

MITCHELL INSTITUTE
for Aerospace Studies



Future Long-Range Strike:

**Resetting the Balance of
Stand-in and Stand-off Forces**

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and Capability Assessments**



Overview

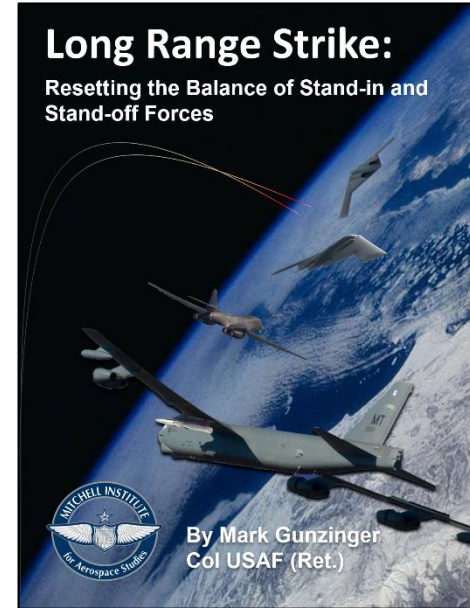
- **What's the issue?**

- Understanding stand-off and stand-in (penetrating) strike capabilities
- The diminished U.S. bomber force
- An unbalanced force mix

- **Factors that should shape the future force balance**

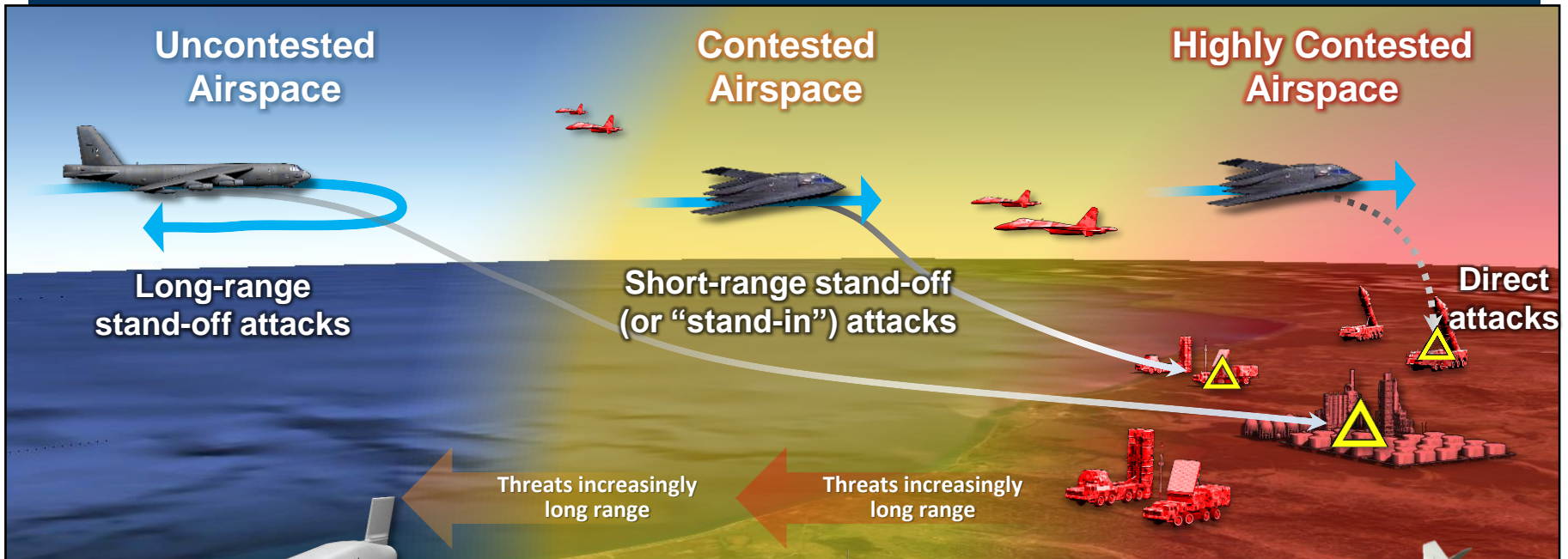
- Stand-off ranges for non-stealth strike platforms
- Weapon effectiveness against mobile/relocatable, hardened/deeply buried targets
- Weapons cost and cost-per-effect



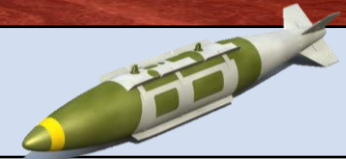
- **An arsenal plane: quick and cheap?**





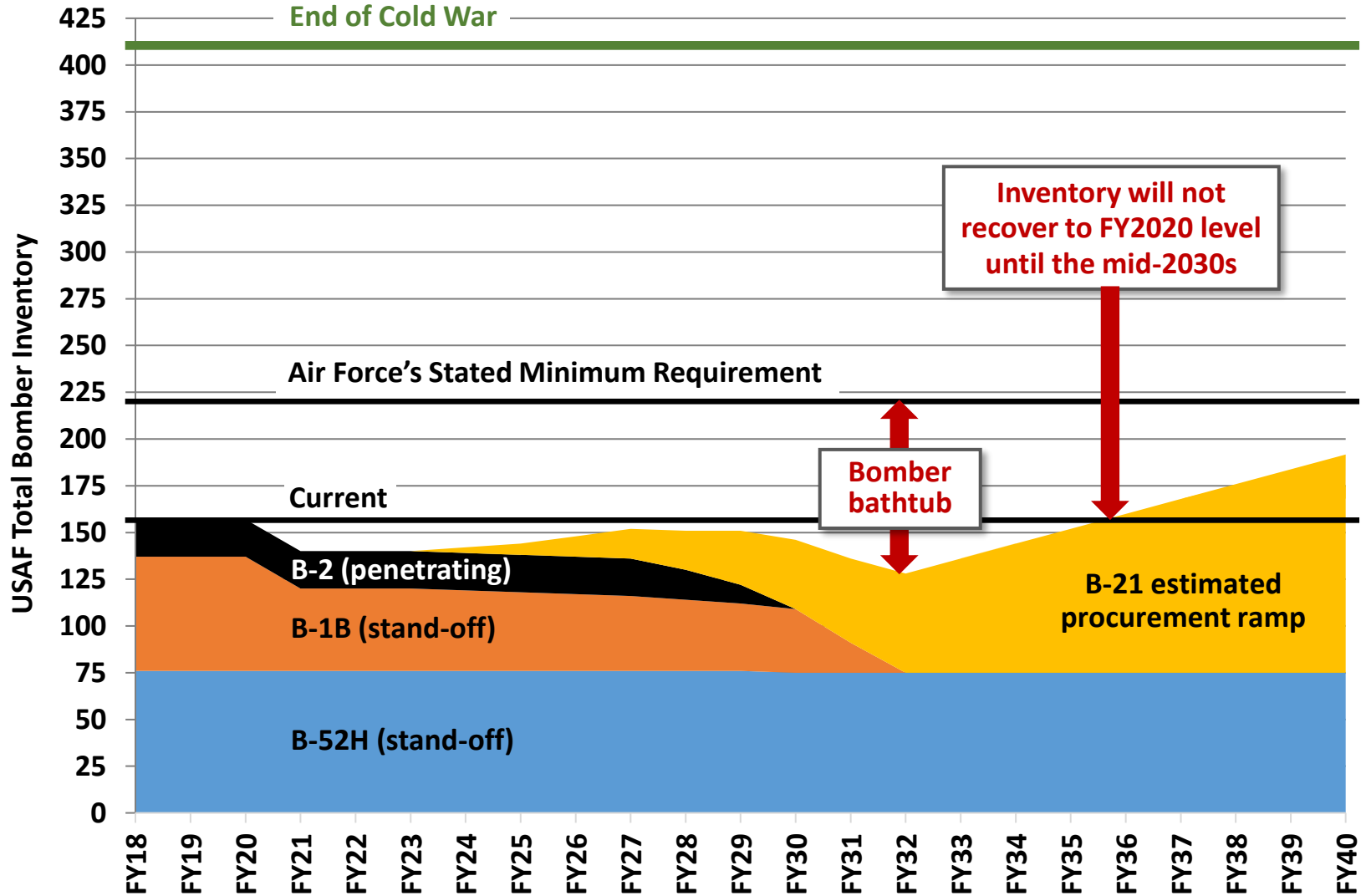
Describing “stand-off” and “stand-in”



