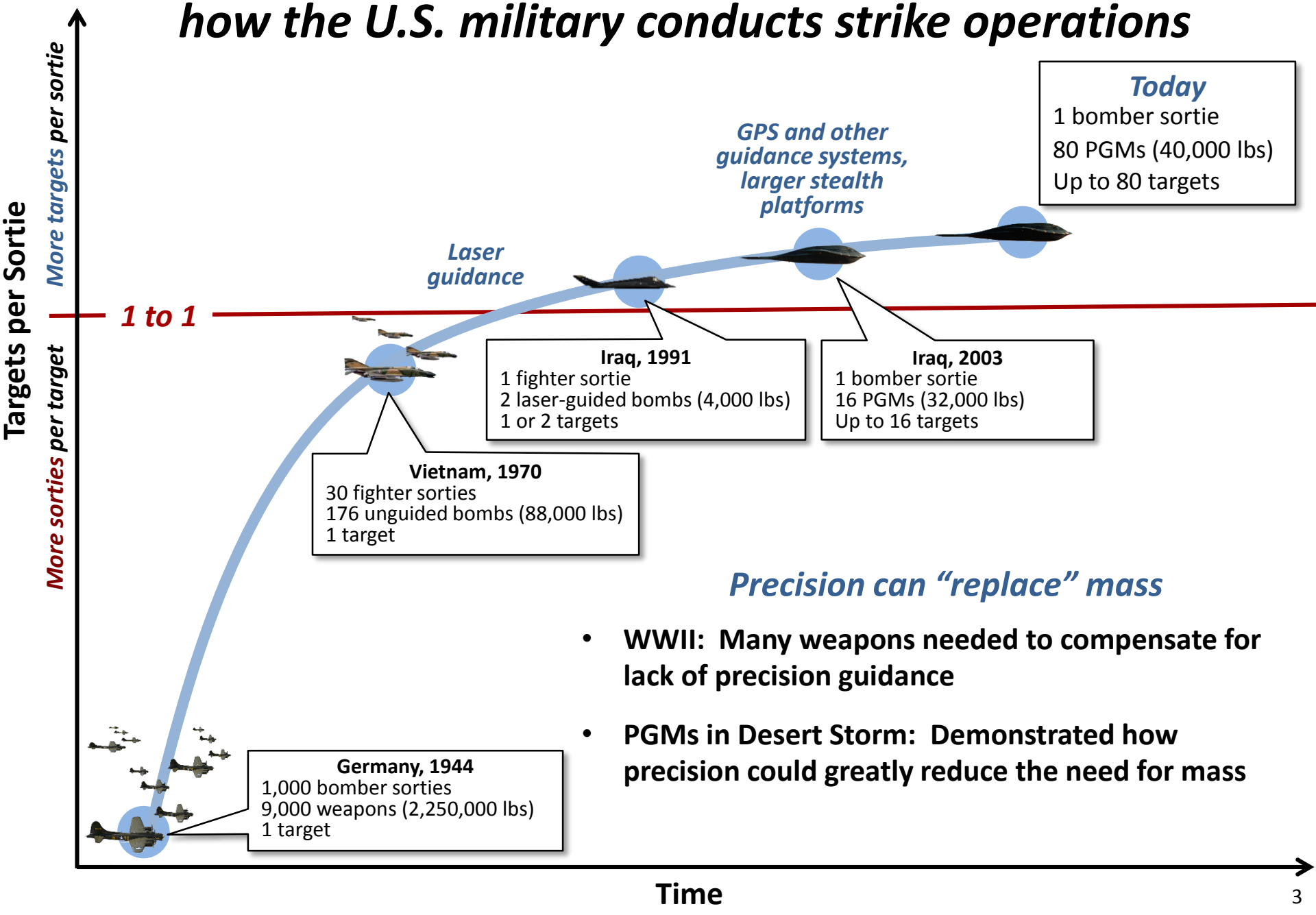
Maintaining the U.S. Military's Advantage in Precision Strike

Overview

- Background
- Emerging salvo competition
- Operational concepts and weapons technologies to sustain our precision strike advantage
- Recommendations

Background: Precision guidance changed how the U.S. military conducts strike operations



Precision can "replace" mass

- **WWII: Many weapons needed to compensate for lack of precision guidance**
- **PGMs in Desert Storm: Demonstrated how precision could greatly reduce the need for mass**

Some advantages of precision

Conflict	Unguided Bombs	Precision-Guided Munitions		
	Number Used	Total Number PGMs Used	% of Total Munitions Used	PGM Per Target Ratio
1991 Desert Storm	210,900	17,162	7.5	1.9 : 1
1999 Allied Force	2,334	3,590	60.6	2 : 1
2003 Iraqi Freedom (reported April 2003)	9,127	19,269	67.8	1.5 : 1

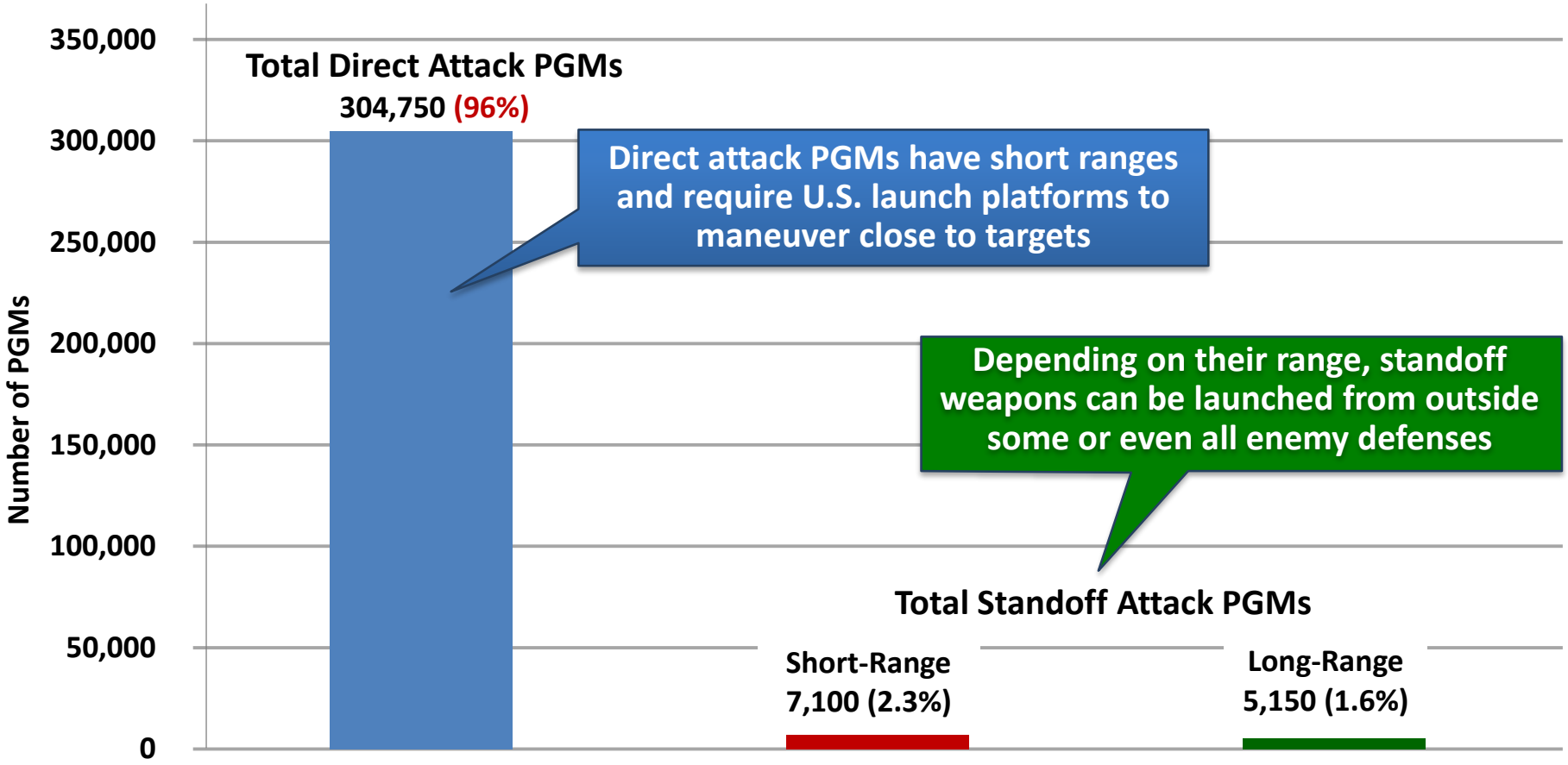
Creates advantages in time: Enables synchronized strikes 24/7 and in all weather conditions

Enables standoff strikes: Reduces risk to launch platforms operating in contested areas

Improves effectiveness against challenging targets: Moving, relocatable, hardened, buried

Has a force multiplying effect: More targets per platform; part of rationale for cutting force structure

PGMs procured by DoD since 2001



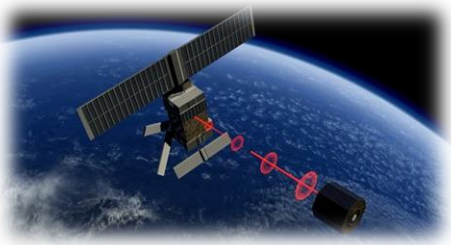
PGM procurement budget reflects assumption that U.S. strike forces will operate in permissive conditions

Problem: emerging countermeasures

- **Enemy active and passive defenses can reduce the probability that U.S. PGMs will arrive at their targets (reduce PGM "probability of arrival" or "PA")**
  - Active defenses include surface-to-air weapons capable of intercepting PGMs
  - Passive defenses include deception tactics that can result in strikes on false targets

