Army Science Board
2003 Summer Study

Force Protection Technologies for the 2010-2020 Timeframe

Terms of Reference

- Review prior Force Protection studies
- Address FP issues during and after deployments
- Identify advanced technologies for the 2010-2020 timeframe to support Force Protection mission
- Use analysis and models to evaluate potential contributions of Force Protection technologies in specific scenarios
- Address FP opportunities and risks associated with the interactions with non-Army organizations
- Based on sponsor input and current events the study is also addressing near term options to improve Force Protection ASAP

Force Protection Study Organization

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Outline

- Study Vision and Scope
- Prior Studies of the Problem
- Our Approach and Key Conclusions
- The Force Protection Problem: Threats, Environments and the Operational Needs
- Opportunities to Apply Technologies to the Problem: Generic Cases and Integrated Systems
- Seeking Leverage: Opportunities Beyond Direct Technology Investments
- Recommendations and Conclusions

Force Protection Vision

Soldiers, civilian employees, dependents, facilities, information, and equipment are protected in all locations/situations at acceptable manpower/costs while successfully performing missions

This vision can be achieved through the following:

- **Broad, immediate, and thoughtful application of available technologies**
- **Army S&T program focused upon on gaps, and leverage S&T work from other agencies/entities**
- **Force protection requirements/technologies integrated into FCS and other new platforms**
- **Stability and Support Operations that improve force protection effectiveness**
- **Reliance upon improved technologies/procedures, but continued diligence from the Soldier to the Commander – *Every Soldier is a Sensor***

Scope of This Study

- Threats ranging from terrorists trying to create mass casualties to groups trying to cause sustained low level casualties
- Situations we addressed
  - CONUS
  - Deployment
  - Peacekeeping
  - Stability Operations
  - Rear area security
- Situations we did not address
  - Large scale organized conventional force maneuver operations
  - Global Missile Defense (Theater and National)
  - Broader Homeland Defense and Security issues, and Critical CONUS Infrastructure

Previous Force Protection Studies

- We reviewed documents from the following sources:
  - Selected Joint Staff task force findings
  - Selected Department of the Army regulations and guides
  - Commission reports pertaining to Khobar Towers and USS Cole attacks
  - Previous and ongoing studies completed by DoD Science Boards
  - Studies completed by other governmental entities including Allies
  - Studies at the national security level completed by think tanks and other research institutions
  - Professional publications
  - Reports on peacekeeping and stability operations, including Kosovo, Bosnia, Afghanistan, and Iraq; and reports on the role of contractors

Our Conclusions Are Consistent With And Expand Upon Prior Studies

Our Common Conclusions With Prior Studies

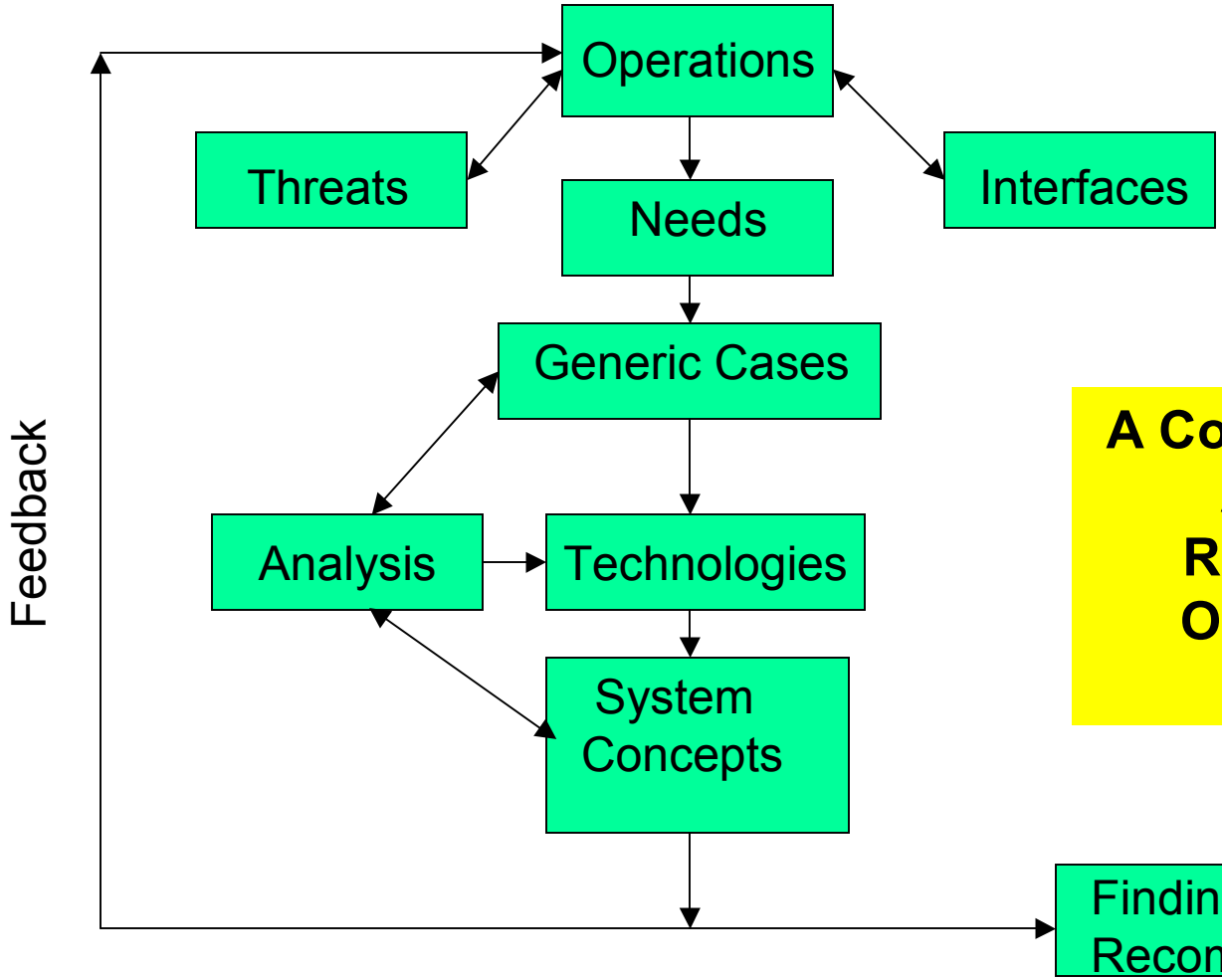
- Existing COTS technologies fill many Force Protection requirements
- Training and doctrine to exploit new Force Protection technologies must be developed
- Force protection is an ongoing training requirement
- Reliable intelligence (particularly HUMINT and interaction with local populace) is critical component of Force Protection
- During operations, Force Protection is largely the responsibility of the individual soldier and commander
- Force Protection must be an integral part of tactical operations
- In post-conflict operations, Force Protection has been impacted by the mixed success in transitioning to stable and secure civilian authorities

