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Presentation at TASER International
Scottsdale, Arizona
6 June 2016
Innovation

Cool Facilities

Geekiest Offices

Compelling Mission

PROTECT LIFE

PROTECT TRUTH
Advisory Roles in US National Security:
Dr. George Poste and US Secretary of Defense Dr. Ashton Carter

- Defense Science Board
- DOD Bioterrorism Task Force
- National Academy of Medicine Global Forum on Infectious Disease
- National Blueprint for Biodefense
- In-Q-Tel
- Defense Threat Reduction Agency
- Department of Homeland Security
- Council on Foreign Relations
Security

- threat mitigation/elimination
- proactive risk assessment and mitigation versus reactive post-incident actions
- immediate and long-term protection
- channeling events to most desired outcomes
- escalating complexities
- constant learning and adaptation
Rumsfeld’s Rules

- known, knowns
  - preparedness
- known, unknowns
  - R&D for new capabilities
- unknown, unknowns
  - potential for rude surprises

Hon. D. Rumsfeld
US Secretary of Defense
### Global Security Risks: Escalating Diversity and Complexity

<table>
<thead>
<tr>
<th>Rise of New Powers</th>
<th>WMD Proliferation</th>
<th>Jihadi Terrorism and Religious Fundamentalism</th>
<th>Failed States</th>
<th>Refugees</th>
</tr>
</thead>
</table>

- **Homeland Security**
- **Cybersecurity**
- **Biosecurity**
- **Robotics, Autonomous Weapons**
- **Asymmetric Vulnerabilities**
Global Security Risks: Escalating Diversity and Complexity

- Pandemic Disease
- Climate-Change and New Vector Range
- Natural Resources Depletion
- Feeding 9 Billion

- Antibiotic Resistance
- Aging Society and Health Cost
- Automation and Unemployment
- Future Workforce Education
Global Urbanization

- 28 megacities in 2016
- 70% current/projected megacities in countries with Global Conflict Risk Index probability of conflict within 10 years
- Unprecedented stresses on infrastructure and services by 2030:
  - Food (35% ↑), water (40% ↑), energy (50% ↑)
- Susceptibility to extreme weather/natural disaster:
  - Littoral locations, slums
Global Security Risks: The Impact of Urbanization

<table>
<thead>
<tr>
<th>Developing Countries and Failed States</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Megacities in DCs</td>
<td>Climate Change</td>
</tr>
<tr>
<td>Inadequate Health Infrastructure</td>
<td>Offshoring and Supply Chain Risk</td>
</tr>
<tr>
<td>Warlords, Gangs and No Go Zones</td>
<td>Aging Infrastructure</td>
</tr>
<tr>
<td>MOUT/DUCT COIN</td>
<td>Disaster Management</td>
</tr>
</tbody>
</table>
The ‘Fog of Disaster’: Crisis Standards of Care and Proliferation of Unanticipated Events and Consequences
Domestic Social Issues and Perceived Inequity as Triggers of Resentment, Unrest and Instability
Security: Sustained Competitiveness in Advanced Technologies

- Genetic and Synthetic Biology
- Nanotechnology and Novel Materials
- Photonics and Optics
- Sensors and IoT
- 3-D Manufacturing
- Cognitive Computing and Neurotechnology
- Robotics and Automation
- Man-Machine Interactions
- Machine Learning
- Deep Learning and Artificial Intelligence
Convergence, Connectivity and Complexity

- Living systems
- Mechanical systems
- Digital systems
The Big Data V6 Challenge:
The Pending Zettabyte-Brontobyte Worlds

- volume
- velocity
- variety
- veracity
- visualization
- value
Big Data and Analytics: Integration of Diverse Data Streams for Comprehensive Real Time Situational Awareness

“Actionable Intelligence Starts at Ingestion”
Ubiquitous Sensing

Internet – of – Things (IoT)

Biometrics and Surveillance

AORTA: Always On, Real Time Awareness

Faster Data, Smarter Analytics, Better Decisions
The Relentless Battle Against Ever Changing Infectious Diseases

- pandemic (avian) influenza
- HIV
- West Nile virus
- MERS
- Ebola virus
- bush meat food chain
- Zika virus
- what’s out there?
Geodemographic Information Systems (GIS): Ground Zero Data

Comprehensive Front Line Sampling of Sentinel Species

Real-time Intelligence and Faster Preparedness
Engineering Pathogenic Organisms With Increased Virulence and/or Ability to Evade Detection by Body’s Immune System

- synthetic poliovirus
- creation of pandemic influenza strains
- Ebola as a potential bioweapon
CRISPR/Cas9-mediated gene editing in human tripronuclear zygotes

Puping Liang 1, Yanwen Xu 1, Xiya Zheng 1, Chenhui Ding 1, Rui Huang 1, Zhen Zhang 1, Jie Lv 1, Xiaowei Xie 1, Yuxi Chen 1, Yujing Li 1, Ying Sun 1, Yaofu Bai 1, Zhou Songyang 1, Wenli Ma 1, Canquan Zhou 1 and Junjui Huang 1

