
The Role of Systems Engineering in Combating Terrorism

**Dr. William F. Mackey, Facilitator
Anti-Terrorism International WG**

**Track 4, Session 5, Thursday, August 1, 2002
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Terror Attack

Hijacked Jets Fly Into Trade Center, Pentagon



Flight 11, a Boeing 767, was hijacked by a man who said he was a member of the Islamic extremist group al-Qaeda. The plane struck the North Tower of the World Trade Center at 8:28 a.m. Flight 115, a Boeing 767, was hijacked by a man who said he was a member of al-Qaeda. The plane struck the South Tower of the World Trade Center at 9:03 a.m. Flight 77, a Boeing 757, was hijacked by a man who said he was a member of al-Qaeda. The plane struck the Pentagon at 9:03 a.m. Flight 93, a Boeing 767, was hijacked by a man who said he was a member of al-Qaeda. The plane crashed in a field in Pennsylvania at 10:03 a.m.

UPDATE
A second plane struck the North Tower of the World Trade Center at 9:03 a.m. The plane was hijacked by a man who said he was a member of al-Qaeda. The plane struck the South Tower of the World Trade Center at 9:03 a.m. The plane was hijacked by a man who said he was a member of al-Qaeda. The plane struck the Pentagon at 9:03 a.m. The plane was hijacked by a man who said he was a member of al-Qaeda. The plane crashed in a field in Pennsylvania at 10:03 a.m.

Timeline of Terror

| | |
|------------|---|
| 8:28 a.m. | Flight 11 strikes the North Tower of the World Trade Center. |
| 9:03 a.m. | Flight 115 strikes the South Tower of the World Trade Center. |
| 9:03 a.m. | Flight 77 strikes the Pentagon. |
| 10:03 a.m. | Flight 93 crashes in a field in Pennsylvania. |

A Day of Carnage and Chaos

By [Author Name]

The terrorist attacks of September 11, 2001, were a day of carnage and chaos. The attacks resulted in the deaths of nearly 3,000 people and the destruction of property worth billions of dollars. The attacks also led to a major shift in U.S. foreign policy and the beginning of the War on Terror.







The Role of SE in Combating Terrorism: Panel Thesis and Relationship to Systems Engineering

- q **Panel Thesis:** The multidisciplinary approach of systems engineering is useful in evaluating future terrorist threats, identifying existing system vulnerabilities, and reducing or eradicating international terrorism

- q **Definition and origins of Terrorism**
 - **Terrorism** is the systematic use of force and violence to create fear as a means of coercion.
 - It emerged as a concept in 1793-94 during the Reign of Terror in France
 - It has been used by dissident groups to violently intimidate a population or government into granting their demands.
 - The calculated murder of political personalities and military personnel to achieve political objectives has given way to the almost random killing of innocent people and civilian populations.

Introduction to the Panelists

- q **William Mackey – Sr. Member Exec. Staff, CSC**
“The History of Terrorism and INCOSE’s Response to the Events of September 11”
- q **Art Pyster – FAA Deputy CIO**
“The FAA Response to the Highjacking and Cyberterrorism Threats”
- q **Steve Mayian – Attorney, Former Marine Pilot and Commercial Airline Captain**
“A Commercial Airline Pilot’s View of the Terrorist Threat”
- q **Harry Crisp – Director of Naval Collaborative Engineering Environment, Dept. of the Navy**
“Military Roles in Response to the Terrorism Threat”

Introduction to the Panelists (cont'd)

- q **Shabaz Raza – GIS Engineer for the State of Maryland,
“A Practicing Muslim’s View of the Terrorist Threat”**
- q **David Cropley – Systems Engineer, Australia INCOSE
Chapter
“The International View of the World Response to the
Terrorist Threat”**
- q **James Long – President, Vitech Corp.
“Anti-Terrorism Simulations and Applications to
Intelligence Analysis”**
- q **Patrick Sweeney – SE Initiatives TC Chair
“ Systems Engineering Approaches to Anti-Terrorism”**

