The Rapidly Changing International Landscape for Advanced Research Technologies: Implications for Law Enforcement, National Security and Industrial Espionage

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Keynote Presentation at FBI Campus Liaison Initiative Conference
Tempe, Arizona • 17 March 2010
Personal Engagement with the Challenge of Terrorism, Industrial Espionage and National Security

  - Chair, Bioterrorism Task Force (2001 – 2003)
  - Chair, Synthetic Biology Task Force (2008 – 2009)
- Member, Defense Health Board, DoD (2008 – present)
- Member, National Academy of Sciences – Institute of Medicine Panels
  - Global Forum on Infectious Diseases (2003 – present)
  - Dual-Use Technologies and WMD Proliferation (2003 – present)
- Member, Council for Foreign Relations
- Advisory Roles to DHS and IC
Campus Liaison Initiative

- contacts
- culture
- cynicism
- compartments

- compliance
- (keeping) current
- convergence
- connecting the dots

- consistency
- credibility
Navigating a World of Increasingly Complex and Diverse Threats

NEW THREATS

NEW CAPABILITIES
An Unbounded Problem?

- No Clear Enemy
- No Front Line
- No Set Definition of Victory

Success is Measured by Things That “Don’t Happen”
New Polarities and Asymmetries

- nation state adversaries
- geographically constrained adversaries
- dominant concepts of nationality
- formal, national governing structures for diplomacy
- western social democratic ideologies and international legal codes of conduct
- non-state actors
- new group identities in virtualscapes
- virtual Jihadist movement/caliphate
- autonomous cells and global terror networks
- theocratic fundamentalism
- ‘no limits’
“Each of the three last Administrations have been slow to recognize and respond to the biothreat”
Escalating Polarities and New Asymmetrics

- geographic concentration of technological/economic/military power
- rapid diffusion of critical technologies
- rise of new economic centers
## From Small-Time to Prime-Time: Companies with #1 Global Market Share

<table>
<thead>
<tr>
<th>Company</th>
<th>Industry</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsung</td>
<td>flash memories, hard disks, flat screen monitors</td>
<td>South Korea</td>
</tr>
<tr>
<td>Aracruz</td>
<td>market pulp for paper products</td>
<td>Brazil</td>
</tr>
<tr>
<td>Sasol</td>
<td>synthetic fuels</td>
<td>South Africa</td>
</tr>
<tr>
<td>TSMC</td>
<td>logic semiconductors</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Misc</td>
<td>liquified natural gas shipping</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Gazprom</td>
<td>natural gas</td>
<td>Russia</td>
</tr>
<tr>
<td>Tenaris</td>
<td>oil pipes</td>
<td>Argentina</td>
</tr>
</tbody>
</table>
RED STAR OVER IRAQ

China's ambitions in the Iraqi oil fields could change the landscape

By Stanley Reed

Business Week

2/2/10

CHINA INTO AFRICA

TRADE, AID, AND INFLUENCE

Robert I. Rotberg, Editor

CHINA'S RELIANCE ON MIDEAST OIL

MILLIONS OF BARRELS PER DAY

MIDDLE EAST 1.8

AFRICA 1.1

ASIA-PACIFIC 0.1

OTHER 0.6

TOTAL IMPORTS: 3.6 MILLION BARRELS A DAY

Data: Energy Information Administration, FACTS Global Energy
New Polarities and Asymmetries

- ‘flat world’ globalization and supply chain outsourcing
- structured global trade and formal economies
- new ‘blowback’ vulnerabilities from supply chain choke points/trojan horses
- parallel universe of uncharted economies of criminal capital and goods
  - smugglers, traffickers, counterfeiters
  - linkage of organized crime and terror networks
The Enormous Complexity and Expansion of CONUS Threat Response Capabilities
Ubiquitous Sensing: Everything Becomes a Sensor

Managing Natural Risks and Resources

- Biosecurity

Identification and Pre-emption of Adversarial Threats

- Military, Intelligence, and Law Enforcement Capabilities

Global Security

- Socio-Cultural
- Economic
- Infrastructure
- Information Networks
Transcending Boundaries: Emergent Domains Arising from Technology Convergence

<table>
<thead>
<tr>
<th>Systems Biology</th>
<th>Targeted Rx</th>
<th>Regenerative Medicine</th>
<th>HPO</th>
<th>Genetic Identity</th>
</tr>
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- Bio-Enhancement
- Bionic-Enhancement
- Cognitive Enhancement
- Genetic Enhancement
- Bio-Stratified Population
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<th>Molecular Foundries</th>
<th>Novel Materials</th>
<th>Micro-Devices</th>
<th>Ubiquitous Sensing</th>
<th>Robotics</th>
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<tr>
<td><img src="image1" alt="Molecular Foundries" /></td>
<td><img src="image2" alt="Novel Materials" /></td>
<td><img src="image3" alt="Micro-Devices" /></td>
<td><img src="image4" alt="Ubiquitous Sensing" /></td>
<td><img src="image5" alt="Robotics" /></td>
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<th>Digital Anthropology</th>
<th>Cogint</th>
<th>Intelligent Machines</th>
<th>Competition and Espionage</th>
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<tr>
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<td><img src="image7" alt="Digital Anthropology" /></td>
<td><img src="image8" alt="Cogint" /></td>
<td><img src="image9" alt="Intelligent Machines" /></td>
<td><img src="image10" alt="Competition and Espionage" /></td>
</tr>
</tbody>
</table>

