Defining Expertise and Developing Training for All-Source Intelligence Analysts

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ABSTRACT

Following the 9/11 attacks, the U.S. Air Force faced an urgent need to improve the efficiency of its training processes in an effort to reduce costs and increase the capabilities of hundreds of newly-hired, entry-level analysts. The Intelligence Community surged to deal with the increased volume and complexity of intelligence processing due to continuously-evolving threats posed by a variety of state and non-state actors. All new hires require specialized training to enable them to apply their expertise, acquired in higher education (e.g. science, technology, engineering, and mathematics degrees), to the unique needs in their specific area. Concurrently, existing training had to be revitalized to address the shifting mission and influx of new hires, but mission requirements didn't provide sufficient time for senior analysts to dedicate to training new personnel. A structured approach had to be used to bring the entry-level analysts up to speed quickly and evolve the curriculum to match the current threat environment.

We will describe the competency-based approach (Mission Essential Competencies, or MECs) used to define expertise by eliciting knowledge from experienced analysts identifying the groundwork essential for new analysts to be able to complete the job 95 percent of the time without the support of others. Over 110 knowledge and skills, 25 common supporting competencies, and over 100 experiences with eight learning environments across three groups of all-source analysts were identified within National Air and Space Intelligence Center (NASIC). Surveys (N=141) revealed 55 training gaps. NASIC completed a curriculum overhaul resulting in a newly designed and streamlined curriculum for 30 student analysts taught in a cohort over six weeks. NASIC's Training and Development Committee and senior analysts across the organization applied the lessons learned from the MECs to ensure on-the-job training is interactive, relevant and taught at the appropriate level for junior analysts. Lastly, we defined the training requirements and how they are applied to develop a web-based training technology. Using a Guided Problem-Based Learning approach, we are developing a virtual framework that allows analysts to proceed through multiple levels applying scientific steps to cultivate a conclusion on information gathered throughout the process. Specifications for the new technology were based upon 92 common knowledge and skills, and 55 common experiences to create learning objectives which outlined course content addressing 26 of the training gaps uncovered during the survey process. The framework developed for the flexible intelligence trainer will be generalizable enough to apply to other domains for further use outside the Intelligence Community.

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DEVELOPING FUTURE INTELLIGENCE ANALYSTS

Competency-based approaches to training are becoming prominent across organizations (Goldstein & Ford, 2002). These methods typically consist of a functional analysis of occupational roles, tasks, preferred outcomes, and assessment of trainee progress based on demonstrated performance. Reported benefits of the analysis include performance-based measures for assessment, clearly defined standards, and training content aligned with these standards (Alliger et al, 2012). Criticisms include the potential for reducing holistic training to a number of independent tasks and challenges associated with the transfer of competency definition (e.g., knowledge elicitation) into actual training didactics and systems (Mitchell & Wolf, 1991).

To address these criticisms, the United States Air Force has applied a tailored approach to competency-based training. The Mission Essential Competency (MEC) process has been applied quite broadly to define training standards for many domains (e.g., pilots, aircrew, etc.) (Alliger et al, 2012). Additionally, MECs have been used to provide the basis for the design of training technology (Tossell et al, 2006).

In this article, we extend the above research by showing the applicability of the process to the intelligence, surveillance, and reconnaissance domain and with curriculum overhaul, training technology design, and content development. In other words, our focus in this work is on the link between competency definition, training gap analysis, and the application of this information to produce actual training. First, we briefly describe the competency-based process used to define expertise through the elicitation of knowledge from experienced analysts working within the National Air and Space Intelligence Center (NASIC). Second, we detail how the analysis was used within NASIC to complete a curriculum overhaul resulting in a streamlined curriculum. Third, we define how these training requirements were translated into design specifications for the development of web-based training technology for NASIC along with didactics for the trainer. Finally, we discuss applications of the approach beyond NASIC.