In Memoriam

- Ω **To the 3,018 victims lost in the airplanes, the World Trade Center and the Pentagon on September 11, 2001, including**
 - 2,794 in the World Trade Center attacks**
 - Including 494 killed or missing victims of 91 different nations**
 - Britain had 67 lost**
 - Including 343 heroic firefighters and 72 heroic policemen**
 - 184 killed or missing at the Pentagon**
 - 40 killed on the Pennsylvania airplane crash**

In Memoriam: The United States Naval Academy Lost 14 Alumni

American Airlines Flight 11

Ω Kenneth Edmund Waldie, '78

World Trade Center

Ω Kevin Patrick Connors, '69

Ω Kenneth Miles McBrayer, '74

Ω Michael Gregory McGinty, '81

American Airlines Flight 77

Ω Capt. Charles "Chic" Burlingame III, USNRR (Ret.), '71

Ω Rear Adm., Wilson "Buddy" Falor Flagg, USNR, '61 **

Ω Capt. John David Yamnicky, USN (Ret.), '52

The Pentagon

Ω Capt. Gerald Francis DeConto, USN, '79

Ω Capt. Robert Edward Dolan, USN, '81

Ω Cdr. William Howard Donovan Jr., USN, '86

Ω Cdr. Patrick Dunn, USN, '85

Ω Lt. Jonas Martin Panik, USN, '97

Ω LtJG. Darin Howard Pontell, USN, '98

Ω Lcdr. Ronald James Vauk, USNR '87

** **USNA Classmate of two of our panelists**

Issues Posed to the Panelists

- q **From your viewpoint, what could have been done to avoid the events of September 11?**
- q **What needs to be done to existing systems to mitigate similar terrorist threats?**
- q **How can Systems Engineering be useful in preventing future terrorist events?**

***“The History of Terrorism and INCOSE’s Response
to the Events of September 11”***

**Dr. William F. Mackey
Computer Sciences Corp. and
University of Maryland University College**

**INCOSE Technical Board Chair
Anti-Terrorism International Working Group
Chair**

Recent History of Terrorism

Major World Terrorism Incidents Since 1970

- 1972 – Munich, Germany Olympic Massacre
- 1988 – Lockerbie, Scotland
- 1988 – Pan Am Flight 103
- 1995 – Tokyo, Japan Sarin Attack
- 1996 – Khobar Towers
- 2001 – World Trade Center Attack
- Over 360 major incidents worldwide since 1967**

Major Terrorism Attacks on the United States Since 1985

| | Date | Attack | Killed | Injured |
|---|--------------|---|---------------|----------------|
| Q | Aug. 7, '88 | US Embassy Bombings | 252 | 5,000+ |
| Q | Feb. 27, '93 | WT Center Bombing | 6 | 1,000+ |
| Q | Apr. 19, '95 | Oklahoma City Bombing | 168 | 300+ |
| Q | July 27, '96 | Atlanta Olympic Park | 1 | 0 |
| Q | Jan. 16, '97 | Atlanta Abortion Clinic | 0 | 0 |
| Q | Oct. 12, '00 | USS Cole Bombing | 17 | 39 |
| Q | Sep. 11, '01 | WTC Aircraft Attacks | 2,794 | 6,000+ |
| Q | Sep. 11, '01 | Pentagon and Penna. Aircraft Attacks | 224 | 100+ |

Who Are the Terrorists Responsible?

- Q There is no international terrorism without the support of sovereign states (Terrorist States)**
 - Iran**
 - Iraq**
 - Syria**
 - Taliban Afghanistan**
 - Palestinian Authority**
 - Sudan**

- Q Terrorist states and terror organizations form a Terror Network whose constituent parts support one another operationally as well as politically**
 - Over 43 major terrorist organizations worldwide, examples include:**
 - Hamas (Islamic Resistance Movement)**
 - Palestine Liberation Front (PLF)**
 - Al-jihad (Egyptian Islamic Jihad)**
 - Al-Qaida (Usama Bin-Laden led)**
 - Japanese Red Army (JRA)**

What is Their Motive?

