Promoting Air and Space Operations Center (AOC) Training Transformation by Quantifying and Refining AOC Training Scenarios

Capt David Rodriguez, Lt Chad Tossell
Air Force Research Laboratory
Mesa, AZ
Chad.Tossell@mesa.afmc.af.mil

Dr. Michael Garrity, Rebecca Morley
Aptima Inc.
Woburn, MA
MGarrity@aptima.com, RMorley@aptima.com

ABSTRACT

The AOC is a weapon unlike any other in the United States Air Force (USAF) inventory. Training hundreds of personnel across various duty specialties to function toward common Joint Force Air Component Commander (JFACC) objectives is a complex and arduous task. The Air Force Research Laboratory (AFRL) Warfighter Training Research Division, along with Aptima Inc., and the Group for Organizational Effectiveness (gOE), have undertaken this challenge and have begun to define AOC training requirements. The method by which they have defined these requirements includes an in-depth and specific functional work analysis of each division to obtain the necessary knowledge and skills a person needs to be competent in his or her position within an AOC.

This paper focuses on three ways to apply this process to transform traditional AOC training. To date, AOC training events utilize large-scale scenarios built by experienced AOC personnel. These scenarios focus on training objectives at a general level across the AOC. Consequently, due to the numerous jobs within an AOC and the generality of the current scenarios, traditional AOC training has not been efficient. The outcomes of this research can be used to enhance scenarios used for AOC training and construct a training repertoire at a level more inclusive of the entire training audience, thus optimizing the training received during large-scale exercises and ensuring AOC operators receive the most comprehensive training possible. By linking a comprehensive list of specific knowledge and skills to actions elicited by scenarios, we aim to (1) identify possible training gaps missed by current scenarios, (2) refine current scenarios to better focus the training objectives for all participants, and (3) develop a more comprehensive list of scenarios to cover all knowledge and skills required to be an expert AOC operator working within the Combat Operations Division (COD) and related support functions.

ABOUT THE AUTHORS

Chad Tossell is a Behavioral Scientist for the Warfighter Training Research Division, Air Force Research Laboratory. Chad supports research and development (R&D) in training enhancement for the Air and Space Operations Center and Information Operations. He helps integrate R&D efforts with users, customers, decision makers, DoD, industry, and support contractors. Chad also facilitates R&D program management for the Air and Space Operations Center and Information Operations Training Research.

Michael J. Garrity is an Industrial-Organizational Psychologist and Business Area Leader for Competency Development for Aptima, Inc. Dr. Garrity has acted as a facilitator and analyst for several MEC^{SM} efforts including (AOC, SPACE AOC, IWAS, and JFACC). Michael has a Ph.D. in Industrial-Organizational Psychology from Clemson University.

Rebecca Morley is a Human Factors Analyst at Aptima, Inc. in Woburn, MA. Her major research interests include various knowledge elicitation techniques (MECs^{SM}, CTA, CWA), team training systems, and immersive technologies (spatial audio displays, HMDs).

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INTRODUCTION

One word describes the training requirements of the over two hundred personnel, multi-mission, operational level, air and space command and control (C2) node: *complex*. The Air and Space Operations Center (AOC) is undoubtedly the most multifaceted weapons system in the United States Air Force (USAF) inventory. Five divisions separate the numerous teams within an AOC; each with different functions to carry out the Joint Force Air Component Commander (JFACC) objectives. Needless to say, training this diverse crowd to function as a warfighting whole is challenging and important.

To date, the USAF has used an all-or-none approach to training AOC Warfighters. Either an individual is engulfed in a high-level, large-scale exercise with hundreds of others or misses the few opportunities to participate. Primarily, these exercises (Blue Flag, UFL) are used as mission-readiness training for persons that have been through an AOC Initial Qualification Training (IQT) class. Unfortunately, due to the large number of people at a given exercise, everybody that attends does not receive an optimal amount of training. During a time-sensitive targeting (TST) scenario, for example, personnel working in the defensive operations team may sit around for its duration. Training is focused at such a high and general level that position-, team-, and even division-level training is often overlooked. It is very possible that a person goes through an exercise of this nature and receives a checkmark on a box labeled "mission qualified" even though he has never been through a scenario testing his AOC-specific knowledge and skills.

