Future Long-Range Strike:
Resetting the Balance of Stand-in and Stand-off Forces

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Overview

• What’s the issue?
  o Understanding stand-off and stand-in (penetrating) strike capabilities
  o The diminished U.S. bomber force
  o An unbalanced force mix

• Factors that should shape the future force balance
  o Stand-off ranges for non-stealth strike platforms
  o Weapon effectiveness against mobile/relocatable, hardened/deeply buried targets
  o Weapons cost and cost-per-effect

• An arsenal plane: quick and cheap?
Describing “stand-off” and “stand-in”

### Long-Range Stand-off Weapons
- Tomahawk cruise missile, JASSM-ER, etc.
  - Ranges more than 400 nm
  - Typically powered to extend range
  - Enable attacks by non-stealth aircraft from outside contested areas

### Short-Range Stand-off Weapons
- SDB II, Joint Standoff Weapon, etc.
  - 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

### Direct Attack Weapons
- JDAMs, Quickstrike mines, etc.
  - Ranges of single digit to low 10s of nm
  - Weapons are typically unpowered
  - Must be released close to targets

**Diagram Description:**
- **Uncontested Airspace**
  - Long-range stand-off attacks
  - Short-range stand-off (or “stand-in”) attacks
- **Contested Airspace**
  - Threats increasingly long range
- **Highly Contested Airspace**
  - Direct attacks
Today’s bomber force is too small

Current Air Force’s Stated Minimum Requirement

End of Cold War

Inventory will not recover to FY2020 level until the mid-2030s

Bomber bathtub

B-21 estimated procurement ramp
Bomber force lacks sufficient sortie capacity and is unbalanced

Inventory after 17 B-1Bs are retired in FY2021

These 50 mission-capable bombers could generate about 30 sorties per day depending on mission ranges/durations

- Estimated Mission Capable Rates
  - 63% B-2
  - 52% B-1B
  - 61% B-52H

- Total Bomber Inventory
  - 76 B-52H
  - 45 B-1B
  - 20 B-2

- Primary Mission Bombers Assigned to Combat Units
  - 44 B-1B
  - 26 B-2
  - 16

- Mission Capable Bombers
  - 44
  - 26
  - 16
  - 8-10
  - 13
  - 27
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

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

<table>
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<th>Assume 550 nm bomber standoff</th>
<th>Assume 800 nm bomber standoff</th>
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<td>60% of aimpoints in range of JASSM-ER-like weapons</td>
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Potential targets not covered:
- Interior C2 nodes
- Ballistic missile sites, bomber bases
- Anti-satellite threats
- Military aerospace industry, etc.

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

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

PLAAF underground hanger

Ballistic missile TEL

Mobile HQ-9 SAM
Weapons delivered per sortie is another key to campaign success.

- 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.

The diagram illustrates the relationship between weapon launch distance from the target and time to reach the target, categorizing weapons into Low Subsonic (e.g., SDB), High Subsonic (e.g., JASSM), Mach 2 Supersonic (e.g., Advanced Anti-Radiation Guided Missile), and Mach 5 Hypersonic. The chart highlights the stand-off distance where the flight time of a Mach 5 weapon exceeds 5 minutes. Additionally, it notes that S-300 SAMs can relocate about 5 minutes to the right on the chart, indicating their response time. The diagram visually represents the increase in flight time and distance for higher Mach numbers, emphasizing the need for rapid kill chain response.
Arsenal plane: must also consider cost effectiveness from a campaign perspective

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

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
### New arsenal plane availability?

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### Notes:

- **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**