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# **Affordable Mass**

## **The Need for a Cost-effective Air Force PGM Mix for Great Power Conflict**

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# The Air Force's legacy PGMs are increasingly unsuitable for a 5<sup>th</sup> generation combat force

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**“You’re not a true fifth-gen Air Force until your fifth-gen fighters have fifth-gen weapons and fifth-gen sensing”**

**Gen Mark Kelly, ACC Commander**

## ***Five Recommendations for the future munitions inventory***

### **1. Maximize the Air Force's 5<sup>th</sup> gen advantage.**

Prioritize precision-guided munitions (PGMs) that enable the Air Force to take full advantage of the survivability, range, and payload capacity of its penetrating 5<sup>th</sup> generation fighters and stealth bombers

### **2. Fill the gap between long-range stand-off & direct attack PGMs.**

Acquire a family of mid-range (50 nm to 250 nm) weapons that can be delivered by penetrating aircraft on 100,000-plus aimpoints during a peer conflict



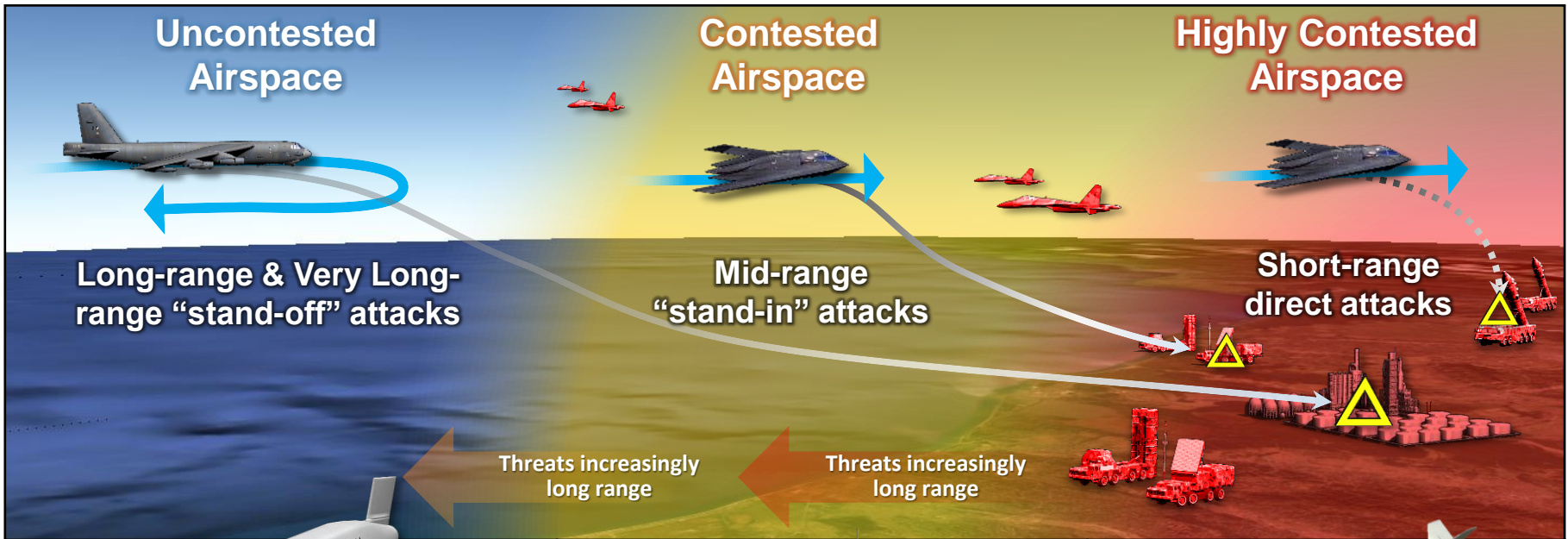
## Five recommendations (continued)

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- 3. Increase PGM survivability to reduce sortie requirements.**  
Design next-generation mid-range PGMs to penetrate advanced air defenses to reach their designated aimpoints
- 4. Increase lethality against challenging targets.**  
The USAF's PGM mix must be effective against target sets that are increasingly mobile, relocatable, hardened, deeply buried, and distributed over wide areas
- 5. Maximize the Air Force's bang for the buck.**  
Ideally, mid-range PGM unit costs should be less than \$300,000 if the Air Force is to procure them at scale considering the likelihood of flat or declining budgets



