Striking Globally: Knowledge, Reach, and Power in the Age of Surprise

BLUE HORIZONS 2012

UNITED STATES AIR FORCE
CENTER FOR STRATEGY AND TECHNOLOGY
Meta-Strategy for the Age of Surprise

at The Air University
**USAF Tradition - Transforming to Meet Future Challenges**

Our tradition is to re-invent ourselves to provide meaningful policy options for the President.
USAF is at a new inflection point, beyond stealth and precision

- **Generation of Knowledge** becomes an Air Force core function
  - Ability to sense improves, but threats multiply in type, number & severity
  - Finding is as important to deterrence as fighting in a chaotic world

- **Air Force thinking on Reach** evolves
  - Reach = maintain sensor and weapons density at range over time
  - Connectivity eclipses platforms in thinking; enables new CONOPS

- **Power comes from new effects; nuclear weapons remain essential**
  - Volumetric weapons return; weapons survivability becomes a concern
  - Defense is back; uncontested dominance ends; continuous competition

<table>
<thead>
<tr>
<th>DATA</th>
<th>INFORMATION</th>
<th>AWARENESS</th>
<th>KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>uncorrelated facts</td>
<td>correlated data</td>
<td>fused information with context</td>
<td>actionable, attributable awareness</td>
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</tbody>
</table>
Operational Assumptions for Our Study

1. Precise positioning and timing are available without GPS
2. USAF purchases next-generation bomber (Top 3 AF priority in ‘12)
3. Kinetic global strike from space is not viable
4. Group/individual problem set is a lesser included case of the nation-state problem set
5. Line of sight communications can be degraded, but rarely wholly denied; impacts operations intermittently, backups required
6. US stealth advantage contested: stealth/counter stealth competition
7. In anti-access, missiles will always get through on both sides
8. The homeland is in range in an expanding number of scenarios
9. Expect operational surprises—no US corner on innovation
Global Strike Today

• A strategic attack directed by the NCA designed to deny or punish an adversary
• A tiered mission for nuclear, conventional, & virtual deterrence
• Used against states or groups/individuals
• Involves entire targeting process
• Requires elements of all 12 Air Force core functions to execute

Global Strike defines for Airmen what we are about in simple terms
Technologies are:

- leveling the playing field
- merging with synergistic impacts

- Geostrategic & technological competition return
- Absent ISR/PED, deterrence fails
- Counter-sensor battle results

- Internet of Things: 7 trillion devices by 2025—2035?

“Google Maps” + Ubiquitous Precision
Breaking News About 2035

Globalization dramatically reduced the multi-year, Cold-War-era US technology lead

A more “leveled,” multi-player competition will be different:

- ISR/PED foundational to deterrence
- Speed-to-field is the next big race
- Innovation trumps doctrine and tradition
- Flexible architectures trump enterprises
- Build to either a throw-away standard or continuous upgrade standard

Technologies are:

- leveling the playing field
- merging with synergistic impacts

- Geostrategic & technological competition return

- Absent ISR/PED, deterrence fails

- Counter-sensor battle results

- Internet of Things: 7 trillion devices by 2025—2035?
Everything becomes connected: An estimated 56 BILLION devices

Signal to noise problem—but of much greater dimensions

“going off the grid” is difficult to sustain

Zero electromagnetic emissions in an array of others creates a hole that can be detected

Breaking News About 2035

Technologies are:
- leveling the playing field
- merging with synergistic impacts
- Geostrategic & technological competition return
- Absent ISR/PED, deterrence fails
- Counter-sensor battle results
- Internet of Things: 31 billion devices by 2025—2035?
## Three Schools on Global Strike

<table>
<thead>
<tr>
<th>Prompt Strike</th>
<th>Standoff</th>
<th>Penetrating</th>
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<tbody>
<tr>
<td>• CONUS-based ICBMs, hypersonics &amp; cyber</td>
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<tr>
<td>• Cheaper than defending forward</td>
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<tr>
<td>• Simpler: No A/R, military or diplomatic access</td>
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<td></td>
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<tr>
<td>• Fixed target base; less capability vs. mobile or deeply buried; magazine limited</td>
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<tr>
<td>• Air-breathing cruise or hypersonic missiles, cyber</td>
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<tr>
<td>• Saturate air defenses; cheaper than buying long-range strike</td>
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<tr>
<td>• Less capability vs. mobile or deeply buried; what happens when all missiles expended?</td>
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</tr>
<tr>
<td>• Stealth, standoff-support, hypersonics, cyber</td>
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<tr>
<td>• Better persistence with greater risk</td>
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<tr>
<td>• Reinforces extended deterrence; enables flexible deterrent options</td>
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<tr>
<td>• Can strike full range of targets</td>
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These schools are differentiated by their approach to time, distance, target, platform, payload, purpose to deter or prevail
...But the Debate Transitions

