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NAVAL VERSIONS OF THE DAUPHIN AND THE AS 15 TT WEAPON SYSTEM

J. P. DUBREUIL
Société Nationale Industrielle Aérospatiale

Helicopter Division
Marignane, France

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DEUTSCHE GESELLSCHAFT FUER LUFT- UND RAUMFAHRT e.V.
GOETHESTR, 10, D-5000 KOELN 51, F.R.G.

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ABSTRACT

Aerospatiale's Dauphin II helicopter family, which was initially intended to satisfy civil market demand, is presently subject to developments that make it possible to derive military versions from it. This exposé presents the equipment specific to «naval versions» whose basic system is the AS 15 TT.

The Dauphin family is well known on the civil helicopter market :

- the SA 360 single-engine version exists since 1976 and the twin-engine versions first came to light in 78 with the SA 365 C.
- the N version represents the evolution towards a better market adaptation decided upon in 77.

In fact, the modifications between the C and the N versions affected almost all the constitutive elements and aimed at improving not only performance but also maintenance and led to a reduction in fabrication and operation costs. While the civilian market was the main target for the SA 365 N Dauphin II, it was yet possible thanks to the important technological choices made before launching the Dauphin II program to derive, from the basic aircraft certified by DGAC and the FAA in July 81, perfectly adapted military versions that are being developed presently at Aerospatiale's.

The purpose of this exposé is to describe all the arrangements and modifications that were necessary to adapt the N aircraft to naval, rescue and attack missions and which led to the SA 365 F version. Moreover, the AS 15 TT anti surface vessel system will be described in detail.

Fig. 1 : SA 365 N - DAUPHIN 2

I – MAIN CHARACTERISTICS OF THE DAUPHIN «N»

Empty weight 1,920 kg
Gross weight 3,850 kg
Hover ceiling } ISA=1,300 m
OGE at 3,850 kg } ISA + 20°:300 m.

Fast cruise speed :
3,850 kg 283 km/hr (158 kt)
3,000 kg 298 km/hr (160 kt)

Best range cruising speed :
240 to 250 km/hr (130 to 135 Kt)

Specific fuel consumption : 1 kg/km.

1– MAIN ROTOR

The rotor of the 365 N is a four-blade Starflex similar with that of the 365 C. However it was reinforced through the local application of carbon fibers to allow for an increase in weight and speed.

The insensitiveness to corrosion and notches, two of the famous qualities of this type of hub-featuring also a low weight, a great fatigue strength, a fail safe design a reduced maintenance are decisive as regards naval missions.

2– BLADES

They are the great novelty of the N against the C, as they now have optimized evolutive airfoil called OA2. profiles.

The OA 212 12 % relative thickness airfoil extends up to .7R of the length then evolves towards an OA 207 airfoil (7 % relative thickness at the tip with a 10 degree twist).

The spar is fabricated through a mechanical winding procedure. The blade is filled with foam and carbon fiber cloth ensures the torsional stiffness. Thanks to the new rotor it was possible to increase the take-off weight by 120 kg and the maximum speed for the same engine power.

3– FUSELAGE

The cabin space is very large thanks to a particular routing of the flight controls.

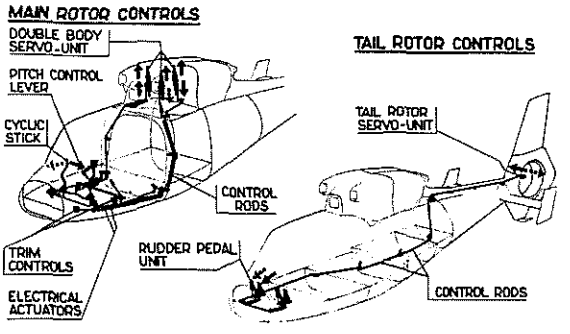


Fig. 2 : SA 365 N - FLYING CONTROLS

The lower section allows accommodating large capacity tanks (1.140 l.) and the retractable, tricycle landing gear.

Thanks to the fact that it is integrated into the structure it was possible to adapt the emergency flotation gear to military use. Composite materials account for 20 %