We Gathered Information from a Wide Variety of Sources

In addition to reviewing past studies, we:

- Received briefings from a wide range of organizations involved in FP including
  - Sponsors
  - DIA, CIA, DTRA, OSD, NGIC
  - G3, National Guard, Army Reserves
- Visited many activities involved in technology development
  - DARPA, Sandia, UT Austin, ARL, NVL, ICT, JPEO/CBD, etc.
  - Force Protection Equipment Demonstration—Quantico
- Visited Ft. Myer, Kirtland AFB, and Ft. Hood

Force Protection Study Methodology



A Concerted Effort to Address the Relationship of Operations and Technology

Principal Conclusions of the Study

- Force Protection has always been a priority and is now even more central to Army mission success
- Technology offers great opportunities for improving Force Protection
  - Integrated system solutions should be pursued
  - Existing technology offers significant opportunities now and technologies in development offer even greater advances
  - There are a small number of capability gaps that need to be addressed by S&T investments
- Additionally, actions beyond direct technology applications have high leverage and are equally important
- The Army has an opportunity to improve the way it is organized to address Force Protection

Characteristics of the Threat

- Types of threats considered: terrorists, military and paramilitary forces, independent actors
- Threat objectives vary; but generally have a political (not military) focus
  - Increase their political power, image and influence
  - Destroy U.S. political commitment to the mission
  - Gain attention by inflicting casualties or destroying high value targets
- Threat methods also vary widely
  - Some conduct detailed pre-attack planning and surveillance
  - Some attack opportunistic targets
  - Weapons range from WMD to conventional to improvised
- Common threat characteristics
  - Has the initiative – the advantage of choosing time, place and method
  - Capitalizes on our predictability and structure
  - Focuses on our most vulnerable assets
- Significantly different problems in CONUS, OCONUS, or post-conflict operations

The Current Force Protection Situation: CONUS

- Strong emphasis on installation physical security and access control
  - Investing in COTS, fencing/barriers, monitoring systems, and gate/access control automation
  - Generally not buying fully integrated security systems; selected improvements
  - Employing manpower-intensive FP measures
- Manpower costs are high but are hard to measure
  - Visible and invisible costs
  - Taking increased manning out of hide
- Strategy seems to be to deter attacks without over-penalizing access
  - Effectiveness of physical security investments is not clear
  - Not clear we are conducting aggressive red-teaming of our defenses

Army Operations Are Manpower Intensive

MOB CAP
168,003

FORCE PROVIDER	MOBILIZED ISO NOBLE EAGLE	MOBILIZED ISO ENDURING FREEDOM	ACTIVE FEDERAL SERVICE TOTALS
ARMY NATIONAL GUARD	17,502	50,921	68,423
ARMY RESERVE	3,591	55,488	59,079
IMA SOLDIERS MOBILIZED	430	1,505	1,935
IRR SOLDIERS MOBILIZED	166	527	693
MOBILIZED RC FORCES ON ACTIVE FEDERAL SERVICE	21,689	108,441	130,130