		
<p>Long-Range Stand-off Weapons</p>	<p>Short-Range Stand-off Weapons</p>	<p>Direct Attack Weapons</p>
<p>Tomahawk cruise missile, JASSM-ER, etc.</p>	<p>SDB II, Joint Standoff Weapon, etc.</p>	<p>JDAMs, Quickstrike mines, etc.</p>
<ul style="list-style-type: none"> • Ranges more than 400 nm • Typically powered to extend range • Enable attacks by non-stealth aircraft from outside contested areas 	<ul style="list-style-type: none"> • Ranges up to 400 nm • Winged/glide capable, may also be powered to extend range • Enables attacks from beyond the most lethal ranges of some point defenses 	<ul style="list-style-type: none"> • Ranges of single digit to low 10s of nm • Weapons are typically unpowered • Must be released close to targets

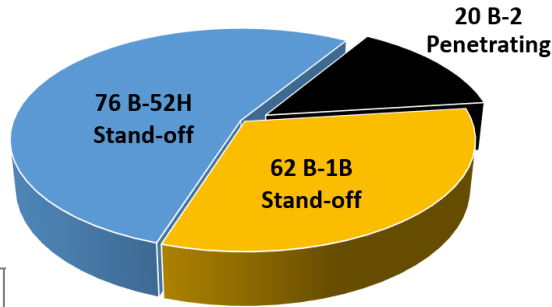


Today's bomber force is too small

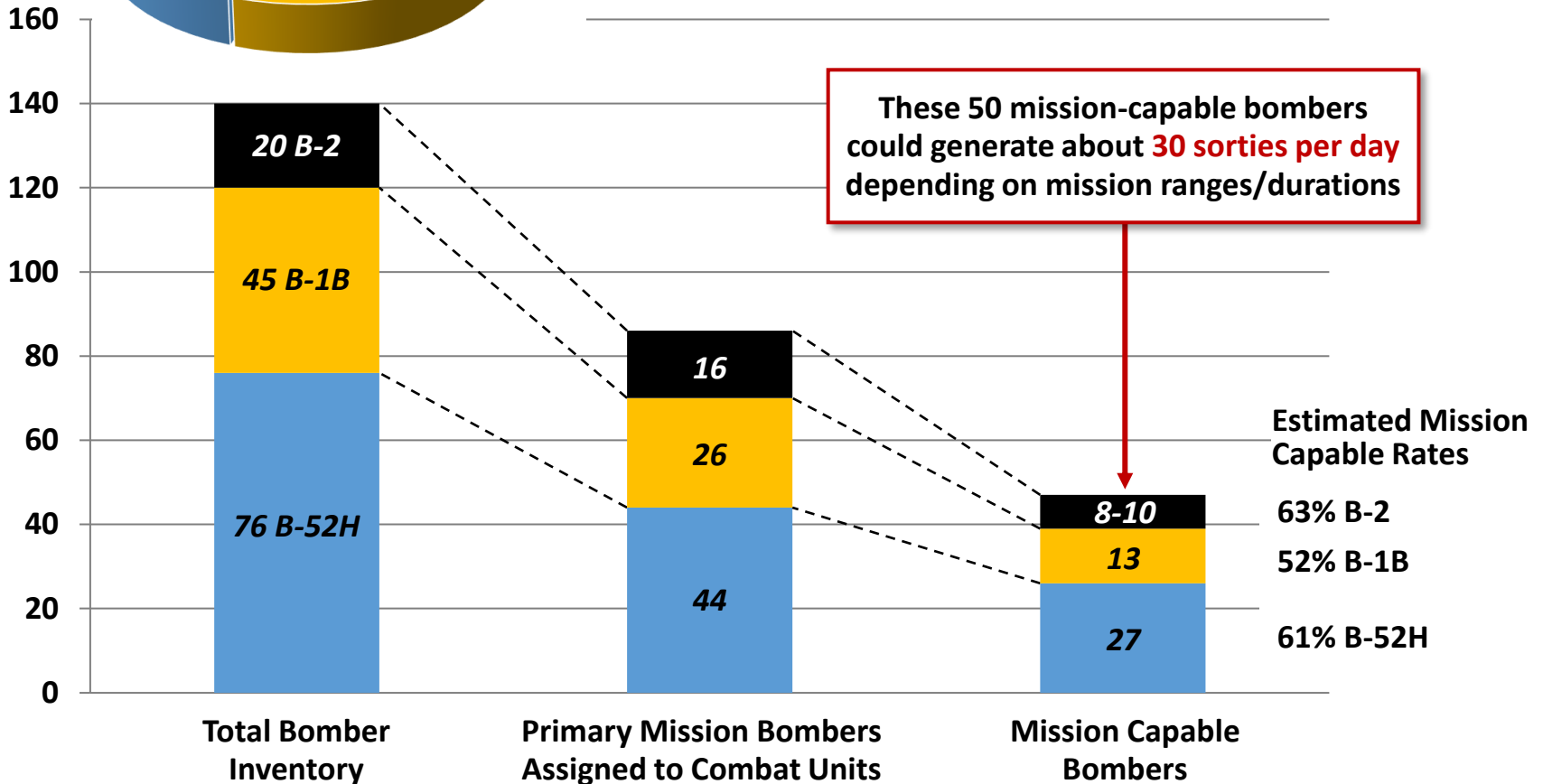




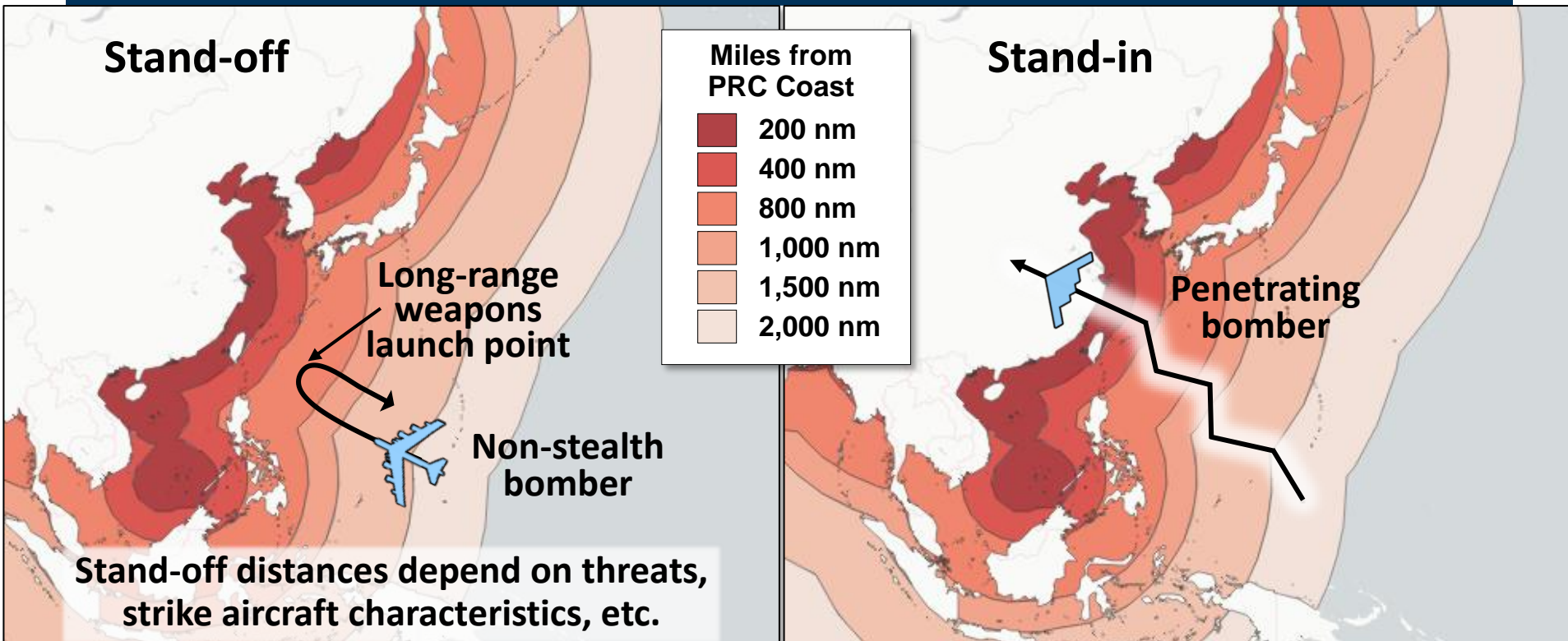
Bomber force lacks sufficient sortie capacity and is unbalanced



Inventory after 17 B-1Bs are retired in FY2021



Both have advantages and disadvantages



- Both can strike on night-one to achieve time-sensitive objectives
- Both increase survivability of the force
- Stand-off strike platforms must use long-range weapons
- Stand-in bombers can employ short-range/direct attack weapons

Create differences

Targets at risk

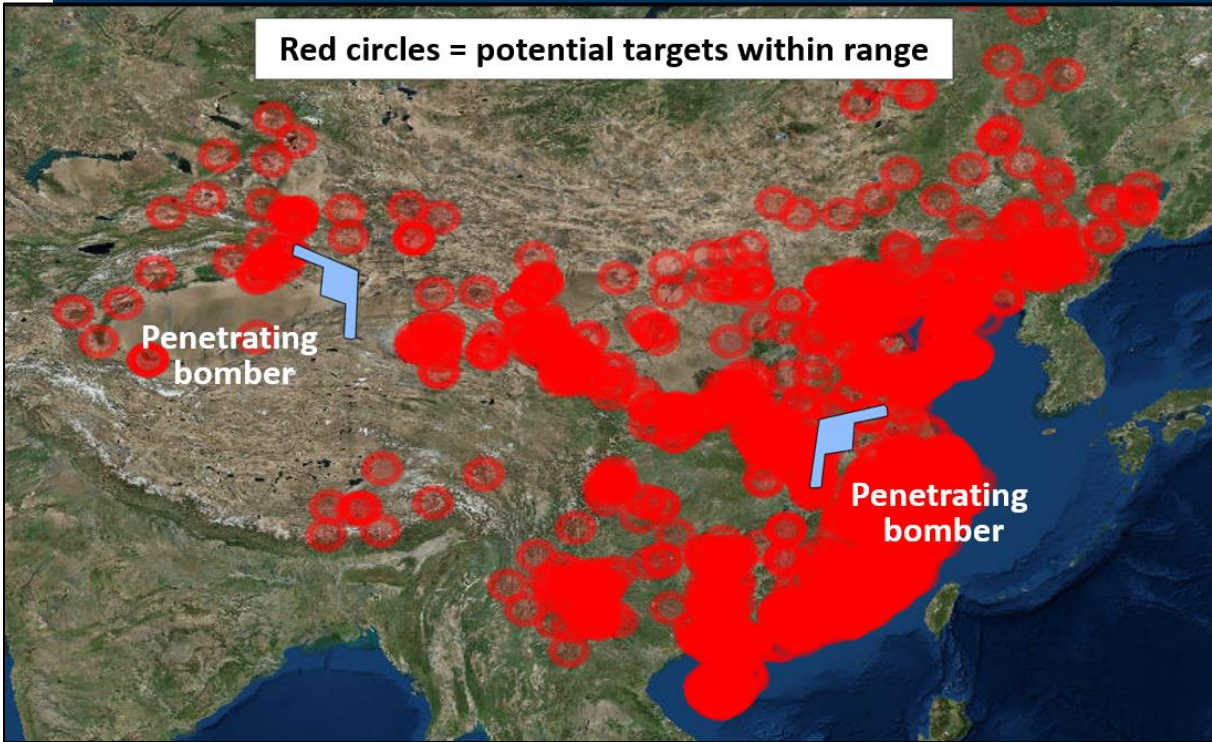
Effectiveness against challenging targets