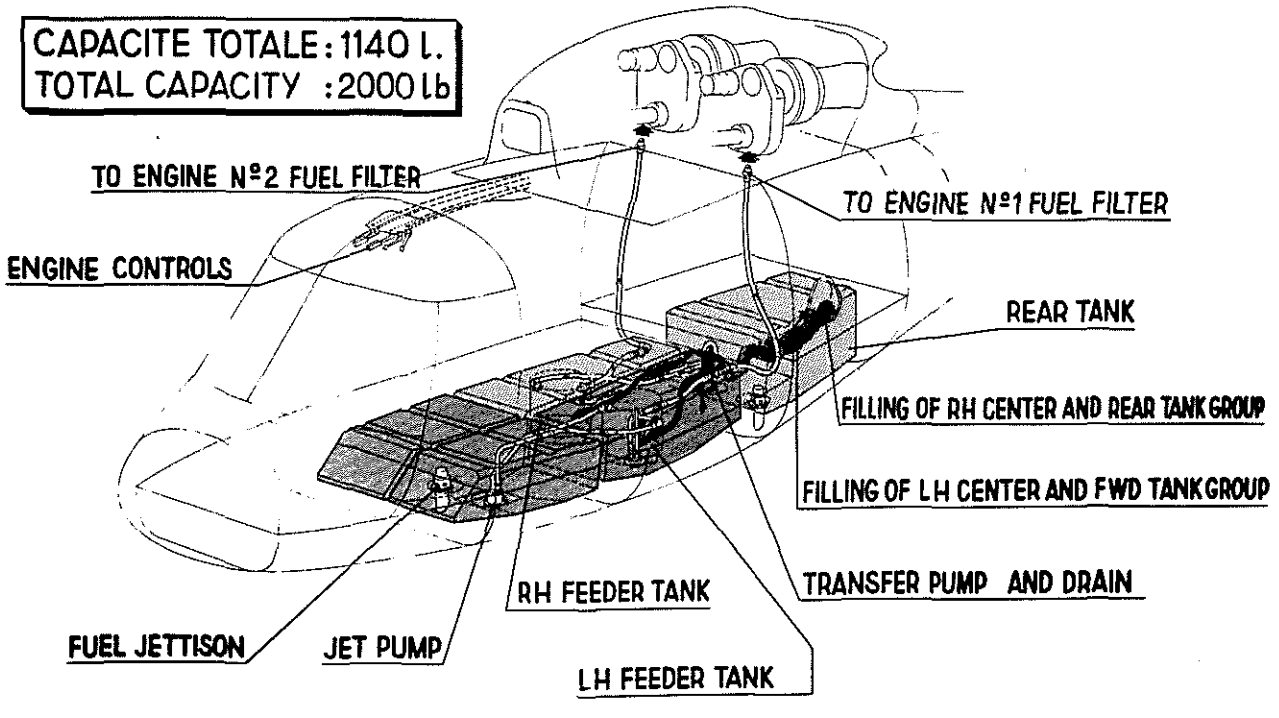


Fig. 3 : SA 365 N - FUEL SYSTEM

of the aircraft although primary structures are still of metal. The future evolution envisaged will increase this percentage to 25% There again, the resulting insensitiveness to corrosion will be very beneficial for a naval utilization of the aircraft.

These modifications affect mainly :

