97-12	Kate	Dec. 39	low	3	15.518	7.5	10.30	3.700	37.7	2274	3800	4100	204/3600	61	65	226	85	7,640
		TENSEN-11	Jill	Aug. 43	low	3	14.896	7.210	10.365	3.700	37.2	3010	5200	5650	251/4800	72	70	274	130	8,650
		-12	Jill	Mar. 44	low	3	14.896	7.210	10.865	3.800	37.2	3010	5200	5650	260/4900	72	70	259	130	9,040
		RYUSEI	Grace	Mar. 44	Mid.	2	14.40	7.5	11.49	4.070	35.4	3614	5700	6500	293/6200	69	70	250	130	8,950
Cata-pulted	Recco	ZUIUN	Paul	Aug. 43	low	2	12.80	--	10.84	4.74	28.0	2713	3800	4230	242/5580	L**	65			10,280
		SEIRAN	Paul	Jan. 45	low	2	12.21	--	10.64	4.58	27.0	3310	4032	4729	254/4000	L**	65			

*"Max. Speed" - Max. Normal Speed (not war emergency speed) in knots at optimum altitude (given in meters).

**L-Launching.

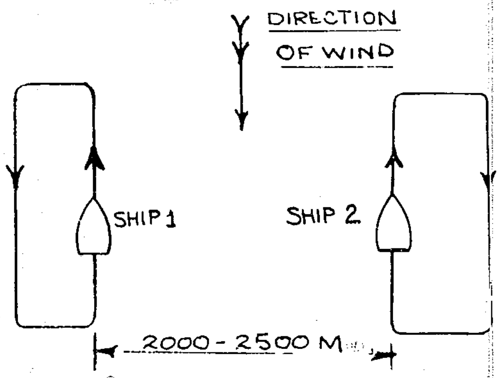


Figure 4
CARRIER LANDING CIRCLES

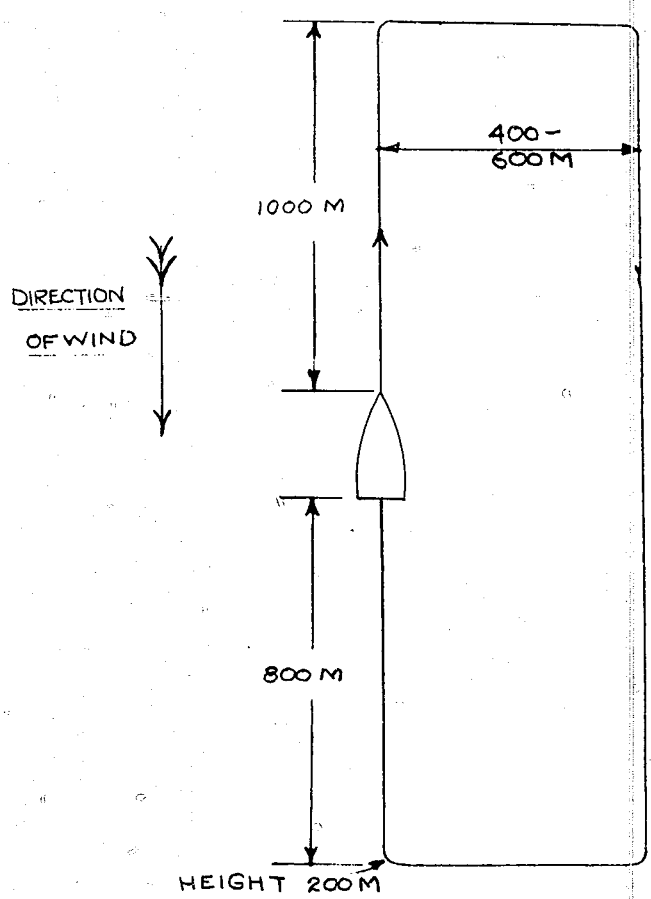


Figure 5
DETAILS OF CARRIER LANDING CIRCLE

Flying operations were controlled by a Commander or Lieutenant Commander of the Air Branch called the HIKOOCHOO, stationed on the bridge. He had two junior officers there to assist him and one, called the SEIBIIN, aft on the port side.

a. Taking-Off. The first aircraft was signalled off by a white flag displayed by the HIKOOCHOO. As long as this flag was displayed, succeeding aircraft took off without further signal. Intervals of 20 to 30 seconds were normal.

b. Landings. When the ship was ready an Aldis signal was flashed to the pilot abreast the bridge on the down-wind leg, instructing him to lower his hook and land on. After that, everything was left to his judgment. He estimated wind speed by the behavior of the steam jet forward by day, and by colored light signals at night. His approach path was indicated by aligning various deck lights. Only in emergency did the SEIBIIN wave off an incoming pilot. It was quite possible for a plane to land so soon after another that, if it missed the arrestor wires, it hit the plane ahead before the barrier was up.

Barriers were only used if there was a deck park forward. On operations the after one was used; the forward one was kept for training and as a spare.

On landing, the SEIBIIN controlled taxiing but the resetting of the wires and barrier was controlled by the HIKOOCHOO.

Landing intervals aimed at were:

Fighters................................25 to 30 seconds
Torpedo and bomber aircraft.............40 to 45 seconds

Landing crashes on operations averaged about 3%. Enclosure (B) gives particulars of a hook designed so that the pilot could disengage it from the arrestor wire. Owing to difficulties of production, it was not supplied to new aircraft after the spring of 1944.

Table II outlines the principal particulars of the latest Japanese aircraft used operationally. Operation details were obtained from Captain Nagaishi MUSATAKA, a torpedo plane pilot with about 150 carrier landings to his credit and once HIKOOCHOO of HIRYU.

5. Arresting Gear

The following is a brief summary of the arresting system used in Japanese carriers. More detailed information is available in ATIG Reports No. 5, 14, and 19, and from the arresting equipment and drawings forwarded to Washington by ATIG.

The pilot of each aircraft, on a given signal from the deck landing officer, let down an arresting hook and approached the flight deck in a shallow glide. A number of arresting wires (from 8 to 14) were stretched across the flight deck between the forward side of the after elevator and the vicinity of the bridge, being held, at a minimum height of 160mm, by lifting bars at the extreme edges of the flight deck. Each wire was led down over guide pulleys to an arresting engine compartment situated below the lower hangar deck. When the hook engaged a wire, a system of pulleys caused a ram to be pushed into a hydraulic cylinder, thus forcing oil through a series of restrictions into an air loaded accumulator.

Table III
ARRESTING GEAR DATA

Ship	No. of Units	No. of Wires
TAIHO	2 Model 10 + Model 11 + Model 12	14
SHINANO	3 Model 10 + Model 11 + Model 12	15
UNRYU	2 Model 10 + Model 11 + Model 10	9
TAIYO	Model 10 + Model 11	8
JUNYO	Model 10 + Model 11	8
HOSHO	Model 10 + Model 11	6

Table IV
SHIP INSTALLATIONS (with Type 3 Gear)

Type	Max. Wt. of Plane Arrested (kg)	Arresting Distance (m)	Speed of Plane m/sec.	Maximum Revariation (g)	Method of Setting Wire	Time to Reset (sec)	Wires Unit	Weight of Unit (t)
Kure-Model	4000	35	30	2.0	E*	12	1	5
Kure-Model	4000	35	30	2.0	E	12	1	5
Type 3 Model 10	6000	40	40	2.5	H**	7	4	6
Type 3 Model 11	6000	25	30	3.0	H	5	4	6
Type 4 Model 12	6000	30	35	2.5	H	6	4	6

*E-Electric.
**H-Hydraulic.

The shape of the restrictions, together with the increasing pressure of air in the accumulator as the plane was decelerated resulted in an approximately constant decelerating force being applied to the plane, until it was brought to rest.

Tables III and IV show the capabilities of the several types of arresting gear and the ships in which they were fitted.

The differences lay only in the type of arresting engine employed. In the KURE type the two ends of a wire were led to the two sides of a winding drum inside and affixed to which was a squirrel cage made of rather high resistance bronze. The drum and squirrel cage rotated around a six pole stator energized with 120 amperes at 220 volts at the maximum setting. To reset the wire the current in the stator was reversed. This type was dropped early in the war in favor of the Type 3. This was a hydraulic unit (see ATIG Report No. 5), each unit accommodating four arresting wires, and having settings for the several weights of aircraft.

The arrangement of arresting wires in TAIHO is clearly shown on the flight deck plan of that ship, (NavTechJap Document No. ND50-1404). The after seven wires were led to two Type 3, Model 10 arresting engines, only three of the four sets of wires being used on one engine and the spare set anchored.

Alternate wires were led to a different engine as a precaution against failure of wires and engine. The next four wires were taken to a Type 3, Model 11 engine and the last three (before the crash barrier) were to a Model 12 unit. Similar arrangements were fitted to other carriers. The method of reeving the wires is illustrated by NavTechJap Documents No. ND50-1438 to -1441, for the small carrier IBUKI.

6. Crash Barriers

Crash barriers were situated abreast the bridge (see drawings of TAIHO, NavTechJap Documents No. ND50-1403 to -1415), and at the forward end. There were usually two abreast the bridge and one at the forward end. One of the barriers abreast the bridge, usually forward one, was kept for training purposes and as a spare. Wires from the ends of each barrier were led to a separate hydraulic cylinder, the principal being the same as that of the arresting engine, but the retardation much more intense (9.5 g from 20 meters/second) and movement of barrier much less (12 meters at center). Each barrier and its equipment weighed 4.5 tons. For further details see ATIG Report No. 5 and NavTechJap Documents No. ND50-1442 to -1445.

F. Firefighting Arrangements

All Japanese carriers except SHINANO had closed hangars. Accordingly, the first measure against fire was to divide the hangars into separate sections by means of roller, blind-type fire curtains. These were of vertical type, the roller having its axis vertical at one side of the hangar, and the top and bottom of the curtain being guided in slots supported from the deck above and from the hangar deck. These curtains are adequately represented in the general arrangement drawings of the recent carrier TAIHO (NavTechJap Documents No. ND50-1403 to -1415). From these it will be observed that the upper hangar of TAIHO was divided by these curtains into seven portions and the lower hangar into six portions, curtains being provided next to the elevators or shafts to enable the latter to be isolated from the hangars proper. Arrangements were provided to spray all fire curtains in an emergency from the firemain!

