THE AIR UNIVERSITY

BLUE HORIZONS 2035:

Airpower in the Age of Surprise

Or "Elvis is Dead and I Ain't Feelin' So Good Myself"

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

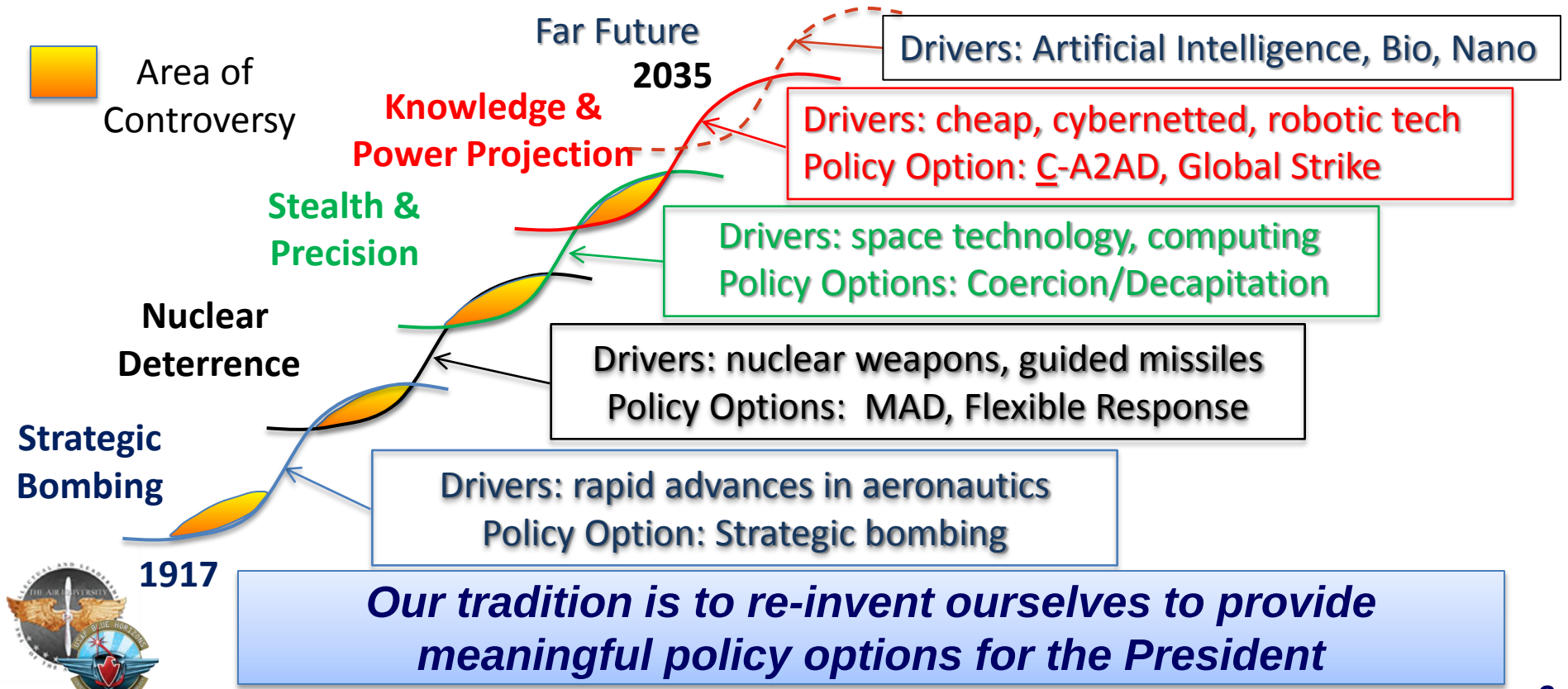
at The Air University

UNCLASSIFIED

Rapid Technological Change

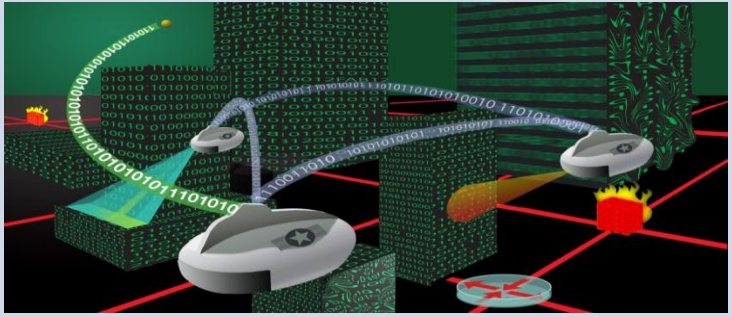
- Last Decade of the 20th Century
  - World Wide Web (93)
  - MP3s (94)
  - EBay (95)
  - Google 1998
  - N Korea Nukes (99)
  - Cable TV (93)
  - Amazon (94)
  - Tivo (99)
  - Paypal (99)
  - Stream Video (93)
  - DVDs (95)
- In the first decade of the 21st Century:
  - iTunes (00)
  - Blackberry (03)
  - Twitter (06)
  - Global Recession (08)
  - iPod (01)
  - Facebook (04)
  - iPhone (07)
  - iPad (10)
  - Wikipedia (01)
  - YouTube (05)

