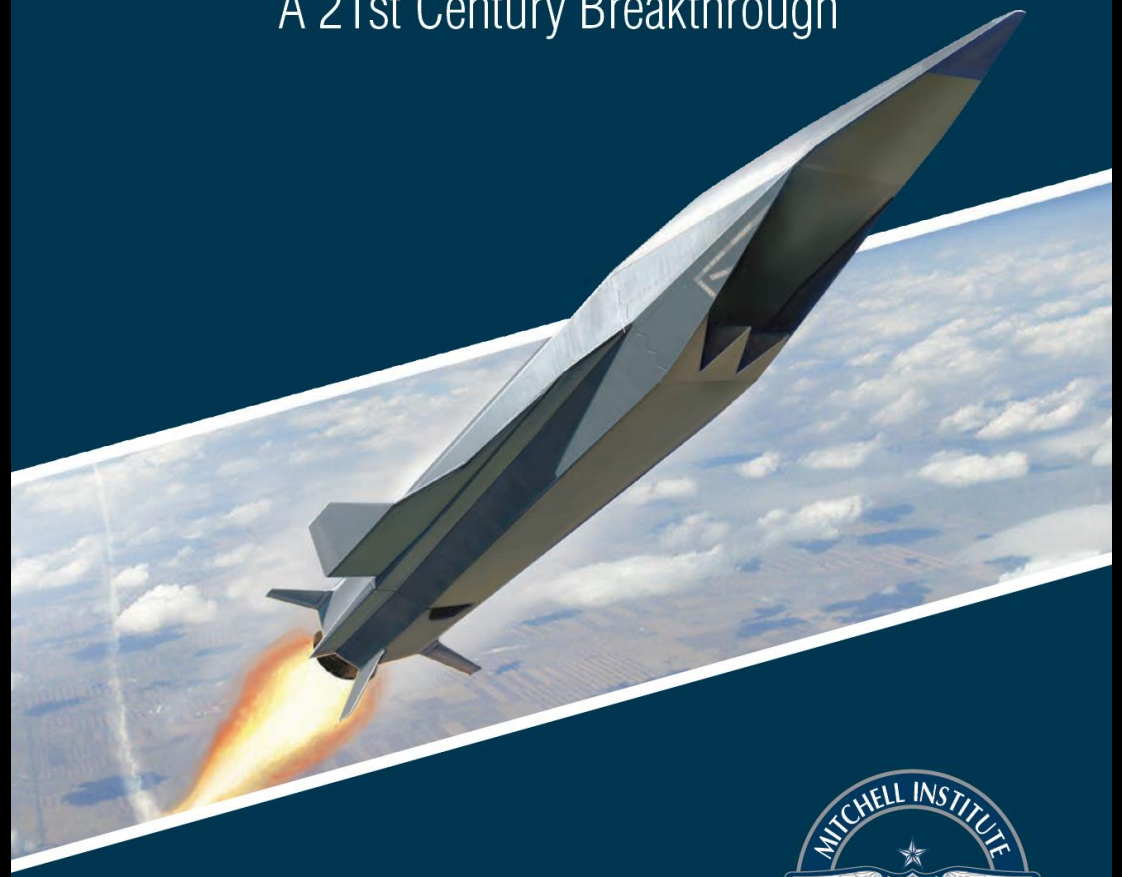
HYPERSONIC WEAPONS AND US NATIONAL SECURITY:

A 21st Century Breakthrough



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HYPERSONICS: WHY READ THIS PAPER?

- Hypersonic Weapons are now both Important…and Inevitable
- It's time to get Serious and Focused

- Quick Tutorial for Busy Decision Makers
- Bridges the gap between Techno-gibberish and Condescending Tripe
- No company advocacy
- No specific program advocacy
- Designed to either scan quickly or read in more depth

- GOAL: Decision-makers understand and support a Disciplined Path Forward

HYPERSONICS

What is it?

Why is this technology important now?

How can it benefit the United States, its allies, and partners?