**Massive Computing Power and Analytical Parsing**
The Scale and Complex Diversity of a Major Campus
Intelligent Monitoring Systems for Detection of Emerging Infectious Diseases and Global Public Health

Emerging Infectious Diseases (EIDs)  Urbanization in Developing Countries  Bioterrorism
Future Trajectory Trends and Threat Expansion

New ‘Dual-Use’ Technologies
Executive Order: Strengthening Laboratory Biosecurity in the United States
January 9, 2009
The Expanded Dimension of the CB Challenge

- thinking beyond ‘bio’ as just infectious agents (bugs)

- systems biology
  - targeted disruption of ANY body function
  - novel Chem and Bio threats

- synthetic biology
  - exploring biospace: designing new life forms
  - designer organisms to attack materials/infrastructure
Synthetic Biology

- emerging technology with myriad applications across diverse industrial sectors

<table>
<thead>
<tr>
<th>Healthcare</th>
<th>Public Health</th>
<th>Agriculture</th>
<th>Functional Foods</th>
<th>Novel Materials</th>
<th>Textiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioenergy and Biofuels</td>
<td>Industrial Enzymes</td>
<td>‘Green’ Mfg</td>
<td>Bio-remediation</td>
<td>Clean Water</td>
<td>Ubiquitous Sensors</td>
</tr>
</tbody>
</table>
C332,652; H492, 388; N98, 245; O131, 196 P7, 501; S2,340
(a.k.a. poliovirus)

ATTGACTGCAA ........................(design specifications)
Biohackers: An Emerging Challenge
Executive Order (EO 13486) 9 January 2009
“Strengthening Laboratory Biosecurity In the United States”

- working group reported January 2010
- improve agency coordination in classification, inventory, inspection process and regulations for select agents (SA)
- improve security risk assessment (SRA) vetting at Federal level and continuous monitoring of individuals with BSAT access
- physical security and transportation of BSAT materials
DNA

DNA: Deoxyribonucleic acid
bases: Adenine
Thymine
Guanine
Cytosine
structure: Double Helix

22-26 Angstroms

ACGT

DNA
The Infocosm: Emerging Networks of Global Connectivity
• everything will become a reporter
• everything will move faster
• everything can go everywhere
• everything carries a signature
Its all about signatures...

Who’s been using explosives?

Who’s handled a biothreat?

Is this someone I’m looking for?

Who’s lying?

Who’s been inoculated against an agent?

Can a biosignature tell me where someone has been and whom they interacted with?
...and the systems required to collect them

- Contact
- Close-in
- Proximate
- Novel Tags
- Invasive
- Space
- Terrestrial
- Airborne
Coming To Our House
Biometric Screening Regime

Unknown Terrorists
Collection of latent prints

Known Terrorists
Collection of 10-print sets

Provided by cooperating governments from crime scene files, arrest records

Collection during overseas intelligence exploitation and clandestine operations

Domestic law enforcement collection during arrest and from crime scenes

Defense collection from detainees and battlefield collection of latents from safehouses, weapons, and IEDs

National fingerprint database (IAFIS)

Central repository of all known terror-related latent and ten-print sets

Full interoperability with all relevant biometric screening systems

Screening of detainees in theater

US-VISIT: at the border

Visa adjudication

Domestic law enforcement

Trusted traveler programs

TWIC, TWP, others...
Next Generation Identification (NGI)
Commensal Microorganisms, Viruses and Parasites as Sensors and Taggants

- Engineered tag insertion into carrier organism/materials
  - Constitutive or induced expression of tag
  - Activatable tags

- Variable standoff detection range
  - Magnetic, metallic, spectral tags

- Induction of biomarkers by exposure as evidence of presence in red location
Ubiquitous Sensing and Ambient Intelligence

- profound national security, legal and societal implications
- improved supply chain logistics and industrial automation and reduced dependence on human labor
- foreign suppliers as simultaneous single-source and single point-of-failure/vulnerability
- cost of high false positive and false negative detection in early era may jeopardize public trust
- massively parallel sensor fusion may undermine social cohesion if incompatible with privacy and Fourth-amendment guarantees against unreasonable search
Cyber-Attacks and Vulnerable Infrastructure: Compromising Critical Systems
Infrastructure Vulnerabilities

- Destruction of Hoover by destruction of Glen Canyon
- Deprive 22 million people of water
- Eliminate 50% electrical power in California
- Destroy irrigation of 1.5 million acres US farmland

- 20 million pounds HE
- $2.7 \times 10^7$ acre feet stored water
- $8.6 \times 10^{15}$ Joules
- 22 Kt
- $1 \times 10^{14}$ Joules
- $3 \times 10^7$ acre feet stored water
- $1.2 \times 10^{16}$ Joules
Dark Visitors

ROGUES GALLERY

GOODWELL
Founder of the Green Army, with a membership of as many as 3,000, Goodwell is perhaps China's most famous hacker, directly or indirectly responsible for hacking countless foreign Web sites.