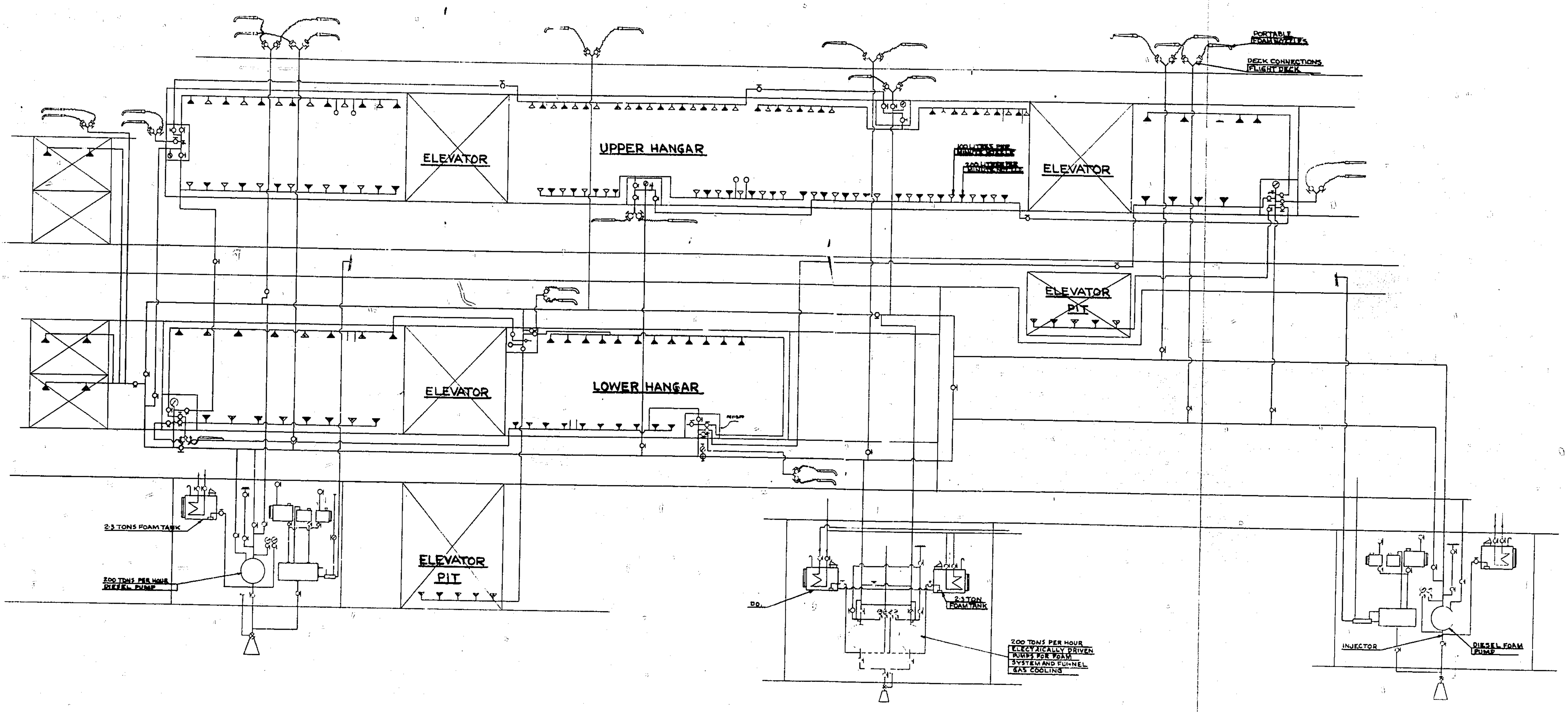


Figure 6

DIAGRAMMATIC SKETCH OF FOAM SYSTEM IN "CHITOSE" CLASS

Fires within the subdivisions formed by the fire curtains were fought with foam. Two rows of nozzles were provided along each side of each hangar for this purpose, the lower row of nozzles, with a capacity of 100 liters per minute, being placed at a height of 1.5 meters above the deck intended to spray the hangar deck. The upper row of nozzles placed at a height of two meters above the deck, were intended to project the foam, resulting from 200 liters per minute of soap solution, into the upper part of the hangar and on to those parts of the deck not covered by the lower rows.

Fires on the flight deck were dealt with by hoses, ending in foam nozzles, run from the hose connection in the flight deck ground crew pockets. Hoses were kept rigged during flying operations.

In the lower hangars a CO_2 blanketing system was also fitted. This system was intended solely for use in the event of serious bomb or torpedo damage and consisted of a perforated pipe running along the underside of the upper hangar deck, supplied from bottles stowed in the elevator pits. Valves controlling this system were placed at the entrances to the lower hangar. Sufficient CO_2 was carried to displace 18% of the volume of the lower hangar.

Hose connections from the normal fire main (arranged as a ring main in carriers) were also provided at the sides and ends of both hangars, and at numerous points along the sides of the flight deck. The foam system was, however, the principal means of fighting aircraft or gasoline fires. This system was controlled from fire observation stations built out from the hangar bulkheads. Two such stations were situated in each portion of each hangar (i.e. in each part between two fire curtains), one on each side, at strategic positions. These stations were constructed of 25mm Ducol steel, had armor glass windows and were entered by hatches from the deck above. Each station contained control switches for the fire curtains at the ends of its section, the foam control valves for its side of its section of the hangar, and was in telephonic communication with adjacent control points. In addition it was usually possible to control the adjacent section of foam pipes from such stations, or the portion of the hangar above or below, which was visible from that point.

In the lower hangar of TAIHO there were two stations on the port side of the hangar proper, one on the starboard side between them, and one in each end section beyond the elevators. In the upper hangar there were two in the forward section, two in the middle section between elevators and one in the after section.

The foam solution supplied to the sprayers from the system consisted of a 2% solution of a special salt water soap in sea water, which was pumped into the foam main by large capacity pumps at upper platform deck level. The usual arrangement of pumps was, one diesel pump in the forward end of the ship, one diesel pump in the after end and two electrically driven pumps in the amidship portion. Thus, the electrically driven pumps were used as the immediate supply and the diesel pumps, which were started up when danger threatened, were independent of separate power supply. The pumping capacity was based on a figure of 0.6 tons per hour per square meter of hangar area. In UNRYU class, the four pumps were each of 200 tons per hour capacity. In TAIHO, the combined pumping capacity was from a seacock and a solution of 30% special soap in salt water, stowed in a nearby tank (capacity 2.4 tons), was injected into the suction below the pump. The pumps delivered to the rising main a pressure of about 10 kg/cm^2, corresponding to from 7 to 8 kg/cm^2 at the sprayers. Pipe sizes were chosen to give a maximum velocity of 3.5 m/second.

The foam system was supplied from a main foam pipe running beneath the protective deck, of 230mm (≃6 inch) diameter in UNRYU class. Separate feeders were run from this main to each fire observation point in the hangar, from which distribution to the various spraying sections were accomplished. The foam sprayers consisted of a fine jet surrounded by an annular pipe, drilled with air induction holes and ending in the nozzle.

The foam system is adequately illustrated by the diagrammatic layout of the system as fitted in CHITOSE (as converted - Figure 6) and detailed deck plans of the systems in UNRYU and CHITOSE, (NavTechJap Documents No. ND50-1427 to -1436).

As an additional measure against failure of power, the ends of the main foam line were connected to the firemain so that water spray could be used if foam supply failed.

G. Aircraft Maintenance and Repair

Although the tendency in the later years of the war was not to repair aircraft in the carrier after damage or when engine troubles developed, but to keep these planes in reserve and land them on return to base, this situation is understood to have been due to a shortage of skilled mechanics rather than choice. (It was felt that mechanics could be more economically employed repairing and servicing planes at the bases.) All carriers possessed spare engine stores (the capacity for spare engines being one-third of those in planes) and shops for engine examination and stripping down.

The engine examination shops in TAIHO and UNRYU were situated on the port side of the after end of the upper hangar, and a large hatch therein was trunked down to the spare engine store on the platform deck. A drawing of the engine examination shop in UNRYU is shown in NavTechJap Document No. ND50-1437.

The method of dealing with faulty engines appears to have been to remove the engine from the plane by means of chain blocks in the hangar, and to transport it to the examination shop by means of a truck, using the after elevator in the case of engines brought from the lower hangar. An overhead traveling hoist on an I-beam was used for lifting spare engines out of the store, landing defective engines and shipping replacements.

The after end of the lower hangar was intended for the stowage of spare wings and other body parts.

H. Aircrew Accommodations

Japanese naval pilots and navigators were in the ratio of three petty officers and warrant officers to one commissioned officer. Pilots and navigators of petty officer rank were accommodated in a separate mess and had sleeping accommodations similar to those provided for petty officers in the U.S. Navy (i.e. tier type bunks). Commissioned officers were accommodated in normal type cabins. Hatches from these accommodations (forward upper galley deck in UNRYU and TAIHO) were double and had double ladders for quick access to the bridge and flight deck.

Pilots had a ready room in the forward portion of the bridge at flight deck level, and were briefed in the air operations room, three crews at a time. This operations room was situated on the first bridge level and was controlled from the operations room, but, during periods of intense activity, the responsibility for flight deck activities was delegated to a deck operations officer, of the rank of Lieutenant Commander.

Each hangar was under the direction of a hangar control officer and fighter direction was given from the upper bridge by the Air Defense Officer, also a Lieutenant Commander air specialist.

Part II
OTHER AIRCRAFT-CARRYING VESSELS

A. Types of Japanese Warships Carrying Seaplanes:

Seaplanes were carried on the following types of warships:

- Capital Ships
- Heavy Cruisers
- Light Cruisers
- Training Cruisers (probably used as reconnaissance craft in wartime)
- Seaplane Carriers
- Large Minelayers
- Special Submarines

B. Ships Other Than Seaplane Carriers

1. Aircraft Storage

In all the above types of ships aircraft were launched from revolving catapults, except in the case of submarines, which had fixed catapults.

The older battleships (except ISE class as converted) had one center line catapult and a separate crane for handling aircraft, and stored one aircraft on the catapult and two on the after superstructure. YAMATO class had two catapults, one on either side of the quarterdeck aft, the quarterdeck being fitted with rails for use as a parking space. Six aircraft were stored in a small hangar underneath the quarterdeck and lifted up through a large hatch by the center line crane.

The battleships ISE and HYUGA were modified to carry 18 to 20 seaplanes aft, by removing the two after 14 inch turrets and adding a seaplane hangar abaft the mainmast. Ten aircraft were stowed in the hangar and 8 to 10 on the deck above, which was fitted with parking rails (as shown in Figure 7) to serve the two catapults (situated before the hangar) and the elevator, with which aircraft were transferred to and from the hangar. Aircraft had completely folding wings and were largely expendable.

All heavy cruisers of conventional design mounted two catapults, (as shown in Figures 8 and 9) one on either side of the after superstructure, plumbed by a single center line crane. Two planes were carried on the catapults and two on parking rails. All cranes were capable of lifting 5 tons at a radius greater than half the beam of the ship plus half the beam of the aircraft plus 2½ meters, and were usually incorporated with the mainmast on similar lines to those fitted in U.S. ships.

The cruisers TONE and OYODO as originally built were departures from conventional cruiser design, the whole of the after end of both ships being devoted to aircraft stowage and all the main armament placed forward. This was due to a desire to combine the functions of cruiser and seaplane carrier, due apparently to a lack of capacity for building sufficient ships of both types. Aircraft arrangements on TONE (a 14,000 ton ship carrying six aircraft as shown in Figure 10) were a development of those used in previous heavy cruisers; viz, a catapult on either side of the after superstructure with one aircraft on each and the remainder on parking rails on the quarterdeck.

OYODO, however, was designed for very long range reconnaissance and was to have carried six special type seaplanes in a hangar in the after superstructure (as shown in Figure 11). This type of seaplane, of which only the prototype was built, was designed for a very long range at high top speed (270 knots when the center line float was jettisoned for operational work) and weighed 5 tons (for details see Table V). Due to their high take-off speed and weight, a special catapult 46 meters in length was designed to occupy the whole of the quarterdeck abaft the hangar. The plane, however, failed to pass its tests (it was unstable in flight) and in consequence OYODO was never able to operate as intended. It was, therefore, modified for use as the CinC's flagship, the hangar being subdivided for accommodation of his staff. The special catapult was removed and replaced by one of conventional design, carrying one aircraft and parking rails for another before the catapult. The modified arrangement is shown on NavTechJap Documents No. ND50-1400, -1401, and -1402.

AOBA and AGANO class cruisers had a catapult and carried two aircraft (see Figure 12). Minelayers and training cruisers (see Figure 13) had a catapult and one aircraft.

The large submarines of the I-400 class were also a departure from conventional practice. Designed to permit reconnaissance and the bombing or torpedoing of important targets on the U.S. Pacific coast, they were constructed with two pressure hulls, placed side by side to minimize diving stresses, supporting a pressure-tight hangar. All three pressure-tight hulls were surrounded by an outer hull, the annular space being used for the stowage of fuel. The forward end was used for a fixed catapult, the rails being continuous with those in the hangar. Planes carried were special torpedo-bomber type with folding wings. They jettisoned their floats for an actual operation.

2. Catapults

These are very adequately described in ATIG Reports No. 5, 7, 8, and 19.

