FORCE PROTECTION JOINT EXPERIMENT

By Mrs. Sonia L. Taylor

Current technologies, concepts of operations (CONOPS), and policies do not provide a comprehensive and sustainable joint force protection capability. Fielded force protection systems do not interoperate and integrate effectively nor do they provide comprehensive and integrated situational awareness. The Force Protection Joint Experiment (FPJE), through a series of four integrating assessments (IAs), was undertaken to assess how fusion, automation, and integration of force protection technologies reduce risk for the Joint Force Protection Advanced Security System (JFPASS) Joint Capability Technology Demonstration (JCTD), while exercising the integrated unit, base, and installation protection (IUBIP) CONOPS against relevant threats. The experiment involved a variety of force protection technologies to form a system of systems working in a synergistic fashion to defend and secure a base defense operating center.

The FPJE was a multi-Service collaboration of acquisition and combat development organizations created under the direction of the Department of Defense Physical Security Equipment Action Group with concurrence and sponsorship from the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD), the United States Army Maneuver Support Center, and the United States Air Force 642d Electronic Systems Squadron. The FPJE IAs were guided by a joint advisory committee that chartered a joint integrated product team to plan and execute each assessment.

Multiple analytic protection efforts were being conducted by all the Services, with no overarching integrated design, in an attempt to lessen the numerous gaps and seams in protection capabilities. The Protection Joint Functional Concept (PJFC) describes protection as "*. . . a process, a set of activities and capabilities by which the joint force protects personnel, information, and physical assets against the full spectrum of threats. The joint force will achieve this through the scaled and tailored selection and application of multi-layered, active and passive, lethal and nonlethal measures, within the air, land, sea, space, and cyberspace domains, across the range of military operations, based on assessment of an acceptable level of risk. The joint force must protect itself starting from point-of-origin, continuing through transit, employment, sustainment, and redeployment. The goal is to prevent adversaries from employing capabilities that would restrict or prevent the joint force from conducting decisive actions at a time and place of our choosing.*"[1]

The IUBIP capabilities-based assessment (CBA) and the FPJE efforts have both attempted to identify protection capabilities and integrate existing Service capabilities into a family of systems using the defined protection construct of detect, assess, warn, defend, and recover (DAWDR). The operational application of the PJFC requires greater granularity and specificity in determining the joint force commander's protection responsibilities and capabilities.

The IUBIP functions consist of the capabilities required to provide integrated protection to units, bases, and installations during the 2012-2024 timeframe across the scope of fixed site, semifixed/expeditionary site, and mobile operations. The IUBIP effort began with the development of the CONOPS, a fully integrated, networked, persistent, scalable, and effective approach toward developing and employing protection capabilities. The functional area analysis identified 22 new tasks and associated standards that corresponded to each of the five protection functions. These 22 tasks formed the basis for the CBA's required capabilities. The relationship between the joint force protection construct and the 22 protection tasks developed for the IUBIP CBA are shown in Figure 1, page 22. The tasks highlighted in white were within the scope of the FPJE.

A model-experiment-model approach was used for the FPJE, beginning with a modeling and simulation event followed by a live experiment conducted at Eglin Air Force Base, Florida. The exploratory modeling and simulation runs established feasibility; refined concepts and tactics, techniques, and procedures (TTP); and identified the high-payoff runs to conduct for record. This iterative process was repeated four times. The first IA established the baseline and each subsequent IA built on the lessons learned from the previous one while incorporating additional technologies. The experimental design of the FPJE is shown in Figure 2, page 22.