# Describing “stand-off” and “stand-in” strikes



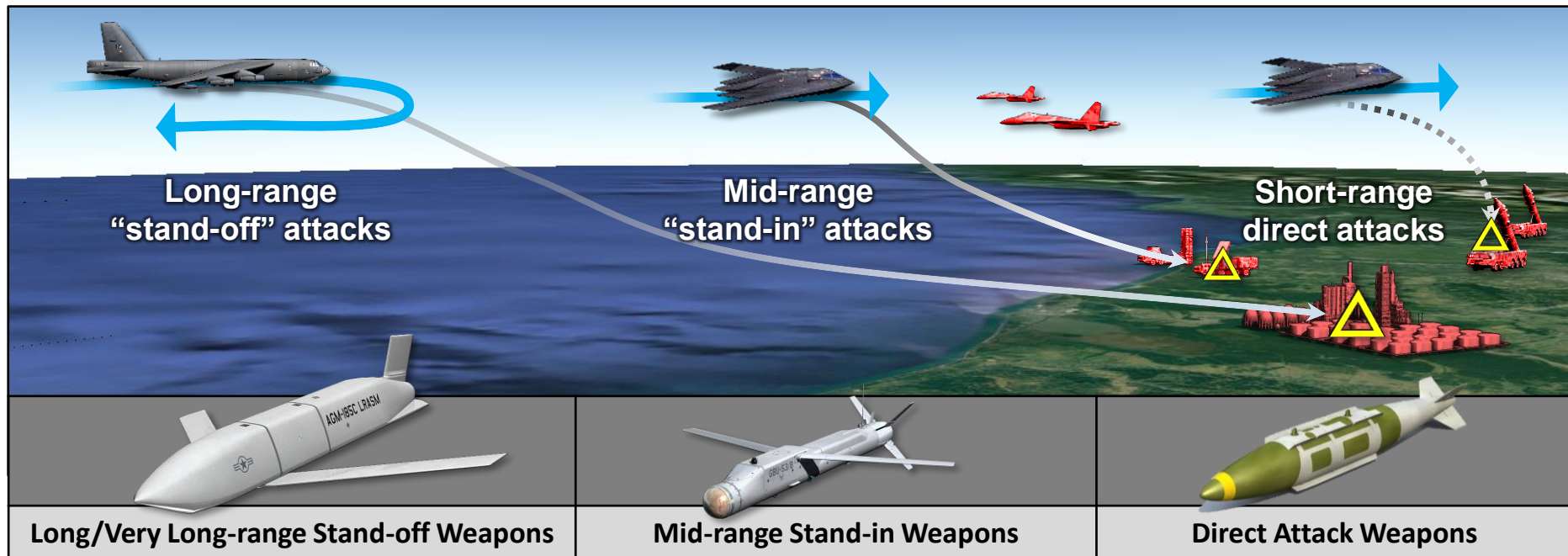
 <p>Long/Very Long-range Stand-off Weapons</p>	 <p>Mid-range Stand-in Weapons</p>	 <p>Direct Attack Weapons</p>
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JASSM-ER, Tomahawk cruise missiles, etc.	SDB II, Joint Standoff Weapons, etc.	JDAMs, Quickstrike mines, etc.
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<ul style="list-style-type: none"> <li>• Long-range = 250 to 750 nm</li> <li>• Very long-range &gt; 750 nm</li> <li>• Typically powered to extend range</li> <li>• Non-stealth aircraft may need 500 nm or greater stand-off ranges to attack targets in contested areas</li> </ul>	<ul style="list-style-type: none"> <li>• Mid-range = 50 to 250 nm</li> <li>• Winged/glide capable, may also be powered to extend range</li> <li>• Enables attacks while avoiding short-range “point” defenses surrounding high-value targets</li> </ul>	<ul style="list-style-type: none"> <li>• Ranges of single digits to very low 10s of nautical miles</li> <li>• Weapons are typically unpowered</li> <li>• Must be released very close to targets</li> </ul>
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# Inventory is unbalanced: mostly direct attack and a much smaller number of stand-off PGMs