Offensive Cyber Operations

Anti-Satellite Weapons



Surface-to-Air Missiles

High-fidelity decoys

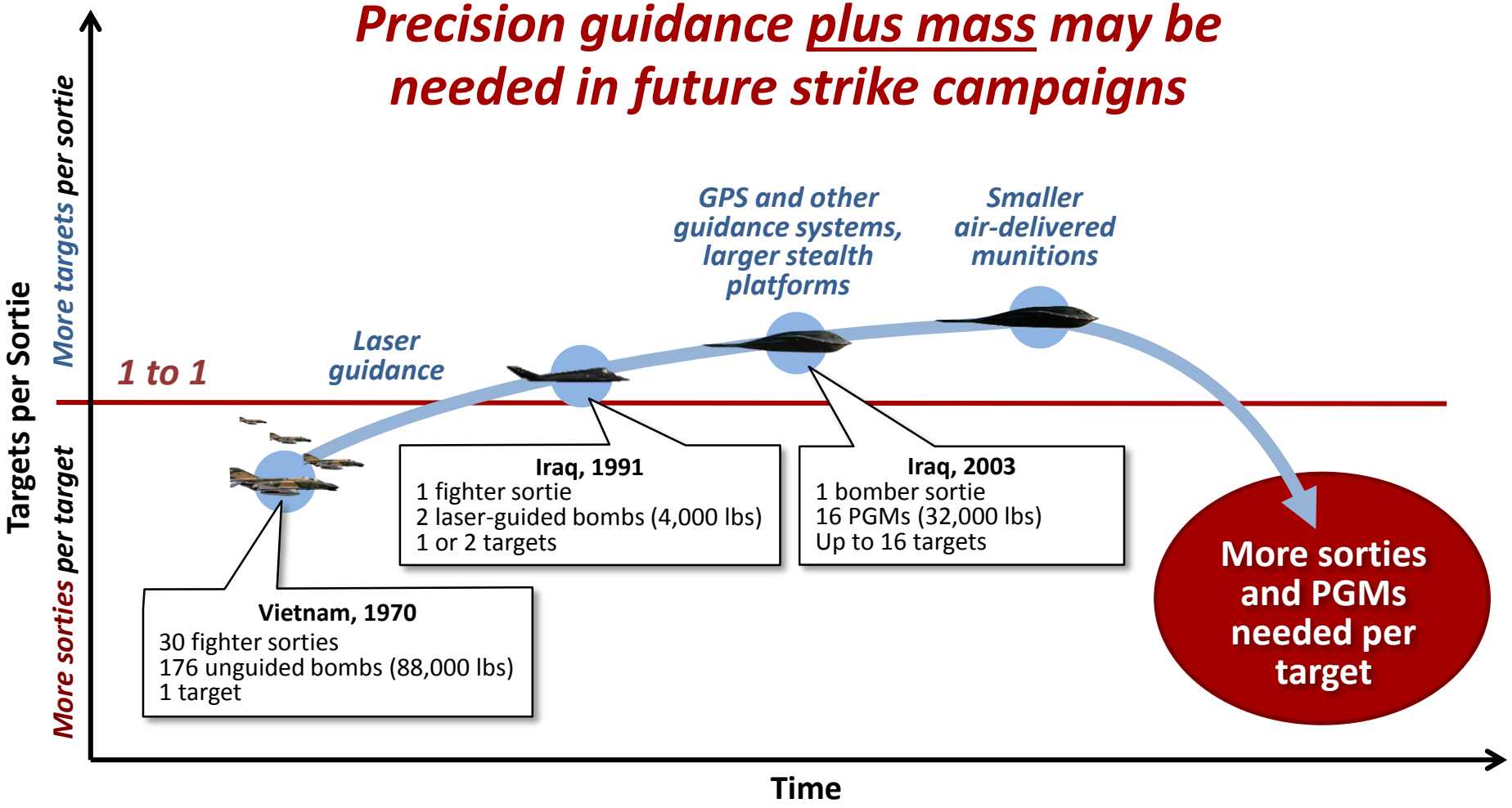
Electronic Warfare

Buried/Hardened Facilities

Capabilities to counter each element of the U.S. "F2T2EA" precision strike kill chain

A new operational reality?

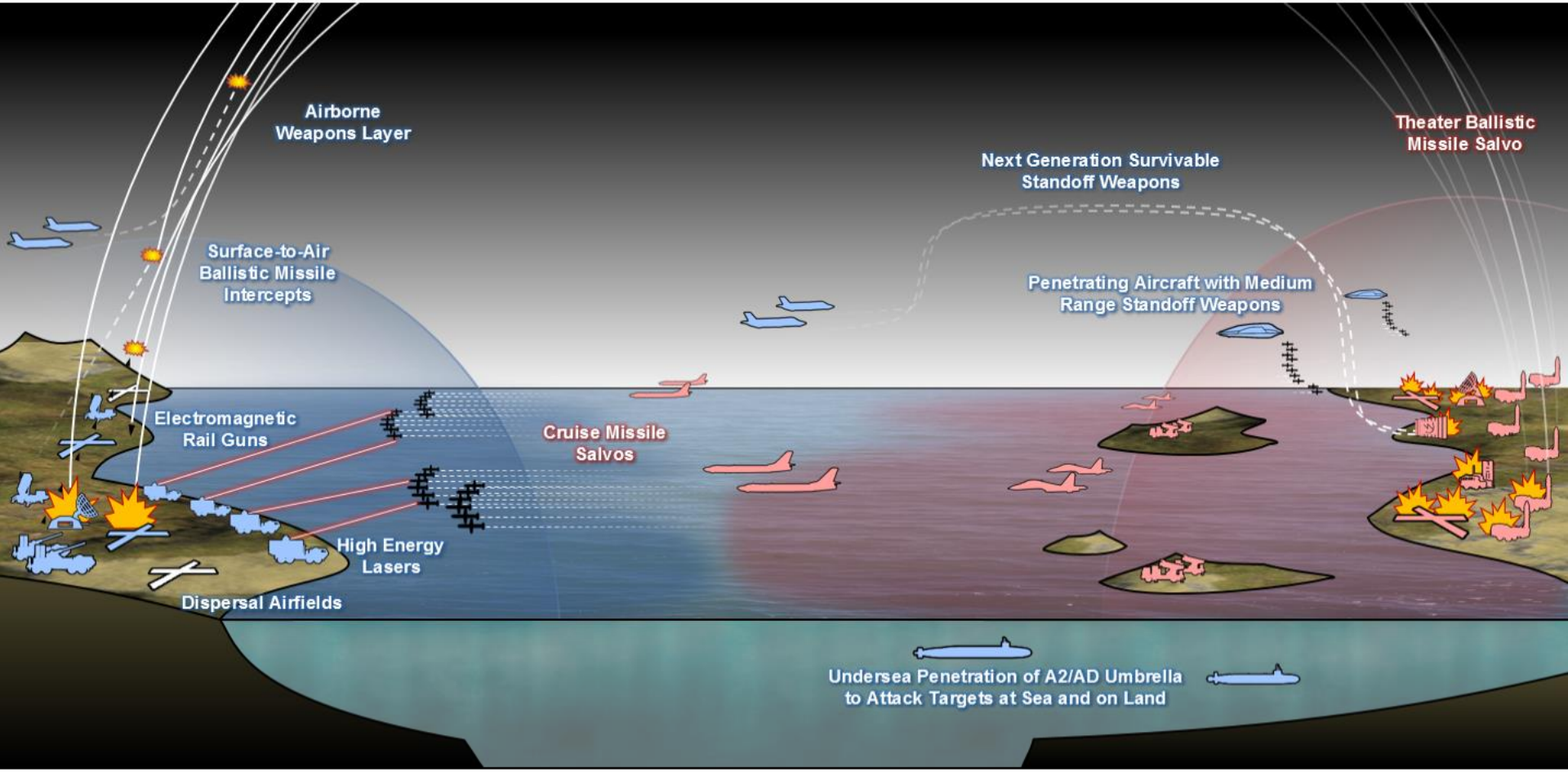
Precision guidance plus mass may be needed in future strike campaigns



One or two weapons per aimpoint no longer the rule for target sets protected by precision defenses and other active and passive countermeasures

CSBA Study used a "salvo competition" framework

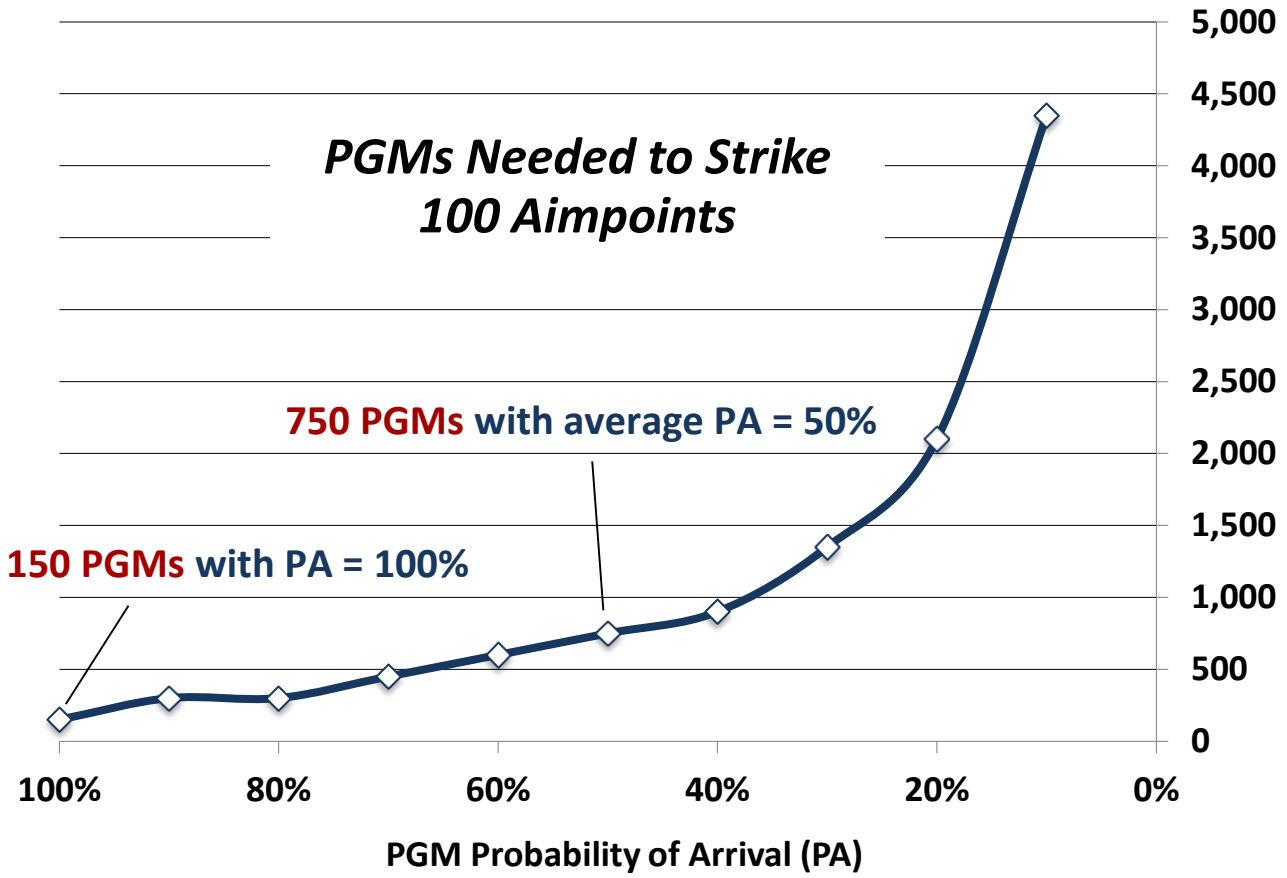
- **Salvo competition = the dynamic between opposing militaries that each have PGMs and effective defenses against precision strikes**