Background

NASIC is the primary Department of Defense producer of foreign aerospace intelligence. NASIC develops its products by analyzing all available data on foreign aerospace forces and weapons systems to determine performance characteristics, capabilities, vulnerabilities and intentions. NASIC's assessments help to shape national security and defense policies, provide insight into foreign aerospace system capabilities, and support American weapons treaty negotiations and verification (Air Force ISR Agency, 2013).

Over the last decade NASIC, like most other government organizations, has faced high turnover rates and a shrinking budget. The former, in particular, created challenges for maintaining readiness. As senior analysts retired, junior analysts were required to become proficient at advanced skills such as synthesizing multiple pieces of intelligence data to respond to requests for information.

In 2010, NASIC teamed up with Air Force Research Laboratory (AFRL) to apply a synchronized approach to address their training challenges. The first goal was to capture the knowledge and skills of expert analysts set to retire and discover the training gaps associated with novices set to take those positions. Second, based on those analyses, we began to develop training that closed those gaps and aligned training curriculum with expert standards. And third, to design and develop a training system with content derived from competency definition. These goals were set to span across analysis and implementation working hand-in-hand with NASIC leadership and subject matter experts (SMEs).

A SYNCHRONIZED APPROACH TO ANALYST DEVELOPMENT

In this section, we describe a competency-based process, the MEC process, used to elicit training data to define standards for all-source analysts at NASIC. We used the gap analysis within this process to apply lessons learned to other NASIC analyst training (i.e. in-house courses, Advanced Technical Intelligence Center (ATIC) intelligence course, and on-the-job training). The results were then applied to the Flexible Intelligence Trainer (currently in development) to fill 26 of the 55 total training gaps analysts at NASIC identified.

NASICs Mission Essential Competencies Project

The MEC process was originally developed to provide job-contextualized work functions that describe higher-order competencies that a fully-prepared individual or team requires for successful mission completion under combat conditions (Alliger et al, 2012). Originally, the MEC process was created with the goal of improving the Ready Aircrew Program, but since then, the MEC process was mandated by then Chief of Staff, General John P. Jumper, for all major Air Force weapon systems (HQ ACC TRSS/TDF, 2010). To date, MECs have been successfully applied to a wide variety of almost 70 Air Force, Navy, Joint, Coalition, civilian airborne, remotely-operated and ground-based systems that perform command and control (C2), tactical air control, intelligence, information operations and leadership functions. At NASIC, the MEC process was applied to analyze training needs for three sets of all-source analysts, who performed similar analytic work, but against different types of intelligence subject matter content. Three separate MEC projects were performed simultaneously over a period of roughly eight months. During each project, two initial working sessions with NASIC SMEs defined the sets of MEC constructs, which would next be incorporated into surveys that were administered to job incumbents.

Developing MEC constructs for NASIC

The MEC process produces a set of empirically-based training constructs that describe training needs at different levels of granularity (Alliger et al, 2012). These constructs include the MEC statements, sets of Knowledge and Skills (KSs), Experiences, Learning Environments, and Supporting Competencies.

The actual MEC competency statements consist of a title, a paragraph-long description, and additional context statements that explain situations in which the MEC comes into importance (referred to as the *Start*), becomes less important (*Stop*), and the purpose for the competency. We standardized the five MEC statements across the three projects, except for any exemplar processes, tools, or products that were specific to specific intelligence work or subject matter in each project. The first three MECs followed the intelligence cycle (Office of the Director of National Intelligence (ODNI), 2011) of identifying customer needs, locating, assembling, and assessing data to answer the customer's question, and then embodying the analytic conclusions into deliverable work products. We also included MECs to address product quality and security functions, and to develop and maintain a specific area of analytic expertise. Table 1 presents MEC 3, *Develop analytic products*, as an example. MECs are used in the training gap analysis to identify how important training is to develop the overall expertise of the population being examined by the MEC project.

