Navy Ship-specific Considerations for Decarbonization Research

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Agenda

• Navy Tactical Fuel Use by Platform
• Force Architecture and Challenges
  • USS/Commissioned Vessels (Warships)
    • Combatant Ships and Amphibious Warships
  • USNS Vessels (Ships of Military Sealift Command)
    • Combat Logistics Force
  • 30 Year Shipbuilding Plan
• Priority Platforms for Decarbonizing
• Technology Readiness Levels
Navy Fuel Use by Platform/Airframe

FY21 Fuel Use by Platform as % of Total Demand

- Navy & Marine Corps Aircraft use **JP-5** (High Flashpoint Aircraft Fuel)
- Navy Ships use **F76** (Marine Diesel)
USS/Commissioned Ships (Warships)

https://www.raytheonmissilesanddefense.com/what-we-do/missile-defense/sensors/spy6-radars
https://www.navy.mil/Resources/Fact-Files/
USS/Commissioned Ships (Warships)

- Commissioned as “United States Ship” (USS)
- Designed to Navy/MIL Standards
- Modernization tightly controlled by Technical Warrant Holders at Naval Sea Systems Command (NAVSEA)
- Non-developmental upgrades generally preferred
- New construction performed at private shipbuilding with NAVSEA overseeing contracts
- Space, Weight, Power, and Cooling limited (very limited)

https://www.raytheonmissilesanddefense.com/what-we-do/missile-defense/sensors/spy6-radars
https://www.navy.mil/Resources/Fact-Files/
Ships of Military Sealift Command (MSC)

https://www.msc.usff.navy.mil/Ships/Ship-Inventory/
https://www.navy.mil/Resources/Fact-Files/
Designated United States Naval Ships (USNS)

- Designed to American Bureau of Shipping (ABS) Steel Vessel Rules

- Modernization controlled by the Technical Directorate at the Military Sealift Command

- New construction performed by private shipbuilders, but NAVSEA and MSC oversee requirements development and contract oversight

- Generally, Space, Weight, Power, and Cooling margins are available

https://www.msc.usff.navy.mil/Ships/Ship-Inventory/
https://www.navy.mil/Resources/Fact-Files/
30 Year Shipbuilding Plan

Three “alternatives” described in the plan. Alternative 2 shown here (327 ships by 2052).

- Reducing Large Surface Combatant inventory by 20 ships (DDG-51 Class, then DDG(X) starting around 2035).
- Increasing Small Surface Combatant inventory by 23. Retiring LCS platforms, then adding FFG-62 Class starting in 2026.
Near – Mid Term

- **DDG-51**: Still being delivered, will replace CG-47 over the next 7 years, and drives demand for CLF ships (T-AO, T-AOE, and T-AKE)
  - Uses Gas Turbine Engines Only
- **T-AKE**: Relatively new, and will be around 20+ years
- **T-AO 205**: T-AO 187 Class near end-of-service-life, being replaced with T-AO 205
- **LPD-17**: Ships still being delivered, with 30-year service life

Mid-Long Term

- Concepts for Next Generation Logistics Ship, Light Amphibious Warship, and the next Large Surface Combatant (DDG(X)) are in development.
- Unmanned Surface Ships and other unmanned/asymmetric capabilities and concepts could leverage “developmental” technologies
# Navy Technology Readiness Levels

<table>
<thead>
<tr>
<th>TRL</th>
<th>Definitions</th>
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<tbody>
<tr>
<td>1</td>
<td>Basic principles observed and reported.</td>
</tr>
<tr>
<td>2</td>
<td>Technology concept and/or application formulated.</td>
</tr>
<tr>
<td>3</td>
<td>Analytical and experimental critical function and/or characteristic proof of concept.</td>
</tr>
<tr>
<td>4</td>
<td>Component and/or breadboard validation in a laboratory environment.</td>
</tr>
<tr>
<td>5</td>
<td>Component and/or breadboard validation in a relevant environment.</td>
</tr>
<tr>
<td>6</td>
<td>System/sub-system model or prototype demonstration in a relevant environment.</td>
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<tr>
<td>7</td>
<td>System prototype demonstration in an operational environment.</td>
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<tr>
<td>8</td>
<td>Actual system completed and qualified through test and demonstration.</td>
</tr>
<tr>
<td>9</td>
<td>Actual system proven through successful mission operations.</td>
</tr>
</tbody>
</table>

For transition/fielding technologies on ships, think “relevant operational environment”

[https://www.navysbir.com/TRL-Definitions.htm](https://www.navysbir.com/TRL-Definitions.htm)
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https://www.navsea.navy.mil/Home/Team-Ships/Media-Gallery/PhotoGallery/
https://www.msc.usff.navy.mil/Ships/Ship-Inventory/