UNIT MISSIONS:	127,502
WARFIGHTER SUPPORT	87,263
C3I	1,683
FORCE PROTECTION	12,153
MOBILIZATION BASE	1,237
TRAINING BASE	444
CONUS BASE SUPPORT	16,214
AIR FORCE SECURITY (9,500)	8,508

Source: MG Chiarelli

as of 11 Mar 03

Current Identifiable Force Protection Investments

	Total Force Protection ($000)			Army Force Protection ($000)		
	FY 2002	FY 2003	FY 2004	FY 2002	FY 2003	FY 2004
Physical Security Equipment	811,771	1,499,293	935,148	216,445	627,813	189,880
Physical Security Site Improvements	226,829	1,835,743	275,830	57,086	318,181	40,265
Physical Security Management and Planning	92,583	130,129	120,927	9,469	8,217	9,357
Security Forces and Technicians	2,631,513	3,612,257	3,582,180	303,982	419,482	297,128
Law Enforcement	1,377,258	1,594,866	2,178,077	693,087	708,770	830,164
Security and Investigative Matters	531,597	637,208	592,773	132,106	149,160	132,465
AT Research, Development, Test, and Evaluation	57,368	160,978	109,310		43,900	34,244
Totals	**$5,728,919**	**$9,470,474**	**$7,794,245**	**$1,412,175**	**$2,275,523**	**$1,533,503**

SOURCE: OSD Combating Terrorism Activities FY 2004 Budget Estimates, 28 April 2003

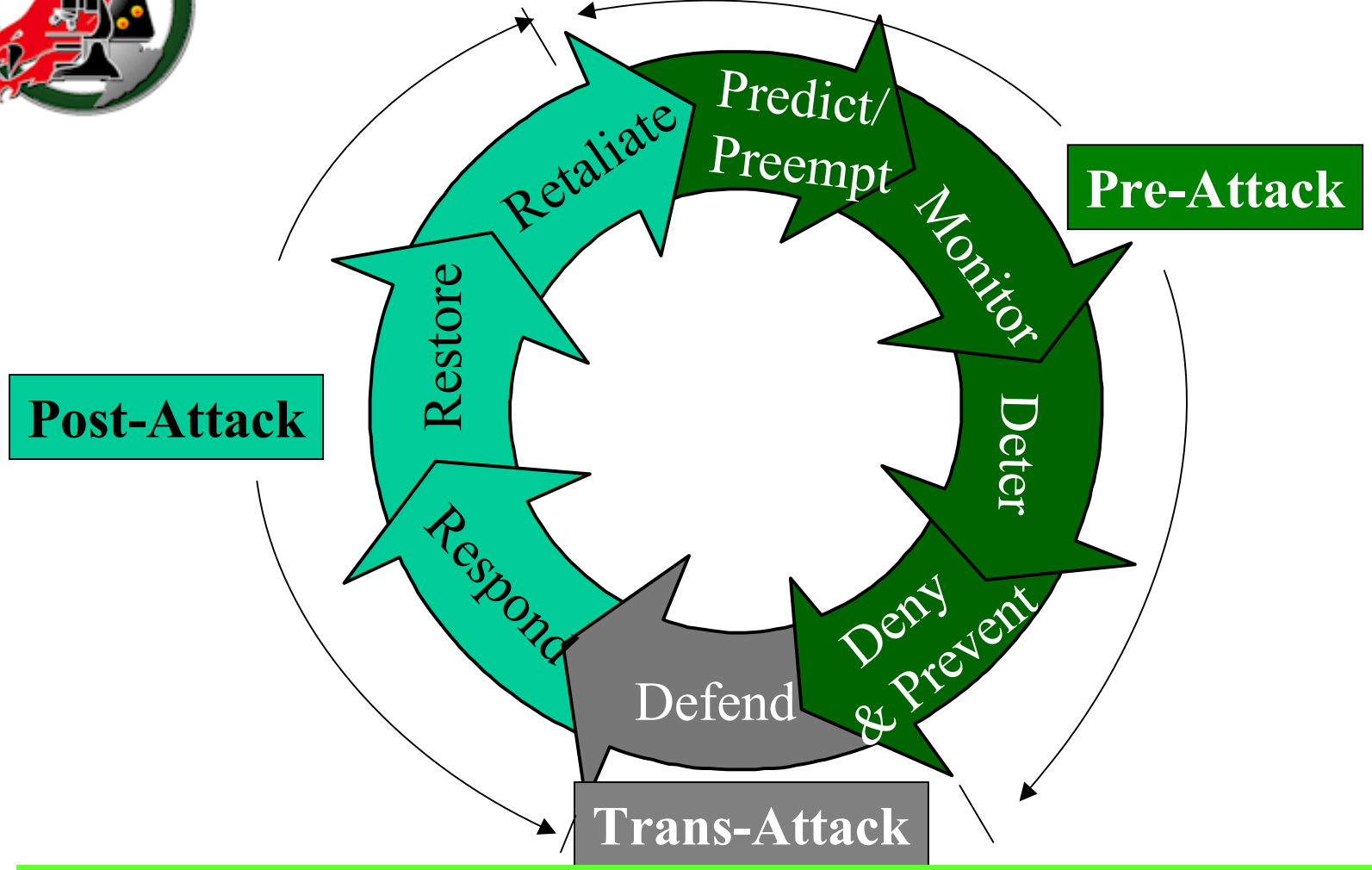
The Current Force Protection Situation: OCONUS