Weapons size, sortie loadouts, and cost



Changing character of target sets must inform future force requirements

Red circles = potential targets within range

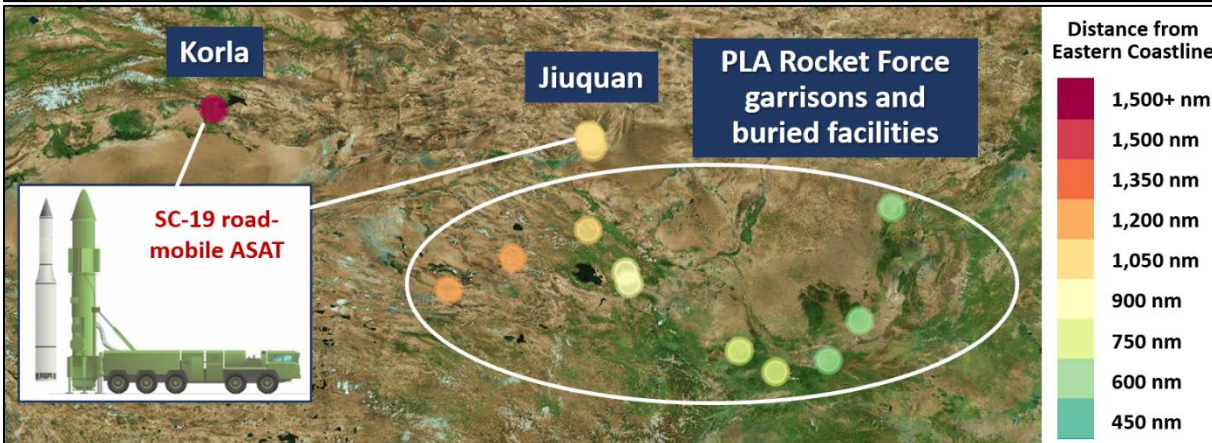


Target sets may be very different

- Far larger than post-Cold War target sets
- More distributed, greater depth of the battlespace
- Enemy countermeasures
Mobility, hardening/deeply burying, active & passive defenses effective against PGMs

Advantages of penetrating bombers

- Can reach all targets at using short-range/direct attack weapons
- Can attack from multiple aspects to complicate enemy defensive operations





Standoff ranges can affect number of targets that can be held at risk

Assume 550 nm bomber standoff

60% of aimpoints in range of JASSM-ER-like weapons

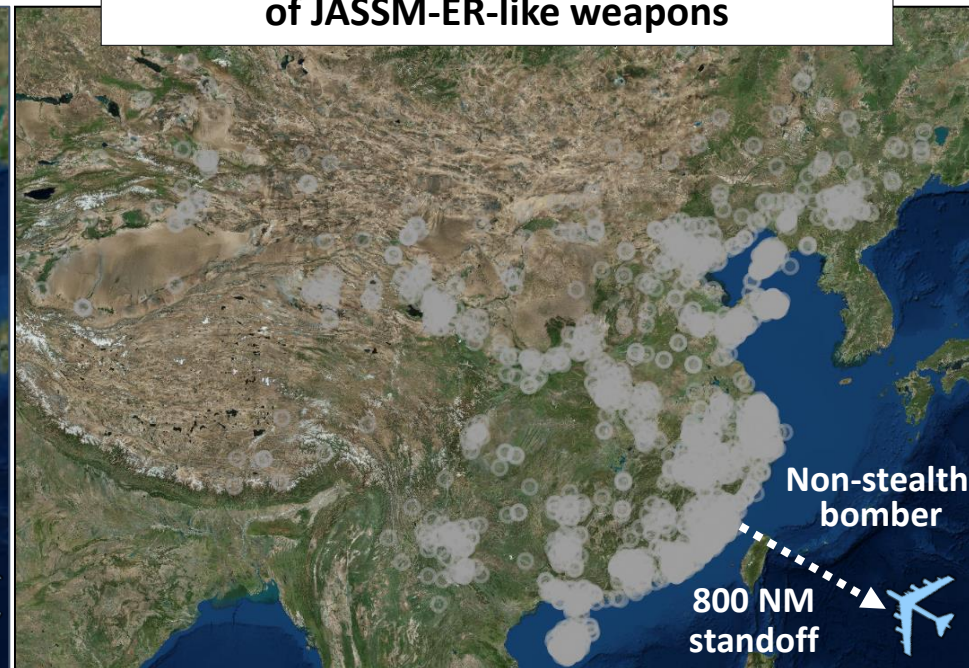


Potential targets not covered:

- Interior C2 nodes
- Ballistic missile sites, bomber bases
- Anti-satellite threats
- Military aerospace industry, etc.

Assume 800 nm bomber standoff

No aimpoints in range of JASSM-ER-like weapons



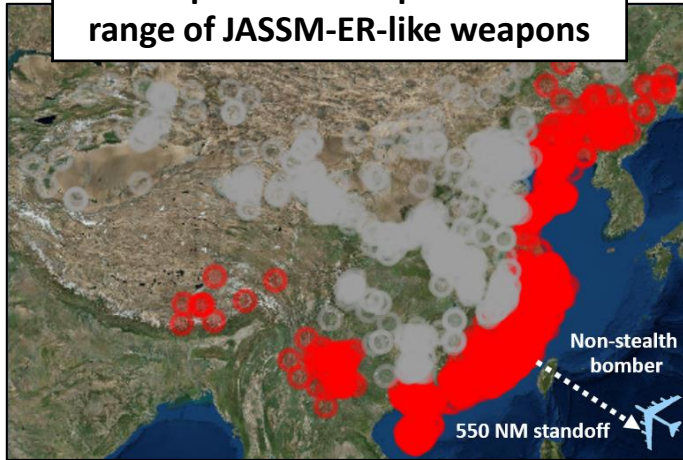
Longer range weapons would help but...

- Range can increase weapon size
- Larger weapons = fewer per sortie
- Can increase time to targets
- Can increase cost of weapons