Too far

"Sweet spot" for penetrating strikes

Too close

- Increasing weapons range increases their size, which reduces weapons per sortie (targets per sortie)
- Longer flight times can reduce effectiveness against mobile/relocatable targets
- Typically carry smaller warheads, reducing their effectiveness against hardened/deeply buried targets
- Higher costs reduce PGM scalability

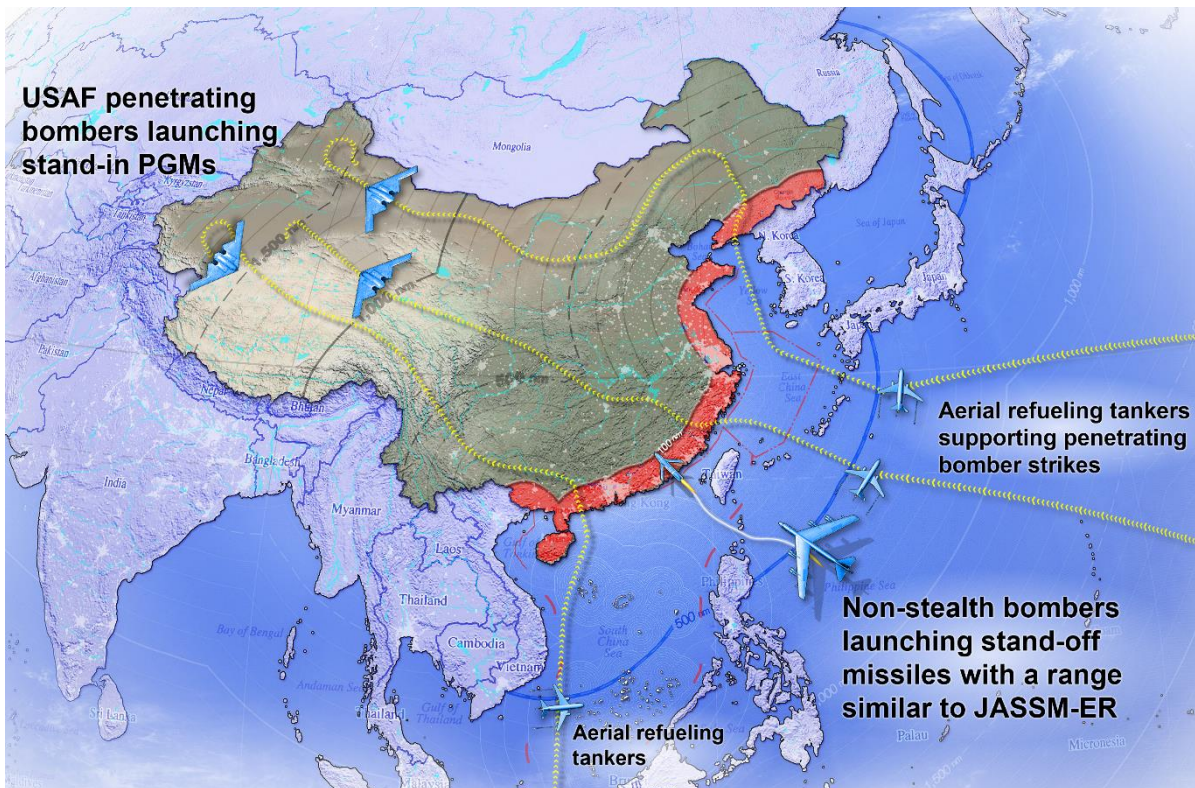
- **There is a gap in the Air Force's PGM inventory**
- **Needed: A family of next-gen mid-range (50–250 nm) PGMs for stand-in strikes**

- Increases risk to penetrating aircraft — reduces ability to avoid lethal short-range "point" defenses around high-value targets



# Mid-range PGMs for stand-in attacks would increase lethality of the USAF's 5th & 6th gen forces

- **Deny adversaries rear-area sanctuaries:** Enable penetrating strikes against large target sets (100,000 or more aimpoints) that are increasingly mobile, relocatable, hardened, deeply buried, and distributed over very large areas
- **Provide just enough standoff:** Enough weapons range for stealth aircraft to avoid short-range point defenses without inordinately increasing weapon size