<table>
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<tr>
<th>Command, Control, Integration of Interdependent Capabilities</th>
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<td>Stage Sustain Defend</td>
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<td>Opposed or Permissive?</td>
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<th>2012</th>
<th>Emphasis Shifts</th>
<th>2035</th>
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<tr>
<td>Engage</td>
<td>Find and Fix</td>
<td>Gateway Architectures</td>
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<tr>
<td>Platforms</td>
<td>Datafighting</td>
<td>Missile Maneuverability</td>
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<tr>
<td>Dogfighting</td>
<td>Hypersonic/Swarm</td>
<td>Volumetric</td>
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<tr>
<td>Platform Maneuverability</td>
<td>Photonic, Electronic</td>
<td>The Five Ds</td>
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<tr>
<td>Stealth</td>
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<td>OODA Point</td>
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<tr>
<td>Precision</td>
<td></td>
<td>Dispersed Operations</td>
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<tr>
<td>High Explosive</td>
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<tr>
<td>Destroy</td>
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<tr>
<td>OODA Loop</td>
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<tr>
<td>One Big Base</td>
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Voice, Data, Timing, Position
Constants: Global Strike Benefits from Joint Participation

- Virginia SSNs equipped with Virginia Payload Module connected to airborne networks could:
  - Strike with missiles or deploy air decoys
  - Launch UAVs (comm, ISR, strike)
  - Employ A/A missiles jointly with aircraft
- Towed Payload Module adds extra capacity
- SOF
  - Act as a sensor; method to gain electronic access
  - Deploy tags, unattended sensors, pocket JTACs

Health and marriage of stealths increasingly important to AirSea Battle
USAF should resist further reductions in nuclear weapons
   – Conventional deterrence may not be possible
Options:
1. US needs a “universal kill switch” short of nuclear exchange
   – A standing EMP capability is a must (others will have)
2. Next USAF ICBM should be mobile
   – Improves US A2AD capabilities/signaling capability
   – Hedges against undersea detection
3. A2AD threat requires a new, long-range cruise missile capability

US needs at least one of these capabilities to maintain nuclear deterrence capability and credibility
Posturing the USAF for Global Strike

Concepts

• Cross-service & domain intelligence and weapons integration
• Logistics systems that support dispersed operations
• Command for machine-based, decision-making environments

Execution

• Hallmark of success: fusing and using time-sensitive knowledge
• Always executing; datafighting & planning are continuous
• Increase emphasis on range in force mix
Posturing the USAF for Global Strike

Investments (1)

- Develop, deploy, & maintain connected gateway architectures
- Cyber = knowledge generation, offense, defense
- Artificial intelligence, virtual assistants and intelligence augmentation to increase decision quality and speed
- PED: agile, resilient, self-forming, self-healing
Posturing the USAF for Global Strike

Investments (2)

• Expand range & payload portfolio; use existing assets creatively
• Pursue low-cost production for quick-to-field, expendable systems
• Force enhancement to win stealth competition: swarms, offensive cyber, DE
• Develop a global training range to exercise Global Strike at scale
• Invest in dual-use airfield infrastructure to enable dispersion
Back-up Slides
- Targets either dynamic or hardened; multiplying; attribution difficult
- Must find method to do ISR/PED at machine speeds direct to user
- Major game changers:
  - Networked, distributed, full-spectrum arrays linked to weapons
  - Integrating cyber as a major finding space; crawl & fuse with ISR information
  - Small and covert sensors: unattended ground sensors, tags and pocket JTAC

**Demonstrating you can find becomes as important to deterrence as showing you will strike**
From Platforms to Gateway Architectures

1992

Vigilance

Process & Cross-Cue

Track & Target

Space Sensors

Air, Land, Sea Sensors

Voice

Fighter Intercept With Onboard Systems

Execution to Preplanned Tgts

2013

Engage
Platforms
Dogfighting
Platform Maneuverability
Stealth
Precision
High Explosive
Destroy
OODA Loop
One Big Base

2035

Find and Fix
Connectivity
Dataflying
Missile Maneuverability
Hypersonic/Swarm
Volumetric
Photonic, Electronic
The Five Ds
OODA Point
Dispersed Operations

UNCLASSIFIED
2012

Global Public Data

Global Private Data

Air, Land, Sea Sensors

Space Sensors

Process & Cross-Cue

Process & Cross-Cue

Track & Target

Track & Target

Data Gateway

Cyber Offense and Defense

Fighter Intercept With Interflight Datalinks

Execution to Dynamic Targets
Toward 2035

Knowledge (Enabled by Cyber)

OEF “Fusion Centers” & B-2 “intelligence operators” are signposts for the future

Two kinds of targets in 2035: hardened or dynamic “Find” task difficult for both; datafighting determines success
### Knowledge for USAF Operations

**Knowledge is**
- A better understanding of real-time events
- Able to deal with data that is false or contradictory
- A more rapid assessment of the strategic environment
- Globally connected, cross-cued, all domain, always on

**Knowledge is not**
- All the relevant data
- 100% accurate
- Perfect understanding

"The ability to learn faster than your competition may be the only sustainable competitive advantage."