- Strong emphasis on using organic tactical assets
  - Some ad hoc investments tailored to individual problems
  - Not employing integrated protection systems
  - CS/CSS units have limited Force Protection capabilities
- Manpower costs are high and direct
- Strategy seems to be defend and respond to attacks while continuing operations
  - Experiencing attacks frequently
  - Attacks are achieving some degree of success
    - Inflicting casualties
    - Changing interactions with the community
    - Impacting mission performance

Force Protection In The Post-Conflict and Stability Operations Contexts

- The Force Protection problem is compounded
  - A purely defensive posture is not acceptable
  - Collateral damage is inimical to the core mission
  - Many U.S. and non-U.S. civilian organizations may be present
  - Coalition and indigenous military and constabulary forces may be present
  - There is a dangerous gap between the end of major conflict and when indigenous authorities can provide civil stability
- The problem can not be avoided

The Force Protection Continuum



FP Has To Be Addressed As A Continuum; Not Just Defense
FP Requires An Integrated Systems Response

Generic Cases Were Extracted to Focus Our Work

- A generic case describes an operation with a specific Force Protection environment common to many situations
  - CONUS Base
  - OCONUS Base
  - Small team or detachment
  - Convoy
- Example integrated systems were defined and technologies were applied within those systems

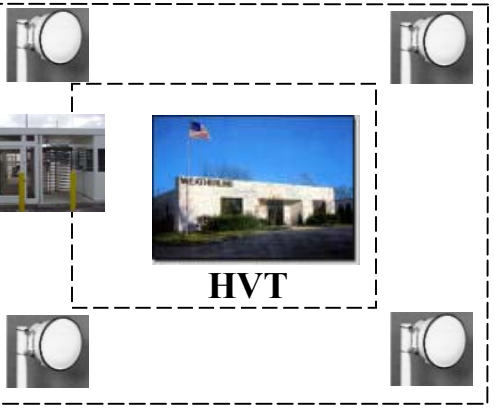
CONUS Base – Integrated FP System


Efficient Access Control


Response Forces


Base Facilities


Perimeter Sensors



Perimeter Fencing


Vehicle Inspection


Barriers


Integrated C2

Key Features

Emphasis on Deterrence while maintaining reasonable tenant entry during FPCON A&B