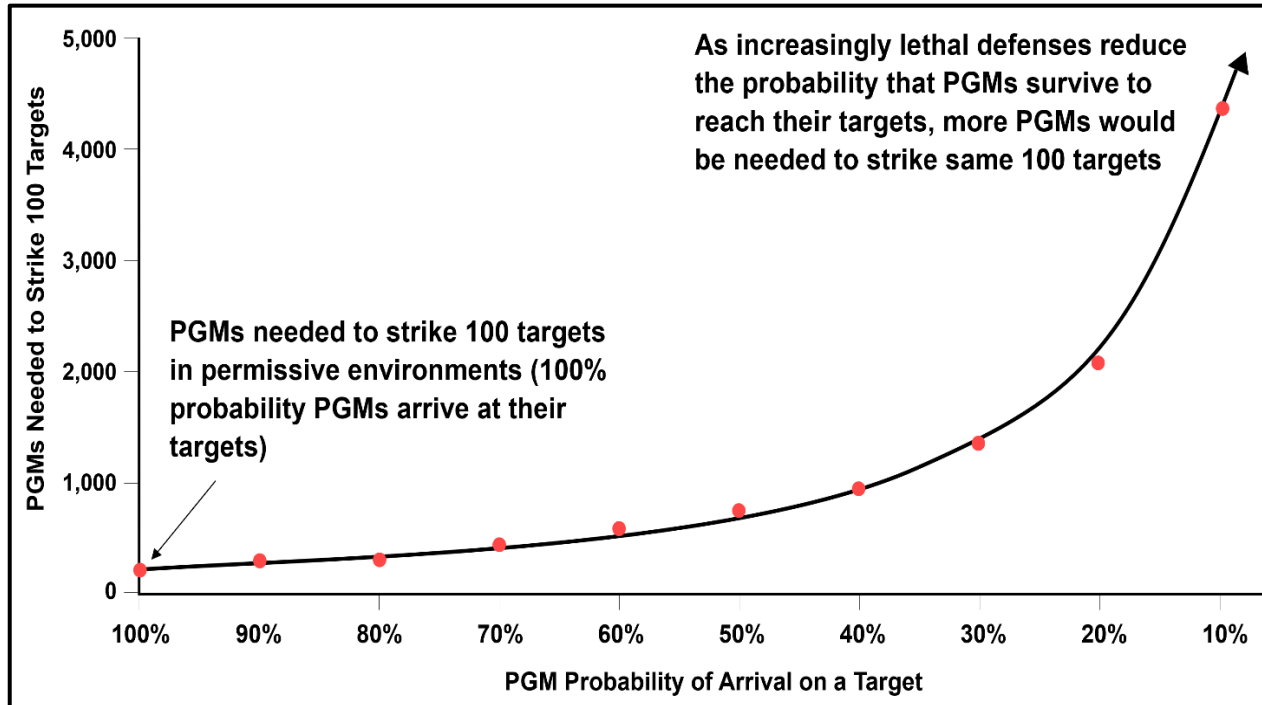


- **Size counts:** Smaller sizes of mid-range weapons would help maximize targets per sortie: increasing aimpoints attacked over short periods of time can be decisive
- **Cost per target also counts:** Lower costs increase the USAF's ability to procure PGMs at scale needed for peer conflict