USAF Tradition– Transforming to Meet Future Challenges

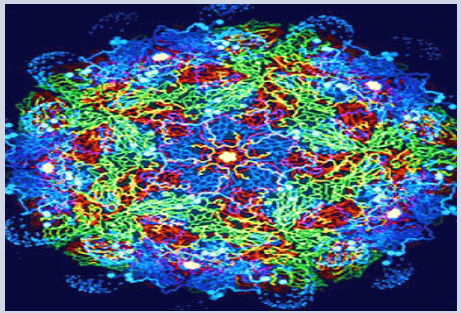


Our tradition is to re-invent ourselves to provide meaningful policy options for the President

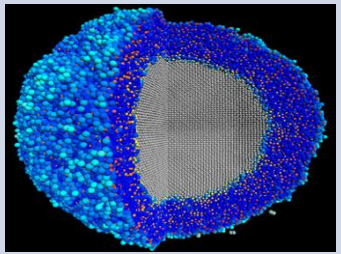
Breaking News About 2035: Cyberspace

Examples	Implications
Much of national critical infrastructure, on which USAF depends, is vulnerable--no business case to address this	
We are constantly under attack from actors ranging from individuals to nation-states now	• Military has a major stake in national critical infrastructure
Cyberspace is where most ISR will be done in the future, and ISR is the original and traditional Air Force mission	• Study will show deterrence hinges on “transparency” & ISR • ISR in cyberspace must be accomplished across the range of potential actors

Breaking News About 2035: Biotechnology

Examples	Implications
‘03: Human Genome decoded ’10: Human Proteome Project completed . All proteins decoded and mapped	 • Two ways to address this threat: • Never let it occur, by creating an environment of transparency… or • USG must be able to decode, prototype, produce & distribute vaccine nation-wide… all in 72-96 hours (vice 9 months for H1N1)
2025: genetically-engineered disease cures available	
A well-trained graduate student in microbiology able to engineer a deadly virus for which no immunity is possible	

Breaking News About 2035: Nano-energetics

Examples	Implications
Nano-energetics improve conventional explosives 5 to 10 fold	  • Conventional weapons may attain significant yields– What is a WMD? • Small “dime”-sized explosive can destroy a civilian aircraft in flight • Corrosives can destroy vital AF systems
Nano-engineered corrosives cause rapid deterioration of metals/composite materials	
Nano fuels – less weight, increased power, solves logistics problems	

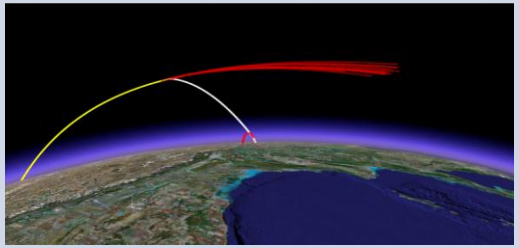
Breaking News About 2035: EMP/Directed Energy

Examples	Implications
Electrical grid vulnerable to voltage caused by HPM, EMP, SCADA attack, or Solar Flares	  • Almost no civilian & few AF systems are hardened • EMP or major solar flare (Carrington Event) are worst case scenarios
Banking, utility, telephone, air traffic control, water systems all similarly vulnerable.	
How would logistics systems operate without communications?	

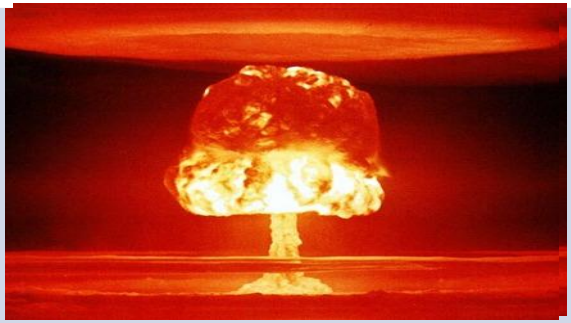
Breaking News About 2035: Lasers

Examples	Implications
Marginally-lethal and permanently-blinding hand-held lasers are already on the commercial market	 
Diode and fiber-optic lasers both surpassed 100 KW levels in ‘09	• 299 attacks against aircraft in U.S. from Jan-Sept 15, 2010 • Blinding incidents on roadways in Germany • AC-130 Laser bored a hole through a Ford F-150 engine block
AC-130 ATL Successfully tested in ‘09. China, India, Russia, and others have advanced programs – megawatt class coming	

Breaking News About 2035: Space

Examples	Implications
Space assets, military &civilian, vulnerable to attack from ground and space	 
Little effort to harden civilian or military satellites	• Military ISR, communications, and some strike (Predator) capabilities at risk
Satellites vulnerable to attacks by direct ascent, directed energy, or attack satellites	• Civilian critical capabilities (timing for banking, telecommunications, etc. at risk.