Dependence on COTS

Key relationships with local/federal authorities


Local/Federal Law Enforcement

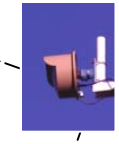
OCONUS Base – Integrated FP System

Perimeter Sensors and Remote Weapons

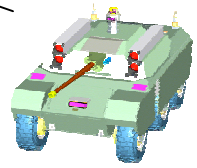
External Reaction Forces

Efficient Access Control

Integrated C2



Beyond Perimeter Sensing



Organic Reaction Forces

HVT Protection

HUMINT

External Support

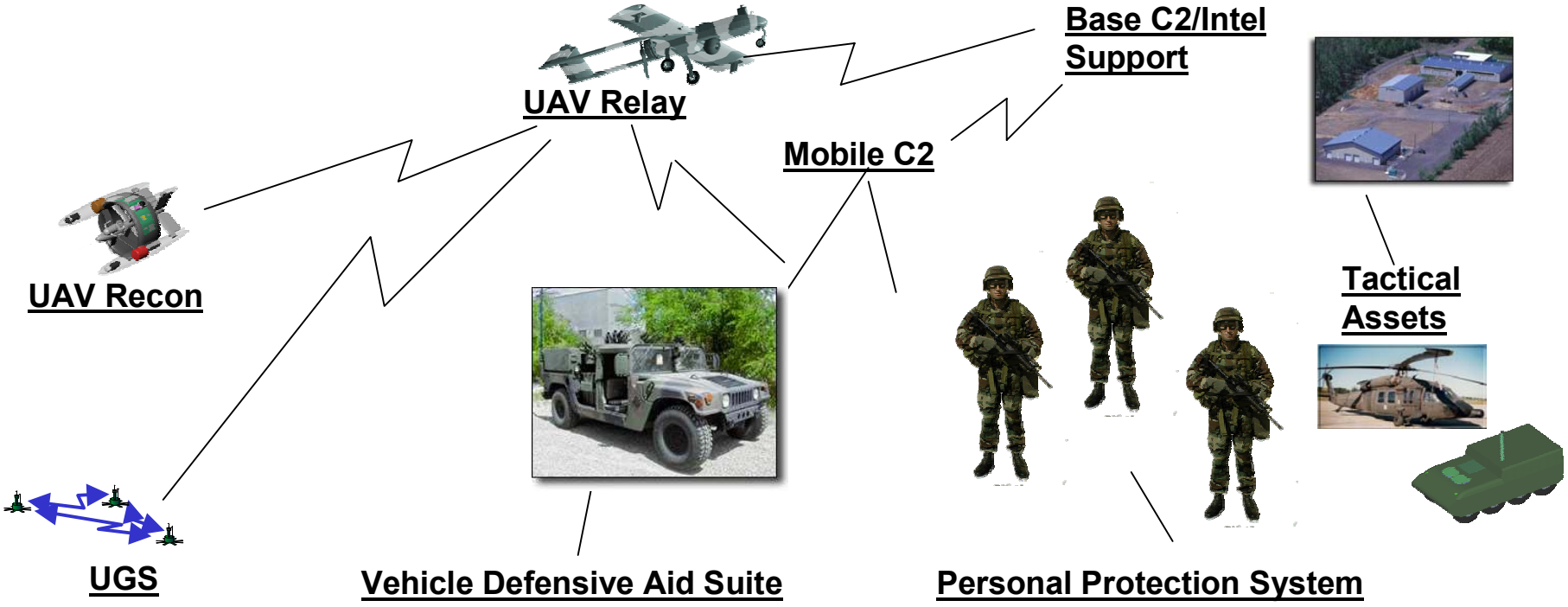
Key Features

Emphasis is on Detection & Defense

A networked layered defense

High degree of automation with person-in-the-loop

Small Team or Detachment – Integrated FP System



Key Features

Predict/Detect/Avoid threats with high SA/SU

Netted-centralized C2 – Base supports multiple teams

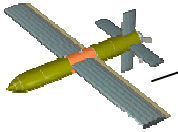
Reliance on assured C2, and defensive suites

Convoy - Long Term Integrated FP System

Joint Assets

UAV Relay

FCS Relay (Class III or IV)



UAV Route Recon

FCS UAV (Class II or III)

Surface Mine Detection

Recently Buried Mines

EO/IR Surveillance

Remote CBRNE Detection

Base C2/Intel Support

Integrated C2 (FCS based)

Terrain Analysis

COA Analysis

Tactical Assets

FCS Equipped Units

NLOS

Mobile C2 Digital Tracking

JTRS

RF Tags

FCS Based C2OTM

UGV Point Vehicle

Armed UGV (FCS)

Mine Detection/ Neutralization

Defensive Aid Suite

Obscurants

Non-lethals

Ballistic appliqués

Threat optics detection

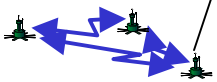
FCS Defensive Aid Suites

Automated Response

Sniper Detection/Response

Non-lethals

Obscurants



UGS Route Monitors

FCS UGS

Key Features

- Predict/Detect/Avoid threats with high SA/SU
- Netted-centralized C2 – Base supports multiple convoys
- Reliance on unmanned systems

** Long term shown in red/ital*

Summary of Prioritized Gap-Filling Technologies for All Cases

Can be fielded quickly

- Initial Decision Support System
- Provide Blue SA to individual deployed vehicle level
  - Radio and GPS
  - Digital maps/digital tracking
  - Dynamic RF Tags
- Beyond fence enhanced surveillance
  - UAV/UGV
  - UGS
  - Radar, EO/IR
  - Surveillance detection
- UAV support for convoys
- Comms and GPS for individual soldiers
- Smart access control
- Ballistic appliqués (blankets)
- Sniper detection systems

Can be fielded by 2010

- Advanced DSS and training systems
- Enhanced surveillance with UAVs
  - Advanced sensors
  - Bio/Chem sensors
- Standoff explosives detection
  - Suicide/car bomb detector
- Assured communications and Blue SA
- Mine detection and neutralization on the move
- Advanced surveillance technologies
  - Automated information extraction
  - Micro Bio/Chem detectors
- Automated threat detection and response
- Robotic ground vehicles
- Non-lethals