3. Gasoline Stowage and Supply (Seaplane Carriers)

Gasoline was stowed in a tank or tanks forming part of the hull structure in the after end of the hold. Tanks were surrounded by an air space which was kept filled with CO_2. Gasoline was pumped up to the planes by an 18 kiloliters per hour, gear type pump, situated in a gasoline control compartment above the tanks.

4. Aircraft Maintenance

Maintenance and small repairs were carried out in the parking spaces.

5. Stowage of Armament

Most reconnaissance planes carried small 250 kg G.P. bombs, which were stowed in the depth charge room.

C. Seaplane Carriers

Four true seaplane carriers were built in recent years viz CHITOSE, CHIYODA, MIZUHO and NISSHIN; their completion dates ranging from 1934 to 1940.

These ships are said to have been built to make up for the lack of strategic air bases. The forward parts of these ships were laid out like a light cruiser but the after part was of construction similar to that of a single hangar carrier, except that there was no flight deck. Aircraft were flown off from catapults, two in CHITOSE class and four in MIZUHO class. The seaplanes used had completely folding wings and were stowed athwartships in the hangar and forward and aft on the upper deck, in trolleys working on rails. All movements were made by means of these trolleys. Transfer from the hangar to the upper deck was effected by means of a hoist which was fitted with rails matching those on the hangar and upper decks. Aircraft were lifted inboard, and from rails to the catapult-launching trolleys, by means of four cranes.

The layout of CHITOSE class and MIZUHO class are adequately shown on the general arrangement drawings of these ships (see Figures 14-19). Gasoline supply, hangar ventilation, firefighting and other arrangements follow the same lines as in aircraft carriers (as outlined in Part I).

Although these ships appear to have been well-thought out designs and the number of aircraft carried in them (twenty-two in MIZUHO class) and their speed (28 knots) were quite good for escort purposes, they had the fundamental disadvantages of a seaplane carrier as opposed to a carrier of wheeled aircraft. CHITOSE and CHIYODA were therefore converted to two-hangar escort carriers during the war years.

A diagrammatic sketch of a typical trolley for handling seaplanes is shown in Figure 20. The trolley incorporates a roller path for rotating the plane with respect to the rails.

Table V
SPECIFICATIONS FOR SPECIAL AIRCRAFT FOR OYODO

SHIUN EISKI	
Tactical Use	Reconnaissance Seaplane
Type	Low-wing Monoplane, Single Float
Crew	2 men
Span	14.000m
Length	11.490m
Height	4.950 (horizontal)m
Weight (empty)	3000 kg
Normal Load	4000 kg
Over Load	4800 kg
Engine KASEI-14	
Rated hp/alt.	1480/2200m 1380/4000m
Propeller	2 blades, constant speed, contra-propeller
Top SP/alt.	270 kt/6000m
Landing Speed	55 kt
Range	2000 st. miles (at 200 kt/2500m)

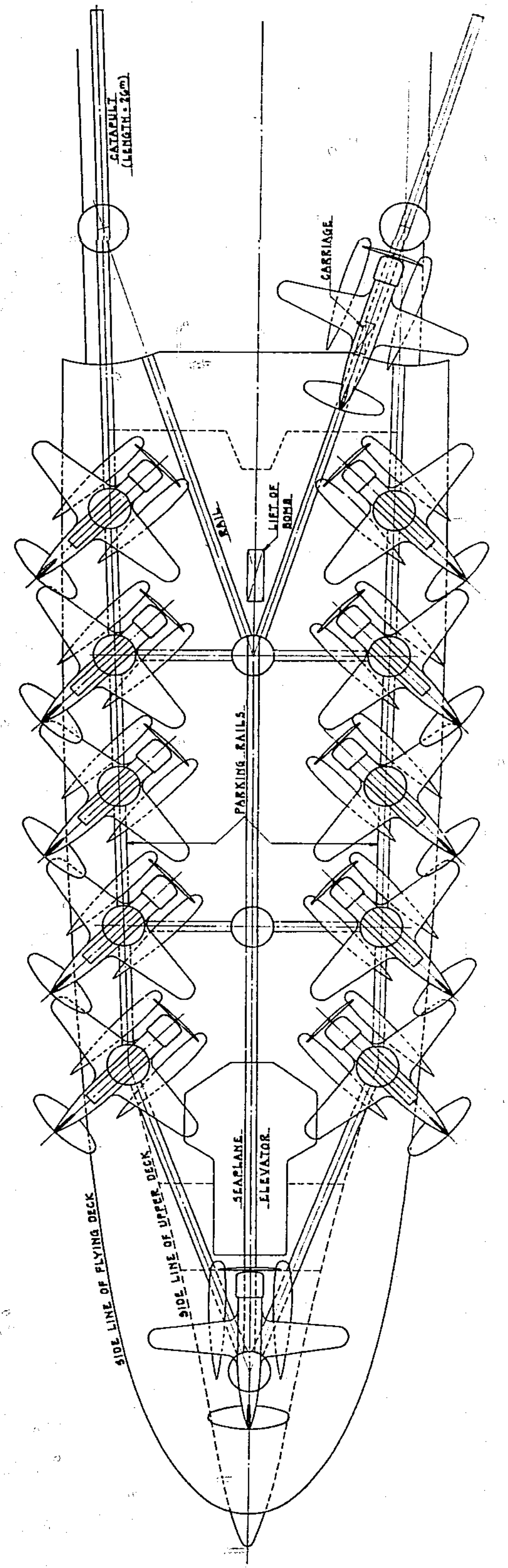


Figure 7
FLYING DECK OF ISE (HYUGA)