- engine power
- structure
- specific equipment adaptation

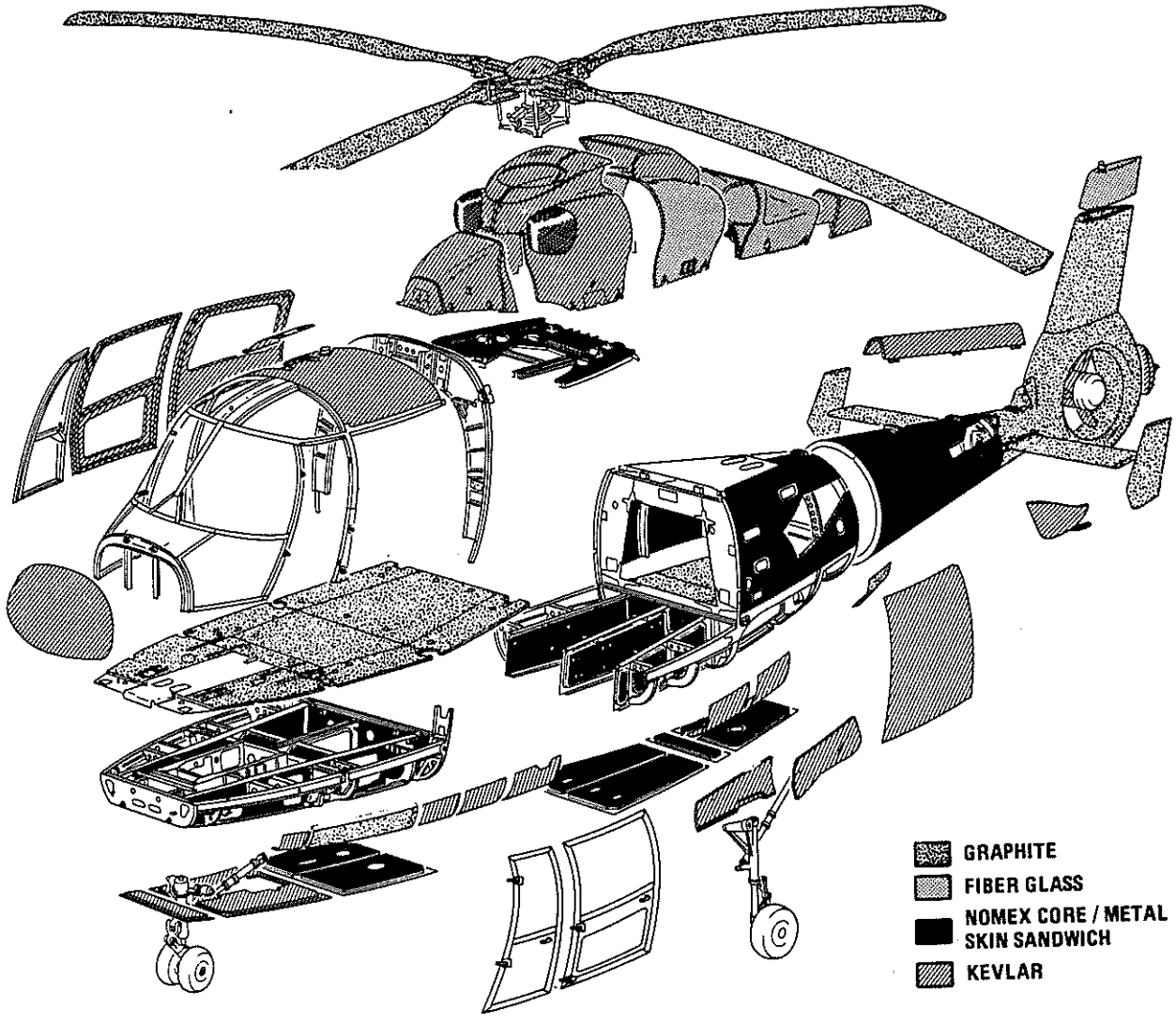


Fig. 4 : SA 365 N - USE OF COMPOSITE MATERIALS

Anyway, it must be pointed out that, among the technological choices made right at the start of the N version, we designed the aircraft to be corrosion-insensitive (compliance with military standards) for its naval utilization. The short-term technological options essentially affect the fenestron/fin assembly, whose enhancement will even better adapt the 365 to an extended military utilization.

II – «NAVALIZATION» OF THE DAUPHIN

«Navalization» covers the entire modifications and operational instructions necessary for the adaptation of the aircraft to a naval utilization from small vessels (especially frigates).

- weapon system integration.

1– ENGINE POWER

Certain constraints imposed by civilian regulations can be disregarded in a military operation context ; the Arriel 1C engine fitted on the N version aircraft will be modified, renamed Arriel 520 M and certified for the following power levels :

5 min. take-off power : 522 kW (instead of 492 kW)

Max. continuous power : 468 kW (instead of 437 kW).

If one engine fails, it is possible to apply on the remain-

ing engine a 580 kW emergency power during one minute followed by a 30 minute operation at take-off power, at the possible cost of a forced maintenance action. On the Arriel 1C emergency power was no more than 522 kW (for 2 1/2 minutes) and 512 kW with no time limit. These modifications together with this philosophy and a particular take-off procedure allow safe take-off weights that are far heavier than under civilian regulations.

2– FUEL SYSTEM

The capability for pressure refuelling on ground and possibly in flight is a must for the operational use of naval aircraft. It was possible to incorporate this capability easily on the SA 365 F.

3– WATERTIGHT FLOOR

The rescue of people at sea and the need for rinsing the cabin thoroughly make a watertight floor a must.

4– ARMAMENT CARRYING CAPABILITY

The structure of the SA 365 N is such that it was easy to adapt multi-purpose armament support arms allowing to carry loads up to 400 kg under normal calculation conditions of military standards.

The characteristics of the landing gear are such that no particular modification was necessary to avoid ground resonance problems under normal naval operation conditions.

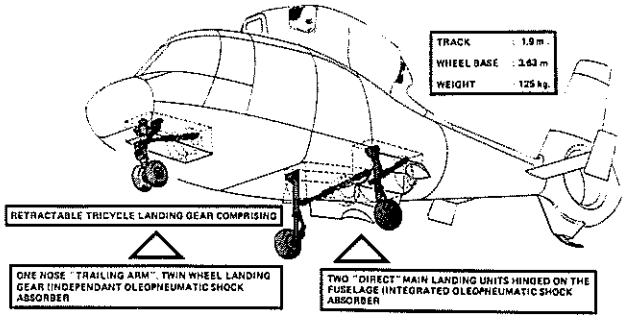


Fig. 5 : SA 365 N - LANDING GEAR

5– BLADE AND MAIN FIN FOLDING CAPABILITY

Helicopters operated from small vessels need a blade folding, or even a fin folding capability. Both are offered by the naval versions of the Dauphin.

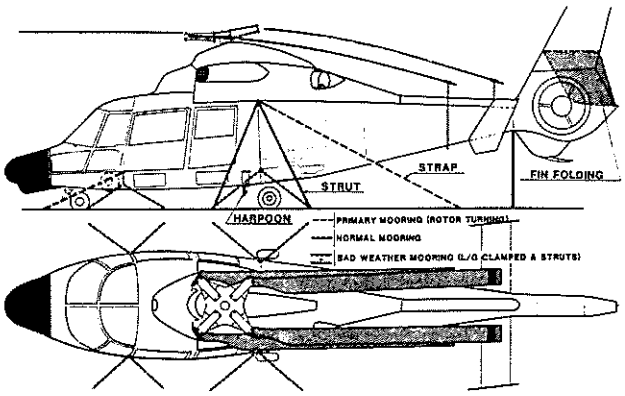


Fig. 6 : SA 365 F - MOORING FOLDING INSTALLATION

6– MOORING HARPOON

The operation of helicopters from small and medium. size vessels is much easier when a quick mooring gear is available allowing to secure the helicopter right after landing and before its final lashing.

