



Research Product 2019-04

**Mitigating Task Saturation for Patriot Engagement
Control Station Crews: Research Product
Development and Evaluation**

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**U.S. Army Research Institute
for the Behavioral and Social Sciences**

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MITIGATING TASK SATURATION FOR PATRIOT ENGAGEMENT CONTROL STATION CREWS: RESEARCH PRODUCT DEVELOPMENT AND EVALUATION

EXECUTIVE SUMMARY

Research Requirement:

The term *supervisory control* refers to human supervision of an automated system, when operators manage and intervene in system operations on a continuum between controlling every system function (i.e., not automated) and the system operating autonomously without human control (e.g., fully automated). This research product report addresses the development and evaluation of a crew-focused task saturation mitigation solution intended to enhance the supervisory control skills of Patriot¹ operators. Task saturation is a situation in which multiple competing task requirements negatively affect crew performance. By enhancing competencies related to crew resource management (CRM), the research product is intended to support crews in mitigating the negative effects of task saturation and thereby enhance effective supervisory control. The research product includes learning materials, exercises, and an assessment tool focused on competencies associated with supervisory control. While this research was focused on Patriot, the research product content, exercises, and assessments may be adapted for crews learning effective CRM to perform supervisory control of automated systems other than those associated with Patriot.

Procedure:

This research was preceded by a front-end analysis phase that identified key supervisory control challenges and associated skill requirements, CRM among them. A workshop leveraging the previous research findings and the input of a panel of ADA subject matter experts (SME) identified task saturation as a situation in which CRM skills are especially critical to crew performance. Based on the results of the workshop, a master design document was produced outlining the objectives and proposed content of the research product. Subsequent development of the product was enhanced by Engagement Control Station (ECS) crew observations and interviews as well as by SME reviews of prototype modules. In addition, the researchers developed a supervisory control (SC) skills assessment. The task saturation mitigation strategies and SC skills assessment were combined into one solution which was again reviewed by ADA SMEs and prepared for pilot evaluation.

A pilot of the research product was conducted, including a train-the-trainer workshop for NCO facilitators who were to deliver the content, exercises, and assessments. Four (4) *ad hoc* ECS crews were formed from MOS qualified pilot unit personnel designated to participate in the pilot evaluation. Pre- and post-pilot knowledge assessments as well post-pilot reaction surveys were administered. The pilot was conducted during one workday followed the next day by instructor and participant interviews. Although a one-day schedule was used to deliver the

¹ Patriot is the standard referent for the acronym of the Phased Array Tracking Radar to Intercept on Target air and missile defense system.

materials in this evaluation, they could also be delivered over multiple days to adapt to unit schedules.

Findings:

Quantitatively, knowledge test scores, on average, increased from pre- to post-pilot. In addition, participants perceived an increase in confidence in their own and their crew's ability to perform targeted skills. Supervisory control skill assessment ratings increased, on average from before, during, and after pilot for task saturation mitigation strategies. Qualitatively, participant reactions were more positive than that of the instructors. Overall training content received a positive reaction for contributions to learning. The Air Battle Board Game received high marks for engagement by participants but a less positive response by instructors who faulted its ability to replicate actual air battle conditions. The materials were commended for their quality and for having detailed facilitator notes which allowed instructors to utilize the research product with minimal preparation time.

Utilization and Dissemination of Findings:

The task saturation mitigation and CRM strategies as well as the associated supervisory control skills assessment may be provided to Air Defense Commissioned Officers, NCOs and Warrant Officers at appropriate points in their professional military education (PME). The materials may also be provided to students in the Patriot Master Gunner Course and to Patriot unit trainers to be used when developing new ECS crews. The research product content has potential for use, subject to adaptation, with other crew/team configurations requiring task saturation mitigation, CRM, and supervisory control competency development. This research and the research product were briefed to the U.S. Army Air Defense Artillery School (USAADAS), and research product materials were transitioned to USAADAS in August 2018.

MITIGATING TASK SATURATION FOR PATRIOT ENGAGEMENT CONTROL STATION CREWS: RESEARCH PRODUCT DEVELOPMENT AND EVALUATION

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Mitigating Task Saturation for Patriot Engagement Control Station Crews: Research Product Development and Evaluation

Introduction

The research product presented in this report is intended to support Soldier performance of supervisory control for contemporary Air and Missile Defense operations. This report documents the development and validation of a research product focused on developing Patriot² Engagement Control Station (ECS) crews task saturation mitigation skills. *Task saturation* arises when multiple issues and/or process requirements occur simultaneously, diminishing the performance of a group of individuals executing a task. While the product is designed to focus on Patriot air defense crews, aspects of the materials, exercises, and assessments presented may be applied to the Army Integrated Air and Missile Defense (AIAMD) training program, or other Air Defense Artillery (ADA) systems where operators perform supervisory control. *Supervisory control* refers to human supervision of an automated system. Supervisory control occurs when operators manage and intervene in system operations, in situations falling between an operator controlling every system function (e.g., no automation) and the system operating completely autonomously (e.g., full automation).

The research product is the culmination of a two-year research project conducted in three phases: (a) front-end analysis, (b) design and development, and (c) evaluation. The research focused on the competencies required by operators of complex highly-automated air defense systems, such as Patriot, particularly identifying opportunities to improve operator competencies related to supervisory control. The resulting research product consists of learning materials, exercises, and a supervisory control skills assessment to support air battle management training, assessment, and feedback. The assessment provides key supervisory control skills and a sample of behaviors associated with each skill and is compiled for use in assessing effective supervisory control skills specific to Patriot crews.

The goals identified during development of the research product included improving crew team performance by providing strategies and techniques that would help crews manage task saturation and effectively adapt to complex evolving air battle situations. In order to do this, the content and exercises focused on helping crews develop a shared mental model and strategies for effective task distribution; the assessment tool supports rapid skill assessment for supervisory control skills. The Supervisory Control Skills Assessment was designed to evaluate Air Battle Management (ABM) performance relative to supervisory control skills.

The target audience envisioned for this training are crewmembers of the Patriot ECS. The ECS is comprised of a three-person crew that includes a Tactical Control Officer (TCO), a Tactical Control Assistant (TCA), and a Network Switch Operator (i.e., the communications operator, commonly referred to as the ‘commo guy/gal’ by Soldiers). It is a primary component for supervisory control within Patriot. The materials, exercises, and assessment tools were targeted specifically for crews who have completed Gunnery Table IV and are Air Battle Management Level (ABML) V certified. This level of certification is achieved when the three

² Patriot is the standard referent for the acronym of the Phased Array Tracking Radar to Intercept on Target air and missile defense system.

crew members have individually completed initial technical training on the ECS system. Crew certification typically occurs at the unit prior to deployment. It is also at this ABML juncture that the crew is transitioning from being certified on the basis of individual technical system competence to collective crew competence.

Background of Supervisory Control in Air and Missile Defense Systems

In the context of this project, supervisory control was defined as an operator's performance capacity to: (a) understand the relationships between mission requirements, system parameters, and operators' roles and responsibilities; (b) initialize or modify system settings to reflect mission requirements; (c) monitor and correctly interpret system and operational data and cues; (d) respond appropriately to these data and cues; and (e) adapt system inputs and operations to changing conditions. (See Drzymala, Buehner, Graves, Cobb, McMahon, & Aude, in preparation, for a discussion of how this definition was derived.) The same research identified six complex key skills that represent operational requirements associated with supervisory control in the subject ADA systems. These skills are system operation, vigilance, interpretation, decision-making, situational awareness (SA), and crew resource management (CRM) (see Drzymala et al., in preparation). Work conducted in the research phase of this project defined each complex skill and identified associated performance requirements (Drzymala et al., in preparation).

System operation has both psychomotor and cognitive requirements for (a) the operation and modification of the system interface to maintain positive supervisory control of the system during air battles, and (b) the integration of complex knowledge to understand how the mission, system, crew processes, and specific operational environments affect supervisory control. Psychomotor aspects include using system controls to modify system settings in response to mission or situation changes, such as a new track appearing on scope. Cognitive aspects include understanding how the system functions within both the mission and tactical context and integrating complex knowledge about the system and the mission to predict how system changes affect real-time performance. System operation is also dependent on the development, use, and modification of an accurate mental model of the system, the kill chain, and crew performance requirements during air battle management.

Vigilance has been described as an ability to maintain attentional control over a length of time, monitoring and detecting changes in the environment, and responding to the detected changes (Shaw et al., 2010; Nelson, McKinley, Golob, Warm, & Parasuraman, 2012; and Warm, Parasuraman, & Matthews, 2008). Although vigilance is a critical skill for effective supervisory control during ABM, it is difficult to train and assess operational vigilance in typical training environments. This is due to the time compressed nature of training and evaluation—in training, it is typically not necessary to maintain vigilance during protracted lulls in activity and therefore not difficult to maintain attentional control.

Interpretation is a process of threat classification, which relies on individual and team abilities to observe, comprehend, evaluate, and communicate data. Interpretation is dependent on applying system and mission knowledge to specific situations determined through SA and communicating with crew members and other actors in the command and control (C2) chain to

reach conclusions. It is an active cognitive process that checks and double-checks system data, conclusions, and recommendations.

Decision-making is a comprehensive skill most critically related to firing decisions as well as other necessary decisions throughout ABM, such as track identification. A unique aspect of Patriot supervisory control decision-making is that it is typically a multilevel process across command echelons with actors inside and outside of the ECS. In other words, ECS decision-making is dependent on communication, timeliness, and crew coordination. Individual factors that can affect decision-making include capacity for information processing, long-term memory, automaticity, working memory, bias, stress, an accurate mental model, confidence, experience, and training (Dryzmala et al., in preparation). Crew factors include rules governing roles and permissions, group dynamics such as quality of communication and leadership, and the total amount of cognitive resources available to the group.

Situational awareness is “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future” (Endsley, 1995, p. 36). For ECS operators, SA is the sum of the system, individual, crew, and external team information, as well as the processes used to apply that information. Operators use system information to monitor tracks, equipment, and resources. Externally-sourced SA includes information, updates, and changes received from higher echelon units. Information, statuses, and updates are shared among the crew and the battery. Crews prioritize what SA to share among required components. Higher echelons prioritize operations based on incoming SA; all actors use SA to anticipate what may happen next in engagements.

CRM is the sixth complex skill required for effective supervisory control. It was selected as the focus for training development for this project. A simple definition for CRM is the “effective utilization of all available resources...to achieve safe, efficient...operations” (Driskell & Adams, 1992, p. 8). CRM crew level processes, including task prioritization, team workload management, situational awareness, and problem identification, are required for performance during Patriot supervisory control.

Several factors may influence Patriot CRM. Team structure (Naylor & Dickinson, 1969), team communication (Macmillan, Entin, & Serfaty, 2004; McKendrick et al., 2014b), mutual performance monitoring (Salas, Sims, & Burke, 2005), task coordination (Hawley & Mares, 2007), and backup behavior (Gao et al., 2014) all contribute to and enable mission performance. For example, team structure establishes procedures and expectations for task distribution and redistribution as the mission situation changes; communication procedures are critical in the multilevel C2 environment; and to complete multiple simultaneous task requirements under time constraints, crewmembers must prioritize tasks, engage in mutual performance monitoring to guard against task overload, and perform backup behavior when necessary. An operator’s understanding of their own role within the tactical environment is also an important part of CRM, and it contributes to individual performance as well as crew performance.

Mental models provide a structure for organizing and understanding all of this information. A Patriot operator’s mental model represents how the mission, system configuration and performance, and crew structure and responsibilities are integrated and interdependent

(Drzymala et al., in preparation). Past research suggests that accurate mental models are a characteristic of Patriot expertise (Buehner et al., 2015).

Why Crew Resource Management?

A focus on formally developing CRM processes for Patriot crewmembers may reap performance benefits. This is based on findings from the research phase of this project, which suggested that effective CRM could limit the effect of other supervisory control issues (Drzymala et al., in preparation). Specifically, the impact of attentional tunneling can be lessened or even avoided when crews engage in mutual performance monitoring, as they can identify problems before performance is affected. Crew backup behavior may allow the affected crew member time to resolve issues and recover. Project research data has also suggested that focusing on CRM early in crew training would allow exercises and scenario-based training events to prioritize development of other crewmember tasks and skills (Drzymala et al., in preparation).

Patriot crews typically develop crew performance strategies through trial and error rather than training to standard procedures, and crew process development is dependent on this experience (Buehner et al., 2015). Drawbacks to these strategies have been identified (Drzymala et al., in preparation). First, less experienced crew members may fail to accumulate experience over time because another more experienced crewmember may habitually assume some of their work. Second, if experienced operators habitually take over tasks from less experienced crewmembers, they may become task saturated more often, and as a result, errors may become more frequent. Third, weaker crewmembers may become over reliant on the backup behavior provided by these stronger or more assertive crewmembers. Crewmembers may be enabled to pass certifications and evaluations and never accumulate the level of knowledge to achieve greater levels of expertise in performance. The backup, training, and knowledge base of more experienced Patriot Soldiers is the backbone of units. In situations in which experienced Soldiers leave units, and crews are increasingly comprised of all inexperienced Soldiers, this could become a significant concern.

Establishing effective CRM processes may be particularly important for AIAMD. This is because crewmembers of the AIAMD Fire Control Element may not perform within set crews and may certify as individuals rather than as a crew (Buehner et al., 2015). This situation would necessitate an ability for Soldiers to rapidly form into effective *ad hoc* crews. General concepts presented in the proposed training will likely be applicable to AIAMD; the factors that influence crew/team performance are common across systems, and the strategies for delineating roles and responsibilities and mitigating task saturation will likely be applicable regardless of the system (Drzymala et al., in preparation).

Why Metrics for Supervisory Control Skills?

Findings from the research phase of this project suggested that using standardized metrics to evaluate supervisory control skills could benefit unit training programs. The supervisory control skillset (described above) is predominantly cognitive, and the assessment of cognitive processes through behavioral observation is difficult. Current outcome-based evaluation strategies, such as indicated by Standardized Patriot Evaluation and Assessment Reporting

(SPEAR)³ procedures and documentation, are based on observable performance milestones. Behavior-based evaluation metrics provide more granularity in evaluation. They indicate needed improvement points by breaking down milestones into clearly differentiated behaviors tied to specific cognitive requirements. The assessment tool developed for this research product identifies intermediate performance behaviors that theoretically reflect underlying cognitive behaviors. It consequently should enable greater insight into specific developmental challenges during the assessment and feedback process.

Supervisory control metrics developed for Patriot assessment or evaluation would likely apply to AIAMD as well. However, the procedure used to evaluate the metrics, the points of measurement and (who is) the focus of the measurement will differ between AIAMD and Patriot. This is because crew roles, responsibilities, system operation, and other performance processes will differ (Drzymala et al., in preparation).

Research Product Development and Evaluation Process

The project team employed a collaborative approach to design and development. Army stakeholder and SME review and collaboration during process milestones played a central role in concept selection. Information provided by Army stakeholders and SMEs provided critical information for development.

The Concept

The team used the results of the front-end analysis findings to identify and propose interventions. The following principles guided development:

- The research product should be adaptable to emerging systems, like AIAMD.
- The research product should address an issue important to supervisory control.
- The research product should be easy to use and implement.

Front-end analysis findings and potential solutions to identified competency development challenges were briefed to USAADAS leadership on 28 July 2017. The team recommended three options for development: (a) a crew-focused product targeting rapid and effective team development, to include the creation of a common team mental model for effective supervisory control skills implementation; (b) an individual-focused product targeting the mitigation of automation bias; and (c) evaluation metrics to assess supervisory control related skills. USAADAS leadership directed development of options (a) and (c), with the expectation that the training could apply to or be adapted to AIAMD.

Research Product Design

Design workshop. A design workshop was held on 7 September 2017 at Ft. Sill, Oklahoma to further define the crew-focused research product to be developed. In preparation for the design workshop, the design team reviewed relevant literature and drafted strawman materials. They discussed the materials with workshop participants.

³ SPEAR is a 32nd Army Air and Missile Defense Command (AAMDC) unique evaluation event.

Workshop participants included seven Chief Warrant Officers (grades CW3 and CW4) who performed as course managers for Patriot courses and served as subject matter experts (SMEs). The SMEs identified task saturation as the situation that would best engage crews in learning the identified concepts and related skills.

Design document. Based on the results of the design workshop, the development team conducted additional research and reviewed the literature for topics specifically related to task saturation and team adaptability. They developed a design document, which served as the roadmap for the development of the research product.

The design document included the:

- Overall goal,
- Target audience,
- Presentation approach and flow of concepts/activities/exercises,
- Learning objectives,
- Recommended frequency,
- Detailed module outlines that showed the alignment of learning objectives to the content outline, estimated duration for each segment, presentation strategies, and resources used,
- Evaluation plan, and
- Description of the materials to be developed.

The development team submitted the Draft Design Document for SME review on 12 October 2017, and held a conference call on 3 November 2017 to review SME feedback on the Draft Design Document. Revisions were incorporated into the document and the Final Design Document was submitted on 6 November 2017.

Structure and Content of the Research Product

The research product conceptual content and exercises were designed to take five hours and 35 minutes to deliver, which can be accomplished in a single session or spread out over multiple days. The research product package includes:

- Facilitator Guide,
- Participant Guide,
- Microsoft PowerPoint (PPT) slides (electronic file), and
- ABM Game Board.

The Facilitator Guide includes all the information needed to present each module and lead practical exercises. Handouts are included in the Facilitator Guide for the Newspaper Challenge Activity as well as assessments and course evaluation forms. Crewmembers will use the Participant Guide to complete other pencil and paper activities. The ABM Game is used in Module 3 to allow crewmembers to practice the strategies (e.g., prioritization, communication) they learned about.

Objectives and Module Overview

There are three overarching objectives for the Task Saturation Mitigation research product. These objectives describe what the crewmembers should be able to do after completing the materials and exercises presented in the research product.

1. Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
2. Develop a Personal Crew Plan for mitigating task saturation.
3. Improve crew performance in mitigating task saturation through practice and team learning.

The research product is comprised of five modules, which are summarized in Table 1.

Table 1
Modules, Descriptions, and Estimated Duration

Module Title	Description	Estimated Duration
Module 0 Introduction	The purpose of this module is to conduct facilitator and participant introductions and briefly provide an overview of the key concepts, including the goals, objectives, and structure. Participants will have an opportunity to share their expectations. Participants will also complete a baseline knowledge and ABM performance assessment.	45 minutes
Module 1 Assessing the Situation	In this module, crews will gain an understanding of their current crew situation. Specifically, crews will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Crews will also establish a shared understanding of ECS crew team roles and responsibilities and identify current crew strengths and weaknesses.	90 minutes
Module 2 Plan Formulation	In this module, crews will learn strategies for improving crew team performance to help mitigate task saturation. As they go through this module, crews will develop a Personal Crew Plan that identifies rules and norms for how their crew will react and respond to situations in an effort to mitigate or reduce task saturation.	90 minutes
Module 3 Practice	In this module, crews will first learn about the importance of team learning and providing psychological safety. ⁴ Crews will then practice the strategies using the Personal Crew Plan they developed in Module 2.	65 minutes
Module 4 Wrap-Up	The purpose of this module is to briefly review the content that was covered and review goals and objectives. The facilitator will revisit the list of participant expectations generated at the beginning to ensure that all expectations were met and address any remaining questions. Participants will also complete an evaluation as well as a final knowledge and ABM performance assessment.	45 minutes

⁴ The psychological safety concept describes a team's openness to allowing interpersonal risk-taking, often manifesting in acceptance and respect among team members, allowing each team member to perform their roles without resistance and/or negative consequences from other members of the team (Edmondson, 1999).

Practical Exercises

Practical exercises were embedded within the various modules. The following describes each of the practical exercises completed by participating crews.

Newspaper challenge activity. The newspaper challenge is an eight-minute activity, plus introduction and discussion time. This activity is designed to help crews better understand what task saturation is in a general context.

Recognizing your crew's tells. This fifteen-minute exercise is designed to have crewmembers identify signs that task saturation is occurring within their own crew. Some tells may occur in many crews, while other tells may be unique to their own. Crewmembers are asked to first identify their own tells, then discuss with their crewmembers each others' tells.

Case study. During this ten-minute activity, crewmembers individually review the case study and answer a series of questions about what went well and what did not go well, how the workload was distributed, and how tasks could have been distributed differently to allow the crew to work more efficiently to avoid task saturation.

Identifying crew strengths and weaknesses activity. The purpose of this twenty-minute activity is to have crews identify their strengths and weaknesses so that crewmembers can determine how best to support one another, build up weak skillsets through additional training/cross-training, and appropriately distribute tasks.

Personal crew plan activity. The personal crew plan is an exercise designed to foster communication and planning among crewmembers. The crew is asked to anticipate air battle scenarios they may encounter, then discuss how they might solve arising problems. Specifically, they are asked how they might monitor each others' performance and provide back-up behavior, prioritize and redistribute tasks, communicate, and manage conflicts. After discussing their plan, crews are advised to use their plans to guide their behaviors during the ABM performance exercise and/or game.

Conflict management activity. The purpose of this twenty-minute activity is to have crews further build out their Personal Crew Plan to include protocols for handling team conflict. Crews review three situations and discuss how they would handle them. They are then asked to generalize their responses into team rules/norms and add them to their Personal Crew Plan.

ABM game. The ABM Game is designed to allow crews to practice the strategies they learned for improving crew team performance and thereby mitigate task saturation. It engages crewmembers to verbally describe how they would respond to air battle management conditions drawn randomly from a deck of cards. Each card specifies a condition (e.g., loss of communications) or an event (e.g., ICC directs a reorientation of your radar to 35 degrees for TBM threat) common to ECS air battle situations. Trainees draw the number of cards specified by a roll of the die, and the crew must complete each task or address each condition within a time limit. Hypothetical ABM scenarios presented in Graves, Blankenbeckler, and Stallings (2017) contributed to game development.

Assessment Tools

A variety of assessment tools were developed to support delivery of key concepts and information, as well as to provide feedback to participating crews. The following describes these assessment tools.

Knowledge assessment. A ten-question multiple-choice knowledge assessment is provided in the Facilitator Guide. The knowledge assessment queries key knowledge that should be acquired from the materials and exercises presented. Two versions of the knowledge assessment are provided, if the facilitator chooses to use a before and after assessment. Answer keys for each knowledge assessment are provided in the Facilitator Guide.

Performance assessment. The purpose of the ABM performance assessment is to assess each individual crew's strengths and weaknesses with air battle management. The Supervisory Control Skills Assessment is designed around 35 items, each item describing a behavior that corresponded to one of five supervisory control skills: (a) Operation of the Automated System, (b) Situational Awareness, (c) Interpretation, (d) Crew Resource Management, and (e) Decision Making (see Drzymala et al., in preparation, for more discussion of the supervisory control skills). The matrix uses a four-point scale to indicate whether a crew's specific behavior was never effective (0), sometimes effective (1), frequently effective (2), or always effective (3). There is also space for the evaluator or trainer to indicate the conditions when the behavior, or lack of behavior, was note-worthy.

Evaluation form. The evaluation form is designed to give crewmembers the opportunity to provide feedback regarding their observations of the research product's strengths and weaknesses. The form has twenty questions with Likert scale response options (varying degrees of agree and disagree) and three open-ended questions for written comments.

Preparation to Use the Research Product

The research product delivers information, exercises, and assessments using multiple methods, tools, and resources. The following materials and resources should be prepared and available for use.

- ✓ Facilitator Guide – at least one copy for use by all the facilitators;
- ✓ Participant Guide – one for each crewmember;
- ✓ Presentation slides – provided in Microsoft PPT format;
- ✓ Projection capability – computer connected to a monitor or to a projector and screen, to project presentation slides and an instructional video;
- ✓ Desktop or laptop computer – connected for projection capability or not connected, to display an instructional video and presentation slides;
- ✓ Patriot equipment – An operational ECS or an RT3. The pre- and post-training ABM performance assessments should be conducted as an air battle exercise.
- ✓ The ABM Game – Used for the Module 3 exercise to allow crews to practice the strategies they learned in Module 2; game components include:
 - o ABM Game instructions,
 - o Die (1),

- o Timer (1),
- o Game board (radar screen),
- o Erasable marker to track missile launcher and communications status on game board,
- o Chips to mark active tracks on radar,
- o Deck of task cards, and
- o Abbreviated version of Supervisory Control Skills Assessment form.
- ✓ Knowledge assessments – before and after, printed for each crewmember;
- ✓ Supervisory Control Skills Assessments – two printed assessments for each crew being trained;
- ✓ Evaluation Form – one printed form for each crewmember;
- ✓ Newspaper Challenge Activity (1 per crew).
- ✓ Miscellaneous items for the Newspaper Challenge Activity in Module 1:
 - o Scissors (two pair for each crew),
 - o Scotch tape (one roll for each crew),
 - o Pens/pencils (at least two for each crew), and
 - o Blank 8 ½ x 11 sheets of paper (one sheet for each crew).

Supervisory Control Skills Assessment Development

The development of the supervisory control skills assessment was initially conducted separate from that of content design and development of the research product. Early in the development process, it was not yet clear if the assessment would be a stand-alone product or be integrated with the other materials and exercises. Consequently, the assessment was initially conceptualized as an evaluation tool to compliment or supplement SPEAR and other unit level crew evaluations.

Design. Behavioral content for the assessment was derived from the front-end analysis activities (Drzymala et al., in preparation). That report describes in detail behaviors the research team either observed or collected from knowledgeable air defense personnel (e.g., crew members, trainers, evaluators) and related to skills as well as identified challenges related to supervisory control skill acquisition. The research team and its supporting ADA SMEs went through multiple iterations of writing, reviewing, editing, and prioritizing the behaviors and their associated issue or skill. An initial list of 16 supervisory control skills and challenges was reduced thematically to five skills and their associated behavioral statements: (a) operation of the automated system, (b) situational awareness, (c) interpretation, (d) crew resource management, and (e) decision-making.

Various scales were considered during design. Initially a bipolar scale was considered, but a scale of all positive behaviors was thought to be more reinforcing of what ‘to do’ rather than what ‘not to do’ for effective supervisory control. Consequently, the scale was designed as a frequency rating of positively worded (as in contributing to performance) statements. The statements were paired with a four-point rating scale: ‘never effective,’ ‘sometimes effective,’ ‘frequently effective,’ and ‘always effective.’ The term ‘effective’ was used to elicit evaluators’ judgement of the outcome of the behavior exhibited, rather than just an evaluation of the degree to which a behavior is manifested.

Subsequent Integrated Concept. The prototype assessment and its associated scaled response were distributed to the design team in the midst of their design and development process. A number of the behaviors, not surprisingly, aligned directly with the materials and objectives being developed. The assessment also provided a means for the facilitator and audience crews to be assessed and provided with feedback as part of the overall learning experience. Still early in its development, the appropriate use of the assessment seemed to be more developmental rather than evaluative. Thus, the Supervisory Control Skills Assessment (as it evolved to be named) was fully integrated into the design and development process with the Facilitator and Participant Guides.

Development of Content and Exercises

Prototype development. The team developed a template for the Facilitator Guide, Participant Guide, and PowerPoint to ensure consistency across the design team. A prototype of a portion of the Administration module along with Module 1: Assessing the Situation was also developed. The prototype's purpose was to gain approval of the design (look and feel) of the materials and the way in which the content was treated prior to full-scale development. In a meeting held at Ft. Sill, team developers walked project stakeholders through the prototype documents, collected feedback, and subsequently incorporated the feedback into the development of the draft research product.

Draft training materials development. The team worked collaboratively with SMEs to develop the draft research product. In addition, members of the design team traveled to Ft. Sill to observe a Mission Readiness Exercise and interview ECS crews. These observations and interviews provided examples used throughout the training. The Draft Facilitator Guide was submitted for ADA SME review. The design team incorporated the feedback to create pilot ready versions of the Facilitator Guide and Participant Guide.

The team also undertook development of an additional component to be used for the pre-pilot performance assessment, Module 3 practical exercise, and post-pilot performance assessment. This component was an interactive air battle management based board game. The board game does not require a Reconfigurable Table Top Trainer (RT3)⁵ or operational ECS van equipment. It was initially developed due to the lack of available RT3s or ECS vans for the research product pilot itself. Yet RT3/ECS van equipment availability is also a legitimate challenge at any time and could, if required, become an obstacle to the unit's use of the research product. Some research indicates that game-based training, while not a direct substitute for hands-on training, can still be an effective learning tool (Boeker, Andel, Vach, & Frankenschmidt, 2013; Gabbett, Jenkins, & Abernethy, 2009). Thus, the board game served multiple purposes for both the pilot and eventual implementation of the product by units. Given that the need for an RT3/ECS van substitute was identified shortly before the pilot itself, time during the pre-pilot facilitator training workshop was allocated to having the facilitators play the board game and provide feedback and recommendations.

⁵ The RT3 is a computer-based trainer used to simulate the Patriot AMD system.

Research product materials were emailed prior to the pilot to participants who would later serve as facilitators. A walkthrough was conducted via conference call to familiarize facilitators with the content and pre-identify any issues.

Pilot Evaluation of the Research Product

The research product was pilot tested and evaluated concurrently with the Air and Missile Defense Test Detachment (AMDTD) personnel assigned to the White Sands Missile Range, New Mexico. AMDTD personnel involved in the pilot possessed Patriot appropriate MOS designations. Given their test mission and unit organization, pilot participants were not currently performing ECS crewmember tasks nor were they formed into ECS crews. One of the unit's senior Warrant Officers designated personnel for the four (4) pilot ECS crews and also assigned each participant to one of three positions (TCO, TCA, or Communications). From the demographic composition of the crews, it appeared that crew and position assignment was made to evenly distribute Soldiers with previous ECS experience across the crews. From this point forward, the term *composite crew* is used to describe this largely *ad hoc* formation of ECS crews from AMDTD unit personnel. While not ideal, active duty Patriot units were not available to support the pilot. One positive of using composite crews, however, is that they would all still have a great deal to learn about how to perform effectively together.

The pilot test and evaluation involved a four-day event using dedicated classroom and interview spaces. The research team spent the first day familiarizing facilitators with the materials prior to the pilot. Based on initial feedback, the design team refined the board game onsite. During the second day, facilitators practiced delivering their assigned modules. The design team concluded facilitator preparation portion of the pilot with a debrief. The formal pilot with composite crew participants was then conducted on the third day. This was followed by a debrief of the facilitators and composite crew participants using group interviews on the fourth day. Facilitators and each composite crew provided additional feedback. The design team made revisions to materials based on feedback received.

Research Product Evaluation Process and Findings

The evaluation of the research product was completed using a combination of knowledge assessments, performance assessments, surveys, and focus group interviews. Based on the Kirkpatrick model of evaluation (Kirkpatrick, 1959), the research team conducted Level 1 (Reaction) and Level 2 (Learning) assessments to evaluate the usefulness of the product.

Participants. All participating personnel were active duty U.S. Army Soldiers assigned at the time to the AMDTD. None of the personnel were, at the time, assigned to Patriot duty, but all had previous Patriot experience. Five non-commissioned officers, ranging in rank grade from Staff Sergeant (E-6) to Sergeant First Class (E-7) (hereafter referred to as Facilitators) delivered the training and performed assessments associated with the research product. Facilitators had five (5) to nineteen (19) years of Patriot experience, and a mean of 11.3 years. Those same personnel reported two (2) to thirteen (13) years of ECS experience, and a mean of four (4) years. A Chief Warrant Officer 3 (CW3) was also present and had the role of oversight responsibility for the unit's support of the pilot. He also observed the pilot test and provided informal feedback to the design team.

Twelve (12) Soldiers (non-commissioned officers and enlisted) participated as four (4) composite crews of three (3) Soldiers each (hereafter referred to as participants). Nine (9) participants reported having more than one (1) year of Patriot experience, two (2) participants reported having three (3) to six (6) months of Patriot experience, and the remaining participant reported more than six (6) months but less than one (1) year of experience. Although all participants had prior Patriot experience, five (5) of the participants had no prior experience as an ECS crewmember. Two (2) of the remaining seven (7) participants had more than six (6) months but less than one (1) year of experience, and five (5) participants had more than two (2) years of ECS experience. Patriot experience was distributed across the groups, which should have reduced the potential impact of experience on the variability of group performance. Each group had at least one (1) crewmember with ECS deployment experience. Each group also had at least one (1) crewmember with no prior ECS experience.

Method. Table 2 summarizes the pilot’s validation activities and schedule. All interviews followed a semi-structured format, allowing follow-up with open-ended questions.

Table 2
Training Pilot and Evaluation Activities

Day	Activity	Description
Day 1	Facilitator Training	The Soldiers participating as facilitators were introduced to the materials, including the practical exercises and assessment requirements.
Day 2	Facilitator Training (continued)	The facilitators rehearsed delivery of materials and practical exercises.
	Facilitator Training Follow-up Interview	The facilitators were interviewed collectively for their feedback regarding research product design.
Day 3	Delivery	The materials and exercises were delivered to the participants, including knowledge and performance pre- and post-pilot assessments.
	Reaction Survey	The participants completed a post-pilot reaction survey.
Day 4	Facilitator Post-Pilot Interview	The facilitators were interviewed collectively for their feedback regarding implementation of the materials and exercises.
	Participant Post-Pilot Interviews	The participants were interviewed for their opinions about the research product design, content, and utility.

We conducted two facilitator focus group interviews with the Soldiers in a single group each time. We divided the twelve composite crew participants into four three-Soldier teams representing ECS crews. The composite crew interviews were conducted on a per crew basis, with the interview groups composed of the ECS crew teams. All trainees also completed a post-pilot reaction questionnaire individually. The questionnaire was comprised of 31 questions with rating scale responses and three open-ended comment questions. Interview and questionnaire responses were compiled and analyzed to assess course value and determine potential course

modifications. The interview protocols and reaction questionnaire are provided in Appendix A and detailed results, in Appendix B.

We used the pre- and post-pilot knowledge assessments, a Supervisory Control Skills Assessment, and a board game as evaluation assessment tools. These tools are included in the research product package and are intended to be used during standard implementation. The pre- and post-pilot knowledge assessment was administered to the participants by the facilitators. The facilitators used the matrix to assess crew team performance during exercises that required crews to play the board game. Composite crew participants played the board game three times: at the start of the pilot, during the pilot as a practical exercise, and at the conclusion of the pilot. The facilitators used the Supervisory Control Skills Assessment to evaluate composite crews' gameplay each time.

We compiled knowledge assessment and Supervisory Control Skills Assessment scores and used them to determine the potential impact of the research product content and exercises. The knowledge assessment and Supervisory Control Skills Assessment are both described in the Research Product Structure and Content section of this report. Both instruments are provided in the Facilitator Guide (see Appendix C).

Results. Evaluation results indicated overall favorable impressions of the research product's design, content, and exercises, particularly among the less experienced trainees who, based on their responses, valued being provided with resources which they could use to make contributions to their crew performance. Facilitators liked the Facilitator Guide's ease of use and reported that the content was well-written. Facilitators' opinions were more reserved about the potential implementation of the research product than about the content itself, with their responses focused on concerns about targeting the appropriate audience and finding available time to work through the content and exercises with new crews. Composite crew participants felt that the value of the information provided was dependent on experience; Soldiers with more ECS experience generally found the information less valuable than did less experienced Soldiers. The pilot test of the course took the expected amount of time, and the composite crew participants rated the course pace to be 'just right.'

Knowledge assessment findings. Knowledge assessment mean comparisons suggested that the training was effective in that learning occurred (see Table 3). The mean differences between the group's pre- and post-pilot knowledge assessment scores were significant based on a dependent-sample *Student's t-test*. While test-retest bias may have accounted for some of that change, comparing means of trainees with no ECS experience to those with ECS experience also suggested that learning occurred. Although these subgroups were too small for in-depth statistical analysis, mean scores of trainees with no ECS experience improved more than the scores of trainees with prior ECS experience ($\Delta = 1.6$ points for the no-experience group compared to $\Delta = 1.0$ for the experienced group), and the no experience post-pilot standard deviation (*SD*) decreased. Also, the pre-pilot low scorers among the no-experience group improved the most on the post-pilot knowledge test. This suggested that the improvement was not due solely to test-retest effects.

Table 3
Knowledge Assessment Means

	All Trainees		Trainees with NO ECS Experience		Trainees with ECS Experience	
	Mean	SD	Mean	SD	Mean	SD
Pre-Pilot	6.92	1.78	6.20	2.17	7.43	1.40
Post-Pilot	8.17	1.27	7.80	0.84	8.43	1.51
Difference (Δ)	1.25*					

* $p=0.028$ using dependent-sample *Student's t-test*. The p -value describes the probability that the observed mean difference between scores is due to chance.

Supervisory control skills assessment and board game findings. Facilitators used the Supervisory Control Skills Assessment to assess composite crew performance during the board game practical exercises. Composite crews played the board game three times during the pilot session: at the start (Time 1), in the middle of the session as a practical exercise (Time 2), and at the end of the session (Time 3). The mid-session practical exercise differed from those at the start and the end in that facilitator-evaluators were encouraged to add verbal injects in the form of technical questions during gameplay.

Figure 1 presents a graph of the mean scores on the Supervisory Control Skills Assessment for each composite crew⁶ and combined groups for the starting, ending, and mid-session practical exercises. The data table of all the scores is provided in Appendix B.

⁶ Each composite crew was assigned a color to provide non-identifying separation of collected data. The colors used in this report correspond to the colors assigned to composite crews.