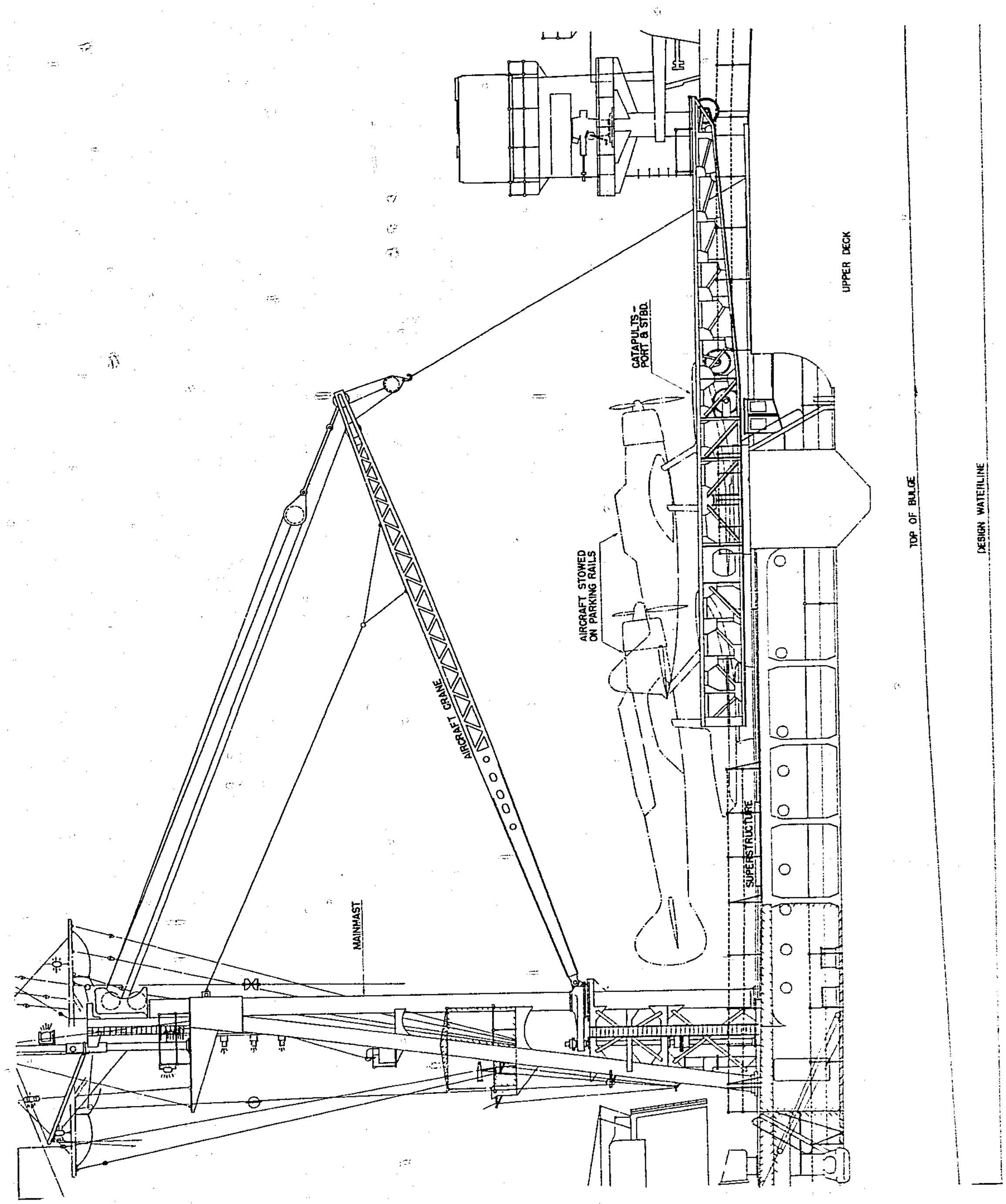


Figure 8
PART PROFILE SHOWING AIRCRAFT ARRANGEMENTS
CRUISER "ATAGO" CLASS

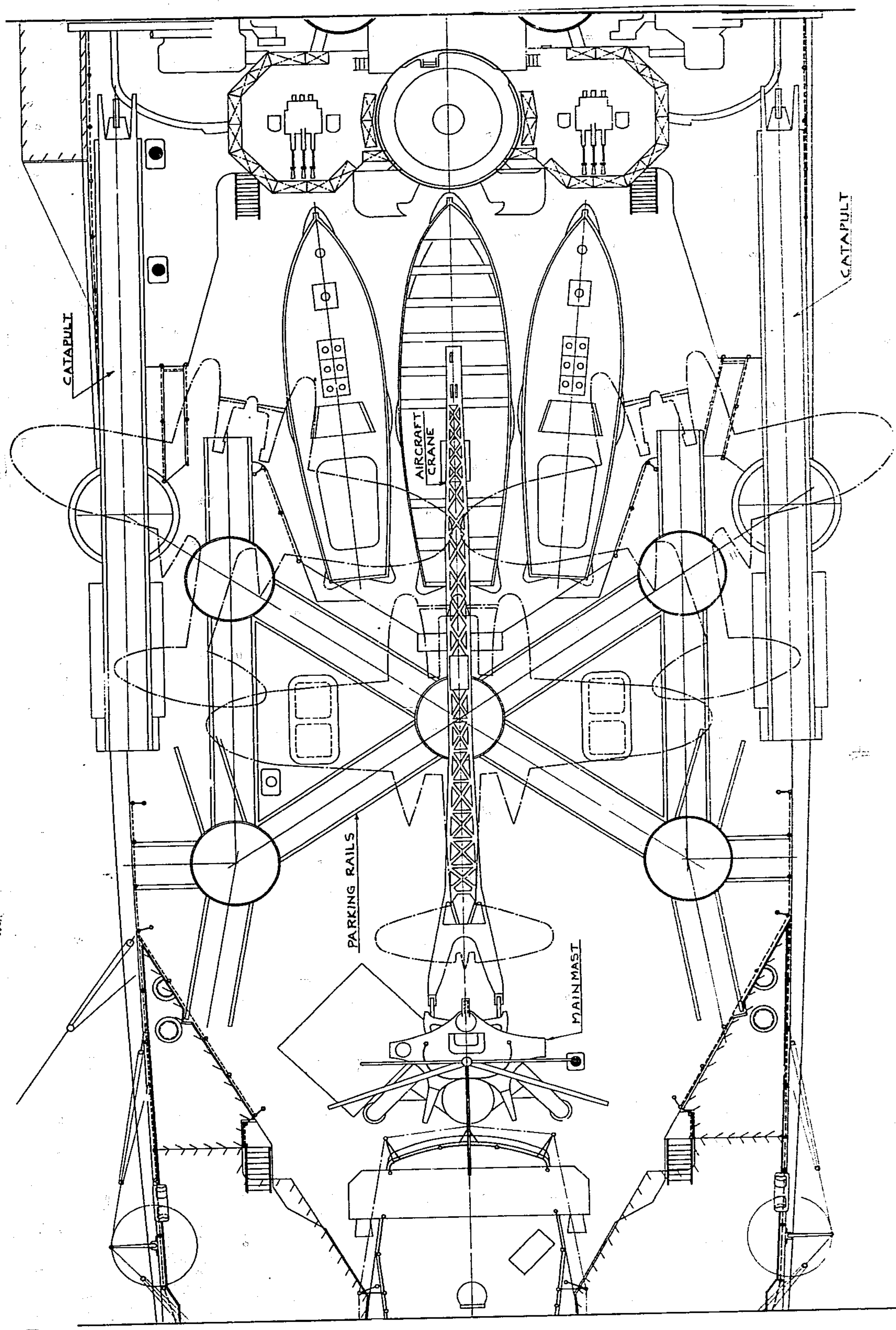


Figure 9
PART PLAN OF WEATHER DECK SHOWING AIRCRAFT ARRANGEMENTS
CA "ATAGO" CLASS

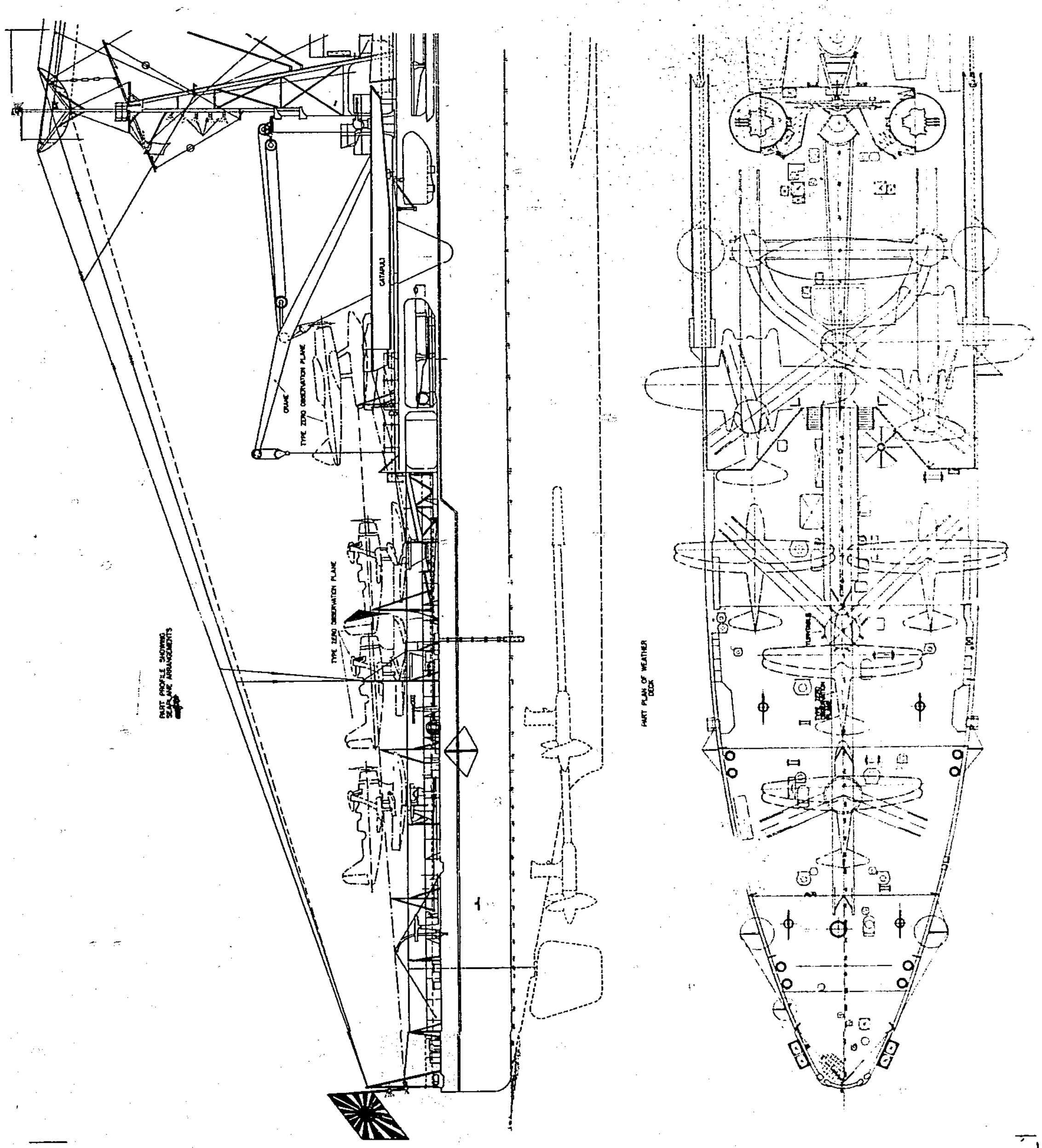


Figure 10
PART PROFILE AND PART PLAN OF WEATHER DECK
CA TONE CLASS

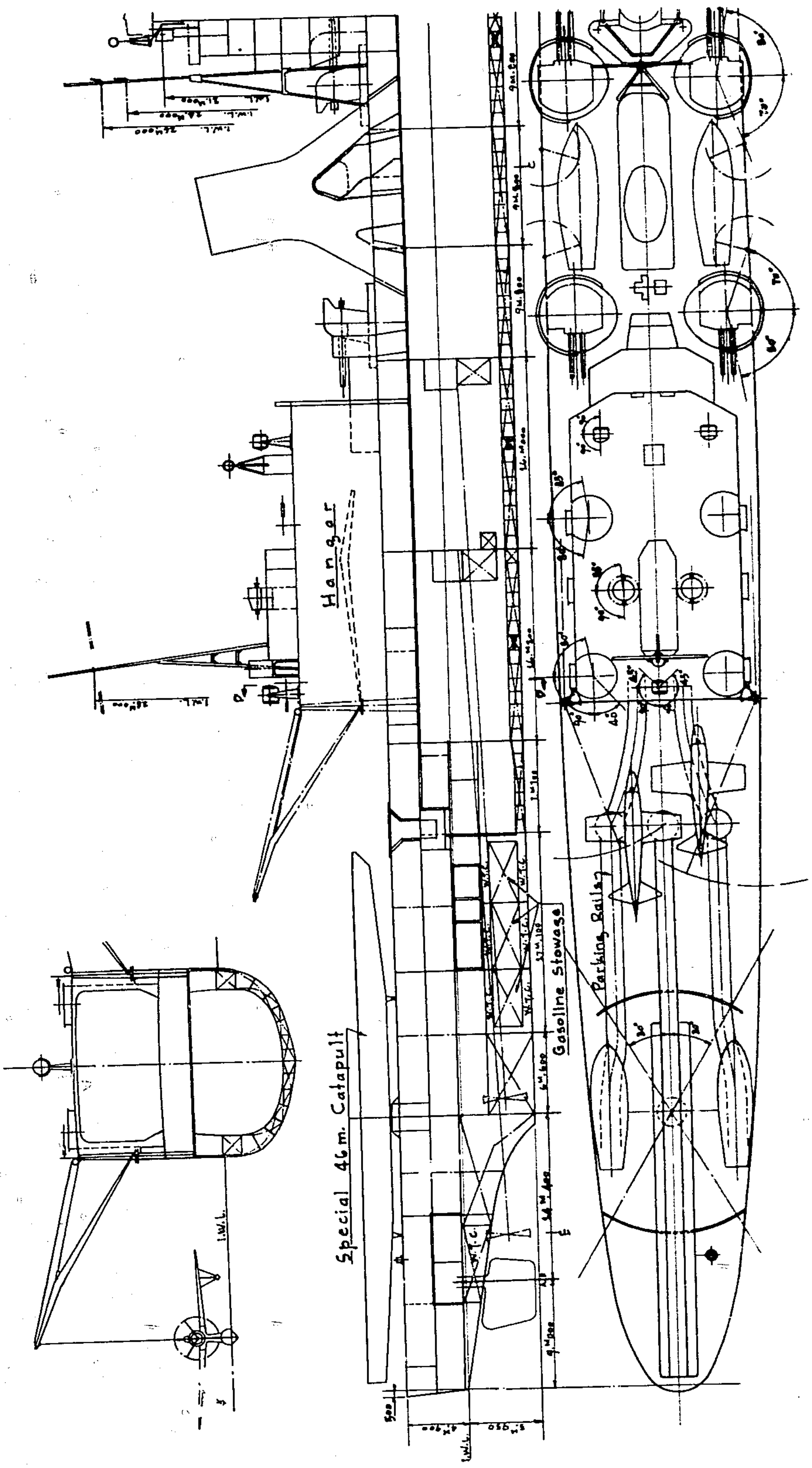
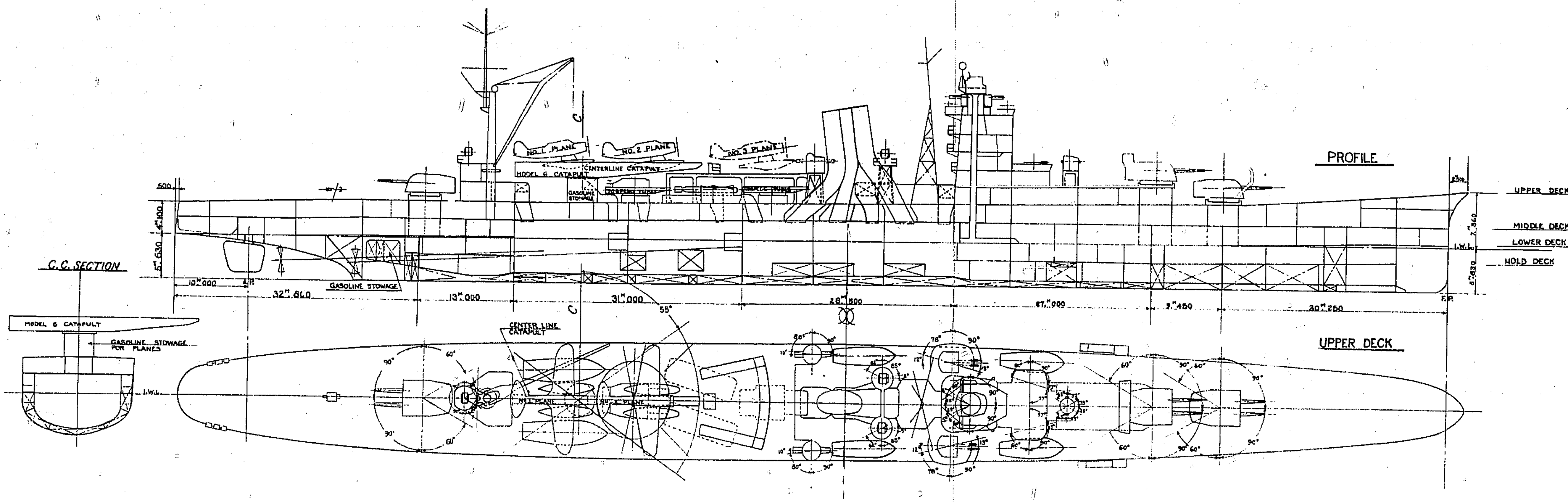


Figure 11
OYODO AIRCRAFT ARRANGEMENTS AS DESIGNED



O. A. LENGTH	174.m500
LENGTH OF W.L.	162.m000
BEAM	15.m200
DEPTH	10.m170
DISPLACEMENT	7710 TONS
DRAFT	5.m630
FUEL CAPACITY	1 420 TONS
SPEED	35 KTS
HORSEPOWER	100,000
CRUISING RANGE (18 KTS)	6 000 Mi.