Breaking News About 2035: Nuclear Weapons

Examples	Implications
Traditional concerns about state use of nuclear weapons apply	
“Nuclear club” now stands at 9; Iran close to joining	• While technology is “old” infrastructure costs are high – clearly not in the purview of individuals • Proliferation increases chances for a group to buy/steal a device
Technology pre-dates the Edsel by 15 years; it is old; it is not “hard”; it will proliferate	

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: 7 trillion devices by 2025—2035?**

TMS-320

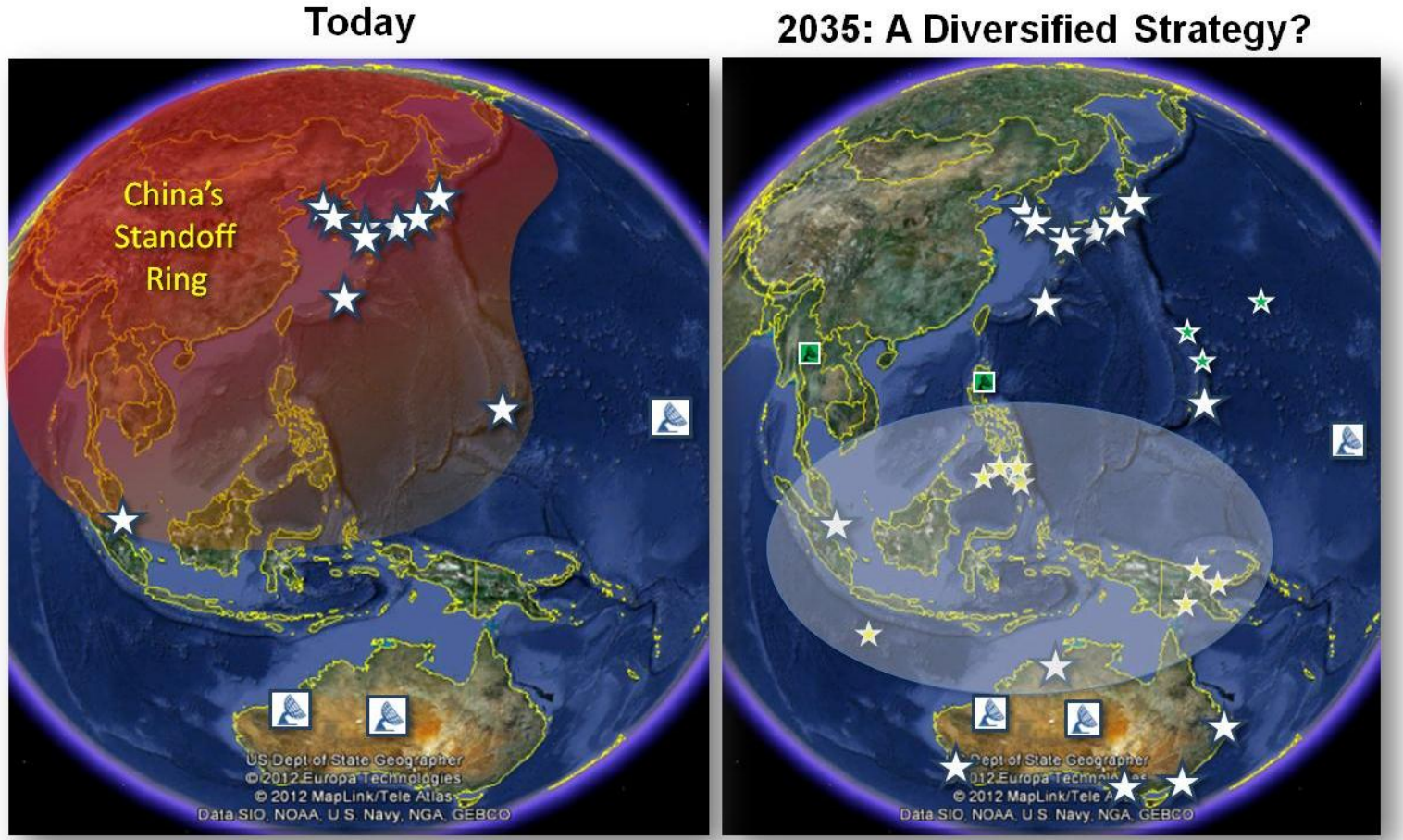
PL-12/SD-10

AIM-120

R-77/AA-12

"Google Maps" + Ubiquitous Precision

The Pivot to Asia: Military/Technical Competition



Breaking News About 2035

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- Internet of Things: 7 trillion devices by 2025—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

Breaking News About 2035

Technologies are:

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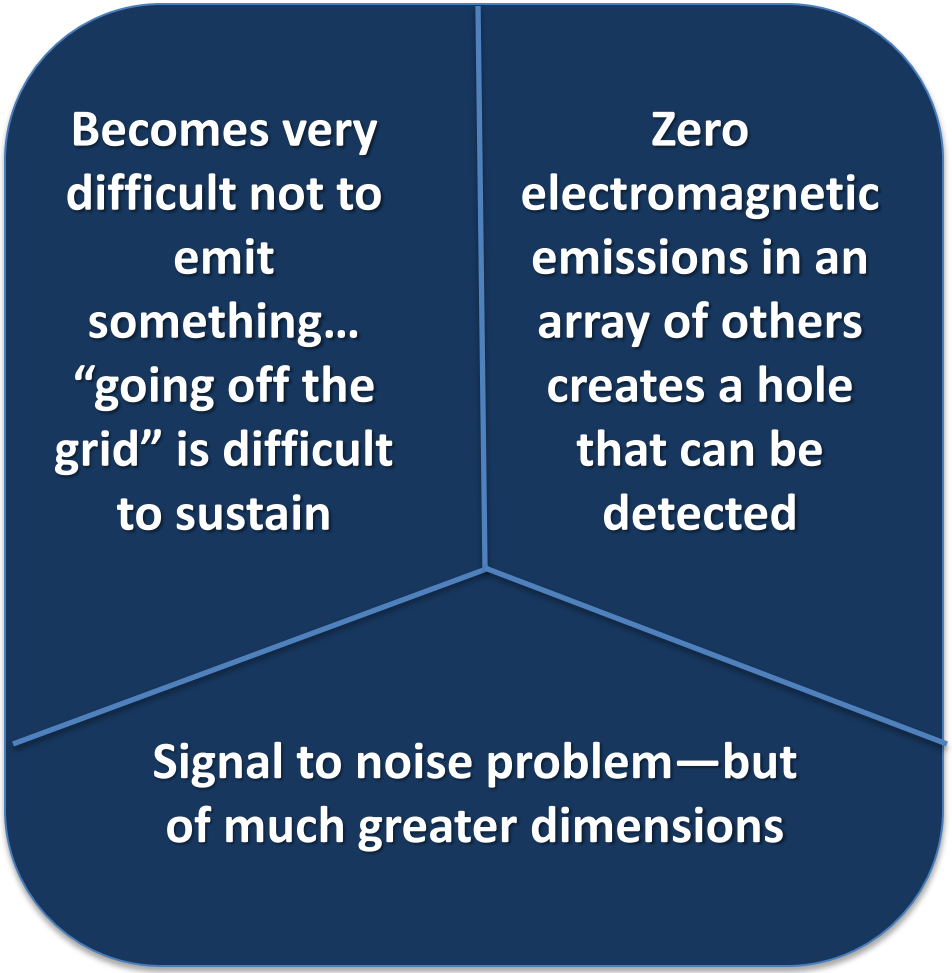
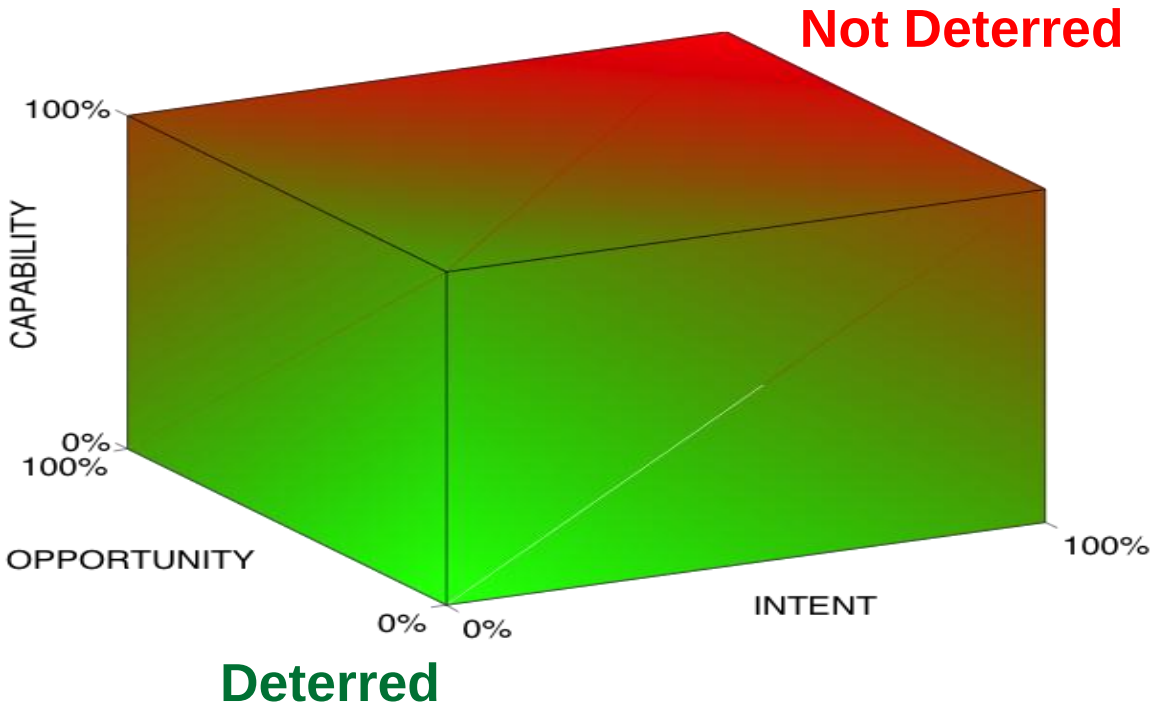
- Counter-sensor battle results