Aerospatiale's usual solution comprises a grid / harpoon assembly that, for an aircraft of the Dauphin type, allows to apply a 1,700 daN force that really pins the aircraft on the ship's deck. Our harpoon expertise, first implemented on the Alouettes, has benefited from the experience gained on the Lynx. The adaptation of a hydraulic harpoon on the 365 N did not impose any major structure modification. This harpoon is located practically between the two wheels of the main landing gear and thus makes it possible to rotate the aircraft moored with the power of the sole anti-torque rotor.

7– EQUIPMENT

Self-contained navigation.

Naval missions demand a high-precision navigation system.

It was possible to adapt the self-contained navigation system recently developed for French Army helicopters to the SA 365 F.

It features :

- a Doppler radar for the calculation of ground speeds
- an air data system for the calculation of true air speed.
- a gyromagnetic compass
- a NADIR calculator giving the aircraft's present position and guiding coordinates towards 9 way-points or towards research patterns.

The overall accuracy is better than 3 % of the distance covered.

Radio-communication

It was necessary to install a radio-communication/

radio-navigation system adapted to military missions in lieu of the IFR system of civilian aircraft.

Instrument panel

It was necessary to revamp entirely this panel. However we succeeded in designing a single instrument panel for all the different naval versions which can be supplemented by a small specific kit to suit the requirements of each individual mission.

III– SPECIFIC EQUIPMENT AND SYSTEMS ON THE VARIOUS EXISTING NAVAL VERSIONS

These are being developed or adapted and they will supplement the various equipment items and modifications mentioned above and common to all naval versions.