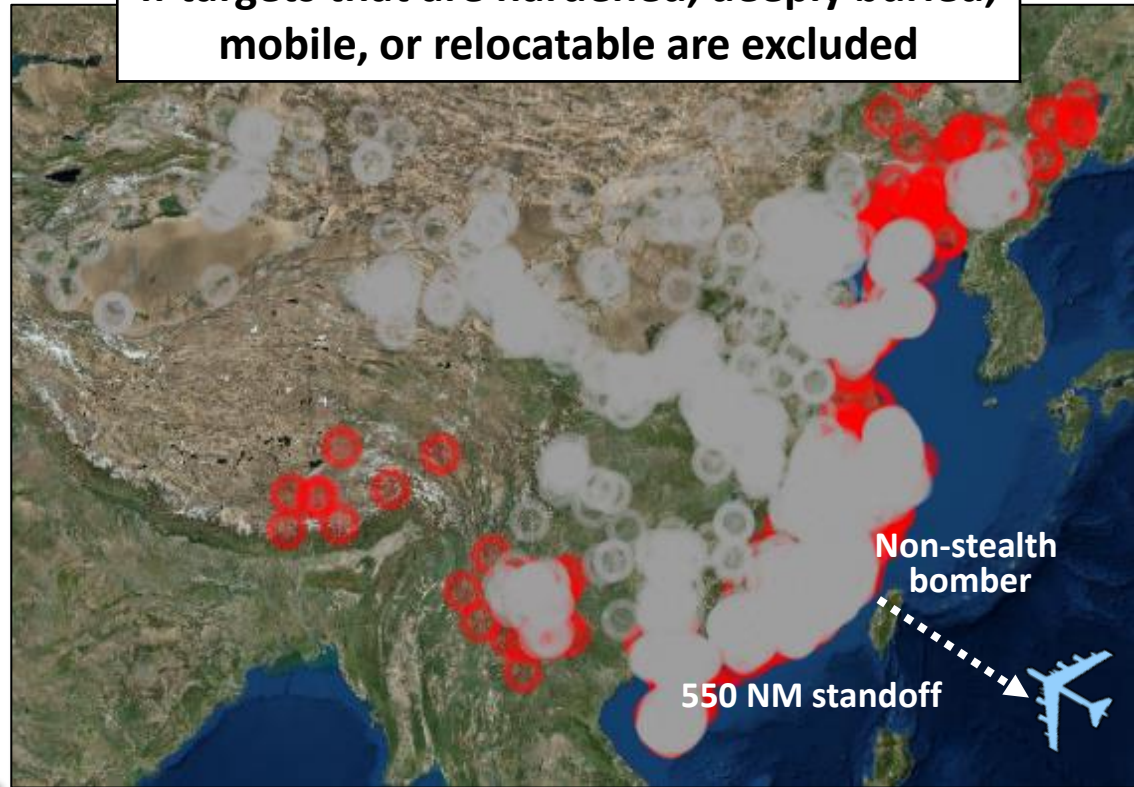


Enemy countermeasures can reduce effectiveness of long-range standoff strikes

60% of potential aimpoints within range of JASSM-ER-like weapons



If targets that are hardened, deeply buried, mobile, or relocatable are excluded



PLAAF underground hanger



Ballistic missile TEL



Mobile HQ-9 SAM

- Standoff weapons can't carry warheads large enough to kill very hard/deeply buried targets
- Kill chain latency can reduce long-range standoff weapon effectiveness against mobile/relocatable targets



Weapons delivered per sortie is another key to campaign success

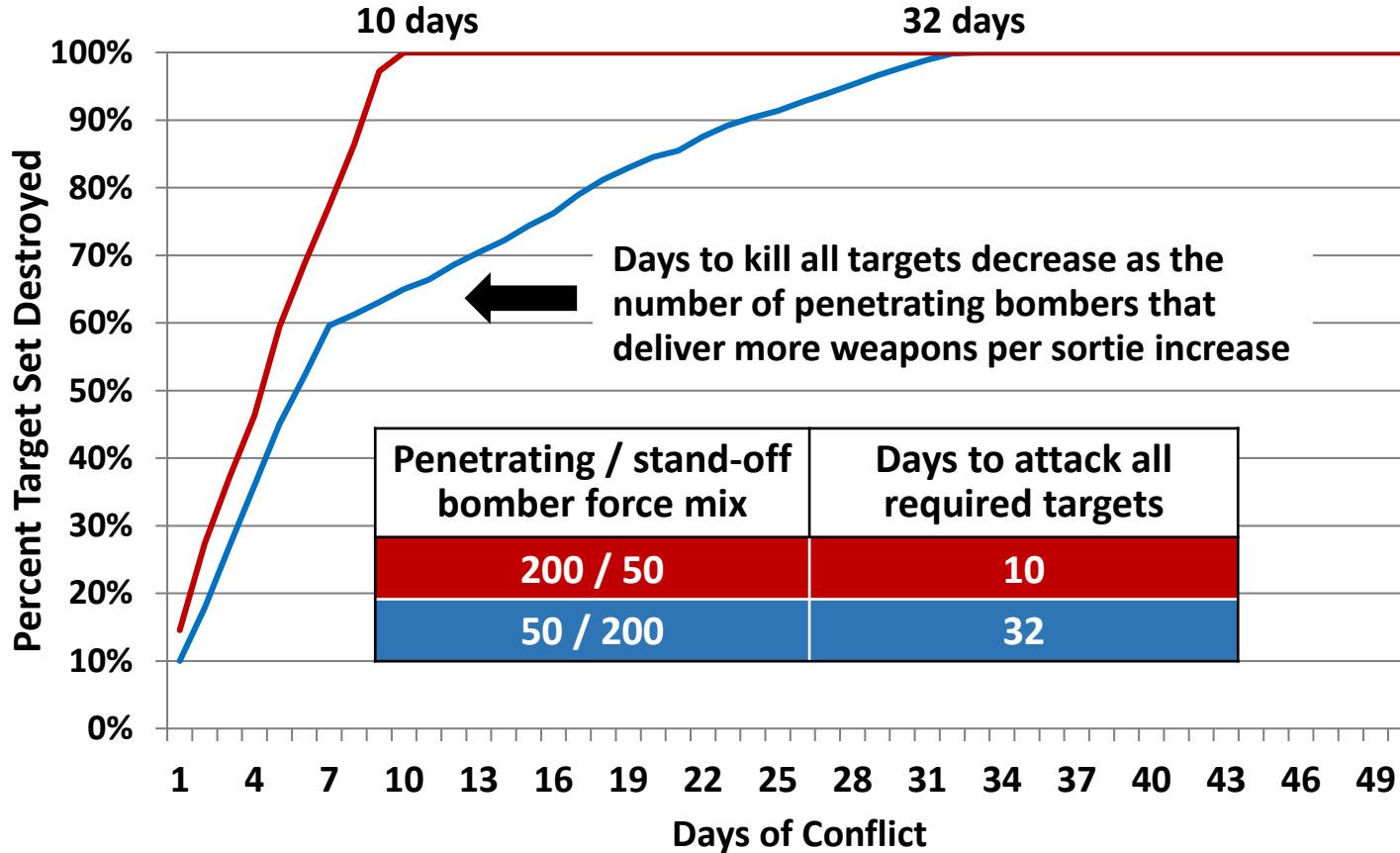
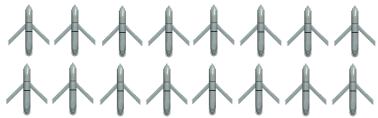