(1) Guangdong Province Key Laboratory of Reproductive Medicine, the First Affiliated Hospital, and Key Laboratory of Gene Engineering of the Ministry of Education, School of Life Sciences, Sun Yat-sen University, Guangzhou, 510275, China

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Editing Humanity: No Longer An Abstract Question
Gene Editing As One of the Top Six Existential Threats to the USA
The Crucial Value of Point-of-Need Multiplex Diagnostic Devices for Real-Time Health Status Monitoring
Wearable Devices and Wireless Monitoring of Health Status

Vital Signs Monitoring

Gastroenterology Mini-Cam

Pills with Chips

Glucose Monitoring
Implantable Devices and Wireless Monitoring (and Modulation)

next-generation miniaturized power sources

security and hacker protections
Invasion of the Body Trackers

Remote Health Status and Behavior Monitoring

Meta-Data  Consent  Privacy and Security
Your Molecular Uniqueness

- genome
- proteome
- exposome
- immunosignature
Construction of Biometric Databases
Facial Recognition and Identification of Terrorism Suspects
The DNA Identikit: Tracking Genes Coding for Facial Bones, Eye and Hair Color
Biometrics of Unknown Person (BUPs)

- recovery of DNA and other biological markers from objects seized abroad in military/intelligence operations
- bomb casings, keyboards, phones, clothing
- matching of recovered papers and electronic materials to other datastreams
Computer-Based Facial Recognition Plus Idiosyncratic Patterns of Body Language and Movement
The Challenge of Real-Time Monitoring and Individual Recognition in Crowded Spaces
Evolution of Dynamic Interfaces for Computer-Based Individual Recognition and Real Time Decisions
Legal and Policy Issues Generated by Use of Body-Worn Cameras (BWC) and other Technologies for Front-Line Police and On-Ground Military

- privacy, transparency, accountability
- the ‘gotcha’ phenomenon
  - every action potentially recorded by third parties
  - vital record of the perspective of the front-line operator(s)
- integrated end-to-end data ecosystem
Integrated Ecosystems for Facile, End-to-End Secure Data Capture, Authentication and Analytics

From Capture to Courtroom

- Evidence.com

From Conflict Zone to Adaptive CONOPS

- C4ISR

- security
- scalability
- sustainability
- authenticity
- availability
- audit
- speed
- search
- synthesis
Tracking Personal Behavior and Activities

Digital Signatures/Traces/Exhaust/Dust

Predictive Analytics
Digital Traces

- every move you make
- every twitter feed you update
- every facebook friend you add
- every internet search you log
- every cell phone call you transmit
- every time you use your credit card

SOMETHING AND/OR SOMEONE IS TRACKING YOU
You’re So Predictable!
Social Behavior Becomes Quantifiable

- who knows why people do what they do?
  - the fact is that they do!

- these actions can now be traced and measured with unprecedented precision

- with sufficient data, the patterns reveal increasingly predictable behavior and individual risk patterns

- new opportunities in multiple business sectors

- broad utility in national security, intelligence and military operations

- new ethical and legal issues regarding privacy and data security
Cell-Phone Based Digital Geo-spatial Information Services
Individual-Specific Patterns of App Use and Keyboard Use Dynamics
Avatar Personalities in Gaming Reveal Behavioral Clues to Match With Other Aspects of User Activities

- risk profiling
- predispositions to anti-social actions/susceptibilities
- mapping correlation with real world actions, including law breaking
International Mobile Subscriber Identity (IMSI)
Catcher Technology (Cell-Site Simulator)

- tracking of mobile phones by IMSI signal
- police depts., FBI, IRS and IC (restricted)
  - Hailstorm
  - Stingray, Triggerfish, Kingfish, Amberjack, Harpoon
- consumer products
  - Snoopsnitch, Cryptophone
- legal challenges to privacy invasion
Your Car Knows A Lot About You
Will We Even Call It A Phone In 2020?

- Bendable LED Screens
- Holographic Imaging
- Wearable Mobile Computing
- Gesture Based UIs
- Augmented Reality (AR)
- Facial & Eye Recognition
- Mobile Biometrics
Lots of Little Brothers Create – Big Brother

The Democratization of Surveillance
Large Scale Probabilistic Analysis of Electronic Traffic Networks to Identify Anomalies and Potential Risk Emergence
Real Time Analytics (Mining) of High Volume Social Media Feeds
Profiling of Militant Islamic Fundamentalists and Terrorism Behavioral Indicators
<table>
<thead>
<tr>
<th>City</th>
<th>Year(s)</th>
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<tr>
<td>Mogadishu</td>
<td>1993</td>
<td>Grozny</td>
<td>1994 and 1999</td>
<td>Fallujah</td>
<td>2004</td>
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<tr>
<td>Sadr City</td>
<td>2008</td>
<td>Gaza</td>
<td>2013</td>
<td>Aleppo</td>
<td>2016</td>
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</table>