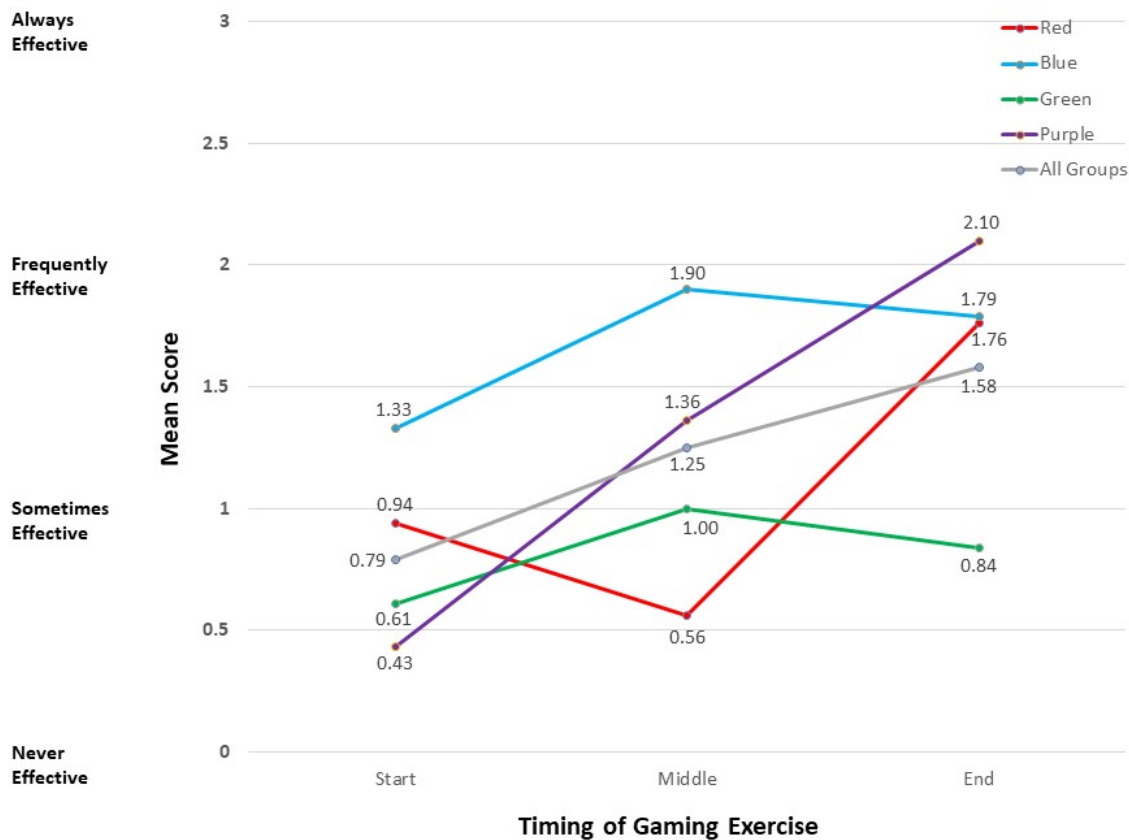


Figure 1. General trends in composite crews’ Supervisory Control Skills Assessment scores.

Figure 1 shows the general trends indicated by each composite crew’s score and the combined means for all four groups (gray line).⁷ We were unable to confidently draw meaningful conclusions associating score changes to performance changes because (a) it was likely that practice effects of learning the game had a positive impact on achieving better scores, and (b) there were indications that the evaluators did not use the tool in a consistent manner. Some facilitators indicated some measures as ‘not applicable’. The measures identified as not applicable are shown in the gray boxes in Appendix B Table 8.

The game was also scored using cleared cards. During gameplay, crews cleared drawn cards by responding to the cards’ directions or requirements. Crews scored one point if they responded correctly to a card. A point was deducted if a crew responded incorrectly. Scores, then, could be represented as positive or negative numbers. Table 4 presents crew game scores.

⁷ Recall that the implementation condition for the practical exercise (i.e., the game) was different so the course exercise scores cannot be compared directly to the pre- and post-training scores.

Table 4
Crew Game Scores by Time and Group

Groups	Timing of Gaming Exercise		
	Starting Score	Middle Score	Ending Score
Red	-20	-2	4
Blue	27	51	33
Green	-10	-5	-5
Purple	11	40	49
All	2.00	21.00	20.25

Table 3 shows notable disparity in scores between groups. The relative similarities in experience across groups should not have yielded such disparate scores; we identified two possible causes. First, facilitator-evaluators possibly implemented the game differently due to insufficient time during the facilitator training session to establish and practice standard procedures. Second, game practice effects may have impacted the results. The exercise condition should have yielded lower scores, but it did not. Under this condition, facilitator-evaluators were asked to introduce injects during game play for purposes of adding stress and delaying game responses. That the condition did not yield lower scores suggested that a significant part of the score increase was due to game practice effects.

During the post-pilot focus group interviews, we asked facilitators to discuss how useful they believed the Supervisory Control Skills Assessment may be in helping them assess crew performance. The majority of their responses were negative in nature; however, only three (3) of the fourteen (14) responses, were actually specific to the matrix and its potential use. One positive response indicated the assessment may be useful if it facilitates open communication. Facilitators recommended that frequency metrics be eliminated from the assessment. They also suggested the assessment matrix be used as a training aid, possibly in the Warrant Office Basic Course, Basic Officer Leadership Course, or Advanced Leadership Course. Other responses indicated resistance to new evaluation tools, new types of evaluation, specificity in measurement, and standardization among instructors.

Facilitators questioned how results could be interpreted using the assessment. They were concerned that the results left “too much gray area without the evaluator’s specific notes” and would not be useful in briefing a commander. One respondent stated he did not like numbers because he did not understand what the numbers indicated, particularly within their current frame of reference for evaluation. “What do the numbers equate to? Is it a go or no-go?”

Two responses described the assessment matrix as undesirable because of its behavioral based metrics. Facilitators called the metrics “irrelevant” and inappropriate. They viewed them as irrelevant because they are behavioral-based rather than outcome-based. They viewed them as

inappropriate for operational units because Patriot is currently evaluated on specific performance levels.⁸ Their responses indicated a reluctance to tie a metric to a behavior rather than to the overall outcome. This feedback indicated that the current paradigm may present significant obstacles to the potential implementation of evaluation methods outside of outcome-based evaluation for Patriot. That said, the potential for developmental rather than evaluative application of the metrics is still an open question.

Composite crew reaction survey. Composite crews completed a 34-question questionnaire after the session. Complete questionnaire results are provided in Appendix B. The first 21 questions assessed their opinions regarding quality of the learning experience, quality of the design and content, flow of content, credibility of examples provided, and the relevance of questions. Response options were on a five-point scale: disagree (-1), strongly disagree (-2), neither agree nor disagree (0), agree (+1), and strongly agree (+2). Composite crews' reaction score means were positive for each of the 21 quality-related statements.

We asked composite crewmembers to respond to four crew process measures about whether their crew understands how to communicate and work with each other (see Table 5). Mean scores along this five-point spectrum indicated that all crewmembers, on average, agreed with the statements about communication and teamwork. Since these aspects were not measured prior to the pilot session, we were unable to determine if the presented material affected trainees' opinions. On the other hand, since the trainees were not already part of an ECS crew and teams were constructed only for the pilot, we surmised that many crewmembers had no prior understanding of crew communication or processes.

Table 5
Crew Process Question Group Means

Crew Process Questions	Mean
My crew members and I understand how we prefer to communicate with each other.	1.08
My crew members and I have a good understanding of the roles played by each member.	1.08
My crew members and I understand how members are going to work together to achieve our goals.	1.25
When one person is struggling with a task, I am confident that another crew member will step in to help.	1.00

The final five scaled response questions asked crewmembers to use a seven-point Likert style scale to rate (i.e., estimate) their knowledge and skill competence before and after the pilot materials and exercises were presented. The range of responses varied considerably, from zero (no knowledge or skill) to seven (excellent knowledge or skill) for each question. Given the

⁸ However, the team noted the use of behavioral indicators and discussion of specific behaviors during our recent SPEAR observations of crew performance assessment and in multiple AARs. The Chapter 4 Annex C (Fire Unit ECS Operations) to Standardized Patriot Assessment of Readiness (SPEAR) Program contains several behavioral items, including those which have the evaluators check off whether crewmembers reacted to electronic countermeasures (ECMs), implemented new Airspace Control Orders (ACOs), implemented new Space Tasking Orders (STOs), or monitored party line communications, questions 8, 9, 10, and 13 respectively.

experience range of the composite crewmembers as well as the role-playing nature of the exercises, this finding was not surprising. The differences between the before and after scores we found most relevant. Positive mean difference increases, ranging from 0.92 to 2.08, were observed for these before and after questions (see Table 6). These score differences, with significant *p* values for the mean scores, indicated positive improvement in composite crewmembers' understanding and anticipated abilities related to the training.

Table 6
Knowledge and Skill Ratings, Mean Differences

Question	Before Mean	Before SD	After Mean	After SD	Mean Difference	<i>p</i> *
My understanding of ECS crew roles and task responsibilities that can be shared.	3.58	2.75	4.50	2.54	0.92	0.014
My understanding of how my crew's strengths and weaknesses impact task distribution.	2.75	2.80	4.17	2.66	1.42	0.003
My crew's ability to apply strategies to manage task saturation.	2.58	2.50	4.50	1.93	1.92	0.001
My crew's ability to communicate effectively.	2.75	2.30	4.67	2.10	1.92	0.001
My crew's ability to manage conflict when it arises.	2.50	2.24	4.58	2.11	2.08	0.002

* The *p* values were calculated using a two-tailed dependent samples *Student's t*-test.

When asked what they attributed the differences to between their before and after scores, crewmembers generally agreed that learning to communicate with each other, over time and through practice and repetition, was the greatest contributing factor for improvement. They also cited learning specific strategies and information (e.g., crew responsibilities) and learning each other's skills as contributing factors. Several responses related to the fact that some crewmembers had little knowledge/experience to begin with (and presumably could only get better).

Interview findings. Crewmembers expressed generally favorable reactions to the research product's structure and content. Facilitators' opinions about content and methods were also positive. In particular, the Facilitator Guide was reported to be well written and easy to follow. Facilitator opinions about the need for this type of research product and available time to utilize the product were less favorable. The instructors focused several times on the appropriate level for the content and exercises throughout the pilot and often asserted that some of the material would be better received somewhere other than in operational units. They also qualified any statements offering praise of components of the research product with similar recommendations. This was also observed during discussions with the composite crewmembers. Most Patriot units run a very tight training and certification schedule, and this may contribute to resistance to what participants may have perceived to be additional requirements.

Both facilitators and composite crews reported that Patriot crews and units address the similar objectives to those addressed by the research product, albeit not as explicitly as accomplished by the research product. Based on input from both facilitators and composite

crews, the current training related to this research product's objectives does not take place in a standardized manner. Rather, the associated subject matter is left to the discretion of individual units, based on unit developed Tactics, Techniques, and Procedures (TTPs), crews, or unit trainers. More experienced facilitators and crewmembers specifically reported that training content related to task redistribution and task saturation has already been worked through among crews in units and that aspects of the training including identifying strengths and weaknesses and crew tells/signs were already accomplished in units. Both facilitators and crewmembers suggested multiple alternative contexts for the research product; however, there was no consensus on any particular setting for a particular objective.

The majority agreed the research product content provided them with better insight about crewmember tells as well as strengths and weaknesses. When asked if the material and exercises improved their crew's team performance, crewmembers responded with mixed opinions but there was some agreement in two areas: a) task redistribution information and practice was useful and b) course value is related to experience. Facilitators identified learning tells as indicators of attentional tunneling, understanding call outs and call backs, and learning roles and responsibilities as contributing most to improved crew performance. The facilitators asserted, however, that the roles and responsibilities training is already covered in the gunnery tables, and that material related to call-outs and call-backs is more appropriate for the Advanced Leadership Course.

The facilitator consensus was that the composite crews preferred the hands-on activities generally, i.e., the board game and newspaper challenge. This is supported by feedback from the facilitators that the crews were not as engaged during delivery of conceptual content, as well as feedback from the crewmembers as to what they found most engaging. Crewmember responses also indicate they preferred interactive methods and those sections of content that involved group interaction or interaction with a facilitator.

Composite crews were particularly engaged in the game, as demonstrated by their enthusiastic discussion of it. They appreciated how it enabled learning (e.g., tasks and task redistribution, team building and coordination, and cognitive multi-tasking) and evaluator feedback and knowledge sharing. Crewmember responses indicated course content taught them to change the way that they played the game, but did not necessarily indicate whether that play was more effective or better in some way. Crewmembers cited multiple course concepts used in the games. These included identifying tells and strengths and weaknesses, task redistribution, prioritization, mutual performance monitoring, and aspects of psychological safety. On the other hand, some crewmembers questioned the game's relevance to air battle management, particularly as a replacement for ECS van or Reconfigurable Table Top Trainer (RT3) exercises. Negative responses also focused on the need for an experienced crewmember to compensate for inexperienced crewmembers.

Crewmembers also enjoyed the newspaper activity and indicated that the "breaking news" inject toward the end of the activity contributed to its value. Crewmembers successfully related the activity to Patriot ECS requirements, such as task prioritization and saturation, as well as experiencing stress due to time pressure. There was appreciation that performance was not dependent on ECS experience. Crewmembers reported they could focus on their process rather than be hindered by lack of technical knowledge. Facilitators pointed out that an advantage of the

activity is that it evened the playing field among crewmembers with varying levels of experience—activities that require proficiency in technical knowledge are difficult to engage in for all crewmembers since their experience and/or proficiency in Patriot often varies.

Less experienced personnel in particular found the Personal Crew Plan useful (see Participant Guide). Positive responses indicated that plan elements contributed to inexperienced crewmembers' basic understanding of what is required in Patriot crews. When asked about their motivation to use the Personal Crew Plan, crewmembers responded primarily positively, associating the plan with activities in both Patriot job performance and their daily lives. Its applicability to both settings and the relatability of its concepts (for those with little to no technical Patriot knowledge) would motivate its use. Concerns about timing, learning audience, and the assertion that people already do these things detract from its use. Responses indicate that use of the Personal Crew Plan may best apply to new Patriot crewmembers or to help the accession of a new crewmember into an existing crew.

Negative responses generally were related to crewmembers having either too much or too little experience and inconsistent opinions about whether the activities would be valuable with more or less ECS crew experience. Some respondents devalued activities due to the artificiality and role playing nature of the training session. Their responses generally indicated opinions that the training is best suited for inexperienced personnel who have not served as part of a certified crew (i.e., Table VIII or above). Crewmembers' responses indicated that the content and exercises may not be useful if experienced crewmembers disregard it as something already done in units, or if the crewmembers are too new to the job to understand their own strengths and weaknesses. The unanimous facilitator opinion was that games cannot create stress; therefore, they believed that the game-based activity contributed the least to crew performance. They asserted that the RT3 would need to be used to create stress. The facilitators' viewpoint was put forth generally, and it was unclear whether their issue was with games in general, the lack of a realistic air battle environment, or the specific content of the game used for the training.

We asked crews to identify what might help them successfully apply the training to their job, but they had little to no input. None answered the question, and instead provided suggestions of how to implement the content and exercises. When crews were asked what they anticipated would inhibit using what they learned in the course on their job, they had few responses. None of the responses specified an impediment to application of the concepts. One crewmember stated that the logistics of maintaining personal booklets would be a potential obstacle.

Finalizing the Research Product

Following the course pilot, the design team prepared a list of recommended changes detailing planned revisions to the research product. Recommended changes were based on observations during the pilot and the evaluation data collected from facilitators and composite crewmembers. Recommended changes were reviewed by the research team and approved changes were incorporated into the training materials. The most significant revisions were: (a) using the game solely as the in-course practical exercise; (b) game card and board changes to reflect input gathered during the pilot; (c) renaming the Supervisory Control Skills Assessment; (d) refining the list of Supervisory Control Skills Assessment behaviors used in conjunction with the game; and (e) learning goals were revised to remove "help crewmembers effectively adapt to

their changing environments.” The refinement of Supervisory Control Skills Assessment behaviors removed indicators that were largely based on systems operations and therefore could not be observed or assessed by the board game exercise. Other course revisions were primarily wording changes to reflect facilitator feedback.

Discussion

This research product is intended to provide a foundation of knowledge and crew skills to further develop CRM skills among ECS crewmembers, supporting crews in mitigating task saturation and performing supervisory control tasks. It is not intended to replace existing ABM preparation, but to supplement it. According to previous research, Patriot crews often rely on trial and error to develop crew performance strategies across repeated exercise rehearsals and experiential crew process development (Buehner et al., 2015; Drzymala et al., in preparation). The research product discussed in this report provides initial competency development and practice focused solely on crew processes with the benefit of working out these aspects prior to the performance of air battles. This conceivably allows crews to focus on more technical aspects of ABM during ECS-based training. Additionally, the research product may prompt the further development of ABM proficiency by forcing experienced Soldiers to explain the procedures, techniques, and tactics during situations encountered in the game, as well as increase individualized immediate feedback by evaluators during performance. Taken together, these two benefits may help reduce the burden for knowledge and skill coaching on experienced Soldiers in units comprised primarily of inexperienced Soldiers.

This research product should help to improve the efficacy of subsequent ECS crew training. It is designed to increase crewmember understanding of what contributes to effective CRM and provides tools to help crews tailor those characteristics to their own situation. As a result, training efficacy should improve because there should be less training time spent on trial and error learning of crew processes in the van, and more time spent on learning the technical intricacies of operating the Patriot system.

The research product pilot evaluation indicated that crewmembers successfully learned the associated strategies and techniques to manage situations of task saturation; however, no evidence indicates that this training helped crewmembers to adapt effectively to rapidly evolving ABM environments. This is possibly due to the limitations placed on the pilot, including the classroom training environment, lack of ECS equipment, and lack of the RT3. Subsequently, course goals have been revised to remove reference to effective adaptation.

The research product supports rapid skill assessment and task distribution in ECS crews. The evaluation indicated that crewmembers were better able to redistribute tasks and assess their crews’ skills as a result of the presented content and exercises, including individual strengths and weaknesses and indicators of task saturation. Crewmembers also reported improvements made in crew communication and conflict management. We cannot, however, confidently conclude shared mental models were successfully established, although the research product laid the groundwork by improving trainees’ understanding of crew performance processes. This knowledge, combined with an understanding of the system and the firing chain, may contribute to a shared mental model of Patriot ABM.

The target audience and timing is appropriate. This research product is recommended for Patriot ECS newly formed crews certified at Table IV as they begin their crew training. Benefits are realized through the application of knowledge gained through team practical exercises, such as the Personal Crew Plan and the ABM Game; because of this training, there should be less training time spent on trial and error learning of crew processes in the van, and more time learning the technical intricacies of operating the Patriot system. Several Soldiers, both facilitators and crewmembers, recommended alternative programs for the training, such as Basic Officer Leadership Course, Advanced Individual Training, and small group training; however, these respondents may not have considered the benefits of the training and intent to positively impact overall ABM training for Patriot. Aspects of this research product could also be used for refresher training or crew development tools. The Personal Crew Plan, Knowing Your Crews' Tells, and the ABM Game should be particularly useful when integrating a new crewmember—i.e., helping to mitigate turnover effects—or to resolve crew coordination issues that arise during other training or evaluation events.

The ABM Game may be used to support reinforcement of technical knowledge and applications when specific tasks and rationales for actions are described during play. The game play can expose gaps in technical and tactical knowledge, forcing crewmembers to explain how and why they would execute an action. The game has the added benefits of providing crewmembers with an opportunity to learn from an experienced evaluator in a relatively safe environment, allowing failure without jeopardizing equipment or air battle outcomes. The game proved to be the most engaging component for the Soldiers and the most intriguing aspect of the pilot evaluation for the researchers. Despite reluctance among several Soldiers to affirm its impact on them, and a tendency to devalue the game in juxtaposition with RT3 ABM training, crewmembers reported that it produced feelings of frustration and being overwhelmed, particularly in experienced Soldiers, who were forced to take on extra burdens when paired with inexperienced crewmembers. Based on previous observations (Buehner et al., 2015; Drzymala et al., in preparation), it is likely ECS personnel experience similar feelings during crew training in the ECS. The game is unquestionably a safer and less expensive alternative to introducing Soldiers to these dynamics and provides a convenient and accessible means to begin working out crew solutions.

Limitations

Game performance, despite its engaging characteristics and learning potential, cannot be associated with job performance, nor should it be expected to replace equipment-based exercises. Nor can we determine what impact the game-based exercises may have on Soldier supervisory control performance or on task saturation mitigation during ABM. Although there are indications the presented content and exercises improved related knowledge and future performance expectations among trainees, the small sample size and limitations of the pilot evaluation do not allow for causal relationships to be determined.

The utility of the Supervisory Control Skills Assessment is inconclusive at this time. The research team was not able to observe or assess its use in the intended environment during ABM exercises. As the Supervisory Control Skills Assessment was used to assess game performance in the pilot, each evaluator approached the assessment differently. There is evidence that a reluctance to implement evaluation methods that are not outcome-based may have presented an

obstacle to pilot testing of the instrument. That said, the tool may be useful to provide feedback to crews concerning specific behaviors and conditions that may occur during air battle exercises—i.e., using the Assessment to provide formative rather than evaluative feedback. This conclusion is based on facilitator comments that the tool may help identify specific behavioral deficiencies that crews should address during future training.

Future Use and Research

Our expectation that this research product will improve subsequent ECS training efficacy is based on instructional theory and evaluation findings from a limited sample of facilitators and composite crewmembers. Consequently, the effectiveness of this research product would benefit from additional study to verify whether it provides a beneficial foundation to facilitate crews' CRM skill development. Given the critical and central role of CRM during supervisory control of the Patriot system, such study would be worth the time and resources to verify the research product's value to the Patriot community. It could also serve to advocate for the consideration of similar competency development approaches for other ADA environments that rely on effective crew teamwork and task sharing.

The Supervisory Control Skills Assessment would also benefit from further study. This would not require a cause and effect design, but rather another pilot test where the tool could be used and assessed in its initially intended context. The tool was designed from research and SME input and is conceptually valid (i.e., it has limited construct and content validity at this point). It is still unknown, however, how usable the tool is for Patriot personnel, how it can be successfully integrated into a training and/or evaluation program, and how well the measured behaviors associate with effective ABM performance.

Looking ahead to AIAMD implementation and training, the training of established CRM processes may become critical, particularly if crewmembers of the AIAMD Fire Control Element certify as individuals rather than crews. In that condition, it would be important to establish variably configured crew processes quickly. The knowledge concepts and exercises presented in this research product will likely be applicable to AIAMD, although the ABM Game will need to be revised to reflect AIAMD characteristics. Likewise, the Supervisory Control Skills Assessment developed for Patriot should also apply to crewmembers of the AIAMD fire control element.⁹ Differences in the respective systems' crew roles, responsibilities, system operation, and other performance processes will drive reconsideration of the behavioral elements and the applicable crew positions included.

Finally, facilitators suggested that enhancement of task saturation mitigation skills would be valuable for nearly all Army small group training contexts. Although this may be true, it is well beyond the scope of this project to determine the veracity of this recommendation. We would recommend, however, that interested parties review, or even test, the course contents in different situations and participants to determine its potential value. Many of the Army's (and military services for that matter) weapons (e.g., tanks, artillery), transport (e.g., helicopters), and systems (command and control) crews likely experience task saturation and could benefit from adaptations of this research product. ADA-specific language will need revision, but the

⁹ We anticipate, at this time, that at least some AIAMD Fire Control Element crewmembers will perform supervisory control and thus the measures would apply to them.

knowledge content and exercises could be generalized to different situations and personnel requirements.

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ACRONYMS

ABM	air battle management
ABML	air battle management level
ACO	airspace control order
ADA	Air Defense Artillery
AIAMD	Army Integrated Air and Missile Defense
AMDTD	Air and Missile Defense Test Detachment
ARI	Army Research Institute
C2	command and control
CRM	crew resource management
ECS	Engagement Control Station
ECM	Electronic Countermeasure
IAMD	Integrated Air and Missile Defense
IDT	Instructional Design Team
IBCS	Integrated Air and Missile Defense Battle Command System
Patriot	Phased Array Tracking Radar to Intercept on Target
PPT	PowerPoint
RT3	Reconfigurable Table Top Trainer
SA	situational awareness
SD	standard deviation
SME	subject matter expert
SPEAR	Standardized Patriot Evaluation and Assessment Reporting
STO	Space Tasking Order
TCA	Tactical Control Assistant
TCO	Tactical Control Officer
TTP	tactics, techniques and procedure
USAADAS	U.S. Army Air Defense and Artillery School

APPENDIX A
EVALUATION INSTRUMENTS

Appendix A. Evaluation Instruments

Train the Trainer Follow-up Group Interview Questions

Train the Trainer (Assess/obtain trainers' expectations of how useful the training will be for their ECS crews; the ease or difficulty of their conducting the training)

1. Do you think this training will help crews mitigate task saturation during air battle exercises? [Follow up to understand opinion]
2. Do you think this training will improve crews' team performance? [Follow up to understand opinion]
3. Does the Facilitator Guide provide enough guidance to successfully teach this course? How could it be improved?
4. Does the course format provide the flexibility needed to teach the course across one day or multiple days if desired?
5. What are your concerns about teaching/facilitating the modules of instruction?
6. What are your concerns about using the Supervisory Control Performance Metric Matrix during the pre- and post-training ABM assessment?
7. What do you think about crews using the Supervisory Control Performance Metric Matrix to assess themselves and/or their own crew?
8. Do you anticipate any impediments to course implementation, other than any concerns you have already expressed?

Trainer Group Interview Questions

Questions to ask facilitators (Task Saturation Mitigation Training post-training survey and group interview administered to both trainees and trainers)

1. How did the training impact crew air battle performance?
2. Were the participants engaged throughout the course?
 - a. Were there any segments in which they were particularly engaged?
 - b. Were there any segments where they were not engaged?
3. What segments of the training do you feel will contribute most to improved crew performance? Why?
4. Which segment(s) contribute least to improved crew performance? What makes you say that?
5. Was the Supervisory Control Performance Metric Matrix easy or difficult to use? Why?
6. How useful was the Supervisory Control Performance Metric Matrix as a tool to help you assess crew performance?
7. Do each of the metrics make sense to you? [Discuss if needed]
8. Did the Facilitator Guide provide you enough guidance to teach the course? [Discuss if needed]
9. Are there any particular sections of the Facilitator Guide where you felt uncertain or where the directions could be improved?

ECS Crew Group Interview Questions

Questions to ask participants/trainees (Task Saturation Mitigation Training post-training survey and group interview administered to both trainees and trainers)

1. Did the course improve your crew's team performance? [Discuss]
2. Which parts of the course did you find most engaging and why?
3. I am now going to ask you about specific parts of the course:
 - a. What did you think about the Newspaper Challenge activity? Did it help provide a better understanding of what task saturation is and how it's not limited to ECS crews?
 - b. In Module 1, did the Recognizing Your Crew's Tells and Identifying Crew Strengths and Weaknesses activities provide you better insights about yourself and your other crew members?
 - c. How did the mitigation strategies taught in Module 2 help you and your crew improve crew team performance?
 - d. Were the practical exercises in Module 3 an effective way to practice applying the strategies learned in the course?
4. I am now going to ask you specific questions about the Personal Crew Plan:
 - a. Was the development of a Personal Crew Plan a useful activity? Why or why not?
 - b. What about the Personal Crew Plan motivates you to use it outside of the course? What about it detracts from its use outside the course?
5. What will help you successfully apply what you learned to your job (e.g., job aid(s), supervisor reinforcement, follow-up training)?
6. What, if anything, do you anticipate inhibiting your ability to use what you learned in the course on the job?

ECS Reaction Survey

Crew Designation _____ Crew Position _____

Instructions

You recently completed Task Saturation Mitigation Training. Please report your reactions to the training using the following questions. Your feedback and remarks are important in making improvements and changes to the training you experienced. Thank you in advance for your participation.

Please indicate your level of agreement with the following items by circling the number that corresponds to the response scale:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Before taking this course, I understood why the course would be important to my work.	-2	-1	0	+1	+2
Quality of Learning Experience					
2. I would recommend that this training be made available to all Patriot ECS crews.	-2	-1	0	+1	+2
3. I would use this training to refresh my skills at a later date.	-2	-1	0	+1	+2
4. I feel I have a better understanding of how to handle my task saturation after completing the training.	-2	-1	0	+1	+2
5. The course content was relevant to my learning needs	-2	-1	0	+1	+2
6. I understood the course objectives.	-2	-1	0	+1	+2
7. My interest stayed high throughout the course.	-2	-1	0	+1	+2
8. Overall, I was satisfied with the course.	-2	-1	0	+1	+2
9. I intend to use what I learned in this course on the job.	-2	-1	0	+1	+2
Quality of Design and Content					
10. The material was clear and understandable.	-2	-1	0	+1	+2
11. The information presented seemed accurate and doctrinally correct.	-2	-1	0	+1	+2

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
12. The course materials facilitated my achievement of the course objectives.	-2	-1	0	+1	+2
Continuity of Topics					
13. The sequence of topics seemed to build on each other.	-2	-1	0	+1	+2
14. Training module content was grouped to facilitate learning.	-2	-1	0	+1	+2
15. There was a clear focus of topics in the training module.	-2	-1	0	+1	+2
Credible Examples					
16. The scenarios contributed to my learning.	-2	-1	0	+1	+2
17. The practical exercises were an effective way for me to learn.	-2	-1	0	+1	+2
18. The scenarios made sense.	-2	-1	0	+1	+2
19. I learned a lot about task saturation from the scenarios.	-2	-1	0	+1	+2
20. Scenarios were presented in a realistic mission context.	-2	-1	0	+1	+2
Focus and Relevance					
21. Questions asked within the training modules were reasonable and helped me to understand the topic.	-2	-1	0	+1	+2
Crew Process					
22. My crew members and I understand how we prefer to communicate with each other.	-2	-1	0	+1	+2
23. My crew members and I have a good understanding of the roles played by each member.	-2	-1	0	+1	+2
24. My crew members and I understand how members are going to work together to achieve our goals.	-2	-1	0	+1	+2
25. When one person is struggling with a task, I am confident that another crew member will step in to help.	-2	-1	0	+1	+2

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Use the scale to the right to complete the next statement.	Much Too Slow	Too Slow	Just right	Too Fast	Much Too fast
26. The pace of the course was:	-2	-1	0	+1	+2

Instructions

The matrices below permit you to self-assess your pre- and post-training understanding and skills. In top half of the matrix, rate your before-training understanding or skill by placing an “X” in the box corresponding to the scale in the middle of the matrix. Then rate your current, or after-training, understanding or skill in the bottom half of the matrix using the same scale.

To what degree did the Task Saturation Mitigation Training improve on your understanding of the following?

27. My understanding of ECS crew roles and task responsibilities that can be shared.

Mark appropriate box with an “X” for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good			Excellent
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an “✓” for AFTER

28. My understanding of how my crew’s strengths and weaknesses impact task distribution.

Mark appropriate box with an “X” for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good			Excellent
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an “✓” for AFTER

To what degree did the Task Saturation Mitigation Training improve on your understanding of the following?

29. My crew's ability to apply strategies to manage task saturation.

Mark appropriate box with an "X" for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good			Excellent
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an "✓" for AFTER

30. My crew's ability to communicate effectively.

Mark appropriate box with an "X" for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good			Excellent
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an "✓" for AFTER

31. My crew's ability to manage conflict when it arises.

Mark appropriate box with an "X" for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good			Excellent
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an "✓" for AFTER

Please respond to these questions based on your experience of the training you just completed.

32. To what do you attribute the differences in your PRIOR and AFTER responses?

33. What were the strengths of the course?

34. How could the course be improved?

Thank you again for your time, participation, and insight.

Trainee Demographic Survey

Crew Designation_____ **Crew Position** _____

The following items ask demographic information about you, your work experiences and plans, and your role within ADA. These questions will only be used to conduct subgroup analyses to better target recommended improvements (as adequate sample sizes permit). The information you provide will not be used in any way to identify your responses. Your responses to these & all items in this survey will be kept strictly confidential and your name is not associated with them.

1. What is your MOS? _____
2. How long have you served in U.S. Army Patriot unit(s)? If applicable, please include all time in Reserve and Guard components.
 - ☐ Less than 1 month
 - ☐ 1-3 months
 - ☐ More than 3 months and less than 6 months
 - ☐ 6 months and less than 1 year
 - ☐ 1-2 years
 - ☐ 3-4 years
 - ☐ 4-5 years
 - ☐ More than 5 years
3. How long have you worked as a Patriot ECS crew member?
 - ☐ I have not worked in an ECS
 - ☐ Less than 1 month
 - ☐ 1-3 months
 - ☐ More than 3 months and less than 6 months
 - ☐ 6 months and less than 1 year
 - ☐ 1-2 years
 - ☐ More than 2 years
4. What is your current Patriot assignment and duty position?
 - ☐ Battery trainer
 - ☐ ECS TCO
 - ☐ ECS TCA
 - ☐ ECS Communications Specialist
 - ☐ Other _____
5. How long have you served in that position? _____
6. How many times have you been deployed (any non-CONUS service) as an ECS crew member? _____

7. How long has your current crew been assigned together?
- ☐ Less than 3 months
- ☐ 4-6 months
- ☐ 7-12 months
- ☐ More than 1 year
8. Using the table below, please circle the highest Patriot Gunnery Table that your current crew has been externally evaluated as having attained and the air battle management level (ABML) you have attained.

<i>Level</i>	<i>Table</i>	<i>Subject Matter</i>	<i>Corresponding ABML</i>
Basic Gunnery Tables	I	Basic System Skills	
	II	Ready-for-Action Drills	
	III	Basic Air Battle Management	1 through 5
	IV	Basic Gunnery Certification	5
Intermediate Gunnery Tables	V	Air Battle Management/Missile Reload	6 through 9
	VI	March Order and Emplacement	
	VII	Commander's Assessment Precertification to Table VIII (Tables V and VI)	1 through 11
	VIII	Intermediate Level Gunnery Certification	11
Advanced Gunnery Tables	IX	Alert State Assumption	
	X	Advanced Level Air Battle Management and Missile Reload, and Maintenance Management	12 and 13
	XI	Commander's Assessment Precertification to Table XII (Tables IX and X)	14 and 15
	XII	Advanced Level Gunnery Certification	16
ABML air battle management level			

9. Referring to the above Gunnery Table, what is the highest Table Level you have ever attained (at any crew position, with this crew or another crew)? _____
10. Referring to the above Gunnery Table, what is the highest ABML Level you have ever attained (at any crew position, with this crew or another crew)? _____
11. Please select the statement(s) that best describe your past experience with crew training. (Select all that apply.)
- ☐ I have participated in ECS crew training
- ☐ I have participated in a SPEAR evaluation as part of an ECS crew
- ☐ I have been part of a certified ECS crew
- ☐ I have been deployed as part of an ECS crew

Thank you for your time and responses.

APPENDIX B

EVALUATION RESULTS

Appendix B. Evaluation Results

Reaction Survey Responses

Group means for each survey question assessed on the agree-disagree scale (questions 1-25) are presented in Table 6. The scale had 5 categories:

- (2) – Strongly agree;
- (1) – Agree;
- (0) – Neither agree nor disagree;
- (-1) – Disagree; and
- (-2) – Strongly disagree.

Note that all scores are in the positive (+) range; the group reports positive feedback on the training along the measure parameters.

Table 1

Reaction Survey Means

Question	Mean
1. Before taking this course, I understood why the course would be important to my work.	0.50
<i>Quality of Learning Experience</i>	
2. I would recommend that this training be made available to all Patriot ECS crews.	1.00
3. I would use this training to refresh my skills at a later date.	0.67
4. I feel I have a better understanding of how to handle my task saturation after completing the training.	1.00
5. The course content was relevant to my learning needs	0.83
6. I understood the course objectives.	1.50
7. My interest stayed high throughout the course.	0.58
8. Overall, I was satisfied with the course.	0.83
9. I intend to use what I learned in this course on the job.	1.33
<i>Quality of Design and Content</i>	
10. The material was clear and understandable.	1.08
11. The information presented seemed accurate and doctrinally correct.	0.92
12. The course materials facilitated my achievement of the course objectives.	1.17
<i>Continuity of Topics</i>	
13. The sequence of topics seemed to build on each other.	1.17
14. Training module content was grouped to facilitate learning.	1.17
15. There was a clear focus of topics in the training module.	1.25
<i>Credible Examples</i>	
16. The scenarios contributed to my learning.	1.17
17. The practical exercises were an effective way for me to learn.	1.00
18. The scenarios made sense.	0.92

Question	Mean
19. I learned a lot about task saturation from the scenarios.	1.08
20. Scenarios were presented in a realistic mission context.	0.42
Focus and Relevance	
21. Questions asked within the training modules were reasonable and helped me to understand the topic.	1.25
Crew Process	
22. My crew members and I understand how we prefer to communicate with each other.	1.08
23. My crew members and I have a good understanding of the roles played by each member.	1.08
24. My crew members and I understand how members are going to work together to achieve our goals.	1.25
25. When one person is struggling with a task, I am confident that another crew member will step in to help.	1.00

Note. $N = 12$

For Question 26, course pace, the group reported the pace of training to be just right {Mean= (-0.25), question 26}. The scale categories used for question 26 (course pace) were:

- (2) – Much too fast;
- (1) – Too fast;
- (0) – Just right;
- (-1) – Too slow; and
- (-2) – Much too slow.

Questions 27 through 31 asked students to rate (i.e., estimate) their knowledge and skill competence **before** receiving the training and **after** receiving the training. The rating scale used for each question is shown in Figure 3.

Mark appropriate box with an “X” for PRIOR

PRIOR to taking this training								
Scale	0	1	2	3	4	5	6	7
Associated phrase	None	Can get by			Pretty good		Excellent	
Scale	0	1	2	3	4	5	6	7
AFTER taking this training								

Mark appropriate box with an “✓” for AFTER

Figure 2. Knowledge and skill estimating scale

The range of responses varied considerably across students, from zero (0) to seven (7) for each question. This is not surprising, however, given the experience range of the students as well as the role-playing nature of the training. Individual scores are also not particularly relevant; the relevant measure for these questions are the differences between the **before** and **after** scores.