80 x 500-lb JDAMs



or

16 x larger JASSMs

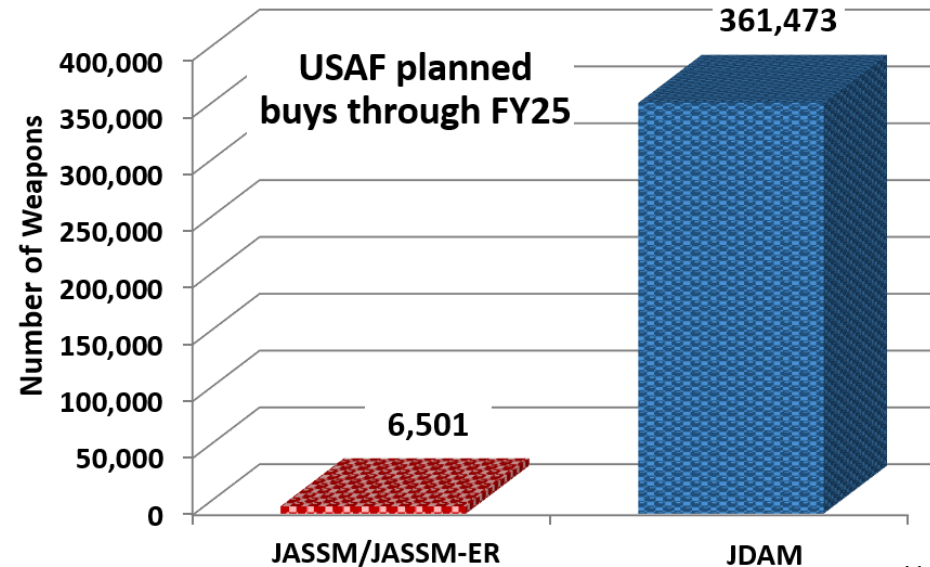
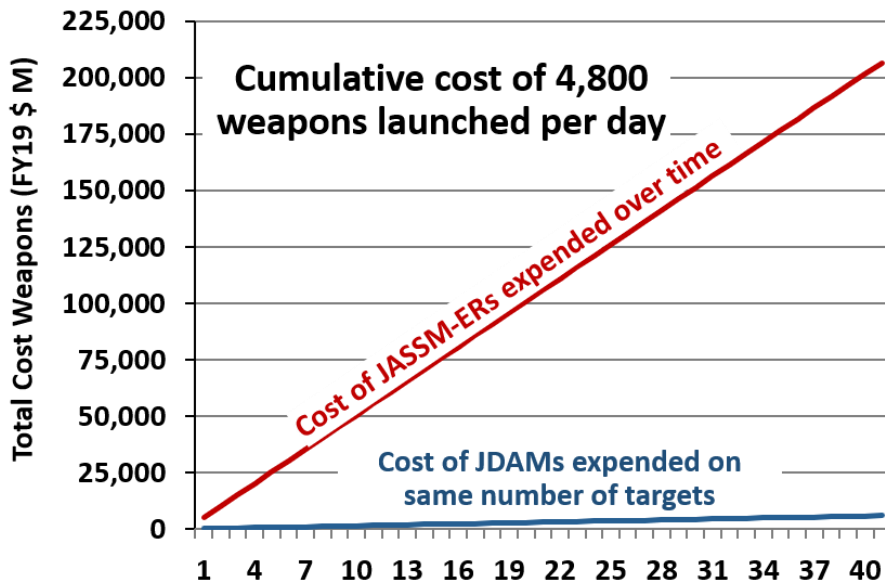
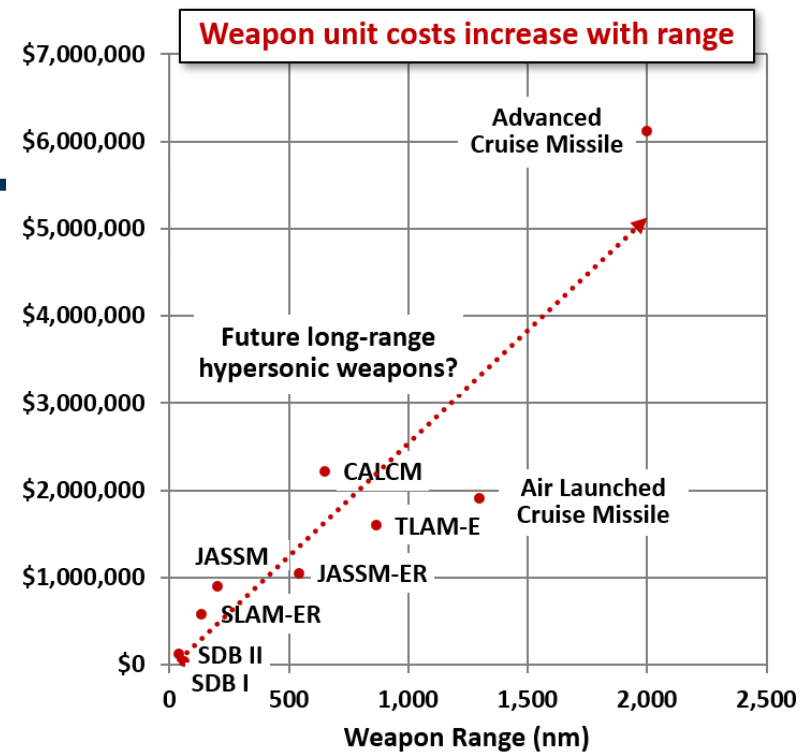


- The size of weapons generally increase with their range
- Increasing weapons size reduces weapons delivered per sortie (targets per sortie)
- Campaign success can hinge on maximizing weapons placed on targets in the shortest amount of time



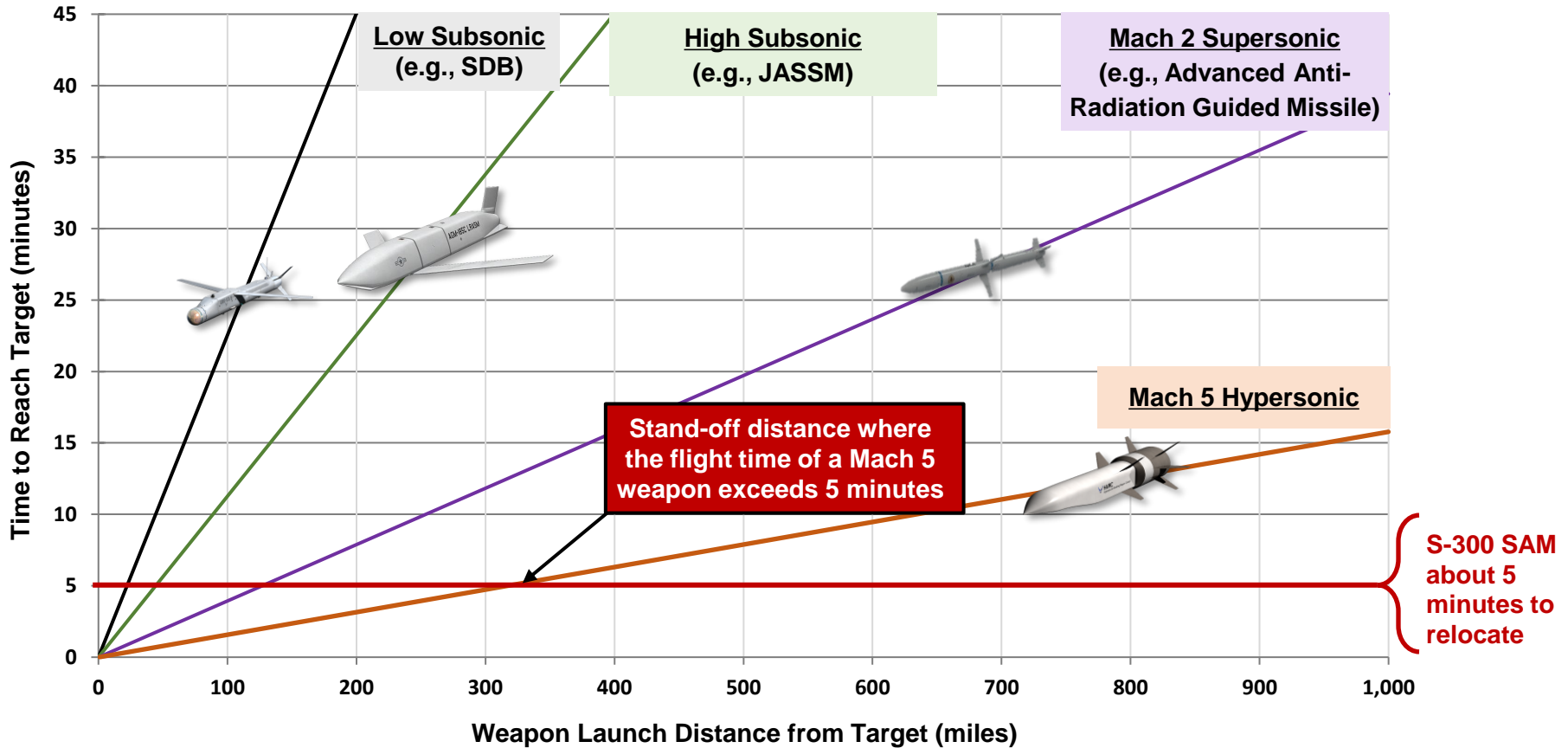
Weapons affordability also shapes the force mix