(Excerpts from the Fighting Terrorism by Benjamin Netanyahu)

- Ⓜ **Militant Islamists resent the West for pushing back the march of Islam into the heart of Europe during the Crusades many centuries ago**
- Ⓜ **More recently, the supposedly inferior West penetrated the Islamic realms in North Africa, the Middle East, and the Persian Gulf**
- Ⓜ **They hate the establishment of Israel in 1948, because it is an island of Western democratic values in a Moslem-Arab sea of despotism**
- Ⓜ **Bin Laden accuses America of continuing aggression against the Arabian peninsula by “plundering its riches, dictating to its rulers, and humiliating its people”**
- Ⓜ **Ultimate Goal: Destroy America and win eternity**

What Must Be Done to Defeat Them?

(Recommendations from the Fighting Terrorism by Benjamin Netanyahu)

- 1. Impose sanctions on suppliers of nuclear technology to terrorist states**
- 2. Impose diplomatic, economic, and military sanctions on the terrorist states themselves**
- 3. Neutralize terrorist enclaves**
- 4. Freeze financial assets in the West of terrorist regimes and organizations**
- 5. Share intelligence**
- 6. Actively pursue terrorists**
- 7. Do not release jailed terrorists**
- 8. Train special forces to fight terrorism**

What Must Be Done to Defeat Them? (cont'd)

(Recommendations from the Fighting Terrorism by Benjamin Netanyahu)

9. Educate the public

10. Revise legislation to enable greater surveillance and action against organizations inciting violence, subject to periodic renewal

Such legislative revision might include:

- **Outlaw fund-raising and channeling of funds to terrorist groups**
- **Permit investigation of groups preaching terror and planning the violent overthrow of the government**
- **Loosen warrant requirements in terrorist cases**
- **Restrict ownership of weapons**
- **Tighten immigration laws**
- **Require periodic legislative review to safeguard civil liberties**

INCOSE Response to the Events of September 11

History of INCOSE Initiative

Initial Discussions of INCOSE Initiative

- Began in 1999 at SEATC Meetings
- Spurred by
 - Expand successes of SEATC
 - Desire to involve all TC's
 - Need to make a real difference
 - Need to retain and involve membership

SEATC Meetings at IW in Mesa, AZ (January 2001)

- Discussions reduced to presentation slides entitled “INCOSE Revitalization Project”
- Consideration given to addressing BOD

Events of September 11, 2001 acted as catalyst in bringing SEATC plans to fruition

Systems Engineering Initiatives Technical Committee (SEITC) Mission and Goals

- q **SEITC Mission:** Involve entire membership in the selection and creation of an INCOSE-wide product, which demonstrates the use of systems engineering principles, techniques, and practices to address a public interest challenge or a series of challenges that have potential international impact.

- q **SEITC Goals:**
 - Revitalize the INCOSE Technical Board and membership
 - Focus INCOSE's energy on issues of public service and need
 - Demonstrate the value of SE through its application to a public interest challenge
 - Increase the influence and prestige of INCOSE to the international community
 - Improve member retention and professional standing

Examples of Public Interest Challenges

- **Public Interest Challenge:** An unsolved problem that has negative effects on people of various cultures and geographical locations and that is amenable to the application of systems engineering
- Reduction and eradication of international terrorism
- Reduction of global warming
- Eradication of the AIDS epidemic
- Creation of an international energy policy
- Provision of international clean water supplies
- Reduction of air and water pollution
- Delivery of health care to disaster areas
- Expansion of international agriculture production
- Prevention of drug trafficking and abuse
- Provision of affordable housing

Anti-Terrorism International Working Group (ATIWG)

Mission and Structure

- q **ATIWG Mission:** Involve entire membership in the creation of an INCOSE-wide product, which demonstrates the use of systems engineering principles, techniques, and practices to the reduction and eradication of international terrorism

