BLUE HORIZONS 2035: AIRPOWER IN THE AGE OF SURPRISE
OR “ELVIS IS DEAD AND I AIN’T FEELIN’ SO GOOD MYSELF”
Rapid Technological Change

- **Last Decade of the 20th Century**
  - World Wide Web (93)        Cable TV (93)        Stream Video (93)
  - MP3s (94)                  Amazon (94)          DVDs (95)
  - EBay (95)
  - Google 1998               Tivo (99)
  - N Korea Nukes (99)        Paypal (99)

- **In the first decade of the 21st Century:**
  - iTunes (00)               iPod (01)           Wikipedia (01)
  - Blackberry (03)           Facebook (04)       YouTube (05)
  - Twitter (06)              iPhone (07)
  - Global Recession (08)     iPad (10)
Drivers: nuclear weapons, guided missiles
Policy Options: MAD, Flexible Response

Drivers: space technology, computing
Policy Options: Coercion/Decapitation

Drivers: rapid advances in aeronautics
Policy Option: Strategic bombing

Drivers: cheap, cybernetted, robotic tech
Policy Option: C-A2AD, Global Strike

Drivers: Artificial Intelligence, Bio, Nano

Knowledge & Power Projection

Stealth & Precision

Nuclear Deterrence

Strategic Bombing

1917

Area of Controversy

Far Future
2035

Our tradition is to re-invent ourselves to provide meaningful policy options for the President
## Breaking News About 2035: Cyberspace

<table>
<thead>
<tr>
<th>Examples</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much of national critical infrastructure, on which USAF depends, is vulnerable—no business case to address this</td>
<td>• Military has a major stake in national critical infrastructure</td>
</tr>
<tr>
<td>We are constantly under attack from actors ranging from individuals to nation-states now</td>
<td>• Study will show deterrence hinges on “transparency” &amp; ISR</td>
</tr>
<tr>
<td>Cyberspace is where most ISR will be done in the future, and ISR is the original and traditional Air Force mission</td>
<td>• ISR in cyberspace must be accomplished across the range of potential actors</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>‘03: Human Genome decoded</td>
<td>• Two ways to address this threat:</td>
</tr>
<tr>
<td>’10: Human Proteome Project completed . All proteins decoded and mapped</td>
<td>• Never let it occur, by creating an environment of transparency… or</td>
</tr>
<tr>
<td>2025: genetically-engineered disease cures available</td>
<td>• USG must be able to decode, prototype, produce &amp; distribute vaccine nation-wide… all in 72-96 hours (vice 9 months for H1N1)</td>
</tr>
<tr>
<td>A well-trained graduate student in microbiology able to engineer a deadly virus for which no immunity is possible</td>
<td></td>
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### Breaking News About 2035: Nano-energetics

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<td>Nano-energetics improve conventional explosives 5 to 10 fold</td>
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| Nano-engineered corrosives cause rapid deterioration of metals/composite materials | • Conventional weapons may attain significant yields—What is a WMD?  
| Nano fuels – less weight, increased power, solves logistics problems | • Small “dime”-sized explosive can destroy a civilian aircraft in flight  
| | • Corrosives can destroy vital AF systems |
**Breaking News About 2035: EMP/Directed Energy**

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<td>Electrical grid vulnerable to voltage caused by HPM, EMP, SCADA attack, or Solar Flares</td>
<td>• Almost no civilian &amp; few AF systems are hardened</td>
</tr>
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<td>Banking, utility, telephone, air traffic control, water systems all similarly vulnerable.</td>
<td>• EMP or major solar flare (Carrington Event) are worst case scenarios</td>
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<td>How would logistics systems operate without communications?</td>
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## Breaking News About 2035: Lasers

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<td>Marginally-lethal and permanently-blinding hand-held lasers are already on the commercial market</td>
<td>• 299 attacks against aircraft in U.S. from Jan-Sept 15, 2010</td>
</tr>
<tr>
<td>Diode and fiber-optic lasers both surpassed 100 KW levels in ‘09</td>
<td>• Blinding incidents on roadways in Germany</td>
</tr>
<tr>
<td>AC-130 ATL Successfully tested in ‘09. China, India, Russia, and others have advanced programs – megawatt class coming</td>
<td>• AC-130 Laser bored a hole through a Ford F-150 engine block</td>
</tr>
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<tr>
<td>Space assets, military &amp; civilian, vulnerable to attack from ground and space</td>
<td>• Military ISR, communications, and some strike (Predator) capabilities at risk</td>
</tr>
<tr>
<td>Little effort to harden civilian or military satellites</td>
<td>• Civilian critical capabilities (timing for banking, telecommunications, etc. at risk.</td>
</tr>
<tr>
<td>Satellites vulnerable to attacks by direct ascent, directed energy, or attack satellites</td>
<td></td>
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<td>Traditional concerns about state use of nuclear weapons apply</td>
<td>• While technology is “old” infrastructure costs are high – clearly not in the purview of individuals</td>
</tr>
<tr>
<td>“Nuclear club” now stands at 9; Iran close to joining</td>
<td>• Proliferation increases chances for a group to buy/steal a device</td>
</tr>
<tr>
<td>Technology pre-dates the Edsel by 15 years; it is old; it is not “hard”;</td>
<td></td>
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<td>it will proliferate</td>
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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?
The Pivot to Asia: Military/Technical Competition