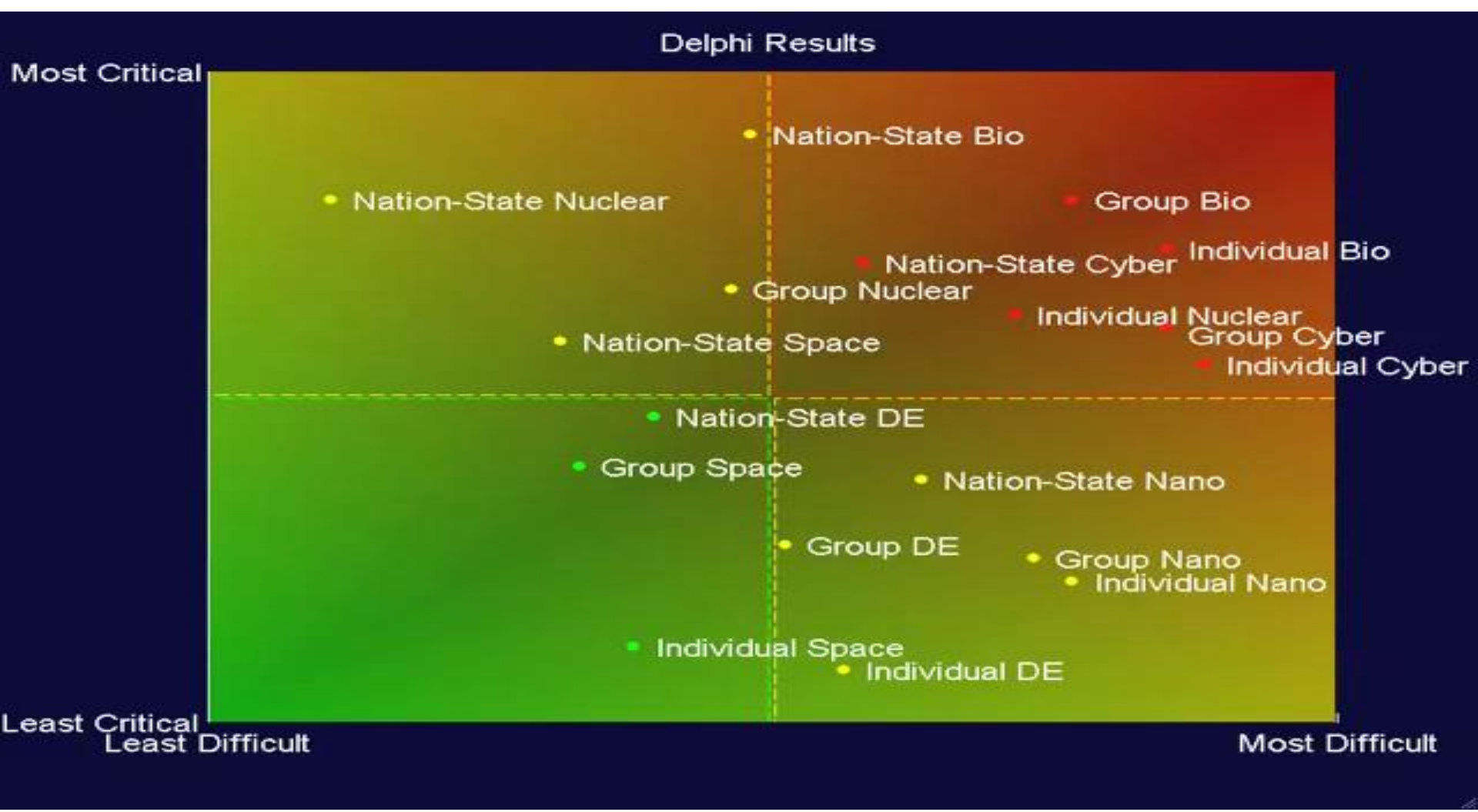
- **Internet of Things: 31 billion devices by 2025—2035?**

