Thinking about Cost-Effectiveness Analysis

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Describing cost-effectiveness analysis

Compares the costs and potential effects created by different capabilities for the purpose of maximizing the value of desired outcomes

- Considers the total cost involved with achieving specific mission outcomes
- For air operations, this can include the cost of aircraft, their mission systems, and weapons they expend to execute tasks such as striking targets
- It can also include costs of other direct support assets such as aerial refueling tankers, electronic jamming platforms, surface-to-air missile suppression efforts, aircrews, and support equipment required to achieve the task
Cost-effectiveness analysis can help inform DOD’s modernization choices

**DOD has a growing strategy-resource mismatch:** There is a gap between the capabilities and capacity of our military and the challenges it must prepare for

- Unprecedented array of threats to the U.S. homeland, multi-polar strategic competition, mid-tier adversaries, non-state actors with access to asymmetric weapons...
- Delayed modernization has created budget “bow waves” that cannot be further deferred
- Reality of flat or declining defense budgets

**Reducing this gap requires force design and acquisition decisions that maximize combat effectiveness**

- Budget-driven factors such as unit cost & cost per operating hour tend to dominate debates over future force design and modernization investments
- Focusing on these costs absent consideration of mission effectiveness drives procurement of capabilities that may have less operational capability and capacity

**Additional DAF challenges**

- Now funding 2 services without significant budget growth
- Budget “pass-through” masking the Air Force’s smallest share of the defense budget
Example: USAF fighter force design

Table from a 2019 OSD/CAPE presentation supporting F-15EX acquisition

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Ave APUC (FY20$M)</th>
<th>Service Life (Hours)</th>
<th>2020-2035 Ave CPFH (FY20$K)</th>
<th>Total Cost of Ownership per Hour (FY20$K)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-35A</td>
<td>$100</td>
<td>8,000</td>
<td>$44</td>
<td>$56</td>
</tr>
<tr>
<td>F-35B</td>
<td>$120</td>
<td>2,100³ / 8,000</td>
<td>$44</td>
<td>$101 / $59</td>
</tr>
<tr>
<td>F-35C</td>
<td>$110</td>
<td>8,000</td>
<td>$44</td>
<td>$58</td>
</tr>
<tr>
<td>F-15EX</td>
<td>$90</td>
<td>20,000⁴</td>
<td>$29</td>
<td>$34</td>
</tr>
<tr>
<td>F/A-18E/F</td>
<td>$80⁵</td>
<td>9,000</td>
<td>$23</td>
<td>$30</td>
</tr>
</tbody>
</table>

Table is UNCLASSIFIED

² Total Cost of Ownership per Hour = (APUC + Service Life) + CPFH
³ F-35B current certified service life is 2,100 hours’ structural fatigue test to increase service life to 8,000 hours TBD
⁴ Boeing estimate
⁵ Multi-year procurement pricing for 24 F/A-18E/F Block III aircraft
⁶ Excludes initial spares

- This narrow, budget-driven analytical focus fails to fully value the operational advantages of 5th gen aircraft

- Future force mix analyses should also consider:
  - Cost of larger mission packages needed to support 4th gen fighter operations
  - Higher 4th gen fighter attrition rates and pilot losses in combat
  - Increased potential for mission failures

Breaking news: will be $35k by 2023 (in FY20$)
Must consider cost to achieve specific effects, not just acquisition and CPFH

- Cost of kinetic and non-kinetic effectors
- Survivability of aircraft and their weapons; the Air Force cannot absorb high attrition rates with a force that is now too small for a *single* peer conflict
- Aircraft range and payload capacity have an impact
- Ability to complete kill chains in contested areas with reduced external support

<table>
<thead>
<tr>
<th>Sweep/Escorts</th>
<th>Defense Suppression</th>
<th>Tankers</th>
<th>Escort</th>
<th>Defense Suppression</th>
<th>Bomb Droppers</th>
<th>Bomb Droppers</th>
<th>Total aircraft:</th>
<th>Total targets:</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/A-18s</td>
<td>BQM-74 drones</td>
<td>A-6s</td>
<td>F-117s</td>
<td>F/A-18s</td>
<td>BOM-74 drones</td>
<td>BOM-74 drones</td>
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<td>F-4Gs</td>
<td></td>
<td>Tornados</td>
<td></td>
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<td>147</td>
<td>2</td>
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<td>EA-6Bs</td>
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<td>$7.5B</td>
<td>$1.1B</td>
</tr>
</tbody>
</table>

Value of stealth: comparing the first conventional strike package in Desert Storm with stealth F-117 strikes at the same time

Value of stealth plus larger aircraft payloads (more targets per sortie) & greater range (less refueling)
Cost-effectiveness analyses should consider cross-service options to achieve desired mission effects.

Example includes costs to acquire a missile battery, a notional stealth bomber, 30-year O&S for all three platforms, and the weapons they expend.

![Graph showing cost comparisons](image)

Cost of the ground-launched Long Range Hypersonic Weapon option quickly exceeds cost of stealth bomber options.

- Battery with LRHW (hypersonic boost-glide)
- New stealth bomber with Stand-in Attack Weapon
- B-52 bomber with airbreathing hypersonic weapon

Notional missile battery in long-range fires battalion.
Thoughts on implementing

- Include in USAF future force design planning — assess mission effects
- Adopt as part of JCIDS process evaluating potential new capabilities
- Create cost-per-effect Key Performance Parameters for new acquisition programs
- OMB, GAO, and others update their assessment methodology

In Millions of Dollars

- $80 million for 2 weapons
- $80 million for reusable 5th gen fighter
- $80 million for 66 weapons

Weapon cost

- $40 million
- $1.2 million

2 Long-Range Hypersonic Weapons (LRHW)
1 F-35A
66 air-launched Stand-in Attack Weapons (SiAW)