Table 1. Mission Essential Competency Example

MEC	MEC Description	Start	Stop	Purpose
Develop analytic products	Apply NASIC and ODNI standards, techniques, styles, and formats to draft analytic products. Use NASIC, Joint, and Intelligence Community templates, production tools, and production processes to produce analytic products. Create and deliver intelligence briefings for policy makers, acquisition community, and warfighters. Coordinate with other IC stakeholders. Task production specialists as needed to finalize products, for example text-based, online, graphics, and multi-media. Meet customer time requirements.	How to fill the need is understood	Completed product is published	Develop a product to provide the needed information to the customer

MEC projects also develop a list of Supporting Competencies (SCs), which are sets of high-level skills that are demonstrated in the context of operational conditions and constraints. Some SCs support a specific MEC, while others support multiple MECs. We developed approximately twenty-five SCs for each set of NASIC all-source analysts. Two example SCs are *perspective taking* and *critical thinking*, shown in Table 2.

Table 2. Supporting Competency Examples

Supporting Competencies	Supporting Competency Description
Perspective Taking	Understand the mindset and tactics from the target's perspective rather than thinking as would an American. Understand how an individual's cultural background influences their behavior.
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems. Used in taking what information is available to try to solve a puzzle without knowing what the final answer is supposed to be; used in evaluating sources of information/intelligence.

In the MEC process, a *knowledge* is defined as information or fact that can be assessed quickly under stress, while a *skill* is a compiled sequence of actions that can be carried out error-free under stress. The MEC process collects self-report survey data from each participant to describe their individual level of proficiency in each Knowledge and Skills (KSs), and the averages of these responses are compared against minimum standards to identify potential shortfalls. Approximately 110 KS statements were identified across the three projects, about 80 percent of which were common to at least two of the projects. Table 3 displays three example knowledge statement examples.

Table 3. Knowledge Examples

Knowledge	Knowledge Description
Adapt Products	Methods to adapt products to the target audiences (such as by considering the intended use, audience technical background, and developing multiple formats for different audiences providing tailored levels of detail, classification, and releasability).
Writing Techniques	Apply NASIC, Intelligence Community, and journalistic writing techniques (such as active voice and bottom-line up front), styles, standards, and guidelines in writing analytic products.
Report Guidelines	ODNI, Joint, and NASIC report style guides; dealing with conflicting styles; how to document process used to derive assessments (such as footnotes).

Experiences are developmental events during training and/or careers that help facilitate application of a KS, or allow one to practice a MEC under operational conditions. Over 100 experiences were identified across the three projects, about 70 percent of which were common to all three projects. Each experience is accompanied by a statement of the purpose for the experience (Table 4).

Table 4. Experience Examples

Experience	Purpose of Experience
Write an item for the Presidential Daily Brief (PDB)	Work under pressure to produce something of interest to POTUS.
Propose, develop, and publish an initiative product	Apply analytic skills to produce a product from start to finish.
Update an existing intelligence product with a revised assessment based on new information	Learn ODNI standards; how to explain why a change was made; practice determining whether new information changes existing product.

Learning environments are categories of situations or events where warfighters may acquire any of the identified experiences. The learning environments identified for the NASIC all-source analysts included (1) self-study; (2) on-the-job training; (3) in-house training (training developed and conducted by NASIC); (4) external training (formal courses, certification programs, and/or internships offered by US or foreign universities, government or military organizations, or commercial providers); and (5) site visits (such as to other agencies or commercial factories).

The NASIC MEC projects had to facilitate comparison across all three groups which had previously never been done. Because the survey content in MEC projects is typically unique to the specific project, comparisons across survey results—even with minor differences in item wording exist—can be problematic (Dillman et al, 2009). To create a master content file, two Aptima researchers, who were each experienced job analysts, created a single Excel file that combined the draft content across all three projects. This task offered the additional value of increasing the potential that the separate MEC projects would reflect a comprehensive inventory of competency and training need information for the target population, since the final results could be combined from three independent research projects. The master file enabled side-by-side comparison across the three projects, and based on the similarity of each item, the analysts either (a) adjusted the text to be identical, (b) chose the version that seemed to have the best qualities based on industry standards for creating test and survey items, or (c) included the item in all three sets of surveys. When project-specific examples were included in the text, these were retained for the respective project.