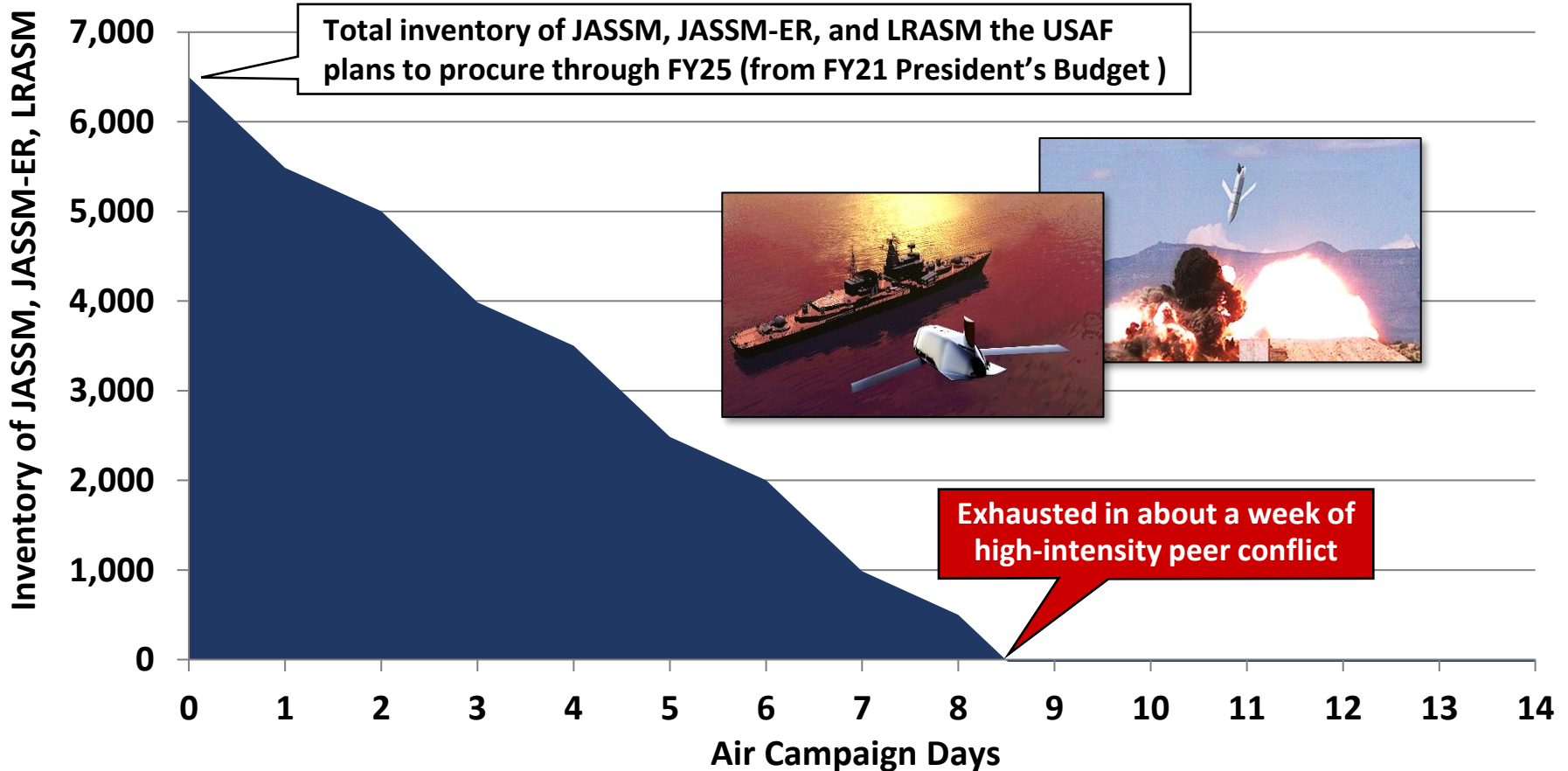
# Another reason why a 5<sup>th</sup> gen force needs 5<sup>th</sup> gen weapons

- **Advanced IADS are increasingly capable against the Air Force's legacy weapons as well as its 4<sup>th</sup> gen combat aircraft—this can grow weapon and sortie requirements**
  - The Air Force's acutely diminished size and insufficient budget means it cannot shift from many targets per sortie back to many sorties per target
- **A better choice: Design mid-range PGMs to survive in contested environments, which will help maximize targets per sortie and the USAF's bang for the buck**