Semiautonomous/Autonomous Systems for Force Protection

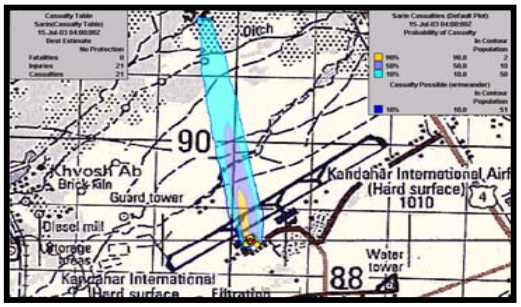
Some systems available now, others could be available within a few years

- Increase the acquisition and insertion of autonomous robotic systems for force protection (for example, MDARS(E) for perimeter defense)
- Create ATDs and sponsor ACTDs with capability to accelerate FP technologies from S&T into operational capabilities
  - Use the ATDs and ACTDs to foster tight coupling between all elements of the S&T community
- Develop the appropriate requirements, metrics, and technology-enabled TTPs
- Demonstrate air-ground-soldier team in a routine patrol scenario with air-ground robots providing surveillance with minimal human intervention

Counter Sniper Systems

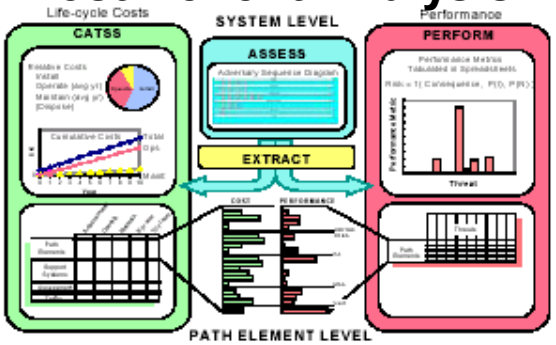
- Systems based upon detection of flash, sound, an/or pressure
- Both counter fires and location detection
- Both Army and Marine R&D programs
- Several foreign systems available

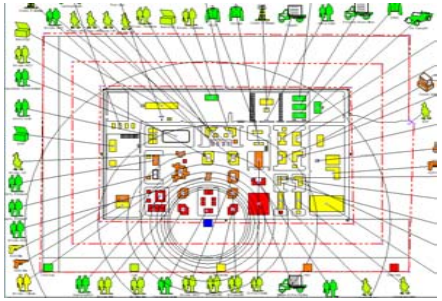
Decision Support Systems Enhance All Aspects of Force Protection



