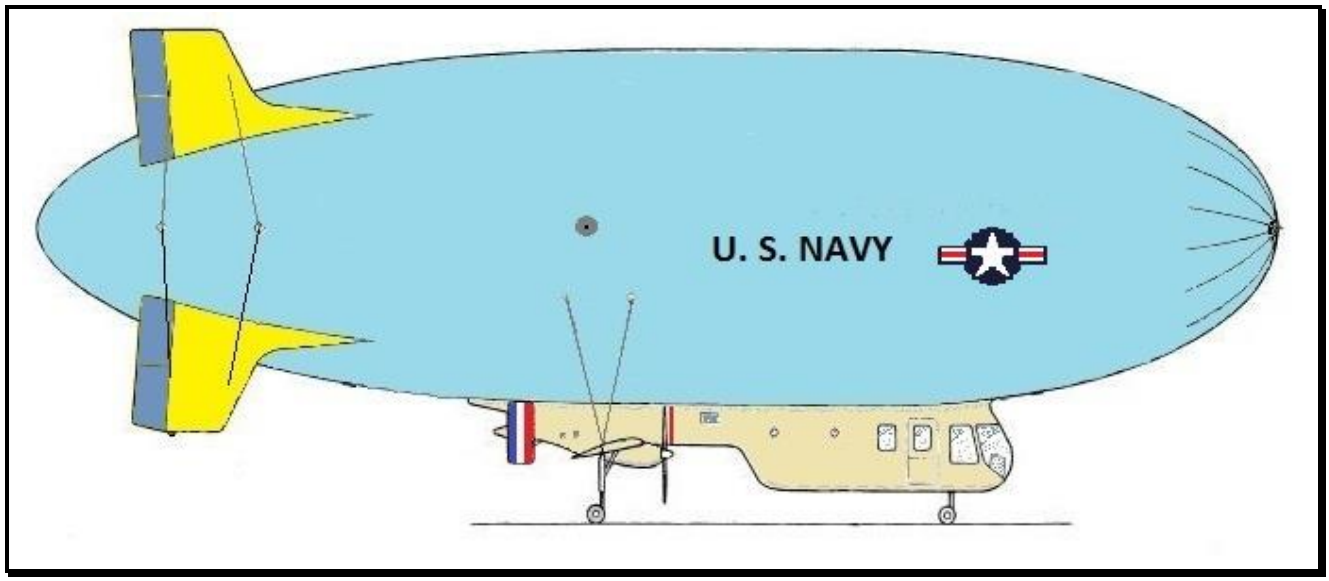
Patroller 3 hybrid aircraft

Onboard System specifications



Airframe systems, accessories, furnishings

a) Flight control – The primary flight controls are the ruddervators (providing mixed pitch and yaw control) installed and hinged on the four X-configured stabilisers. Each ruddervator is comprised of two separate sections, operated by a total of eight (8) actuators. The FBW system (Fly-By-Wire) is duplicated from the flight compartment back to the location of the stabilisers; at this point the system separates into four branches, then is divided again into two to service the eight actuators. Pitch-Yaw may be varied in mixing and strength. Two joysticks with spring-centring are provided.

b) Aerodynamic lift control – The wing flap is a simple flap in two sections, mounted at the rear spar of the wing. The flaps may be electrically actuated Down (increase lift), and Up (decrease lift), in 5^{o} gradations to $\pm 35^{o}$ maxima.

c) Envelope pressure control – The system is fully automatic, providing a standardised envelope pressure at any altitude and airspeed. A switch is provided for Normal and for Rough weather settings.

d) Buoyancy control – An active aerostatic buoyancy control system is an optional item. Basic buoyancy control via Helium venting only is provided for. An Envelope Rip system is provided for total evacuation of the helium.

e) Engine exhaust condensation (EEC) – An EEC system is an optional item. When installed, the collected fluid may be retained or be dumped as ballast.

f) Ballast – No ballast system is provided (except, see “e”).