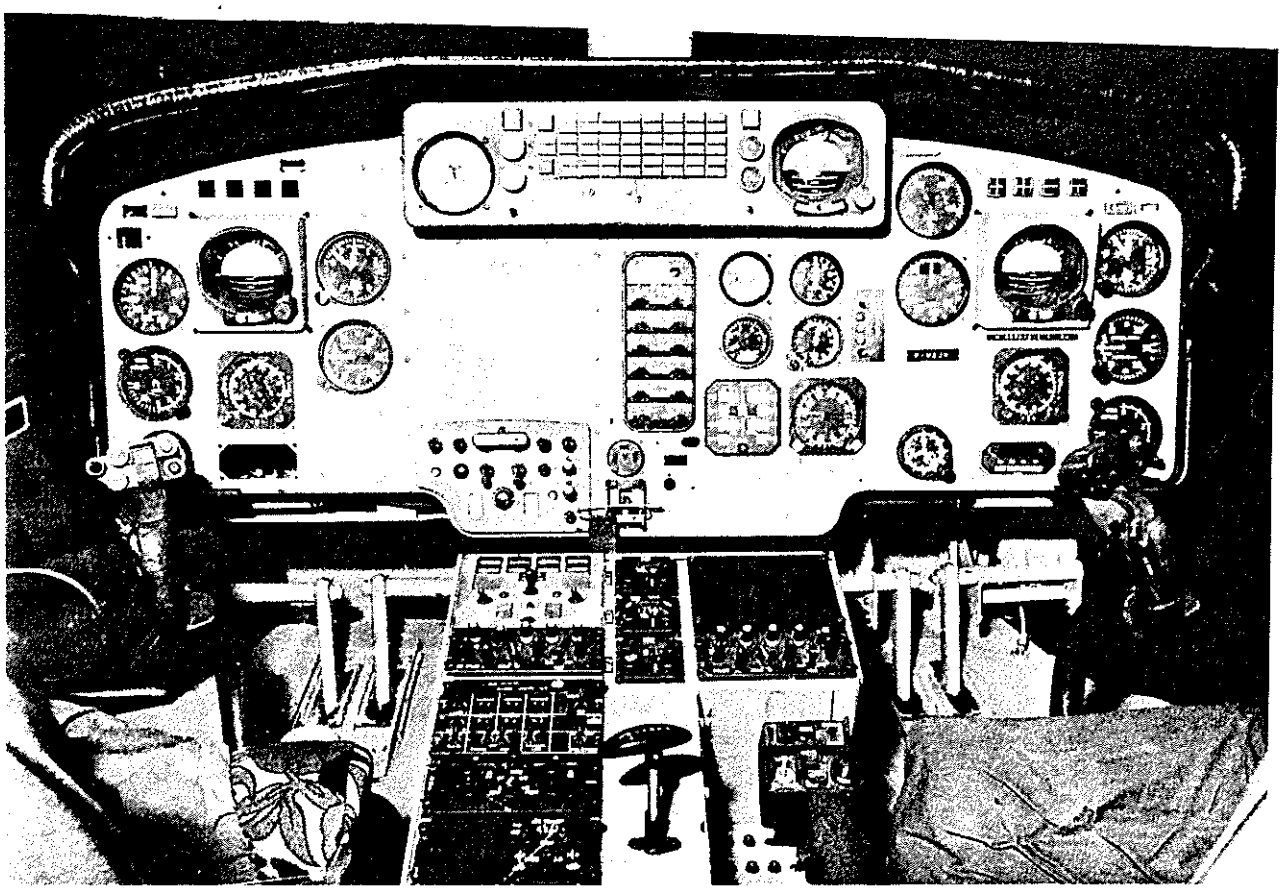


Fig. 7 : SA 365 N - INSTRUMENT PANEL

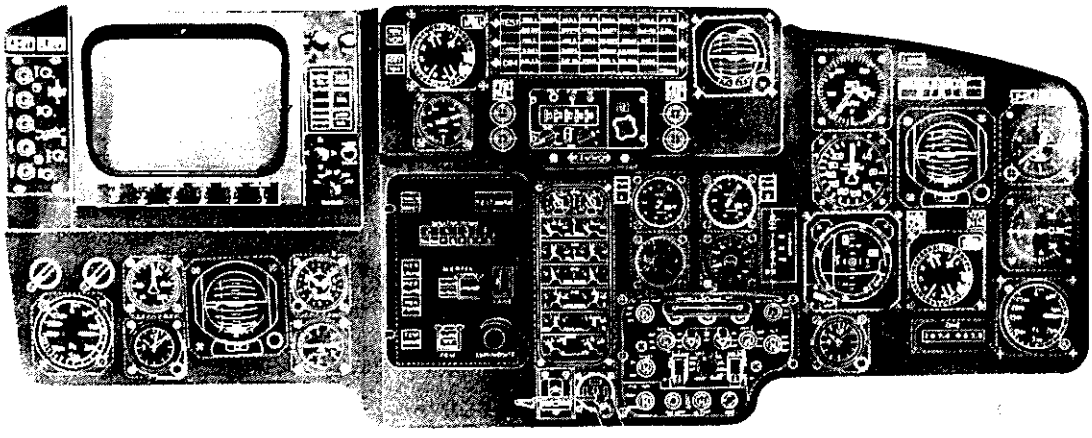


Fig. 8 : SA 365 F - INSTRUMENT PANEL (AS 15 VERSION)

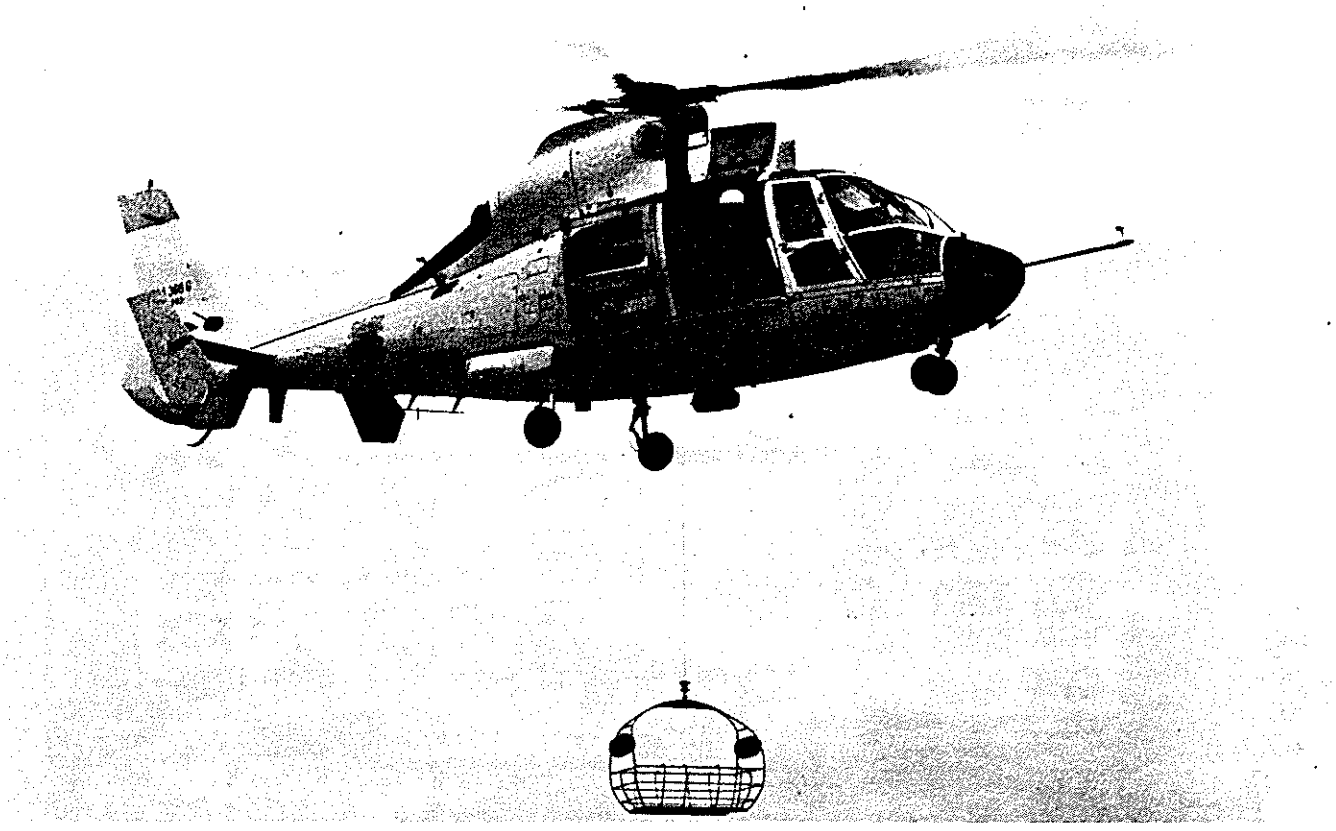


Fig. 9 : SA 366 - USCG - SHORT RANGE RECOVERY AIRCRAFT

1– SAR VERSION

The SAR-specific equipment comprises :