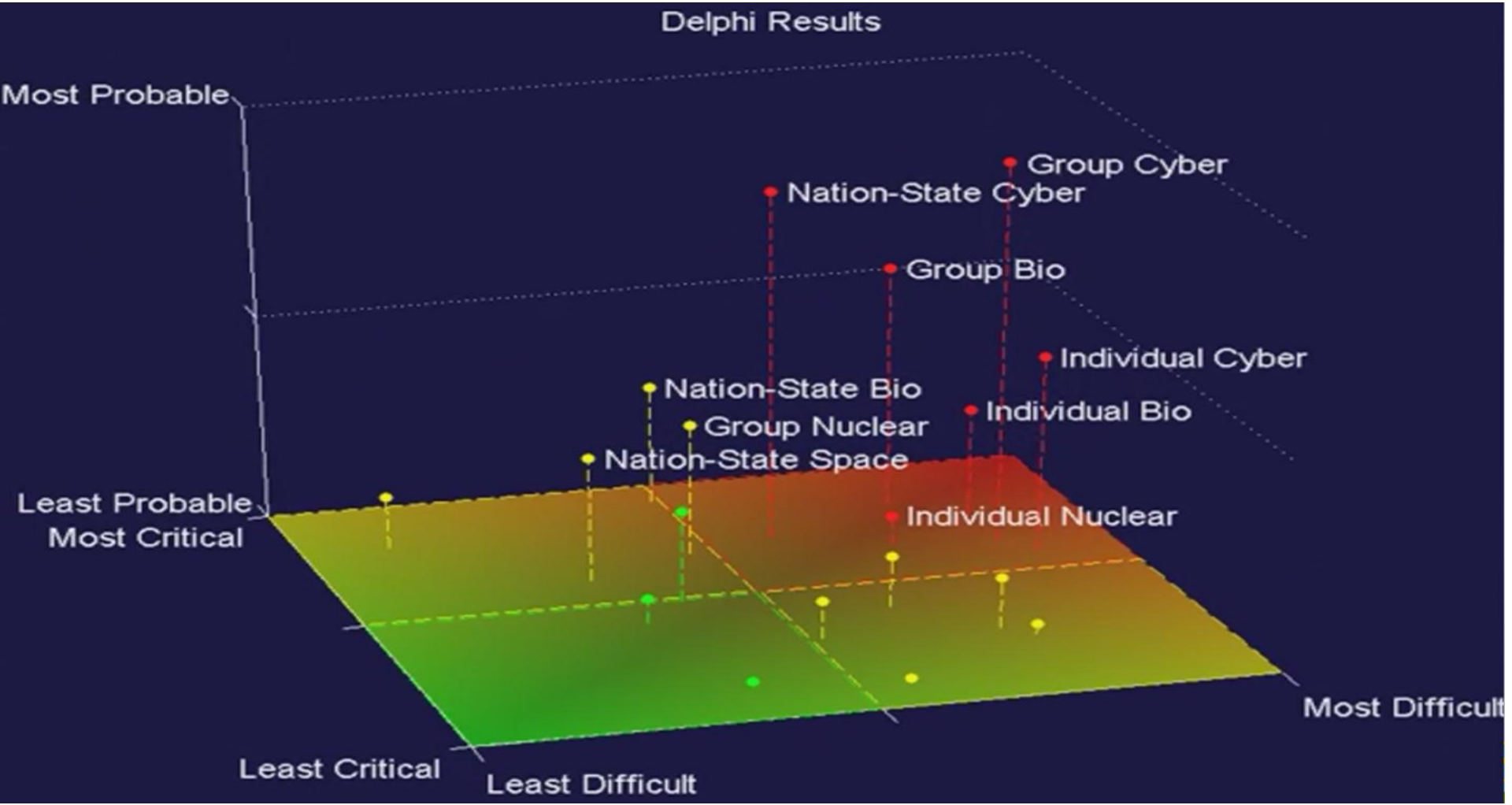


Thinking About Deterrence

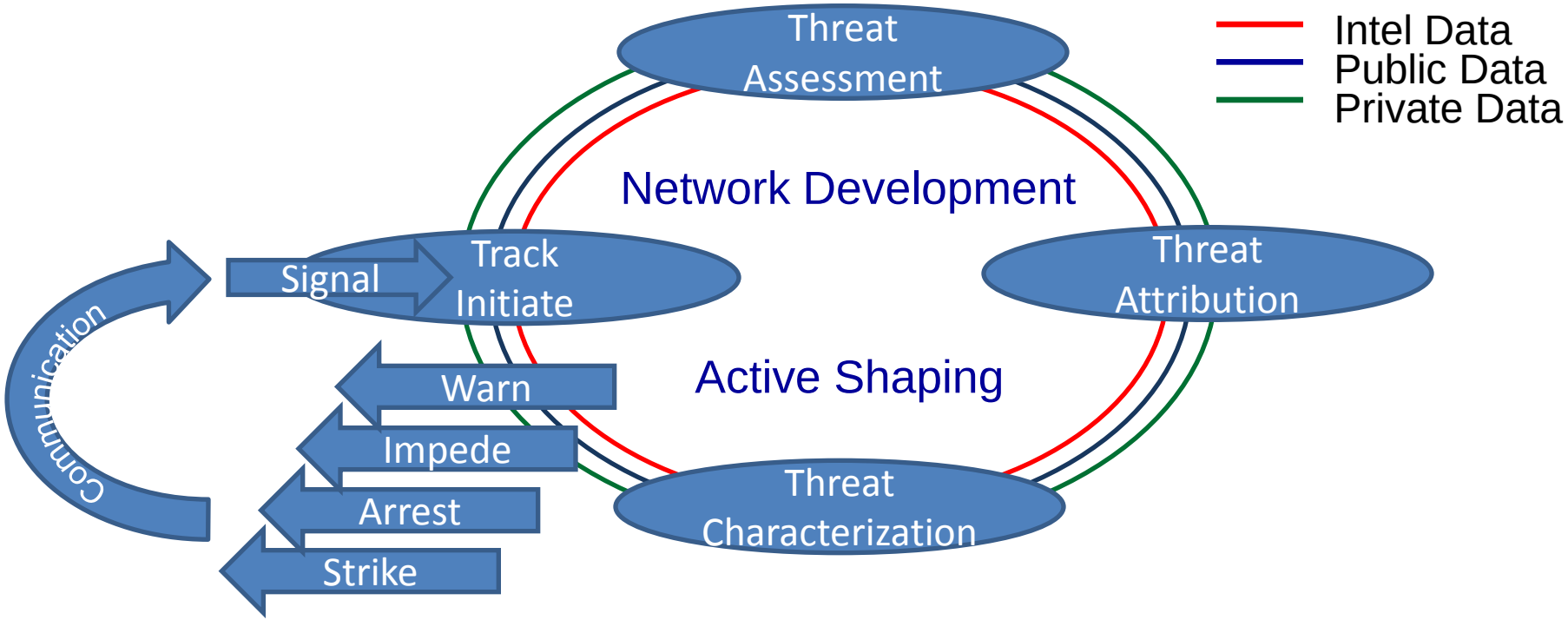


If I can shape the threat's assessment of his capability, opportunity, or intent, then deterrence is successful