Both combatants seek advantages by increasing size or survivability of their strikes, and by increasing their defensive capacity and lethality

Illustrating impact of effective PGM defenses

- **DoD accustomed to PGM PA of nearly 100%**
- **Against enemies with capable defenses, PGM PA values likely to be far less**

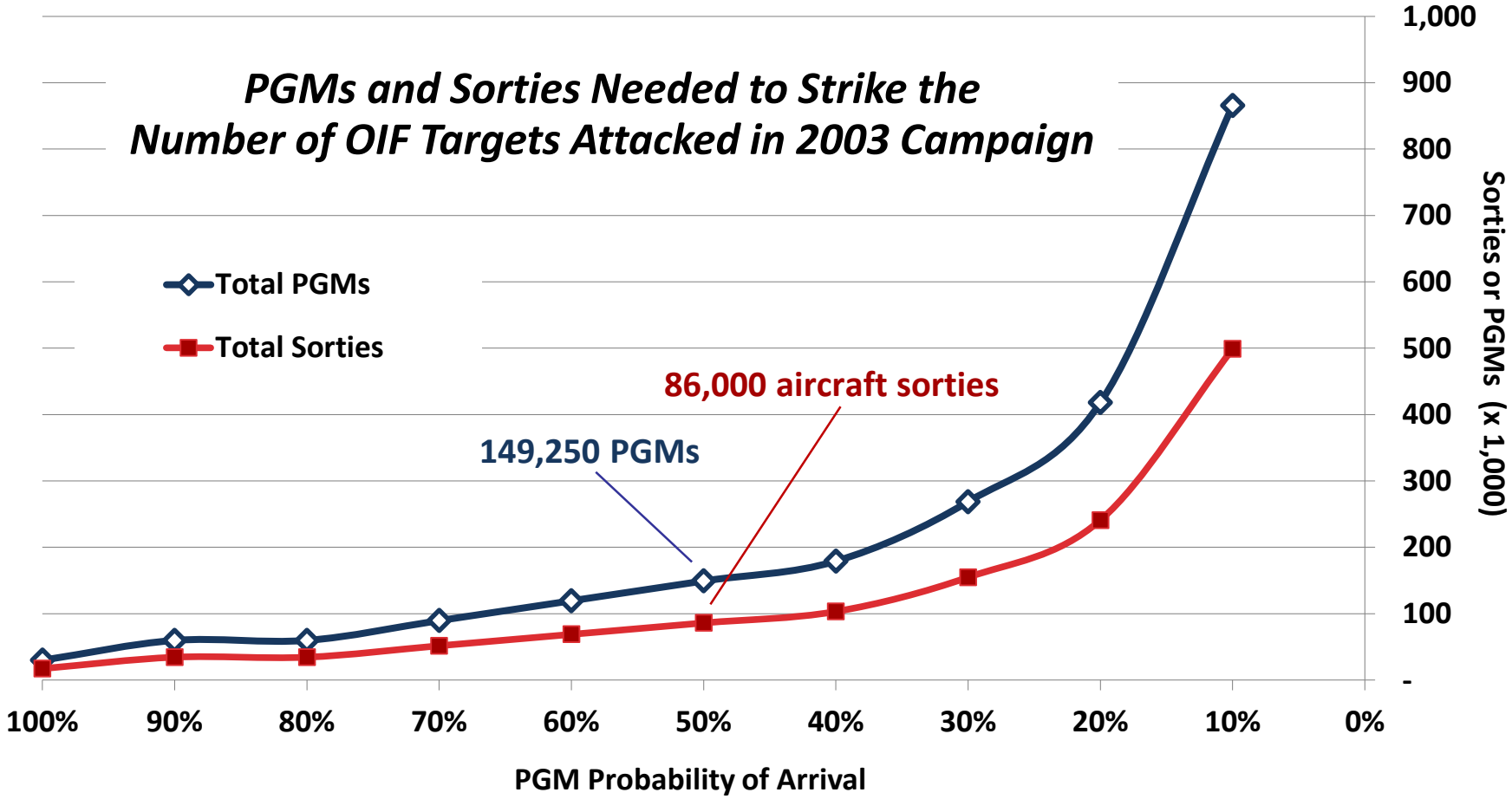


Probability of Damage (PD) is a measure of PGM effectiveness against various targets

Probability of Arrival, a subset of PD, is an estimate of the likelihood that PGMs will actually reach their targets once launched

Result of reduced PA: Need more PGMs and strike sorties to achieve desired results on target sets

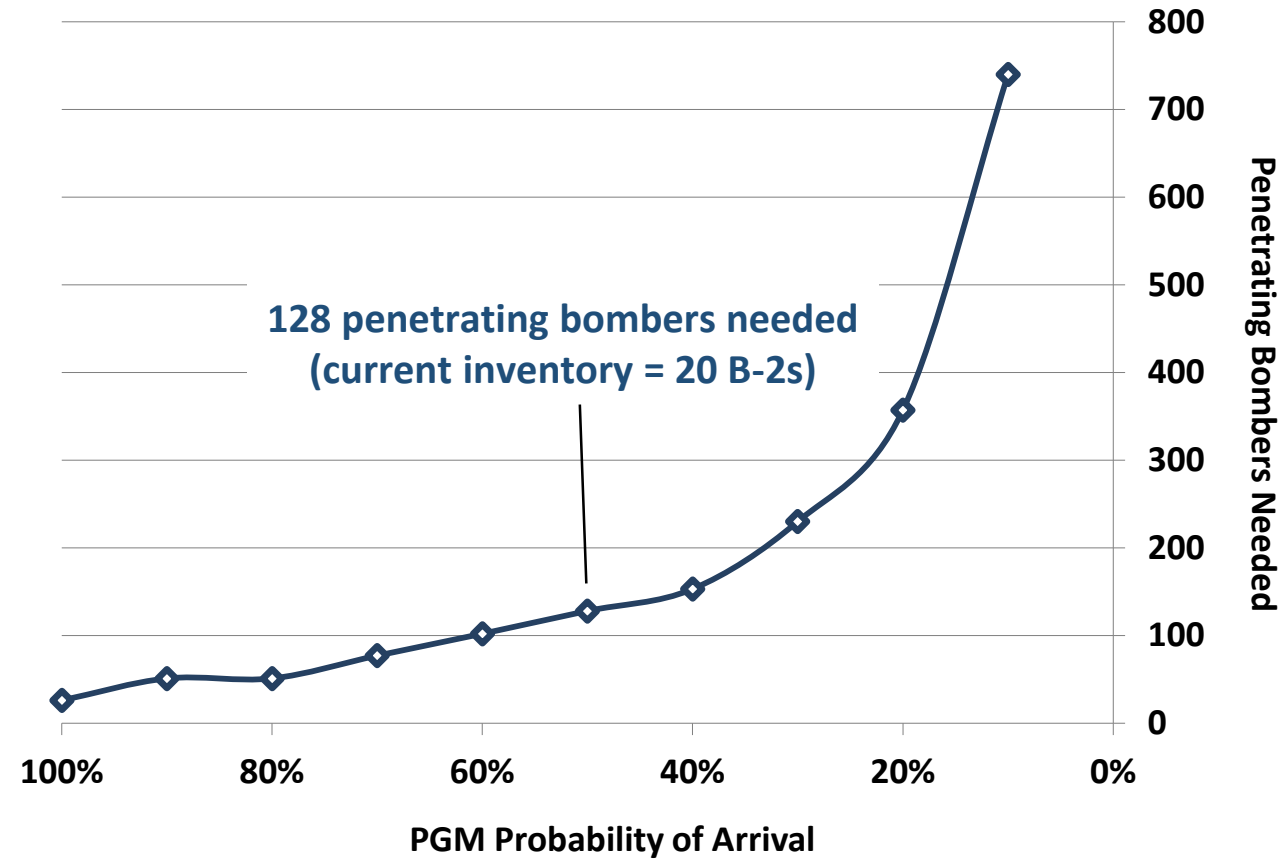
Campaign level example



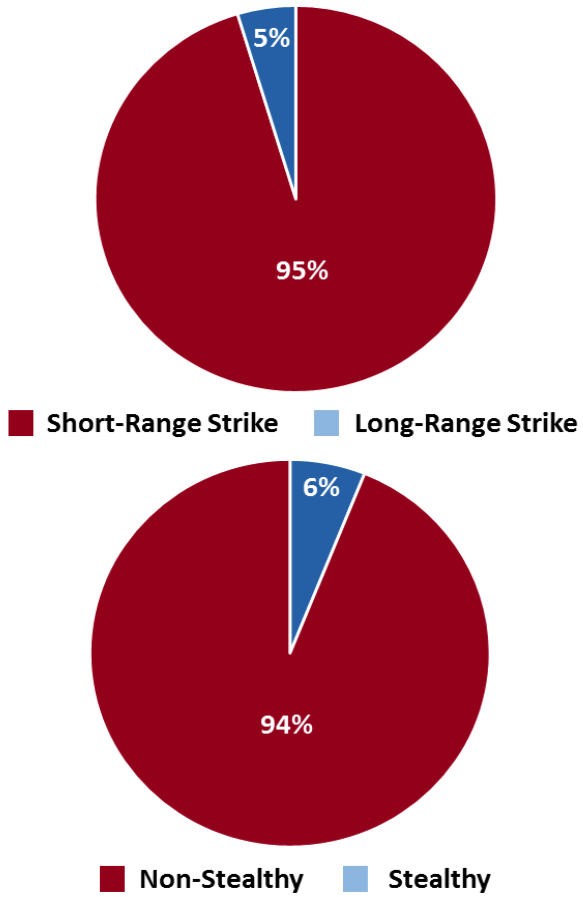
- 300,000 PGMs for two OIF-sized campaigns = about the total number of PGMs DoD bought from 2001 through 2014
- 86,000 strike sorties = 5 times the number flown during the 2003 OIF air campaign