Analysis of NASIC Training Gaps

The MECs, Experiences, Learning Environments, KSs are built into a set of six surveys, including one that includes demographic information. The results of the surveys are presented in a product called the COMprehensive MEC Analysis and Needs Determination file, or COMMAND file. The COMMAND file is not merely a summary of the survey results, but is used in a final workshop in which SMEs interpret the survey results, determine whether the survey results and their insider knowledge suggest that training gaps exist, and identify methods to close these gaps. Figure 1 represents an exemplar of the COMMAND file data display, which SMEs use to identify the importance of constructs to job performance, whether survey respondents think the construct can be trained, and the degree to which they are receiving training. The results are summarized as a decision of whether a training gap exists, and if so, what to do about it.

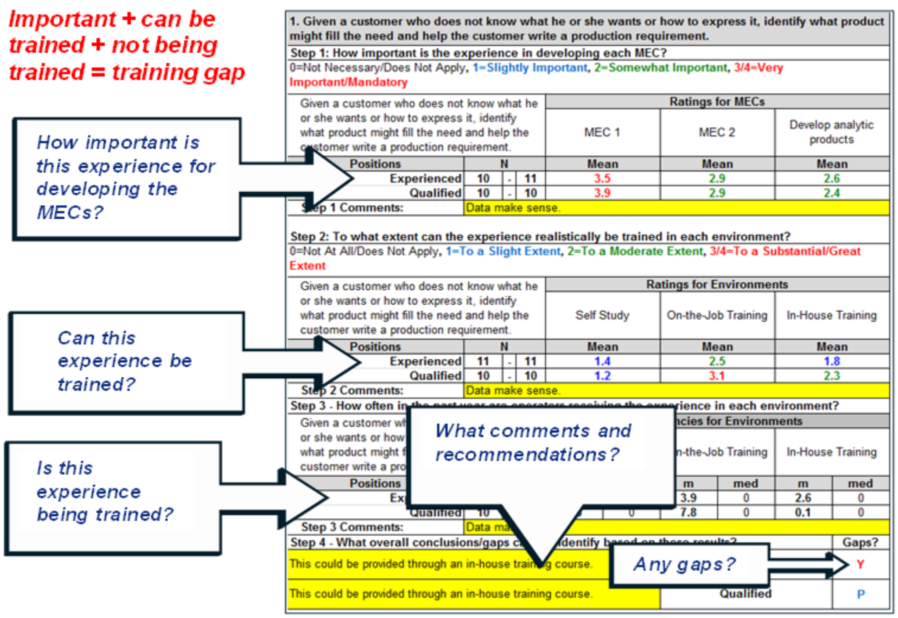

Figure 1. The MEC process identifies training constructs and shortfalls

For NASIC, an additional set of analyses, and an additional work product, were performed to summarize and integrate the results across the three projects. This work revealed that almost 10 experiences had gaps across all three projects. An example of one of these experiences was "Put a product into the appropriate template." The analysis tool displayed the total gap count across roles by project, total number of experiences with gaps across all three projects and within each project, and by role (i.e. junior or senior all-source analyst, or supervisor).

NASIC absorbed the feedback from the SMEs and applied the lessons learned to their in-house courses which will ultimately increase their return on investment. NASIC's training budget has been cut over the years and with reduced funding for travel, training and conferences, it's hard to provide the roughly 800-1000 all-source analysts opportunities to hone their skills. With the knowledge gained from the MEC projects identifying specific areas for improvement, NASIC is able to fill those gaps and providing their own courses within NASIC instead of sending analysts to outside courses. The section below delves into how NASIC applied the MEC projects to their internal courses.