Ari de Geus, Director for Strategic Planning, Shell Oil
Toward 2035

Connecting distributed sensors and weapons enables new CONOPS, strategy and tactics

Gateway model matures; everything connects without “common” gear; enables distributed sensors and weapons
• Disruptive opportunity for USAF
  – Generating transparency through all-source data fusion
  – Major future weapons system, the CAOC of 2035
  – Holistic distribution: need to share vs. need to know, “data TPFDD” = data priority and paths
  – Resilient: a variety of connection paths, alternative networks

• But others will have this tech too
  – Impacts planning/stealth/defense

Whole of government challenge: technology moving much faster than strategy, policy & legal thinking
• Missiles getting smarter, more deadly
• Missile and the radar/sensor no longer required to be co-located
• Sensors/seekers become all band
• Can launch larger missiles from larger platforms, dramatically increasing engagement range

As sensor and weapon capability increase, platform performance less important—huge implications for CONOPs & force structure
• Degree of stealth advantage may vary
• But penetrating strike still needed to hold hard and deeply buried targets at risk
• Needed: hypersonic, swarm, decoy & deception
  – Hypersonics provide survivable access & timely strike
  – Swarm overwhelms IADS, creates large apertures & multi-axis, multi-domain attacks
  – Countermeasures, decoy, deception: cyber or EW

Stealth is still essential, but its employment will increasingly depend on the generation of chaos
• Precision: a focus of airpower since 1930s

• …but future targets may be either too small, mobile, fleeting, or distributed to find & destroy precisely

• …in an economic way

• Cyber & RF-directed energy weapons = return to volumetric attacks
  – Area attacks against electronics: only sure way to achieve objectives?
  – Chem, Bio, Nano, RF, Cyber targets demand 3D, wide area effects

*Precision may be defined more by effect & less by CEP with a wholly different understanding of collateral damage*
Explosives become more powerful in this period...

But photonic and electronic weapons come of age

- Near term challenge: Synchronizing with kinetic attacks; understanding capabilities & limitations

Far term challenge: how to defend...

- Sensors and eyeballs increasingly at risk
- Target platforms AND weapons inflight using hit-to-kill missiles or directed energy

Expect a counter sensor battle; expect higher expenditure rates for weapons
• Time and timing much more important
  – Denial may provide same strategic impact as control
  – Disruption may achieve same effects as destruction

• Some targets cannot be destroyed
  – HDBT may require third-way attacks

• Impact of these attacks may be difficult to assess—no image confirmation

Tasks to degrade, disrupt, deny, delay, deceive become more common than tasks to destroy
Current debate on automated decision making will set a trajectory
– What reliability standard is required for machine-made decisions?
– What is the difference between man-made and machine-made mistakes?

Global Strike C2 not designed for this future
Time is shrinking, more important
– All domain hider/finder competition
– Decisions: machine speed, faster human, pre-delegation
– What is command in a world run by algorithms?

Culture may drive the US in one direction; other nations may choose different directions, creating an asymmetry.
From One Big Base to Dispersed Operations

- Tankers become more essential as find task becomes more difficult
- Stacking aircraft at forward bases may not be tenable as threat expands
- Options: defend, disperse, distance
  - Defend: Active defense cost imposing on US
  - Dispersal: Ramp space and logistics the issue
  - Distance: Requires large ramps to concentrate tankers & strike platforms

Moving tankers and strike platforms back requires more ramp space to support more aircraft to fly longer missions
In the Beginning…

SAC Mission Statement, 1946: “The Strategic Air Command will be prepared to conduct long-range offensive operations in any part of the world, either independently or in co-operation with land and naval forces; to conduct maximum-range reconnaissance over land or sea…; to provide combat units capable of intense and sustained combat operations employing the latest and most advanced weapons; to train units and personnel of the maintenance of the Strategic Forces in all parts of the world; to perform such special missions as the Commanding General Army Air forces may direct.”