Unlikely that current DoD strike forces could achieve needed precision + mass

Example: Penetrating Bombers Needed for a 30-Day Campaign Against Number of OIF Targets Attacked in 2003

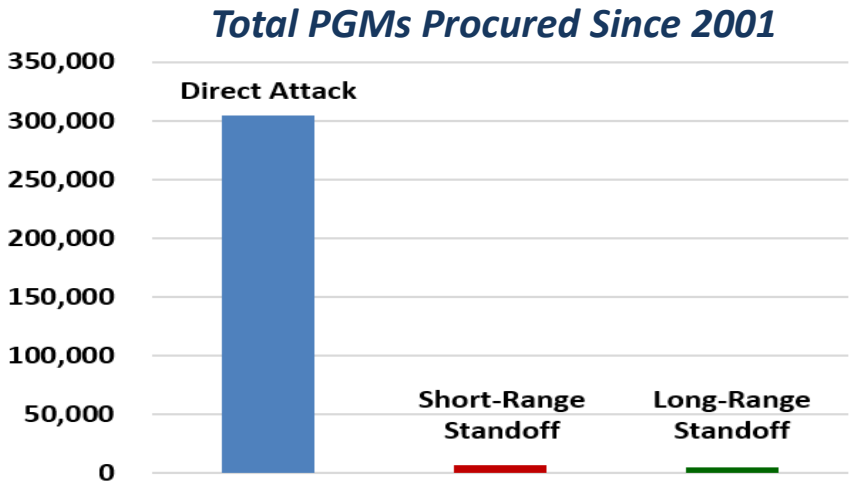


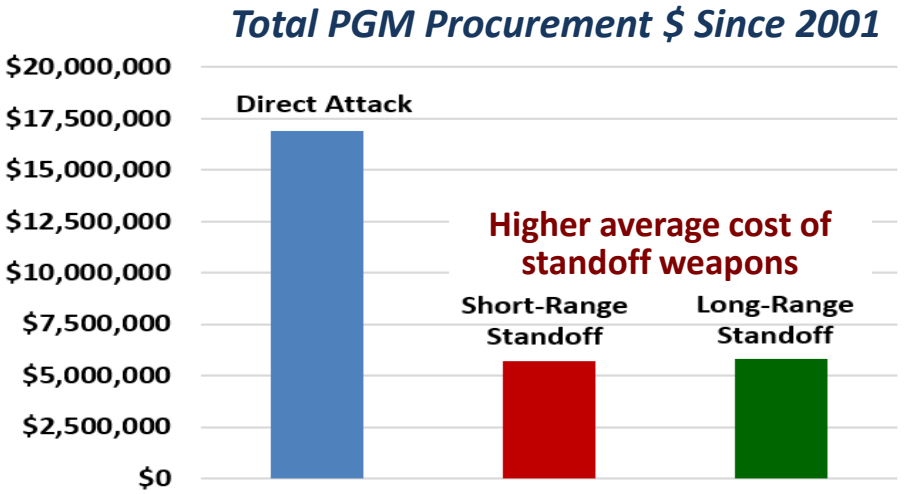
2015 Force

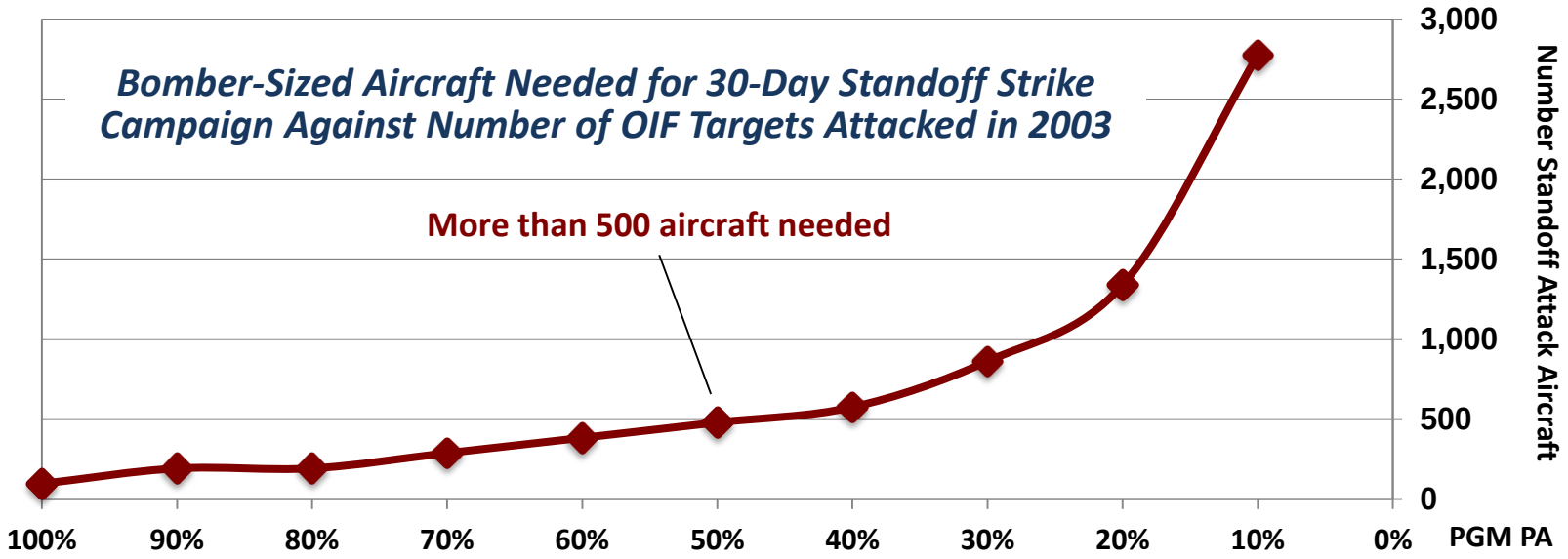


Penetrating bombers delivering direct attack PGMs = greatest efficiency, but campaigns that rely heavily on direct attack PGMs may not be feasible against enemies with effective defenses

Using many more large, expensive standoff weapons would be a much greater challenge







Use of larger standoff weapons = even more platforms and sorties

CSBA
Center for Strategic and Budgetary Assessments

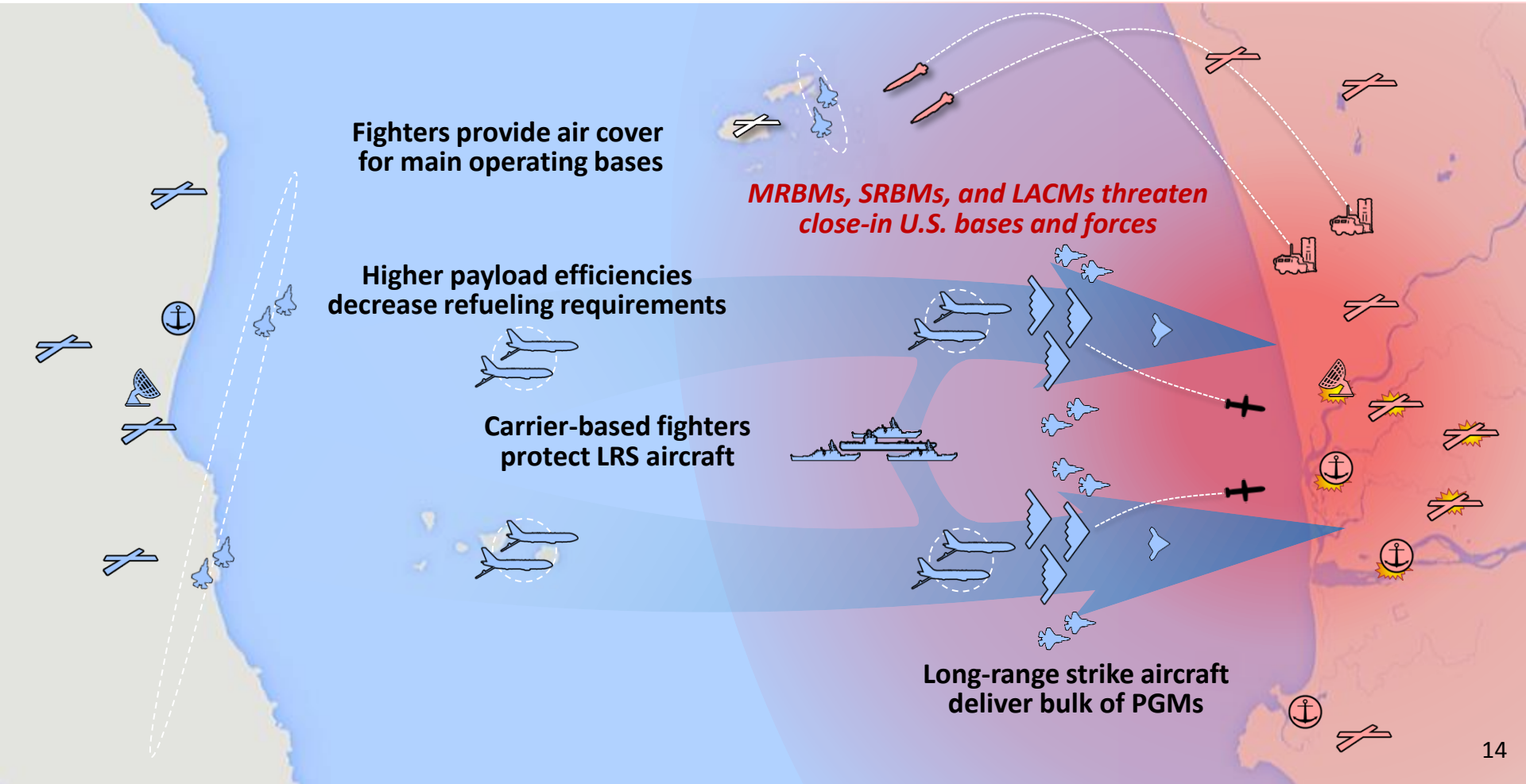
Alternatives to precision + mass

- Operational concepts that increase salvo size and PGM PA values
- Technologies that increase probability of arrival for PGMs and PGM salvos