NASIC's Revised Analyst Training Curriculum

Like the rest of the Intelligence Community, NASIC was faced with an urgent need to substantially improve the efficiency of its training programs and processes. A robust training budget did not necessarily guarantee an instructionally sound approach to develop analysts at various levels of skill, training, or experience. After 9/11, the Intelligence Community experienced a major hiring surge, missions increased at NASIC, and hundreds of entry-level analysts with Science, Technology, Engineering and Mathematics (STEM) degrees were hired. A scientific degree did not prepare a new US Air Force employee to perform intelligence analysis. The analysts who had been doing analysis for decades were neither well-prepared nor trained to teach, coach, and mentor this influx of inexperienced, untrained analysts. Furthermore, they were unable to dedicate sufficient time to training due to the impact this would have on critical mission duties.

In 2010, the Training and Development Committee–comprised of intelligence analysts across the organization and the Chief of the Development Division (DPD)–helped identify a set of seven basic courses to introduce basic intelligence analytic skills, explain the Intelligence Community and its functions, and provide instruction in analytic writing and presentation skills. All entry-level intelligence analysts were directed to complete these seven courses. This was a step in the right direction, acknowledging that junior analysts would benefit from some common training. Challenges with too many independent instructors teaching their own preferred content, and leaving training registration to the junior analyst proved inefficient and ineffective. Junior analysts were not receiving training in a consistent, predictable, or timely manner.

Once the partnership was formed with AFRL, MEC research created a rich source of data to help design a new training and development plan. The Chief of DPD led an effort to approach changes to analyst training from an Instructional Systems Design approach. Since February 2012, DPD and NASIC's Training and Development Committee streamlined their training program from working with multiple contractors down to one contractor who was well-qualified in intelligence analysis training and instructional design. This contractor enabled NASIC to design training requirements for an entry-level analyst as identified by the "qualified analysts" who participated in the MEC surveys. A qualified analyst had less than five years performing intelligence analysis.

Using the MEC data, DPD differentiated training requirements for junior (qualified) analysts and senior (experienced) analysts. The Defense Intelligence Strategic Analysis Program (DISAP) defines three levels of competencies for analysts. NASIC's Analyst Initial Qualification Training (IQT) Program now meets the DISAP Level I requirements. It is a 6-week course built using intelligence tradecraft standards from the Office of Defense National Intelligence, Air Force instructions for Intelligence Training, and the MEC data. The MEC data also provided insights into training and development needs for senior (experienced) analysts, and NASIC's long-term goal is to design training to meet DISAP Level II competencies in a locally-developed course as well. A five-day Coaching and Leading Analysis (CLA) Course was designed to develop coaching and mentoring skills for senior analysts. The senior analysts learned active listening skills, improved their ability to ask open-ended questions, and to guide junior analysts to problem solve on their own, not just give them the answer. The long-term goal is that these senior analysts will help the junior analysts apply knowledge and skills introduced in the Analyst IQT. The six-week Analyst IQT establishes standards for analyst development to begin within 6-8 months of their arrival to the organization. It sets the standard for analyst development to continue in the analytic production squadron under a Mission Qualification Training program to be designed and monitored in each analytic production group.

For example, the first pilot Analyst IQT course was in session May 6- June 14 2013. The first pilot CLA Course convened 29 Apr – 3 May 2013, with 25 senior analysts in attendance. Ten senior analysts who attended CLA coached students at the Analyst IQT which was in session through mid-June. DPD is actively collecting feedback from students and coaches on a weekly basis to continue improving the course. The seven courses previously taught by seven independent instructors are no longer offered. Since NASIC has invested in this streamlined approach with one contractor, we are not currently utilizing the analyst training courses offered through ATIC.

After two pilot Analyst IQT courses were completed, final revisions were coordinated and approved through NASIC's senior leaders. Analyst IQT will be considered "Full Operating Capability" in FY14 and scheduled as needed based on entry-level analyst hiring rates. The CLA Course will be scheduled, budget allowing, accommodating senior analysts in Principle Intelligence Analyst and Senior Intelligence Analyst positions.