Thus, there are two problems to be addressed. The first is the generalness of AOC Training. The majority of AOC Warfighters are not getting specific position- or team-level training from participating in the aforementioned large-scale exercises. The second is developing scenarios that now target those positions that were previously overlooked.

Seeing the need for more specific training, the USAF is scaling down its approach to training by using Mission Essential Competencies[SM] (MECs[SM]) to define lower-level training requirements and developing relevant technology to, not only focus training on a position- or team-level, but provide it more often (Colegrove & Alliger, 2002, 2003). Additionally, the MECs[SM] provide the knowledge, skill, and experience constructs to map to actions elicited by AOC training scenarios. Consequently, scenarios can be developed to target the training of certain knowledge and skills. Determination of mission-readiness will not solely rest on one's attendance in an exercise; but the competency-based assessment of their performance. Finally, training will take place more frequently and will be relevant to those participating.

This paper will describe how the MECs[SM] are being used to scale down AOC training. Detail will be given to how the MEC[SM] constructs feed training scenario development and the implications of this approach to AOC Continuation Training.

Current AOC Training

Current AOC scenario-based training is general and, while it does target operational-level training objectives, does not ensure every team and position takes part in an adequate way. These instances replicate large-scale operations and are intended for a broad training audience. They are executed in large-scale exercises such as Blue Flag and Ulchi Focus Lens. The exercises take several months to plan and organize. The actual training event typically runs for two weeks covering about the same amount of time in a simulated war. They cover processes across the entire AOC from strategy development through detailed planning, execution, and assessment. Because of this, they are assumed to provide valuable training for all AOC operators involved. Unfortunately, this is not true for many, perhaps the majority, of the participants.

There are numerous reasons why individuals in an AOC do not get the training they need from these large-scale training events. The events happen too infrequently, they only focus on the high-visibility processes, and they only train against one scenario with one enemy (or group) and one course of action.

The complexity involved in planning and organizing large-scale events means they occur infrequently, about once per year. This does not allow individuals the opportunity to practice and repeat the processes they are involved in. All jobs require repetition to build expertise. Through repetition, proficiency is developed and decision-making timelines decrease. Also, alternative processes and decisions can be tried and assessed for improvements in quality or timeliness. Therefore the frequency of training events needs to be increased greatly to improve operator proficiency. However, providing this more frequent training during large-scale events is not feasible due to the increased resource requirements in both time and people (not to mention dollars). Obviously, another solution needs to be found.

Another reason operators in these large-scale events do not receive the training they need is because the scenario development tends to focus on the high visibility processes. The processes that require notifying the senior leadership or that make the evening news are things such as time sensitive targeting of high priority targets or fleeting targets of opportunity. Because of this, operators involved with the time sensitive targeting and the offensive operations team in general tend to receive good training. However, other individuals not involved with these processes tend to get minimal training objectives built into the scenario. Strategists and planners, for example, primarily participate to develop a single executable plan. Once developed, it is executed and rehearsed by the current operations personnel. There is little, if any, feedback to the strategy or plans personnel on strengths or weaknesses in the plan that they can use to re-address in their training. This is unfortunate because individual inputs to the plan will have a greater effect on the outcome of an operation than individual actions will during operations. More emphasis needs to be placed on meeting the training needs of all the AOC operators. Unfortunately, because of the nature of the large-scale exercises, some important personnel will be missed during these events.

Another key shortfall in large-scale training exercises is that they are limited to facing only one particular military operation. There is one enemy or group (red) with a fixed set of assets and a predisposed course of action. There is no variability in the threat lay-down, even in the cases where current intelligence estimates will allow for numerous probable instantiations. This could lead to operators building false assumptions or having biases about a particular real-world situation with unintended consequences. Also, the red force is typically "non-thinking" or limited to various options determined prior to the training event. If trainee (blue) actions were not correctly anticipated in the scenario planning, red's actions in the exercise can be nonsensical in that they do not react intelligently or realistically to the unanticipated blue actions. One way to remedy this would be to increase the red force players in the training event which obviously requires more resources in planning and training the red force. Another possible approach is to increase the fidelity of the models and simulations used to run the exercise scenario to have more intelligent entities. There are numerous efforts throughout the government working on such capabilities but these are far-term solutions at best.