Recommendation: conduct large-scale strikes from lower threat areas (including undersea)

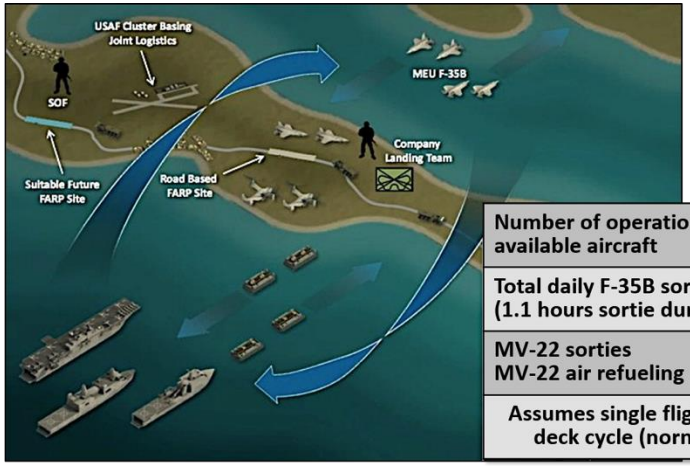
Benefits: **Less risk of enemy attacks that cut U.S. operational tempo and salvo size**

Challenges: **Reduced sortie rates caused by operating from range; offset by using larger strike aircraft with bigger payloads, and shifting fighters to counterair role**



Recommendation: conduct dispersed operations inside higher threat areas

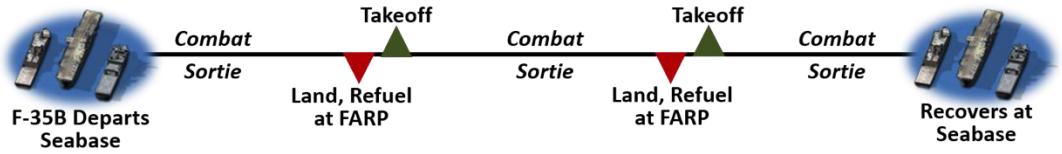
Distributed STOVL Operations



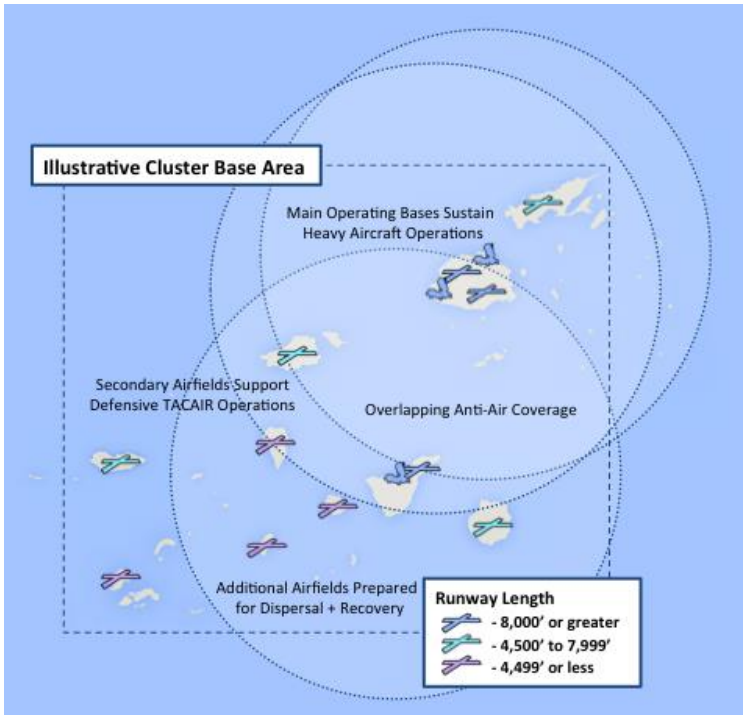
Marine Expeditionary Unit (MEU) sized operation, 100 nm from seabase to FARP

Number of operationally available aircraft	5 F-35B 10 MV-22
Total daily F-35B sorties (1.1 hours sortie duration)	15 to 20
MV-22 sorties MV-22 air refueling	42 8
Assumes single flight deck operations and a 12 hour deck cycle (normally 10 hours) for 6 day surges	

Illustrative 24 hour cycle



Cluster Basing



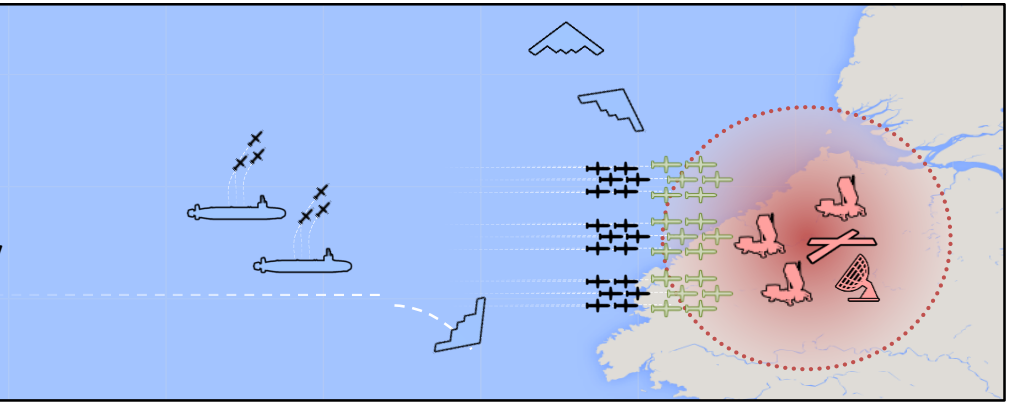
Benefits: **Operating closer to target areas could increase sortie generation and salvo size of smaller aircraft; fighter aircraft can suppress threats to U.S. bombers operating from more distant bases; dispersal complicate enemy targeting**

Challenges: **Logistics to support dispersed bases, and command and control of dispersed forces in degraded communications environments**

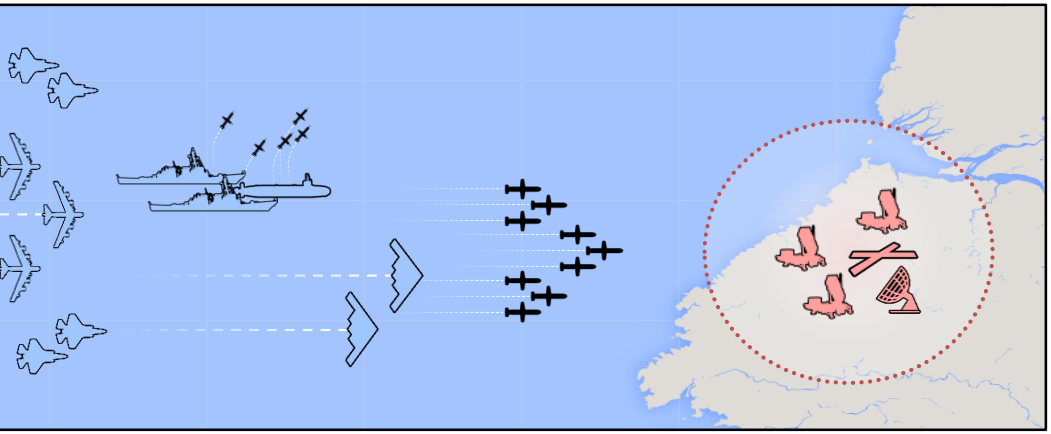
Recommendation: adopt concepts that increase the PA of PGM salvos

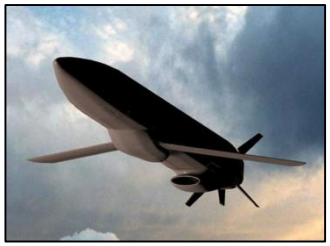
"Tunneling" Concept

1. Stealthy platforms deliver large numbers of small, short-range decoys and inexpensive PGMs to temporarily deplete enemy defenses