In a parallel effort, Ball Aerospace and Technologies Corporation partnered with six other companies to answer a Broad Agency Announcement that AFRL published to develop an interactive training environment for all-source analysts. The MEC results provided a foundation for developing learning objectives to be incorporated in a "Flexible Intelligence Trainer" that will address numerous training gaps the analysts identified during the NASIC MEC project. This prototype immersive learning environment is discussed below.

Development of a Prototype Flexible Intelligence Trainer

Leveraging the results of the MEC analysis process described above, the Warfighter Readiness Research Division (711 HPW/RHA) and its contractor teammates are developing a prototype Flexible Intelligence Trainer (FIT) for all-source intelligence analysts. This trainer is intended to address training gaps identified by the NASIC MEC project and to do so in an engaging, "serious gaming" environment that provides a self-paced, immersive learning opportunity for analysts to acquire and maintain critical skills. It is envisioned that the FIT will augment current classroom training for incoming analysts and will also help analysts maintain critical skills between assignments, while awaiting clearances, or while awaiting job placement.

Learning Objectives

The first step in designing the FIT prototype was to identify the learning objectives it should support. This process began with an examination of nearly 110 KS elements associated with key analyst MECs. Researchers systematically reviewed each element to determine whether it was something that can and should be addressed by the FIT. To arrive at this decision, several attributes were examined. Figure 2 shows how the final number of KSs could be addressed within the FIT.

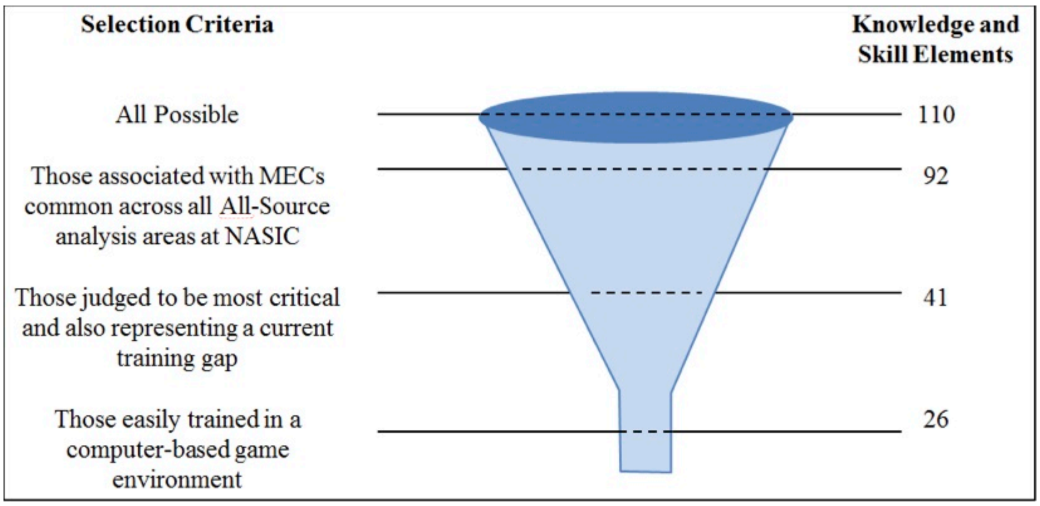

Figure 2. Down-selection of Knowledge and Skills Implemented in FIT

A number of KSs were associated with aspects of interpersonal communication (e.g., giving and receiving constructive criticism from peers and superiors). Although several of these KSs were deemed to be both mission critical and a current gap, the development team concluded that it would not be cost-effective to train such skills in a synthetic environment (e.g. to do so would require highly realistic and interactive, intelligent avatars); and thus, these KSs were removed from consideration. Based on their examination on these three KS dimensions: 1) criticality to the all-source analyst mission, 2) the extent to which it represents a current training gap, and 3) the extent to which it could be cost-effectively addressed in a self-paced, serious gaming environment, the team of instructional designers and all-source analysts down-selected to a set of 26 KSs that will be addressed by the trainer. Subsequently, the team developed learning objectives associated with the KS items and organized the learning objectives into a set of 24 logically-grouped lessons comprising five training modules. These modules cover key KS areas including: 1) intelligence product types, 2) requirements elicitation, 3) information search and retrieval, 4) critical analysis, and 5) documentation development. Upon identifying the candidate set of instructional modules, lessons, and learning objectives, the development team met with NASIC to review the planned trainer content and confirm that it would address key training needs of incoming NASIC analysts.