An obvious solution to these problems is to create smaller-scale training events. These events will enable more frequent training events since they require less planning and assets to execute. Smaller events can also be targeted at a particular group of individuals or teams who are not focused on in the larger events. Smaller scenarios also enable training managers to create multiple plausible threat lay-downs and enemy courses of action because they do not need to fully model a theater or long timeline scenarios to play over the course of several days. Training managers can develop short scenarios with specific problem sets to overcome and several potential branch and sequel events.

In order to build these smaller scale scenarios, one must first understand the individual and team training needs of all positions in the AOC. The Mission Essential Competencies[SM] analysis we have completed over the last two years will give us that insight into the individual training requirements.

MEC[SM] Constructs

The MEC[SM] process is a unique work analysis in that it links the knowledge and skills required to do a job, and the application of those knowledge and skills to perform duties within the realistic context of a work environment. In short, MECs[SM] fill the gap between knowledge and skills and actual job experience. In this section, a discussion of the MEC[SM] process will be provided as well as MEC[SM] product examples (Mission Essential Competencies[SM], Supporting Competencies,

Knowledge and Skill requirements, Developmental Experiences, and Environments) from the AOC's Combat Operations Division. In addition, a description of the method used to identify training gaps (COMMAND Analysis) will be provided.

The MEC[SM] process involves two workshops wherein information about work structure, knowledge, skills, and experiences are collected to form the basis of the MECs[SM]. The participants from the workshops are subject matter experts, as defined by the operational customer. All data gathered in the first workshop is compiled and organized prior to the second workshop, wherein the question is asked, "Is this what you meant/said?" Following the second workshop, an extensive database of expert knowledge about a career area exists. This information is then put into survey formats which are eventually taken to the rest of the career field's community. Data from the survey responses are then analyzed and presented to high level subject matter experts to allow them to assist researchers when interpreting the results (identifying training requirements will be discussed further later in this paper). This interpretation provides decision makers with a comprehensive analysis of the career field that can help determine how relevant certain competencies are to being qualified in a particular career field. With this knowledge, a more efficient and effective training program can be developed that will target those areas which are most important. Additionally, such knowledge (MECs[SM]) can also enable customized training if an individual is lacking in a particular area. See below for a brief description of the MEC[SM] methodology including examples for the Combat Operations Division of the AOC.

MECs[SM]

MECs[SM] are a collection of statements written at different levels of abstraction. At the highest level are the MECs[SM] proper – such as the following statements from the Combat Operations Division:

- **Monitor the Battlespace**: Maintain situational awareness of the battle plans and associated documents, TACS system, logistics, communications, weather, base/wing status, and friendly/adversary air, space, ground and naval force status and activity.
- **Monitor Battle Plan Execution**: Confirm taskings are carried out and that the JFACC objectives, in support of JFC's intent, are achieved. Ensure that tasked aircraft are packaged appropriately for maximum mission effectiveness and force protection.
- **Assess and Integrate Information**: Constantly assess and integrate information to identify potential ramifications to current operations.
- **Dynamic Execution**: Based on the ramifications of current information, make decisions regarding changes in plans, taskings, and execution. Work closely with units and component and allied liaisons for a coordinated application of capabilities and assets.
- **Disseminate, Communicate, Publish Changes**: Make formal changes to the appropriate battle plans, associated documents, and execution and use the proper communication channels to disseminate those changes to internal and external elements in a timely manner.
- **Execution Feedback:** Provide information for execution management, operational assessment, and to improve planning process.

Supporting Competencies

At the next level are Supporting Competencies. These are both more general than the MECs[SM] proper, and reflect areas of competence needed in carrying out the MECs[SM]. For example, SCs identified as important for the Combat Operations Division include:

- **Decisiveness:** Ability and willingness to make timely decisions based on available information.
- **Adaptability:** Identify and adjust to changes in the environment.
- **Multi-tasking:** Ability to effectively perform multiple responsibilities simultaneously.
- **Situational Awareness:** Ability to assimilate information to develop and maintain a perception of current operations scaled to individual responsibilities.