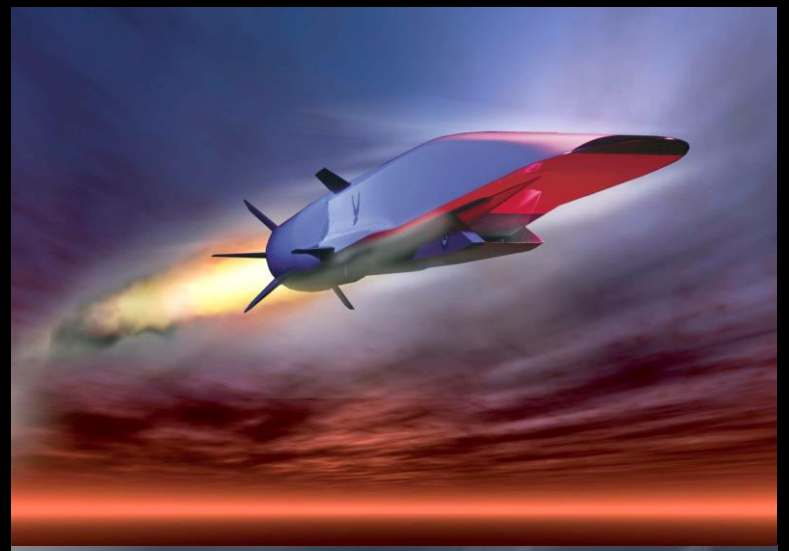
What is a reasonable path forward to realize these benefits?

WHAT IS IT?

Flight at 5 times the speed of sound (Mach 5) (3,600 mph and up)
Not as simple as "Give me more power, Scotty!"
At these speeds, the air begins to ionize…the physics change
Issues: propulsion…heat…materials…control laws…communication

For our purposes:

- Long-range
- Maneuverable
- Air-breathing (SCRAMjet) for Hypersonic Cruise
- Boost-glide (unpowered) for Atmospheric Re-entry



WHY IS IT IMPORTANT NOW?

Adversary threats to U.S. aircraft are improving rapidly

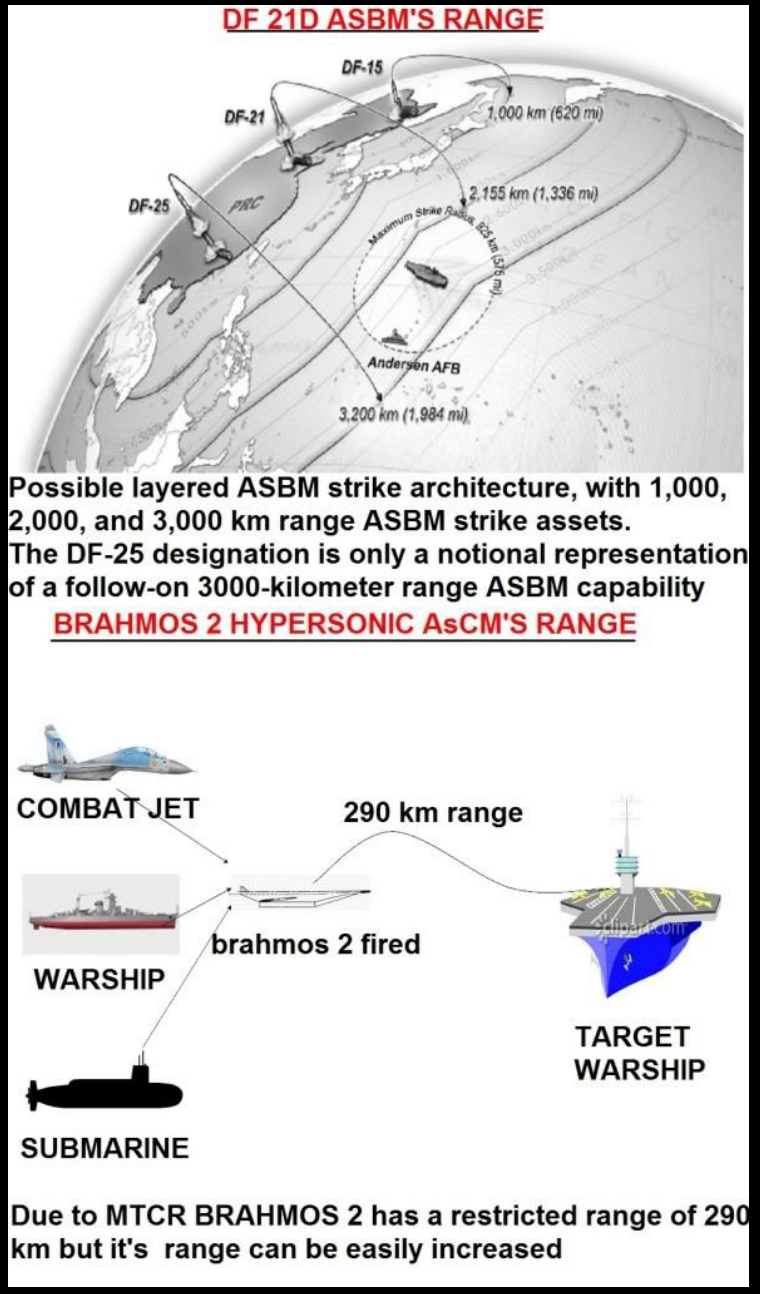
U.S. capability to project power has diminished