Trainer Design

The FIT trainer design reflects the concept of "serious gaming" in which trainees acquire and exercise problem solving skills in an immersive, game-based simulation environment. Underlying this serious gaming approach, the development team has attempted to incorporate David Merrill's "first principles" of instruction and to follow a guided problem-based learning approach (Merrill, 2002). This approach includes five basic tenets: 1) learning is promoted when learners acquire concepts and principles in the context of real-world tasks, 2) learning is promoted when learners activate relevant previous knowledge, 3) learning is promoted when learners observe a demonstration of the skills to be learned, 4) learning is promoted when learners apply their newly acquired KSs, and 5) learning is promoted when learners integrate their new skills into their everyday life. Because developers wanted to design a trainer that was adaptable to the learner as much as possible, a sixth tenet was added to the design philosophy: 6) learning is promoted when instruction is tailored to the needs of individual students.

To support these six tenets, the development team has designed a modular and flexible architecture for the FIT system. In Figure 3, the architecture is centered on a learner model that contains knowledge of the trainee's past experience and learning history (e.g., courses completed), as well as, his or her task performance in the current lesson (e.g., quiz and test performance). With this understanding, the learner model informs an instructional "planner" module that will dynamically drive a multimedia instruction environment, a quiz and test environment, and an immersive performance environment tailored to the needs of the individual learner. It will also interface with a SCORM-conformant learning management system for administration, documentation and tracking.