# The USAF's PGM inventory also lacks capacity for a major conflict with China or Russia



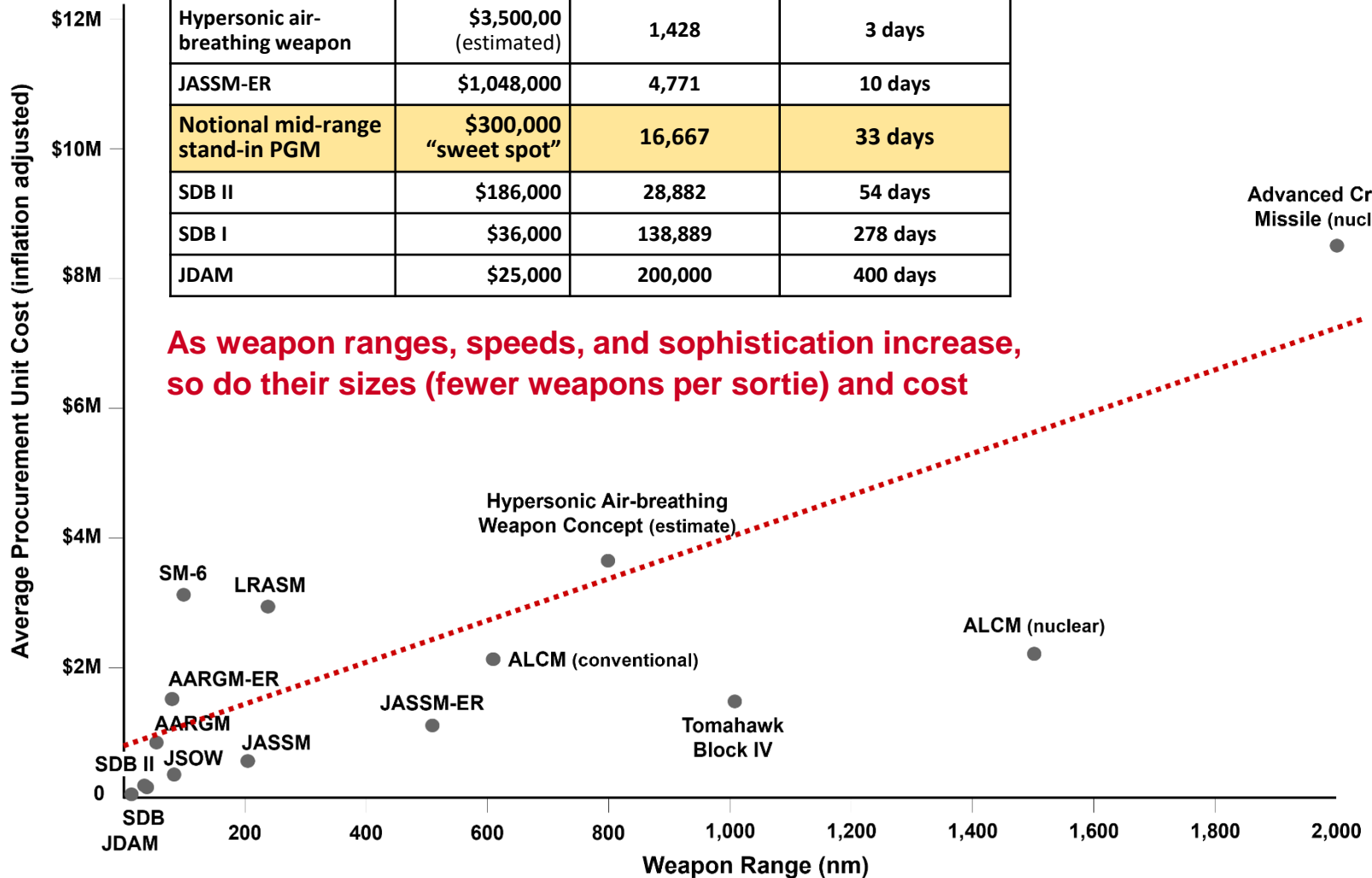
- DOD has chronically underfunded its PGM requirements – risk was acceptable in the past, but not in an era of renewed great power competition and conflict
- Higher cost of long-range and very long-range PGMs is a critical factor





# Must seek the right balance between PGM ranges, speeds, survivability, and weapons per sortie

Weapon	Unit Cost	Number \$5 billion could buy	Assuming launch 500/day
Hypersonic air-breathing weapon	\$3,500,00 (estimated)	1,428	3 days
JASSM-ER	\$1,048,000	4,771	10 days
Notional mid-range stand-in PGM	\$300,000 "sweet spot"	16,667	33 days
SDB II	\$186,000	28,882	54 days
SDB I	\$36,000	138,889	278 days
JDAM	\$25,000	200,000	400 days