Delphi Results
Most Critical
Nation-State Bio
Nation-State Nuclear
Group Bio
Individual Bio
Nation-State Cyber
Group Nuclear
Individual Nuclear
Group Cyber
Nation-State Space
Individual Cyber
Nation-State DE
Group Space
Nation-State Nano
Group DE
Group Nano
Individual Nano
Individual Space
Individual DE
Least Critical
Least Difficult
Most Difficult


Delphi Results
Most Probable
Least Probable
Most Critical
Least Critical
Least Difficult
Most Difficult
Group Cyber
Nation-State Cyber
Group Bio
Individual Cyber
Nation-State Bio
Individual Bio
Group Nuclear
Nation-State Space
Individual Nuclear

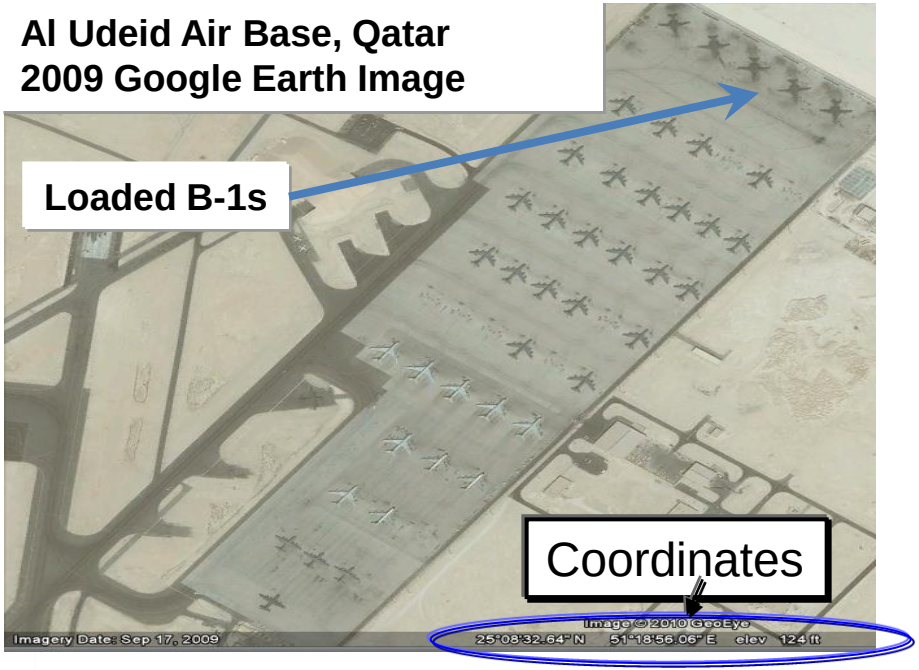
How Transparency Operates

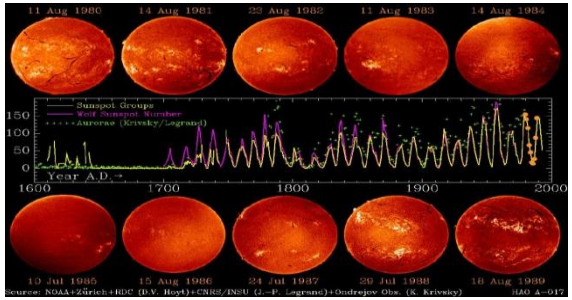


Scale F2T2EA processes developed over the past decade to find, monitor and deter the key actors who can hurt us