2. Creates window in time and space to allow other PGMs reach targets





MALD, MALD-J

JASSM, JASSM-ER

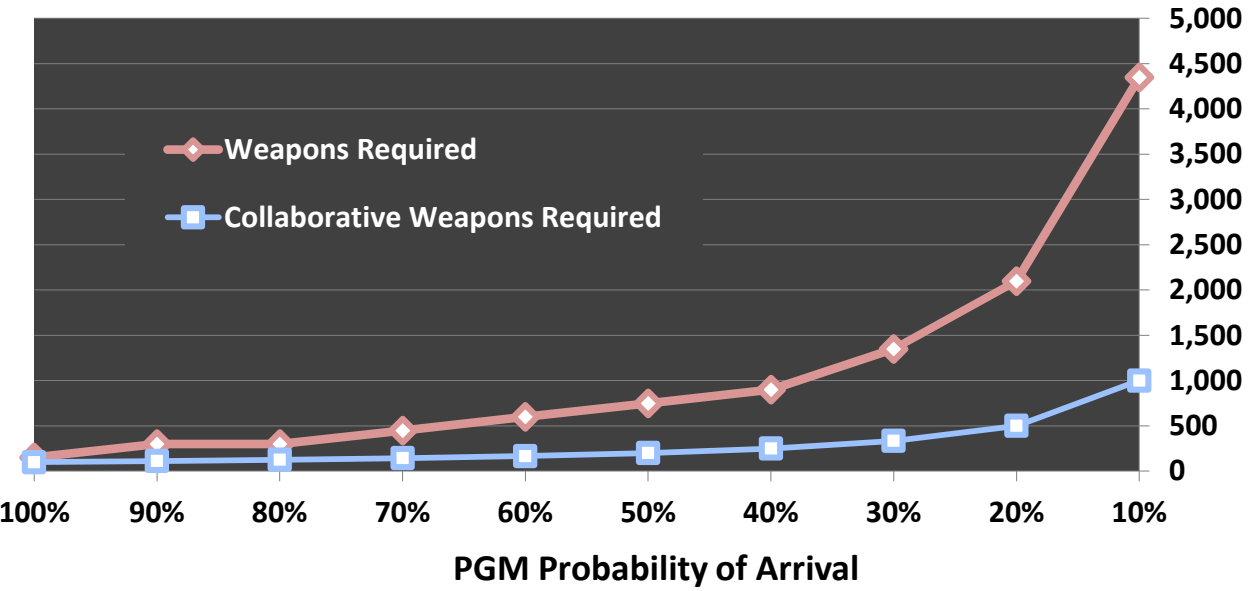
Joint Strike Missile

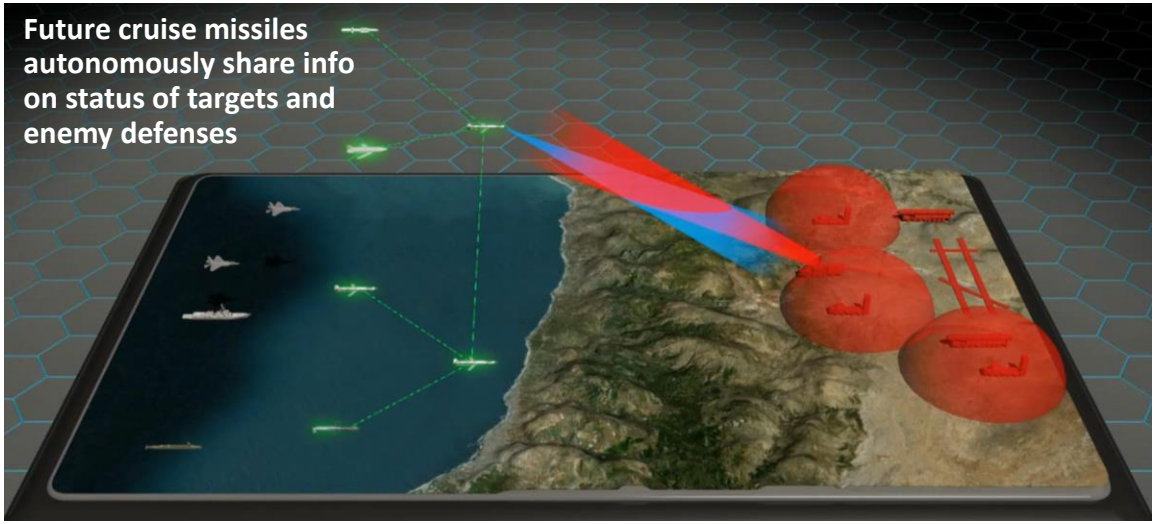
Benefits: **Increase probability that salvos of today's PGMs would penetrate enemy defenses and reach their designated targets**

Challenges: **Coordinating strike operations across platforms and domains; coordinating operations between individual weapons**

Recommendation: adopt concepts that increase the PA of PGM salvos

Collaborative Weapons Operations Concept





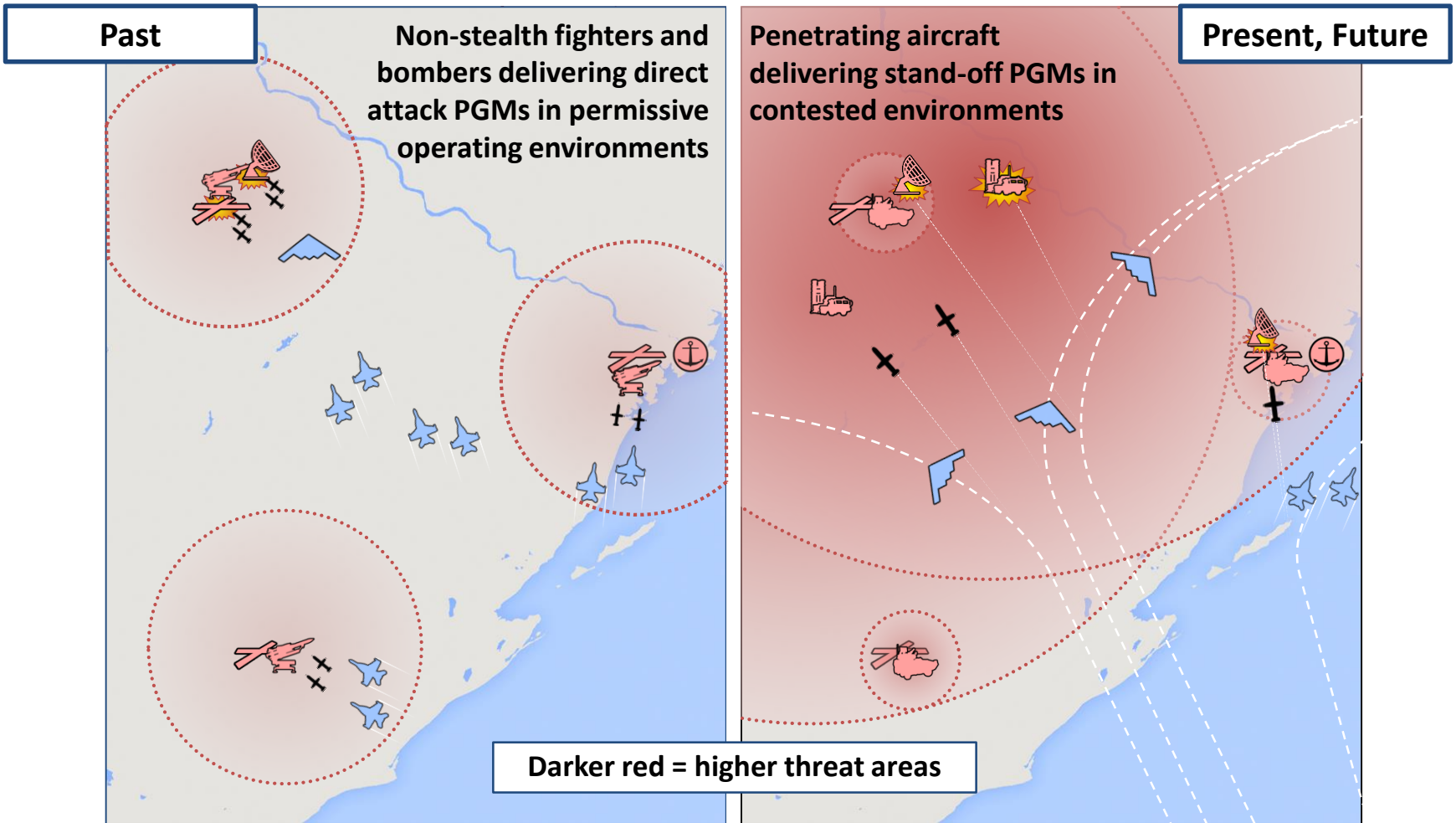
Salvos of loitering PGMs with autonomous target attack technologies and weapon-to-weapon datalinks:

- **Self-select best weapon-target matches**
- **Synchronize arrival to saturate enemy sensors & overwhelm defensive capacity**
- **Compensate for PGMs lost to defenses to ensure all targets are hit**

Recommendation: increase standoff for penetrating strike platforms

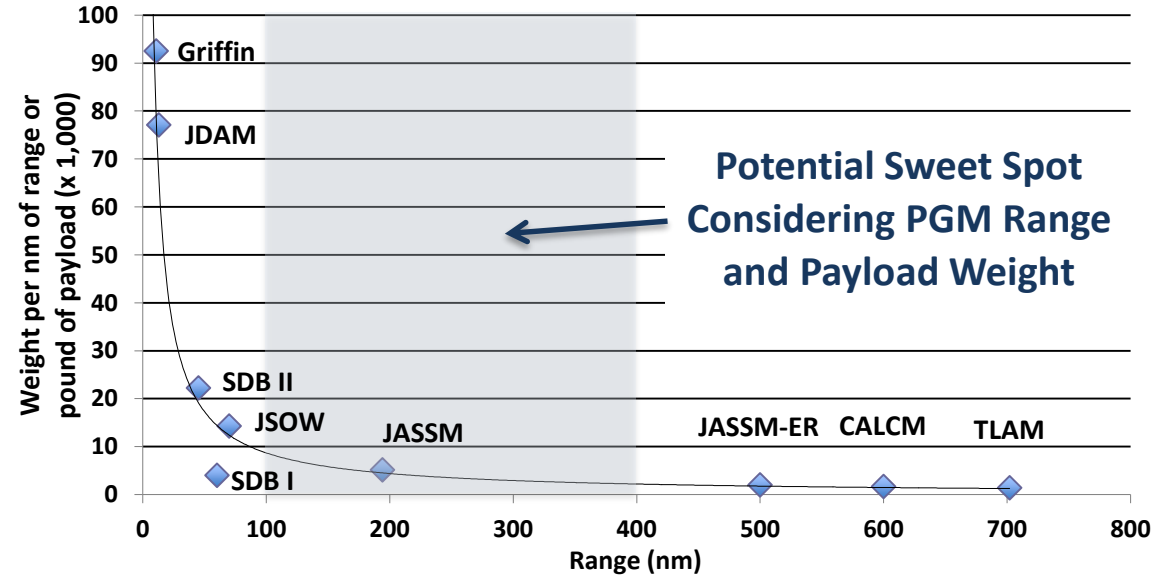
Benefits: **Enables penetrating platforms to deliver weapons despite more lethal point defenses protecting targets; may increase PGM PA by reducing warning time**