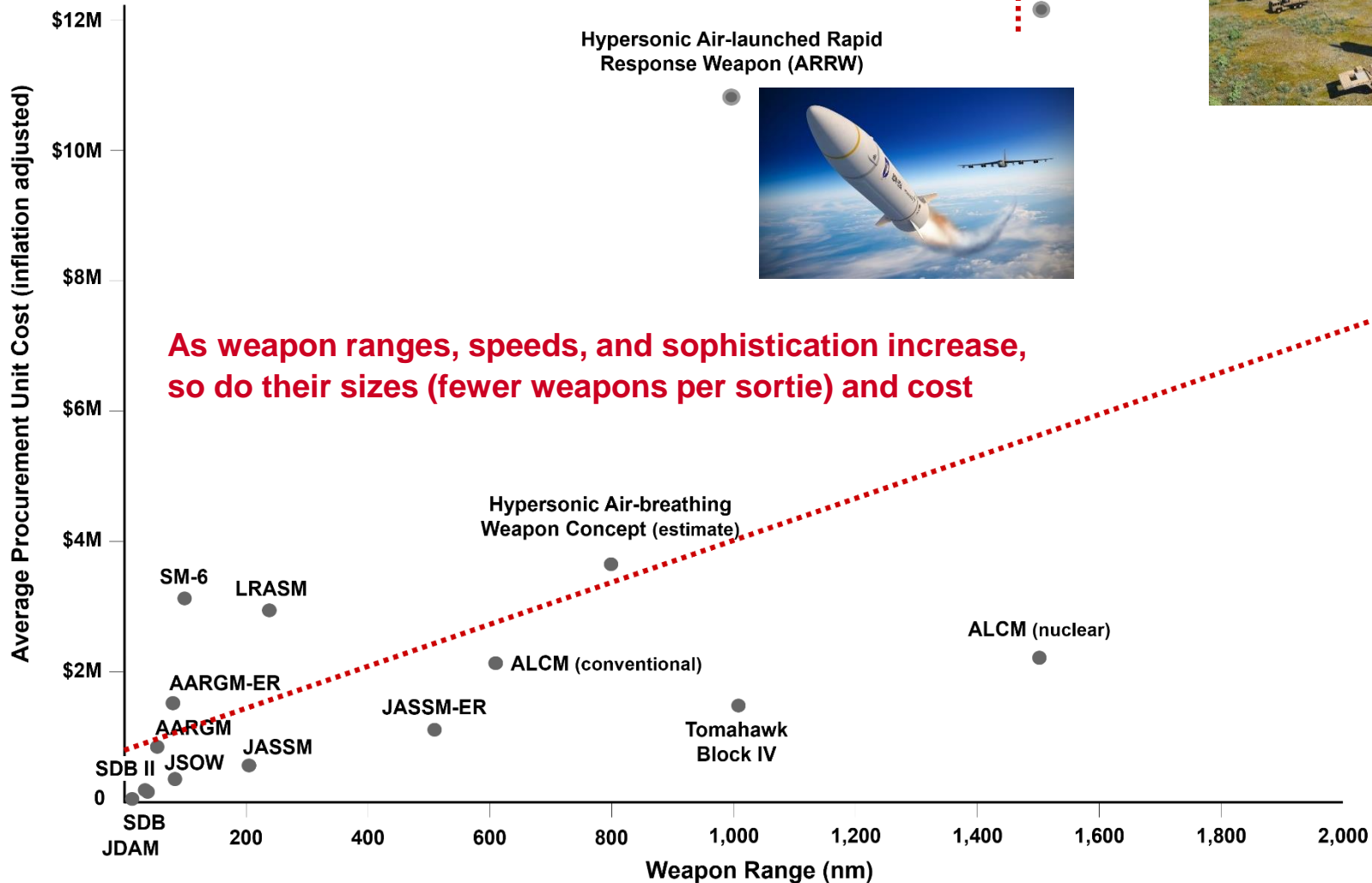
# Must seek the right balance between PGM ranges, speeds, survivability, and weapons per sortie

**Inventories of very long-range hypersonic weapons may be small (“silver bullets”)**

Ground-launched Long Range Hypersonic Weapon \$40M (est.)



Hypersonic Air-launched Rapid Response Weapon (ARRW)



**As weapon ranges, speeds, and sophistication increase, so do their sizes (fewer weapons per sortie) and cost**



**“The Air Force will require a mix of affordable, cutting-edge air-to-air and air-to-ground kinetic and non-kinetic weapons to defeat rapidly evolving peer competitors”** HQ USAF, 2021



- 1. Maximize the Air Force’s 5<sup>th</sup> gen advantage**
- 2. Fill the gap between long-range stand-off weapons and short-range direct attack weapons**
- 3. Increase PGM survivability to reduce sortie and weapon requirements**
- 3. Increase lethality against challenging targets (mobile, relocatable, hardened, or deeply buried)**
- 4. Maximize the Air Force’s bang for the buck**

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