A formal request for information for white papers generated a list of potential technologies. Government and industry technologies were selected according to defined technical assessment criteria, which included technical maturity and relevance to the IUBIP CBA and JFPASS JCTD. The force protection technologies used in the FPJE included the following:

- Day/night surveillance camera systems
- Ground and maritime surveillance radars

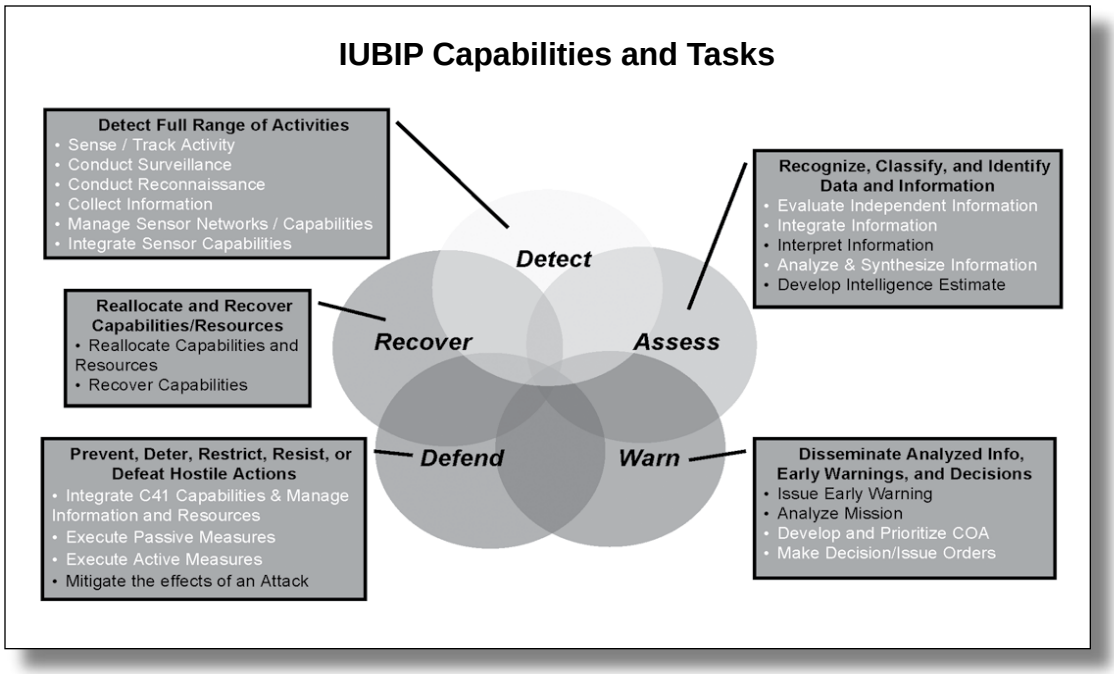

Figure 1. A list of the IUBIP capabilities and tasks. Highlighted in white are the tasks the FPJE is addressing.

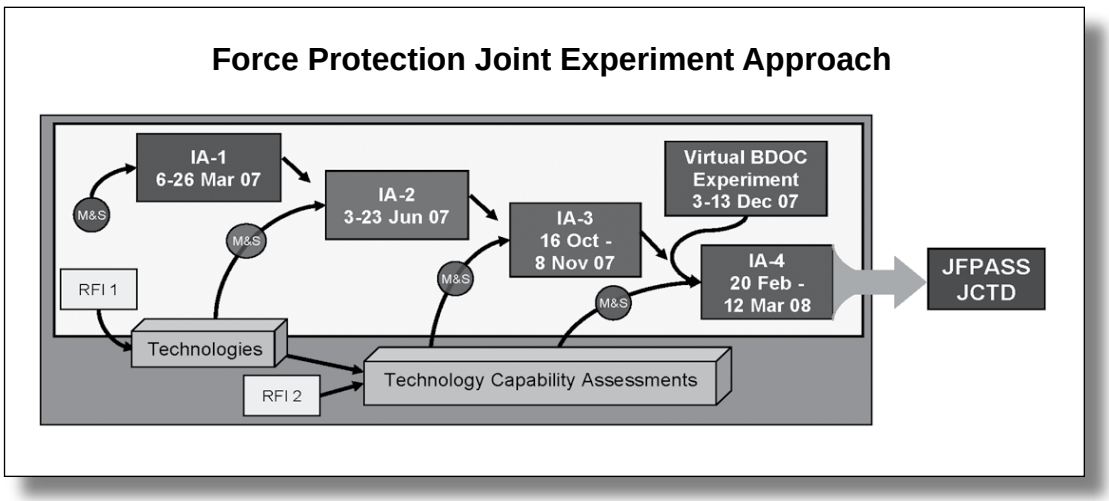

Figure 2. A list of the IUBIP capabilities and tasks. Highlighted in white are the tasks the FPJE is addressing.