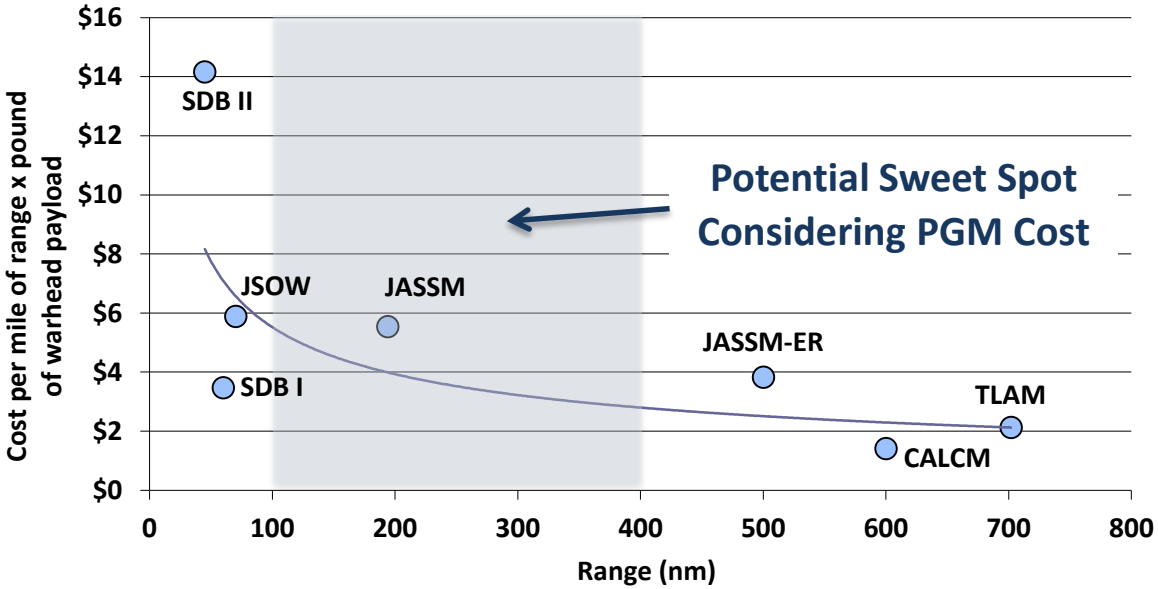
Challenges: **Using very large, long-range standoff weapons would reduce salvo size**



Recommendation: shift PGM mix toward short-range standoff attack weapons

Balance platform survivability, payload size, and PGM cost



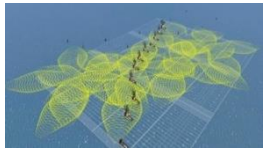


- **There may be a 100-400 nm "sweet spot" for standoff attack PGMs**
  - Today, only the JASSM is in this range band
- **Recommendations:**
  - Modify some direct attack PGMs with inexpensive rockets or motors to extend range
  - Increase mission functionality of some standoff weapons
  - Develop and field new short-range standoff weapons

Other recommendations to increase PGM PA values and salvo sizes

Multiple Targets per Weapon

- Future PGMs with brilliant submunitions

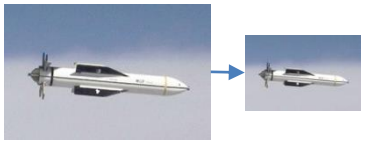


- PGMs with HPM or other RF warheads

PGMs for Hard or Deeply Buried Targets

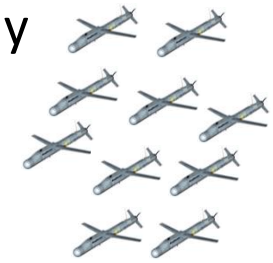
- Boosted penetrators

- Energy-dense explosives to increase penetration with multiples less weight



Swarming and Miniaturization

- Small, loitering weapons capable of cooperatively swarming targets from multiple directions



- Miniaturized PGMs to increase salvo sizes

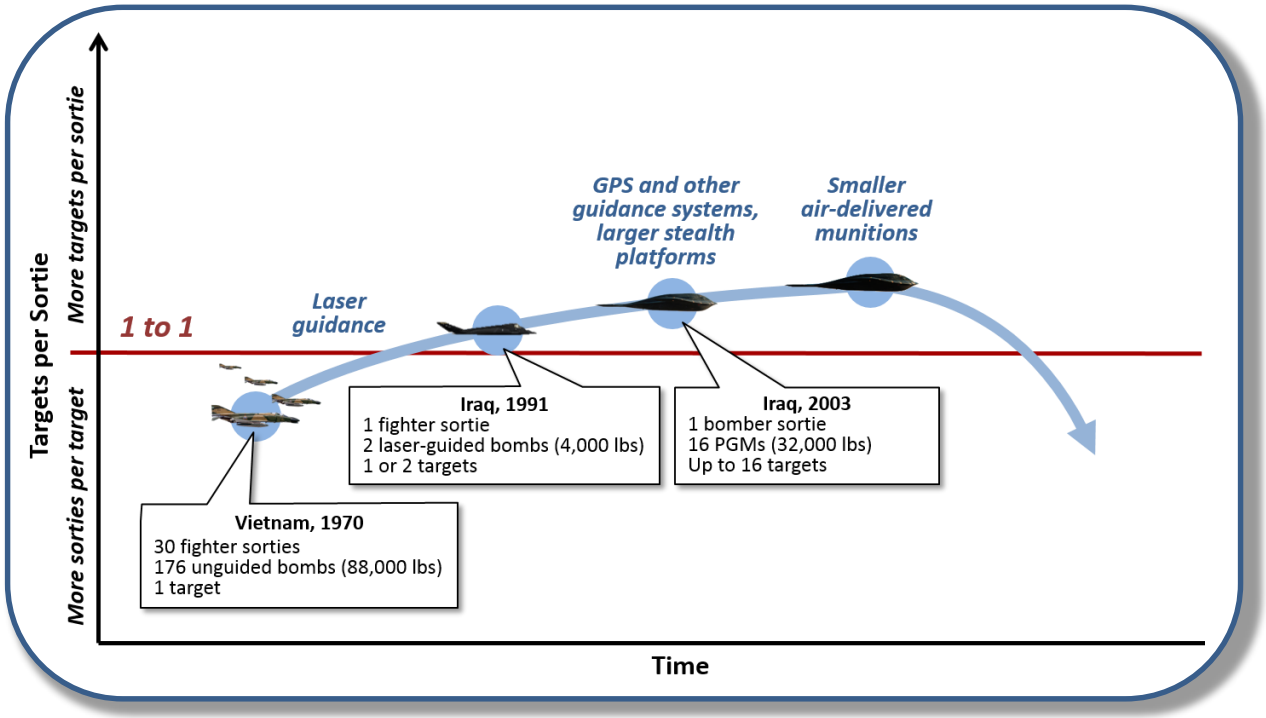
High-Speed / Hypersonic (Mach 5+) Weapons

- Increase PGM survivability, reduce target location errors

- Possible sweet spot: Mach 6 for air-breathing weapons, size/range similar to JASSM to ensure they fit in bomber weapon bays