ARMAMENT

15 cm TWIN MOUNT TURRETS	3
25 mm TRIPLE MOUNT M.G.	2
TYPE 92 QUADRUPLE MOUNT TORPEDO TUBES	2
8 cm TWIN MOUNTS A.A.GUNS	2
110 cm SEARCHLIGHT	3
TYPE 12 THREE SEATER OBSERVATION PLANE	1
SPECIAL OBSERVATION SEAPLANE	1
MODEL 6 CATAPULT	1

GENERAL ARRANGEMENT
CL "AGANO" CLASS

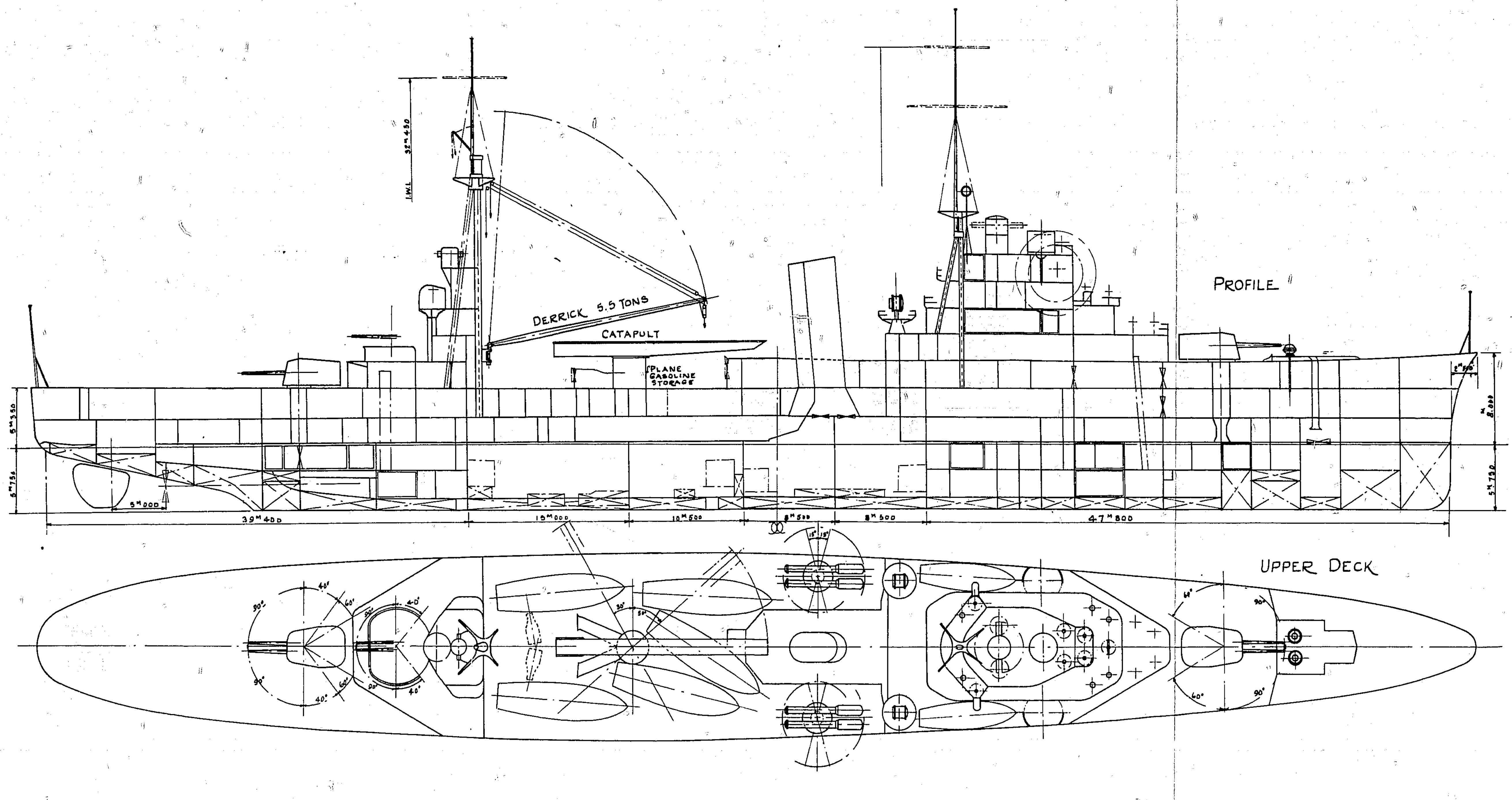


Figure 13

TRAINING CRUISER
GENERAL ARRANGEMENT

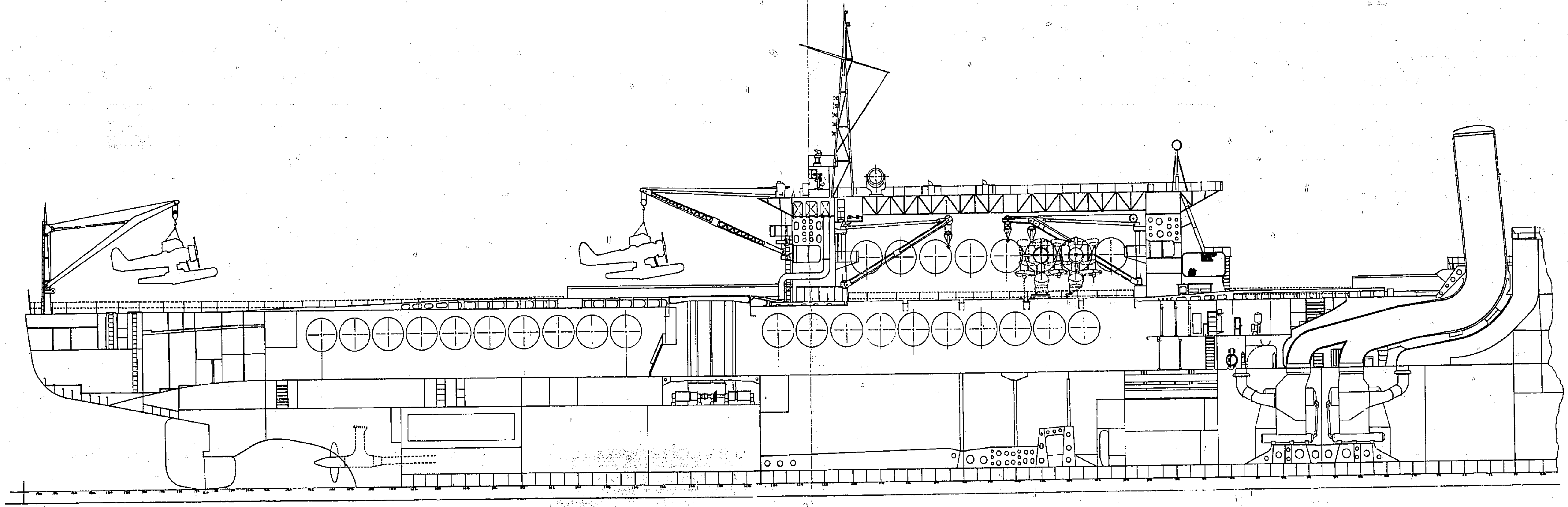


Figure 14
SEAPLANE CARRIER IN "CHITOSE" CLASS
INBOARD PROFILE

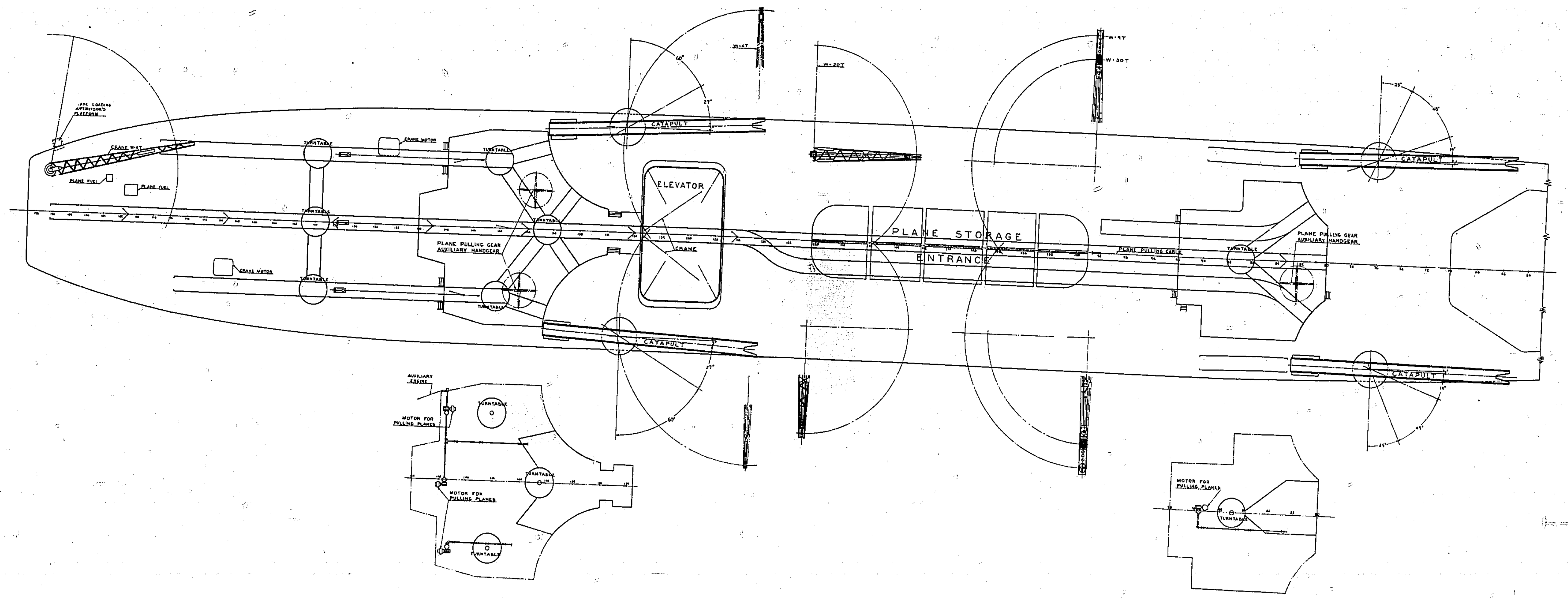