- Unit cost of weapons generally increase with their range and sophistication propulsion, (guidance systems, terminal seeker, data link, etc.)
- Weapons affordability is critical if the requirement is to “kill thousands of targets in tens of days”





Hypersonic weapons are needed...but kill chain latency will still be a challenge

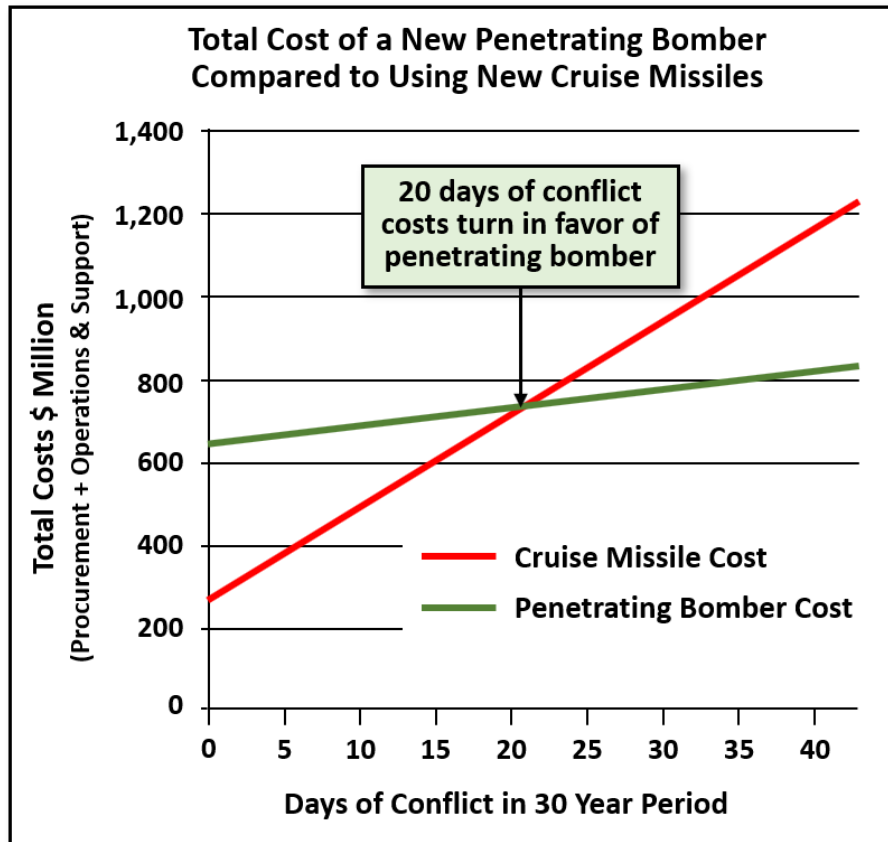




Arsenal plane: must also consider cost effectiveness from a campaign perspective

2010 RAND Project Air Force

Total Cost of a New Penetrating Bomber Compared to Using New Cruise Missiles



Cost of cruise missiles expended in operations can quickly exceed (20 days) cost of a reusable penetrator delivering cheaper short-range weapons

Real-world air campaigns:

- 1991 Operation Desert Storm = 43 days
- 1999 Operation Allied Force = 78 days
- 2003 Operation Iraqi Freedom = 42 days

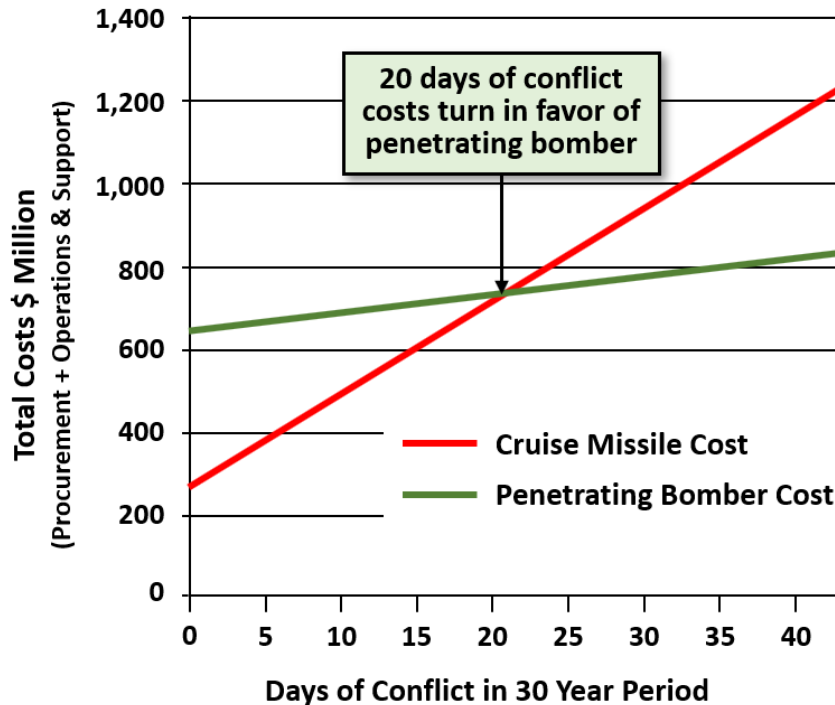
- RAND comparison didn't include cost of a new stand-off arsenal plane
- A "new-old" C-17 or commercial derivative arsenal plane could cost 400m-plus