Knowledge and Skill Requirements

The most specific level of granularity can be found within knowledge and skills. Knowledge is defined as *information or facts that can be accessed quickly under stress*. For our purposes, a skill is defined as *a compiled sequence of actions that can be carried out free of error under stress*. Examples of specific knowledge and skills needed for operators within the Combat Operation Division include:

- Understands ATO change processes and

procedures
- Knows AOC battle rhythm
- Able to maintain daily activity log

Developmental Experiences

The last, and possibly the most relevant components of the MEC[SM] construct to training development, are the developmental experiences. An experience is defined as *a developmental event during training and/or career necessary to learn a knowledge or skill, or practice a MEC[SM] or SC under operational conditions.* Examples of experiences for Combat Operations Division include:

- Late completion of data inputs
- Change of target priorities

In other words, the experiences help to contextualize the knowledge and skills important to perform one's duties.

As mentioned earlier, after survey data are analyzed high-level subject matter experts identify training implications in a facilitated session. Within an AOC division, for each Experience, three questions are asked of SMEs, with survey data being presented for each. Experiences are reviewed in sequence, following the following format:

Table 1. The COMMAND Questions and Data Provided for Each

Question	Data
How important is the experience in developing the MECs[SM]?	By team, averages of expert ratings for each MEC[SM], indicating importance.
How useful would it be to provide this experience in this environment?	By team, averages of expert ratings for AOC learning environments (e.g., Flag, Other Exercises, FTU/IQT), indicating usefulness.
How often have you had this experience in this environment over the last 2 years?	By team, averages of frequencies for operators within AOC learning environments.

Experiences Define Scenario Context

One of the toughest challenges for training managers to overcome is to effectively transition from training requirements in a systematic and principled way to design specific formal training for the warfighter. For the AOC, this challenge is compounded due to the complex nature of the weapon system. Since the AOC functions at the operational level, missions are planned and conducted to meet strategic objectives within the battle theater. This creates a broader context for decisions across dimensions of time and space, making it difficult to create operational level training environments that provide the wide range of variables necessary to support learning. Typical AOC training environments include large-scale exercises that involve hundreds of participants. Although these exercises provide a broad level of practice for participants, this method is not efficient when attempting to provide detailed position-specific training. However, in contrast, simulations, like a part-task trainer, can provide comprehensive, focused training in the areas that are most essential to facilitate improvement in a trainee's performance. Therefore, in order to develop effective training for AOC personnel, we are applying a systematic approach which will link the training requirements identified throughout the MEC[SM] process directly to developmental experiences that can be used to build simulation scenarios (Figure 1).

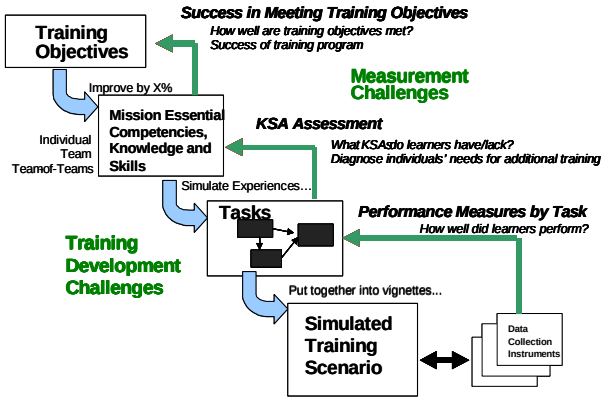

Figure 1. Systematic Approach to Transition from Training Objectives to Training Scenarios

In order to develop a complete library of scenario elements and organize them in a way useful for training, we first had to gain a complete understanding of the AOC responsibilities, work environment, and typical problem areas to focus the training on. We captured

these scenario components during focused workshops with SMEs and through the review of current documents (including the Mission Essential Task List); identifying competencies, knowledge, and skills requirements specific to AOC positions, as well as, the developmental experiences that permit an operator to practice or develop those competencies, knowledge, and/or skills.

To provide effective training we will focus the simulation system around those scenario elements that are most likely to improve overall performance. Therefore, the next step for developing our training system is to link the knowledge and skills needed for mission effectiveness with the developmental experiences that provide the opportunity to practice those skills or acquire the necessary knowledge. In order to identify which experiences will be best suited to train specific knowledge and skills, we will set up a matrix that arrays the developmental experiences as rows and the knowledge and skills as columns, and asked subject matter experts to rate the importance of each knowledge or skill during each critical incident.