Figure 15
UPPER DECK IN "CHITOSE" CLASS

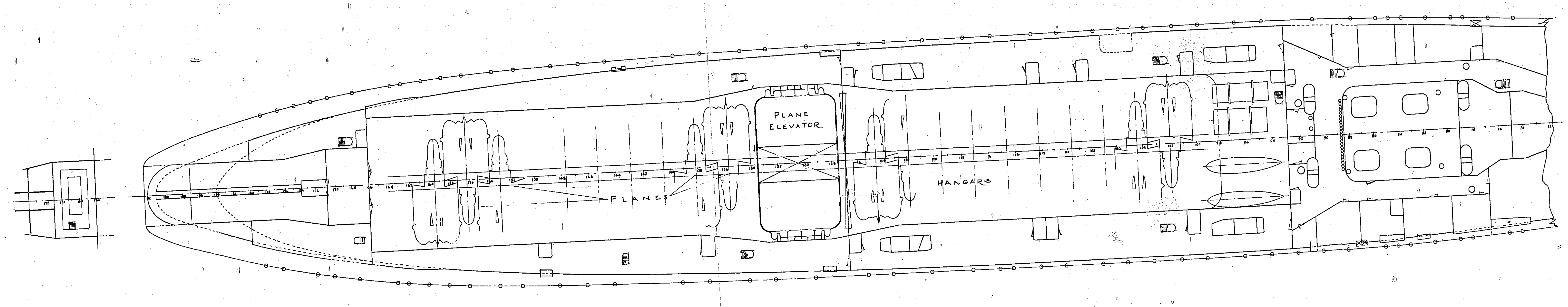


Figure 16
SEAPLANE CARRIER IN "CHITOSE" CLASS
HANGAR DECK

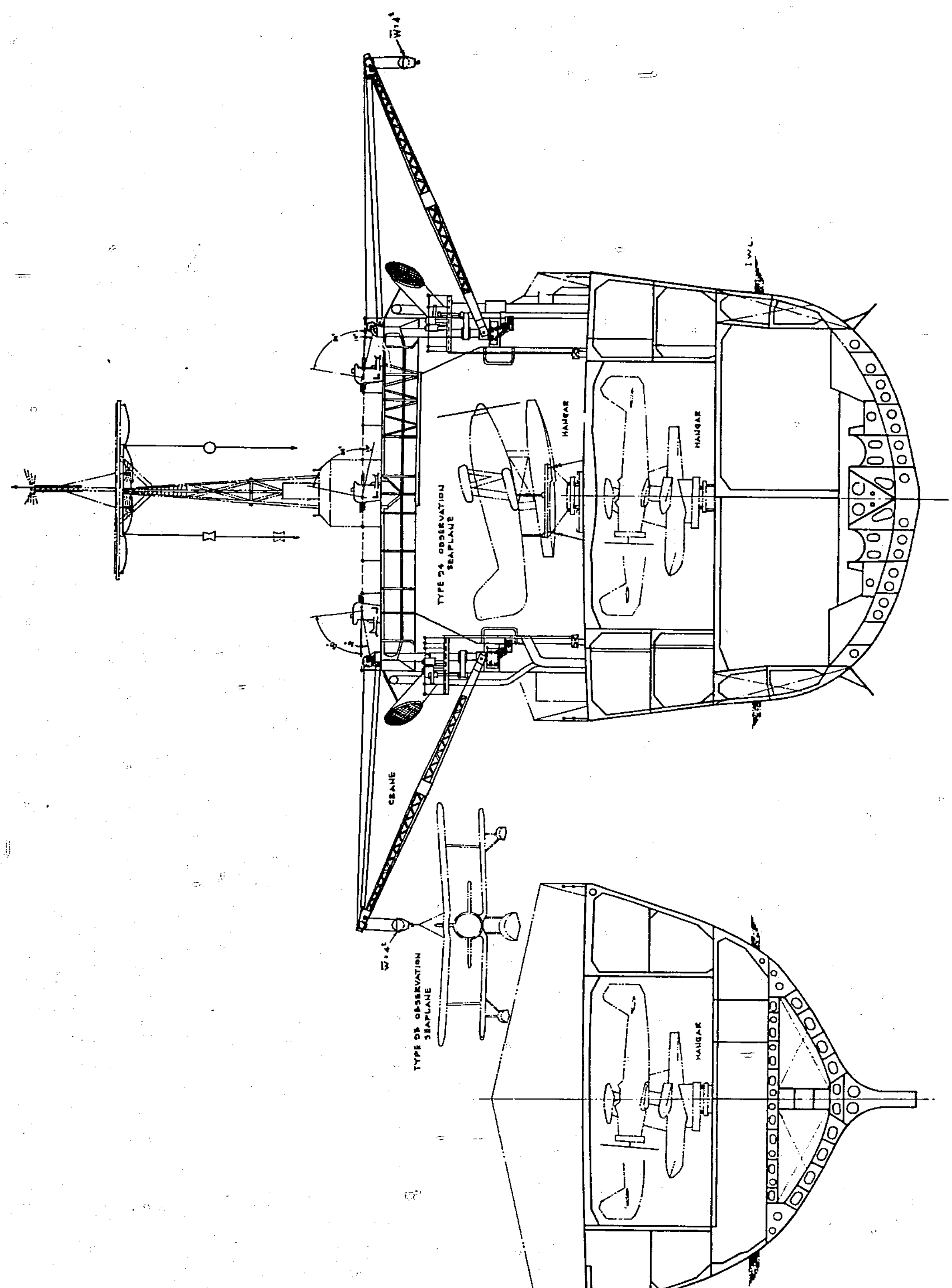
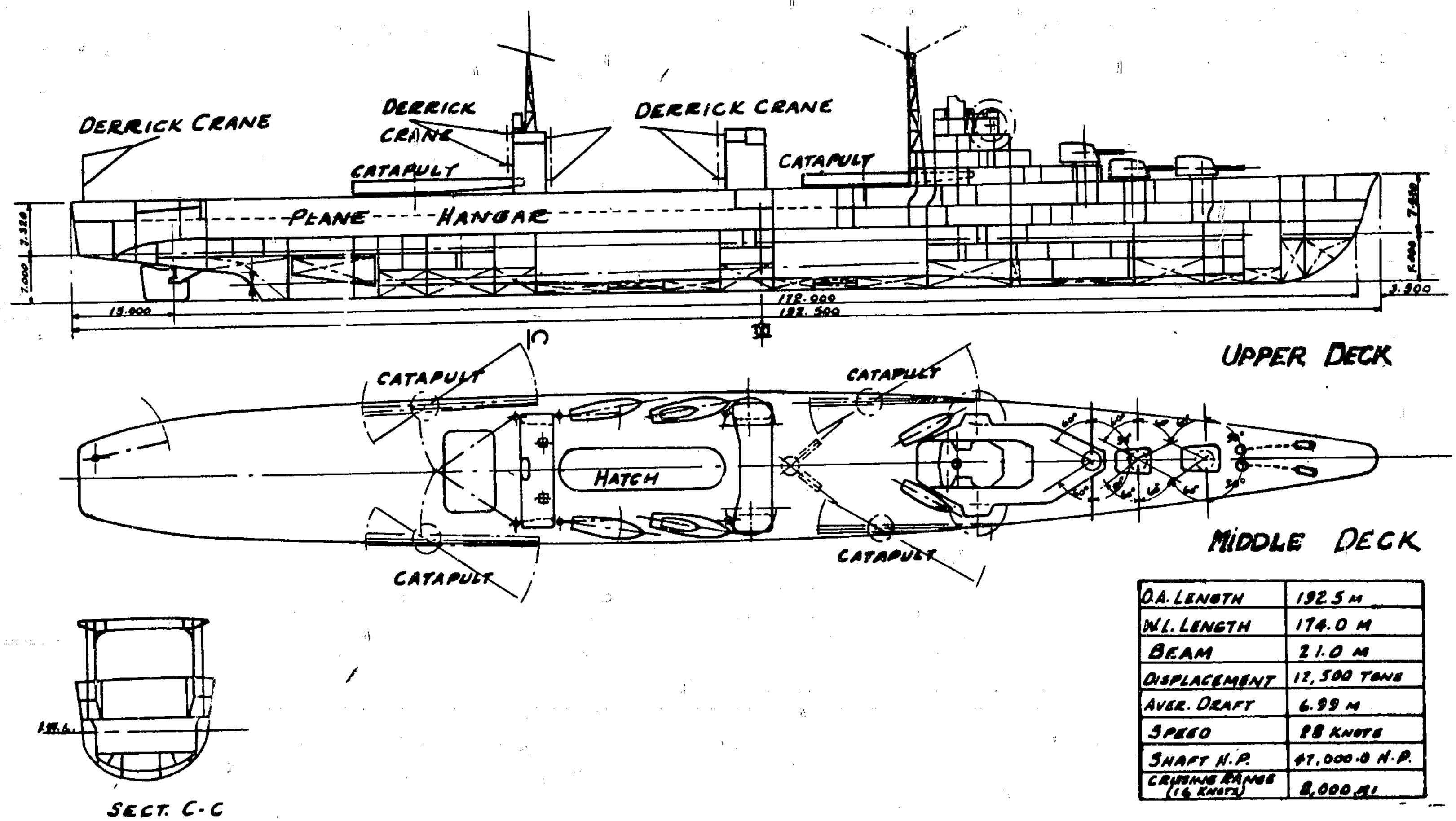


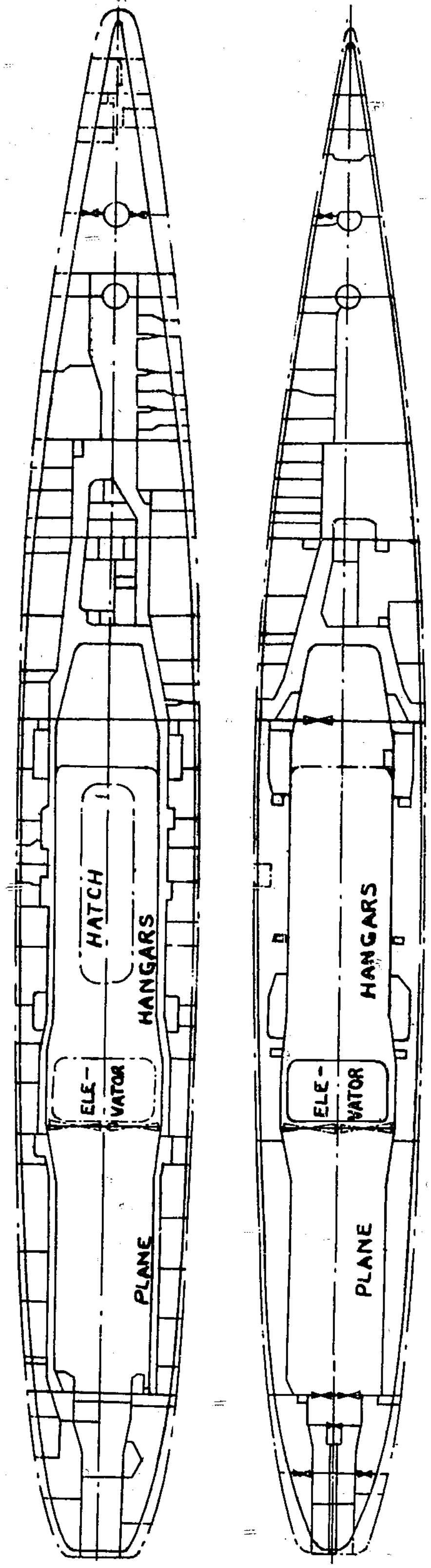
Figure 17

SEAPLANE CARRIER "CHITOSE" CLASS
SECTIONS THROUGH HANGAR AND FLYING DECK



O.A. LENGTH	192.5 M
W.L. LENGTH	174.0 M
BEAM	21.0 M
DISPLACEMENT	12,500 TONS
AVER. DRAFT	6.99 M
SPEED	28 KNOTS
SHAFT H.P.	47,000.0 H.P.
CRUISING RANGE (16 KNOTS)	8,000 MI