– the rescue hoist already developed for civilian aircraft

– the search radar whose aerial is located in the aircraft's nose and whose electronics is grouped in a bay behind the crew

– the hover/automatic transition coupler. When associated with the SFIM 155 automatic pilot, this device allows automatic hover and the automatic transition from and to cruise flight.

Should this item be developed jointly by SFIM and AEROSPATIALE, it will use numerical techniques so as to have the flexibility of operation that analog couplers (on the Super-Frelon or the Lynx) cannot offer so far.

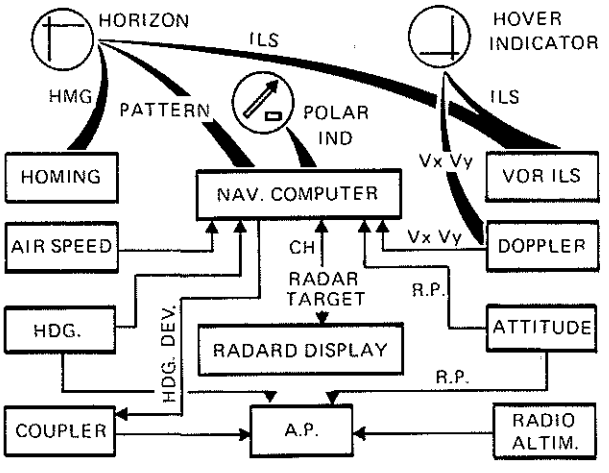


Fig. 10 : SAR MISSION

Emergency flotation gear.

Given the profile of the rescue mission, with long spans of hover at great heights, it was deemed necessary to have an emergency flotation gear available.