- Unmanned ground vehicles (UGVs) equipped with chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) detectors and lethal and non-lethal weapons
- Unmanned aerial vehicles (UAVs) equipped with a day/night surveillance camera
- Global positioning system tracking equipment
- Gunfire/sniper location detection systems
- CBRNE detectors and plume-calculating software
- Seismic, acoustic, magnetic, and infrared unattended ground sensors with image-capture capability
- Fence sensors
- Short-range, microwave, and infrared break-beam perimeter sensors

Integrating Assessments

The FPJE involved the following IAs:

IA-1. The main focus of IA-1 was to establish a baseline to measure subsequent improvements in capabilities and how well gaps were filled. A total of 20 pilot runs were conducted to assess integration, test concepts, and refine TTP for the record runs. Pilot runs served to stabilize the various parts of the live experiment and maximize the effectiveness of the record runs for collecting the information desired. Fourteen record runs (9 daytime and 5 nighttime) established the base case and validated TTP.

IA-2. The addition of several force protection systems and technologies, a longer run time, and more complicated vignettes made IA-2 a more complex experiment. Twenty record runs (15 daytime and 5 nighttime) explored how the systems performed and assessed force effectiveness improvement with regard to fusion, automation, and integration.

IA-3. To allow IA-4 to be fully dedicated to fusion and automation, IA-3 was dedicated to the thorough integration of all technologies and locations. This allowed for incorporation of sensors designed for waterborne threats and the integration of disparate locations into a cohesive force protection plan. No data was collected and consequently IA-3 was not included in the assessment results.

IA-4. The critical technology improvement brought into IA-4 was the incorporation of a data fusion engine (DFE). This system served as the consolidator and disseminator for all data within the FPJE family of systems. The DFE provided greater flexibility to tailor the base defense operating center, depending on a given situation and readiness level. More importantly, it enabled fusion to occur, resulting in better situational awareness and understanding. A total of 29 record runs (17 daytime and 12 nighttime) were conducted using the same runs and vignettes performed during IA-2.

Results

The FPJE problem statement was "*How do fusion, automation, and integration of mature force protection technology solutions reduce risk to the JFPASS JCTD while exercising the IUBIP CONOPS against relevant threats, to include CBRNE, land, sea, and air?*" FPJE results are based on detailed analysis of quantitative data collected to address metrics and qualitative data collected from experiment participants, observers, and subject matter experts. The problem statement was broken into three issues that were addressed as follows:

Issue 1. How do fusion, automation, and integration enhance force protection in an operational context?

The significant force protection enhancement concerning fusion was the implementation of the DFE during IA-4. The DFE is a command and control (C2)/common operational picture (COP) display system that fused multiple pieces of information. This reduced nuisance alarms and irrelevant detections and considerably uncluttered the COP, enabling greater confidence in the system. The battle captain was able to focus on fewer, more relevant detections and employ assets sooner than without the DFE. Consequently, standoff distances increased for detecting, assessing, and defending against a threat to the base defense operating center. The ability to fuse information with the DFE resulted in better situational awareness/situational understanding and more proactive, informed decisions.

The key automation contributions were the ability to automatically track targets through slew-to-cue assessment cameras and to send the UGVs on preplanned navigation routes. These improvements decreased operator workload for tasks such as path/route planning, sensor automated missions, and UGV sentry modes, allowing operators to focus on reconnaissance or surveillance. While the number of tasks steadily increased through IA-4, manpower requirements actually decreased because 95 percent of the added tasks were successfully automated.