Table 7 provides the mean difference between the **before** score means and the **after** score means for questions 27 through 31. The p values indicate the probabilities (low in all cases) that mean

differences are due to random events. The p values were calculated using a two-tailed dependent samples Student T-test.

Table 2

Knowledge and Skill Ratings, Mean Differences

Question	Before Mean	After Mean	Difference	p
27. My understanding of ECS crew roles and task responsibilities that can be shared.	3.58	4.50	0.92	0.014
28. My understanding of how my crew's strengths and weaknesses impact task distribution.	2.75	4.17	1.42	0.003
29. My crew's ability to apply strategies to manage task saturation.	2.58	4.50	1.92	0.001
30. My crew's ability to communicate effectively.	2.75	4.67	1.92	0.001
31. My crew's ability to manage conflict when it arises.	2.50	4.58	2.08	0.002

Student Comments

Students were provided the opportunity to provide open-ended responses to three questions. Those questions, responses, and summary follow. (Responses are color-coded to align to group distinctions {pink/red, blue (originally orange), purple (originally yellow), and green}.

32. To what do you attribute the differences in your PRIOR and AFTER responses?

SUMMARY: The general consensus was learning to communicate with each other, over time and through practice/repetition, was the greatest contributing factor for improvement. There is also some reference to learning specific strategies and information (e.g. crew responsibilities) and learning each other's skills as contributing factors. Several responses relate to the fact that some students had little knowledge/experience to begin (and presumably could only get better).

33. What were the strengths of the course?

SUMMARY: Various aspects of the course resonated with relatively equal distribution of students. The same number of students identified learning specific information/strategies ($n=4$) or applying new knowledge to activities ($n=4$) as the course strengths. Three students referenced the quality or appearance of the course materials. The remaining responses were unclear or irrelevant.

34. How could the course be improved?

SUMMARY: All student recommendations to improve the course were associated with improving the 'game' or scenario-based exercises. Several students mentioned including the RT3 lab. In general, though, there was a general consensus that scenarios should be "better" and/or better mimic real-world conditions. Two responses referenced the course being too long.

Table 3
Performance Matrix Data

		RED			BLUE			GREEN			PURPLE			Combined Groups		
		PRE	MOD3	POST	PRE	MOD3	POST	PRE	MOD3	POST	PRE	MOD3	POST	PRE	MOD3	POST
Operation of Automated System		1.17	1.00	1.75	1.00	2.25	2.00	1.33	1.14	1.00	0.14	1.71	1.57	0.87	1.45	1.45
1	Correctly inputs initial system settings	XXX	XXX	XXX	2	XXX	XXX	1	1	1	1	0	0	1.33	0.50	0.50
2	Accurately modifies initial system settings to reflect changing mission conditions	1	1	2	XXX	XXX	XXX	1	1	1	0	2	2	0.67	1.33	1.67
3	Locates system information in time to support mission accomplishment	1	1	2	XXX	XXX	XXX	1	0	1	0	1	2	0.67	0.67	1.67
4	Recognizes system faults	2	XXX	XXX	0	3	2	2	2	1	0	3	2	1.00	2.67	1.67
5	Responds appropriately to system faults	1	1	1	1	2	2	2	2	1	0	3	2	1.00	2.00	1.50
6	Notifies oddities in system information and questions them	1	XXX	2	1	2	2	XXX	1	1	0	1	1	0.67	1.33	1.50
7	Determines causes of alerts	1	XXX	XXX	1	2	2	1	1	1	0	2	2	0.75	1.67	1.67
Situational Awareness		1.00	0.67	1.67	1.00	1.57	1.38	0.44	1.67	1.44	0.44	1.00	1.78	0.69	1.24	1.55
8	Asks appropriate questions of higher or adjacent echelon crews, staffs or units	1	0	2	1	2	2	2	2	2	1	2	3	1.25	1.50	2.25
9	Cross checks information using multiple sources (crew, ICC, BCP; another ECS).	1	0	1	1	2	2	0	1	2	0	1	2	0.50	1.00	1.75
10	Recognizes when a form of communications goes down	XXX	XXX	XXX	1	2	1	0	3	2	0	1	2	0.33	2.00	1.67
11	Correctly compensates for communications loss	0	1	1	1	1	1	0	2	2	0	1	1	0.25	1.25	1.25
12	Recognizes when automated systems indicators are faulty or incorrect	1	XXX	XXX	XXX	XXX	1	0	1	1	0	0	0	0.33	0.50	0.67
13	Uses all available and reasonable means to restore or compensate for automated system faults or failures	1	1	XXX	1	1	2	0	2	1	1	1	2	0.75	1.25	1.67
14	Applies tactical situation knowledge to the operation of the automated system	1	1	2	1	1	1	0	1	1	0	1	1	0.50	1.00	1.25
15	Maintains automated system in the correct mode	1	1	2	1	XXX	XXX	0	1	1	1	0	2	0.75	0.67	1.67
16	Acknowledges change in situation	2	XXX	2	1	2	1	2	2	1	1	2	3	1.50	2.00	1.75
Interpretation		1.25	-	1.80	2.00	1.67	2.00	0.80	0.80	0.80	0.20	1.40	2.00	0.95	1.07	1.60
17	Identifies threat tracks correctly	2	XXX	2	2	2	2	1	2	1	1	2	3	1.50	2.00	2.00
18	Correctly identifies friendly air assets	2	XXX	2	3	XXX	XXX	1	0	1	0	0	2	1.50	-	1.67
19	Engages threats to protected asset in appropriate priority	0	0	1	1	2	2	0	0	2	0	2	3	0.25	1.00	2.00
20	Takes/makes correct response to system indicators	1	XXX	2	2	1	2	1	2	0	0	1	0	1.00	1.33	1.00
21	Changes track identification based on new or modified ROE or HEU commands	XXX	XXX	2	XXX	XXX	XXX	1	0	0	0	2	2	0.50	1.00	1.33
Crew Resource Management		0.43	0.40	1.75	1.25	2.00	1.88	0.13	0.38	0.63	0.38	1.38	2.50	0.54	1.10	1.69
22	Uses correct brevity communications externally and with crewmembers	0	0	1	2	1	2	0	0	1	1	1	3	0.75	0.50	1.75
23	Responds correctly to brevity language communicated externally and by crewmembers	0	0	1	2	2	2	0	0	1	1	2	3	0.75	1.00	1.75
24	Effectively communicates received information in a timely manner	0	XXX	2	1	2	2	0	1	1	0	1	3	0.25	1.33	2.00
25	Effectively prioritizes tasks as air battle demands increase	1	0	2	1	3	2	0	2	1	0	2	2	0.50	1.75	1.75
26	Maintains automated systems operation when short one crewmember	XXX	XXX	2	1	2	2	0	0	1	0	2	3	0.33	1.33	2.00
27	Seeks crewmember confirmation/challenges to own interpretation	2	XXX	2	0	2	1	0	0	0	0	0	1	0.50	0.67	1.00
28	Performs other crewmembers' responsibilities effectively when needed	0	1	2	1	2	2	1	0	0	1	1	3	0.75	1.00	1.75
29	Recognizes and supports other crewmembers' needs	0	1	2	2	2	2	0	0	0	0	2	2	0.50	1.25	1.50
Decision-making		0.83	0.75	1.83	1.40	2.00	1.67	0.33	1.00	0.33	1.00	1.33	2.67	0.88	1.39	1.63
30	Makes correct decisions when ICC/BCP decision support is not available	1	XXX	1	XXX	2	1	1	0	0	1	2	3	1.00	1.33	1.25
31	Makes timely decisions to protect friendly asset	0	XXX	2	2	XXX	2	1	XXX	1	1	2	2	1.00	2.00	1.75
32	Uses all available information to make decisions	1	1	2	2	2	2	0	2	1	2	1	3	1.25	1.50	2.00
33	Provides accurate information for decision-making	1	1	2	1	2	1	0	2	0	1	2	2	0.75	1.75	1.25
34	Applies rules and permissions correctly to decision-making	1	1	2	1	2	2	0	1	0	1	0	3	0.75	1.00	1.75
35	Makes decisions quickly when the situation calls for it	1	0	2	1	2	2	0	0	0	0	1	3	0.50	0.75	1.75
Cards (+)		13	8	22	45	56	48	15	15	9	21	40	49	23.50	29.75	32.00
Cards (-)		33	10	18	18	5	15	25	20	14	10	0	0	21.50	8.75	11.75
Score		-20	-2	4	27	51	33	-10	-5	-5	11	40	49	2.00	21.00	20.25
Cards Total		46	18	40	63	61	63	40	35	23	31	40	49	45.00	38.50	43.75

APPENDIX C
FACILITATOR GUIDE

Army Research Institute

Task Saturation Mitigation Training

Facilitator Guide



September 2018

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Course Administration

Course Goal

One of the challenges crews face with supervisory control is task saturation during air battle management, particularly when multiple events are occurring simultaneously. While it may be impossible to eliminate the occurrence of task saturation, the goal of this course is to improve crew team performance by providing strategies and techniques to help crews mitigate task saturation when it occurs. The training will help crews develop a shared mental model, support rapid skill assessment, and support task distribution.

This training is not intended to replace existing ABM training, but to supplement it. The focus of this training is on the initial development and practice of crew processes prior to the performance of air battles, allowing crews to focus on the more technical aspects of air battle management when training with live equipment or the RT3. However, this training is also beneficial as continuous training for existing crews and when a new crewmember is introduced to the team.

Target Audience

The target audience for the training is Patriot ECS crews who have completed Table IV and are ABML V certified. The training is designed to be used by Warrant Officers to train their crews in operational units. Ideally, this training will be introduced when individuals first form as a crew to help facilitate the transition from individual competency to collective crew competency.

The training may be delivered at the single crew, battery, or battalion levels. Because the activities and practical exercises in the training involve all crewmembers, it is recommended that the facilitator not be a member of the crew being trained.

Course Objectives

Listed below are the overarching learning objectives for the Task Saturation Mitigation Training. These learning objectives describe what the learner should be able to do at the end of the training. Module-specific learning objectives are also provided within each module.

- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.

Course Structure

The table below shows the sequence of modules for the course with estimated time durations. These are recommended time durations that may need to be adjusted based on crew skill level or crew ability.

Modules may be taught all at once, separately, or in some combination as time permits. For example, Modules 0 and 1 may be taught on the first day, Modules 2 and 3 at a later date, and Module 4 as the last day. For cases in which the modules are taught separately, the Facilitator Guide includes facilitator notes with information to briefly review the content from the previous module and how it connects to the current module.

Module Title	Description	Estimated Duration
Module 0: Introduction	The purpose of this module is to conduct facilitator and participant introductions and briefly provide an overview of the course,	45 minutes

Module Title	Description	Estimated Duration
	including the course goal, course objectives, and course structure. Participants will have an opportunity to share their expectations of the course. Participants will also complete a pre-training knowledge assessment and an ABM performance assessment.	
Module 1: Assessing the Situation	In this module, crews will gain an understanding of their current crew situation. Specifically, crews will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Crews will also establish a shared understanding of ECS crew team roles and responsibilities and identify current crew strengths and weaknesses.	90 minutes
Module 2: Plan Formulation	In this module, crews will learn strategies for improving crew team performance to help mitigate task saturation. As they go through this module, crews will develop a Personal Crew Plan that identifies rules and norms for how their crew will react and respond to situations in an effort to mitigate or reduce task saturation.	90 minutes
Module 3: Practice and Learn	In this module, crews will first learn about the importance of team learning and providing psychological safety. Crews will then practice the strategies they learned for mitigating task saturation using the Personal Crew Plan they developed in Module 2.	65 minutes
Module 4: Wrap-Up	The purpose of this module is to briefly review the content that was covered in the course and review the course goal and objectives. The facilitator will revisit the list of participant expectations generated at the beginning of the course to ensure that all expectations were met and address any remaining questions. Participants will also complete a course evaluation as well as a post-training knowledge assessment and an ABM performance assessment.	45 minutes
Total Time		5 hours, 35 minutes

Training Frequency

The frequency in which this training should be delivered will vary by crew. For example, skill decay will occur more readily for units at home station, and therefore refresher training will be needed more frequently, than for units deployed in operational theater. Following the initial training, it is recommended that units re-take this training when:

- A new crewmember joins the team.
- Training or evaluation observations indicate crews continue to be overwhelmed and struggle to mitigate task saturation.

However, to maintain proficiency, crews should continually practice implementing task saturation mitigation strategies during regular exercises.

Instructional Materials

The instructional materials for this training consist of a Facilitator Guide and a Participant Guide. Additional resources are also required for two activities as described below.

Course Materials	Contents
Facilitator Guide	The Facilitator Guide contains all of the information needed to teach each module of the course. Each module within the Facilitator Guide is organized as follows: • Learning objectives • Estimated time • Facilitation agenda • PowerPoint slides with associated talking points, discussion questions and possible answers, instructions for conducting activities, and all exhibits The following handouts are provided in the appendices. A sufficient number of copies of each handout should be made prior to the training as indicated below: • Pre-training Knowledge Assessment (1 per participant) • Supervisory Control Skills Assessment (2 per crew – one for pre-training assessment and one for post-training assessment) • Newspaper Challenge Activity (1 per crew) • ABM Game Instructions (1 per participant) • ABM Game Materials (1 set per crew) • Course Evaluation Form (1 per participant) • Post-training Knowledge Assessment (1 per participant)
Participant Guide	The Participant Guide is designed to serve as a reference throughout the course and as a workbook where participants can record answers to discussion questions, complete activities, and take notes.

Course Materials	Contents
	The Participant Guide is a streamlined version of the Facilitator Guide. It contains all of the same elements as the Facilitator Guide except for the following: • Course Administration module • Icons • Facilitator notes • Answer keys or debrief information • Appendices
Other Resources Needed	In addition to the information in the Facilitator Guide, you will also need the following items for the Newspaper Challenge Activity in Module 1 and the ABM Game in Module 3. Newspaper Challenge Activity (Module 1) • Scissors (two pair for each crew) • Scotch tape (one roll for each crew) • Pens/pencils (at least two for each crew) • Blank 8 ½ x 11 sheets of paper (one sheet for each crew) • Timer (display time for participants to view on a stopwatch or project onto a screen) ABM Game (Module 3): • Die (one per crew) • Timer (one per crew) • Transparent chips (23 per crew) • Erasable marker (one per crew)

Media/Technology

The following media and technology are used in this course:

- Projector and screen – If teaching in a classroom setting, you would ideally have a projector and screen for the PowerPoint slides. For smaller settings (e.g., in the van), the Facilitator Guide/Participant Guide are set up in a way that you can review the slides directly in the guides.
- Desktop or laptop computer – There is one video in the course (Module 1) for which you will need either a desktop or laptop computer with audio to play.
- Operational equipment – The pre-training and post-training ABM performance assessments in Module 0 and Module 4 are designed to be conducted in an air battle exercise; therefore, operational equipment or the RT3 is optimal for the continuum of learning.

Practical Exercise Prep

During the course, participants will complete the following practical exercises:

- Module 0: Pre-training ABM performance assessment – Participants will run through an ABM exercise to establish a baseline of crew strengths and weaknesses with air battle management.

- Module 3: ABM Game – Working within their crews, participants will practice the strategies they learned for mitigating task saturation using the Personal Crew Plans they developed in Module 2.
- Module 4: Post-training ABM performance assessment – Participants will run through an ABM exercise to determine how crew performance has improved as a result of the training.

Due to constraints on the availability of operational equipment, the pre- and post-training ABM performance assessment is not required; however, the use of the RT3 or MTOE (van) and simulated air battle scenarios will help induce task saturation and maximize behavioral change outcomes. It will take the course from a crawl-walk without equipment to a walk-run with equipment. Therefore, these materials assume that the pre- and post-training ABM performance assessment will be conducted. Coordination with Air Defense School/Unit support (in garrison) or Battery/Battalion support (in the field) will be required in advance for the ABM performance assessments.

Use of Icons

The following icons appear in the Facilitator Guide. These icons serve as cues for the type of action you need to take as a facilitator.

Instructional Method	Icon
Lecture	
Discussion	
Assessment	
Activity	
Video	

Course References

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Module 0: Introduction

Learning Objectives

- N/A

Estimated Time

45 minutes (time will vary depending on the air battle management (ABM) level required to generate task saturation in crews during the pre-training ABM performance assessment, number of crews in the class, and number of facilitators)

Facilitation Agenda

Topics	Method	Time
Module Overview	Lecture	1 minute
Introductions		
Facilitator Introductions	Lecture	1 minute
Participant Introductions	Lecture	5 minutes
Course Overview		
Course Goal	Lecture	1 minute
Course Objectives	Lecture	1 minute
Course Structure	Lecture	1 minute
Instructional Methods	Lecture	1 minute
Participant Expectations	Discussion	4 minutes
Pre-training Assessment	Assessment	30 minutes
Total Estimated Time		45 minutes

Slide 1



Module 0: Introduction

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Module Overview



- Welcome participants to the course.
- Explain that the purpose of this module is to conduct facilitator and participant introductions and briefly provide an overview of the course, including the course goal, course objectives, and course structure. Participants will also have an opportunity to share their expectations of the course.
- Point out that, at the end of the module, participants will complete a pre-training assessment consisting of a knowledge assessment followed by an ABM performance assessment to establish a baseline of participants' knowledge and performance level.

Slide 2



Facilitator Introductions



- Name
- Position
- Professional experience

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2

Facilitator Introductions



- Facilitate the introductions by:
 - Starting with the lead facilitator introducing himself or herself.
 - Next, asking any other co-facilitators to introduce themselves including name, position, and professional experience.

Slide 3



Participant Introductions

- Name
- ECS role
- Deployment experience
- Experience supporting air battle management and operating within an ECS crew

3

Participant Introductions



- Have participants introduce themselves. Ensure that each participant shares his or her:
 - Name
 - ECS role
 - Deployment experience
 - Experience supporting air battle management and operating within an ECS crew
- Acknowledge that participants will have varying levels of experience and will play different roles in the course.
 - The role of the more experienced participants is to mentor those who are less experienced to help them complete the exercises. They should allow less experienced participants to take on challenging tasks and coach them through those tasks.
 - The role of the less experienced participants is to learn from the more experienced participants and improve their contribution to crew performance.

Slide 4



Course Goal



- Improve crew team performance by providing strategies and techniques to help crews mitigate task saturation.

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4

Course Goal



- Explain that even though the Patriot system is automated, it still relies on operator understanding of the system and a shared awareness amongst the crew of what is happening during air battle management.
- Explain that one of the challenges crews face during air battle management is task saturation, particularly when multiple events are occurring simultaneously.
- Point out that, while it may be impossible to eliminate the occurrence of task saturation, the goal of this course is to improve crew team performance by providing strategies and techniques to help crews mitigate task saturation when it occurs.

Slide 5



Course Objectives



- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.



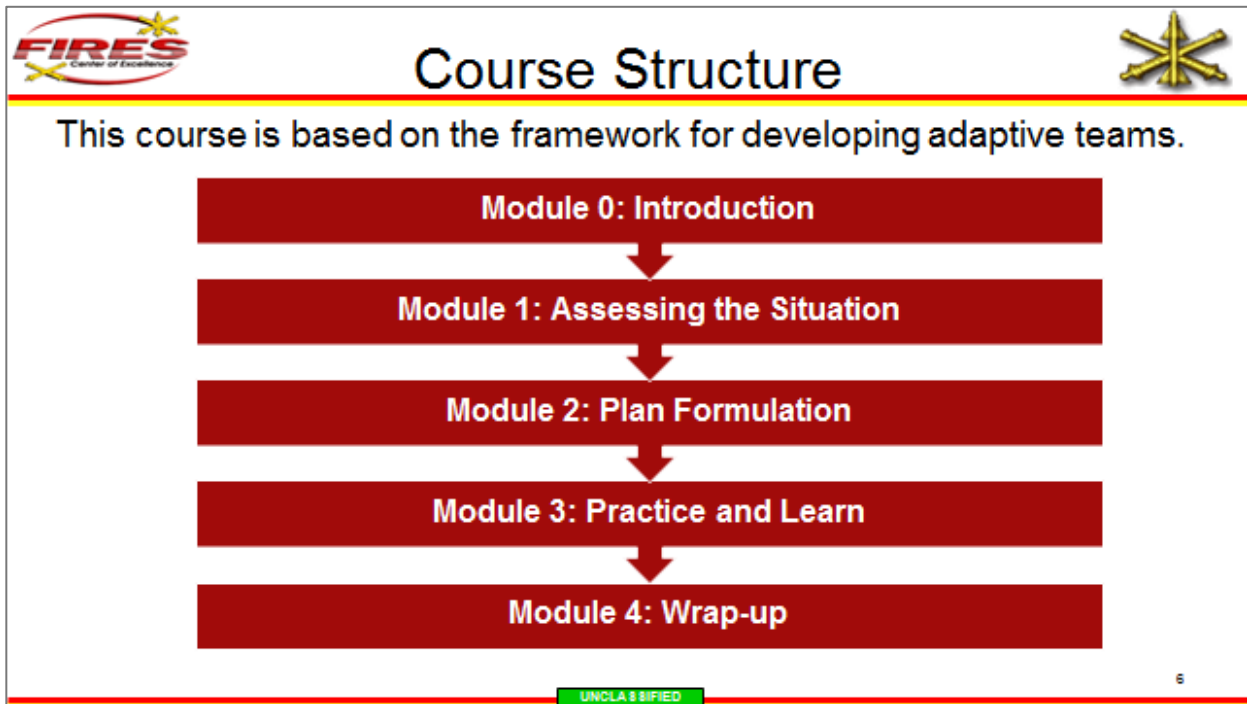
5

Course Objectives



- Explain that, by the end of this course, participants should be able to:
 - Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
 - Develop a Personal Crew Plan for mitigating task saturation.
 - Improve crew performance in mitigating task saturation through practice and team learning.
- Point out that these are the overarching objectives for the course. More specific learning objectives are provided within each module.

Slide 6



Course Structure



- Tell participants that the course is built around the framework for developing adaptive teams because ECS crews must be able to readily adapt to changing conditions. Adaptive teams assess a situation, formulate a plan, execute that plan, learn from their performance, and then repeat this process when faced with new situations.
- Provide a brief description of each course module.
 - **Module 0: Introduction** provides an overview of the course and allows time for facilitator and participant introductions. Participants will also complete a pre-training knowledge assessment and an ABM performance assessment.
 - **Module 1: Assessing the Situation** allows crews to gain an understanding of their current situation. They will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Crews will also establish a shared understanding of ECS crew team roles and responsibilities and identify current crew strengths and weaknesses.
 - **Module 2: Plan Formulation** provides strategies for improving crew team performance to help mitigate task saturation. Crews will develop a Personal Crew Plan that identifies rules and norms for how their crew will react and respond to situations to mitigate or reduce task saturation.
 - **Module 3: Practice and Learn** explains the importance of team learning and providing psychological safety. Crews will then practice the strategies

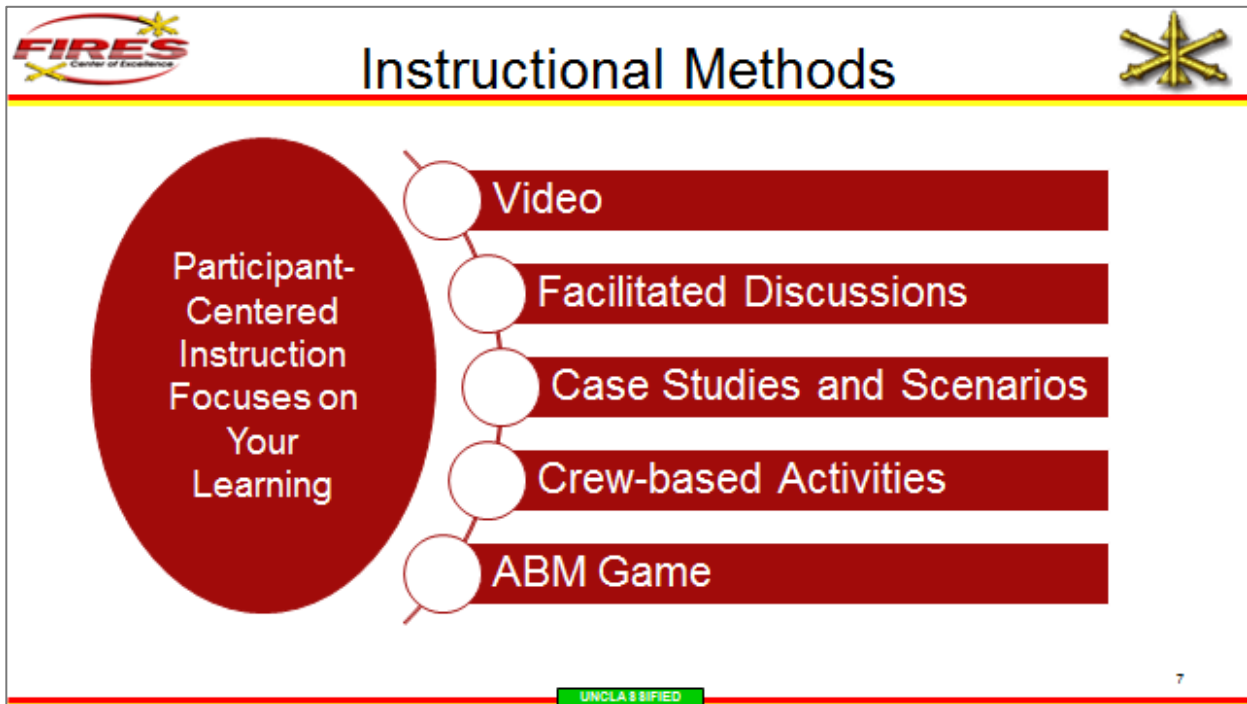
they learned for mitigating task saturation using the Personal Crew Plan they developed in Module 2.

- **Module 4: Wrap-up** provides a summary of the content covered in the course and reviews the course goal and objectives. Participants will also complete a course evaluation as well as a post-training knowledge assessment and an ABM performance assessment.
-

Facilitator Note:

If the course modules will not occur all at once, point out to the participants that due to time constraints, this course will be taken a module at a time or however you plan to divide the modules.

Slide 7



Instructional Methods

Participant-Centered Instruction Focuses on Your Learning

- Video
- Facilitated Discussions
- Case Studies and Scenarios
- Crew-based Activities
- ABM Game

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7

Instructional Methods



- Explain that this course is participant-centered and uses a variety of active learning methods that includes participants identifying signs of task saturation in a live action video, engaging in facilitated discussions on relevant topics, reviewing case studies and scenarios, participating in crew-based learning activities, and playing the ABM Game to learn to address real-world challenges. Lectures are purposely limited.

Slide 8



Participant Expectations









Participant Expectations



- Ask participants to share an expectation of the class.
- Record each participant's expectation (via paper, laptop, etc.). Keep the list visible or available throughout the class. Refer back to the list as expectations are covered.

Slide 9



Pre-training Assessment



- Measures course effectiveness
- Establishes a baseline of participants' knowledge and performance level



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9

Pre-training Assessment



- Explain to participants that they will now complete a pre-training assessment consisting of a knowledge assessment followed by an ABM performance assessment.
- Point out that the purpose of the pre-training assessment is to establish a baseline of participants' knowledge and performance level. Compared with the post-training assessment, it will be used to measure course effectiveness.
- Hand out the pre-training knowledge assessment found in Appendix A to each participant. Exhibit 0-1 on the next page contains the answer key for the knowledge assessment. The correct answers are bolded.
- Once everyone has completed the knowledge assessment, conduct the ABM performance assessment. Recommendations for conducting the ABM performance assessment are provided in Exhibit 0-2.

Exhibit 0-1: Answer Key for Pre-training Knowledge Assessment

1. Task saturation is:
 - a. When a crewmember performs more tasks than the other crewmembers.
 - b. When a crew cannot perform a difficult task.
 - c. When a task is unfamiliar to a crewmember.
 - d. **When multiple issues occur at the same time that diminishes crew performance.**
2. Which of the following is a sign of task saturation?
 - a. Increased energy
 - b. Increased performance under stress
 - c. **Heightened emotional displays**
 - d. Effective multitasking
3. Which of the following is NOT likely a cause of task saturation?
 - a. Loss of communications with the ICC
 - b. **Fighting an air battle with few tracks to identify**
 - c. A replacement crewmember with little ECS experience
 - d. One crewmember is experienced and assumes multiple tasks
4. Which of the following statements about crew task responsibilities is the most accurate?
 - a. Crewmembers should only perform the tasks associated with their role.
 - b. A task may be performed by any crewmember regardless of role.
 - c. **A task may be performed by any crewmember, but it should be delegated to the crewmember if it does not fall under his/her role.**
 - d. Friendly protect can be delegated to another crewmember.
5. The main benefit of understanding crewmembers' strengths and weaknesses is it allows you to:
 - a. Avoid distributing tasks to the weakest crewmember.
 - b. **Determine how each crewmember can best contribute to crew performance.**
 - c. Identify performance hindrances.
 - d. Identify the crewmember that can take on the majority of the tasks.
6. All of the following are strategies for mitigating task saturation, EXCEPT:
 - a. Conduct "what if" scenarios.
 - b. Provide backup support.
 - c. **Maintain current task distribution and prioritization.**
 - d. Conduct mutual performance monitoring.

7. Which communication strategy can be used to help crewmembers anticipate next steps?
 - a. **Call-out**
 - b. Hand-off
 - c. Check-back
 - d. Touch-back
8. The purpose of a crew's conflict management plan is to develop:
 - a. A list of crewmembers' "tells" during a conflict.
 - b. Evidence of a team member's poor performance.
 - c. **Agreed-upon rules and norms to resolve an issue.**
 - d. Recommendations on how to redistribute tasks during task saturation.
9. The qualities of an effective crew include all of the following EXCEPT:
 - a. **Crewmembers focus on their own crew responsibilities.**
 - b. Crewmembers adhere to established communication protocols.
 - c. Crewmembers maintain an open environment to share and question.
 - d. Crewmembers recognize each other's "tells" that they are becoming task saturated.
10. Which of the following is a key factor for team learning?
 - a. Avoid topics that are known to cause team conflict
 - b. **Be willing to openly share problem areas**
 - c. Practice easy-to-implement improvements during the next training
 - d. Minimize the number of questions asked to complete training on time

Exhibit 0-2: Recommendations for Conducting the ABM Performance Assessment

Read below for detailed instructions on how to conduct the ABM performance assessment. It is recommended that you utilize the Scenario Generation Group (SGG) to automate injects and inputs as much as possible so that you can observe the actions during the performance assessment and ensure task saturation is attained.

Overview

- **Purpose:** The purpose of the pre-training ABM performance assessment is to assess each crew's strengths and weaknesses with air battle management. The assessment results will be used in the Module 1 Strengths and Weaknesses Assessment Activity.
- **Time:** Each air battle will last approximately 20 minutes.
 - One facilitator must be available per crew to assess each crew.
 - The number of crews that will be able to complete the ABM performance assessment simultaneously will depend on the number of available facilitators and available equipment.
 - If it is not possible for all crews to complete the exercise at the same time, it is recommended that crews be provided designated times for their assessment.
- **Scenario Development:** Below is a list of potential injects that can be used to create task saturation. Be sure to combine and time these injects to create task saturation:
 - Alert state changes (e.g., a TBM has been detected or enemy aircraft detected by radar)
 - Orders coming in (STO or ACMAF) that temporarily takes out a crewmember
 - Launcher goes NMC or Missile Hazard/Missile Misfire
 - Tactical order comes in to make system modifications or configure systems differently
 - Comms go down (data or voice or both)
 - ICC loses picture so ECS screen info has to be relayed verbally to ICC or vice versa
 - System fault
 - Order to slew the radar
 - mIRC chat and Outlook communications
 - Change self-defense criteria (e.g., from 10,000 feet to 5,000 feet)
 - Change in ROE - couldn't engage aircraft previously but now can
 - ICC is busy so need to conduct own track identification
 - Multiple aircraft at once so have to prioritize tracks
 - Ambiguous/unknown track – doesn't fit with current threats
 - Voice warnings from SADC
 - Commo has to leave the van to battle short the EPP
 - ICC requests missile/ammo status
 - ICC notifies the crew to hold fire on engaged track or requires ECS to change ID on track due to communication degradation

- **Assessment tool:** Facilitators should use the Supervisory Control Skills Assessment located in Appendix B to assess each crew's ABM performance.

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Module 1: Assessing the Situation

Learning Objectives

- Define task saturation.
- Identify the signs of task saturation.
- Identify task responsibilities that can be shared across crewmembers.
- Identify crew strengths and weaknesses.

Estimated Time

90 minutes

Facilitation Agenda

Topics	Method	Time
Module Overview	Lecture	1 minute
What Is Task Saturation and How Do You Know It's Happening?		
Introduction to Task Saturation	Activity	20 minutes
Task Saturation Defined	Lecture	2 minutes
Signs of Task Saturation	Video	8 minutes
Recognizing Your Crew's "Tells"	Activity	15 minutes
Have a Clear Understanding of Shared Roles and Responsibilities		
ECS Crew Roles and Task Responsibilities	Lecture	10 minutes
Flexibility of Tasks	Discussion	3 minutes
Case Study	Activity	10 minutes
Recognize Crew Strengths and Weaknesses		
Understanding Crew Knowledge and Experience	Lecture	5 minutes
Identifying Your Crew's Strengths and Weaknesses	Activity	15 minutes
Module Summary	Lecture	1 minute
Total Estimated Time		90 minutes

Slide 1



Module 1: Assessing the Situation

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Module Overview



- Explain that, in this module, crews will gain an understanding of task saturation and their current crew situation. Specifically, crews will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Crews will also establish a shared understanding of ECS crew team roles and responsibilities as well as current crew strengths and weaknesses.

Facilitator Note:

If this module is taught separately from Module 0: Introduction, provide a brief refresher of what was covered in Module 0 before beginning Module 1:

- Introduced the participants and learned about their experiences
- Reviewed the course goal and objectives
- Provided an overview of the course structure and instructional methods that will be used
- Discussed participant expectations
- Completed the pre-training assessment
- {Highlight any other important discussion items that took place during this module}

Slide 2



Introduction to Task Saturation Activity

- Working with your crew, review the Newspaper Challenge Activity instructions that were distributed.
- When signaled by the facilitator, complete the activity.
- Be prepared to discuss your experience.

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Introduction to Task Saturation



- Explain that task saturation occurs in our everyday lives. It's that sensation of feeling overwhelmed when you have multiple competing demands.
- Point out that you will now conduct an activity to help participants better understand what task saturation is.
- Refer to Exhibit 1-1 for detailed instructions on how to conduct this activity.

Exhibit 1-1: Newspaper Challenge Activity

Read below for detailed instructions on how to conduct this activity.

Distribute Materials

Distribute the following materials to each crew:

- Newspaper Challenge Activity materials found in Appendix C. (Note: Only hand out pages C-1 through C-26 initially. Page C-27 should not be visible to the participants. Page C-27 will be handed out later in accordance with the instructions below in the *Stop the Press!* section.)
- Blank 8 ½ x 11 sheet of paper (one sheet)
- Scissors (two pair)
- Scotch tape (one roll)
- Pens/Pencils (at least two)
- Timer (display time for participants to view on a stopwatch or project onto a screen)

Introduce the Activity

Working with their crew, have participants review the activity instructions and ask any questions they have. If participants ask about roles and responsibilities, refer them to what is written in the instructions; do not provide additional guidance.

Understand Your Role

As the facilitator, your role is to be the newspaper editor. When participants complete the activity, you will review their front page to ensure compliance with all rules (listed under Front Page Requirements in Appendix C).

Additionally, as the editor, you will introduce a breaking news story when there are two minutes remaining in the activity. **You should not tell participants about this inject beforehand.**

Start the Clock

Once participants have read the activity instructions and you've answered their questions, set the timer to 8 minutes and have crews begin the activity.

During the activity, announce the time remaining every minute. Following the inject, announce the remaining time every 30 seconds.

If participants ask about how articles should be classified, use the following guidelines:

- **FrankCoin:** technology and/or business
- **Bowling:** sports
- **Tesla:** technology and/or business
- **Charles Barkley:** politics
- **A.I. Teachers:** technology and/or business or education
- **Beef Wellington:** archaeology and/or food

Stop the Press!

At the 6-minute mark or when the first group completes its front page (whichever occurs first), introduce a breaking news story that groups must use as their headline story. Distribute Page C-27, which contains a story about the NASA discovery of potential extraterrestrial life as well as several additional photos.

If a group completed its front page, that group will be required to make adjustments upon receiving the NASA story as will all other groups. For front-page requirement purposes, this breaking story should not be considered a technology story.

Conduct a Debrief

Following completion of the activity, groups should briefly present their front pages. They should share their headlines and their rationale for choosing articles/pictures.

Spend approximately 10 minutes conducting a debrief with all participants, using the questions below to guide the discussion.

- Did you feel overwhelmed by this activity?
- How did you overcome handling all the tasks? Did you delegate tasks?
- Did you trust that your crewmember would be able to complete a task correctly and in a timely manner?
- Was the breaking news story disruptive?
- Did you feel stressed at any point during this activity?
- Do you think your crewmembers were stressed? How could you tell?
- How does this apply to the work you do as an ECS crew? What is similar or different about this activity?

Point out that this activity introduced several pressures that you will face while working with your ECS crew. To be successful in this activity, you had to be familiar with your team's roles, monitor each other's progress, and redistribute and reprioritize tasks.

Example

The example below is a front page that meets all of the requirements.

BREAKING: NASA SUGGESTS WE ARE NOT ALONE

NASA announces potential extraterrestrial lifeforms found in Colorado. Just yesterday, a meteorite that the agency had been tracking for the past six months crashed down to the Earth and was located in Telluride, Colorado. Skiers and snowboarders watched in awe as the meteorite flashed across the sky near sundown.

"It was beautiful. I thought someone was firing fireworks, but it's not the Fourth of July." One onlooker told reporters.

