The Roadmap to
Global “All-Hazard” Security Engineering

as part of
the Barbara Rucinska Memorial Global Security Engineering Workshop Series

by
Prof. Andrzej Rucinski, IEEE & University of New Hampshire, USA

UNECE WP.30 Session, Geneva, Switzerland
June 4, 2008
Former Presidents George H.W. Bush and William Jefferson Clinton are Keynote Speakers at the University of New Hampshire’s 137th Commencement May 19.
Fundamentals of Security Engineering

ECE668. Introduction to Computer Engineering

January 25, 2008, 11:10am to 12n
Kingsbury, Room S-320

• Introduction to the elements of security
• A typical physical security system
• Physical security system elements
• Project: "Take Me to the Ball Game"

Mr. Lennart E. Long and Mr. George Neat
Guest Speakers, Electrical and Computer Engineering Department

University of New Hampshire
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Institute of Electrical & Electronics Engineering

- 350,000+ IEEE Members Worldwide
- IEEE Provides
  - Global Reputation for Standards (e.g. 802.11, 1149)
  - Professional, Ethical Conduct, and Intellectual Honesty
  - The World’s Largest Technical Publishing Enterprise
  - Highest Quality Conferences and Publications
Outline

• Motivation: New Science and Education for Global Security
• All-Hazard Safety and Security Strategy
• Global Security Engineering
• Safe and Secure Silk Road
• Transatlantic Security Initiative
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Motivation: New Science and Education for Global Security

- UN General Assembly Resolutions
- UNECE Initiatives
- Computerized TIR Procedure (eTIR)
- Global Security: Role of Science
- Vision: All-Hazard Safety and Security Strategy
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All Hazards
The Ice Storm of 1998 was a natural disaster like no other. It affected millions of Canadians and left everyone wondering just how vulnerable modern society was to the elemental forces of nature.
The effects of magnetic storms - what scientists call space weather - extend from the ground to geostationary orbit and beyond.
All Hazards
DMSP F13 All Hazards
14 August 2003
0129Z
~20 hrs before Blackout
Global Security
Protection of Critical Infrastructure
Against All Hazards

• Nature
  – Direct
  – Trigger
• Accident
  – Design & Implementation
  – Operations
• Malicious Actions
  – Sabotage (Internal)
  – Terrorism (External)
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Global Security Transportation: Current Status
Global Security Transportation: **Political Sphere**

![Diagram of global security transportation in the political sphere]

- **USA**
  - UNECE EU
  - TIR Convention
  - "SAFE" Framework
- **Homeland Security**
  - IEEE
- **IRU Management**
  - IRU Carnet System
  - Certified IRU Academy

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Global Security Transportation: Commerce

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Global Security Transportation: **Science**

- USA
- UNECE EU
- TIR Convention
- "SAFE" Framework
- WCO
- Homeland Security
- IEEE
- IRU Management
- IRU Carnet System
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Rainbow Framework for Global Security Engineering

- United Nations Economic Commission for Europe
- US Government
- Science and Technology Gap
- Global Secure Transport System e.g. IRU
Global Security Engineering as a New Scientific Discipline

  - Global Ambient Intelligence Network (GAIN)
  - Design for Globalization (DfG)
  - GNAT-1 (presented at Waltham, Massachusetts by UNH Students)
The Transistor Era
SSI Era

a

b

c
Design for Globalization (DfG)

- Quality, Trust, MDA Design Environment
- IEEE Standards
- Design Tools
  - UML, Simulink, VHDL
- Design Libraries
  - Bangalore
- Collaborative Engineering
- Test Tools
  - Intellitech
- ASIC/VLSI
  - MOSIS
- FPGA
  - Xilinx, Altera
- Global Ambient Intelligence Network
- Multi-Core
  - Intel
- Customer
  - Gov, Commerce, U-ED
- WWW
Magnetometer System for Space Research in Polar Region

South Pole ULF magnetometer installed by UNH and AGO (Automatic Geophysical Observatories) sites in Antarctica

Courtesy of Hyomin Kim

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Magnetometer System for Space Research in Polar Region

Ny Alesund (NAL), Norway

Barentsburg (BAB), Russia

Longyearbyen (LYR), Norway

Horsund (HOR), Poland

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* Data Base with automatic update/scheduler

 Courtesy of Hyomin Kim
Example of Current Magnetometer System for Space Research in Space

- **Satellite- and rocket-borne**
- **magnetometers**

![Image](image1.png)

Courtesy of Hyomin Kim
The Barbara Rucinska Memorial Global Security Engineering Workshop Series