The integration of new systems was successfully completed by the end of IA-3 with the exception of the CBRNE UGV and the unmanned aerial system. The final IA integrated 28 different subsystems consisting of 148 total individual sensors or components, at three geographically separate locations. Establishing and adhering to a common interface language requirement ensured that the technologies worked within the digital architecture of the experiment. Technologies that were not fully integrated with the C2 system were difficult to keep track of and quickly lost value on the battlefield. Additionally, the operator stations were interchangeable, which allowed operators to share the workload and ultimately reduce manpower requirements without compromising the effectiveness of the system.

Issue 2. What technologies can potentially support the IUBIP capability gaps?

The IUBIP CBA process identified a number of mission tasks for each of the DAWDR functions, and each of the mission tasks was broken down into attributes. The FPJE identified capabilities that can accomplish 83 percent of the detect attributes, 60 percent of the assess attributes, 50 percent of the warn attributes, and 44 percent of the defend attributes . The recover function was not covered within the experiment.

The use of UGVs improved situational awareness by augmenting camera and radar surveillance and conducting close reconnaissance, reduced security force patrolling requirements by minimizing the need for manned patrols and checkpoints, and limited exposure of friendly personnel to hostile action by patrolling and challenging intruders.

An independent assessment of the FPJE capabilities was conducted by the United States Army Test and Evaluation Center (ATEC), Alexandria, Virginia. Capabilities were assessed with a focus on risk to the JFPASS JCTD as defined by a semifixed/expeditionary location primarily in the United States European Command area of responsibility, but with consideration to the United States Central Command area of responsibility. Overall, the majority of the systems in place during IA-4 are considered operationally suitable in the JCTD environment. Generally, the sensors were assessed as *low risk* to the JCTD, with the exception of the CBRNE sensors, the UGVs, and the UAV. The nonlethal UGV was assessed as *medium risk* to the JCTD, while the lethal UGV was assessed as *high risk* due to the system's lack of technical maturity. The UAV was assessed as *high risk* due to its lack of full integration into the FPJE system. Figure 3, page 24, depicts the overall assessment of the FPJE capabilities against the force protection functions pertinent to the FPJE.

Capability Bin	DETECT	ASSESS	WARN	DEFEND
FPJE System	G	G	A	G
C2/Fusion Engine	A	A	R	G
UAVs	A	N/A	N/A	N/A
CBR Sensors	R	R	R	N/A
UGVs	G	N/A	N/A	N/A
Optical Systems	G	N/A	N/A	N/A
Radars	G	N/A	N/A	N/A
Unattended Ground Sensors	G	N/A	N/A	N/A
Maritime	G	N/A	N/A	N/A
Miscellaneous	N/A	N/A	N/A	N/A
KEY				
G	Demonstrated capability during the FPJE			
A	Demonstrated capability with significant shortfall			
R	Not successfully demonstrated			
N/A	Not applicable to a particular capability			

Figure 3. ATEC assessment of FPJE capabilities

Required Capability	Ideas for Materiel Approaches in the Near Term (Present to 2018)
2. Ability to provide detected activity (information) that is mutually supporting (provide to, accepted from, used) across Services and agencies regardless of format.	Integrate system of systems to track all threats (standardized, deployable, bundled package of sensors).
	Establish communication and sensor systems that are synchronized and linked.
	Enhance real time, common tracking, and management tool for air, ground, and sea threats.
	Establish joint sensor network.
	Integrate existing detection sensor architectures to provide standardized equipment and procedures.
4. Ability to share information among ground, air, and sea forces.	Integrate existing architecture to provide fused information from a single node.
	Integrate existing architecture/systems used to gather independent information to provide a relevant common operational picture.
5. Ability to integrate sensing capabilities to send, receive, and exchange data across Services and agencies.	Integrate "like" tracking capabilities into one node.
	Integrate "like" sensor capabilities into one sensor.
8. Ability to link (share) resources across Services and agencies.	Create hardware decision support system for gathering independent information.
	Select/leverage best existing detector/sensor architecture to support standardized equipment and procedures.
10. Ability to enable defensive operations across the Services and agencies.	Integrate existing architecture/systems to display ground, sea, and air common operational picture.
	Select/leverage best existing architecture to manage ground, sea, and air defense capabilities and resources in a single situational awareness application.
11. Ability to provide information to enable the commander's decision-making ability across the Services and agencies.	Leverage existing systems and databases with the ability to analyze information and provide real-time feedback.
	Create an architecture managing ground, sea, and air defense capabilities and resources in a single situational awareness application.