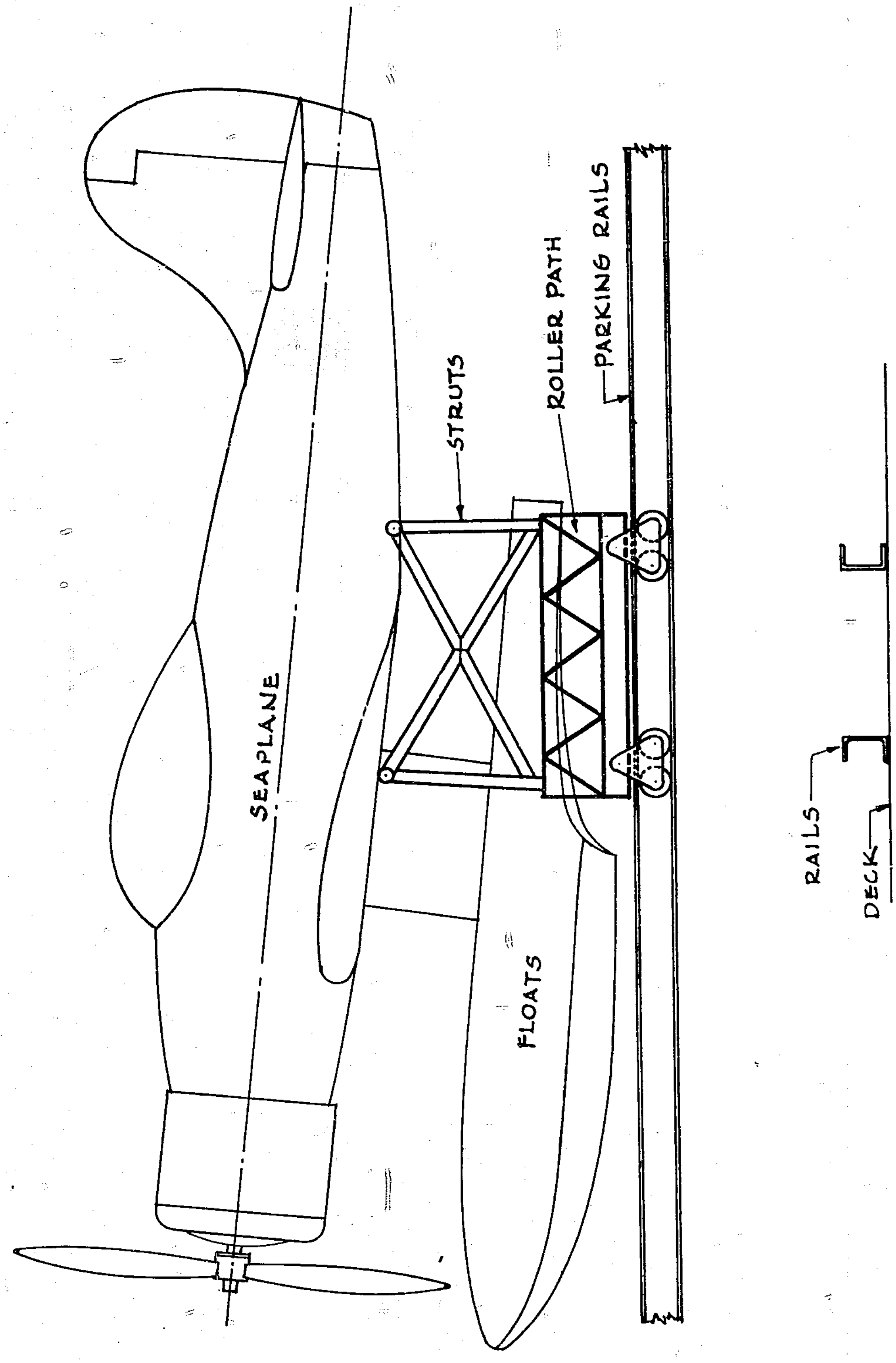
Figure 18
SEAPLANE CARRIER "MIZUHO" CLASS



TYPE 12 OBSERVATION SEAPLANE	12
SPECIAL TYPE OBSERVATION SEAPLANE	8
BIPLANES (TYPE 12)	3
BIPLANES (SPECIAL TYPE)	2
CATAPULTS	4

Figure 19

SEAPLANE CARRIER IN "MIZUHO" CLASS



SECTION THRU PARKING RAILS

Figure 20
TROLLEY FOR HANDLING PLANES ON A SEAPLANE CARRIER

ENCLOSURE (A)

LIST OF DOCUMENTS FORWARDED TO BUREAU OF SHIPS

NavTechJap No.	Title	ATIS No.
ND50-1403	TAIHO, General Arrangement-Sectional Profile.	4412
1404	Flight Deck.	4453
1405	Upper Gallery Deck.	4413
1406	Upper Hangar Deck.	4414
1407	Lower Gallery Deck.	4415
1408	Lower Hangar Deck.	4416
1409	Lower Deck.	4417
1410	Upper Platform Deck.	4418
1411	Lower Platform Deck.	4419
1412	Hold.	4420
1413	Bottom Compartments.	4421
1414	Forward Sections.	4422
1415	After Sections.	4423
ND50-1416	CHITOSE, Gasoline Arrangement-Lower Hangar	4424
1417	Layout and Pump Room.	4425
1418	Flight Deck & Upper Hangar	4426
1419	Layout of Control Room.	4427
1420	Diagrammatic Layout.	4428
ND50-1421	UNRYU, CO_2 Safety Arrangements for Petrol System.	4429
1422	Concrete Protection for Gasoline Tankers.	4430
ND50-1423	CHITOSE, Ventilation Arrangements-Diagrammatic Sketch of Forward System.	4431
1424	Diagrammatic Sketch of After System.	4432
1425	Hangar Forward	4433
1426	Hangar Aft.	4434
1427	Foam Arrangements-Upper Decks.	4435
1428	Lower Decks.	4436
ND50-1429	UNRYU, Foam System-Hold and Inner Bottoms.	4454
1430	Flight Deck.	4437
1431	Upper Gallery Deck.	4438
1432	Upper Hangar Deck.	4439
1433	Lower Gallery Deck.	4440
1434	Lower Hangar Deck.	4442
1435	Lower Deck.	4441
1436	Upper & Lower Platforms	4443
1437	Engine Inspection Shop.	4444
ND50-1438	IBUKI, Arresting Gear-Control System	4445
1439	Method of Reeving Wires	4446
1440	Method of Reeving Wires	4447
1441	Deck Pulleys.	4448
1442	Crash Barriers-Arrangements of Deck Fittings.	4449
1443	Detailed Layout.	4450
1444	Detailed Layout.	4451
1445	Detailed Layout.	4452
ND50-1400	Seaplane Arrangments in OYODO as Modified to Fleet Flagship	4455
1401		4456
1402		4457

ENCLOSURE (A)

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1432	Upper Hangar Deck.	4439
1433	Lower Gallery Deck.	4440
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1441	Deck Pulleys.	4448
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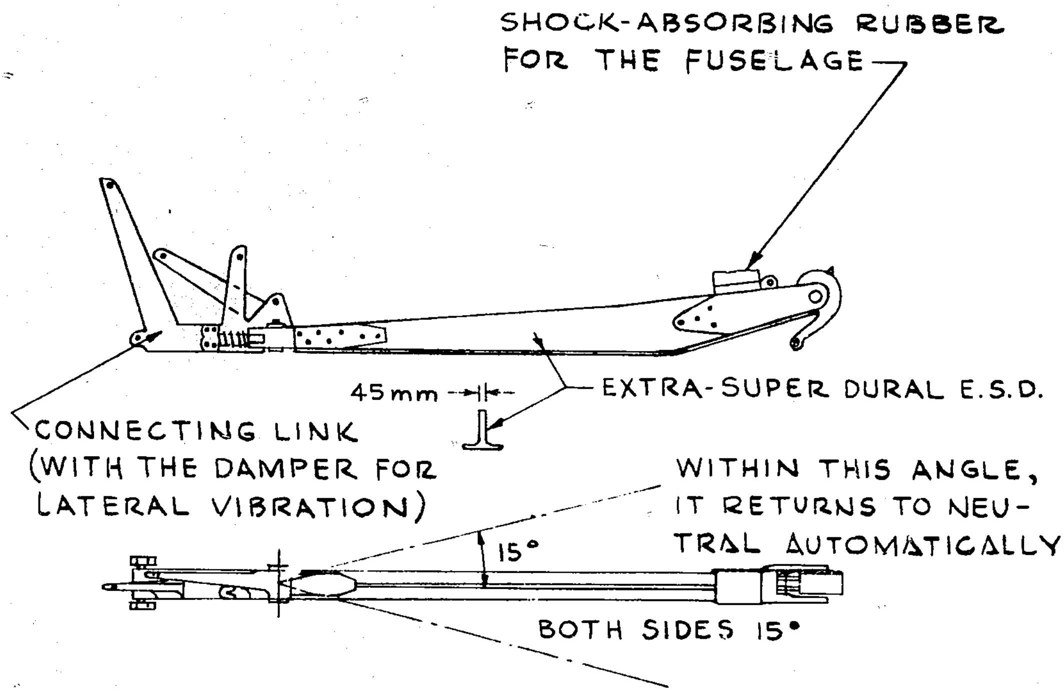
1444	Detailed Layout.	4451
1445	Detailed Layout.	4452
ND50-1400	Seaplane Arrangments in OYODO as Modified to Fleet Flagship	4455
1401		4456
1402		4457