Hypersonic speeds offer us the ability to regain the advantage

Hypersonic weapon technologies are surprisingly close to maturity

China, Russia and India have sophisticated, committed programs

We must focus and succeed, or we will cede our lead

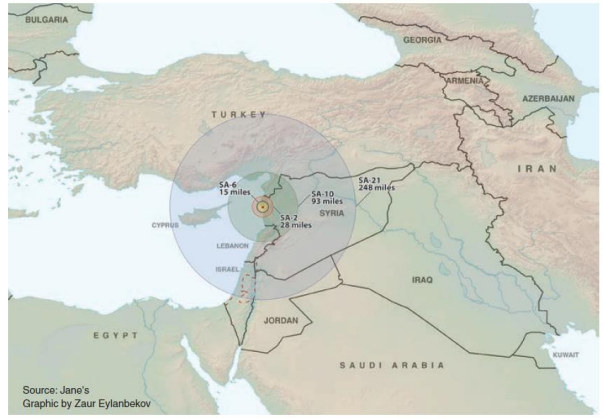


HOW CAN IT BENEFIT US?

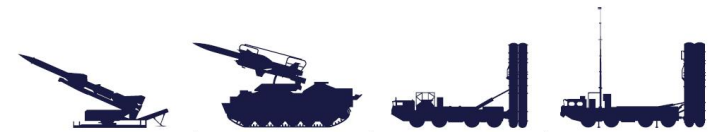
Speed – Range – Survivability

Rapid Reach: Less time to get to time-critical targets
Global Target Access: Launch from outside the threat zone
Offset Air Defenses: Less time in the threat zone
"Fourth-Dimension" Effects: Get inside enemy's decision cycle

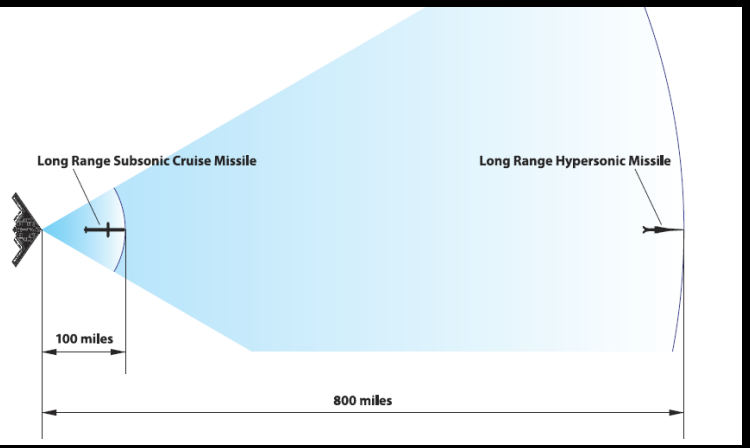
Negates many adversary surface-to-air and air-to-air defenses
Acts as a deterrence against adversary capabilities



Effective maximum surface to air missile ranges, from the SA-2 to the SA-21, as notionally depicted at the Bassel Al Asad airfield in Latakia, Syria.



Type:	SA-2	SA-6	SA-10	SA-21
Max Range (miles):	27	16	93	268



WHAT IS A REASONABLE PATH FORWARD?