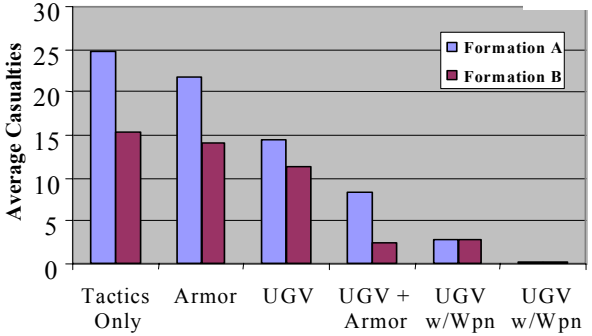
Chem/Bio Attack Effects

Cost/Benefit Analysis

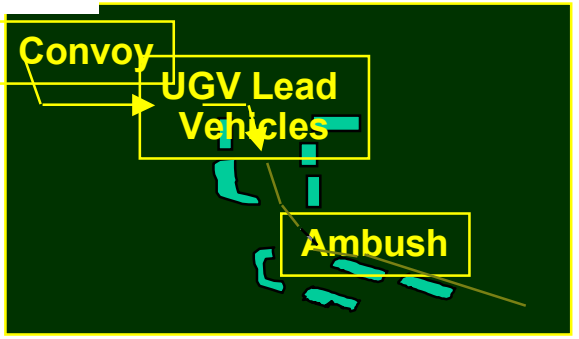




Vulnerability Analysis



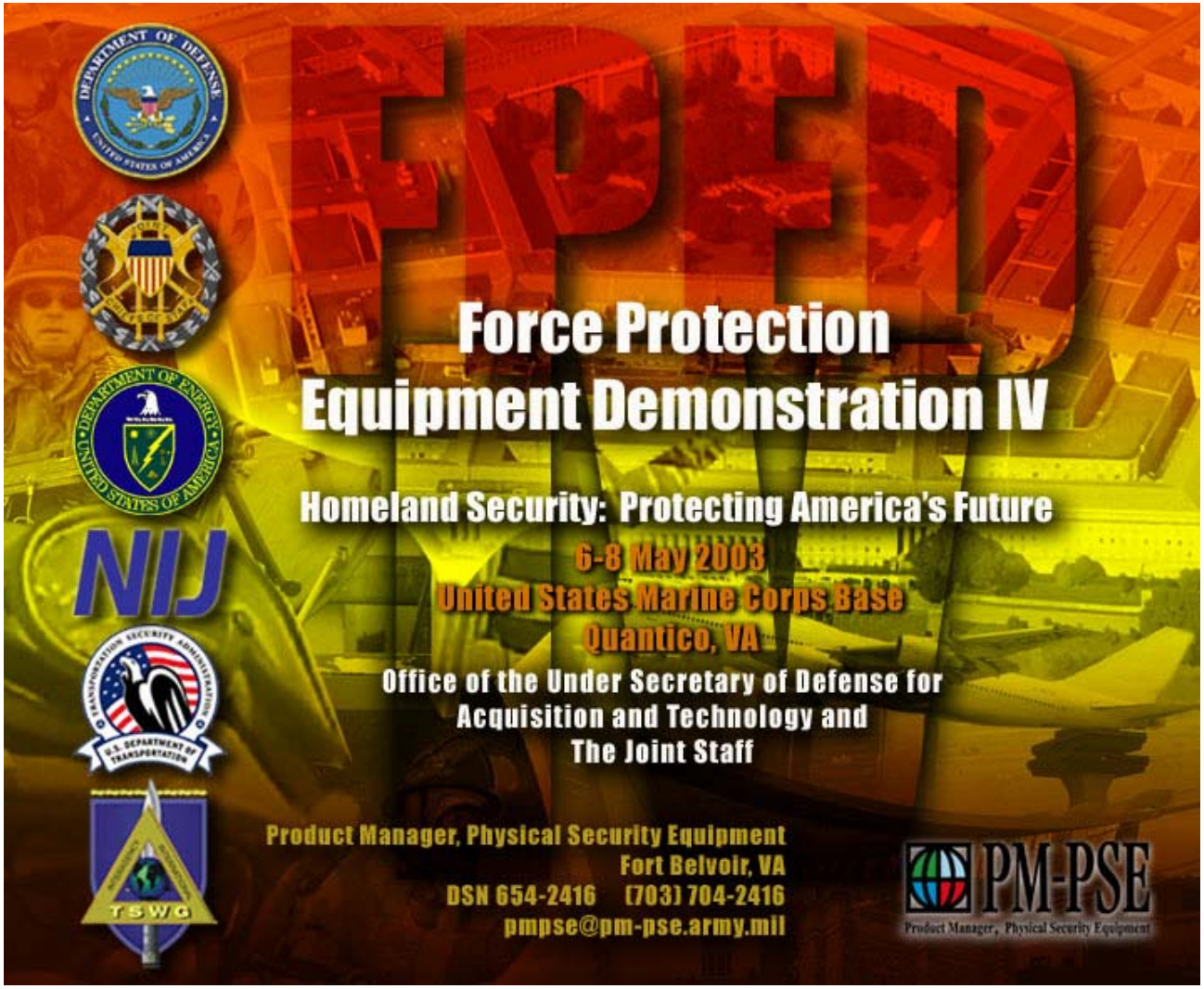
Technology Options Comparisons



Tactical Operations

A Decision Support System integrates all Force Protection decision tools to assist in Force Protection planning, execution, and training. It utilizes a common architecture to support all levels of Command.

Force Protection Equipment Demonstration



Opportunities Beyond Direct Technology Investment

- High Leverage Opportunities
  - Intelligence
  - Doctrine and Training
  - Civil-Military Operations
  - Modeling and Simulation
  - Management of Force Protection Investments
  - Other Programs

Intelligence

- The three top priority investments in intelligence capability for OCONUS FP are: HUMINT, HUMINT, and HUMINT
  - The highest operational leverage is in pre-attack threat ID and preemptive attack
  - Technical collection has limited utility in anticipating attacks or preempting them
  - The threat's perspective on asset value has to be understood
  - Culture-based analyst training is needed
  - HUMINT operations training and staffing is needed

Doctrine and Training

- Doctrine
  - Current FP emphasis is on physical security and installation security rather than on precluding and responding to attacks
  - There should be more emphasis on integrated Force Protection solutions including pre-, trans-, and post-attack options that include local intelligence, deception, redundancy, unpredictability and effective responses to attack
- Training
  - FP proficiency could be greatly enhanced by increasing its emphasis in all training
  - Real time collaborative distributed simulations for FP would have a high payoff

Force Protection Improvements Must Include Doctrine and Training Components

Civil-Military Operations (CMO)

- Integration with local populations and civilian organizations can be a Force Protection multiplier
  - Particularly important in Phase IV Operations
  - Supports HUMINT
  - Improves situational awareness/understanding
  - Engenders good will
- Increased civil security capacity can assume security burden and lower the threat level
- CMO improvements are needed: better comms (cell phones/ radios); training, simulations and exercises; translation capacity

Effective CMO Provides The Stability Necessary For The Transition From Military To Civilian Authorities Which Reduces Force Protection Requirements