Needed: A Way To Improve Resiliency of Forces

Enemy also has access/transparency





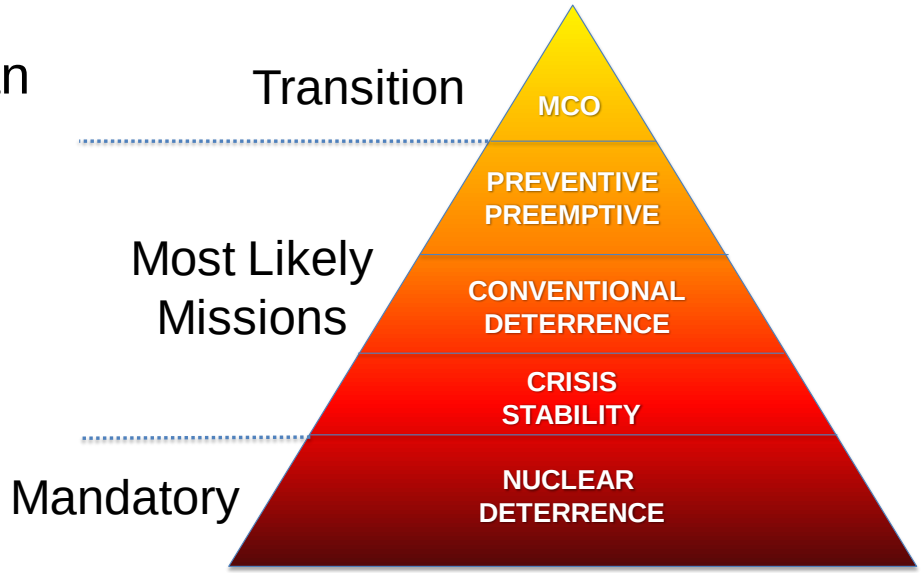
The enemy may be nature…

…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



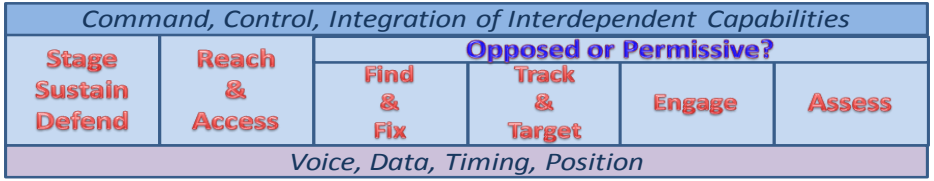
Global Strike defines for Airmen what we are about in simple terms

Three Schools on Global Strike

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

These schools are differentiated by their approach to time, distance, target, platform, payload, purpose to deter or prevail

…But the Debate Transitions



2012	Emphasis Shifts	2035
Engage	→	Find and Fix
Platforms	→	Gateway Architectures
Dogfighting	→	Datafighting
Platform Maneuverability	→	Missile Maneuverability
Stealth	→	Hypersonic/Swarm
Precision	→	Volumetric
High Explosive	→	Photonic, Electronic
Destroy	→	The Five Ds
OODA Loop	→	OODA Point
One Big Base	→	Dispersed Operations

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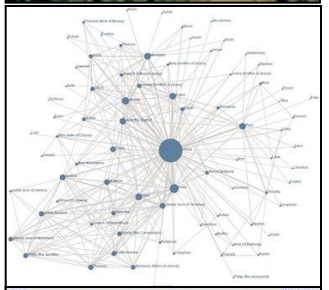
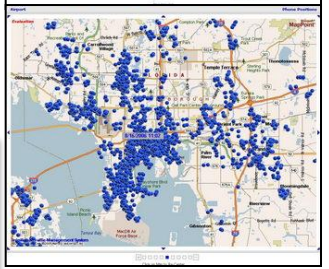
From Dogfighting to Datafighting

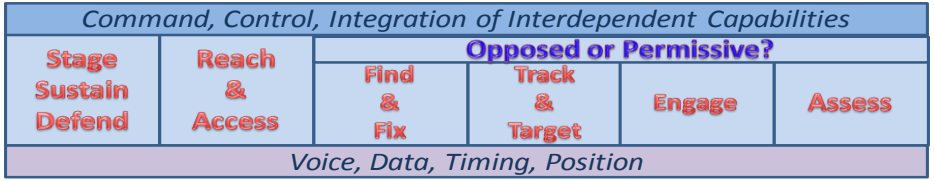
- **Disruptive opportunity for USAF**
  - Generating transparency through all-source data fusion
  - Major future weapons system, the CAOC of 2035
  - Holistic distribution: need to share vs. need to know, “data TPFDD” = data priority and paths
  - Resilient: a variety of connection paths, alternative 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

…But the Debate Transitions



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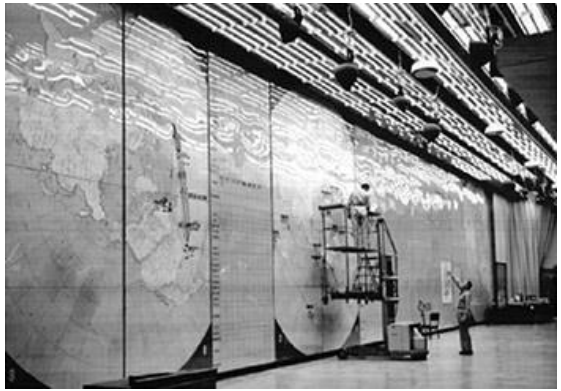
From OODA Loop to OODA Point



- **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

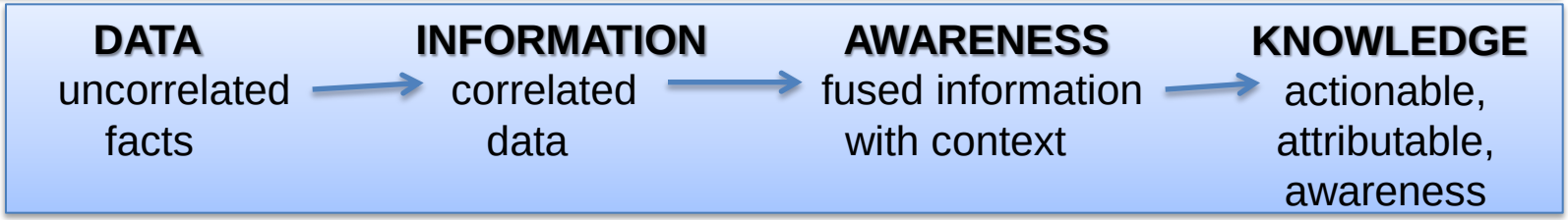
Key Findings

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



Key Findings

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?