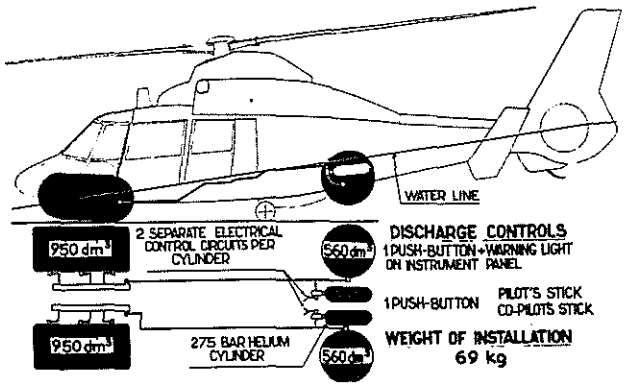


Fig. 11 : SA 365 N - EMERGENCY FLOATATION GEAR

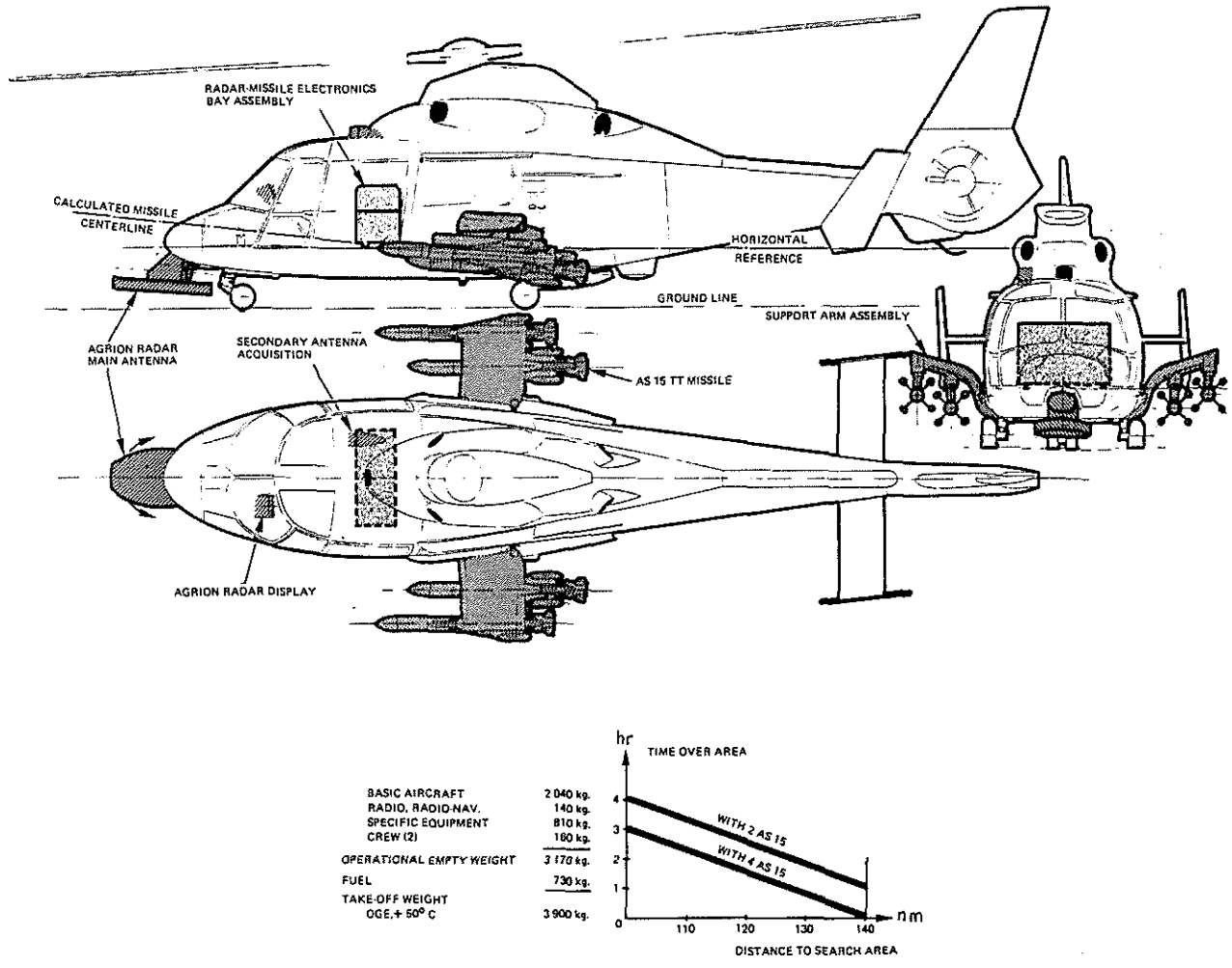
The built-in gear certified for the 365 N was lightened through the cancellation of tail balloons and by making the tail-boom/fin assembly watertight.

2– ARMED VERSIONS

The armed versions presently under development are :

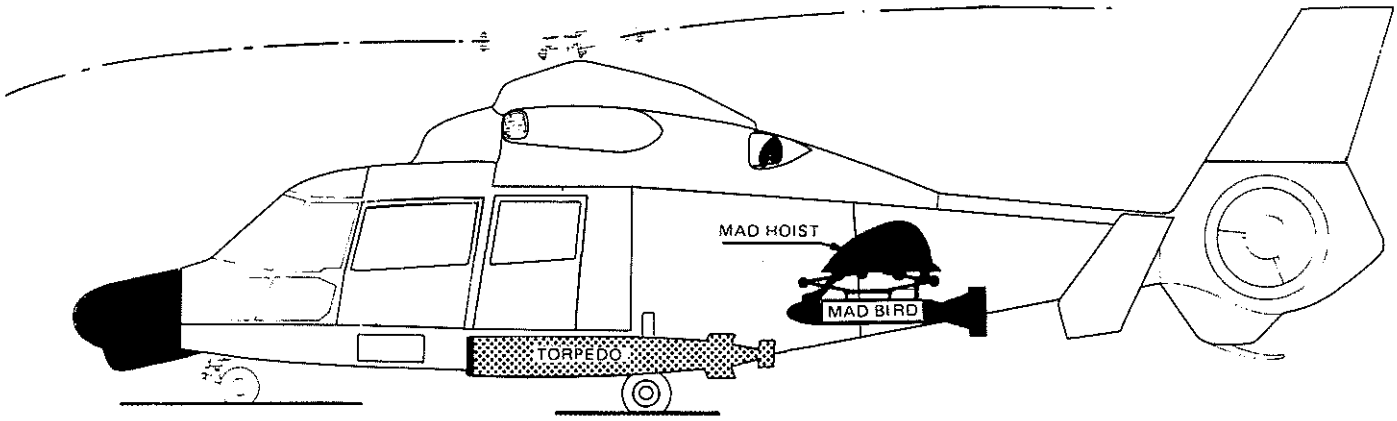
- an anti-surface-vessel version fitted with the AS 15 TT system comprising the Thomson / CSF AGRION radar and 4 Aerospatiale AS 15 TT missiles with a 15 km range.

- two ASM versions capable to fire two torpedoes, one with the MAD, the other with the SONAR.



BASIC AIRCRAFT	2 040 kg.
RADIO, RADIO-NAV.	140 kg.
SPECIFIC EQUIPMENT	810 kg.
CREW (2)	180 kg.
OPERATIONAL EMPTY WEIGHT	3 170 kg.
FUEL	730 kg.
TAKE-OFF WEIGHT OGE, + 50° C	3 900 kg.