Tests are being run on samples, and although full reports have not been published, a senior official at NASA has confirmed that the agency believes the samples contain living extraterrestrial organisms. While the world awaits the results of the tests, others are already proclaiming the presence of extraterrestrials. One Telluride business owner acquired a large piece of the space matter when the meteorite crashed behind his coffee shop, Java the Hutt.

"I'm a huge Star Wars fan, so the idea of a life form from a galaxy far, far away landing in my back yard is a dream come true. I can't wait for the NASA test results, but I know that this meteorite contains other life." Against the advice of NASA, Java the Hutt has started serving an "Intergalactic Brew," which contains tiny shards of the meteorite ground with the coffee beans.

BOWLING A STRIKE
SPORT REVIEWERS TO OLMPIC GAMES

The International Olympic Committee (IOC) approved one new sport for the 2024 Summer Olympics to be hosted in Paris, France. After years of campaigning from the bowling industry, the Committee announced that bowling would be played in 2024.

Bowling made its sole appearance at the 1988 Summer Olympic Games in Seoul, South Korea as a demonstration sport. In the Seoul Summer Games, 21 nations and 24 bowlers participated in the exhibition. Despite the fact that all 1,000 tickets for the event were sold, bowling would not see the Olympic stage again. Bowling was deemed to be too expensive for young people in third-world countries to develop skill in, and the sport's Olympic dreams were shelved.

SHUTTERSTOCK

That is, until now. A mysterious organization known as Bowlers for Tomorrow has constructed regulation lanes and donated balls, pins, and shoes to developing nations around the world. Although the intentions of this organization are unclear, one thing is certain: their actions have catapulted bowling into the international spotlight. It is estimated that these efforts over the past several years have tripled the amount of bowlers outside of the United States.

The IOC responded and recognized the large increase in bowlers worldwide (now estimated at 300 million people age twelve and above) by adding bowling to the 2024 Games. Under Olympic rules, professional bowlers will not be allowed to participate, paving the way for a generation of young up-and-comers to take the lanes and go for the gold.

Picture: Telluride, Colorado

Others were not as enthusiastic. One father of three had this to say, "When I saw that meteorite, I started skiing for my life! I thought for sure there would be an avalanche. I didn't know what I was going to do. I just knew I had to get down that mountain if I wanted to see my kids again."

In early 2017, NASA announced discovery of a solar system filled with Earth-like planets that scientists believed may be capable of supporting life. It is believed that this meteorite originated from the same solar system. NASA first noticed the meteorite from outside of its solar system and have tracked it since.

MUSK: ENERGY-SAVING APPLIANCES NEXT STEP FOR TESLA

Tesla CEO Elon Musk announced today the latest venture from his innovative car company: home appliances. Speculation began late last week when Musk tweeted a "thinking face" emoji in response to a question about what was next for the industry giant. The tweet, pictured below, started as a joke according to its author, Twitter user @luv_my_dishwasher.

Appliance Fan @luv_my_dishwasher | 12:02 PM - 22 Jan 2018

What's next, @ElonMusk? Dishwashers?

Musk's company has already proven itself in the home with its Powerwall home battery. The battery is a rechargeable lithium-ion battery that stores solar power to be used during the night or in the event of a power outage. The also battery boasts 7+ days of continuous power during an outage.

It appears that Musk intends to extend Tesla's presence in the home with a line of energy-saving home appliances. In the announcement made by Tesla on Monday, Musk said, "We want to continue accelerating sustainability in any way we can, and we believe the next step is with energy-saving appliances."

On the heels of the announcement, consumers are lining up to buy their own Tesla appliances. It is currently estimated that Tesla's appliances will be available for preorder in Q4 of this year.

Picture: Various Household Appliances

Slide 3



Task Saturation Defined



- Task saturation is when multiple issues occur at the same time that diminishes the performance of the crew in their interaction with and/or control of the Patriot system.



3

Task Saturation Defined



- Explain that task saturation within an ECS crew is when multiple issues occur at the same time that diminishes the performance of the crew in their interaction with and/or control of the Patriot system. For example, task saturation may occur when the crew receives a STO, ACMAF, and engagement command all at the same time.
- Point out that task saturation results when the brain takes in the maximum amount it can handle – it's working at full capacity – but more information or task demands are still coming in and the brain can't process it.
- Use the following analogy to help bring this concept to life:
 - Think about the ground during a major rainstorm. When the rain is light or moderate, the ground is able to absorb the water into the soil. However, if it keeps raining, the amount of rainwater eventually becomes greater than the soil can absorb. The ground becomes saturated, so the water runs off the land and can cause flooding.
 - The same is true of task saturation. When task demands are low or moderate, the brain is able to absorb and process all of the information. However, when task demands are high, the flow of information can become greater than the brain can absorb and process.

Slide 4



Task Saturation Defined (Cont'd.)



- **Causes**
 - One member is strong and assumes too much of the work
 - A crewmember encounters something new and is not sure how to handle it
 - Increase in intensity and difficulty of ABM

- **Consequences**
 - Tunnel vision
 - Freezing/going blank
 - Missing or dropping tasks
 - Decreased situational awareness

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Task Saturation Defined

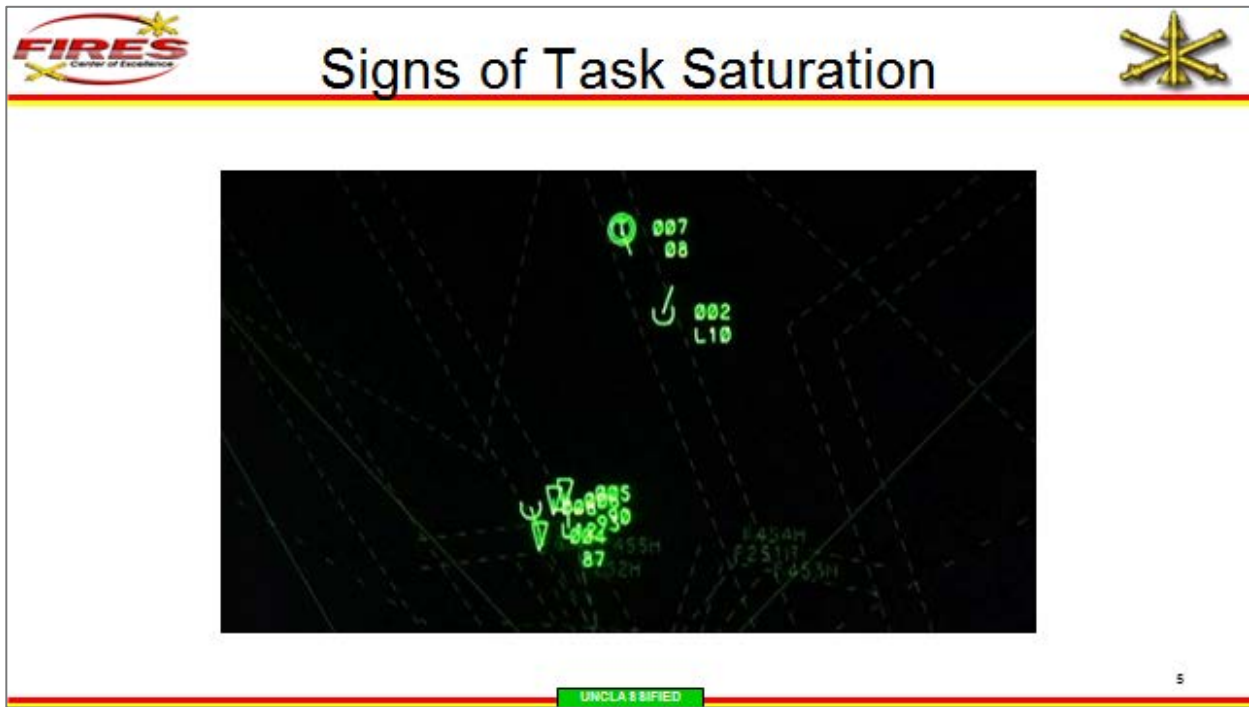


- Point out that task saturation can be both a cause and a consequence.
 - Task saturation can be caused by the following:
 - One member is strong and assumes too much of the work.
 - A crewmember encounters something new and is not sure how to handle it.
 - There is an increase in intensity and difficulty of ABM.
 - Task saturation can also have consequences such as:
 - Tunnel vision.
 - Freezing or going blank.
 - Missing or dropping tasks (e.g., tuning out comms).
 - Decreased situational awareness.



- Ask participants:
 - What other causes and consequences would you add to the list?
 - *Potential additional causes include too many tasks occurring at once or not knowing how to prioritize tasks.*
 - *Potential additional consequences include anxiety, anger, frustration, or chaos in the van.*

Slide 5



Signs of Task Saturation



- Emphasize that mission success is significantly harder to achieve when crewmembers are unable to recognize task saturation cues and support the mission critical areas that it will affect. But what does task saturation in an ECS crew look like?



- Tell participants that you are going to show a video (02:39). As they watch the video, have them identify signs of task saturation and write them in their Participant Guide.
- Point out that due to the staging required to produce an unclassified video, you may notice some inconsistencies and filming errors (e.g., inconsistent target displays, operator claiming track as Hostile after system changed track to Friend immediately following the IFF request, etc.). Please disregard these inconsistencies and focus instead on the crewmembers' behaviors.
- Click on the slide image to play the video.



- Ask participants:
 - What are some of the signs of task saturation you observed in the video?
 - *Potential answers include swearing when comms went down, freezing/going blank when it was time to make a decision, conducting steps out of order (engaging before checking kinematics and IFF responses), and missing steps (there seemed to be enough time to re-establish comms).*

-
- Beyond the video, what are some other signs of task saturation that you've observed during ABM exercises or events? (Note that responses to this question will serve as a lead-in to the next slide.)
 - *Answers will vary.*
-

Slide 6



Signs of Task Saturation (Cont'd.)



- Behavior change (e.g., body language, communication)
- Increased fatigue
- Heightened emotional displays
- Tunnel vision
- Declining task performance

6

Signs of Task Saturation



- Compare participants' responses with the bullets on Slide 6, highlighting those that were not mentioned.
- Explain that crewmembers should monitor one another and look out for cues that individuals are becoming overwhelmed during performance.
- Point out that a crew should also monitor its progress toward goals and its interactions with the external environment (e.g., new surface to air missile tactical order (STO), early warning from ICC, or missile launcher down). In so doing, the crew can catch important cues that might cause task saturation and the need to make adjustments in order to continue making progress towards overarching goals.



- Ask participants:
 - When a crewmember recognizes the signs of task saturation in a superior (e.g., in the video, the TCA recognized that the threat was misclassified while the TCO demanded that he engage the track), how could the lower ranking crewmember handle the situation?
 - *Answers will vary but may include the TCA saying "Sir, do you understand that I've informed you this is a misclassified track?" Or "Sir, I can take your switches for a minute while you re-look at that target." Or "Recommend that I take your switches while you look at that target because I last saw it as a misclassified track." The point*

is to provide an opportunity to take on some of the task so that the superior officer can reassess, or at least be advised one more time of what your assessment is prior to executing that engagement. There should be checks and balances between crewmembers who are operating as a team.

Slide 7



Recognizing Your Crew's "Tells" Activity

- Working individually, answer the questions in Exhibit 1-2.
- Discuss your answers with your crew.
- Be prepared to share your responses.

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Recognizing Your Crew's "Tells"



- Explain that the purpose of this activity is to have participants identify signs that task saturation is occurring within their own crew. Some "tells" may occur in many teams, while other "tells" may be unique to their crew.
- Have participants spend approximately 5 minutes working individually to answer the questions in Exhibit 1-2 of their Participant Guide and then another 5 minutes discussing the responses with their crew.
- Spend approximately 5 minutes conducting a debrief.
- Have a volunteer from each group share its responses.

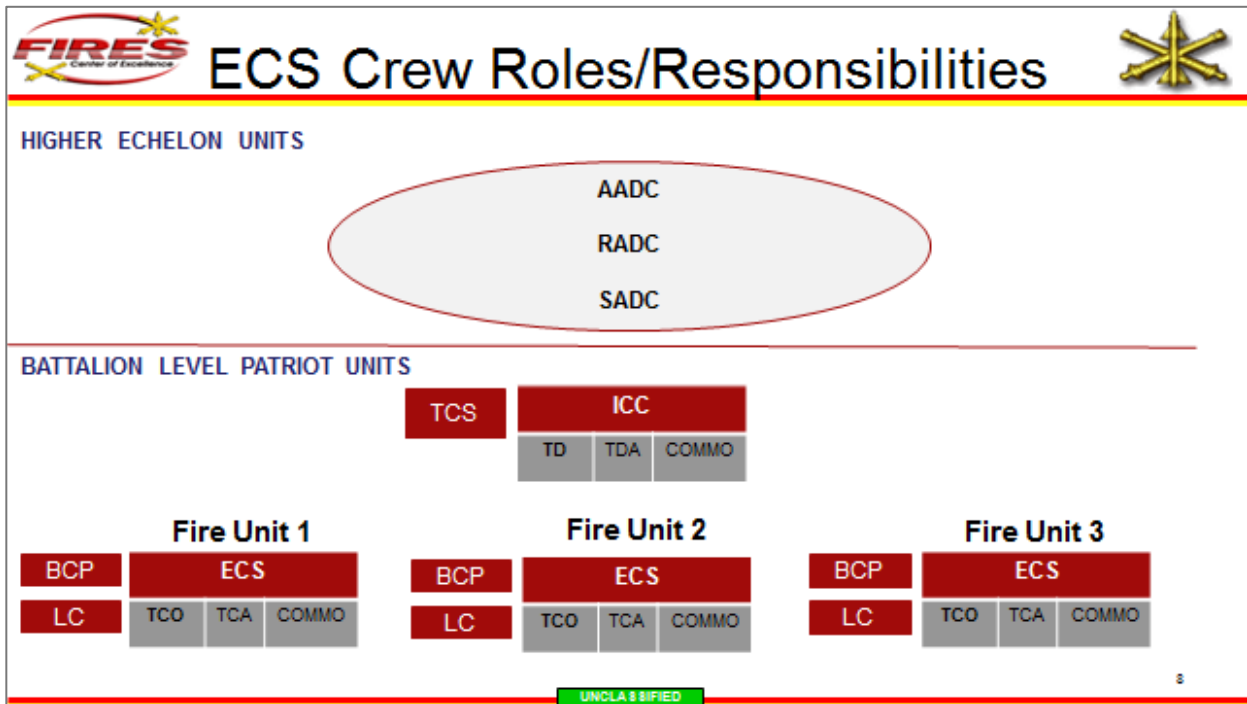
Exhibit 1-2: Recognizing Your Crew’s “Tells” Activity

1. During an air battle, what causes task saturation to occur in your crew?

2. What are your “tells” when task saturation is occurring?

3. What are your crewmembers’ “tells”?

Slide 8



ECS Crew Roles and Task Responsibilities



- Point out that, in addition to having a shared understanding of what task saturation is and its cues, crews must have a shared understanding of each team member's role and task responsibilities and be both willing and able to provide and seek assistance when needed.
- Explain that, without an accurate shared understanding of each other's roles, crewmembers cannot effectively catch mistakes or lapses, nor can they successfully perform another crewmember's task if necessary.
- Briefly review where ECS crews sit within the fire crew layout.
- Refer participants to Exhibit 1-3 in their Participant Guide and review the ECS crew roles and primary task responsibilities.
- Emphasize that, regardless of whether it is part of their assigned role, crewmembers need to support one another and step in when needed.
 - As the mantra goes, there's "no rank in the van." While each crewmember has their assigned responsibilities, no one member should have a controlling attitude but rather be supportive, open to suggestions, and willing to pass or take on tasks.
 - Different crews may have different plans on who or how specific types of support is provided.
 - For example, crews need to decide who takes responsibility for responding to communications (e.g., who is going to take down and

process an incoming STO) when the COMMO has tasks that have to be performed outside the van. That individual may take communications temporarily.

Facilitator Note:

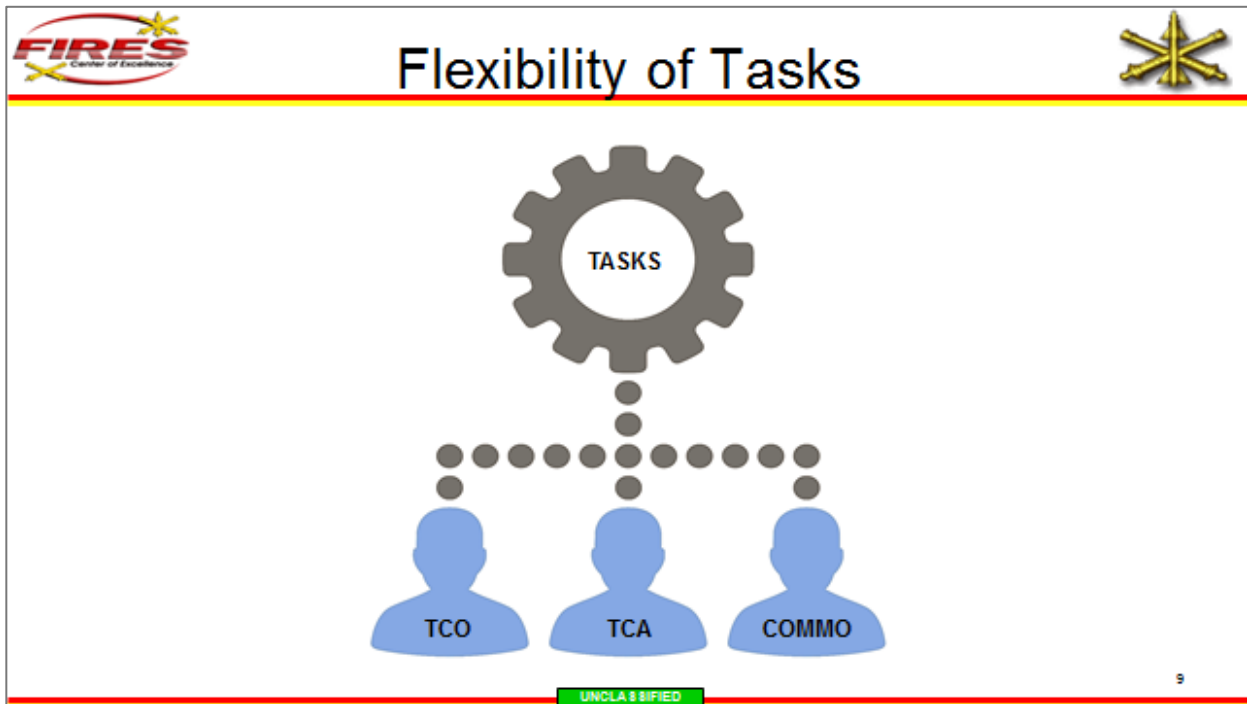
Participants should already be familiar with ECS crew roles and responsibilities, so there is no need to explain it in depth. The purpose is to ensure all crewmembers have a shared understanding of how their crew fits in to the bigger picture and task responsibilities.

Exhibit 1-3: Roles and Responsibilities

Role	Primary Task Responsibilities
TCO	
- Officer in Charge (OIC) of the Patriot ECS crew - Friendly protect	- Identify targets - Ensure system is in assigned Search, Identification, and Engage Mode - Verify activation/deactivation IFF - Identify false targets based on track amplifying data tab and situation display - Monitor situation display and alert messages - Monitor party line for Air Battle - Apply or remove Cease Fire, Hold Fire, or Engage Hold - Monitor clutter conditions and activate clutter mapping - Make FIDOC changes - Direct radar emission control schedule - Direct system reorientation - Monitor status alerts and assess selected alerts - Conduct air battle management in compliance with directives received from Higher Echelon Units - Monitor mIRC chat
TCA	
Weapons Control	- Engage targets and continue to monitor the engagement - Ensure system in assigned Search, Identification, and Engage Mode - Activate/deactivate IFF - Identify false targets based on track amplifying data tab and situation display - Reorient system - Place system in assigned mode of control - Place appropriate launchers to operate/standby/local - Check that system is in assigned weapons control status - Activate/deactivate areas enable, radiate, and control alternate search sectors - Monitor for faults presented by the system or observed during operation - Monitor party line 1 for engagement operations

Role	Primary Task Responsibilities
	• Monitor mIRC chat
Role	Primary Task Responsibilities
Multichannel Transmission Systems Operator (COMMO)	
• Monitors and operates system communications equipment	• Ensure the appropriate address is assigned to the RLRIU • Ensure all communications equipment is configured according to the current communications plan • Pass and receive tactical reports to and from the BCP such as the Surface to Air Missile Tactical Order (STO) and the Surface to Air Missile Status Report (SAMSTAT) • Monitor chat, missile count, and engagement reports • Assist the TCO in assessing communication faults • Monitor the AMG • Rotate and elevate the UHF antennas when required • Implement all communications electronic counter-countermeasures (ECCM) • Coordinate communications plan changes with the ICC and battalion communications control

Slide 9



Flexibility of Tasks



- Ask participants, “Which roles and task responsibilities are fixed and cannot be shared?”
 - *Emphasize that **the TCO’s role of friendly protect and the TCA’s role of weapons control are fixed, but all task responsibilities may be shared.** In fact, it is a requirement for the TCO and TCA to understand and be able to perform the others’ task responsibilities. However, before performing someone else’s tasks, **you should be delegated the authority to do so.** For example, the TCA should never declare a target hostile without authorization from the TCO.*

Facilitator Note:

The purpose of this discussion is to ensure all crewmembers have a shared understanding of which task responsibilities can be shared and which cannot.

Slide 10



Case Study Activity



- Working individually:
 - Review the case study in Exhibit 1-4.
 - Answer the discussion questions.
- Be prepared to share your responses.

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Case Study



- Refer participants to Exhibit 1-4 in their Participant Guide.
- Have participants work individually for approximately 5 minutes to review the case study and answer the discussion questions.
- Spend approximately 5 minutes conducting a debrief. Discussion questions are provided below with sample responses, which you can use to help lead the discussion:
 - **What went well?**
 - *There was a good redistribution of tasks when the STO came in requiring tabular changes and slewing the radar (15:35:30). Because the TCA was more experienced, he handed off the switches to the TCO while he completed the STO and slewed the radar.*
 - *It was also good that the TCO verbalized her lack of knowledge about how to slew the radar and her discomfort with taking on both the switches and completion of the STO.*
 - **What didn't go well?**
 - *When the ICC communicated that the track was misclassified (15:55:00), the TCA should have waited for the TCO to hand off the task to him if needed; you should not grab tasks that are the responsibility of someone else even if you think you're being helpful.*

-
- *There was a miscommunication when there were too many tracks on scope and the TCO asked the TCA to help evaluate the tracks outside the 50k range (16:12:00). The TCA accidentally took the tracks inside the 50k range. To prevent this from occurring, it would have been helpful for the TCA to repeat which tracks he was taking.*
 - **How was the workload distributed?**
 - *For the most part, crewmembers completed tasks that were within the responsibilities of their role. When needed, tasks were redistributed based on crewmembers' knowledge and experience.*
 - **How could tasks have been distributed differently?**
 - *The TCO missed the due time for the first ACMAF (15:33:00). The TCO could have handed off the correlation of hostile UAS tracks to the TCA in order to complete the ACMAF on time.*
 - *When the TCA announced a SCUD Alert (16:03:15), both the COMMO and TCO put on their facemasks, leaving the TCA running/monitoring the entire system. A better approach would have been for crewmembers to take turns donning their facemasks. Crews should have a pre-plan for these types of situations.*
-

Exhibit 1-4: Case Study Activity

Background Information

This ECS crew formed three months ago and was just certified in theater. They are still forming as a team and continue to improve through practice. They know they have some problem areas. The TCO is the new member of the crew and it is her first time as a TCO. The TCO is comfortable with her tasks, and she is gaining confidence in performing the TCA's tasks. She does not yet fully understand the COMMO tasks. The TCA has been serving in this role for six months at this same site. He has worked with the current COMMO for the past 4 months. As for the COMMO, this is his second tour as a COMMO. The first tour was in a different country so he's had to get up to speed on the local SOPs, TTPs, authorities, and threats. The TCA and COMMO have an established battle rhythm. They understand each other's tasks and get along well. The threat for this area is generally TBMs, but ABTs could exist. The crew has already postured for the current conditions.

Case Study Dialogue

- 15:30:00 COMMO: ACMAF in, due at 15:33.
- 15:30:05 TCO: ACMAF due at 15:33.
- [COMMO writes down 15:33 and advises TCO; COMMO watches for TCO to implement ACMAF.]
- [TCO busy correlating several possible hostile UAS tracks with the ICC.]
- 15:32:30 COMMO: ACMAF due in 30 seconds.
- 15:32:33 TCO (agitated): Got it.
- 15:33:00 COMMO (loudly): ACMAF due NOW.
- 15:34:00 TCO (with disgust): ACMAF implemented.
- 15:34:05 COMMO: STO, due at 15:38.
- 15:34:08 TCA: Implementing STO. TCO take my switches.
- 15:35:10 TCO: Got your switches.
- 15:35:30 TCA: STO says to slew the radar and has several tabular changes.
- 15:35:35 TCO: I'm not sure how to slew the radar.
- 15:35:45 TCA: You complete the STO. I'll slew the radar.
- 15:35:50 TCO: I can't complete the STO and maintain the switches.
- 15:35:55 TCA: Alright, I'll complete the STO and slew the radar. You keep the switches, but it may take a bit.
- 15:37:00 TCA: Radar slew completed.
- 15:37:00 COMMO: STO due in 1 minute.
- 15:37:55 TCA: STO implemented. I can take my switches back.
- 15:38:00 TCO: Switches back to you.
- 15:55:00 TCO: ICC says digital data link is down and that we need to change track ABC to HOSTILE.
- 15:55:02 TCA: Roger, changing ABC to HOSTILE.
- 15:55:04 TCO: No, it's my responsibility.
- 15:55:06 TCA: No, I got it.

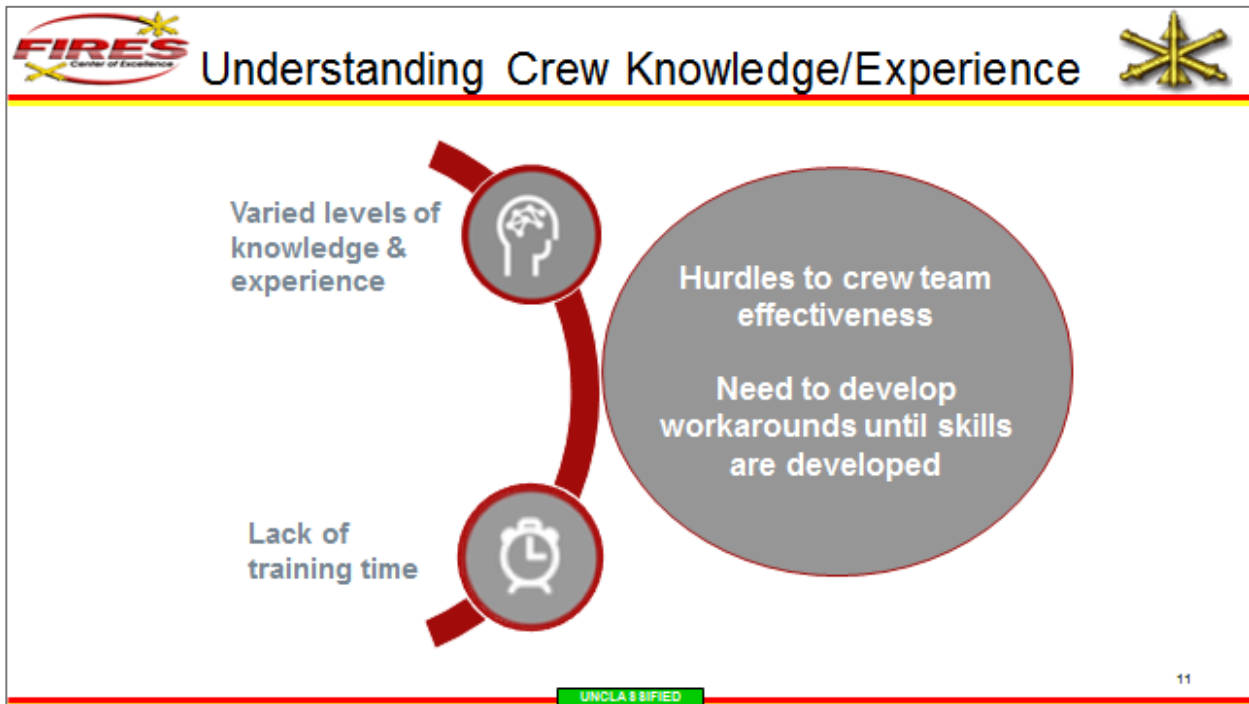
- 15:55:30 TCA: Track ID changed.
- 16:00:00 COMMO: New STO is in.
- 16:00:02 TCA: Implementing STO. TCO take my switches.
- 16:00:04 TCO: Got your switches.
- 16:03:15 TCA: [TBMs on screen] SCUD ALERT! SCUD ALERT! SCUD ALERT!
- 16:03:30 [COMMO and TCO immediately put on facemasks.]
- 16:04:00 TCA: Sir! I don't have your switches! [TCA scrambles to take his own switches and TCO's while TCO scrambles to finish donning mask.]
- 16:04:30 TCA: Retake my switches.
- 16:04:32 TCO: I have your switches.
- 16:04:45 TCA: STO implemented. [Dons facemask.]
- 16:05:10 TCA: I can take my switches back.
- 16:05:15 TCO: Switches back to you.
- 16:12:00 TCO: Too many tracks on scope. TCA, can you evaluate tracks outside the 50k range?
- 16:12:01 TCA: BIRDS AWAY on inbound SCUD.
- 16:12:05 TCA: I'm monitoring engagement on inbound SCUD. I will try. (TCA inadvertently takes the tracks within 50k.)
- 16:12:30 TCO: ICC has declared Track XYZ at range of 60k from unit is an ARM carrier. Do you agree?
- 16:12:35 TCA: I don't know. I have the tracks within the 50k area and the inbound SCUD engagement.
- [Digital engage command appears onscreen.]
- 16:12:40 TCO: No, I'm doing inside 50K. You're supposed to be tracking outside 50k.
- 16:12:45 COMMO: BCP is calling from the Command Chain asking why we haven't engaged Track XYZ.
- 16:12:46 TCO: I have a fast-mover at 25k under evaluation. I need you to switch to the outer 50k and review Track XYZ.
- 16:13:00 TCA: Roger, I'm taking outside the 50k.
- 16:13:05 TCA: SPLASH SCUD Track.
- 16:13:20 TCA: Track XYZ has a VALID MODE 3 response. I don't think it's an ARM Carrier.
- 16:13:30 TCO: ICC, Track XYZ has a VALID MODE 3. Please confirm ID.
- 16:15:00 TCO: TCA, my fast-moving track has cleared. I'm resuming full screen monitoring.
- 16:15:00 TCA: Full screen monitoring.
- 16:32:20 TCA: Standing by for confirmation of ID on Track XYZ. TCO, can you review?
- 16:32:30 TCO: Will review track XYZ.
- 16:33:00 COMMO: ACMAF in, due at 16:36.
- [COMMO watches for TCO to implement ACMAF.]

- [TCO busy reviewing track XYZ.]
- 16:34:00 COMMO: New STO is in.
- 16:34:03 TCA: STO. TCO take my switches.
- 16:34:06 TCO: Got your switches.
- 16:35:00 TCO: Too many tracks to handle. Got a jammer and possible multiple false targets. Still reviewing Track XYZ.
- 16:35:15 TCA: Updating tabs.
- 16:35:30 COMMO: ACMAF due in 30 seconds.
- 16:35:45 COMMO: ACMAF due in 15 seconds.
- 16:36:00 COMMO (in loud voice): ACMAF due NOW. STO is due NOW.
- [ACMAF is overdue, STO is overdue, Track XYZ has yet to be properly identified, jammer is still on screen and system effect is unknown, multiple unknowns on screen potentially caused by jammer, and system is no longer properly configured. TCO is task saturated, not responding, and staring blankly at screen.]

Discussion Questions

1. What went well?
2. What didn't go well?
3. How was the workload distributed?
4. How could tasks have been distributed differently?

Slide 11



Understanding Crew Knowledge and Experience



- Acknowledge that while crewmembers should be able to share responsibilities seamlessly, the reality is that there isn't enough time to initially train all members on all roles. Lack of training time combined with the Army's sustainment readiness model (SRM) and unit personnel turbulence results in crewmembers with varying levels of knowledge and experience, which leads to crew strengths and weaknesses.
- Point out that weaknesses can pose hurdles to crew team effectiveness. However, strengths can also be problematic if a crew relies on one strong member instead of developing capabilities across all crewmembers.
 - It's important that crewmembers speak up when they don't know how to do something or don't understand something. They should never keep it to themselves.
- Explain that effective teams have the ability to identify performance hindrances and find ways to avoid or work around them. Understanding crewmembers' strengths and weaknesses is important because it allows crews to determine how each crewmember can best contribute to crew performance. It also allows crewmembers to build up weak skillsets through additional training/cross-training and appropriately distribute tasks.
 - Provide an example: If a crewmember isn't comfortable with [identify a task (e.g., assessing a jammer)], the team should recognize the

-
- crewmember's limitations and refrain from distributing that task to that crewmember during an actual event.
 - While challenging tasks shouldn't be attempted by that crewmember during an actual event, training exercises should be used in the meantime to build those task skillsets for that crewmember.
 - Crews are encouraged to quiz each other to improve their knowledge and understanding as well as ask how or why certain tasks are done.
 - Emphasize that crewmembers should continually reassess their capabilities as they gain more experience.
-

Slide 12



Identifying Crew Strengths/Weaknesses Activity

- Working individually, complete Parts I and II of the activity in Exhibit 1-5.
- Working with your crew:
 - Share your responses to Parts I and II with your other crewmembers.
 - Review the results of the pre-training ABM performance assessment.
 - Complete Part III of the activity.
- Be prepared to share your responses.

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Identifying Your Crew's Strengths and Weaknesses



- Explain that the purpose of this activity is to have crews identify their strengths and weaknesses.
- Refer participants to Exhibit 1-5 in their Participant Guide.
 - Have participants work individually for approximately 5 minutes to complete Parts I and II of the activity.
 - Once finished, share your pre-training ABM performance assessment results with each crew.
 - Allow participants approximately 10 minutes to share their responses to Parts I and II with their other crewmembers and review the results from the pre-training ABM performance assessment.
 - Next, have crew teams complete Part III of the activity.
- Spend approximately 5 minutes conducting a debrief.
- Have a volunteer from each group share its responses.

Facilitator Note:

The purpose of this activity is to help crews understand their team's strengths and weaknesses, not to identify poor performance. Stress that most teams will have weaknesses. Weaknesses can simply be due to inexperience.

Exhibit 1-5: Strengths and Weaknesses Assessment Activity

Complete each part of this activity as directed by the facilitator.

Part I				
Supervisory Control Skills Assessment				
Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
A. Operation of the System				
1. Correctly inputs initial system settings	0	1	2	3
2. Accurately modifies initial system settings to reflect changing mission conditions	0	1	2	3
3. Locates system information in time to support mission accomplishment	0	1	2	3
4. Recognizes system faults	0	1	2	3
5. Responds appropriately to system faults	0	1	2	3
6. Recognizes oddities in system information and questions them	0	1	2	3
7. Determines causes of alerts	0	1	2	3
B. Situational Awareness				
8. Asks appropriate questions of higher (ICC) or adjacent echelon crews, staffs, or units	0	1	2	3
9. Crosschecks information using multiple sources (equipment, crew, ICC, BCP, another ECS)	0	1	2	3
10. Recognizes when a form of communications goes down	0	1	2	3
11. Correctly compensates for communications loss	0	1	2	3
12. Recognizes when system indicators are faulty or inaccurate	0	1	2	3
13. Uses all available and reasonable means to restore or compensate for system faults or failures	0	1	2	3
14. Applies tactical situation knowledge to the operation of the system	0	1	2	3
15. Maintains system in the correct mode	0	1	2	3
16. Acknowledges change in situation	0	1	2	3

Indicator	Effectiveness			
	0 = Never Effective		2 = Frequently Effective	
	1 = Sometimes Effective		3 = Always Effective	
C. Interpretation				
17. Identifies threat tracks correctly	0	1	2	3
18. Correctly identifies friendly air assets	0	1	2	3
19. Engages threats to protected asset in appropriate priority	0	1	2	3
20. Takes/makes correct response to system indicators	0	1	2	3
21. Changes track identification based on new or modified ROE or HEU commands	0	1	2	3
D. Crew Resource Management				
22. Uses correct brevity communications externally and with crewmembers	0	1	2	3
23. Responds correctly to brevity language communicated externally and by crewmembers	0	1	2	3
24. Effectively communicates received information in a timely manner	0	1	2	3
25. Effectively prioritizes tasks as air battle demands increase	0	1	2	3
26. Maintains systems operation when short one crewmember	0	1	2	3
27. Seeks crewmember confirmation/challenges to own interpretation	0	1	2	3
28. Performs other crewmembers' responsibilities effectively when needed	0	1	2	3
29. Recognizes and supports other crewmembers' needs	0	1	2	3
E. Decision-Making				
30. Makes correct decisions when ICC/BCP decision support is not available	0	1	2	3
31. Makes timely decisions to protect friendly asset	0	1	2	3
32. Uses all available information to make decisions	0	1	2	3
33. Provides accurate information for decision making	0	1	2	3
34. Applies rules and permissions correctly to decision making	0	1	2	3
35. Makes decisions quickly when the situation calls for it	0	1	2	3

Part II**Individual Reflection Questions**

1. What are your crew's strengths (i.e., what do you do well)? Which crewmembers exhibit each strength?
2. What are your crew's weaknesses (i.e., where could you improve)? Which crewmembers exhibit each weakness?
3. How does this impact how you'll distribute tasks amongst crewmembers in the short-term?