WITHERED ROSE
His group, NCPH, built viruses that may have stolen classified U.S. documents. Withered Rose represented the Sichuan Military Command in a hacker competition against other provinces—and won.

XIAO TIAN
In the male-dominated world of hacking, Xiao Tian, leader of a female hacker group called the China Girl Security Team, is a rarity. Her 2,200-plus-member group is responsible for several defacements.

ONE THIRD OF CHINESE ELEMENTARY-SCHOOL STUDENTS CLAIM THEY ASPIRE TO BE HACKERS.
Ubiquitous Sensing: (Ambient Intelligence) Using Very Small Things to Solve Big Problems

defining robust signatures

Complex Signal deconvolution and wireless networks

actionable information

Profile
Sense
Act
“Hell is the Place Where Nothing Connects”
T. S. Eliot
The Fragmented Silos of USG: A Dangerous Vulnerability
Great Expectations: Intelligent Monitoring Systems for Improved Analysis of National Security Threats and Their Implications

- dramatic expansion in ‘signatures for interest’
- formidable data mining and context analytics
- new tradecraft
- new open sources (OSINT)
- new ways to validate sources
- new technical competencies
- new knowledge integration tools
- new behaviors
Social Network Analysis of al-Qaeda Cells
ECOLOGY OF WAR
Statistical patterns of insurgency and terrorism
Big SIS is Watching You
• estimated 7 trillion wirelessly connected devices and objects by 2017 (c.1000/person)

• mobile devices and monitoring consumer habits
  – behavioral targeting
  – contextual targeting
  – social network profiling

• the politics of privacy
  – growing pressure for legislative oversight
  – US Energy and Commerce Internet Subcommittee
  – EU Article 29 Working Party

• two-thirds of new products now come with some electronic component or tracking potential
Enhancing Human Capabilities to Use the Increased Volume, Diversity and Complexity of Information Flows
The Neurobiology of Decision

choice  risk reward  rational (?) economics  religion
Behavioral Genetics: A Non-PC But Unavoidable Domain of Cognitive Neurosciences
“The problem is religion. Our Islamist enemies are inspired by it, while we are terrified to talk about it. We are in the unique position of denying that our enemies know what they themselves are up to.”

Ralph Peters
J. Int. Sec. Affairs (2009) 16, 7
Economic Espionage

- national initiatives
- targeted espionage
- universities
Capability of the People’s Republic of China to Conduct Cyber Warfare and Computer Network Exploitation

Prepared for
The US-China Economic and Security Review Commission

Information Systems Sector
7575 Oldshire Drive
McLean, VA 22102
October 9, 2009

NORTHROP GRUMMAN

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China Increases Research Ventures
Growth in Funding Broadens Development Spectrum

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Biotech in China

中国生物科技专辑

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China’s Use of Perception Management and Strategic Deception

Prepared for the U.S.-China Economic and Security Review Commission
by
Dr. Eric C. Anderson with Mr. Jeffrey G. Engstrom
Science Applications International Corporation

Revised November 2009
Criminal Justice Information Services (CJIS)

Provides timely and relevant information to intelligence, law enforcement, civilian, academic, employment, and licensing agencies.
“Fortress America”: NRC Report

- Unilateral US control efforts outdated
- Origins in effective Cold War policies but now eclipsed by rapid diffusion of technologies OCONUS
- USG maintains long list of controlled obsolescent technologies and export bans on products freely available OCONUS
- Lack of USG staff with advanced training to revise controlled technologies lists
- Adverse impact on competitiveness of US high-tech companies/universities
The Gathering Storm: The USA is Losing Scientific and Technical Leadership

- Annual Competition in algorithm coding
- 4200 competitors (2009)
- finalists
  - China (20)
  - Russia (10)
  - USA (2)
- rapid growth in number and nationalities competing
- major presence of PRC teams
- contest winners now largely non-US
“Tracking Expertise”
Intelligence

Foreign Policy

Biosecurity

Defense and Homeland Security

- strategic communication and projection of non-military dimensions of US influence
- new international mechanisms for oversight/governance of dual-use technologies

• threat diversification
  new conflict patterns

• public-private sector initiatives
“Politics is the art of the possible, the calculated science of survival”

Prince Otto von Bismarck

“Survival owes little to the art of politics, but everything to the calculated application of science”.

Professor Rudolph Virchow (in reply)