We will then collapse the matrix by identifying the cells in which at least a majority of SMEs rated the relationship as important. The data from the rating matrix will then be analyzed to identify those incidents or experiences that draw on many different types of knowledge and skills. We anticipate that these incidents will be "rich" scenario events for training because successful performance throughout the scenario will indicate that the learner possesses many different types of knowledge and skill. These "rich" developmental experiences will provide us with a context with which to build training scenarios, and by including these critical experiences in the simulation system, we expect them to tap into the competencies required for successful performance.

MECs[SM] Applied to Training Scenario Development

Thus, while the developmental experiences can be linked to scenario elements to provide context for competency development, the knowledge and skills are at the right level of granularity to ensure one is targeting the appropriate areas for training effectiveness when building a scenario. MECs[SM], again, are higher-level competencies that overarch the Supporting Competencies, knowledge, and skills. Knowledge and skills, in contrast, are much more specific and detail what a person must know or be able to do as an AOC Operator in a given position.

These knowledge and skills, as seen in Table 2, are mapped to positions within an AOC. This position-level mapping is key to developing more specific scenarios for position- and team-level training. Again, larger exercises miss the more specific training needs of every individual. By mapping a position-specific catalog of knowledge and skills to individual positions, we can understand not only what an individual in each position has to know or be able to do, but at what level each knowledge or skill is required for effective performance of the job.

Table 2. Example of CPD Knowledge and Skills

	CCP	GAT				MAAP				ATO Production				C2 Planning					
Knowledge or Skill	CCP	Chief	Planner	IW	ISR Element	Chief	Planner	IW Planner	ISR Planner	Chief	SPINS Officer	NCOIC	Tech	Chief	Air Defense Planner	C2 Architecture Planner/ Air Support Planner	Airspace Planner	Air Support Planner	Comm/ Freq Planner
Able to convert targets and threat situation to plan of action	I	A	A	A	A	A	A	A	A	B	B	B	_	B	B	_	_	_	_
Understands the offensive and defensive capabilities, limitations, and effects of weapons systems	I	I	I	A	A	A	A	A	A	B	_	B	_	B	A	B	B	B	B
Understands package development process & procedures	I	B	B	B	B	A	A	A	A	B	_	_	_	_	_	_	_	_	_
Knows and understands current guidance (e.g., ROE, SPINS)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Able to lead team (e.g., communication, delegation, performance monitoring)	A	A	_	_	_	A	_	_	_	A	_	A	_	A	A*	A*	A*	A*	A*
Able to ensure quality of MAAP	A	_	_	_	_	A	I	I	I	_	_	_	_	_	_	_	_	_	_
Able to DEVELOP BRIEFING AND brief effectively (ops)	A	A	I	A	A	A	I	A	A	I	_	_	_	A	A*	A*	A*	A*	A*
Understands combat PLANS processes, functions	A	A	I	I	I	A	I	I	I	A	I	I	B	A	A*	A*	A*	A*	A*

Key: What level of knowledge or skill is required for effective performance of the job?
B = Basic; I = Intermediate; A = Advanced;
-- = Not Applicable

This still begs the question, though there is now an index of training requirements for each position, how do we use this to develop focused training scenarios? Evidently, this is a complicated and important problem. First, we have a list of specific knowledge and skills by AOC Division. These knowledge and skills are then scored to teams and positions within that division. To ensure the relevancy of each knowledge and skill score to positions, a rating is given indicating the level required for effective performance in a given position. So, for example, one could identify the specific knowledge and skills a C2 Planning Chief needs to be proficient in for his or her duty. From the data collected, the C2 Planning Chief only needs a basic level of aptitude in converting targets and threat situation to a plan of action (example of skill); but needs an advanced knowledge of how to develop a briefing and how to brief effectively. These knowledge and skills are part of the overarching MECs[SM] that apply to the Combat Plans Division. Most importantly, the knowledge and skills are detailed and specific enough to be classified as the measurable portion of the MEC[SM] construct. The knowledge and skills are the linking point between the MECs[SM] and scenario elements.

Smaller-scaled scenarios for continuation training can now be developed using this framework. A scenario must ensure it is focused on training the knowledge and skills outlined for a given position. To train the Strategy Plans Team, for example, one would not build a scenario testing their skill in relaying Time Sensitive

Targeting (TST) information. Since the Strategy Plans Team is looking beyond three days in war, this skill is obviously irrelevant. Similarly, a large-scale scenario going through the Joint Air Operations Planning (JAOP) Process will not benefit the TST cell of the Combat Operations Division for their duties. By breaking down the training elements required for each position, we can develop more focused scenario elements exercising relevant cognitive skills for all participating.