Part III**Crew Team Assessment**

Based on your individual answers, your crew discussion, and the results of the pre-training ABM performance assessment, what are your team strengths and weaknesses?

Slide 13



Module Summary



- You should now be able to:
 - Define task saturation.
 - Identify the signs of task saturation.
 - Identify task responsibilities that can be shared across crewmembers.
 - Identify crew strengths and weaknesses.

13

Module Summary



- Explain that this module helped crews gain a shared understanding of their current crew situation. They should now be able to:
 - Define task saturation.
 - Identify the signs of task saturation.
 - Identify task responsibilities that can be shared across crewmembers.
 - Identify crew strengths and weaknesses.
- Answer any questions participants may have about this module.
- Point out that in the next module, participants will learn strategies for improving crew team performance to help mitigate task saturation.

Module 2: Plan Formulation

Learning Objectives

- Describe strategies for mitigating task saturation.
- Given a scenario, develop a plan for mitigating task saturation.
- Determine intra-crew communication rules and norms.

Estimated Time

90 minutes

Facilitation Agenda

Topics	Method	Time
Module Overview	Lecture	2 minutes
Strategies for Mitigating Task Saturation		
Task Saturation Mitigation Strategies	Lecture	1 minute
Conduct “What If” Scenarios	Lecture	2 minutes
Conduct Mutual Performance Monitoring and Provide Backup Support	Lecture	5 minutes
Prioritize Tasks	Lecture	4 minutes
Redistribute Tasks	Lecture	4 minutes
Develop a Personal Crew Plan	Activity	30 minutes
Intra-Crew Coordination and Communication		
Communication Strategies	Discussion	20 minutes
Handling Conflict	Lecture	1 minutes
Conflict Management Activity	Activity	20 minutes
Module Summary	Lecture	1 minute
Total Estimated Time		90 minutes

Slide 1



Module 2: Plan Formulation

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1

Module Overview



- Explain that, in this module, crews will learn strategies for improving crew team performance to help mitigate task saturation. As they go through this module, crews will develop a Personal Crew Plan that identifies rules and norms for how their crew will react and respond to situations in an effort to mitigate or reduce task saturation.

Facilitator Note:

If this module is taught separately from Module 1: Assessing the Situation, provide a brief refresher of what was covered in Module 1 before beginning Module 2:

- Defined task saturation and identified signs that it is occurring
- Worked with your crew to recognize your “tells”
- Discussed ECS crew roles and responsibilities and reviewed a case study
- Reviewed the importance of understanding crew knowledge and experience and conducted an exercise to formulate a team assessment of crew strengths and weaknesses
- {Highlight any other important discussion items that took place during this module}

Slide 2



Task Saturation Mitigation Strategies



- Conduct “what if” scenarios
- Conduct mutual performance monitoring and provide backup support
- Prioritize tasks
- Redistribute tasks

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Task Saturation Mitigation Strategies



- Explain that while it may not be possible to eliminate task saturation, there are strategies crews can implement to better manage task saturation when it does occur.
- List the following strategies that can be used. Each strategy will be discussed in more detail during this module:
 - Conduct “what if” scenarios.
 - Conduct mutual performance monitoring and provide backup support.
 - Prioritize tasks.
 - Redistribute tasks.

Facilitator Note:

Note that this slide is solely an advance organizer. Each of these strategies will be explained in detail in the following slides.

Slide 3



Conduct “What If” Scenarios



- Devise a plan of action based on likely trigger events (e.g., new STO comes in, comms go down).
- Helps crews gain efficiencies as the complexity of the air battle increases.



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Conduct “What If” Scenarios



- Emphasize that planning how to react and respond to changing situations and conditions plays a significant role in the success of the overall mission.
- Explain that establishing a crew-wide understanding of priorities and evaluating the points at which task saturation is likely to occur will help a crew develop a plan to avoid common obstacles.
- Point out that during slow or down times, crewmembers should talk through “what if” scenarios to plan what to do and who does what under different situations.
 - This includes specifying alternative courses of action and rules that the crew will use at the appropriate time if/when needed. For instance, the crew may devise a plan of action that would take effect if a new STO comes in, communications go down, crewmembers need to mask up, or a man station goes down.
 - Good contingency planning rests on “if/then” logic tied specifically to various “trigger events.”
- Highlight that spending time up front to discuss and plan for these matters will help crews gain efficiencies as the complexity of the air battle increases. Crews should then go and try out the plan to see if what they decided on actually works and adjust as needed.
- Remind participants that when a new crewmember comes over from another crew, crewmembers may need to renegotiate who does what.

Slide 4



Mutual Performance Monitoring





- Establishing a “shared mindfulness” among team members will help identify when backup support is needed.
- Providing backup support is the foundation of high-performing teams.

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Conduct Mutual Performance Monitoring and Provide Backup Support



- Explain that keeping track of your crewmembers’ actions, inactions, and performance will contribute to the team successfully completing a mission. Crewmembers should offer backup support when monitoring reveals a problem.
- Point out that providing backup support is the foundation of high-performing teams. It establishes a shared “mindfulness” among team members that helps to focus on the mission objective at hand. Working as a team, the crew can make up for any individual who is momentarily overwhelmed.
 - Examples of ways crews can support one another during an air battle include having one crewmember track what is due next and verbalizing the due time as it approaches or maintaining an electronic version of the fault handbook for easy access.
- Emphasize that crews should continually be aware of the actions of their crewmembers and watch for mistakes, slips, lapses, errors, and performance discrepancies in an effort to catch and correct them in a timely manner.
 - This awareness enables crewmembers to recognize when assistance may be needed.
 - When a crewmember needs help, feedback in the form of verbal suggestions or coaching can assist in getting performance back on track by alerting the crewmember to the adaptive action needed.

-
- Provide an example: Crewmember A realizes that Crewmember B is having difficulty based on Crewmember B's "tells". Crewmember A may either offer verbal instruction or offer to temporarily take over a specific responsibility of Crewmember B until the problem is resolved.
 - If you offer to perform a task for another crewmember, your crewmembers must be able to trust that you will effectively complete the task in a timely manner. Take on additional tasks that you are confident you can successfully accomplish. If conditions change, let your crewmembers know.
 - If a crewmember makes a mistake, don't allow him/her to shut down. Encourage him/her to stay motivated. Remind that crewmember that he/she is still needed to contribute to ABM.
 - Explain that it is the information gathered through mutual performance monitoring and expressed through feedback, backup support, and coordination that boosts the team beyond the sum of individual performance to the synergy of teamwork and, in doing so, promotes plan execution and team adaptation.
 - Point out that backup support can occur in response to specific requests for help or from recognition that there is a task workload distribution problem in the team.
 - When underutilized individuals back up the individual whose capacity is being surpassed, teams can dynamically adjust and perform at a level that could not have been otherwise achieved by individuals acting alone.
 - In contrast, when there isn't a legitimate need for backup support, the provision of such support can actually detract from team performance because it leads to redundant instead of complementary behavior.
-

Slide 5



Prioritize Tasks

PRIORITIES

1
2
3

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5

Prioritize Tasks



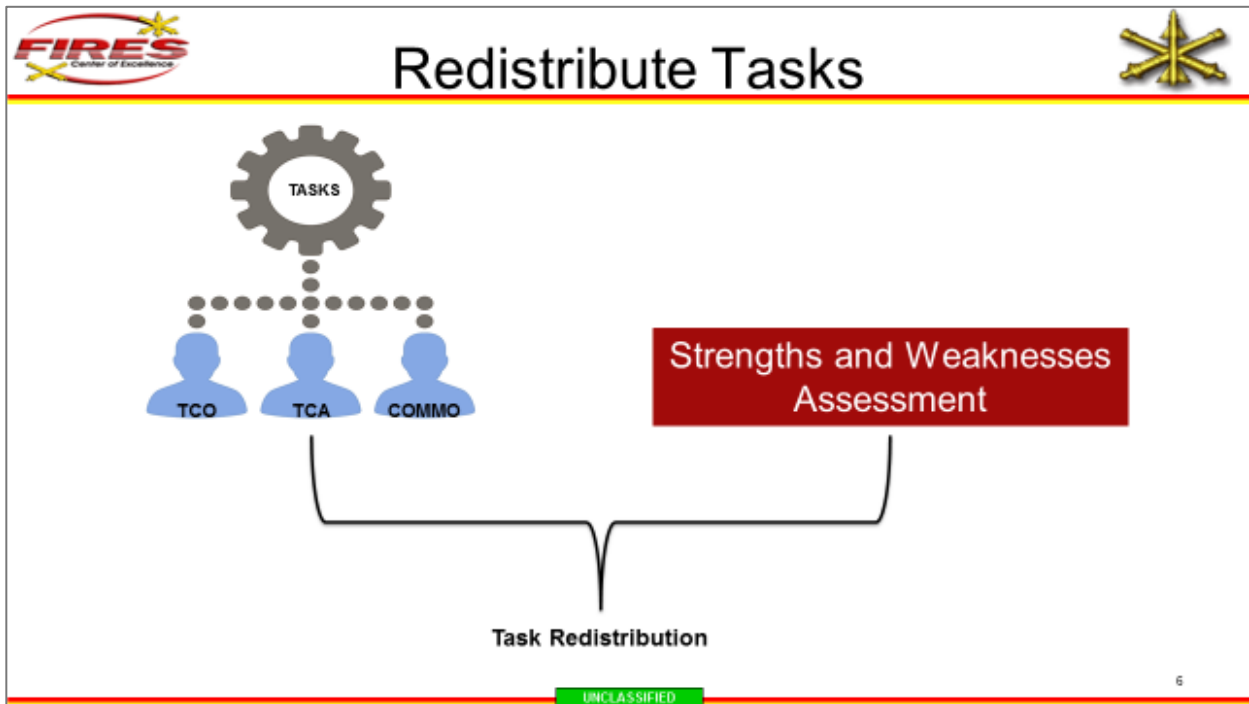
- Explain that task prioritization requires crewmembers to maintain focus on the most important initiatives, peeling away peripheral tasking at the individual level.
- Point out that because it's very difficult for crewmembers to recognize their own task saturation, mutual support is integral to helping them recognize the signs.
- Emphasize that once a crewmember recognizes that task saturation has set in, the crewmember should redistribute his/her tasks sequentially from bottom to top.
 - If an item is not strategically aligned with the mission objective, cross it off or lower its priority. For example, if the radio goes down to the BCP but the chat option with the BCP is still available and the crew is in the middle of a STO change and heavy engagements, then the COMMO can try to fix the radio after the STO and engagements.
 - If an item is tactically important and still must be done, delegate this task to a less task saturated crewmember.
- Tie in the Newspaper Challenge Activity from Module 1 by reminding participants that when the breaking news story hit unexpectedly, teams had to reprioritize tasks.



- Ask participants:
 - What tasks are perceived to be a higher priority?

-
- *Answers will vary but might include STOs, tracks within 50k heading toward the asset, engagement, NMC faults, and launch station down.*
 - What might change that priority?
 - *Answers will vary but might include if a major fault occurs or if there is a major or essential loss of equipment.*
-

Slide 6



Redistribute Tasks



- Point out that there is no set standard for task redistribution among Patriot ECS crews.
 - A strong crew may have more task redistribution because there is trust that each crewmember can fulfill all duties. On the other hand, a strong crew may have less redistribution because each crewmember can multitask and fulfill his specific responsibilities.
 - Certain crews have little difference in roles of TCO and TCA; one does it and the other verifies. Other crews have more defined roles and can complete them in time.
- Remind crews about the discussion they had about tasks that can be shared and the Strengths and Weaknesses Assessment Activity in Module 1. These factors will help inform the crew in the redistribution of tasks.
 - Provide some examples:
 - Mapping is a task that is typically performed by the TCA. However, not everyone is good at mapping. If the TCA struggles with mapping and the TCO is good at it, the TCO may perform this task instead.
 - If the Communications Operator is an E6, he can technically take on more tactical responsibilities.

-
- If there is a STO and a system fault, the TCO will often process the STO while the TCA handles the system fault because the TCA has more experience with the system.
-

Slide 7



Develop a Personal Crew Plan Activity

- Working with your crew:
 - Refer to Exhibit 2-1.
 - Complete Part I of the Personal Crew Plan.
- Be prepared to share your responses.

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Develop a Personal Crew Plan



- Explain that the purpose of this activity is to have crews develop a Personal Crew Plan for mitigating task saturation.
- Refer participants to Exhibit 2-1 in their Participant Guide.
- Working with their crew, have participants spend approximately 20 minutes completing Part I of the Personal Crew Plan.
- Spend approximately 10 minutes conducting a debrief.
- Have a volunteer from each group share its responses.

Facilitator Note:

Emphasize that **there is no one correct answer**. Crews will need to determine what works best for them.

Exhibit 2-1: Personal Crew Plan Activity

Instructions: Complete Part I of the Personal Crew Plan. Parts II and III will be completed later in this module.

Crewmember Names:		Date:	
Part I			
Conduct “What If” Scenarios			
What are the top 10 challenges that can potentially happen during an air battle?			
1.		6.	
2.		7.	
3.		8.	
4.		9.	
5.		10.	
Conduct Mutual Performance Monitoring and Provide Backup Support			
When is task saturation likely to occur?			
How will you know when a member of your crew is becoming task saturated? (Refer to the cues you identified in Module 1.)			
Prioritize Tasks			
Describe the circumstances under which the following tasks would move up or down in priority.			
Responding to a STO			
Fixing a system fault			

Slewing the radar				
Implementing an ACMAF				
Reclassifying track(s)				
Addressing an NMC launcher				
Fixing downed communications				
Redistribute Tasks				
Using the list of challenges that can potentially happen and where task saturation is likely to occur from above and based on the strengths and weaknesses of your crew (from the Module 1 assessment), who should you redistribute tasks to and why?				
If	Then			Rationale
	TCO	TCA	COMMO	
	TCO	TCA	COMMO	
	TCO	TCA	COMMO	
	TCO	TCA	COMMO	
	TCO	TCA	COMMO	
Part II				
Communication Strategies				
Document your crew's agreed-upon rules and norms for the communication strategies below.				
Call-outs				

Hand-offs**Check-backs****Part III****Conflict Management**

Document your crew's agreed-upon rules and norms for handling task saturation-related conflict.

Situation	Crew Norm/Rule

Slide 8



Communication Strategies



Call-outs

- Crewmembers verbalize what they are doing
- Inform all crewmembers simultaneously for shared situational awareness
- Help crews anticipate next steps

Hand-offs

- Used to direct information to a specific individual
 - Task redistribution
 - Clarity of information
 - Verbal communication of information
 - Acknowledgement by receiver

Check-backs

- Used to verify and validate information exchanged
- Sender initiates message, receiver accepts message and confirms what was communicated, and sender verifies that message was received

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Communication Strategies



- Explain that communication is critical for maintaining shared knowledge and situational awareness across the crew.
- Emphasize that communication occurs not only within your crew but also with the ICC, BCP, and higher echelons.
 - Remind participants that standard brevity language exists and is important to follow when communicating across party lines and when other DoD organizations are involved. However, within your crew, you may personalize how you convey information.
- Point out that verbal communication can be further challenged when masked (loss of clarity) or when a team member is soft spoken or has an accent. Therefore, it is important that crewmembers speak clearly.
- Describe some communication strategies that can be used:
 - Call-outs** are when crewmembers speak aloud what they are doing. Call-outs are a way of informing all crewmembers simultaneously for shared situational awareness. Call-outs can also be used to repeat information received that will affect the crew, so that crewmembers can anticipate next steps.
 - Provide the following examples:
 - Example of a crewmember calling out what he is doing: “Slewing the radar.”

- Example of a crewmember calling out a party line communication: “STO coming in.” In this example, the call-out will help the TCO anticipate that the TCA will likely pass Weapons Control to the TCO in order to process the STO.
- Newly formed crews or crews that have a new team member will likely need to “talk out loud” more often until they grow comfortable with one another and learn what is expected of them.



- Ask participants:
 - Within your crew, what level of detail do you want your team members to call out? Using what specific brevity language?
 - *Answers will vary by crew.*



- **Hand-offs** are used to direct information to a specific individual.
 - There are some important elements to conducting hand-offs:
 - Task redistribution – When handing off a task, it is your responsibility to know that the person who must accept responsibility is aware of assuming that responsibility. Similarly, you are accountable until both parties are aware of the transfer of task responsibility.
 - Clarity of information – When uncertainty exists, it is your responsibility to clear up all ambiguity of the task responsibility before the transfer is completed.
 - Verbal communication of information – You cannot assume that the person obtaining responsibility will read or understand written or nonverbal communications.
 - Acknowledgment by receiver – Until it is acknowledged that the hand-off is understood and accepted, you cannot relinquish your task responsibility.
 - Example: Giving an engagement command



- Ask participants:
 - Within your crew, is there a particular way or certain language you should use when handing off different types of tasks?
 - *Answers will vary by crew. Possible responses include different levels of clarity for different tasks (i.e., the brevity that will be used; the word(s) for accepting a task).*



- **Check-backs** are used to verify and validate information exchanged.
 - It involves the sender initiating a message, the receiver accepting the message and confirming what was communicated, and the sender verifying that the message was received.

-
- Check-backs are commonly used as part of call-outs to confirm information exchange and as part of hand-offs to validate task redistribution.
 - When under task saturation, crews may need to verbalize more and acknowledge “I got it.”
 - Sometimes you may have an expectation that the crewmember should have responded after a certain amount of time. If you do not receive a response, you may want to do a check-back to confirm receipt of your initial message. The crew should discuss how long is acceptable to wait for a response.
 - Example: The TCA needs to redistribute his tasks (engagement monitoring) to comply with a radar slew command, so he calls out to the TCO “take my switches.” The TCO verifies and validates receipt of the hand-off by saying “Roger. Taking your switches.”
-



- Ask participants:
 - Within your crew, what language should be used for a check-back? How long should you wait before requesting a confirmatory check-back?
 - *Answers will vary by crew.*
 - Give crews 10 minutes to add their agreed-upon rules and norms related to call-outs, hand-offs, and check-backs to Part II of their Personal Crew Plan.
-

Slide 9



Handling Conflict



- Explain that when stress peaks and task saturation occurs, it is inevitable that conflicts will arise, particularly when things are going poorly (e.g., a crew misses a STO). Crews should develop a conflict management plan so that team members have agreed-upon rules and norms to use to resolve an issue (e.g., how to address conflict when someone hands off too much or is not handing off task responsibilities when they should be).
- Point out that methods for handling conflict can vary by crew as they develop their own rules and norms. Rules and norms might include specifying a word or phrase that indicates a concern or agreeing to no raised voices.
- Provide an example of a team rule/norm: The TCO attempts to hand off a task to the TCA. In accordance with the established team norm, if the TCA needs to decline, the TCA should say “full-up” and then offer solutions. For example, the TCA should respond, “Full-up. Ask COMMO or tell us which task to deprioritize for now.”

Slide 10



Conflict Management Activity



- Working with your crew:
 - Review each situation in Exhibit 2-2.
 - Discuss how you would handle it.
 - Formulate a team rule/norm and add it to Part III of your Personal Crew Plan.
- Be prepared to share your responses.

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Conflict Management Activity



- Explain that the purpose of this activity is to have crews further build out their Personal Crew Plan to include protocols for handling team conflict.
- Refer participants to Exhibit 2-2 in their Participant Guide.
- Working with their crew, have participants spend approximately 10 minutes reviewing each situation and discussing how they would handle it.
- Spend approximately 5 minutes conducting a debrief of the provided situations.
 - Ask crews if they've had any other task saturation related situations that resulted in team conflict.
- Following the discussion, have crews spend approximately 5 minutes generalizing their responses into team rules/norms and add them to Part III of their Personal Crew Plan.

Exhibit 2-2: Conflict Management Activity**Situation 1**

The TCO formally hands off a task to you that you think will overload you, but you take it on. You then discover the TCO is doing the task anyways. How would you handle this situation?

Situation 2

The TCA is showing signs of tunnel vision by focusing on a single task and not performing other tasks. You suspect that task saturation is occurring, so you step in to help but the TCA becomes belligerent and won't hand off tasks. How would you handle this situation?

Situation 3

The COMMO recently joined a new crew. His last crew handled stressful situations in a quiet and calm manner. Therefore, he was quite taken aback when he was chewed out for not completing a task in a second! Things got really heated in the van that day. How would you handle this situation?

Slide 11



Module Summary

- You should now be able to:
 - Describe strategies for mitigating task saturation.
 - Given a scenario, develop a plan for mitigating task saturation.
 - Determine intra-crew communication rules and norms.

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Module Summary



- Explain that this module helped crews formulate a plan for mitigating task saturation. They should now be able to:
 - Describe strategies for mitigating task saturation.
 - Given a scenario, develop a plan for mitigating task saturation.
 - Determine intra-crew communication rules and norms.
 - Answer any questions participants may have about this module.
 - Point out that in the next module, participants will learn about the importance of team learning and will then play an ABM Game to practice the strategies for mitigating task saturation.
-

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Module 3: Practice and Learn

Learning Objectives

- Describe key factors for team learning.
- Using the ABM Game, apply strategies for mitigating task saturation.

Estimated Time

65 minutes (time will vary depending on the number of crews in the class and number of facilitators)

Facilitation Agenda

Topics	Method	Time
Module Overview	Lecture	1 minute
Team Learning		
Importance of Team Learning	Lecture	1 minute
Key Factors for Team Learning	Lecture	1 minute
Practice		
Practice Mitigating Task Saturation	Lecture	1 minute
ABM Game	Activity	60 minutes
Module Summary	Lecture	1 minute
Total Estimated Time		65 minutes

Slide 1



Module 3: Practice and Learn

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1

Module Overview



- Explain that, in this module, crews will first learn about the importance of team learning and providing psychological safety. Crews will then practice the strategies they learned for mitigating task saturation using the Personal Crew Plan they developed in Module 2.

Facilitator Note:

If this module is taught separately from Module 2: Plan Formulation, provide a brief refresher of what was covered in Module 2 before beginning Module 3:

- Learned strategies for improving crew team performance to help mitigate task saturation, including conducting “what if” scenarios, conducting mutual performance monitoring and providing backup support when needed, prioritizing tasks, and redistributing tasks based on crewmembers’ strengths
- Developed a Personal Crew Plan
- Discussed communication strategies and the need to develop a common language amongst your crewmembers (and others)
- Developed team rules and norms around how to handle conflict when it arises
- {Highlight any other important discussion items that occurred during this module}

Slide 2



Importance of Team Learning



- Try new things
- Take on different roles and responsibilities
- Take risks
- Make (and learn from) errors



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Importance of Team Learning



- Explain that team learning is an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions.
- Point out that training is an opportunity to try new things, take on different roles and responsibilities, take risks, and make errors. Trainees who are allowed to make errors while learning a task achieve a better grasp of task principles than trainees who are prevented from committing errors.

Slide 3



Key Factors for Team Learning



- Promote psychological safety
- Conduct team learning activities after each ABM event
- Integrate improvements into future events

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Key Factors for Team Learning



- Review the following key factors for team learning:
 - **Promote psychological safety:** For maximum learning to occur, crewmembers must be willing to expose themselves by openly and honestly discussing mistakes, shortcomings, and alternative viewpoints. Seeking help and guidance as well as admitting and discussing mistakes are important behaviors to improve team performance. Asking questions should be an accepted practice and should be encouraged. Crewmembers should not feel uncomfortable sharing concerns or questioning situations.
 - **Conduct team learning activities after each ABM event:** Team learning activities may include discussions about what went well, what didn't go well, and how to integrate the feedback to make adjustments (similar to an After Action Review). The team discovers the consequences of previous actions, how to prevent those unintended consequences, and how courses of action can be revised in future training exercises or live events.
 - **Integrate improvements into future events:** It is not enough to simply identify improvements that need to be made. These improvements need to be documented and explicitly integrated into the next training exercise or event in order to improve team performance.

Slide 4



Practice Mitigating Task Saturation



- A good ECS crew:
 - Understands that at times each member could become task saturated.
 - Recognizes everyone's "tells."
 - Knows which tasks can be shared and which cannot.
 - Knows their team strengths and weaknesses.
 - Can effectively redistribute tasks when needed.
 - Knows their call-out, hand-off, and check-back protocols.
 - Knows their brevity language expectations.
 - Maintains an open, honest environment to share and question.

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Practice Mitigating Task Saturation



- Point out that it is now time for crews to take all of the information they learned in this course and practice applying these strategies using the ABM Game.
- Remind participants that a good ECS crew:
 - Understands that at times each member could become task saturated.
 - Recognizes everyone's "tells."
 - Knows which tasks can be shared and which cannot.
 - Knows their team strengths and weaknesses.
 - Can effectively redistribute tasks when needed.
 - Knows their call-out, hand-off, and check-back protocols.
 - Knows their brevity language expectations.
 - Maintains an open, honest environment to share and question.

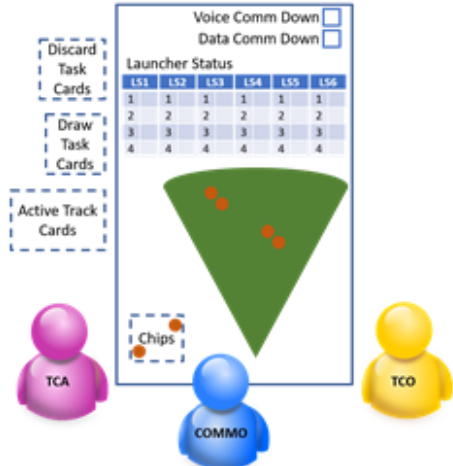
Slide 5



ABM Game Activity



- Practice strategies for improving crew team performance to help mitigate task saturation
 - First half: Pause to talk through thought process
 - Second half: No interruptions
 - Team learning session



The diagram illustrates the ABM Game Activity. It features a central green cone representing a target area. To the left of the cone are three colored circles representing crew members: a purple circle labeled 'TCA', a blue circle labeled 'COMMO', and a yellow circle labeled 'TCO'. Above the cone is a 'Launcher Status' table with columns labeled LS1 through LS6 and rows numbered 1 through 4. To the left of the table are three dashed boxes labeled 'Discard Task Cards', 'Draw Task Cards', and 'Active Track Cards'. Below the table is a dashed box labeled 'Chips' containing two red chips. At the top right of the table are two checkboxes: 'Voice Comm Down' and 'Data Comm Down'. A small number '5' is located at the bottom right of the diagram area.

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ABM Game



- Explain that the purpose of the ABM Game is to tie together all of the learning content and have crews practice the strategies they learned for mitigating task saturation using the Personal Crew Plans they developed in Module 2.
- Point out that, during the first half of game play, the facilitator will periodically pause the game to ask crewmembers questions and have them talk through the actions that they took. Crews will complete the second half of game play without interruption and will then conduct a team learning session.
- Following the team learning session, have crews document what went well and what didn't go well during the game session as well as areas of focus for the next ABM Game session or training event in Exhibit 3-1.
- Refer to Exhibit 3-2 for detailed instructions on how to conduct the ABM Game.

Exhibit 3-1: Documentation of Team Learning Session

Document what went well and what didn't go well during the ABM Game session as well as focus areas for your next ABM Game session or training event.

ABM Game Results	
Date:	What went well
	What didn't go well
Date:	What went well
	What didn't go well
Date:	What went well
	What didn't go well
Date:	What went well
	What didn't go well
Date:	What went well
	What didn't go well

Exhibit 3-2: Conducting the ABM Game

Read below for detailed instructions on how to conduct the ABM Game. It is recommended that you have a timekeeper so that you can engage crews and observe their actions during game play.

Overview

- **Purpose:** The purpose of the ABM Game is to tie together all of the learning content and have crews practice the strategies for mitigating task saturation using the Personal Crew Plans they developed in Module 2. It is a cooperative game in which the goal is for the crew to succeed as a team. It is not intended for a single player to win the game.
- **Time:** The ABM Game session will last approximately 60 minutes per crew:
 - 20 minutes of game play with periodic interruptions to ask crewmembers probing questions and talk through the actions that they took
 - 20 minutes of game play with no interruptions and crew performance assessed
 - 20 minutes for a team learning session
- **Scheduling Parameters:**
 - One facilitator must be available per crew to assess each crew. One timekeeper per crew is also highly recommended.
 - The number of crews that will be able to complete the ABM Game simultaneously will depend on the number of available facilitators.
 - If it is not possible for all crews to complete the ABM Game at the same time, it is recommended that crews be provided designated times for their turn to play.

Game Materials

The following materials are required for game play and should be distributed to each crew. Some materials may not be readily available depending on where the game is being conducted. The guidance below provides alternative suggestions when the materials are not available.

- **ABM Game instructions (1 per participant).** The game instructions are located in Appendix D.
- **ABM Game materials (one set per crew).** The following materials can be found in Appendix E.
 - **Game board.** The game board should be printed on 11 x 17 paper and laminated if possible. The game board could be printed in halves on 8 ½ x 11 sheets of paper and then taped together. It is not recommended to shrink the game board to one 8 ½ x 11 sheet of paper as the size will be difficult to see active tracks and use the status areas.
 - **Task cards.** The task cards should be printed single-sided and cut the same size so that it is easier to shuffle them. To add more task cards, print the blank task card page, write the new task information on it, and add it to the task deck. If you add a new track, it should be added to the game board.
 - **STO cards.** The STO cards should be printed single-sided and cut the same size as the task cards. The STO cards should be kept separate from the task cards. After the task cards have been shuffled, the facilitator should insert the STO cards in sequential order at random locations within the task card deck.

- **Assessment form.** During the second half of game play, the facilitator will assess crew performance using this form.
- **Die (one per crew).** The roll of the die determines the number of task cards a player draws from the pile. Alternatively, the numbers one through six could be randomly drawn from a pile or could be randomly generated using a mobile phone app.
- **Timer (one per crew).** The timer is used to track the duration of the first half of game play, the duration of the second half of game play, and an individual player's turn time. A stop watch, a mobile phone app, or other means can be used to track these times.
- **Transparent chips (23 per crew).** Each chip is placed over an active track on the game board. The game board was sized for using 3/4-inch translucent discs (e.g., bingo chips). The transparency allows the players to see the type of active track. If transparent chips are not available, players can use a pencil to circle active tracks and cross out tracks taken out by friendlies or the crew.
- **Erasable marker (one per crew).** When the game board is laminated, an erasable marker will be needed to note the launcher and missile status and the communication (data and voice) status. If the board is not laminated, a pencil and eraser would work.

Talk-through Questions

Below is a list of potential questions you might ask crewmembers during the first half of game play:

- What were you thinking when you did XXX?
 - What was happening that made you think that?
- What did you expect to happen when you did XXX?
 - Did you consider other options at the time? If so, what?
- When did you have an indication that XXX was not correct or insufficient in that situation?
- If YYY had occurred, would that change your current course of action? How so?

Assessment

During the second half of game play, observe the game play, take notes on player interactions and decisions, and track the number of task cards completed incorrectly and why the task card was completed incorrectly. At the end of the game, transfer your notes to the assessment form in Appendix E for reference during the team learning session.

Team Learning Session

Following the ABM Game session, ask crewmembers the following questions:

- Overall, how did you feel your crew did during game play?
- Did you find the talk-through portion of game play helpful?
 - If so, how?
 - If not, why not?
- What did your crew do well during the game?
- What did your crew struggle with during the game? Why?
- Did your crew try anything new during game play? How did it go?
- What, if any, adjustments need to be made to your Personal Crew Plan?

- What areas will your crew focus on during your next game session or training event?

Provide additional feedback based on your observations during the ABM Game using the completed assessment form. Include an explanation of why they did not correctly complete a task card and the possible consequences of those actions/inactions.

Have crews document what went well and what didn't go well during the ABM Game as well as areas of focus for the next ABM Game session or training event in Exhibit 3-1.

ABM Game Suggestions

- **Timekeeper.** A timekeeper is highly recommended so that the facilitator can focus on engaging and observing the crew. The timekeeper can be anyone and does not have to have ECS crew experience. The timekeeper should note when the first half of game play time is done so the facilitator can switch to assessing the crew. At that time, we recommend the timekeeper restart the timer. When a player's turn time is up (e.g., a player gets one minute per turn), the timekeeper says "time." The next player rolls the die, the timekeeper notes the time when that occurred, and calls time when a minute has passed. The timekeeper will announce game over when total time reaches 20 minutes or as specified by the facilitator.
- **Crew New to ABM Game.** If new to the game, the facilitator should conduct a brief practice session with the crew. The facilitator should stack the deck such that the top cards include a hostile track card (known and unknown), an engagement card, a launcher card, a communication card, and a system fault card. Each player draws two task cards. Each player must describe the steps he/she would take to complete the task on the card. Each player must provide enough detail so that the facilitator knows the player could accomplish the task in real life; this includes stating the tabs or physical actions to be taken and voicing what is communicated to others. (This is the opportunity for the facilitator to provide players the level of detail expected to indicate successful task completion.) The player must also perform the game actions such as marking when communications go down, noting that a missile was launched, and placing chips on the game board to mark active tracks. The players have now been introduced to the different types of task cards used in the game. Game play can continue with the roll of the die.
- **Game Scoring.** Game score is based on the number of correctly completed task cards during the second half of game play (i.e., the assessed game play). The facilitator will need to note which task cards were completed incorrectly. At the end of the second half of game play, the facilitator enters on the assessment form the number of completed task cards in the discard pile, the number of incorrectly completed task cards noted, and then subtracts the number of incorrect task cards from the total completed cards to attain the number of correctly completed task cards. Scores may be compared over time to show improvement.
 - Optional: If desired, facilitators may maintain a LeaderBoard of crew scores. For example:
 - Crew Team A accurately completed 100 tasks within 20 minutes.
 - Crew Team B accurately completed 100 tasks within 18 minutes.
 - Crew Team C accurately completed 90 tasks within 20 minutes.
- **Game Usage.** The ABM Game can also be used by crews outside of the course to practice task saturation mitigation strategies and to increase their ability to address tasks supporting ABM.

- **Game Complexity.** Depending on individual crew capabilities, the game complexity could be altered by the facilitator. The facilitator could:
 - Change the amount of time allotted per turn (e.g., increase to 2 minutes).
 - Change the total game play time (e.g., extend from 40 minutes to an hour).
 - Stack the deck (include only the more difficult or longer duration tasks).
 - Change the roles crewmembers play.
- **Game Customization.** The ABM Game can be customized to your location, local TTPs, and to the learning needs of each crew. Task cards can be continually added to further enhance the game.

Slide 6



Module Summary



- You should now be able to:
 - Describe key factors for team learning.
 - Using the ABM Game, apply strategies for mitigating task saturation.

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Module Summary



- Explain that this module taught crews the importance of team learning and providing psychological safety to one another. Crews then practiced the strategies they learned for mitigating task saturation using the Personal Crew Plan they developed in Module 2. They should now be able to:
 - Describe key factors for team learning.
 - Using the ABM Game, apply strategies for mitigating task saturation.
- Answer any questions participants may have about this module.
- Point out that the next module will provide a course wrap-up and participants will provide feedback on the course as a whole as well as complete a post-training assessment.

Module 4: Wrap-up

Learning Objectives

- N/A

Estimated Time

45 minutes (time will vary depending on the ABM level required to generate task saturation in crews during the post-training ABM performance assessment, number of crews in the class, and number of facilitators)

Facilitation Agenda

Topics	Method	Time
Module Overview	Lecture	1 minute
Course Review		
Course Goal	Lecture	1 minute
Course Objectives	Lecture	1 minute
Participant Expectations	Discussion	2 minutes
Course Evaluation	Activity	5 minutes
Post-training Assessment	Assessment	35 minutes
Total Estimated Time		45 minutes

Slide 1



Module 4: Wrap-up

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1

Module Overview



- Explain that the purpose of this module is to briefly review the content that was covered in the course and review the course goal and objectives. The facilitator will also revisit the list of participant expectations generated at the beginning of the course to ensure that all expectations were met and address any remaining questions.
- Point out that at the end of the module, participants will be asked to complete a Course Evaluation Form. Participants will also complete a post-training assessment consisting of both a knowledge assessment and an ABM performance assessment.

Facilitator Note:

If this module is taught separately from Module 3: Practice and Learn, provide a brief refresher of what was covered in Module 3 before beginning Module 4:

- Learned the importance of and key factors for team learning
- Practiced applying strategies for mitigating task saturation using the ABM Game
- Conducted a team learning session
- {Highlight any other important discussion items that occurred during this module}

Slide 2



Course Goal



- Improve crew team performance by providing strategies and techniques to help crews mitigate task saturation.

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Course Goal



- Point out that the goal of this course was to improve crew team performance by providing strategies and techniques to help crews mitigate task saturation when it occurs.

Slide 3



Course Objectives



- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.

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Course Objectives



- Explain that participants should now be able to:
 - Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
 - Develop a Personal Crew Plan for mitigating task saturation.
 - Improve crew performance in mitigating task saturation through practice and team learning.

Slide 4



Participant Expectations



- How well did this course meet your expectations?
- How do you plan to use what you learned?



4

Participant Expectations



- Review the list of participant expectations generated at the beginning of the course.



- Ask participants:
 - How well did this course meet your expectations?
 - *Acknowledge participants' responses and, if needed, explain how each expectation was addressed in the training.*
 - How do you plan to use what you learned?
 - *Acknowledge participants' responses.*

Slide 5



Course Evaluation



- Complete the Course Evaluation Form and return it to the facilitator.
 - Gives participants an opportunity to provide feedback regarding their observations of the course's strengths and weaknesses
 - Used to improve future iterations of the course

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Course Evaluation



- Hand out the Course Evaluation Form located in Appendix F to participants.
- Point out that course evaluations are one way that helps to measure the effectiveness of the training. Participants do not have to put their names on the evaluation form.
- Stress that the Course Evaluation Form gives participants an opportunity to provide feedback regarding their observations of the course's strengths and weaknesses. This valuable feedback will be used to improve future iterations of the course.
- Have participants return their completed Course Evaluation Form to the facilitator.