Gen Tooey Spaatz, March 1946
This briefing is the 6th in a series of CSAF directed studies exploring the strategic environment for the Air Force in 2035…

…it is not a set of predictions nor a description of the future…

…it is a collection of fiscally unconstrained insights about what a variety of futures may produce technologically and strategically…

…and a set of ideas to refine the direction the AF to be most relevant and valuable to the nation

It is a briefing more about ideas than things – the risk we face in the future demands that we think differently
“…leverage last year’s technology study and investigate how the Air Force should posture itself with strategic and operationally relevant capabilities to strike globally, on demand and in any domain, in 2035.”
**Blue Horizons Researchers**

**Class Composition**

- Air Ops
- S&T
- Test
- Space Ops
- Cyber Ops

Fellows represent top 12% peer group. Faculty selected 15 from 240 students.

**Academic Program**

- AWC Curriculum
- ~302 Hrs
  - Classroom: 60 Hrs
  - Volunteer Elective: 24 Hrs
  - Research Paper: 136 Hrs
  - Group TDYs: ~70 Hrs
    - Sandia Nat’l Lab
    - Los Alamos Nat’l Lab
    - NASIC
    - AFRL Tech Directorates
  - Individual research TDYs: ~12 Hrs

*A Blue Suit study researching Blue Suit challenges*
We Affirm and Clarify

- The essential attribute of Airpower is power projection
- “Global Strike” is a unique form of power projection
  - Requires sensor and weapons density at range over time
  - Essential for nuclear, conventional, and virtual deterrence
  - Includes elements of all Core Functions
  - Objective: finding and striking targets, whether physical or virtual, anywhere, any time, as soon as feasible
- Global Strike defines for Airmen what we are about in simple terms

After 20 years of tactical warfare, it is time to reinvigorate Airmen and Airpower thinking
Geostrategic Landscape Shifting; Deterrence Becomes More Complex

**State Competition**
- Competition intensifies in Pacific Rim, Indian Ocean, Arctic
- Mideast: resources and political instability
- Africa: resources, ungoverned spaces, expanding conflict
- South America: Brazil rises; potential foreign power proxies

**Military Realities**
- Growing Anti-Access/Area-Denial
- Precision proliferates; threatens bases and power projection
- Datafighting in cyber intensifies
- Nuclear proliferation continues
- Bio most threatening, cost-effective weapon

...And growing threats from non-state actors worldwide
Key Task: Credibly demonstrate the ability to maintain sensor and weapons density at range over time…strategically and operationally relevant capabilities flow from this task.
• Tanker bases tend to be forward
• Tend to stack operational bases during crisis
• Current assumption: USAF can rapidly set tankers in place

Limit: 1500 NM Combat Radius
Refueled in Permissive Airspace
A2AD or loss of diplomatic access could severely limit US operations in most the unstable regions.
SE and NE Asia Operating Locations

Today

2035: A Diversified Strategy?
South China Sea Ramp
RAAF Tindal Today

1200 x 300 Ramp

9000’ Runway

B-1s

Add: 1500’ Runway
Total 10500 feet

Dyess AFB sized ramp to sustain a Spratly Island Campaign from Australia in gamed scenarios
Indian Ocean Tanker Basing

- Thumrait
  - 2x KC-10
  - 1x C-17

- Diego Garcia
  - 6x KC-135
  - 8 x B-52
Indian Ocean Ramp?

Mombassa  Djibouti  Seychelles  Maldives  Christmas/Cocos

USAF should advocate for whole of government approaches to increase ramp space/develop runways at strategically important airfields
C-17s Deliver Counter Air Pickets W/passive IRSTS B-2 Loaded With 32x Pac-2 Strike B-2 Comm Gateway
Formation Crosses Radar Horizon

Enemy Fighter Commit

B-1s Join With JASSM and Hypersonics
Submarines Launch Decoys, Loitering gateway UAV, ISR missiles to locate SAMs

Enemy Fighters Detected ISR Pickets
Gateways link B-1s/B-1 and sub weapons deconflicted
Potential Concept of Operations

6 x Small UCAS with Passive IRSTS

Robust LOS Links

32 PAC-2 Class Missiles (Dual Band)

Enemy Fighters
Cruising @ Mach 1.8

Note: Air mobility aircraft & submarines could be integrated as shooters or to launch UCAS
Potential Concept of Operations

- **32 PAC-2 Class Missiles**
- **6 x AIM-120 Class Missiles**
- Robust LOS Links
- Enemy Fighters Cruising @ Mach 1.8
- Detected by Opposing IRSTS
Potential Concept of Operations

- UCAS detect opposing fighters
- Information fused and distributed to all friendly aircraft
- Human crew assigns targets

32 PAC-2 Class Missiles
Potential Concept of Operations

- UCAS detect opposing fighters
- Information fused and distributed to all friendly aircraft
- Human crew assigns targets
- UCAS turn to delay merge but continue tracking enemy aircraft
- Manned aircraft fires 2 missiles at each opposing fighter from very long range (150+ nm)

Similar Concept Also Works for SEAD