

Originally, France planned to build two carriers, but the idea was shelved after the post-Cold War defence review. Logier is hopeful that a second carrier might be built under a shared programme with the UK.

Talks with the Royal Navy have taken place, while France-UK industrial contacts have also intensified following the appointment of Thomson-CSF as one of the contractors to carry out a five-year study into the programme.

FIGHTING ELEMENT

The marine version of the Dassault Rafale will form the *Charles de Gaulle's* core fighting element, although the carrier will not receive its first operational aircraft until mid-2002, and then just a half-squadron of 10 aircraft. These will join the 20 Dassault Super Etendards to be stationed on the ship at service entry, which are to be upgraded progressively. The carrier will have its full complement of 30 Rafales by 2008.

The *Charles de Gaulle* is much smaller than its US nuclear-powered counterparts. The Nimitz-class carriers, for example, weigh in at 90,000t and carry 70 aircraft – a ratio of one aircraft per 1,300t, whereas the 45,000t *Charles de Gaulle* carries 40 aircraft, equivalent to around one aircraft per 1,000t. "New technology has enabled us to have a more efficient design," says Logier. "The Rafale, for example, has all of the multiple capabilities of the [Grumman] F-14 and [Boeing] F/A-18, but is much smaller and lighter." The twin catapults, capable of launching 100 aircraft daily, therefore function with less power than that required for the US aircraft. This has called for compromises. "We knew we couldn't do everything," says Logier. "The cost vs efficiency equation ruled through-out in the design process."

Being relatively small, the *Charles de Gaulle* has a much tighter turning circle than its US counterparts. The ship is equipped with an innovative computer-controlled stabilising system which limits flightdeck roll to just half a degree in a rough sea state of 5/6. Below the water line, four fast-acting stabilisers act in conjunction with the rudder to keep the ship level during turns at speeds of up to 20kt (37km/h).

The stabilisers work with a unique self-leveling system in which two sets of 120t weights can be rolled from one side of the ship to the other at 1m/s, on tracks just below the flightdeck. The 240t shift in weight, combined with the stabiliser system, contributes towards exceptional stability, a feature that widens the ship's operational envelope, says Logier.

Most of the experience that has been used in developing the *Charles de Gaulle's* nuclear powerplant has come from the extensive knowledge gained through France's nuclear submarine programme. The propulsion system for the carrier set new challenges, however. The two reactors on the *Charles de Gaulle* provide enough energy to run the catapults and four 16mW turbines, providing a top speed of 27kt, enabling the ship to travel 1,000km a day.



The *Charles de Gaulle* will have a complement of 30 Dassault Rafales by 2008

The choice to go nuclear was taken when the fuel was cheaper and conventional fuel prices were high. While there remain advantages to this kind of propulsion, particularly in that it enables the ship to sail for 45 days without replenishment, nuclear power means that the navy is saddled with an expensive maintenance task. Safety requirements have also become Draconian – and some countries prohibit the docking of nuclear-powered ships in their ports.

Under its normal regime, the *Charles de Gaulle* will need to be laid up every seven years for major maintenance and nuclear fuelling, taking up to 18 months. Its first period of unavailability will occur in early 2003, however, when the carrier is to be docked for six months for its first major maintenance.

Three Northrop Grumman E-2C Hawkeyes will form the *Charles de Gaulle's* airborne early-warning force. Two, built to the US Navy standard, have been delivered and the third, modified to the more capable Group 2 standard, is to arrive in 2003. France is being offered the option of upgrading all three to the later Hawkeye 2000 standard.

Originally, France planned to develop its own 15t surveillance aircraft, but the lack of a major domestic requirement or likely export market meant the development costs would be astronomical. The plan was therefore dropped in favour of the Hawkeye, a well-proven aircraft available off-the-shelf, but, at 24t maximum take-off weight, weighing much more.

In preparation for its deployment on the *Charles de Gaulle*, the worst-case landing scenario for an E-2C was simulated: the aircraft was landed at maximum weight, but caught the last of the three arresting cables, which then "failed". The result proved to be a Hawkeye stuck at the end of the angled deck, unable to turn or be pulled clear by a tractor.

The 30min delay to clear the aircraft while others were circling with diminishing fuel was unacceptable, so the deck was lengthened by 4.40m (14ft) at a cost of Fr4 million. "We always knew there may be a need to make it slightly longer," says Logier, "but the decision was put off until we had tested the aircraft."

Another, much more expensive, modification came with the revision of the international recommendations for acceptable radioactive leakage, which were revised down to the level of radiation detectable from the ground. The navy was left with no choice but to add extra protection all around the reactor at a cost of Fr1 billion, meeting the new European CIPR standards that come into force on 13 May.

The first Rafales to become operational on the carrier will be air-to-air F1 standard aircraft, which will be progressively replaced by F2 air-to-ground standard aircraft from 2007/8 as the type becomes available. The Super Etendards, which by then will have served almost half a century with the France navy, will be retired as the F2 versions arrive.

The NH Industries NH90 navy utility helicopter will be the rotary-winged workhorse aboard. Two of the 27 being purchased by the navy will be based permanently on the *Charles de Gaulle*, replacing ageing Super Frelons.

Initial tests of the *Charles de Gaulle* took place in January last year, with the first Rafale landing on the 262m-long flightdeck in July and the first catapult take-off the following day. Since then, every system of the carrier has been tested over 40,000km, sailing in the waters near Brest. Further tests are planned until July with aircraft, armaments and all systems fully operational. □

SHIP STATISTICS

Displacement	40,600t
Overall length	262m
Beam	65m
Height	75m
Flightdeck area	12,000m ²
Hangar deck area	4,600m ²
Electrical	21,000kw
Maximum speed	2kt
Mobility	1,000km daily
Air craft attached aircraft:	
40 aircraft, including Dassault Rafale, Dassault Super Etendard, Northrop Grumman Hawkeye AEW, Eurocopter Dauphin, NH Industries NH90	