Fig. 12 : SA 365 F - AS 15 TT VERSION



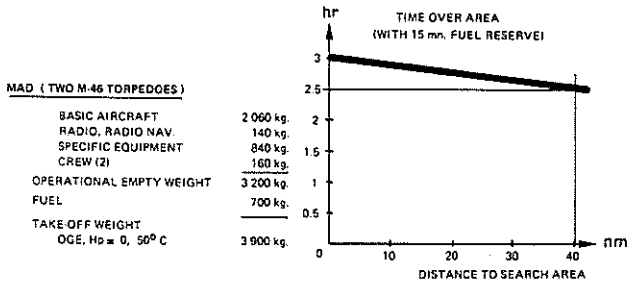
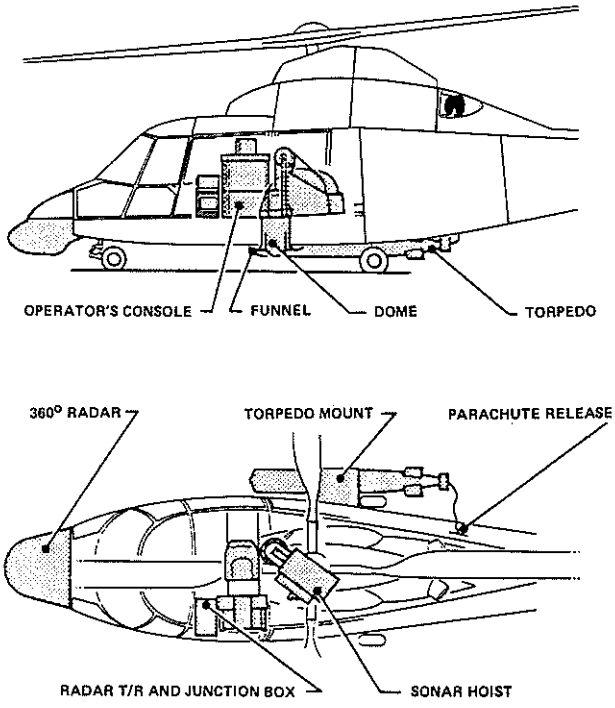


Fig. 13 : SA 365 F - MAD TORPEDO INSTALLATION



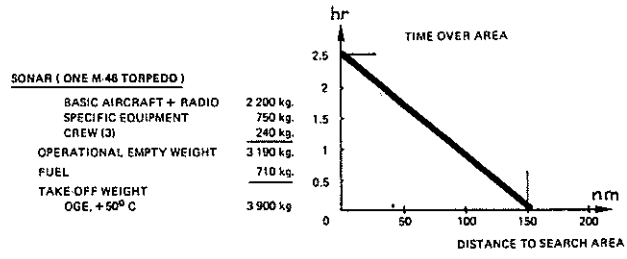


Fig. 14 : SA 365 F - SONAR INSTALLATION

IV – THE AS 15 TT WEAPON SYSTEM

This system (air-to-surface, 15 km, all-weather) is a light weapon system for the search and attack of naval objectives. When fitted on a ship-borne helicopter it permits to stretch considerably the range of detection and intervention means of ships at sea. When fitted on helicopters operated from a ground base, it is an unequalled instrument for the defense of the shore against surface-vessels.

The weapon system itself comprises :

- the firing installation with its AGRION 15 radar
- the AS 15 TT missiles.

The AGRION radar ensures the surveillance, search and missile-guiding functions. Moreover, it can designate targets beyond the horizon (for instance designation of targets to the Aerospatiale EXOCET MM 40 missile). The AS 15 TT missile weighs less than 100 kg and has a range of over 15 km. It can be fired from a point beyond the reach of enemy anti aircraft with a very high hit-probability and all the efficiency that a 30 kg warhead can ofter.

1 – THE AGRION 15 RADAR

The surveillance, search and firing AGRION 15 radar fabricated by Thomson / CSF features :

- long-distance surveillance possibility thanks to the choice of the appropriate frequency
- high discretion thanks to pulse-compression
- high resistance to counter-measures
- 360 degree panoramic scan
- Track-While-Scan
- small-size targets detection capability (periscopes, dinghies).

2 – THE AS 15 TT

The 98 kg missile is propelled for 45 seconds, thus obtaining a range exceeding 15 km.

Its trajectory is roll-stabilized and controlled by :

- a vertical gyro
- a radio-altimeter
- an active transponder
- a receiver of radar-transmitted guiding signals.

In the horizontal plane :

- the initial trajectory is programmed to ensure the helicopter's safety.
- initial homing is ensured by a large-lobe auxiliary antenna.

In cruise flight, the radar tracks the missile in direction and distance through the transponder. The firing installation generates guiding instructions from angular deflection measurements supplied by the radar. These instructions reach the missile through radar signals.

In the vertical plane :

- once it is homed, the missile performs a programmed descent and stabilizes in sea-skimming flight (just a few meters above the surface). Near the target, the missile descends and impacts the target efficiently whatever its vertical size.

Moreover, these characteristics are compatible with an elusive maneuver in the horizontal plane right after the firing of the missile.

CONCLUSION

As a first step towards the «militarization» of the Dauphin II at Aerospatiale's, naval versions were designed for embarkment on frigates.

The main technological options selected upon the launching of the SA 365 N version of the Dauphin II have largely facilitated this operation which does not entail large structural modifications and will allow first deliveries by mi 1983.

Fig. 15 : SA 365 F - AS 15 TT VERSION