In one example, AOC MECs[SM] are being used by the AFRL Warfighter Training Research Division to assess the training effectiveness of scenarios that are being created for the primary mission trainer for AOC units worldwide. The Command and Control Warrior School Part Task Trainer (C2WSPTT) is a system of integrated computers and applications that enable multiple operators to train simultaneously on a particular operational scenario. These systems were fielded at all of the AOC units by ACC, and work is now beginning to develop the scenarios to populate the system databases. In layman's terms, the video game consoles are already fielded, but the actual games that operators will play are not.

As scenario development begins on this effort, the assessment of scenario training effectiveness starts with an analysis and decomposition of a scenario into its various critical decision points. Critical decision points, or events, are those times within a scenario when certain individuals are required to take certain actions based on the circumstance. For example, if there is an air support request from the Army, specific actions must be taken by certain operators in the AOC for the air support to occur. For those individuals to take the correct actions, they must have certain knowledge, skills and competencies. The knowledge and skills analysis for AOC positions mentioned earlier in this paper must be linked to critical decision points (This will occur as scenarios are developed.). Building the appropriate scenario for a particular position is then a matter of building scenarios that incorporate the events that target specific knowledge, skills and competencies. Variation, as well as quick syllabus development, is possible through a library of known scenarios that target specific competencies.

A Master Scenario Events List (MSEL) serves as a guide to show the tasks included on a scenario and expected actions to be performed in each event. Before this more systematic approach, Subject Matter Experts used a subjective approach to developing scenarios and deciding what events should be included. The Training Tasks Lists (TTLs) are used as a guide in the desigsn of the scenario development. These events put participants in situations where their decision-making skills are tested and performance can be evaluated by instructors or experts. Needless to say, going through the AOC processes and receiving feedback from expert observers is beneficial to participants' training. Nevertheless, the completeness of the training (did the scenarios used train all or most of the knowledge and skills required for each position?) and effectiveness in improving the participants' knowledge and skill level (did the scenarios target the relevant developmental experiences that improve his knowledge of AOC processes or aptitude in, for example, the execution of the JAOP Process?) are critical to training effectiveness. Accordingly, though current scenarios are useful to a point, a more comprehensive approach is recommended.

Again, the MEC[SM] constructs offer a taxonomy of what an individual needs to understand and be able to do in his or her job. By linking this taxonomy with actions to be exercised in a scenario, (1) training objectives will be comprehensive and (2) focused on every position instead of just the high-visibility ones. This is not to suggest that qualitative methods should not be used to develop and decide when to use scenarios. However, the MEC[SM] analysis has uncovered the training gaps that exist today in the AOC community. Refining current scenarios and creating new ones that target the position-level knowledge and skills will lead to the closing of those gaps.

Again, MECs[SM] are the vital pieces to this scenario development and assessment. It assures comprehensive AOC training at all levels. The MECs[SM] further enhance scenario design by enabling the creation of scenarios that provide the greatest training value to the greatest number of AOC operators, even large-scale exercises, or multi-team and team-level exercises. AOC MECs[SM] provide the means to know just how effective a training scenario is, and to what positions. The larger the number of trainees, the greater the challenge there is to provide meaningful training to all those involved. Cross-divisional analysis will thus support the concept of providing training for the full hierarchical structure of the AOC, from position-level to team-level to AOC-level training.

This is the approach AFRL, ACC, and P3I are using to develop training scenarios for use in the C2WSPTT. The initial scenarios are targeted at the Combat Operations Division. This initial step will enable AFRL to establish the networked relationships between the MECs[SM], SCs, K&Ss, experiences and TTLs which

we can expand to other divisions in the AOC. Additionally, AFRL/HEA is building a team-level AOC Testbed to continue the research and development of smaller-scaled scenario-based training.

This scenario-development process coupled with the performance measurement research conducted this year on the AOC will allow empirical studies to be accomplished for better understanding of the training effectiveness of scenarios. Future studies will include research on skill retention and decay to define recurring training requirements.

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