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## Diesel Submarine Support to SOF

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Monterey, California: Naval Postgraduate School

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Covertly inserting special forces for clandestine operations is an essential capability for U.S. Special Operations Command (USSOCOM).

A few allied nations operate modern diesel-electric submarines enhanced with air-independent propulsion (AIP) technologies. These submarines require less draft than nuclear submarines and have better maneuverability in coastal waters.

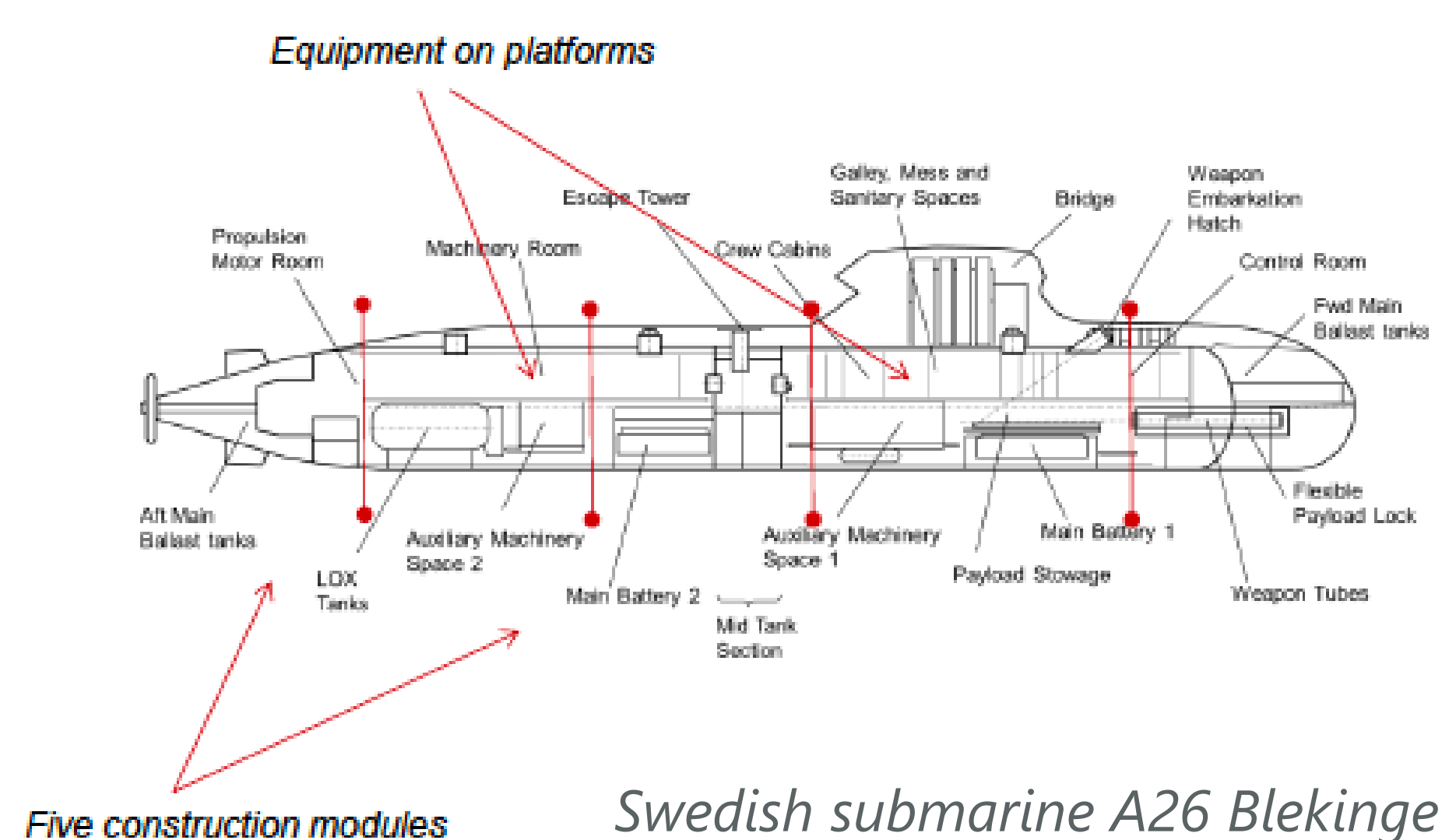
They are typically less expensive and quieter than nuclear submarines, but with shorter endurance.