ENCLOSURE (B), continued

ARRESTING HOOK

OO CARRIER-BORNE FIGHTER
LENGTH ABOUT 1130 mm
WEIGHT " 25 kg
LOAD APPLIED 11100 kg



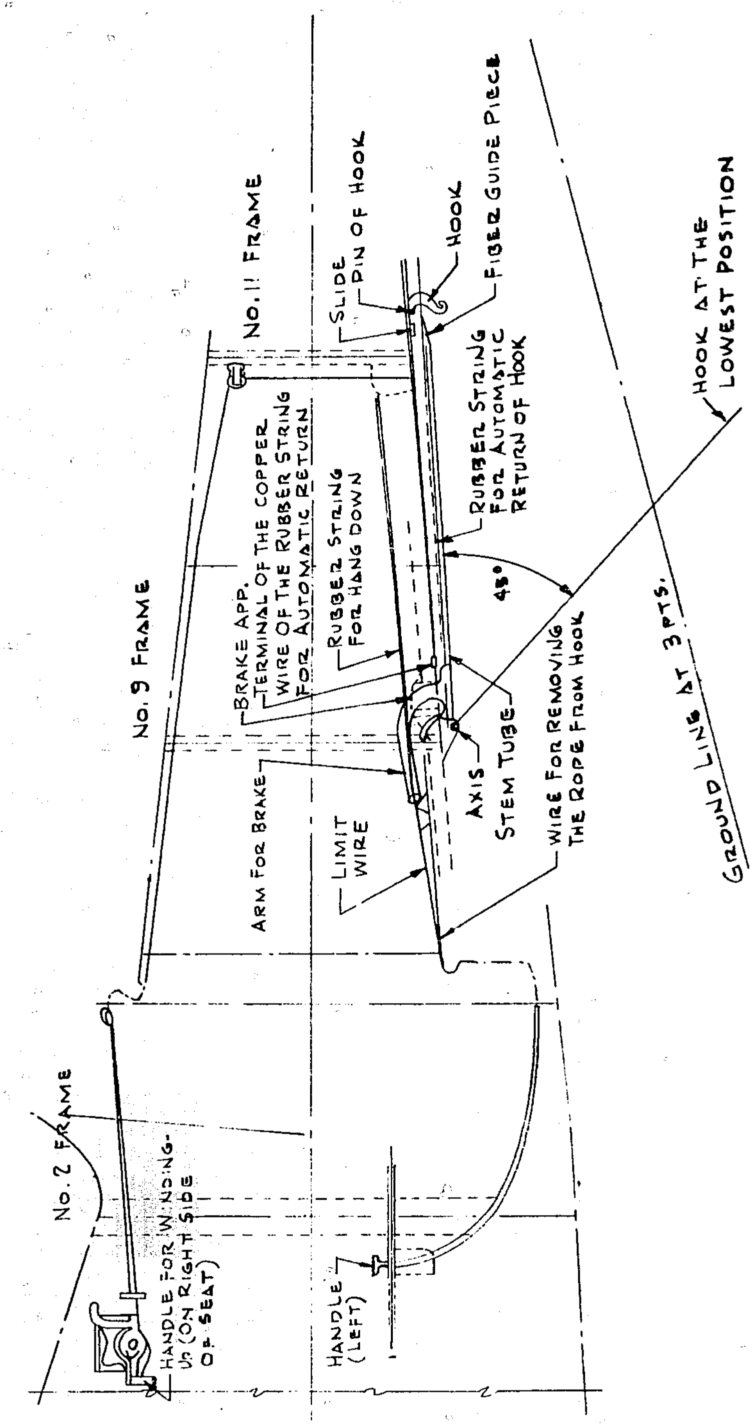
OO CARRIER-BORNE FIGHTER

ENCLOSURE (B), continued

Arresting Hook System

96 Carrier-borne Fighter

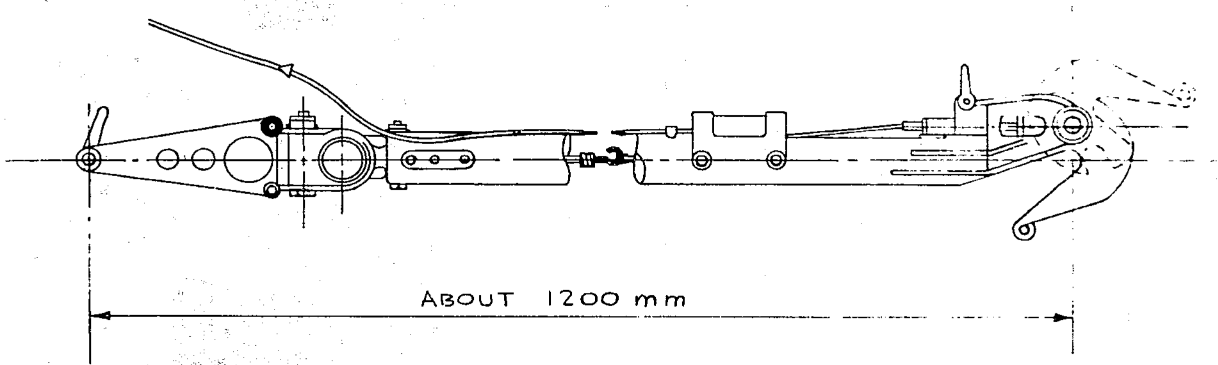
Length of Hook	1100 mm
Weight	22 kg
Load Applied	6280 kg



ENCLOSURE (B), continued

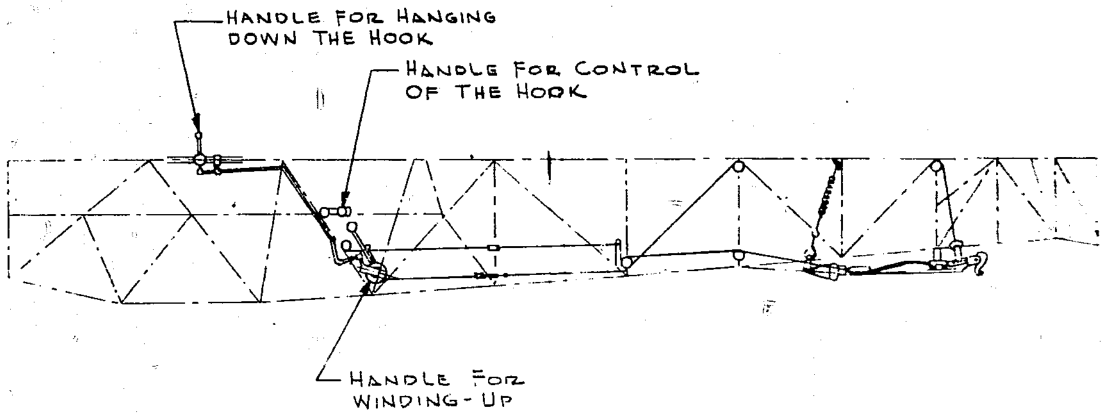
ARRESTING HOOK

96 DIVE BOMBER
LENGTH ABOUT 1200 mm
WEIGHT " 25 kg
LOAD APPLIED 11200 kg

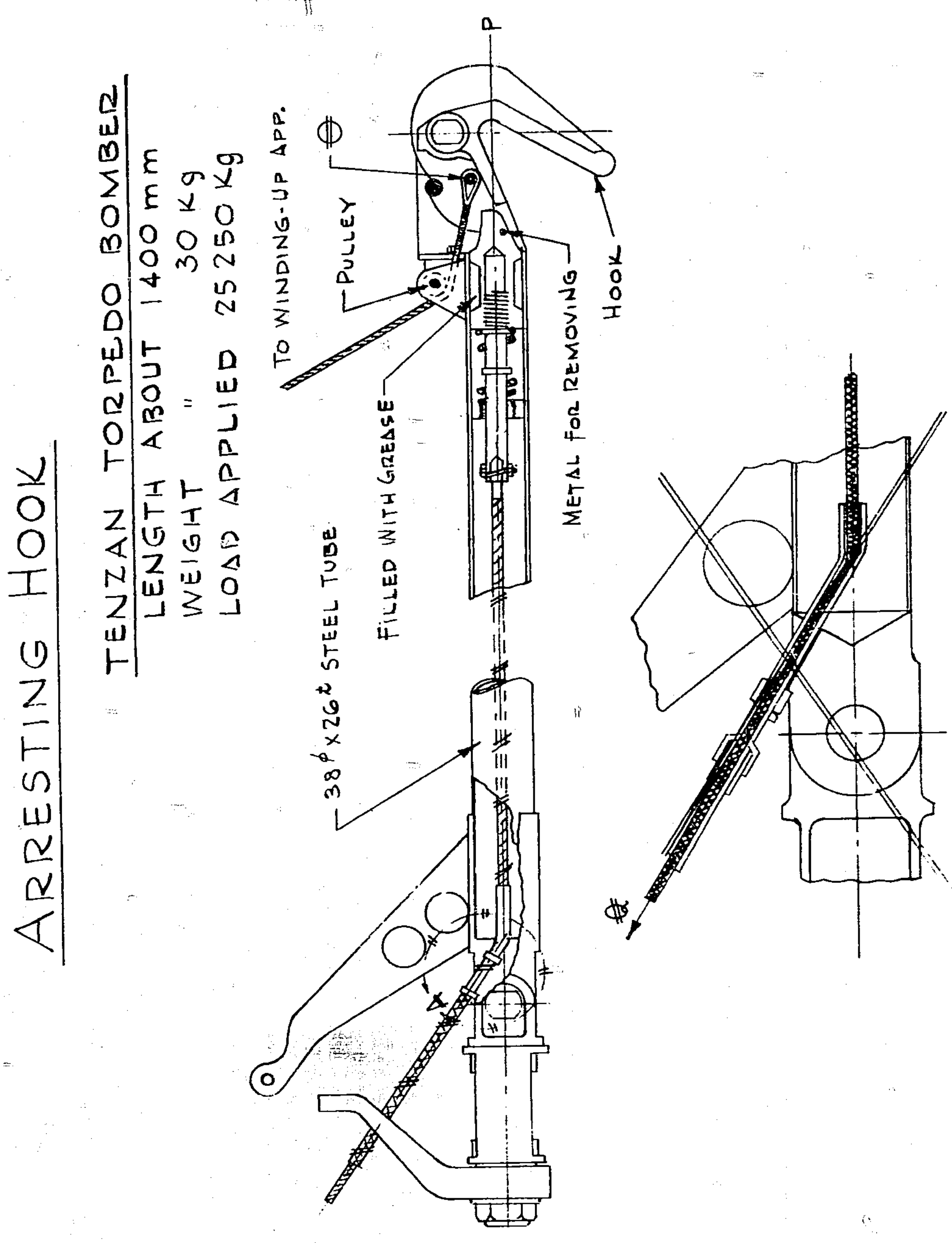


ARRESTING HOOK CONTROL SYSTEM

96 DIVE BOMBER



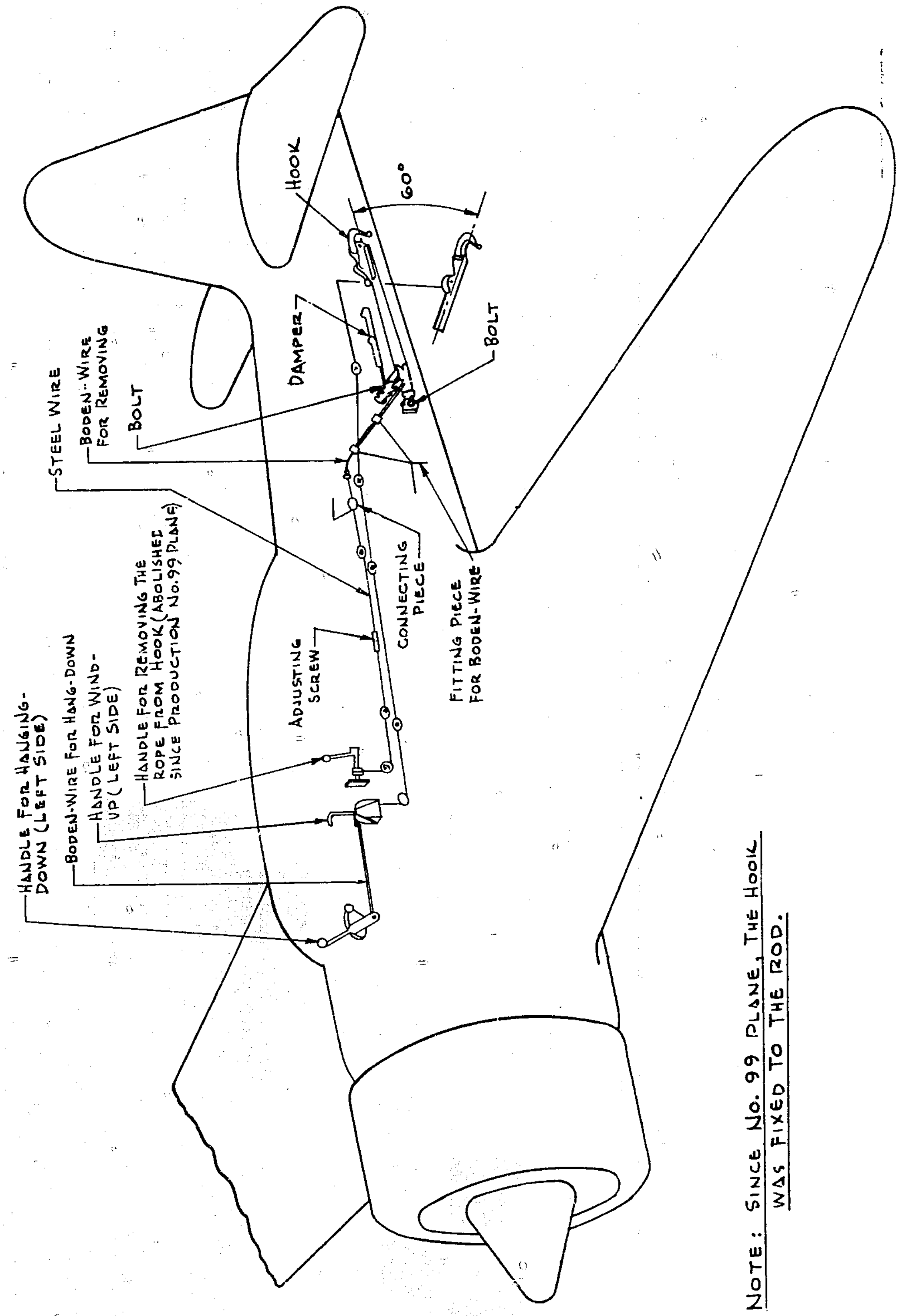
ENCLOSURE (B), continued



ENCLOSURE (B), continued

ARRESTING HOOK CONTROL SYSTEM

TENZAN CARRIER-BORNE TORPEDO BOMBER



NOTE: SINCE No. 99 PLANE, THE HOOK WAS FIXED TO THE ROD.