Slide 6



Post-training Assessment



- Measures participants' growth in knowledge and skills
- Used to determine course effectiveness



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Post-training Assessment



- Explain to participants that they will now complete a post-training assessment that, similar to the pre-training assessment, consists of a knowledge assessment followed by an ABM performance assessment.
- Point out that by assessing participants' knowledge and skills at the beginning and end of the course, we are able to measure how effective the course is.
- Hand out the post-training knowledge assessment located in Appendix G to participants. Exhibit 4-1 on the next page contains the answer key for the knowledge assessment. The correct answers are bolded.
- Once everyone has completed the post-training knowledge assessment, conduct the ABM performance assessment. Recommendations for conducting the ABM performance assessment are provided in Exhibit 4-2.

Exhibit 4-1: Answer Key for Post-training Knowledge Assessment

1. The qualities of an effective crew include all of the following EXCEPT:
 - a. Crewmembers adhere to established communication protocols.
 - b. Crewmembers focus on their own crew responsibilities.**
 - c. Crewmembers recognize each other's "tells" that they are becoming task saturated.
 - d. Crewmembers maintain an open environment to share and question.
2. Which of the following statements about crew task responsibilities is the most accurate?
 - a. A task may be performed by any crewmember regardless of role.
 - b. Crewmembers should only perform the tasks associated with their role.
 - c. Friendly protect can be delegated to another crewmember.
 - d. A task may be performed by any crewmember, but it should be delegated to the crewmember if it does not fall under his/her role.**
3. Which communication strategy can be used to help crewmembers anticipate next steps?
 - a. Check-back
 - b. Touch-back
 - c. Call-out**
 - d. Hand-off
4. Task saturation is:
 - a. When a task is unfamiliar to a crewmember.
 - b. When multiple issues occur at the same time that diminishes crew performance.**
 - c. When a crewmember performs more tasks than the other crewmembers.
 - d. When a crew cannot perform a difficult task.
5. All of the following are strategies for mitigating task saturation, EXCEPT:
 - a. Provide backup support.
 - b. Conduct "what if" scenarios.
 - c. Conduct mutual performance monitoring.
 - d. Maintain current task distribution and prioritization.**
6. The main benefit of understanding crewmembers' strengths and weaknesses is it allows you to:
 - a. Identify performance hindrances.
 - b. Avoid distributing tasks to the weakest crewmember.
 - c. Determine how each crewmember can best contribute to crew performance.**
 - d. Identify the crewmember that can take on the majority of the tasks.

7. Which of the following is a key factor for team learning?
 - a. **Be willing to openly share problem areas**
 - b. Avoid topics that are known to cause team conflict
 - c. Practice easy-to-implement improvements during the next training
 - d. Minimize the number of questions asked to complete training on time
8. Which of the following is a sign of task saturation?
 - a. Increased performance under stress
 - b. Increased energy
 - c. Effective multitasking
 - d. **Heightened emotional displays**
9. The purpose of a crew's conflict management plan is to develop:
 - a. Recommendations on how to redistribute tasks during task saturation.
 - b. **Agreed-upon rules and norms to resolve an issue.**
 - c. A list of crewmembers' "tells" during a conflict.
 - d. Evidence of a team member's poor performance.
10. Which of the following is NOT likely a cause of task saturation?
 - a. **Fighting an air battle with few tracks to identify**
 - b. Loss of communications with the ICC
 - c. One crewmember is experienced and assumes multiple tasks
 - d. A replacement crewmember with little ECS experience

Exhibit 4-2: Recommendations for Conducting the ABM Performance Assessment

Read below for detailed instructions on how to conduct the ABM performance assessment. It is recommended that you utilize the SGG to automate injects and inputs as much as possible so that you can observe the actions during the performance assessment and ensure task saturation is attained.

Overview

- **Purpose:** The purpose of the post-training ABM performance assessment is to assess whether each crew's performance improved with the implementation of strategies to mitigate task saturation.
- **Time:** Each air battle will last approximately 20 minutes.
 - One facilitator must be available per crew to assess each crew.
 - The number of crews that will be able to complete the ABM performance assessment simultaneously will depend on the number of available facilitators and available equipment.
 - If it is not possible for all crews to complete the exercise at the same time, it is recommended that crews be provided designated times for their assessment.
- **Scenario Development:** Below is a list of potential injects that can be used to create task saturation. Be sure to combine and time these injects to create task saturation:
 - Alert state changes (e.g., a TBM has been detected or enemy aircraft detected by radar)
 - Orders coming in (STO or ACMAF) that temporarily takes out a crewmember
 - Launcher goes NMC or Missile Hazard/Missile Misfire
 - Tactical order comes in to make system modifications or configure systems differently
 - Comms go down (data or voice or both)
 - ICC loses picture so ECS screen info has to be relayed verbally to ICC or vice versa
 - System fault
 - Order to slew the radar
 - mIRC chat and Outlook communications
 - Change self-defense criteria (e.g., from 10,000 feet to 5,000 feet)
 - Change in ROE - couldn't engage aircraft previously but now can
 - ICC is busy so need to conduct own track identification
 - Multiple aircraft at once so have to prioritize tracks
 - Ambiguous/unknown track – doesn't fit with current threats
 - Voice warnings from SADC
 - Commo has to leave the van to battle short the EPP
 - ICC requests missile/ammo status
 - ICC notifies the crew to hold fire on engaged track or requires ECS to change ID on track due to communication degradation

- **Assessment tool:** Facilitators should use the Supervisory Control Skills Assessment located in Appendix B to assess each crew's ABM performance.

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Appendix A: Pre-training Knowledge Assessment

Knowledge Assessment **Crew Designation**_____ **Crew Position** _____

Directions

Circle the letter corresponding to the best response for each question.

1. Task saturation is:
 - a. When a crewmember performs more tasks than the other crewmembers.
 - b. When a crew cannot perform a difficult task.
 - c. When a task is unfamiliar to a crewmember.
 - d. When multiple issues occur at the same time that diminishes crew performance.
2. Which of the following is a sign of task saturation?
 - a. Increased energy
 - b. Increased performance under stress
 - c. Heightened emotional displays
 - d. Effective multitasking
3. Which of the following is NOT a likely cause of task saturation?
 - a. Loss of communications with the ICC
 - b. Fighting an air battle with few tracks to identify
 - c. A replacement crewmember with little ECS experience
 - d. One crewmember is experienced and assumes multiple tasks
4. Which of the following statements about crew task responsibilities is the most accurate?
 - a. Crewmembers should only perform the tasks associated with their role.
 - b. A task may be performed by any crewmember regardless of role.
 - c. A task may be performed by any crewmember, but it should be delegated to the crewmember if it does not fall under his/her role.
 - d. Friendly protect can be delegated to another crewmember.
5. The main benefit of understanding crewmembers' strengths and weaknesses is it allows you to:
 - a. Avoid distributing tasks to the weakest crewmember.
 - b. Determine how each crewmember can best contribute to crew performance.
 - c. Identify performance hindrances.
 - d. Identify the crewmember that can take on the majority of the tasks.

6. All of the following are strategies for mitigating task saturation, EXCEPT:
 - a. Conduct “what if” scenarios.
 - b. Provide backup support.
 - c. Maintain current task distribution and prioritization.
 - d. Conduct mutual performance monitoring.
7. Which communication strategy can be used to help crewmembers anticipate next steps?
 - a. Call-out
 - b. Hand-off
 - c. Check-back
 - d. Touch-back
8. The purpose of a crew’s conflict management plan is to develop:
 - a. A list of crewmembers’ “tells” during a conflict.
 - b. Evidence of a team member’s poor performance.
 - c. Agreed-upon rules and norms to resolve an issue.
 - d. Recommendations on how to redistribute tasks during task saturation.
9. The qualities of an effective crew include all of the following EXCEPT:
 - a. Crewmembers focus on their own crew responsibilities.
 - b. Crewmembers adhere to established communication protocols.
 - c. Crewmembers maintain an open environment to share and question.
 - d. Crewmembers recognize each other’s “tells” that they are becoming task saturated.
10. Which of the following is a key factor for team learning?
 - a. Avoid topics that are known to cause team conflict
 - b. Be willing to openly share problem areas
 - c. Practice easy-to-implement improvements during the next training
 - d. Minimize the number of questions asked to complete training on time

Appendix B: Supervisory Control Skills Assessment

Purpose: This is a developmental tool for assessing individual and/or collective Patriot ECS crew performance. The assessment is based on indicators related to effective operator supervisory control of systems. This tool is primarily designed for use during air battle management training exercises. It may be used by an external trainer or evaluator (such as a Battery trainer) or as a self-assessment tool by crewmembers.

Form Instructions: Indicate using the boxes below who is performing the assessment and who is being assessed. If applicable, record the date and time span of the air battle during which the assessment was conducted.

This assessment was conducted

1. For: ____ an individual ____ a crew (check one).
2. On: Name/Crew Designation _____
3. By: _____
(Name and position of assessor. For example: self, crew, battery/battalion trainer, etc.)
4. Date Time Group (DTG) of the assessment from: _____ to _____

Assessment Instructions:

1. Using the effectiveness scale provided, identify the individual or crew's effectiveness at performing the indicated behaviors.
2. In the left column write-in space below each set of indicators, describe key air battle situations where an indicator stood out as having an impact on performance (positive or negative).
3. In the corresponding right column write-in space, describe the consequences (positive or negative) that the indicator had on individual or crew air battle management performance.

A. Operation of the System

Indicator	Effectiveness			
	0 = Never Effective 1 = Sometimes Effective	1	2 = Frequently Effective 3 = Always Effective	3
1. Correctly inputs initial system settings	0	1	2	3
2. Accurately modifies initial system settings to reflect changing mission conditions	0	1	2	3
3. Locates system information in time to support mission accomplishment	0	1	2	3
4. Recognizes system faults	0	1	2	3
5. Responds appropriately to system faults	0	1	2	3
6. Recognizes oddities in system information and questions them	0	1	2	3
7. Determines causes of alerts	0	1	2	3
Describe situation(s) in which an indicator stood out when performance either failed or was successful in conducting an air battle.	Describe the performance consequences (positive or negative) of the situation on air battle management.			
	→			
	→			
	→			

B. Situational Awareness

Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
8. Asks appropriate questions of higher (ICC) or adjacent echelon crews, staffs, or units	0	1	2	3
9. Crosschecks information using multiple sources (equipment, crew, ICC, BCP, another ECS)	0	1	2	3
10. Recognizes when a form of communications goes down	0	1	2	3
11. Correctly compensates for communications loss	0	1	2	3
12. Recognizes when system indicators are faulty or inaccurate	0	1	2	3
13. Uses all available and reasonable means to restore or compensate for system faults or failures	0	1	2	3
14. Applies tactical situation knowledge to the operation of the system	0	1	2	3
15. Maintains system in the correct mode	0	1	2	3
16. Acknowledges change in situation	0	1	2	3
Describe situation(s) in which an indicator stood out when performance either failed or was successful in conducting an air battle.	Describe the performance consequences (positive or negative) of the situation on air battle management.			
	→			
	→			
	→			

C. Interpretation

Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
17. Identifies threat tracks correctly	0	1	2	3
18. Correctly identifies friendly air assets	0	1	2	3
19. Engages threats to protected asset in appropriate priority	0	1	2	3
20. Takes/makes correct response to system indicators	0	1	2	3
21. Changes track identification based on new or modified ROE or HEU commands	0	1	2	3
Describe situation(s) in which an indicator stood out when performance either failed or was successful in conducting an air battle.	Describe the performance consequences (positive or negative) of the situation on air battle management.			
	→			
	→			
	→			

D. Crew Resource Management

Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
22. Uses correct brevity communications externally and with crewmembers	0	1	2	3
23. Responds correctly to brevity language communicated externally and by crewmembers	0	1	2	3
24. Effectively communicates received information in a timely manner	0	1	2	3
25. Effectively prioritizes tasks as air battle demands increase	0	1	2	3
26. Maintains systems operation when short one crewmember	0	1	2	3
27. Seeks crewmember confirmation/challenges to own interpretation	0	1	2	3
28. Performs other crewmembers' responsibilities effectively when needed	0	1	2	3
29. Recognizes and supports other crewmembers' needs	0	1	2	3
Describe situation(s) in which an indicator stood out when performance either failed or was successful in conducting an air battle.	Describe the performance consequences (positive or negative) of the situation on air battle management.			
→				
→				
→				

E. Decision-Making

Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
30. Makes correct decisions when ICC/BCP decision support is not available	0	1	2	3
31. Makes timely decisions to protect friendly asset	0	1	2	3
32. Uses all available information to make decisions	0	1	2	3
33. Provides accurate information for decision making	0	1	2	3
34. Applies rules and permissions correctly to decision making	0	1	2	3
35. Makes decisions quickly when the situation calls for it	0	1	2	3
Describe situation(s) in which an indicator stood out when performance either failed or was successful in conducting an air battle.	Describe the performance consequences (positive or negative) of the situation on air battle management.			
	→			
	→			
	→			

Appendix C: Newspaper Challenge Activity

Overview

Your team works for a prominent newspaper. The publication's mission is to inform the public and sell newspapers with interesting and significant stories!

Based on your roles, your team must decide which articles make the front page, and how they will be presented. Your team is responsible for determining the layout of selected articles, the article titles, and selecting and captioning photos.

To meet printing deadlines, your team has **8 minutes** to create your front page.

Roles

Multiple roles are required to accomplish this activity. The roles and their descriptions are provided below. Assign each of your team members a primary role.

Primary Role	Description
Editorial Staff 1	Primary responsibilities include: • Reading and selecting articles for use. • Creating article headlines.
Editorial Staff 2	Primary responsibilities include: • Design layout (e.g., arranging material on the newspaper page). • Ensuring that the entirety of all selected stories and photos fit on the front page.
Photographer	Primary responsibilities include: • Taking photos (i.e., selecting a photo from the pool of provided images). • Captioning the photos. The photographer must receive approval from the editorial staff on both the image and the image caption.

Front Page Requirements

There are several requirements set forth by the publication that are catered to the interests of the target audience. If the front page does not meet all of these requirements, it cannot be printed.

There must be at least three articles on the front page.

- The front page must be created in the landscape layout.
- Articles may be manipulated (cut and rearranged) as long as all text is included.
- All article titles must be fewer than 12 words.
- One article must be politics or sports, not both.
- The headline story cannot be sports or politics.

Each article must have at least one photo.

- The headline story must have two photos.

- Photos must be captioned with 10 or fewer words.
- The photos must accurately represent the story.
- Photos may be manipulated (cut and trimmed) in any way to fit the front page as long as no meaning is lost.

Articles and photos must be taped in place on the front page to be considered final.

It does not matter how your team meets these requirements. When you believe your team has completed an acceptable front page, submit it to the editor (facilitator) for review.

Articles

You've heard of Bitcoin, but have you heard of FrankCoin? In light of the cryptocurrency craze that is hitting the country, Major League Baseball has announced its own cryptocurrency.

Late last week, Major League Baseball announced the release of FrankCoin. FrankCoin is a virtual currency that fans can use in place of USD to purchase concessions at each of the 30 MLB stadiums across the country. Hot dogs, which are often referred to as frankfurters, or franks for short, are fan favorites at ball parks everywhere. It is from this popular snack that FrankCoin gets its name.

"We've been trying to find ways to bring more millennials to ballparks for years. Our hope is that by giving them an alternative – and virtual – method of payment for concessions that we are able to encourage them to come to more games, and also to make more concessions purchases."

Major League Baseball is the first of the major national sports to adopt such a coin.

When asked for comment, the Commissioner of Baseball had this to say:

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The International Olympic Committee (IOC) approved one new sport for the 2024 Summer Olympics to be hosted in Paris, France. After years of campaigning from the bowling industry, the Committee announced that bowling will be played in 2024.

Bowling made its sole appearance at the 1988 Summer Olympic Games in Seoul, South Korea as a demonstration sport. In the Seoul Summer Games, 21 nations and 24 bowlers participated in the exhibition. Despite the fact that all 1,000 tickets for the event were sold, bowling would not see the Olympic stage again. Bowling was deemed to be too expensive for young people in third-world countries to develop skill in, and the sport's Olympic dreams were shelved.

That is, until now. A mysterious organization known as Bowlers for Tomorrow has constructed regulation lanes and donated bowling balls, pins, and shoes to developing nations around the world. Although the intentions of this organization are unclear, one thing is certain: their actions have catapulted bowling into the international spotlight. It is estimated that these efforts over the past several years have tripled the amount of bowlers outside of the United States.

The IOC responded and recognized the large increase in bowlers worldwide (now estimated at 300 million people age twelve and above) by adding bowling to the 2024 Games. Under Olympic rules, professional bowlers will not be allowed to participate, paving the way for a generation of young up-and-comers to take the lanes and go for the gold.

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Tesla CEO Elon Musk announced today the latest venture from his innovative car company: home appliances. Speculation began late last week when Musk tweeted a “thinking face” emoji in response to a question about what was next for the industry giant. The tweet, pictured below, started as a joke according to its author, Twitter user @luv_my_dishwasher.

Appliance Fan @luv_my_dishwasher
1 12:02 PM - 22 Jan 2018

What’s next, @ElonMusk?
Dishwashers?

Musk’s company has already proven itself in the home with its Powerwall home battery. The battery is a rechargeable lithium-ion battery that stores solar power to be used during the night or in the event of a power outage. The battery also boasts 7+ days of continuous power during an outage.

It appears that Musk intends to extend Tesla’s presence in the home with a line of energy-saving home appliances. In the announcement made by Tesla on Monday, Musk said, “We want to continue accelerating sustainability in any way we can, and we believe the next step is with energy-saving appliances.”

On the heels of the announcement, consumers are lining up to buy their own Tesla appliances. It is currently estimated that Tesla’s appliances will be available for preorder in Q4 of this year.

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After a third and final recount, it has been officially determined that Independent candidate Charles Barkley has won the mayoral election of a Virginia suburb outside of Washington, D.C. Barkley, not to be confused with the former NBA star and T.V. announcer of the same name, ran on a platform dedicated to ensuring clean water for residents and animal shelter reform.

His opponents were astounded by the election results. One staffer from an opponent said to reporters, “His policies have no place in the mayor’s office. Barkley is an absolute dog.”

voters over with his preference for belly rubs over barking politics. Although Barkley is only seven years old, his municipality has no age restrictions on mayoral candidates. As his owners put it, “Charlie is particularly mature for his age, and let’s not forget that 7 in dog years is 49 in human years.”

Due to the structure of the municipality’s government, the mayor has become a primarily ceremonial role. That doesn’t mean that Mayor Barkley will be a lame duck mayor, however. The newly elected mayor will attend a ribbon cutting for the groundbreaking of a new dog park downtown. From there, a spokesperson has said that the mayor intends to relax with his family for the weekend before getting back down to business on Monday morning.

It is not clear what the staffer meant with the latter half of his statement, as Barkley is actually a dog. The Chesapeake Bay Retriever won

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An archeological dig site in Wiltshire, England has uncovered hundreds of handwritten recipes estimated to be from the late 20th century. Although many of the recipes have become illegible due to their aging, it is estimated that anywhere from 100-200 can be fully recovered. Wiltshire is best known for another ancient relic – Stonehenge – but the discovery of these recipes is creating new waves in archeological circles around the world.

Archaeologists have revealed that among the documents recovered is a recipe with instructions for the perfect beef wellington. While the scientists continue working to decode the recipe, they have already discovered that instead of olive oil, as is frequently used in making beef wellington, the recipe calls for three tablespoons of Guinness.

the recipe, and were met with this response:

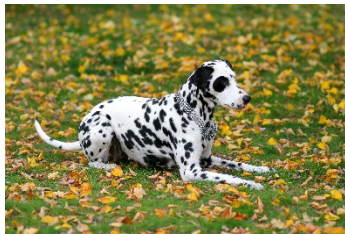
“I can’t imagine it’d be any good. The properties of olive oil are completely different than those of Guinness. It’s hard to say whether this recipe will truly make the perfect beef wellington, but I suppose there’s only one way to find out. I reckon I’ll give it a try when the full recipe is released.”

The dig site is located in a field behind a suburb. Skeptics believe that the recipes were simply discarded by a resident, but archaeologists remain confident in the historical significance of the discovery. On the heels of these findings, the British Archaeological Association (BAA) received additional funding that is expected to last through 2049. With renewed funding and a global spotlight, a BAA spokesperson released the statement below.

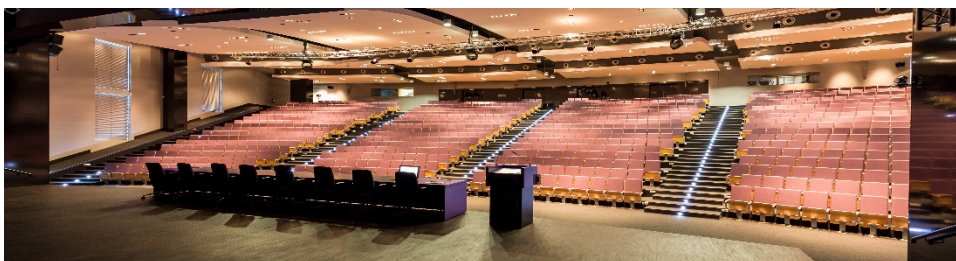
“Archaeologists around the world are celebrating our recent discovery. We hope continuing our Wiltshire digs will both inspire a new generation of archaeologists, and find the perfect fish and chips or the perfect shepherd’s pie.”

Our journalists asked a culinary expert what effect using Guinness instead of olive oil may have on

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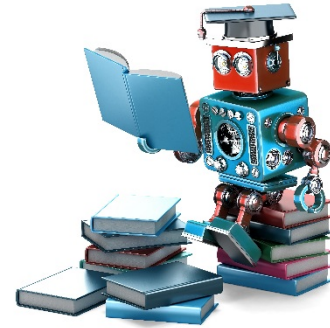
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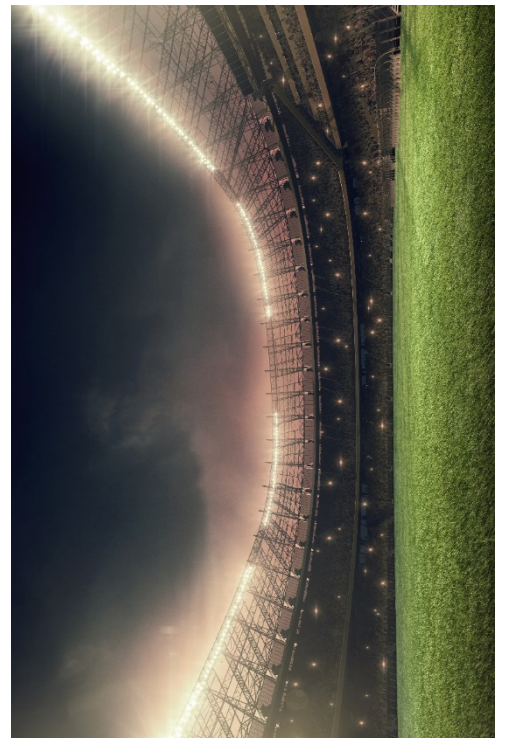
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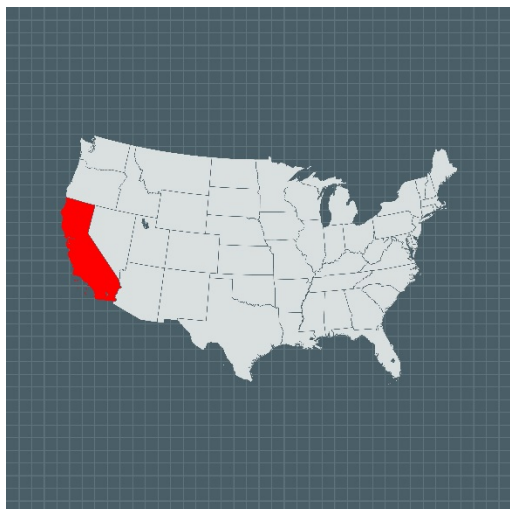
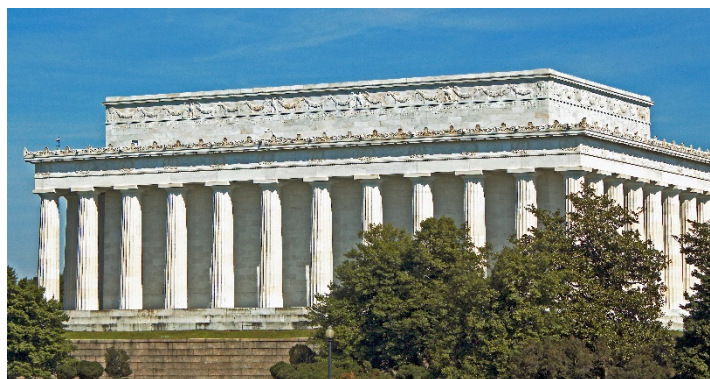
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Inject: Stop the Press!

NASA announces potential extraterrestrial lifeforms found in Colorado. Just yesterday, a meteorite that the agency had been tracking for the past six months crashed down to the Earth and was located in Telluride, Colorado. Skiers and snowboarders watched in awe as the meteorite flashed across the sky near sundown.

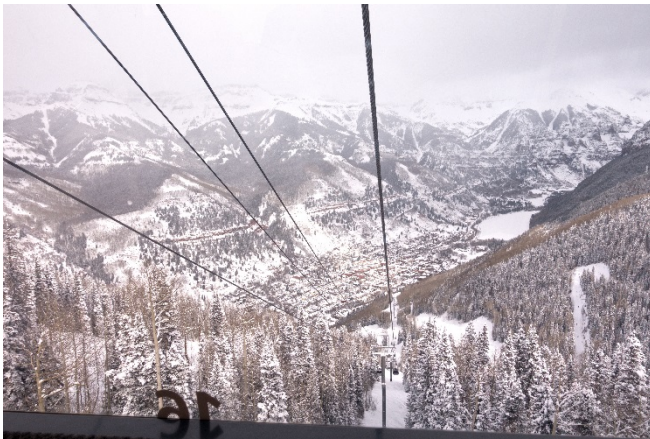
“It was beautiful. I thought someone was firing fireworks, but it’s not the Fourth of July.” One onlooker told reporters.

Others were not as enthusiastic. One father of three had this to say, “When I saw that meteorite, I started skiing for my life! I thought for sure there would be an avalanche. I didn’t know what I was going to do; I just knew I had to get down that mountain if I wanted to see my kids again.”

In early 2017, NASA announced discovery of a solar system filled with Earth-like planets that scientists believed may be capable of supporting life. It is believed that this meteorite originated from the same solar system. NASA first noticed the meteorite from outside of its solar system and have tracked it since.

Tests are being run on samples, and although full reports have not been published, a senior official at NASA has confirmed that the agency believes the samples contain living extraterrestrial organisms. While the world awaits the results of the tests, others are already proclaiming the presence of extraterrestrials. One Telluride business owner acquired a large piece of the space matter when the meteorite crashed behind his coffee shop, Java the Hutt.

“I’m a huge Star Wars fan, so the idea of a life form from a galaxy far, far away landing in my back yard is a dream come true. I can’t wait for the NASA test results, but I know that this meteorite contains other life.” Against the advice of NASA, Java the Hutt has started serving an “Intergalactic Brew,” which contains tiny shards of the meteorite ground with the coffee beans.



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Appendix D: ABM Game Instructions

Game Overview

This is a cooperative game where players must work together in order to succeed. You and your fellow players are members of an ECS crew, working together to conduct air battle management with a Patriot missile system and protect your assets from enemy fire. Each of you will assume a role within the team: TCO, TCA, and COMMO. Your goal is to correctly complete as many tasks as you can within the allotted timeframe.

Game Duration

Total game play is 40 minutes or as specified by the facilitator. During the first half of game play, the facilitator will periodically pause the game to ask you questions. A player's turn time is not limited. At the end of the first half of game play, the facilitator will collect and reshuffle the task cards, re-insert the STO cards, and clear the game board. Game play will restart without interruption and your crew performance will be assessed. A player's turn time is limited to one minute or as specified by the facilitator during the assessment period.

Game Participants

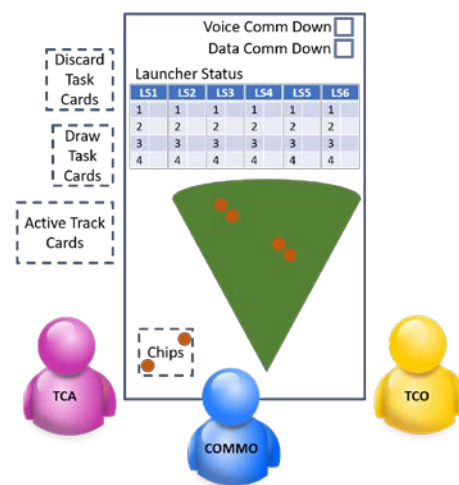
- **Facilitator:** Questions and assesses crew game play
- **Timekeeper:** Notifies crew when the first half of game play has completed; during the second half of game play, tracks time per player turn and notifies crew when the second half of game play has finished
- **Three game players:** One plays as the TCO, one as the TCA, and one as the COMMO

Materials

- Die (1)
- Timer (1)
- ABM game board (includes radar screen)
- Erasable marker to track missile launcher and commo status on game board
- Chips to mark active tracks on radar
- Deck of task cards
- STO cards

Game Setup

- Place the ABM game board and chips in the center of the table/game area.
- Shuffle the deck of task cards and, after the facilitator has inserted the STO cards in sequential order at random locations, place the deck face down next to the game board.
- Leave space for active track cards where all players can see them.
- Leave space to discard completed task cards.



Game Play

The task card deck controls game play. The task card deck has different types of tasks requiring different game play actions. Some cards will indicate you lose a turn at which time you must give your cards to your crew members. Players must always state the actions they would take to address the task. Task cards include:

- **Track card:** This card type describes the status of an enemy or unknown radar track. Place the card face up in the selected area for active track cards, place a chip on the radar screen in the corresponding location, and state how you would handle this card.
- **Launcher status card:** This card type describes if a launcher goes down or is reloaded. Use the erasable marker to track launcher and missile status on the game board so that players can accurately state launcher and missile count status during game play.
- **Engagement card:** This card type states that your crew, or friendly fire, engaged and took out an enemy. Select and remove an active track card and place it in the discard task pile. Also remove the corresponding chip from the game board. If your crew engaged the enemy, remove missiles from a missile launcher using the erasable marker. If you receive this card but have no active tracks, hold onto the card in your hand until an active track appears.
- **Communication card:** This card type provides information to be processed or describes communication status (up or down). State how you would handle the task and then place the card in the discard task pile. For communication status cards, use the erasable marker to track the status on the game board. If you receive a “comms are back up” card but the comms are not down, hold onto the card in your hand until your comms go down.
- **System card:** This card type describes faults. State how you would handle it and then place the card in the discard task pile.
- **STO card:** This card provides information that would typically be provided in a STO – air defense warning alarm state, alert state, and weapons control status. State the implications of the STO and then place the card in the discard task pile.

Game Rules

- **Begin Play**
 - Determine the role each player will take: TCO, TCA, COMMO. This may be based on crewmembers’ current roles within their ECS crew or may be an opportunity to try out a different role.
 - Each player rolls the die. The player who rolls the highest number goes first and game play proceeds clockwise.
- **Your Turn**
 - Roll the die and draw the associated number of task cards.
 - Review and prioritize the task cards in your hand. You may delegate a task to another player (i.e., give them a task card). If you draw a “lose your turn” card, immediately redistribute all of your cards to your fellow crewmembers.
 - Talk through the steps you will take to accomplish each task one by one.
 - The other players must agree that the task was conducted properly or must provide corrective feedback before the player can discard the task card.

- Your turn ends when: (1) you have completed all task cards in your hand or (2) the timekeeper says your time expired. Play continues with the player on the left.

Game End

The game ends when either of the following occurs:

- The player who drew the last task card completes his/her turn. Note: Some track cards may still be active on the game board and players may still have task cards in their hand.
- Game time expires.

Team Learning Session

At the end of the game, the facilitator will transfer notes to the formal assessment form and then review with your crew. The facilitator will also report the number of task cards completed, the number of task cards completed incorrectly, and your final score. Your final score is the total number of correctly completed task cards.

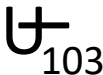
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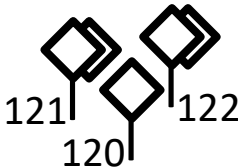
Appendix E: ABM Game Materials

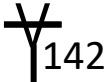
Game Board

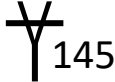
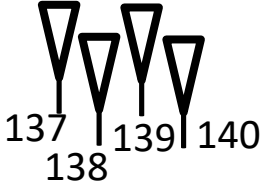
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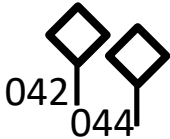
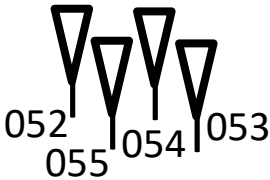
Task Cards

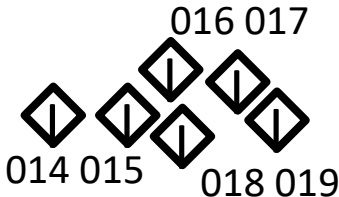
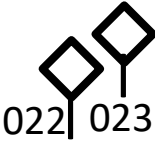
You receive a STO to slew the radar to 25°. Redistribute your cards to the other two players. You may not receive cards from the other players until after your next turn.	103 109 107 Tracks: all Unknown IFF: No Response for all tracks Heading: all are in tight elliptical orbit inside Nordland and over Norski Province Points of origin: All launched from remote sites in Nordland and Norski Province Altitude: 4.20 kft / 1.28 km, steady Speed: 100 kt / 50 m/s Length: 2.3 meters Other:	117 Track: classified as Jammer IFF: No Response Heading: Moving WSW Point of origin: Roach Altitude 38.5 kft / 11.74 km, steady Speed: 420 kt / 220 m/s Length: 16.8 meters Other: Type: Non-range resolve

 089	 121 120 122	 129
Track: classified as a TBM IFF: No Response Heading: 270°, lateral track, not threatening protected asset Point of origin: UNK Altitude: 14.5 kft / 4.42 km, steady Speed: 500 kt / 260 m/s Length: Other: No GIP indicated	Tracks: classified as hostile ABTs, some multiple IFF: No Response Heading: South (205°) toward protected asset Point of origin: Bug Altitude: 13.2 kft / 4.02 km, steady Speed: 870 kt. / 450 m/s Length: 15.8 meters Other: Range 90 km	Track: classified as hostile ABTs, multiple – 3 IFF: No Response Heading: South Southeast (153°) toward the protected asset Point of origin: Bug Altitude; 47.27 kft / 14.4 km, climbing Speed: 1,110 kt / 570 m/s Length: 17.3 meters Other: Range 50 km

		
Track: Unknown IFF: No Response Heading: 180°, approaching protected asset, within friendly airspace, but outside designated corridor Point of origin: UNK Altitude 2.2 kft / 0.671 km, steady Speed 89 kt / 46 m/s Length: 7.3 meters Other: Range 40 km	Track: classified as hostile ABT IFF: No Response Heading: South Southwest (208°) toward protected asset Point of origin: UNK Altitude: 4.25 kft / 1.3 km, steady Speed: 110 kt / 570 m/s Length: 2.3 meters Other: Range 100 km	Track: classified as an ARM/ASM IFF: No Response Heading: South (176°) toward protected asset Point of origin: Track XXX Altitude: 51.00 kft / 15/54 km, steep dive angle Speed: 1,890 kt / 970 m/s Length: 4.7 meters Other: Range 20 km

 Track: classified as an ARM/ASM IFF: No Response Heading: 172° Point of origin: Track XXX Altitude: 47.30 kft / 14.42 km, deep dive angle Speed: 1,800 kt / 930 m/s Length: 4.7 meters Other: Range 20 km	 Tracks: classified as hostile ABTs IFF: No Response Heading: SSE (150°) toward protected asset Point of origin: Roach Altitude: 44 kft / 13.4 km, climbing Speed: 425 kt / 220 m/s Length: 16.7 meters Other: Range 100 km	 Tracks: classified as TBMs IFF: No Response Heading: South (185°) toward protected asset Point of origin: BMOA 8 Altitude: <u> X </u>, steep dive angle Speed: 6,800 kt / 3,500 mm/s Length: Other: GIP in defended asset

 Tracks: classified as hostile ABTs IFF: No Response Heading: SSW (215°) toward protected asset Point of origin: Roach Altitude: 40 kft / 12/2 km, steady Speed: 400 kt / 210 m/s Length: 17.3 meters Other: Range 60 km	 Tracks: classified as hostile ABTs IFF: No Response Heading: South (180°) toward protected asset Point of origin: Roach Altitude 40 kft / 12.2 km, steady Speed: 400 kt / 210 m/s Length 17.3 meters Other:	 Tracks: classified as hostile TBMs IFF: No Response Heading: South (168°) toward protected asset Point of origin: BMOA 10 Altitude: steep dive angle from extreme altitude Speed: 6,800 kt / 3,500 m/s Length: Other: GIPs – Southern area of AA DOG and your battery location

 Tracks: classified as hostile ABTs IFF: No Response Heading: SSW (196°) toward protected asset Point of origin: remote site in Norski Province Altitude: 8.9 kft / 2.7 km, steady Speed: 115 kt / 60 m/s Length: 2.3 meters Other:	 Tracks: classified as hostile ABTs IFF: No Response Heading: SW (206°) toward protected asset Point of origin: remote site in Norski Province Altitude 8.6 kft / 2.6 km, steady Speed: 125 kt / 65 m/s Length: 2.3 meters Other:	 Tracks: classified as hostile ABTs IFF: No Response Heading: SSW (197°) toward protected asset Point of origin: Bug Altitude: 37 kft / 11.3 km, climbing Speed: 875 kt / 450 m/s Length: 16.7 meters Other: Range 75 km

Launch Station 1 goes NMC.	A hazard warning appears for Launch Station 3.	mIRC communications dropped. Fix it.
Missile misfires on Launch Station 3.	The system alerts you to an air launch.	Amber light on operational equipment lights up Launch Station 6.