## The Littorals



*The Littorals – where SEAL teams operate*

## Stirling AIP propulsion



*Swedish submarine A26 Blekinge*

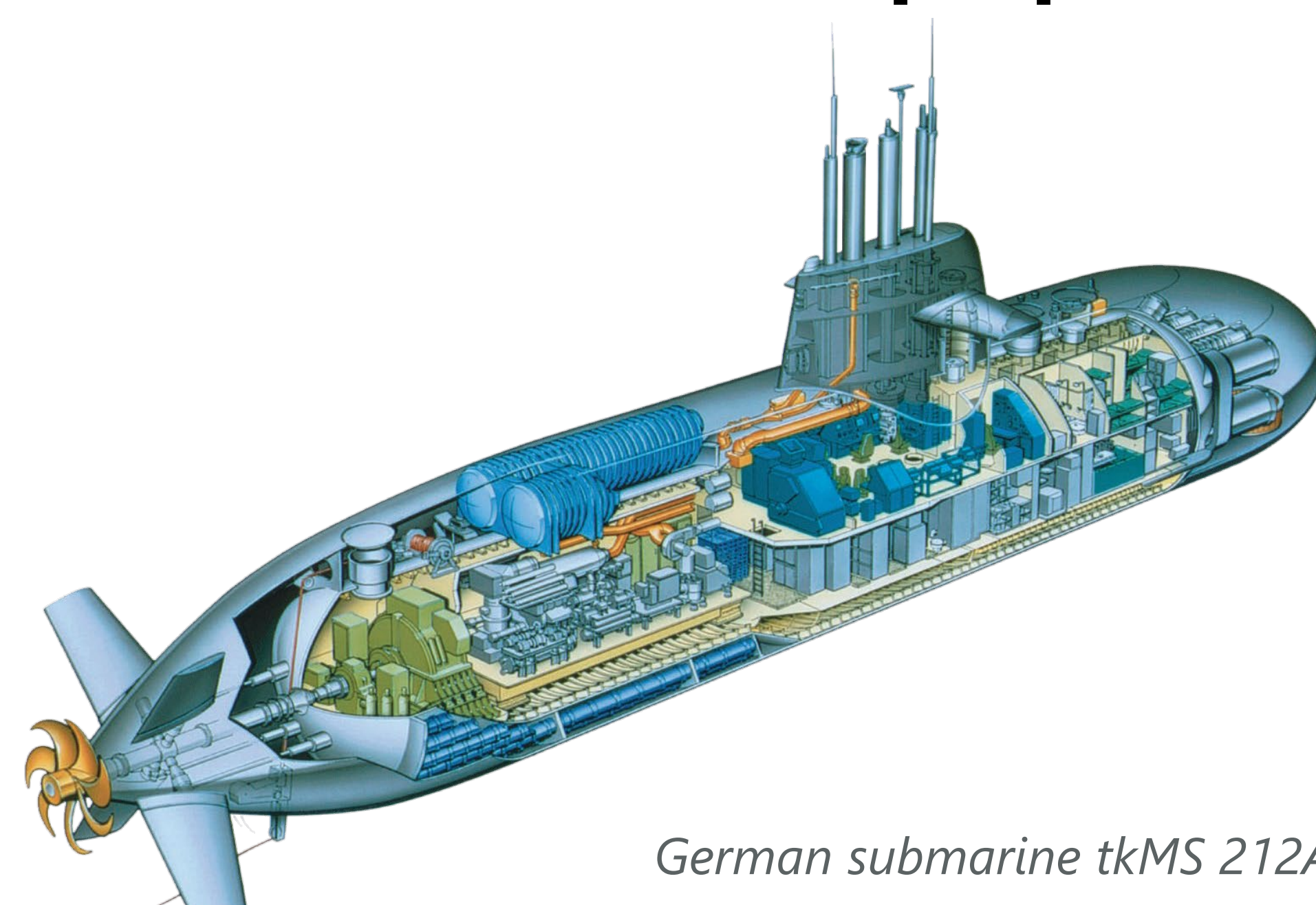
Saab-Kochums is in its third generation of AIP diesel-electric submarines, the Blekinge class, using a Stirling system to provide low power range and high energy density at patrol speeds.

The battery provides sprint speed capability, the diesel engine generation system allows both rapid recharge at sea and during long range relocation while snorkeling. Although the AIP system mode provides low speed, it allows for lengthy submergence, only limited by the amount of liquid oxygen in storage.

## Fuel cell AIP propulsion

The tkMS type 212A is the hull design with integrated air-independent system. Ten units are currently operated by the German and Italian navies. The boat is operated with a small crew of 28 sailors.

It has reduced signature (noise, magnetism, radar reflection, infrared) in addition to a water pressure torpedo expulsion system.



*German submarine tkMS 212A*

## Recommendations

We interviewed USW subject matter experts, reviewed intelligence data on foreign made submarines, interviewed AIP submarine makers in Germany and Sweden, and reviewed archival data and previous studies.

While the preponderance of this study was classified, stakeholders in the Special Forces community should consider reading the classified report available in the Defense Technical Information Center archives.



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