- Stockholm EWME2006 (Global Engineering Education)
- San Diego MSE2007 (Special Issue of IEEE Trans. on Education)
- Boston HST2008 (Proc. IEEE: Special Issue on Global Security Engineering)
- Gdansk IT2008 (EURO2012)
- Budapest EWME2008 (Bologna + ABET)
- Geneva 2008 United Nations (Global Security Working Session)
- Copenhagen WSS2008 (Microelectronics for Maritime Security)
- San Francisco MSE2009 (Special Issue of IEEE Trans. on Education)
- Almaty 2009 TIR Congress (Safe and Secure Silk Road)
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- Stockholm EWME2006 *(Global Engineering Education)*
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- Boston HST2008 *(Proc. IEEE: Special Issue on Global Security Engineering)*
- Gdansk IT2008 *(EURO2012)*
- Budapest EWME2008 *(Bologna + ABET)*
- Copenhagen WSS2008 *(Microelectronics for Maritime Security)*
- San Francisco MSE2009 *(Special Issue of IEEE Trans. on Education)*
- Almaty 2009 TIR Congress *(Safe and Secure Silk Road)*

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Global Security Engineering Think Tank

- IEEE
- WP.30 Ad Hoc Technology Expert Group
- US Chamber of Commerce
- European Commission
- IMO
- Transport Research Board
- Global Infrastructure Alliance - International Think Tank
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Global Security Engineering Pilots

• Earth Magnetic Field Monitoring
• Safe and Secure EURO2012
• Safe and Secure Silk Road
• Canada – US Secure Cargo Project
Evolution of sea containers in ports

Global Container Overslag
1971

Courtesy of Dr. Janusz Lacny – President of Int. Transport Road Union
Safe and Secure Silk Road

Courtesy of Dr. Janusz Lacny – President of Int. Transport Road Union

Key:
- Sea transport
- Land transport

Saturated

to US West Coast

US West Coast
Interconnecting all the businesses along the reopened Silk Road

Key:
- **Sea transport**
- **Land transport**

To US West Coast

To US East Coast

To EU

To CIS

To East Coast

Saturated

To

Courtesy of Dr. Janusz Lacny
President of IRU
Interconnecting all the businesses along the reopened Silk Road

Key:
- Sea transport
- Land transport

To US West Coast

To US East Coast

Labour costs = $200/month

Saturated

To East Coast

To Black Sea

Diesel fuel = 30 cents / litre

Courtesy of Dr. Janusz Lacny
President of IRU
Canada US Transatlantic Cargo Security Pilot

1) Build & test prototype package

2) Install & verify package and scan at load point

3) Track shipment, log data & report status to website

4) Scan at transshipment points

5) Compare logged and real-time data

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Secure Testing Infrastructure

Field Deployment

Satellite link
Blowfish Encryption

Sensor Data

Satellite
Ex-filtration

Satellite ground station

Remote Monitoring Stations

VPN tunnel / Internet

VPN tunnel

Modem link
Firewall
Data server
Web server
Firewall

Base Station

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Equipment Installation (Mainz) and Cargo Loading (Lollar)

1: Empty Container

2: Delivery of Equipment

3: Unpacking and Setup

4: Roof Mount Sat/GPS antenna

5: Installation into the Container

6: Final System Setup

Shipping Container to be Outfitted with LLNL Monitoring System

Loading the LLNL monitored container in Lollar, Germany.

Container loaded and ready for shipping

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cargo monitoring hardware

- Neutron / Gamma Spectroscopy
- Radiation Detector
- Satellite Phone, GPS
- Voltage, Current Monitors and Data Logging Hardware
- Micro-power Impulse Radar Intrusion Sensors
- Magnetic and Optical Intrusion Sensors
- Environmental Sensors
- 3-Axis Acceleration and G-force sensors
Real Time Tracking

Destination: 4700 miles away
Londonderry, New Hampshire

Origin: Mainz, Germany

System Altitude: Dec 9th – 16th

Container travels to Lollar, at a higher altitude, for loading

Container travels down Rhine to Antwerp at sea level by barge, clear sky view yields high accuracy tracking

Container is sitting in the port of Antwerp, Belgium

Container is sitting in the port of Antwerp, Belgium

GPS proximity limit

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Sample Data

Humidity Sensor #1, Data logging Enclosure: Dec 8th – 18th

- Spikes from moist air entering the container when the door was opened
- Once the container was sealed for its voyage the humidity stabilized to the ambient level

Temperature Sensor #1, Data logging Enclosure: Dec 8th – 18th

- Container final loading in a heated warehouse in Lollar, Germany
- Heating and cooling from Day/Night cycles as the sealed container travels
- Cooling spikes and slopes are from the container door being opened during loading and initial setup
Global Security Transportation: Rainbow Framework Implemented
Global “All Hazard” Security Engineering

- All Hazard **Risk Management** is the Essence of Global Engineering i.e. Determines Design Specs for Global Security Systems
- Communication and **Transportation** is the Nerve System of Global Security
- Microelectronics and Embedded Systems are the Nerve System Allowing Global Health Monitoring and Control
- Global Security Engineering as a New Scientific Discipline
- **eTIR** and **Computerized Documentation** Housekeeping are Exemplary Applications
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• CIDLAB Faculty and Students Visiting Intel Massachusetts

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