- q **ATIWG Structure:**
 - Steering Committee
 - W. Mackey, TB Chair
 - P. Sweeney, SEITC Chair
 - H. Crisp, BOD and CAB
 - B. Ewald, BOD
 - H. Stoewer, TB Cochair and Germany Chapter
 - A. Fairbairn, IEWG Cochair and UK Chapter
 - D. Cropley, INCOSE 2001 Tech Chair and SESA Member
 - Jas Madhur, INCOSE 1998 Symp Chair and Vancouver Chapter Member

 - Volunteer members of INCOSE

Multiple Disciplines Required to Address Terrorism Challenges

- Economics**
- Political Science**
- Religions and Culture**
- Psychology and Sociology**
- Geography and Geology**
- Military and Defense**
- International Law**
- Terrorism and Counter-Terrorism**
- Intelligence Collection, Analysis and Distribution**
- Telecommunications and Computer Engineering**
- Aviation and Space Technologies and Engineering**
- Security Engineering**
- Biological, Chemical and Nuclear Technologies and Engineering**
- Energy Production, Distribution and Consumption**
- This challenge is truly multidisciplinary***

Current Status of INCOSE Efforts

- q **SEITC Status:**
 - Charter created Sept. 17, 2001
- q **ATIWG Status:**
 - Charter created Sept. 18, 2001
 - Steering Committee formed
- q **Anti-Terrorism System Behavioral Model - Proposed Strawman**
- q **Anti-Terrorism Concept Exploration Document – written by U. of Maryland SE graduate students**
- q **ATIWG Kickoff Meetings held in Mesa, AZ – Feb 5-7, '02**
- q **Partnerships suggested and being pursued**
- q **WMA Chapter is focused on issue – 2 or 3 meetings**
- q **This panel is further evidence of resolve**

The Anti-Terrorism System Behavioral Model

- q **System = “An interacting combination of elements viewed in relation to function”**

- q **Functions of the Anti-Terrorism System Behavioral Model**
 - **To reduce or eradicate the effects of international terrorism**
 - **To eliminate the stimuli that initiate the development of international terrorism**

The Anti-Terrorism System Behavioral Model (cont'd)