Figure 4. Required capabilities with solutions for materiel approaches

Issue 3. Are the operational insights from the FPJE events consistent with the IUBIP CONOPS?

The FPJE events were primarily conducted according to the detect, assess, and defend functions of the IUBIP CONOPS. The goal of the IUBIP CONOPS is to better equip the joint forces to perform the detect—or "see first"—function first. It can be shown that the emplacement of the integrated FPJE system and the CONOPS within the parameters of the FPJE construct correlate to an improvement in the detect function, thereby contributing to fulfilling the identified requirements in the IUBIP CONOPS.

Overall, the integrated system proved very successful in recognizing, classifying, and identifying data and information for the assess function. This enabled a superior understanding of developing situations and allowed the battle captain to determine intent, formulate correct procedures, and execute appropriate courses of action before the enemy could successfully carry out hostile intentions. These actions fulfilled the "understand first" goal of the IUBIP CONOPS.

With the integrated system and the added DFE capabilities acting in concert throughout the detect, assess, and defend functions, the base defense operating center was successfully defended against insurgent attacks by enabling the Soldiers to "act first" and "finish decisively." With further development of standing operating procedures, TTP, and DFE technology capabilities, the system will continue to improve force protection effectiveness.

Interoperability

Interoperability was determined to be the highest priority attribute, spanning all DAWDR joint functions, and was therefore

the focus of the first IUBIP functional solutions analysis (FSA). The interoperability FSA led to the development of an initial capabilities document (ICD) that identified 11 required capabilities that will address IUBIP shortfalls related to the interoperability of associated DAWDR subtasks. The FPJE addressed several of these required capabilities and provides a potential solution for a number of materiel approaches from the ICD as identified in Figure 4. There is also a good relationship between the demonstrated FPJE capabilities and the second IUBIP FSA (still in draft form), which addresses the detect, assess, and defend shortfalls and potential materiel solutions. The FPJE did not look at the capabilities needed to address inter-Service and interagency interoperability issues, but did provide the basis for a path forward during the JFPASS JCTD to begin to address those issues.

Conclusion

The FPJE was a tremendous success on many fronts. The results from the experiment will serve the overall force protection community in developing both materiel and nonmateriel solutions to semifixed site identified force protection shortfalls. The FPJE successfully—

- Reduced risk for the JFPASS JCTD by exercising technologies that demonstrated the potential for effectiveness in the JCTD operational environment.
- Informed the IUBIP CBA process by demonstrating progress toward meeting the defined shortfalls.
- Evaluated the impact of fusion, automation, and integration.
- Advanced the development of joint force protection CONOPS, capability requirements, and technical solutions.

The FPJE integrating assessments studied a number of technologies and capabilities that collectively demonstrated an increase in situational awareness and a decrease in workload for the base defense operating center staff. The success of the exercise proved that fusing information (not just data), automating optical detection, and integrating on the COP are key contributors toward enhancing force protection.

Mrs. Taylor is the chief of the Studies and Analysis Branch, Maneuver Support Battle Lab, Capability Development and Integration Directorate.

The author gives a special acknowledgement to Major Jackquiline Barnes, Assistant Product Manager, Force Protection Systems, Fort Belvoir, Virginia, for her contributions to this article.

Endnote

[1] Department of Defense, "Protection Joint Functional Concept," p. 4, 31 December 2003.