g) Engine throttle control – Each of the three engines (2 x main, 1 x dash) may be individually throttled from Gnd.Idle-Flt.Idle-Cruise-T.Off. Lightweight Push-Pull cables are used with mechanical throttle quadrants and detents. Single engined flight is anticipated for long endurance sorties.

h) Landing gear – All three landing gear struts may be field-set for free-swivelling, or may be locked in the Fwd. orientation. Nose-wheel steering is an optional item. The P3 hybrid may be successfully operated from unpaved airfields.

i) Environmental control – The entire cabin is provided with a fresh air ventilation system. Air cooling/heating is available as an option.

j) Heaviness – The P3 is intended to be operated always heavy, varying from ~10% (minimum) to ~30% GSL. Variations of heaviness are primarily the consequences of mission fuel tankage and fuel burn (also, see “e”).

k) Lavatory – A toilet and hand basin are provided in the rear of the cabin.

l) Bunks – Two bunks are provided in the cabin, with an enclosure divider.

m) Workstation – The workstation is provided with desktop mounts and wiring for a minimum of two monitors. A selection of electrical and Comm. connections are optional items.

n) Observation stations – A minimum of two observers’ seats are provided on the starboard side of the cabin, with small, folding tables.

o) Standard instrumentation – Envelope pressure; Helium temperature; Ballonet % fullness (Fwd and Aft); Airspeed; Altitude; Rate-of Climb/Descent; Angle of Pitch; Engine RPM/Temp./Oil Pressure; Fuel quantity; EEC quantity (if installed); Flap position; Cabin temperature; Outside air temperature; Lightning indicator; Weather radar (optional); Directional gyroscope; Magnetic compass.

p) Autopilot – Altitude Hold and Heading Hold are provided. Other features may be provided (eg: Auto-Route following) as an optional item.

q) Mobile mast – For mooring and airfield relocations, a mobile mast is provided, operated by two personnel. (No additional ground-crew is required for airfield operations.)

r) Tender vehicle – The client must provide a suitable truck to be used for servicing the P3. This servicing includes fuel, Helium, potable water, toilet draining and minor repairs.

s) Hangar – A suitably sized, oriented and equipped hangar must be provided at the client’s operating airfield. It is recommended that the head (closed) end of the hangar be oriented towards the prevailing wind, and the location be well away from nearby obstacles that will cause wind buffeting and vortices. Alternatively, the hangar should be located in a well sheltered portion of the airfield, such as in the lee of a tall forest stand.

Mission systems

The P3 hybrid may be adapted to mount and support a broad range of surveillance and detection equipment. Such equipment may be mounted on/in the envelope and the gondola (Tricycle assembly). Size and weight restrictions apply where relevant.

The Patroller 3 may be fitted with any suitable optical equipment that is selected by the Navy. Equipment from two of the world leading suppliers is shown below.

Optical systems

SX-16 Nightsun

The Nightsun range of searchlights (above) supplied by Spectrolab of California can produce a brightness of 30 million candlepower.

Wescam 20TS/QS

Multi-function optical system

Wescam of Ontario, Canada, supplies optical systems used for surveillance and observation. Triple or Quad Sensor payloads (IR/daylight/LRF) are available.

Radar systems

Raytheon supplies a wide range of radar systems that may be adapted for use in airborne marine and aerial surveillance.

RL70C LCD 7 inch monitor

A range of 72 Nautical miles is provided by this equipment. The scanner may be externally mounted, or may be mounted inside the helium envelope for protection from the elements. Large scanners can be readily accommodated on a buoyant aircraft, allowing for very long range or precise detection.