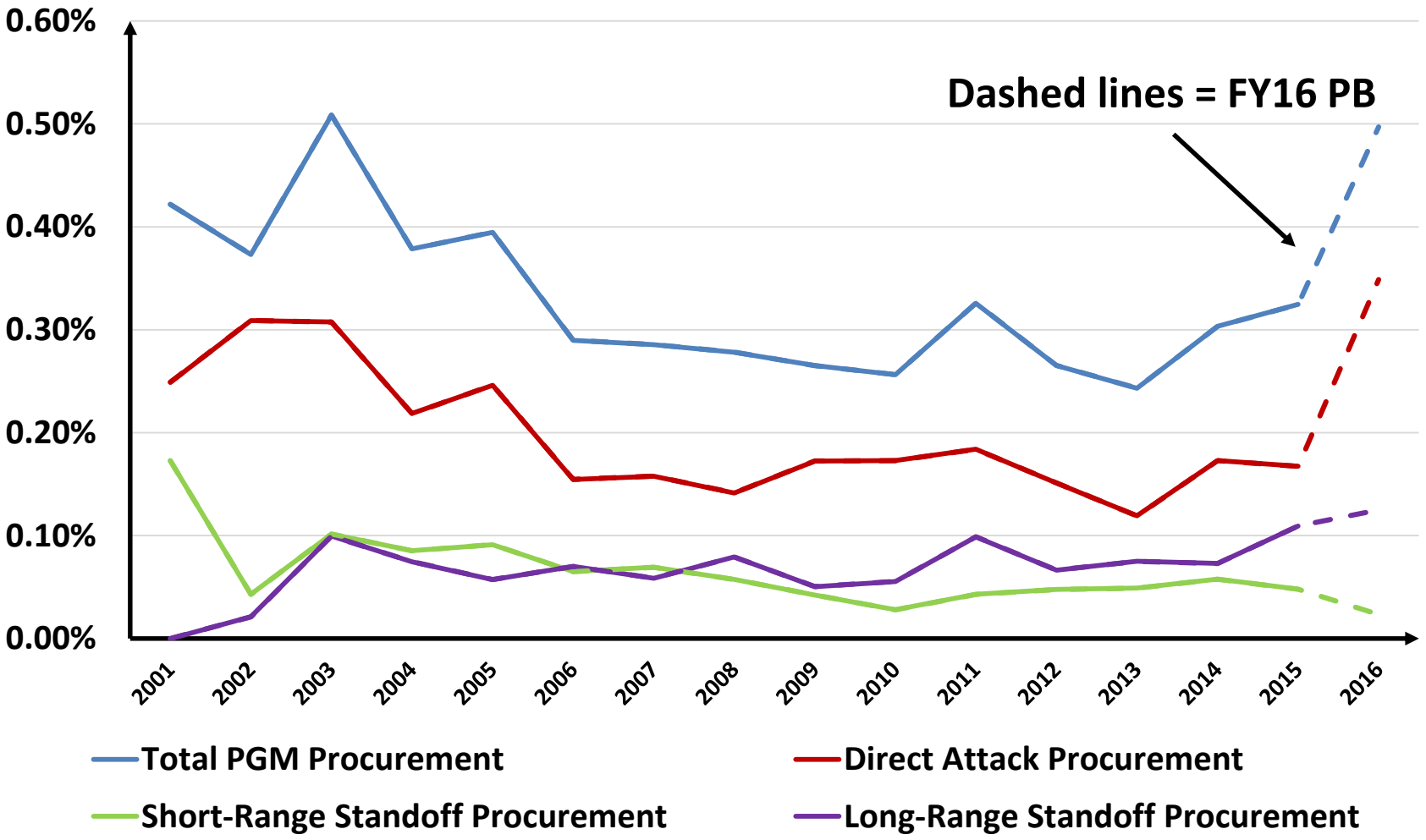
Summary

- The U.S. military is losing its precision strike monopoly
- Salvo competitions could greatly increase PGM and platform (not just strike platforms!) requirements



- Reverting to using much larger numbers of weapons and sorties in future strike campaigns would be very challenging if not infeasible
- DoD's weapons mix appears to be best suited for operations in permissive environments

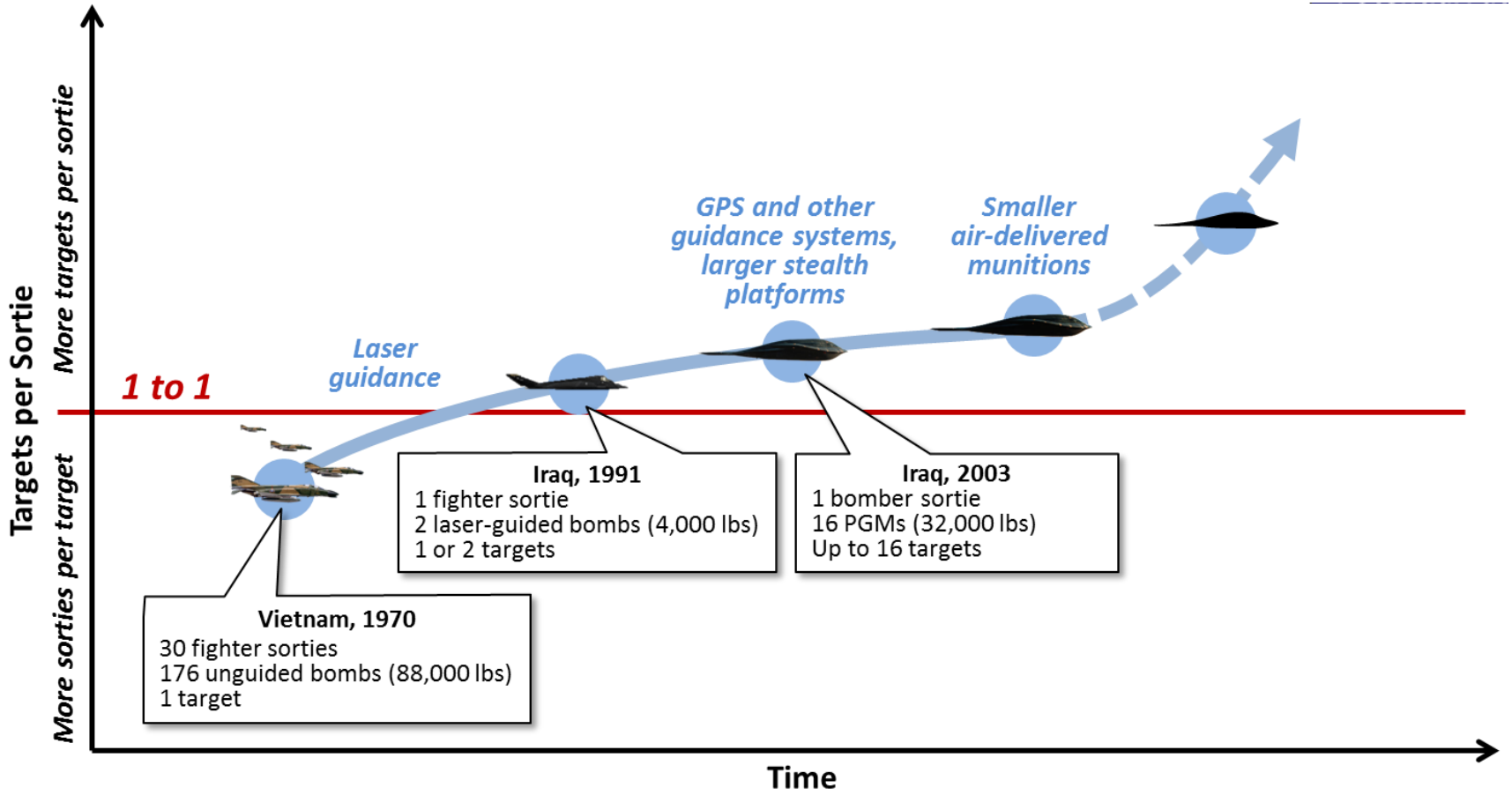
Smart investment in future PGM mix needed

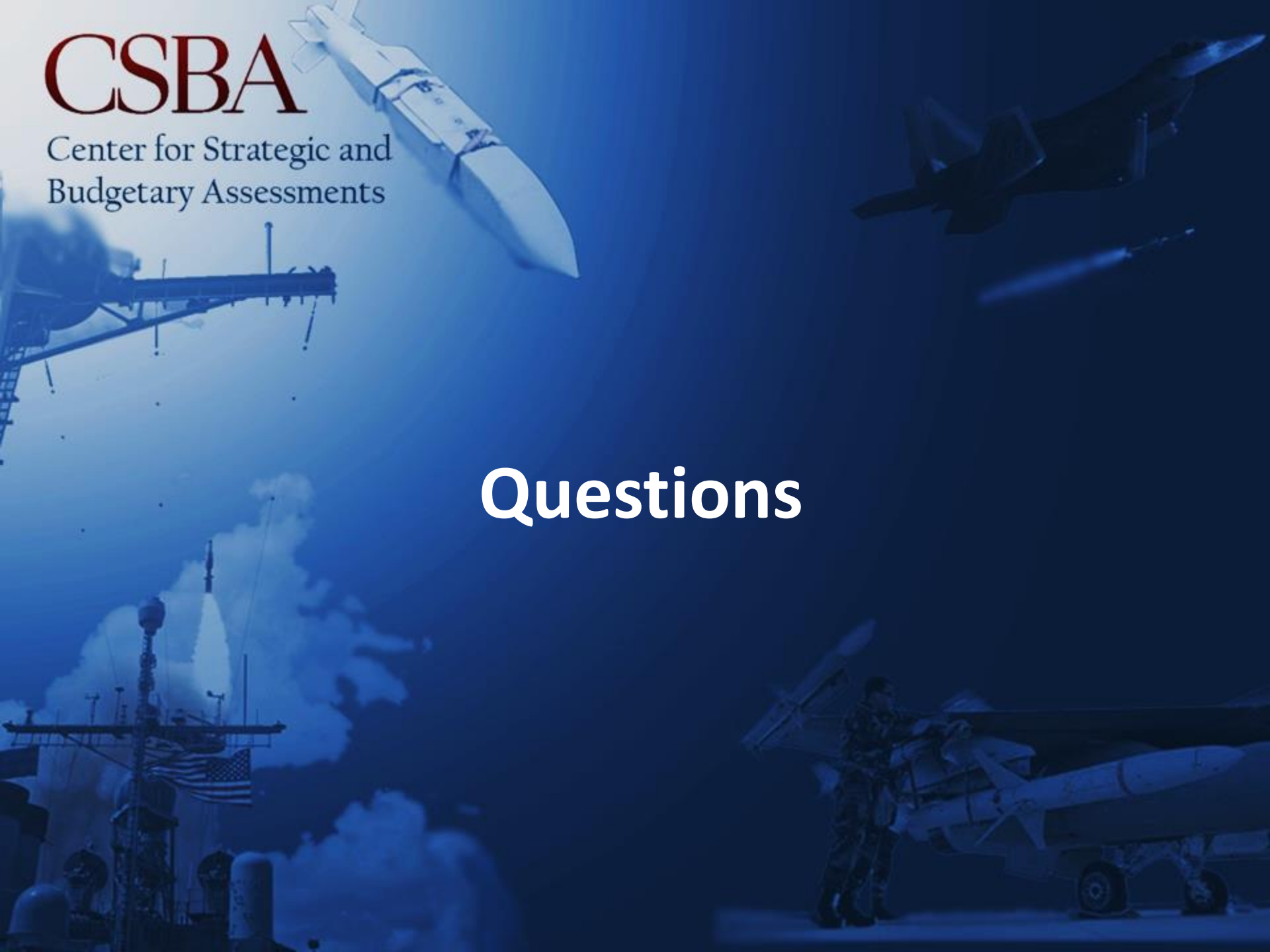


- *Less than 0.5% of DoD's budget on average allocated to PGMs*
- *Most of the FY16 increase is for direct attack weapons*

Need capabilities that will "bend the curve"

- **Maximize PGMs per payload:** Short-range standoff, small/miniaturized
- **Multiple targets per weapon:** Brilliant submunitions, non-kinetic warheads
- **Increased survivability:** Hypersonic speeds, self protection features
- **PGMs for challenging targets:** Loitering, autonomous, enhanced penetrators
- **Multi-mission PGMs:** Increase flexibility and responsiveness of strike platforms

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Questions