HEAVYWEIGHT TORPEDO

Using state-of-the-art technology, the F21 features exceptional performances, fulfilling all the stringent French Navy requirements: advanced self-guided mode, shallow and confined water capability, latest generation of countermeasures resistance and compliance with nuclear submarines safety norms.

Thanks to its intelligence, range and fire power, it offers navies an unrivalled tactical advantage by increasing the spectrum of operational scenarios.

The F21 will equip the entire French SSBNs and SSNs fleet, as well as the Brazilian Scorpène® SSKs.

The F21 is also launchable from surface ships.
KEY FEATURES

Intelligence
Equipped with a complete “sonar suite” and an advanced mission system both with extremely high computing power allowing real-time combined complex signal and data processing, the F21 torpedo maintains a clear tactical picture even in the most confined coastal areas and against the most sophisticated torpedo defence systems. Whatever the operational sequence (search, pursuit, attack…), the F21 benefits from a high level of discrimination, identification, Acoustic Counter-Counter-Measures (ACCM) and homing.

Endurance and power
The F21 is powered by a new generation of silver oxide-aluminium (AgO-Al) sea-water primary battery using dissolved sodium dioxide powder as electrolyte and incorporating a new electronic closed loop electrolyte circulation system. The battery delivers power and energy independently of the depth. In comparison with silver-zinc and other technologies, AgO-Al energy density is unrivalled. It ensures both maximum speed beyond 50 knots and endurance around 1 hour without compromising safety.

THEORETICAL CHEMICAL ENERGY DENSITY COMPARISON

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>Energy Density (Wh/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver oxide-aluminium (AgO-Al)</td>
<td>1,040</td>
</tr>
<tr>
<td>Silver oxide-zinc (AgO-Zn)</td>
<td>490</td>
</tr>
<tr>
<td>Lithium-Ion (Li-Ion)</td>
<td>600</td>
</tr>
<tr>
<td>Lithium-polymer</td>
<td>600</td>
</tr>
<tr>
<td>Lithium-iron phosphate (LiFePO₄)</td>
<td>520</td>
</tr>
<tr>
<td>OTTO fuel II</td>
<td>645</td>
</tr>
</tbody>
</table>

* Thermal motor - value indicated without Carnot limitation

Safety
The AgO-Al primary battery electrolyte only starts once sea water enters the battery section, which is impossible as long as the torpedo is in the submarine's tube, preventing any unexpected electrolyte triggering on board. In addition, the F21 features a B2211D insensitive explosive warhead and a fully electronic fuse which fulfills not only Insensitive Munition (IM) STANAG 4439 and 4187 standards but also the numerous additional French Navy requirements for SSN and SSBN weapon integration. This results in IM signature being validated at torpedo level by the French assignment authority.

CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull diameter / hull length / weight</td>
<td>533 mm / 6,000 mm / &lt; 1.5 t</td>
</tr>
<tr>
<td>Speed</td>
<td>Variable stepless from &lt; 25 kts to &gt; 50 kts</td>
</tr>
<tr>
<td>Endurance</td>
<td>~ 1 h</td>
</tr>
<tr>
<td>Range</td>
<td>&gt; 50 km</td>
</tr>
<tr>
<td>Operational depth</td>
<td>from &lt; 10 to &gt; 500 m</td>
</tr>
</tbody>
</table>
**KEY FEATURES**

![Diagram of F21 torpedo](image)

**Fibre optic wire guidance**

**Energy**

**Acoustic head**

**Afterbody**

**Propulsion**

**Guidance and control**

**Warhead**

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**Exercise version**

This version of the F21 torpedo carries an exercise section instead of a warhead along with a pinger and a strobe light for easy detection and recovery after completing its run. The exercise version features a lithium-ion rechargeable secondary battery granting a behaviour similar to the combat version torpedo, to ensure highly realistic training exercises. The power delivered is similar, with a maximum speed identical to the combat version. The energy is limited compared to the one delivered by AgO-Al primary battery, but offering a sufficient endurance for training. This lithium-ion secondary battery also provides the robustness and is compliant with safety standards necessary to be installed on board nuclear submarines. The secondary battery offers at least 50 recharging cycles over five years, thus significantly reducing the F21 life-cycle cost.

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**Widening the tactical employment**

The advanced sonar and mission system associated with unmatched vehicle capability such as endurance, engagement distance, minimum and maximum speed, silent electric propulsion, wake homing and fibre optic wire guidance widen significantly the F21 operational employment in times of both war and crisis.

The 250 kg warhead, which is detonated either on impact or on acoustic triggering, makes the F21 capable of destroying any submarine or any surface vessel including those with unconventional hulls.

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**MIGAL fire control system**

MIGAL fire control system serves as the interface between the torpedo and the submarine’s combat information centre. The MIGAL’s prime function is to control the torpedo firing sequence for combat and training launchings. The MIGAL presets, checks, launches and wire-guides the F21 and other available torpedoes, one at a time or in salvos (up to 4 HWT on four targets). The user friendly Man-Machine Interface is available either in stand-alone mode or through the combat management system. The MIGAL is compatible with any heavyweight torpedo and can be installed on board any submarine or surface vessel. A navy can thus deploy different types of torpedoes from the same platform which in turn helps it to switch smoothly from one torpedo type to another. Today more than 40 MIGAL systems equip six navies.
Background

With over hundred years of experience in designing, producing and maintaining torpedoes, DCNS is a global player in underwater weapon systems, consistently at the forefront of technologies to ensure the French and allied navies tactical advantages. The F21 has been developed based on this long experience to offer navies unrivalled operational capacity.

Equipped navies

![France](https://example.com/france-flag.png) ![Brazil](https://example.com/brazil-flag.png)