Voice comms go down.	Launch Station 3 is currently out of action during reloading.	A Launch Station has completed reloading and is back in action. Update missile status for one launcher.
Data comms go down.	The Alert Line on your scope indicates multiple Air Launch Warnings as an enemy aircraft track releases air to surface missiles.	Shot to ICC goes down. Perform hot stack changeover. Redistribute your cards to the other two players. You may not receive cards from the other players until after your next turn.

Both voice and data comms go down.	A Launch Station has completed reloading and is back in active status. Update missile status for one launcher.	Embedded data recorder is full.
Friendly fighters take out one of your enemies. Discard any one TBM or ABT hostile track card and remove chip from the radar screen.	A hostile TBM or ABT track has suddenly disappeared from your radar screen.	You have been instructed to engage and destroy one hostile track. Discard one TBM or ABT hostile track card and remove chip from the radar screen. Remove two missiles from a launcher.

Friendly fighters take out one of your enemies. Discard any one TBM or ABT hostile track card and remove chip from the radar screen.	You have been instructed to engage and destroy one hostile track. Discard one TBM or ABT hostile track card and remove chip from the radar screen. Remove two missiles from a launcher.	Friendly aircraft engage the hostile with air to air missiles. Discard one TBM or ABT hostile track card and remove chip from the radar screen.

Friendly fighters destroyed an ARM Carrier. Discard one hostile ARM carrier track card and remove chip from the radar screen.	You have been instructed to engage and destroy one hostile track. Discard one TBM or ABT hostile track card and remove chip from the radar screen. Remove two missiles from a launcher.	An enemy jammer becomes active.

Friendly fighters take out two of your enemies. Discard any two hostile track cards and remove the chips from the radar screen.	You have been instructed to engage and destroy one hostile track. Discard one TBM or ABT hostile track card and remove chip from the radar screen. Remove two missiles from a launcher.	You have been instructed to engage and destroy one hostile track. Discard one TBM or ABT hostile track card and remove chip from the radar screen. Remove two missiles from a launcher.
Friendly fighters take out two of your enemies. Discard any two hostile track cards and remove the chips from the radar screen.	TBM launch alert.	The ICC notifies you that you misclassified a track.

ICC provides warning of hostile aircraft approaching from the North and announces that JTF and coalition fighter aircraft have been scrambled.	The ICC notifies you that they've lost picture. Use BRA to correlate track.	ICC directs a reorientation of your radar to 35° for TBM threat. Redistribute your cards to the other two players. You may not receive cards from the other players until after your next turn.
You receive a STO to change self-defense criteria (e.g., from 10,000 feet to 5,000 feet).	STO alert that a CBRN attack is imminent.	Comms are back up.

Comms are back up.	Comms are back up.	Comms are back up.
Comms are back up.	You receive voice communication from the ICC that a TBM has been detected on radar.	The ICC requests missile count.

The ICC notifies you to hold fire on hostile engaged track or requires ECS to change ID on track due to communication degradation.	The ICC requires you to change ID on track due to communication degradation.	The ICC requests a missile count.
Friendly fighters destroyed an ARM Carrier. Discard one hostile ARM carrier track card and remove chip from the radar screen.	Voice comms go down.	Data comms go down.

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STO Cards

STO 01 ADW: Red Alert State: 2 WCS: Hold	STO 02 ADW: Yellow Alert State: 2 WCS: Tight	STO 03 ADW: Red Alert State: 2 WCS: Tight
STO 04 ADW: Yellow Alert State: 2 WCS: Hold	STO 05 ADW: Red Alert State: 2 WCS: Tight	

Assessment Form

Crew: _____

of cards completed: _____

of cards completed incorrectly: – _____

of cards completed correctly: = _____ (score)

Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
A. Operation of the System				
1. Responds appropriately to system faults	0	1	2	3
2. Determines causes of alerts	0	1	2	3
B. Situational Awareness				
3. Asks appropriate questions of higher (ICC) or adjacent echelon crews, staffs, or units	0	1	2	3
4. Crosschecks information using multiple sources (equipment, crew, ICC, BCP, another ECS)	0	1	2	3
5. Correctly compensates for communications loss	0	1	2	3
6. Uses all available and reasonable means to restore or compensate for system faults or failures	0	1	2	3
7. Applies tactical situation knowledge to the operation of the system	0	1	2	3
8. Acknowledges change in situation	0	1	2	3
C. Interpretation				
9. Identifies threat tracks correctly	0	1	2	3
10. Engages threats to protected asset in appropriate priority	0	1	2	3
11. Takes/makes correct response to system indicators	0	1	2	3

Indicator	Effectiveness			
	0 = Never Effective		2 = Frequently Effective	
	1 = Sometimes Effective		3 = Always Effective	
D. Crew Resource Management				
12. Uses correct brevity communications externally and with crewmembers	0	1	2	3
13. Responds correctly to brevity language communicated externally and by crewmembers	0	1	2	3
14. Effectively communicates received information in a timely manner	0	1	2	3
15. Effectively prioritizes tasks as air battle demands increase	0	1	2	3
16. Maintains systems operation when short one crewmember	0	1	2	3
17. Seeks crewmember confirmation/challenges to own interpretation	0	1	2	3
18. Performs other crewmembers' responsibilities effectively when needed	0	1	2	3
19. Recognizes and supports other crewmembers' needs	0	1	2	3
E. Decision-Making				
20. Makes correct decisions when ICC/BCP decision support is not available	0	1	2	3
21. Makes timely decisions to protect friendly asset	0	1	2	3
22. Uses all available information to make decisions	0	1	2	3
23. Provides accurate information for decision making	0	1	2	3
24. Applies rules and permissions correctly to decision making	0	1	2	3
25. Makes decisions quickly when the situation calls for it	0	1	2	3

Appendix F: Course Evaluation Form

Thank you for your participation in the Task Saturation Mitigation Training. Your feedback is extremely valuable and will help us improve future offerings of the course. Please take a moment to complete this questionnaire. We appreciate both your time and your input!

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable
Quality and Relevance of Learning Experience						
1. I understood the course objectives.	1	2	3	4	5	N/A
2. I feel I have a better understanding of task saturation after completing the training.	1	2	3	4	5	N/A
3. The knowledge and/or skills gained through this course are directly applicable to my job.	1	2	3	4	5	N/A
4. My interest stayed high throughout the course.	1	2	3	4	5	N/A
5. I am likely to change the way I do things or see things as a result of taking this course.	1	2	3	4	5	N/A
6. I intend to use what I learned in this training on the job.	1	2	3	4	5	N/A
Course Delivery & Training Materials						
7. The participant materials (handouts, guides, etc.) were useful during this course.	1	2	3	4	5	N/A
8. The way the course was delivered was an effective way for me to learn the subject matter.	1	2	3	4	5	N/A
9. The activities and practical exercises provided me an opportunity to apply new knowledge and skills.	1	2	3	4	5	N/A
10. There was ample opportunity for interaction and participation.	1	2	3	4	5	N/A
Crew Process						
11. My crewmembers and I understand how we prefer to communicate with each other.	1	2	3	4	5	N/A
12. My crewmembers and I understand how members are going to work together to achieve our goals.	1	2	3	4	5	N/A
13. When one person is struggling with a task, I am confident that another crewmember will step in to help.	1	2	3	4	5	N/A
Facilitators						

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable
14. The facilitator(s) were knowledgeable about the subject matter.	1	2	3	4	5	N/A
15. The facilitator(s) presented information in a clear and effective manner.	1	2	3	4	5	N/A
16. The facilitator(s) made the course interesting.	1	2	3	4	5	N/A
17. The facilitator(s) were well prepared.	1	2	3	4	5	N/A
18. The facilitator(s) encouraged participants to ask questions.	1	2	3	4	5	N/A
General Satisfaction						
19. Overall, I was satisfied with the course.	1	2	3	4	5	N/A
20. I would recommend this course to others.	1	2	3	4	5	N/A

21. What did you learn in the course that you plan to use on the job?

22. What were the strengths of the course?

23. How could the course be improved?

Appendix G: Post-training Knowledge Assessment

Knowledge Assessment **Crew Designation**_____ **Crew Position** _____

Directions

Circle the letter corresponding to the best response for each question.

1. The qualities of an effective crew include all of the following EXCEPT:
 - a. Crewmembers adhere to established communication protocols.
 - b. Crewmembers focus on their own crew responsibilities.
 - c. Crewmembers recognize each other's "tells" that they are becoming task saturated.
 - d. Crewmembers maintain an open environment to share and question.
2. Which of the following statements about crew task responsibilities is the most accurate?
 - a. A task may be performed by any crewmember regardless of role.
 - b. Crewmembers should only perform the tasks associated with their role.
 - c. Friendly protect can be delegated to another crewmember.
 - d. A task may be performed by any crewmember, but it should be delegated to the crewmember if it does not fall under his/her role.
3. Which communication strategy can be used to help crewmembers anticipate next steps?
 - a. Check-back
 - b. Touch-back
 - c. Call-out
 - d. Hand-off
4. Task saturation is:
 - a. When a task is unfamiliar to a crewmember.
 - b. When multiple issues occur at the same time that diminishes crew performance.
 - c. When a crewmember performs more tasks than the other crewmembers.
 - d. When a crew cannot perform a difficult task.
5. All of the following are strategies for mitigating task saturation. EXCEPT:
 - a. Provide backup support.
 - b. Conduct "what if" scenarios.
 - c. Conduct mutual performance monitoring.
 - d. Maintain current task distribution and prioritization.

6. The main benefit of understanding crewmembers' strengths and weaknesses is it allows you to:
 - a. Identify performance hindrances.
 - b. Avoid distributing tasks to the weakest crewmember.
 - c. Determine how each crewmember can best contribute to crew performance.
 - d. Identify the crewmember that can take on the majority of the tasks.
7. Which of the following is a key factor for team learning?
 - a. Be willing to openly share problem areas
 - b. Avoid topics that are known to cause team conflict
 - c. Practice easy-to-implement improvements during the next training
 - d. Minimize the number of questions asked to complete training on time
8. Which of the following is a sign of task saturation?
 - a. Increased performance under stress
 - b. Increased energy
 - c. Effective multitasking
 - d. Heightened emotional displays
9. The purpose of a crew's conflict management plan is to develop:
 - a. Recommendations on how to redistribute tasks during task saturation.
 - b. Agreed-upon rules and norms to resolve an issue.
 - c. A list of crewmembers' "tells" during a conflict.
 - d. Evidence of a team member's poor performance.
10. Which of the following is NOT likely a cause of task saturation?
 - a. Fighting an air battle with few tracks to identify
 - b. Loss of communications with the ICC
 - c. One crewmember is experienced and assumes multiple tasks
 - d. A replacement crewmember with little ECS experience

APPENDIX D
PARTICIPANT GUIDE

Army Research Institute

Task Saturation Mitigation Training

Participant Guide



September 2018

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Module 0: Introduction

Learning Objectives

- N/A

Estimated Time

45 minutes (time will vary depending on air battle management (ABM) level required to generate task saturation in crews during the pre-training ABM performance assessment, number of crews in the class, and number of facilitators)

Slide 1



Module 0: Introduction

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1

Module Overview

Welcome to the Task Saturation Mitigation Training! The purpose of this module is to conduct facilitator and participant introductions and briefly provide you an overview of the course, including the course goal, course objectives, and course structure. You will also have an opportunity to share your expectations of the course.

At the end of the module, you will complete a pre-training assessment consisting of a knowledge assessment followed by an ABM performance assessment to establish a baseline of your knowledge and performance level.

Slide 2



Facilitator Introductions



- Name
- Position
- Professional experience

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2

Facilitator Introductions

The lead facilitator will provide a brief introduction along with his/her background. Any co-facilitators will then introduce themselves.

Slide 3



Participant Introductions



- Name
- ECS role
- Deployment experience
- Experience supporting air battle management and operating within an ECS crew

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Participant Introductions

Introduce yourself by sharing the following information:

- Name
- ECS role
- Deployment experience
- Experience supporting air battle management and operating within an ECS crew

Participants will have varying levels of experience and will play different roles in the course.

- The role of the more experienced participants is to mentor those who are less experienced to help them complete the exercises. They should allow less experienced participants to take on challenging tasks and coach them through those tasks.
- The role of the less experienced participants is to learn from the more experienced participants and improve their contribution to crew performance.

Slide 4



Course Goal



- Improve crew team performance by providing strategies and techniques to help crews mitigate task saturation.

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Course Goal

Even though the Patriot system is automated, it still relies on operator understanding of the system and a shared awareness amongst the crew of what is happening during air battle management.

One of the challenges crews face during air battle management is task saturation, particularly when multiple events are occurring simultaneously. While it may be impossible to eliminate the occurrence of task saturation, the goal of this course is to improve crew team performance by providing strategies and techniques to help crews mitigate task saturation when it occurs.

Slide 5



Course Objectives



- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.

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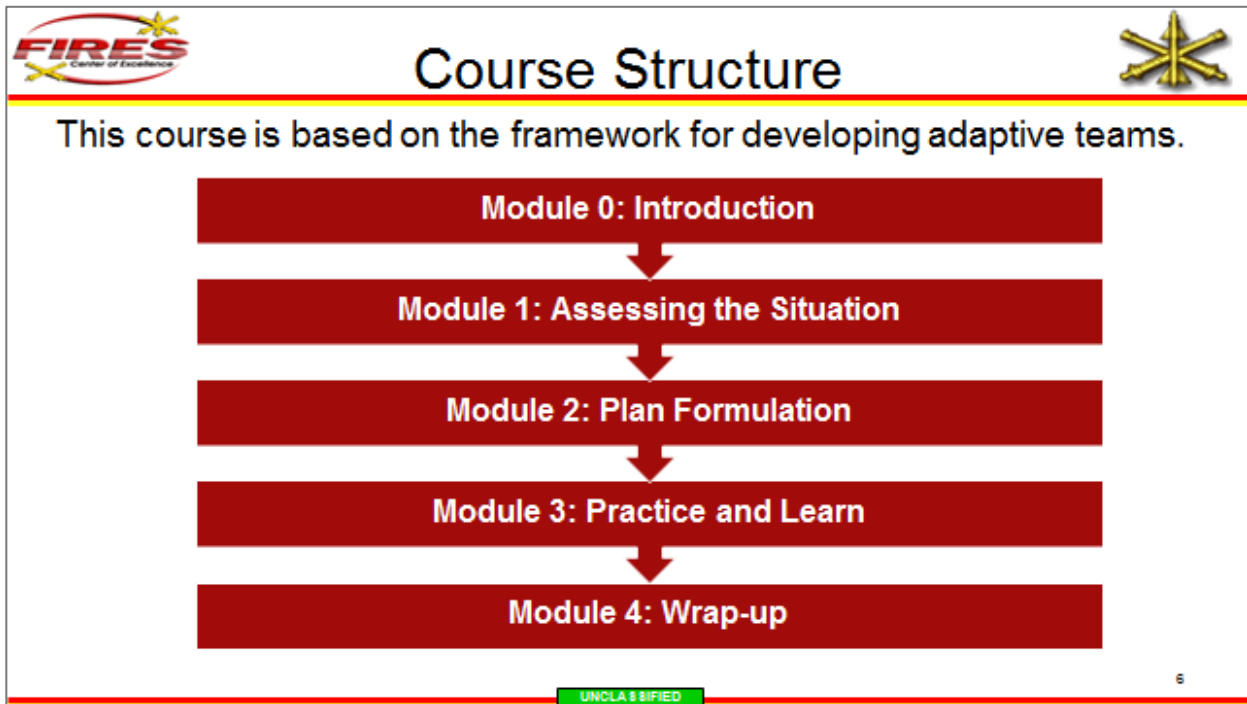
Course Objectives

By the end of this course, you should be able to:

- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.

These are the overarching objectives for the course. More specific learning objectives are listed within each module.

Slide 6



Course Structure

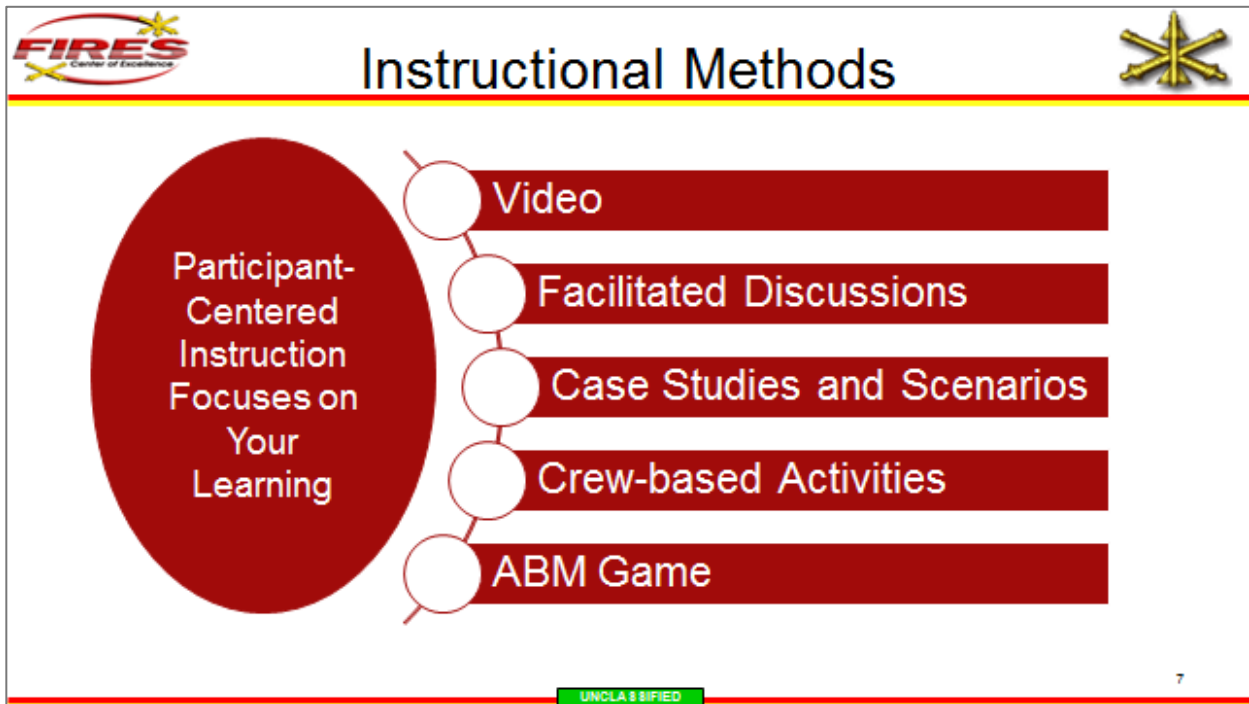
The course is built around the framework for developing adaptive teams because ECS crews must be able to readily adapt to changing conditions. Adaptive teams assess a situation, formulate a plan, execute that plan, learn from their performance, and then repeat this process when faced with new situations.

Here is a brief description of each course module:

- **Module 0: Introduction** provides an overview of the course and allows time for facilitator and participant introductions. Participants will also complete a pre-training knowledge assessment and an ABM performance assessment.
- **Module 1: Assessing the Situation** allows crews to gain an understanding of their current situation. They will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Crews will also establish a shared understanding of ECS crew team roles and responsibilities and identify current crew strengths and weaknesses.
- **Module 2: Plan Formulation** provides strategies for improving crew team performance to help mitigate task saturation. Crews will develop a Personal Crew Plan that identifies rules and norms for how their crew will react and respond to situations to mitigate or reduce task saturation.
- **Module 3: Practice and Learn** explains the importance of team learning and providing psychological safety. Crews will then practice the strategies they learned for mitigating task saturation using the Personal Crew Plan they developed in Module 2.

-
- **Module 4: Wrap-up** provides a summary of the content covered in the course and reviews the course goal and objectives. Participants will also complete a course evaluation as well as a post-training knowledge assessment and an ABM performance assessment.
-

Slide 7



Instructional Methods

This course is participant-centered and uses a variety of active learning methods that includes identifying signs of task saturation in a live action video, engaging in facilitated discussions on relevant topics, reviewing case studies and scenarios, participating in crew-based learning activities, and playing the ABM Game to learn to address real-world challenges. Lectures are purposely limited.

Slide 8



Participant Expectations



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Participant Expectations

Share an expectation you have of the class.

Slide 9



Pre-training Assessment



- Measures course effectiveness
- Establishes a baseline of participants' knowledge and performance level



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Pre-training Assessment

You will now complete a pre-training assessment consisting of a knowledge assessment followed by an ABM performance assessment.

The purpose of the pre-training assessment is to establish a baseline of your knowledge and performance level. Compared with the post-training assessment, it will be used to measure course effectiveness.

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Module 1: Assessing the Situation

Learning Objectives

- Define task saturation.
- Identify the signs of task saturation.
- Identify task responsibilities that can be shared across crewmembers.
- Identify crew strengths and weaknesses.

Estimated Time

90 minutes

Slide 1



Module 1: Assessing the Situation

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1

Module Overview

In this module, you will gain an understanding of task saturation and your current crew situation. Specifically, you will build a shared understanding of what task saturation is and the signs that task saturation is occurring. Your crew will also establish a shared understanding of ECS crew team roles and responsibilities as well as current crew strengths and weaknesses.

Slide 2



Introduction to Task Saturation Activity

- Working with your crew, review the Newspaper Challenge Activity instructions that were distributed.
- When signaled by the facilitator, complete the activity.
- Be prepared to discuss your experience.

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Introduction to Task Saturation

Task saturation occurs in our everyday lives. It's that sensation of feeling overwhelmed when you have multiple competing demands.

You will now participate in an activity to better understand what task saturation is.

Exhibit 1-1: Newspaper Challenge Activity

You will work with your crew during this activity. The facilitator will distribute the following items to each crew:

- Appendix C: Newspaper Challenge Activity
- One blank 8 ½ x 11 sheet of paper
- Two pair of scissors
- One roll of Scotch tape
- At least two pens or pencils

Before you begin, review the activity instructions in Appendix C and let the facilitator know if you have any questions.

Slide 3



Task Saturation Defined



- Task saturation is when multiple issues occur at the same time that diminishes the performance of the crew in their interaction with and/or control of the Patriot system.

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Task Saturation Defined

Task saturation within an ECS crew is when multiple issues occur at the same time that diminishes the performance of a crewmember in their interaction with and/or control of the Patriot system. For example, task saturation may occur when the crew receives a STO, ACMAF, and engagement command all at the same time.

Task saturation results when the brain takes in the maximum amount it can handle – it's working at full capacity – but more information or task demands are still coming in and the brain can't process it.

To help bring this concept to life, think about the ground during a major rain storm. When the rain is light or moderate, the ground is able to absorb the water into the soil. However, if it keeps raining, the amount of rain water eventually becomes greater than the soil can absorb. The ground becomes saturated, so the water runs off the land and can cause flooding. The same is true of task saturation. When task demands are low or moderate, the brain is able to absorb and process all of the information. However, when task demands are high, the flow of information can become greater than the brain can absorb and process.

Slide 4



Task Saturation Defined (Cont'd.)



- **Causes**
 - One member is strong and assumes too much of the work
 - A crewmember encounters something new and is not sure how to handle it
 - Increase in intensity and difficulty of ABM
- **Consequences**
 - Tunnel vision
 - Freezing/going blank
 - Missing or dropping tasks
 - Decreased situational awareness

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Task Saturation Defined

Task saturation can be both a cause and a consequence.

- Task saturation can be caused by the following:
 - One member is strong and habitually assumes more of the work.
 - A crewmember encounters something new and is not sure how to handle it.
 - There is an increase in intensity and difficulty of ABM.
- Task saturation can also have consequences such as:
 - Tunnel vision.
 - Freezing or going blank.
 - Missing or dropping tasks (e.g., tuning out comms).
 - Decreased situational awareness.

What other causes and consequences would you add to the list?

Slide 5



Signs of Task Saturation

Mission success is significantly harder to achieve when crewmembers are unable to recognize task saturation cues and support the mission critical areas that it will affect. But what does task saturation look like?

Watch the video and write down the signs of task saturation you observe in the space below.

Slide 6



Signs of Task Saturation (Cont'd.)



- Behavior change (e.g., body language, communication)
- Increased fatigue
- Heightened emotional displays
- Tunnel vision
- Declining task performance

6

Signs of Task Saturation

Crewmembers should monitor one another and look out for cues that individuals are becoming overwhelmed during performance.

A crew should also monitor its progress toward goals and its interactions with the external environment (e.g., new surface to air missile tactical order (STO), early warning from ICC, or missile launcher down). In so doing, the crew can catch important cues that might cause task saturation and the need to make adjustments in order to continue making progress towards overarching goals.

When a crewmember recognizes the signs of task saturation in a superior (e.g., in the video, the TCA recognized that the threat was misclassified while the TCO demanded that he engage the track), how could the lower ranking crewmember handle the situation?

Slide 7



Recognizing Your Crew's "Tells" Activity

- Working individually, answer the questions in Exhibit 1-2.
- Discuss your answers with your crew.
- Be prepared to share your responses.

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Recognizing Your Crew's "Tells"

The purpose of this activity is to identify signs that task saturation is occurring within your own crew. Answer the questions in Exhibit 1-2.

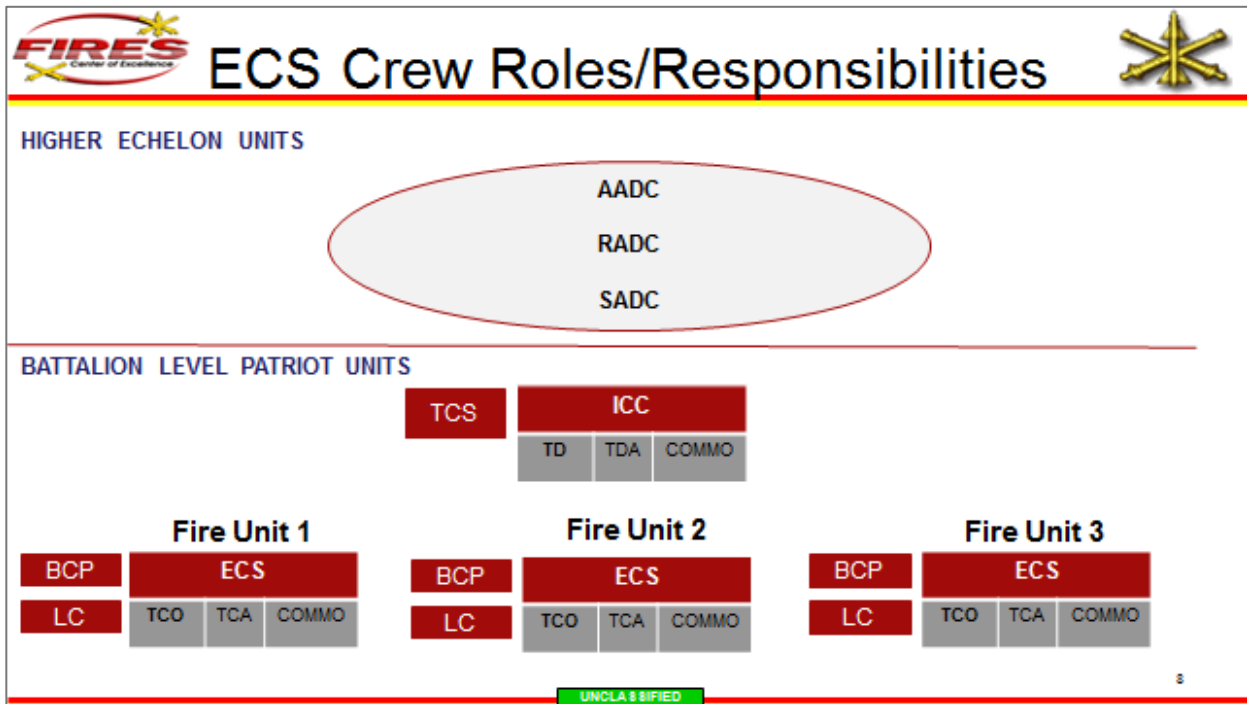
Exhibit 1-2: Recognizing Your Crew's "Tells" Activity

4. During an air battle, what causes task saturation to occur in your crew?

5. What are your "tells" when task saturation is occurring?

6. What are your crewmembers' "tells"?

Slide 8



ECS Crew Roles and Task Responsibilities

In addition to having a shared understanding of what task saturation is and its cues, crews must have a shared understanding of each team member's role and task responsibilities and be both willing and able to provide and seek assistance when needed.

Without an accurate shared understanding of each other's roles, crewmembers cannot effectively catch mistakes or lapses, nor can they successfully perform another crewmember's task if necessary.

Review the ECS crew roles and primary task responsibilities in Exhibit 1-3 on the next page.

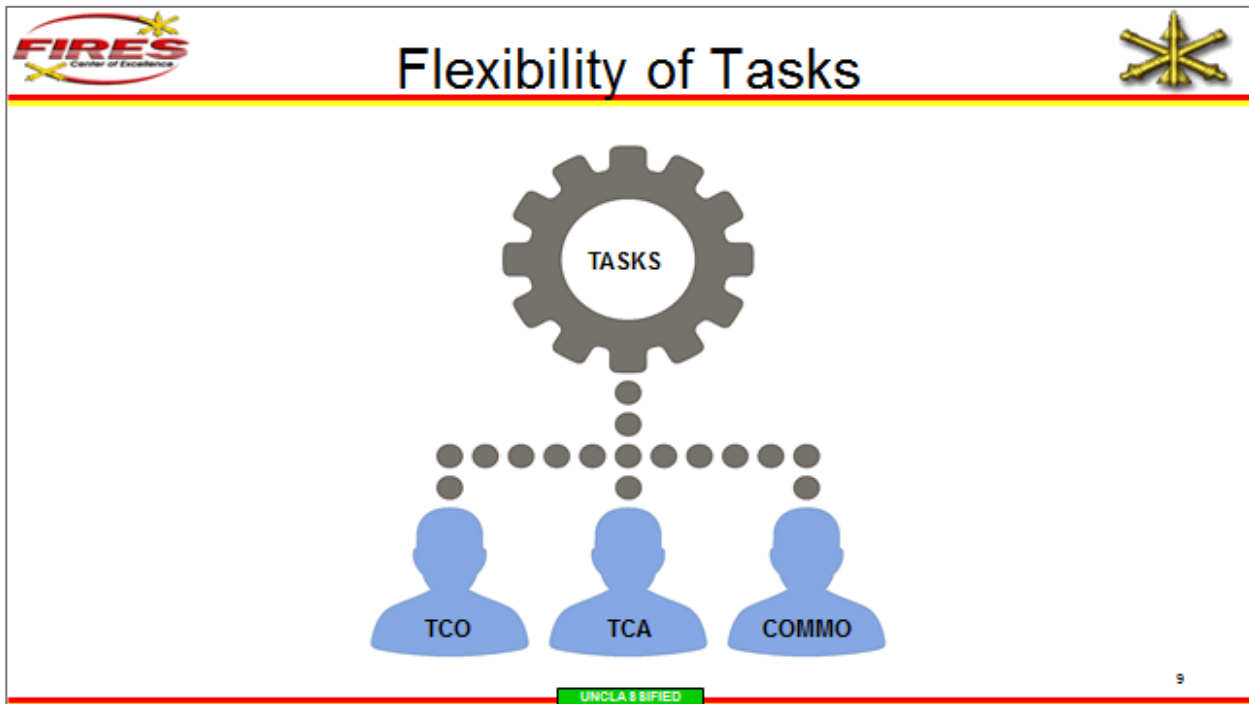
Regardless of whether it is part of your assigned role, crewmembers need to support one another and step in when someone is experiencing task saturation. As the mantra goes, there's "no rank in the van." Different crews may have different plans on who or how specific types of support is provided. For example, crews need to decide who takes responsibility for responding to communications (e.g., who is going to take down and process an incoming STO) when the COMMO has tasks that have to be performed outside the van. That individual may take communications temporarily.

Exhibit 1-3: Roles and Responsibilities

Role	Primary Task Responsibilities
TCO	
- Officer in Charge (OIC) of the Patriot ECS crew - Friendly protect	- Identify targets - Ensure system is in assigned Search, Identification, and Engage Mode - Verify activation/deactivation IFF - Identify false targets based on track amplifying data tab and situation display - Monitor situation display and alert messages - Monitor party line for Air Battle - Apply or remove Cease Fire, Hold Fire, or Engage Hold - Monitor clutter conditions and activate clutter mapping - Make FIDOC changes - Direct radar emission control schedule - Direct system reorientation - Monitor status alerts and assess selected alerts - Conduct air battle management in compliance with directives received from Higher Echelon Units - Monitor mIRC chat
TCA	
Weapons Control	- Engage targets - Ensure system in assigned Search, Identification, and Engage Mode - Activate/deactivate IFF - Identify false targets based on track amplifying data tab and situation display - Reorient system - Place system in assigned mode of control - Place appropriate launchers to operate/standby/local - Check that system is in assigned weapons control status - Activate/deactivate areas enable, radiate, and control alternate search sectors - Monitor for faults presented by the system or observed during operation - Monitor party line 1 for engagement operations - Monitor mIRC chat

Role	Primary Task Responsibilities
Role	Primary Task Responsibilities
Multichannel Transmission Systems Operator (COMMO)	
Monitors and operates system communications equipment	- Ensure the appropriate address is assigned to the RLRIU - Ensure all communications equipment is configured according to the current communications plan - Pass and receive tactical reports to and from the BCP such as the Surface to Air Missile Tactical Order (STO) and the Surface to Air Missile Status Report (SAMSTAT) - Monitor chat, missile count, and engagement reports - Assist the TCO in assessing communication faults - Monitor the AMG - Rotate and elevate the UHF antennas when required - Implement all communications electronic counter-countermeasures (ECCM) - Coordinate communications plan changes with the ICC and battalion communications control

Slide 9



Flexibility of Tasks

Which roles and task responsibilities are fixed and cannot be shared?

Slide 10



Case Study Activity



- Working individually:
 - Review the case study in Exhibit 1-4.
 - Answer the discussion questions.
- Be prepared to share your responses.

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Case Study

Refer to Exhibit 1-4 on the next page to review the case study and answer the discussion questions.

Exhibit 1-4: Case Study Activity**Background Information**

This ECS crew formed three months ago and was just certified in theater. They are still forming as a team and continue to improve through practice. They know they have some problem areas. The TCO is the new member of the crew and it is her first time as a TCO. The TCO is comfortable with her tasks, and she is gaining confidence in performing the TCA's tasks. She does not yet fully understand the COMMO tasks. The TCA has been serving in this role for six months at this same site. He has worked with the current COMMO for the past 4 months. As for the COMMO, this is his second tour as a COMMO. The first tour was in a different country so he's had to get up to speed on the local SOPs, TTPs, authorities, and threats. The TCA and COMMO have an established battle rhythm. They understand each other's tasks and get along well. The threat for this area is generally TBMs, but ABTs could exist. The crew has already postured for the current conditions.

Case Study Dialogue

- 15:30:00 COMMO: ACMAF in, due at 15:33.
- 15:30:05 TCO: ACMAF due at 15:33.
- [COMMO writes down 15:33 and advises TCO; COMMO watches for TCO to implement ACMAF.]
- [TCO busy correlating several possible hostile UAS tracks with the ICC.]
- 15:32:30 COMMO: ACMAF due in 30 seconds.
- 15:32:33 TCO (agitated): Got it.
- 15:33:00 COMMO (loudly): ACMAF due NOW.
- 15:34:00 TCO (with disgust): ACMAF implemented.
- 15:34:05 COMMO: STO, due at 15:38.
- 15:34:08 TCA: Implementing STO. TCO take my switches.
- 15:35:10 TCO: Got your switches.
- 15:35:30 TCA: STO says to slew the radar and has several tabular changes.
- 15:35:35 TCO: I'm not sure how to slew the radar.
- 15:35:45 TCA: You complete the STO. I'll slew the radar.
- 15:35:50 TCO: I can't complete the STO and maintain the switches.
- 15:35:55 TCA: Alright, I'll complete the STO and slew the radar. You keep the switches, but it may take a bit.
- 15:37:00 TCA: Radar slew completed.
- 15:37:00 COMMO: STO due in 1 minute.
- 15:37:55 TCA: STO implemented. I can take my switches back.
- 15:38:00 TCO: Switches back to you.
- 15:55:00 TCO: ICC says digital data link is down and that we need to change track ABC to HOSTILE.
- 15:55:02 TCA: Roger, changing ABC to HOSTILE.
- 15:55:04 TCO: No, it's my responsibility.
- 15:55:06 TCA: No, I got it.