Today

2035: A Diversified Strategy?
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:

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• Geostrategic & technological competition return
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• 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

Becomes very difficult not to emit something... “going off the grid” is difficult to sustain

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

Technologies are:

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• Geostrategic & technological competition return
• Absent ISR/PED, deterrence fails
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Internet of Things: 31 billion devices by 2025—2035?

Breaking News About 2035
If I can shape the threat’s assessment of his capability, opportunity, or intent, then deterrence is successful.
How Transparency Operates

Scale F2T2EA processes developed over the past decade to find, monitor and deter the key actors who can hurt us.
Needed: A Way To Improve Resiliency of Forces

Enemy also has access/transparency

Al Udeid Air Base, Qatar
2009 Google Earth Image

Loaded B-1s

The enemy may be nature...

Coordinates

...or lurking on the ‘net.

We must protect our capabilities
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
## Three Schools on Global Strike

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<th>Prompt Strike</th>
<th>Standoff</th>
<th>Penetrating</th>
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<tr>
<td>• CONUS-based ICBMs, hypersonics &amp; cyber</td>
<td>• Air-breathing cruise or hypersonic missiles, cyber</td>
<td>• Stealth, standoff-support, hypersonics, cyber</td>
</tr>
<tr>
<td>• Cheaper than defending forward</td>
<td>• Saturate air defenses; cheaper than buying long-range strike</td>
<td>• Better persistence with greater risk</td>
</tr>
<tr>
<td>• Simpler: No A/R, military or diplomatic access</td>
<td>• Less capability vs. mobile or deeply buried; what happens when all missiles expended?</td>
<td>• Reinforces extended deterrence; enables flexible deterrent options</td>
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<tr>
<td>• Fixed target base; less capability vs. mobile or deeply buried; magazine limited</td>
<td></td>
<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

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<th>Stage (Sustain, Defend)</th>
<th>Reach &amp; Access</th>
<th>Opposed or Permissive?</th>
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<td>Engage</td>
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Command, Control, Integration of Interdependent Capabilities
Voice, Data, Timing, Position

### 2012

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

### 2035

- **Find and Fix**
- **Gateway Architectures**
- **Datafighting**
- **Missile Maneuverability**
- **Hypersonic/Swarm**
- **Volumetric**
- **Photonic, Electronic**
- **The Five Ds**
- **OODA Point**
- **Dispersed Operations**
• 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
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**2035**
- Find and Fix
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*...But the Debate Transitions*

Command, Control, Integration of Interdependent Capabilities

Voice, Data, Timing, Position
• 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?
• 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?

Culture may drive the US in one direction; other nations may choose different directions, creating an asymmetry
Knowledge: Timely, integrated, tailored, fused, multi-source data

- Finding is as important to deterrence as fighting in a chaotic world
- Sensors improve, but counter-sensor fight results
- Data volume off the scale; datafighting key to producing knowledge

Power projection evolves

- Challenge: maintain sensor & weapons density at range over time
- Range requirement increases as A2AD pushes platforms outward
- Connectivity eclipses platforms in thinking; enables new CONOPS for kinetic/non-kinetic, lethal/non-lethal, volumetric/precision effects

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<th>INFORMATION</th>
<th>AWARENESS</th>
<th>KNOWLEDGE</th>
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<tr>
<td>uncorrelated facts</td>
<td>correlated data</td>
<td>fused information with context</td>
<td>actionable, attributable, awareness</td>
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New effects from new weapons, but nuclear weapons essential

- Volumetric weapons return; weapons survivability becomes a concern
- Defeating small, hidden targets requires volumetric approach
- Hardened and deeply buried targets require third-way approaches
- Defense is back; uncontested dominance ends

Platforms become less important than weapons

Competition is for superior situational awareness (datafighting)

Winning = achieving a sustainable stalemate?

In more dangerous, rapidly changing world, learning faster than your competition is the only sustainable advantage
QUESTIONS?