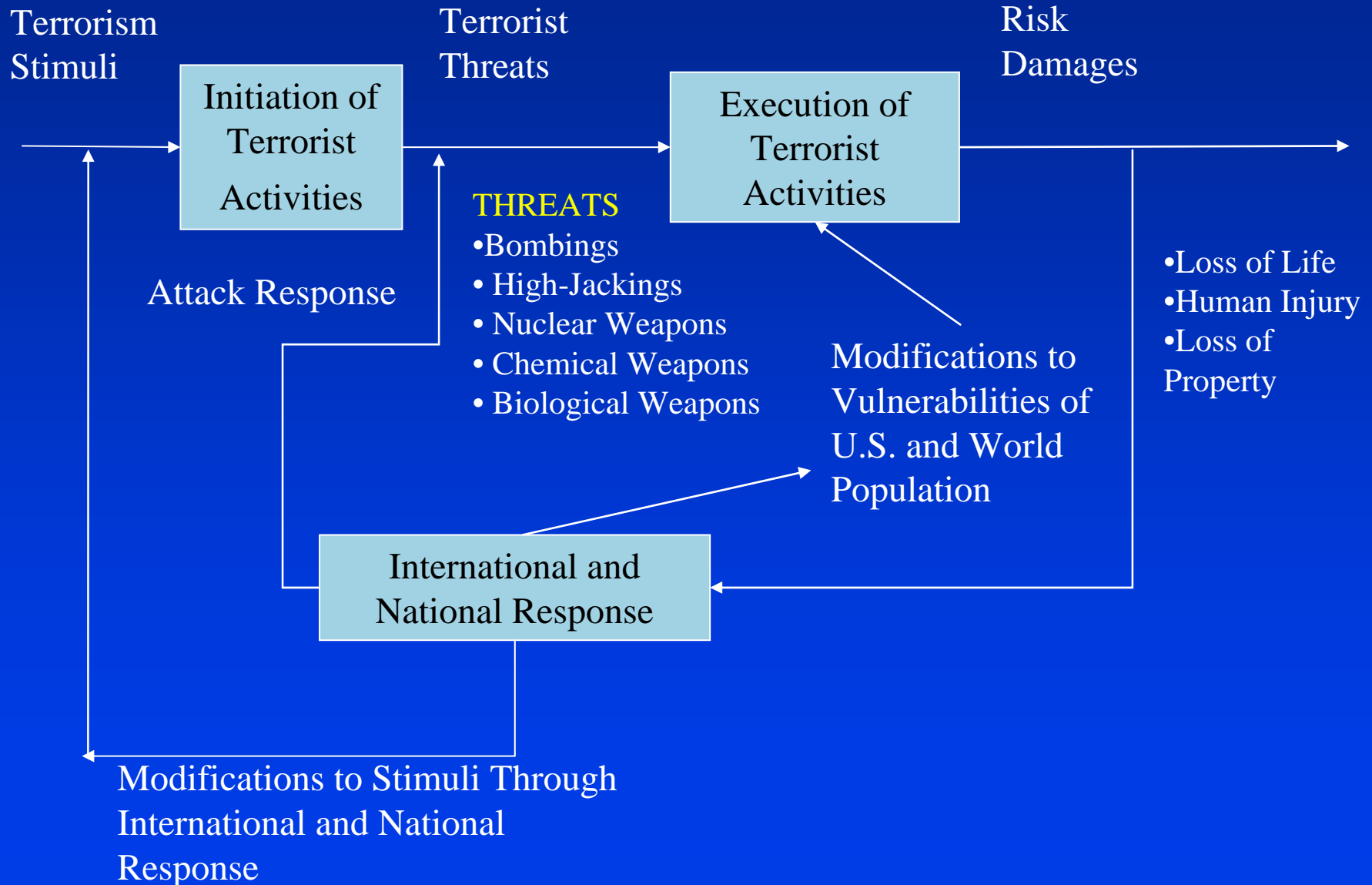
- q Input - stimuli that initiate potential terrorists' desires to commit acts of terrorism in order to satisfy their needs and requirements**
- q Output - the damages arising from loss of life, personal injury and destruction of property resulting from a terrorist's activities**
- q External constraints - international law, economics, environmental prohibitions, geography, etc.**
- q Functions - the activities and processes conducted to combat international terrorism**
- q Mechanisms - people, technologies and processes used to combat international terrorism**
- q Feedback controls - the modifications that can increase or decrease terrorism activity**

THE ANTI-TERRORISM BEHAVIORAL RESPONSE SYSTEM

THE ANTI-TERRORISM RESPONSE PROCESS IS
A TRADITIONAL SYSTEM WITH FEEDBACK
RESPONSE



The Anti-Terrorism Behavioral Concept Model



The Approach to Creating the Anti-Terrorism Behavioral Concept Model

- q **The approach to resolving the Terrorism Problem can only be accomplished by**
 - **Understanding the thought processes of the terrorists who perpetrate such crimes**
 - **Understanding the thought processes of the nations and peoples being attacked**

- q **Creating the Anti-Terrorism System Concept Model must incorporate the understanding of multiple complex disciplines and issues**

What Can a Volunteer Engineering Organization Such as INCOSE Do?

- q Apply our expertise in open forums such as this panel to the terrorism issues facing the world**

- q Create partnerships with organizations needing engineering assistance**
 - American Society of Naval Engineers – Workshop collaboration on “Maritime Aspects of Homeland Security”**
 - NSWCDD (Dahlgren)**
 - FAA – Taxonomy effort for INFOSEC**
 - American Society of Mechanical Engineers – nuclear reactor security analyses**
 - National Guard Bureau – application of readiness assessment tools to local communities**

- q Expand the Anti-Terrorism Concept Exploration document prepared by UMUC graduate students**

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