Modeling and Simulation

- Concept Definition and Technology Investment Decision Support
  - Analytical tools to assess investment options
- Education and training
  - Automated tools for FP exercises
  - Collaborative real time simulations for training – soldiers gain from practicing as both blue and red
- Support to operations
  - An integrated family of decision aids
- Assessment/experimentation
  - A flexible tool kit of models and associated data bases for FP experimentation
  - Cost/Benefit, portfolio analysis and risk assessment tools
- Acquisition
  - A Joint FP M&S testbed to support evolutionary acquisition of integrated systems

There Is Great Potential For Improving Force Protection Through M&S

Acquiring Force Protection Equipment: TDA =0, TOE =0

- Force Protection needs are very situation dependent
- Designing modular FP systems for use as appliqué's would permit selective issue to units needing the capabilities
- Units deployed to conduct stability operations should have adequate time to train with issued equipment
- Host systems (vehicles primarily) will have to be modified or designed to accept modular FP systems when issued

Selected Issue Of Force Protection Equipment Modules Would Limit Total Inventory Costs Dramatically

Army Organization for Force Protection Management

- Presently, responsibilities for Force Protection are generally distributed throughout the Army with the exception of the G-3
  - Multiple PM's/PEO's and S&T Managers
  - Multiple branches
  - Generally the local Commander's responsibility
  - Multiple budget accounts without cross-cutting cost-benefit trades
- Some important steps have been taken to centralize management of Force Protection (e.g., the Guardian Brigade, JPEO/CBD, PSEAG and FPAAT), but there are more opportunities
- Cost-benefit analysis is not being applied uniformly to investment decisions
- There are no single leads for Force Protection requirements, S&T, and acquisition

Force Protection Can Be Improved Through Additional Organizational Changes

Other Programs

- Physical Security Industry
  - A multi-billion dollar per year market developing products for commercial sales
  - Significant government investment due to DHS
- WMD:
  - A major investment area for the Country (DoD, DOE, DHS, NIH, etc.)
  - Army priorities have to be communicated and monitored, but there should be little need for additional Army S&T investments
- FCS:
  - The biggest Army technology investment by a large margin
  - Force Protection beyond combat requirements has generally not been defined and integrated into FCS requirements

Army FP Technology Investments Should Be Focused On Gaps, Unique Needs, Integrating COTS/NDI and Leveraging FCS

Recommendations (1 of 3)

Overarching Recommendations:

- Direct an Army-wide effort led from HQDA to improve Force Protection, including the implementation of the recommendations of this study

  CSA, now

- Designate a lead for Force Protection requirements

  CG TRADOC, 30 days

- Designate leads for Force Protection S&T and Acquisition

  ASAALT, 30 days

Requirements and Integrated System Concepts

- Develop Integrated Force Protection Systems Operational Concepts and define Army Force Protection requirements including impacts on FCS and other pending or ongoing programs (WMD, FTTS, etc.)

  CG TRADOC with ASAALT, 9 months

Intelligence

- Develop and begin implementing a plan to increase proactive intelligence capabilities during the threat's pre-attack phase with focus on HUMINT

  G-2, 6 months

Recommendations (2 of 3)

Doctrine and Training

- Develop revised doctrine/TTP and training tools across the full spectrum of Force Protection activities with emphasis on the threat pre-attack phase

CG TRADOC, 9 months

Post Conflict Planning and Capabilities

- Develop revised tasks, conditions and standards for Army CMO and Phase IV capabilities including the adequacy of Civil Affairs, planning, and force structure

CG TRADOC, 6 months

- Request a Joint/Interagency Review of post conflict planning processes to be led by the Army with goal of replacing the current ad hoc process

G-3, 3 months

Modeling and Simulation

- Develop a plan to address shortfalls in modeling and simulation support of Force Protection needs

DUSAOR, 9 months

Recommendations (3 of 3)

Force Protection Asset Management

- Develop a plan to implement non-TDA, non-TOE inventory planning for FP Integrated Systems Components

ASAALT with G-8, G-4, 6 months

Technology and Development

- Implement the Integrated Systems Concepts defined by TRADOC

ASAALT, 9 months

- Focus Force Protection S&T resources on
  - Integrated FP C2 (including Joint, combined, non–military)
  - Countering specific FP threats and weapons (e.g. indirect fires defense, counter-ambush, stand-off explosive detection, sniper detection and response, countermine, etc.)
  - Decision support systems and training systems
  - Automation and robotics
  - Non-lethal response (Legal and treaty issues must be addressed)

ASAALT with DARPA, 3 months

Principal Conclusions of the Study

- Force Protection has always been a priority and is now even more central to Army mission success
- Technology offers great opportunities for improving Force Protection
  - Integrated system solutions should be pursued
  - Existing technology offers significant opportunities now and technologies in development offer even greater advances
  - There are a small number of capability gaps that need to be addressed by S&T investment
- Additionally, actions beyond direct technology applications have high leverage and are equally important
- The Army has an opportunity to improve the way it is organized to address Force Protection