Arsenal plane: must also consider cost effectiveness from a campaign perspective

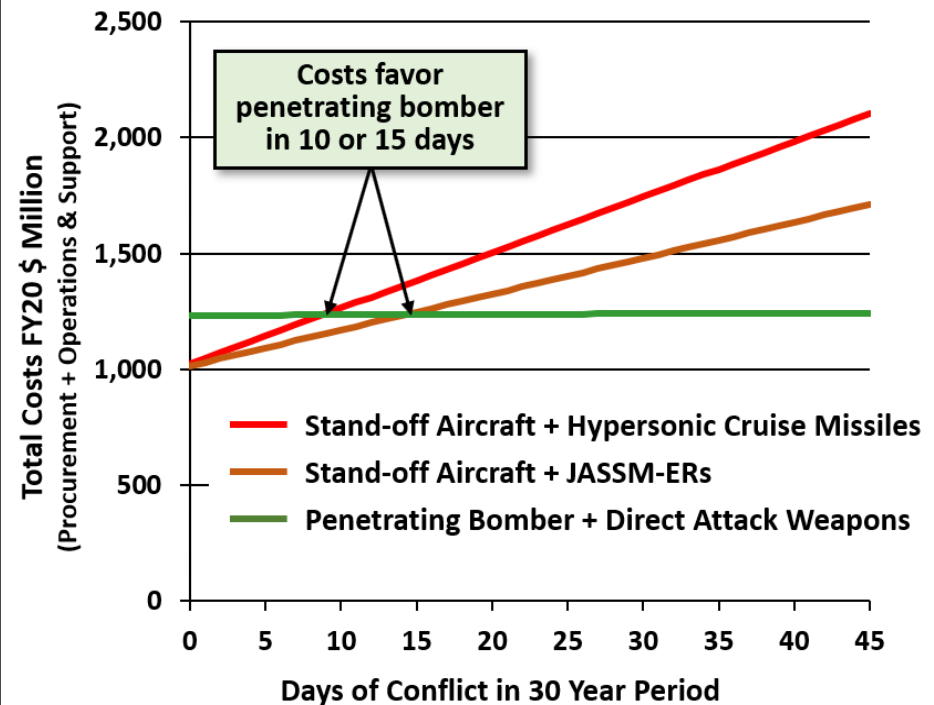
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2020 Mitchell Institute

Total Cost of a New Penetrating Bomber Compared to New Stand-off Aircraft Using Cruise Missiles



USAF new start aircraft programs average 5-6 years to first flight + 4-5 years to first delivery -- B-21s will be rolling off the line at scale before an arsenal plane is operational



Recommendations

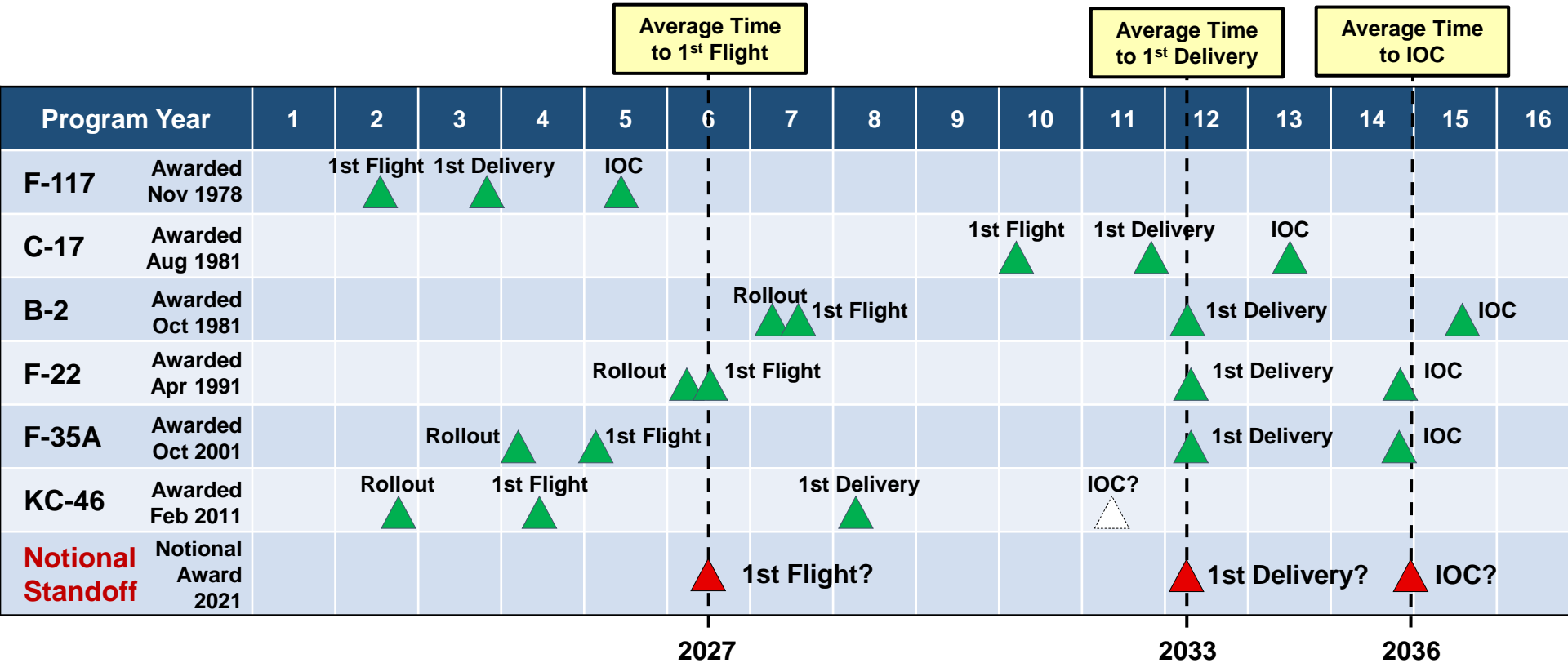
- **The USAF should increase its long-range strike capacity: a total force of at least 316 bombers (still less than the Cold War force)**
- **As it builds its bomber force the USAF should prioritize penetrating strike: at least 240 B-21 stealth bombers**
- **Hypersonic weapons are needed but will not be a panacea**
- **Allocating modified airlift aircraft to conduct strike missions does not make operational sense**
- **A new arsenal plane will not be a quicker/cheaper and could drain resources from penetrating strike programs**



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New arsenal plane availability?



- Average of 5-6 years to first flight , longer to first delivery of an operational aircraft
- B-21s will be rolling off the production line at scale before an arsenal plane is operational