**Urban Warfare, Counter-Terrorism and Counter-Insurgency Operations**
Real Time Intelligence for On-Ground, Dismounted Forces
Electronic Intelligence for On-Ground Dismounted Forces in Urban Settings

seeing round corners

seeing through walls

[Images and graphs related to sensing technology and analysis]
Everything is a Potential On-Ground Sensor and Signal
Satellites, Drones and Robots

The New Automated Battlefield

Semi-Autonomous and Autonomous Weapons
Eyes in the Sky: “Persistent Stare”
The Rise of the Keyboard Warriors: The USAF Now Trains More Drone Pilots Than Conventional Fighter and Transport Pilots
Diversification of Military and Law Enforcement Drone Platforms
Cicada: Covert Autonomous Disposable Aircraft
The Miniaturized Drone That Can Spy From a Leaf
Drone Paramedics

Drones to Your Door

Drones for Your Dog
Paul Revere Updated

The Robots are Coming, The Robots are Coming!
The Robots are Coming

Civilian Sector 4-D Jobs – Dull, Dirty, Dangerous and Digital

Progressive Redundancy and Replacement of Human Skills
All-Terrain Fast Mobility Robotics: Boston Dynamics
Armed Robots
The Complex Ethical and Legal Landscape of New Classes of Fully Autonomous Battlefield Machines

Keeping Humans In-the-Loop
Iron Man: The SOCOM-TALOS Project
Tactical Assault Light Operator Suit (Ekso Bionics)
Human-Machine Interactions

Human-Computer Interactions

Neurotechnologies and Artificial Intelligence
Implanted Brain Microelectrode Arrays and Mind Control of Prosthetic Arm by Quadriplegic Patient
Direct Connection of Nervous Control to Prostheses
“Brain Net”

- first brain-to-brain link via remote transfer of encoded brain pattern to decoder animal and triggering of behavioral mimicry
- build inventory of codes to elicit specific behavior in target (decoder)
  - design of new control systems for robots
- legal and ethical implications of extension to elicited behavior (control, modulation) of humans
Dual-Use Implications of Advances in Neural Science
Designing New Ways to Expand Human Cognitive, Sensory and Motor Capabilities
Heads-up Display Technologies to Optimize Complex Manufacturing Assembly and Reduce Risk
Virtual Reality and Training for Complex, Dynamic Tasks
Advances in Cognitive Neurosciences and New Patterns of Cognitive Processing

- optimize information representation (perception)
- neuroplasticity and selection of new cognitive mechanisms
- modulation of brain function to optimize comprehension
Massive Data and the Sophistication of Analytical Algorithms is Outpacing Human Cognitive and Sensory Capabilities

Why Wait for the Slow Brain to Catchup With the Fast Machine

Machine Learning and Artificial Intelligence
Recent Acquisitions mid-2015 to May 2016

- FoundationDB
- LINX Imaging
- Coherent Navigation
- MapSense
- Metaio
- Vocaliq
- FaceShift
- Perceptio
- Legbacore
- Flyby
- LearnSprout
- Emollient
Automation, Robotics, Machine Intelligence and the Future Workforce
Robotic Dystopias


Original Sin Updated?
Artificial Intelligence and the Elimination of Mankind?
The 19th Video Recruitment of High-level Overseas Talents for China’s Top Universities

The editorial department of CHISA, China Education and Research Network and China Education Online will jointly sponsor this recruitment activity with more than twenty Chinese universities and top disciplines. Those who are intend to participate Chang Jiang Scholars Program and other high-level talents recruitment are warmly invited.

Holding Date : 7:00-24:00 29th May, 2016 (GMT+8)
Recruitment Requirement: Overseas Scholars and Doctors

Participating Universities:

- 上海工程技术大学
- 上海海事大学
- 上海海事大学
- 北京理工大学
- 北京理工大学
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Position Requirements:

Participation Approaches:
1. Please send your resume to wwbh@zol.cn
2. Visit the website http://www.edu.cn/cv. Each university has his own chat room and you can communicate with recruiter face to face. [7:00-24:00 29th May, 2016 (GMT+8)]
For more information, Please contact : 86-10-62603770, 86-15300215485
China’s Military Aspirations
Technology Acceleration and Convergence: Escalating Complexities

Genetics, Biotechnology, Synthetic Biology

Ubiquitous Sensing/ Devices & Social Networks

Advanced Computing Mega- & Meta- Data

Robotics and Advanced Autonomous Systems

Neurosciences and Human-Machine Interactions

“Bio-Space”

“Connected Space”

“Analytics Space” and “Surveillance Space”

“Design Control Space”

“Cognitive Space”
Technology Acceleration and Convergence: Escalating Complexities

- Genetics, Biotechnology, Synthetic Biology
- Ubiquitous Sensing/Devices & Social Networks
- Advanced Computing Mega- & Meta- Data
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“Bio-Space”
“Connected Space”
“Analytics Space”
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“Design Control Space”
“Cognitive Space”

New Patterns of Technology Fusion, Evolution and Adoption

New Knowledge Networks
New Participants
New Markets and Business Models
Slides available @ http://casi.asu.edu/