- 15:55:30 TCA: Track ID changed.
- 16:00:00 COMMO: New STO is in.
- 16:00:02 TCA: Implementing STO. TCO take my switches.
- 16:00:04 TCO: Got your switches.
- 16:03:15 TCA: [TBMs on screen] SCUD ALERT! SCUD ALERT! SCUD ALERT!
- 16:03:30 [COMMO and TCO immediately put on facemasks.]
- 16:04:00 TCA: Sir! I don't have your switches! [TCA scrambles to take his own switches and TCO's while TCO scrambles to finish donning mask.]
- 16:04:30 TCA: Retake my switches.
- 16:04:32 TCO: I have your switches.
- 16:04:45 TCA: STO implemented. [Dons facemask.]
- 16:05:10 TCA: I can take my switches back.
- 16:05:15 TCO: Switches back to you.
- 16:12:00 TCO: Too many tracks on scope. TCA, can you evaluate tracks outside the 50k range?
- 16:12:01 TCA: BIRDS AWAY on inbound SCUD.
- 16:12:05 TCA: I'm monitoring engagement on inbound SCUD. I will try. (TCA inadvertently takes the tracks within 50k.)
- 16:12:30 TCO: ICC has declared Track XYZ at range of 60k from unit is an ARM carrier. Do you agree?
- 16:12:35 TCA: I don't know. I have the tracks within the 50k area and the inbound SCUD engagement.
- [Digital engage command appears onscreen.]
- 16:12:40 TCO: No, I'm doing inside 50K. You're supposed to be tracking outside 50k.
- 16:12:45 COMMO: BCP is calling from the Command Chain asking why we haven't engaged Track XYZ.
- 16:12:46 TCO: I have a fast-mover at 25k under evaluation. I need you to switch to the outer 50k and review Track XYZ.
- 16:13:00 TCA: Roger, I'm taking outside the 50k.
- 16:13:05 TCA: SPLASH SCUD Track.
- 16:13:20 TCA: Track XYZ has a VALID MODE 3 response. I don't think it's an ARM Carrier.
- 16:13:30 TCO: ICC, Track XYZ has a VALID MODE 3. Please confirm ID.
- 16:15:00 TCO: TCA, my fast-moving track has cleared. I'm resuming full screen monitoring.
- 16:15:00 TCA: Full screen monitoring.
- 16:32:20 TCA: Standing by for confirmation of ID on Track XYZ. TCO, can you review?
- 16:32:30 TCO: Will review track XYZ.
- 16:33:00 COMMO: ACMAF in, due at 16:36.
- [COMMO watches for TCO to implement ACMAF.]
- [TCO busy reviewing track XYZ.]

- 16:34:00 COMMO: New STO is in.
- 16:34:03 TCA: STO. TCO take my switches.
- 16:34:06 TCO: Got your switches.
- 16:35:00 TCO: Too many tracks to handle. Got a jammer and possible multiple false targets. Still reviewing Track XYZ.
- 16:35:15 TCA: Updating tabs.
- 16:35:30 COMMO: ACMAF due in 30 seconds.
- 16:35:45 COMMO: ACMAF due in 15 seconds.
- 16:36:00 COMMO (in loud voice): ACMAF due NOW. STO is due NOW.
- [ACMAF is overdue, STO is overdue, Track XYZ has yet to be properly identified, jammer is still on screen and system effect is unknown, multiple unknowns on screen potentially caused by jammer, and system is no longer properly configured. TCO is task saturated, not responding, and staring blankly at screen.]

Discussion Questions

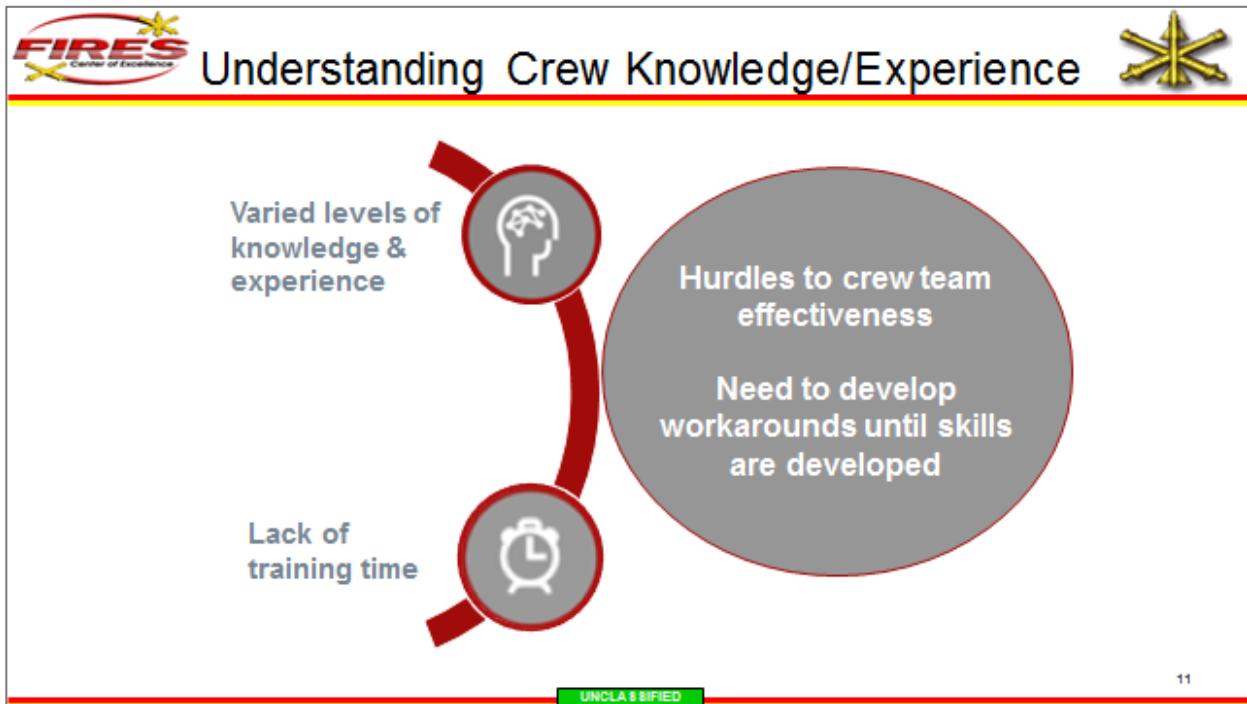
5. What went well?

6. What didn't go well?

7. How was the workload distributed?

8. How could tasks have been distributed differently?

Slide 11



Understanding Crew Knowledge and Experience

While crewmembers should be able to share responsibilities seamlessly, the reality is that there isn't enough time to initially train all members on all roles. Lack of training time combined with the Army's sustainment readiness model (SRM) and unit personnel turbulence results in crewmembers with varying levels of knowledge and experience, which leads to crew strengths and weaknesses.

Weaknesses can pose hurdles to crew team effectiveness. However, strengths can also be problematic if your crew relies on one strong member instead of developing capabilities across all crewmembers.

Effective teams have the ability to identify performance hindrances and find ways to avoid or work around them. Understanding crewmembers' strengths and weaknesses is important because it allows crews to determine how each crewmember can best contribute to crew performance. It also allows crewmembers to build up weak skillsets through additional training/cross-training and appropriately distribute tasks.

While challenging tasks shouldn't be attempted by that crewmember during an actual event, training exercises should be used in the meantime to build those task skillsets for that crewmember. Crews are encouraged to quiz each other to improve their knowledge and understanding as well as ask how or why certain tasks are done.

Crewmembers should continually reassess their capabilities as they gain more experience.

Slide 12



Identifying Crew Strengths/Weaknesses Activity

- Working individually, complete Parts I and II of the activity in Exhibit 1-5.
- Working with your crew:
 - Share your responses to Parts I and II with your other crewmembers.
 - Review the results of the pre-training ABM performance assessment.
 - Complete Part III of the activity.
- Be prepared to share your responses.

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Identifying Your Crew's Strengths and Weaknesses

The purpose of this activity is to have your crew identify strengths and weaknesses.

Refer to Exhibit 1-5 on the next page. Complete Parts I and II of the Strengths and Weaknesses Assessment Activity individually. Then, working with your crew, share your worksheets with your other crewmembers, review the instructor feedback from the pre-training ABM performance assessment, and complete Part III of the activity.

Exhibit 1-5: Strengths and Weaknesses Assessment Activity

Complete each part of this activity as directed by the facilitator.

Part I				
Supervisory Control Skills Assessment				
Indicator	Effectiveness			
	0 = Never Effective	1 = Sometimes Effective	2 = Frequently Effective	3 = Always Effective
A. Operation of the System				
36. Correctly inputs initial system settings	0	1	2	3
37. Accurately modifies initial system settings to reflect changing mission conditions	0	1	2	3
38. Locates system information in time to support mission accomplishment	0	1	2	3
39. Recognizes system faults	0	1	2	3
40. Responds appropriately to system faults	0	1	2	3
41. Recognizes oddities in system information and questions them	0	1	2	3
42. Determines causes of alerts	0	1	2	3
B. Situational Awareness				
43. Asks appropriate questions of higher (ICC) or adjacent echelon crews, staffs, or units	0	1	2	3
44. Crosschecks information using multiple sources (equipment, crew, ICC, BCP, another ECS)	0	1	2	3
45. Recognizes when a form of communications goes down	0	1	2	3
46. Correctly compensates for communications loss	0	1	2	3
47. Recognizes when system indicators are faulty or inaccurate	0	1	2	3
48. Uses all available and reasonable means to restore or compensate for system faults or failures	0	1	2	3
49. Applies tactical situation knowledge to the operation of the system	0	1	2	3
50. Maintains system in the correct mode	0	1	2	3
51. Acknowledges change in situation	0	1	2	3

Indicator	Effectiveness			
	0 = Never Effective		2 = Frequently Effective	
	1 = Sometimes Effective		3 = Always Effective	
C. Interpretation				
52. Identifies threat tracks correctly	0	1	2	3
53. Correctly identifies friendly air assets	0	1	2	3
54. Engages threats to protected asset in appropriate priority	0	1	2	3
55. Takes/makes correct response to system indicators	0	1	2	3
56. Changes track identification based on new or modified ROE or HEU commands	0	1	2	3
D. Crew Resource Management				
57. Uses correct brevity communications externally and with crewmembers	0	1	2	3
58. Responds correctly to brevity language communicated externally and by crewmembers	0	1	2	3
59. Effectively communicates received information in a timely manner	0	1	2	3
60. Effectively prioritizes tasks as air battle demands increase	0	1	2	3
61. Maintains systems operation when short one crewmember	0	1	2	3
62. Seeks crewmember confirmation/challenges to own interpretation	0	1	2	3
63. Performs other crewmembers' responsibilities effectively when needed	0	1	2	3
64. Recognizes and supports other crewmembers' needs	0	1	2	3
E. Decision-Making				
65. Makes correct decisions when ICC/BCP decision support is not available	0	1	2	3
66. Makes timely decisions to protect friendly asset	0	1	2	3
67. Uses all available information to make decisions	0	1	2	3
68. Provides accurate information for decision making	0	1	2	3
69. Applies rules and permissions correctly to decision making	0	1	2	3
70. Makes decisions quickly when the situation calls for it	0	1	2	3

Part II**Individual Reflection Questions**

4. What are your crew's strengths (i.e., what do you do well)? Which crewmembers exhibit each strength?
5. What are your crew's weaknesses (i.e., where could you improve)? Which crewmembers exhibit each weakness?
6. How does this impact how you'll distribute tasks amongst crewmembers in the short-term?

Part III**Crew Team Assessment**

Based on your individual answers, your crew discussion, and the results of the pre-training ABM performance assessment, what are your team strengths and weaknesses?

Slide 13



Module Summary



- You should now be able to:
 - Define task saturation.
 - Identify the signs of task saturation.
 - Identify task responsibilities that can be shared across crewmembers.
 - Identify crew strengths and weaknesses.

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13

Module Summary

This module helped you gain a shared understanding of your current crew situation. You should now be able to:

- Define task saturation.
- Identify the signs of task saturation.
- Identify task responsibilities that can be shared across crewmembers.
- Identify crew strengths and weaknesses.

In the next module, you will learn strategies for improving crew team performance to help mitigate task saturation.

Module 2: Plan Formulation

Learning Objectives

- Describe strategies for mitigating task saturation.
- Given a scenario, develop a plan for mitigating task saturation.
- Determine intra-crew communication rules and norms.

Estimated Time

90 minutes

Slide 1



Module 2: Plan Formulation

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1

Module Overview

In this module, you will learn strategies for improving crew team performance to help mitigate task saturation. As you go through this module, you will work with your crew to develop a Personal Crew Plan that identifies rules and norms for how your crew will react and respond to situations in an effort to mitigate or reduce task saturation.

Slide 2



Task Saturation Mitigation Strategies

- Conduct “what if” scenarios
- Conduct mutual performance monitoring and provide backup support
- Prioritize tasks
- Redistribute tasks

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Task Saturation Mitigation Strategies

While it may not be possible to eliminate task saturation, there are strategies crews can implement to better manage task saturation when it does occur:

- Conduct “what if” scenarios.
- Conduct mutual performance monitoring and provide backup support.
- Prioritize tasks.
- Redistribute tasks.

Each strategy will be discussed in more detail during this module.

Slide 3



Conduct “What If” Scenarios

- Devise a plan of action based on likely trigger events (e.g., new STO comes in, comms go down).
- Helps crews gain efficiencies as the complexity of the air battle increases.



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Conduct “What If” Scenarios

Planning how to react and respond to changing situations and conditions plays a significant role in the success of the overall mission. Establishing a crew-wide understanding of priorities and evaluating the points at which task saturation is likely to occur will help a crew develop a plan to avoid common obstacles.

During slow or down times, crewmembers should talk through “what if” scenarios to plan what to do and who does what under different situations. This includes specifying alternative courses of action and rules that the crew will use at the appropriate time if/when needed. For instance, the crew may devise a plan of action that would take effect if a new STO comes in, communications go down, crewmembers need to mask up, or a man station goes down. Good contingency planning rests on “if/then” logic tied specifically to various “trigger events.” Spending time up front to discuss and plan for these matters will help crews gain efficiencies as the complexity of the air battle increases. Crews should then go and try out the plan to see if what they decided on actually works and adjust as needed.

Note that when a new crewmember comes over from another crew, crewmembers may need to renegotiate who does what.

Slide 4



Mutual Performance Monitoring





- Establishing a “shared mindfulness” among team members will help identify when backup support is needed.
- Providing backup support is the foundation of high-performing teams.

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4

Conduct Mutual Performance Monitoring and Provide Backup Support

Keeping track of your crewmembers’ actions, inactions, and performance will contribute to the team successfully completing a mission. Crewmembers should offer backup support when monitoring reveals a problem.

Providing backup support is the foundation of high-performing teams. It establishes a shared “mindfulness” among team members that helps to focus on the mission objective at hand. Working as a team, the crew can make up for any individual who is momentarily overwhelmed. Examples of ways crews can support one another during an air battle include having one crewmember track what is due next and verbalizing the due time as it approaches or maintaining an electronic version of the fault handbook for easy access.

Crews should continually be aware of the actions of their crewmembers and watch for mistakes, slips, lapses, errors, and performance discrepancies in an effort to catch and correct them in a timely manner. This awareness enables crewmembers to recognize when assistance may be needed. When a crewmember needs help, feedback in the form of verbal suggestions or coaching can assist in getting performance back on track by alerting the crewmember to the adaptive action needed.

If you offer to perform a task for another crewmember, your crewmembers must be able to trust that you will effectively complete the task in a timely manner. Take on additional tasks that you

are confident you can successfully accomplish. If conditions change, let your crewmembers know.

If a crewmember makes a mistake, don't allow him/her to shut down. Encourage him/her to stay motivated. Remind that crewmember that he/she is still needed to contribute to ABM.

It is the information gathered through mutual performance monitoring and expressed through feedback, backup support, and coordination that boosts the team beyond the sum of individual performance to the synergy of teamwork and, in doing so, promotes plan execution and team adaptation.

Backup support can occur in response to specific requests for help or from recognition that there is a task workload distribution problem in the team. When underutilized individuals back up the individual whose capacity is being surpassed, teams can dynamically adjust and perform at a level that could not have been otherwise achieved by individuals acting alone. In contrast, when there isn't a legitimate need for backup support, the provision of such support can actually detract from team performance because it leads to redundant instead of complementary behavior.

Slide 5



Prioritize Tasks

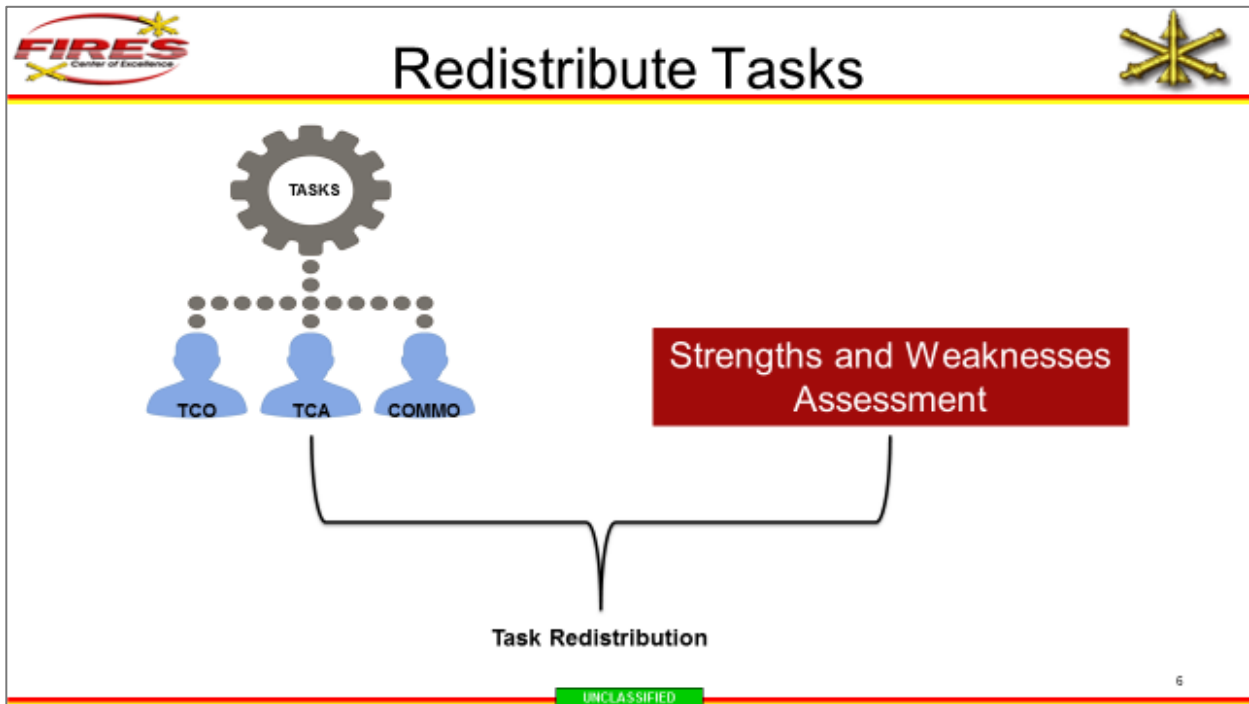
Task prioritization requires crewmembers to maintain focus on the most important initiatives, peeling away peripheral tasking at the individual level.

Because it's very difficult for crewmembers to recognize their own task saturation, mutual support is integral to helping them recognize the signs. Once a crewmember recognizes that task saturation has set in, the crewmember should redistribute his/her tasks sequentially from bottom to top. If an item is not strategically aligned with the mission objective, cross it off or lower its priority. For example, if the radio goes down to the BCP but the chat option with the BCP is still available and the crew is in the middle of a STO change and heavy engagements, then the COMMO can try to fix the radio after the STO and engagements. If an item is tactically important and still must be done, delegate this task to a less task saturated crewmember.

What tasks are perceived to be a higher priority?

What might change that priority?

Slide 6



Redistribute Tasks

There is no set standard for task redistribution among Patriot ECS crews. A strong crew may have more task redistribution because there is trust that each crewmember can fulfill all duties. On the other hand, a strong crew may have less redistribution because each crewmember can multitask and fulfill his specific responsibilities. Certain crews have little difference in roles of TCO and TCA; one does it and the other verifies. Other crews have more defined roles and can complete them in time.

Recall the discussion you had about tasks that can be shared and the Strengths and Weaknesses Assessment Activity in Module 1. These factors will help inform your crew in the redistribution of tasks. For example:

- Mapping is a task that is typically performed by the TCA. However, not everyone is good at mapping. If the TCA struggles with mapping and the TCO is good at it, the TCO may perform this task instead.
- If the Communications Operator is an E6, he can technically take on more tactical responsibilities.
- If there is a STO and a system fault, the TCO will often process the STO while the TCA handles the system fault because the TCA has more experience with the system.

Slide 7



Develop a Personal Crew Plan Activity

- Working with your crew:
 - Refer to Exhibit 2-1.
 - Complete Part I of the Personal Crew Plan.
- Be prepared to share your responses.

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Develop a Personal Crew Plan

The purpose of this activity is to have crews develop a Personal Crew Plan for mitigating task saturation.

Refer to Exhibit 2-1 on the next page. Working with your crew, complete Part I of the Personal Crew Plan.

Exhibit 2-1: Personal Crew Plan Activity

Instructions: Complete Part I of the Personal Crew Plan. Parts II and III will be completed later in this module.

Crewmember Names:		Date:
Part I		
Conduct “What If” Scenarios		
What are the top 10 challenges that can potentially happen during an air battle?		
1.	6.	
2.	7.	
3.	8.	
4.	9.	
5.	10.	
Conduct Mutual Performance Monitoring and Provide Backup Support		
When is task saturation likely to occur?		
How will you know when a member of your crew is becoming task saturated? (Refer to the cues you identified in Module 1.)		
Prioritize Tasks		
Describe the circumstances under which the following tasks would move up or down in priority.		
Responding to a STO		
Fixing a system fault		

Slewing the radar			
Implementing an ACMAF			
Reclassifying track(s)			
Addressing an NMC launcher			
Fixing downed communications			
Redistribute Tasks			
Using the list of challenges that can potentially happen and where task saturation is likely to occur from above and based on the strengths and weaknesses of your crew (from the Module 1 assessment), who should you redistribute tasks to and why?			
If	Then		
	TCO	TCA	COMMO
	TCO	TCA	COMMO
	TCO	TCA	COMMO
	TCO	TCA	COMMO
	TCO	TCA	COMMO
Part II			
Communication Strategies			
Document your crew's agreed-upon rules and norms for the communication strategies below.			
Call-outs			

Hand-offs	
Check-backs	
Part III	
Conflict Management	
Document your crew’s agreed-upon rules and norms for handling task saturation-related conflict.	
Situation	Crew Norm/Rule

Slide 8



Communication Strategies

Call-outs • Crewmembers verbalize what they are doing • Inform all crewmembers simultaneously for shared situational awareness • Help crews anticipate next steps	Hand-offs • Used to direct information to a specific individual – Task redistribution – Clarity of information – Verbal communication of information – Acknowledgement by receiver
Check-backs • Used to verify and validate information exchanged • Sender initiates message, receiver accepts message and confirms what was communicated, and sender verifies that message was received	

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Communication Strategies

Communication is critical for maintaining shared knowledge and situational awareness across the crew.

Communication occurs not only within your crew but also with the ICC, BCP, and higher echelons. Remember that standard brevity language exists and is important to follow when communicating across party lines and when other DoD organizations are involved. However, within your crew, you may personalize how you convey information. Verbal communication can be further challenged when masked (loss of clarity) or when a team member is soft spoken or has an accent. Therefore, it is important that crewmembers speak clearly.

Below is a description of some communication strategies that can be used:

- **Call-outs** are when crewmembers speak aloud what they are doing. Call-outs are a way of informing all crewmembers simultaneously for shared situational awareness. Call-outs can also be used to repeat information received that will affect the crew, so that crewmembers can anticipate next steps.
 - Example of a crewmember calling out what he is doing: “Slewing the radar.”
 - Example of a crewmember calling out a party line communication: “STO coming in.” In this example, the call-out will help the TCO anticipate that the TCA will likely pass Weapons Control to the TCO in order to process the STO.

Newly formed crews or crews that have a new team member will likely need to “talk out loud” more often until they grow comfortable with one another and learn what is expected of them.

Within your crew, what level of detail do you want your team members to call out? Using what specific brevity language?

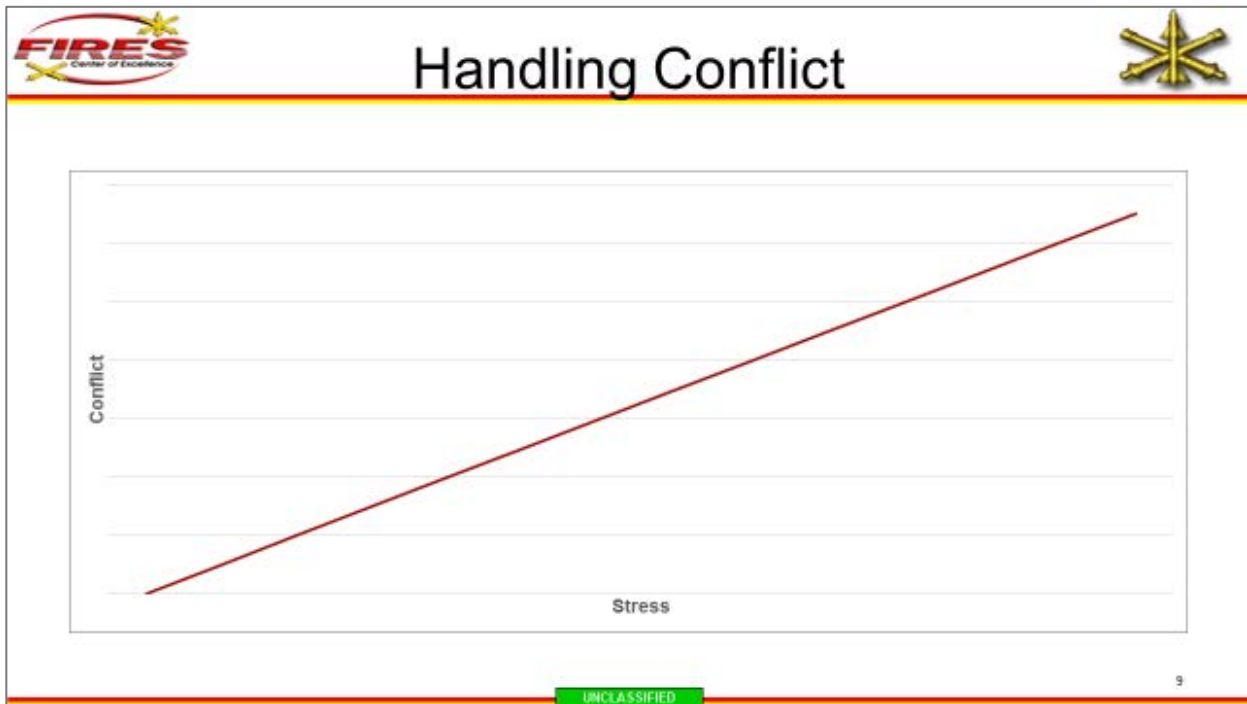
- **Hand-offs** are used to direct information to a specific individual.
 - Some important elements of conducting hand-offs include:
 - Task redistribution – When handing off a task, it is your responsibility to know that the person who must accept responsibility is aware of assuming that responsibility. Similarly, you are accountable until both parties are aware of the transfer of task responsibility.
 - Clarity of information – When uncertainty exists, it is your responsibility to clear up all ambiguity of the task responsibility before the transfer is completed.
 - Verbal communication of information – You cannot assume that the person obtaining responsibility will read or understand written or nonverbal communications.
 - Acknowledgment by receiver – Until it is acknowledged that the hand-off is understood and accepted, you cannot relinquish your task responsibility.
 - Example: Giving an engagement command
-

Within your crew, is there a particular way or certain language you should use when handing off different types of tasks?

-
- **Check-backs** are used to verify and validate information exchanged.
 - It involves the sender initiating a message, the receiver accepting the message and confirming what was communicated, and the sender verifying that the message was received.
 - Check-backs are commonly used as part of call-outs to confirm information exchange and as part of hand-offs to validate task redistribution.
 - When under task saturation, crews may need to verbalize more and acknowledge “I got it.”
 - Sometimes you may have an expectation that the crewmember should have responded after a certain amount of time. If you do not receive a response, you may want to do a check-back to confirm receipt of your initial message. The crew should discuss how long is acceptable to wait for a response.
 - Example: The TCA needs to redistribute his tasks (engagement monitoring) to comply with a radar slew command, so he calls out to the TCO “take my switches.” The TCO verifies and validates receipt of the hand-off by saying “Roger. Taking your switches.”
-

Within your crew, what language should be used for a check-back? How long should you wait before requesting a confirmatory check-back?

Slide 9



Handling Conflict

When stress peaks and task saturation occurs, it is inevitable that conflicts will arise, particularly when things are going poorly (e.g., crew misses a STO). Crews should develop a conflict management plan so that team members have agreed-upon rules and norms to use to resolve an issue (e.g., how to address conflict when someone hands off too much or is not handing off task responsibilities when they should be).

Methods for handling conflict can vary by crew as they develop their own rules and norms. Rules and norms might include specifying a word or phrase that indicates a concern or agreeing to no raised voices.

- Example: The TCO attempts to hand off a task to the TCA. In accordance with the established team norm, if the TCA needs to decline, the TCA should say “full-up” and then offer solutions. For example, the TCA should respond, “Full-up. Ask COMMO or tell us which task to deprioritize for now.”

Slide 10



Conflict Management Activity



- Working with your crew:
 - Review each situation in Exhibit 2-2.
 - Discuss how you would handle it.
 - Formulate a team rule/norm and add it to Part III of your Personal Crew Plan.
- Be prepared to share your responses.

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Conflict Management Activity

The purpose of this activity is to have crews further build out their Personal Crew Plan to include protocols for handling team conflict.

Refer to Exhibit 2-2 on the next page. Working with your crew, review each situation and discuss how you would handle it.

Following the discussion, generalize your responses into team rules/norms and add them to Part III of your Personal Crew Plan on page 51.

Exhibit 2-2: Conflict Management Activity**Situation 1**

The TCO formally hands off a task to you that you think will overload you, but you take it on. You then discover the TCO is doing the task anyways. How would you handle this situation?

Situation 2

The TCA is showing signs of tunnel vision by focusing on a single task and not performing other tasks. You suspect that task saturation is occurring, so you step in to help but the TCA becomes belligerent and won't hand off tasks. How would you handle this situation?

Situation 3

The COMMO recently joined a new crew. His last crew handled stressful situations in a quiet and calm manner. Therefore, he was quite taken aback when he was chewed out for not completing a task in a second! Things got really heated in the van that day. How would you handle this situation?

Slide 11



Module Summary



- You should now be able to:
 - Describe strategies for mitigating task saturation.
 - Given a scenario, develop a plan for mitigating task saturation.
 - Determine intra-crew communication rules and norms.

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Module Summary

This module helped your crew formulate a plan for mitigating task saturation. You should now be able to:

- Describe strategies for mitigating task saturation.
- Given a scenario, develop a plan for mitigating task saturation.
- Determine intra-crew communication rules and norms.

In the next module, you will learn about the importance of team learning and will then play an ABM Game to practice the strategies for mitigating task saturation.

Module 3: Practice and Learn

Learning Objectives

- Describe key factors for team learning.
- Using the ABM Game, apply strategies for mitigating task saturation.

Estimated Time

65 minutes (time will vary depending on the number of crews in the class and number of facilitators)

Slide 1



Module 3: Practice and Learn

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Module Overview

In this module, you will first learn about the importance of team learning and providing psychological safety. You and your crew will then practice the strategies you learned for mitigating task saturation using the Personal Crew Plan you developed in Module 2.

Slide 2



Importance of Team Learning



- Try new things
- Take on different roles and responsibilities
- Take risks
- Make (and learn from) errors



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2

Importance of Team Learning

Team learning is an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions.

Training is an opportunity to try new things, take on different roles and responsibilities, take risks, and make errors. Trainees who are allowed to make errors while learning a task achieve a better grasp of task principles than trainees who are prevented from committing errors.

Slide 3



Key Factors for Team Learning



- Promote psychological safety
- Conduct team learning activities after each ABM event
- Integrate improvements into future events

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3

Key Factors for Team Learning

The following are key factors for team learning:

- **Promote psychological safety:** For maximum learning to occur, crewmembers must be willing to expose themselves by openly and honestly discussing mistakes, shortcomings, and alternative viewpoints. Seeking help and guidance as well as admitting and discussing mistakes are important behaviors to improve team performance. Asking questions should be an accepted practice and should be encouraged. Crewmembers should not feel uncomfortable sharing concerns or questioning situations.
- **Conduct team learning activities after each ABM event:** Team learning activities may include discussions about what went well, what didn't go well, and how to integrate the feedback to make adjustments (similar to an After Action Review). The team discovers the consequences of previous actions, how to prevent those unintended consequences, and how courses of action can be revised in future training exercises or live events.
- **Integrate improvements into future events:** It is not enough to simply identify improvements that need to be made. These improvements need to be documented and explicitly integrated into the next training exercise or event in order to improve team performance.

Slide 4



Practice Mitigating Task Saturation



- A good ECS crew:
 - Understands that at times each member could become task saturated.
 - Recognizes everyone's "tells."
 - Knows which tasks can be shared and which cannot.
 - Knows their team strengths and weaknesses.
 - Can effectively redistribute tasks when needed.
 - Knows their call-out, hand-off, and check-back protocols.
 - Knows their brevity language expectations.
 - Maintains an open, honest environment to share and question.

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Practice Mitigating Task Saturation

It's now time for you to take all of the information you learned in this course and practice applying these strategies using the ABM Game.

As a reminder, a good ECS crew:

- Understands that at times each member could become task saturated.
- Recognizes everyone's "tells."
- Knows which tasks can be shared and which cannot.
- Knows their team strengths and weaknesses.
- Can effectively redistribute tasks when needed.
- Knows their call-out, hand-off, and check-back protocols.
- Knows their brevity language expectations.
- Maintains an open, honest environment to share and question.

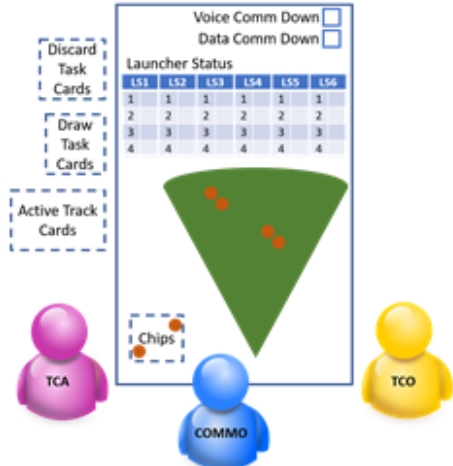
Slide 5



ABM Game Activity



- Practice strategies for improving crew team performance to help mitigate task saturation
 - First half: Pause to talk through thought process
 - Second half: No interruptions
 - Team learning session



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5

ABM Game

The purpose of the ABM Game is to tie together all of the learning content and have your crew practice the strategies you learned for mitigating task saturation using the Personal Crew Plans you developed in Module 2.

During the first half of game play, the facilitator will periodically pause the game to ask you and your crewmembers questions and have you talk through the actions that you took. You will complete the second half of game play without interruption and will then conduct a team learning session.

Following the team learning session, you will document what went well and what didn't go well during the game session as well as areas of focus for your next ABM Game session or training event in Exhibit 3-1.

Exhibit 3-1: Documentation of Team Learning Session

Document what went well and what didn't go well during the ABM Game session as well as focus areas for your next ABM Game session or training event.

ABM Game Results	
Date:	What went well
	What didn't go well
Date:	Focus areas for next session
	What went well
Date:	What didn't go well
	Focus areas for next session

Slide 6



Module Summary



- You should now be able to:
 - Describe key factors for team learning.
 - Using the ABM Game, apply strategies for mitigating task saturation.

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6

Module Summary

This module taught you the importance of team learning and providing psychological safety to your crewmembers. You then practiced the strategies you learned for mitigating task saturation using the Personal Crew Plan you developed in Module 2. You should now be able to:

- Describe key factors for team learning.
- Using the ABM Game, apply strategies for mitigating task saturation.

The next module will provide a course wrap-up, and you will provide feedback on the course as a whole as well as complete a post-training assessment.

Module 4: Wrap-up

Learning Objectives

- N/A

Estimated Time

45 minutes (time will vary depending on the ABM level required to generate task saturation in crews during the post-training ABM performance assessment, number of crews in the class, and number of facilitators)

Slide 1



Module 4: Wrap-up

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1

Module Overview

The purpose of this module is to briefly review the content that was covered in the course and review the course goal and objectives. The facilitator will also revisit the list of expectations you generated at the beginning of the course to ensure that all expectations were met and address any remaining questions.

At the end of the module, you will be asked to complete a Course Evaluation Form. You will also complete a post-training assessment consisting of both a knowledge assessment and an ABM performance assessment.

Slide 2



Course Goal



- Improve crew team performance by providing strategies and techniques to help crews mitigate task saturation.

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2

Course Goal

The goal of this course was to improve crew team performance by providing strategies and techniques to help crews mitigate task saturation when it occurs.

Slide 3



Course Objectives



- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
- Develop a Personal Crew Plan for mitigating task saturation.
- Improve crew performance in mitigating task saturation through practice and team learning.

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Course Objectives

You should now be able to:

- Establish a shared understanding of task saturation, ECS crew team roles and task responsibilities, and the crew's current strengths and weaknesses.
 - Develop a Personal Crew Plan for mitigating task saturation.
 - Improve crew performance in mitigating task saturation through practice and team learning.
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Slide 4



Participant Expectations





- How well did this course meet your expectations?
- How do you plan to use what you learned?

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Participant Expectations

Review the list of expectations generated at the beginning of the course.

How well did this course meet your expectations?

How do you plan to use what you learned?

Slide 5



Course Evaluation



- Complete the Course Evaluation Form and return it to the facilitator.
 - Gives participants an opportunity to provide feedback regarding their observations of the course's strengths and weaknesses
 - Used to improve future iterations of the course

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Course Evaluation

Complete the Course Evaluation Form that the facilitator will hand out to you. Course evaluations are one way that helps to measure the effectiveness of the training. You do not have to put your name on the evaluation form.

The Course Evaluation Form gives you an opportunity to provide feedback regarding your observations of the course's strengths and weaknesses. This valuable feedback will be used to improve future iterations of the course.

Slide 6



Post-training Assessment



- Measures participants' growth in knowledge and skills
- Used to determine course effectiveness



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Post-training Assessment

You will now complete a post-training assessment that, similar to the pre-training assessment, consists of a knowledge assessment followed by an ABM performance assessment. By assessing your knowledge and skills at the beginning and end of the course, we are able to measure how effective the course is.