1. Steady Commitment
2. Realistic Acquisition Strategy
3. Technology Maturation
4. Test & Range Infrastructure
5. Profession Sustained

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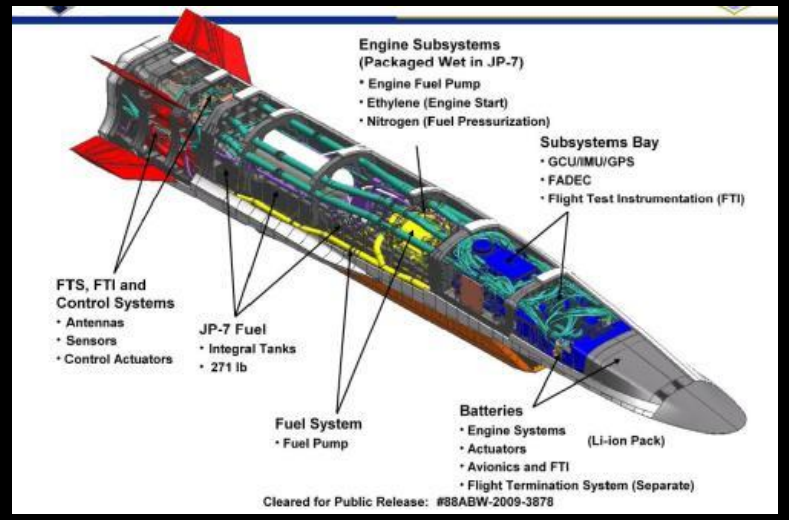

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SC-RA-M TRI-PS

1. STEADY COMMITMENT

History of U.S. Hypersonics Research:

- Success followed by abandonment of momentum
- Overly aggressive, expensive programs that fail
- Expert teams disbanded and scattered to other projects

We must:

- Understand the current state and near-term potential
- Commit to steady, disciplined path to focused milestones
- Avoid “flashy dead-ends” and “stand-alones”
- Insist on real, practical goals

2. REALISTIC ACQUISITION STRATEGY

Practical requirements assessment and development processes

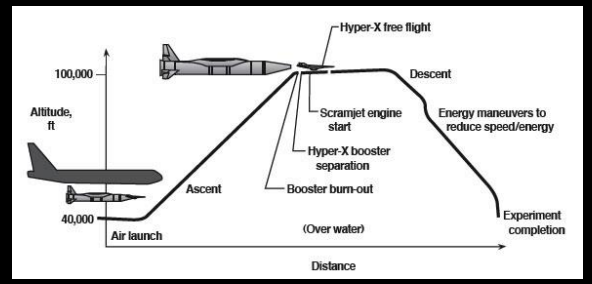
- Concepts of Operation
- Science & Technology Challenges
- Research, Development & Testing

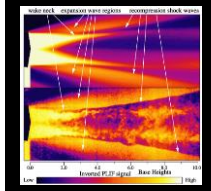
Incremental, realistic and achievable technologies

→ Technology Transition to incremental, useful capabilities

Feasible:

- 2020s: Air-launched medium range strike weapon
- 2030s: More-capable strike/ISR weapon
- 2040s: Persistent, reusable strike/ISR aircraft





3. TECHNOLOGY MATURATION

Close the remaining technical gaps for hypersonic strike weapons

Ensure critical subsystems reach Technology Readiness Level 6

- TRL 6: System/subsystem model or prototype demonstration in a relevant environment

Focus on:

- Seekers and seeker integration
- Terminal guidance and maneuverability
- Aero-shell materials
- Munitions concepts that leverage high terminal velocity

4. TEST & RANGE INFRASTRUCTURE

Maintain or Upgrade Critical Hypersonic Test Facilities:

Examples:

- Hypervelocity Wind Tunnel Nine, White Oak (AF)
- Eight-Foot High Temperature Wind Tunnel, Langley (NASA)
- Arnold Engineering Development Complex, TN (AF)

Address Test Range Infrastructure:

Examples:

- Overland ranges (Edwards AFB/China Lake NAS, White Sands)
- Overwater ranges (Pacific, Western, Eastern, Gulf Test Ranges)

5. PROFESSION SUSTAINED

Ideas to leverage:

- Science, Technology, Engineering, Math (STEM) programs
- Hypersonics-related courses in universities
- Scholarship programs

But only one path is both Necessary and Sufficient:

- Establish a steady, committed, continuous Hypersonics R&D program to allow expert individuals and teams to flourish

Sustain the momentum to achieve “steady flow” in this field

CONCLUSION

Hypersonics technologies are both vitally Important and Inevitable.

Hypersonic weapons let us penetrate and hold adversaries at risk

Other nations WILL gain this technology

Hypersonic technologies are close to maturity…if we commit

The Key is a Disciplined, Reasonable Program:

Steady Commitment – Realistic Acquisition – Technology Maturation – Test & Range Infrastructure – Profession Sustained