5S-48" Open Array Scanner

Powerplants

Main engines – 2 x DAIR 100 diesel http://dair.co.uk/

NUMBER OF CYLINDERS	**2**	**DRY SUMP CAPACITY**	**5 Litres**
NUMBER OF PISTONS	**4**	**INJECTION SYSTEM**	**DIRECT**
NUMBER OF INJECTORS	**4**	**CONTROL**	**SINGLE LEVER**
BORE	**80mm**	**PROPELLER FLANGE**	**SAE 1 / ARP**
STROKE	**90mm**	**ALTERNATOR**	**12V / 20a**
DISPLACEMENT	**1810cc**	**STARTER**	**12 volt**
COMPRESSION RATIO	**18 : 1**	**ENGINE MOUNTS**	**4 POINT**
DRY WEIGHT	**90Kg**	**FUEL GRADE**	**AVTUR / DIESEL**
RATED RPM	**2500**	**POWER**	**130 HP**

Dash engine – Freedom 1590 http://www.freedom-motors.com/

High power to weight ratio - More than 1.5 HP per pound in high-performance versions
Compare 0.6 HP/lb to 1 HP/lb for 2-strokes and 0.3 HP/lb to 0.65 HP/lb for 4-stroke pistons
High power to volume ratio - 100 HP per cubic foot of installed volume
Compare 36 HP/ft³ to 50 HP/ft³ for 2-strokes; 10 HP/ft³ to 20 HP/ft³ for 4-stroke piston engines
Few moving parts - only four main components for triple rotor engine
SFC ~ 0.45 lb/HP-hr (stratified), <0.4 lb/HP-hr when both stratified charge and direct injected
Compare 0.65 lb/HP-hr for 2-strokes and ~0 .4 lb/HP-hr for the best 4-stroke piston
Proven multi-fuel performer - Demonstrated on gasoline, natural gas, alcohol, propane, spark-ignited diesel, kerosene and jet fuel
Very low emissions levels: See Emissions Performance
Enhanced energy at exhaust - Acts like a naturally occurring thermal reactor
Ideal for turbocharger/co-generation applications

P3 Performance summary

Airspeed	- 75 knots maximum (Dash speed, full throttle, 3 engines) - 52 knots cruise (2 main engines, 75% power) - 41 knots cruise (1 main engine, 75% power)
Consumption (185 US gallon capacity)	- 9 US gallons/hour (Cruise setting, 2 main engines) - 34 US gallons/hour (Full throttle, 3 engines)
Endurance (no reserves)	- 100 hours maximum (30 knots, 1 engine) - 24 hours at cruise (50 knots, 2 engines)
Range	- 3000 nautical miles (30 knots, 1 engine) - 1000 nautical miles (50 knots, 2 engines)

Cost and capability comparisons

Three options are presented, along with estimated costs, for the provision of border and coastal patrol aircraft operations.

a)	Beech King Air B200	US$1.4 million (used)
b)	ABC Lightship A-150/170	US$3.1 million (new)
c)	AHA Patroller3	US$1.8 million (new)

Description	King Air B200	Lightship A-150 [4]	Patroller 3
Cruise speed	279 knots	40 knots	52 knots
Operating cost US$	$538/hour [1]	$714/hour [5]	$470/hour [6]
Cabin size	16.7x4.5x4.7 ft	14x6.33x5 ft	26.6x6.5x6.5 ft
Cabin volume	356 cu.ft	443 cu.ft	1120 cu.ft
Range (still air)	1807 N.mile [2]	493 N.mile @40kt	1700 N.mile @ 40kt
Endurance	6.5 hours [3]	12.33 hours	42.5 hours
Ground crew	nil	15 strong men	2 men
Rating [7]	**1200**	**306**	**5266**

Sources and explanations

1	The Aviation Hub	http://www.theaviationhub.com
2	Raytheon Aircraft	http://www.raytheon.com
3	Estimated	By calculations
4	The Lightship Group	http://www.lightships.com
5	Estimated	Lease $250k/month, 25 days, 7 hour/day
6	Estimated Direct Operating Cost	Advanced Hybrid Aircraft Ltd.
7	Rating =	$\frac{\text{cabin volume x endurance x cruise speed}}{\text{operating cost}}$

Comparison types

Beechcraft King Air B200

ABC Lightship A-150