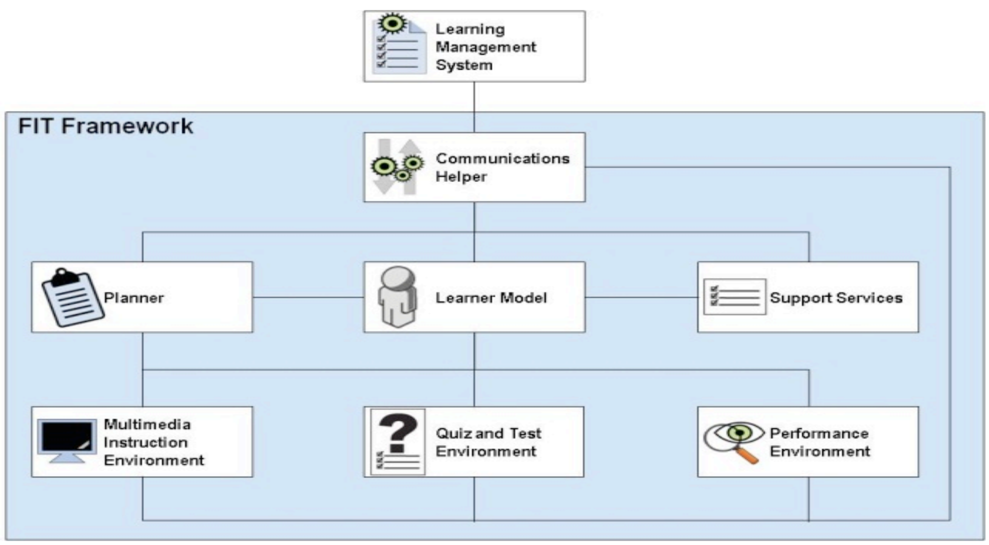

Figure 3. Modular FIT Architecture

Within an immersive gameplay environment, the all-source analyst trainee will progress through various stages of a U.S. intelligence analyst career during World War II (WWII). Over the course of the five training modules, the trainee will learn and practice a variety of analyst tasks while trying to understand and report the true status of a secretive Nazi weapons program aimed at developing a hypersonic space plane (a.k.a. the "Silverbird") capable of reaching the United States. Drawing upon this real-world intelligence scenario offers several key benefits. It offers the intrigue of an actual wartime intelligence issue. Set in WWII, it is far enough in the past that key documents that provide a robust set of evidence have become declassified; yet, it is recent enough that it is representative of a modern-day problem for NASIC analysts (i.e., it requires analysis of rocket propulsion systems and aircraft design data gathered from multiple intelligence channels). Many intelligence products available today were also available in WWII (e.g., reports from human sources, photographs, aerial photographs, signals intelligence), and artifacts of that era can be reformatted to appear as their modern-day counterparts (See Figure 4). In cases where today's technology is completely new (e.g., on-line searches of massive databases), it is relatively easy to weave a "fictional reality" into the scenario that would allow incorporation of these modern capabilities (e.g., "*Welcome to Bletchley Park, Lieutenant. Let me introduce you to our latest invention, the Colossus II electronic indexing system. We currently have records for more than 10,000 pieces of intelligence and we are adding more daily.*") Finally, Operation Silverbird is also an obscure story, rich with multiple storylines that will be unfamiliar to most analyst trainees, and these story-lines offer enough information to exercise analyses of competing hypotheses.

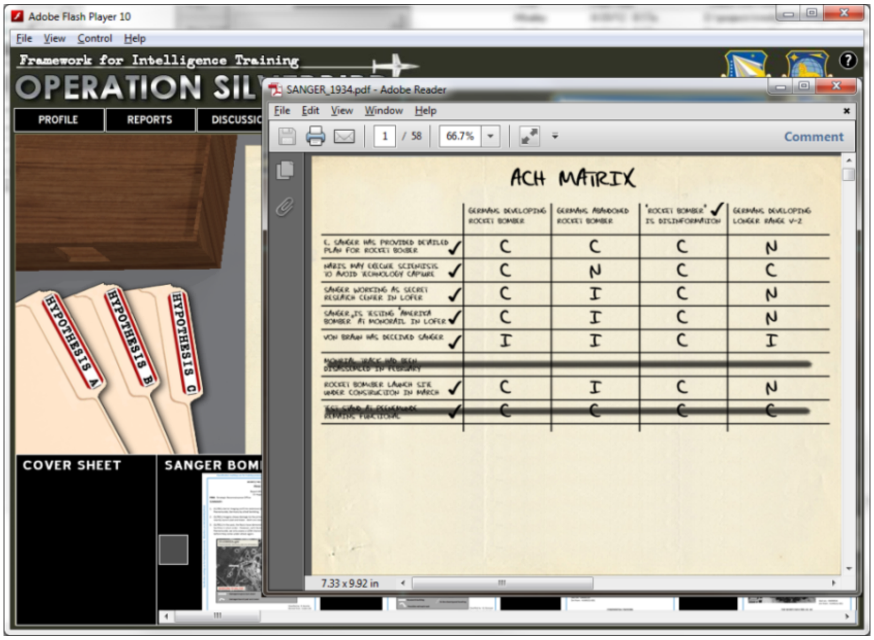

Figure 4. Example of the FIT's performance environment interface (courtesy Sonalysts, Inc)

CONCLUSION

The research and development described above is an example how AFRL intertwined with warfighters and industry partners to develop cost-effective, competency-based training. This effort has addressed long standing problems in the Air Force including shrinking training budgets, decreased manning hours, and increased workload. By collaborating with training leads for the end users, conducting in-depth analysis of current training gaps, and applying modern training approaches such as immersive environments and serious games to satisfy these gaps, AFRL continues to evolve targeted, effective, and affordable training solutions. The impact made will improve the time it takes to get analysts trained to do the job, the quality at which they complete the collection and execution, as well as, their ability to do the job on their own. The different approach, the synchronized implementation, and the depth of detail and data collected will improve the all-source analyst community within NASIC dramatically and for years to come.

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