Mission Essential Competencies for the AOC: A Basis for Training Needs Analysis and Performance Improvement

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ABSTRACT

The Air and Space Operations Center (AOC) is the operational Command and Control center in which the Commander, Air Force Forces (COMAFFOR) has centralized the functions of planning, direction, and control over assigned and attached Air Force resources. If the COMAFFOR is also designated as the Joint Force Air Component Commander (JFACC), these functions will be performed for all aerospace resources from the Air Force and other Services and nations made available for planning and tasking within the guidance provided by the Joint Force Commander.

The core manning of an AOC consists of approximately 252 personnel from over 30 Air Force enlisted and officer career fields. The majority of these personnel do not receive training on their duties and systems within the AOC prior to their assignment. They are expected to meld career field knowledge and skills, professional military education, and AOC unique training to perform their part of the planning, direction and control of Air Force resources. The Air Force has recently declared the AOC a weapon system with the attendant focus on training and certifying AOC operators.

The Air Force Research Laboratory, Warfighter Training Research Division, under the sponsorship of ACC/DOY and AC2ISRC/DOT have begun an effort to define AOC training and rehearsal requirements using an approach based on Mission Essential Competencies (MEC). This effort provides the most complex attempt to date to apply the MEC process across multiple teams and individuals. This paper will discuss the application of the process to two AOC divisions, Combat Plans and Combat Operations, and provide an interim report on the results.

ABOUT THE PRIMARY AUTHORS

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AIR AND SPACE OPERATIONS CENTER

The AOC is the senior element of the Theater Air Control System (TACS). It provides operational level command and control of air and space forces as the focal point for planning, directing, and assessing air and space operations. Although the Air Force provides the core manpower capability for the AOC, other service component commands contributing air and space forces provide personnel in accordance with the magnitude of their force contribution. During any contingency, the Air Force builds the AOC using three primary Unit Type Codes (UTC) and other capabilities incorporated in various enabling UTCs. The discussions in this paper will focus on the core 7FVX1 UTC.

An AOC is typically organized into five divisions and multiple specialty teams. The divisions include Strategy; Combat Plans; Combat Operations; Intelligence, Surveillance, and Reconnaissance; and Mobility. Specialty Teams include Communications, Information Warfare, Space Operations, Special Operations, and Judge Advocate. Core manning, as provided in the 7FVX1 UTC, is the responsibility of a Numbered Air Force with an Air Operations Group (AOG) assigned. Based on the requirements of the particular contingency, the Numbered Air Force commander will direct the formation of an AOC using the organic AOG augmented by various augmentation UTCs and enabling UTCs.

The 7FVX1 UTC is designed to provide the personnel and equipment for initial response, defined as supporting up to two weeks of full spectrum, 24/7 AOC capability. When deployed, this UTC will be augmented with the mobility component from the Air Mobility Command and other enabling UTCs. The officer contingent of the UTC is currently made up of 37 pilots, 22 navigators, 10 air battle managers, 7 space operators, 2 airfield operators, 34 intelligence officers, 1 weather officer, 2 operations support officers, 2 logisticians, 10 communications/computer officers, 1 PSYOPs officer, 1 judge advocate, 1 operations assessor, 1 electrical engineer, and 1 special investigator. The enlisted contingent is made up of journeymen and craftsmen from a variety of career fields including 2 air traffic control, 2 command post, 11 aircraft control and warning, 45 intelligence, 9 ground radio and electronic communications, 1 munitions, 7 information management, 21 communications-computer systems, 2 audio/visual, and 1 security forces. None of these personnel are trained in AOC operations in their basic career field training.

AOC operators need to be mission ready in their specialty areas and are expected to use their knowledge and experience to provide subject matter expertise to the planning and operations functions. Additionally, since the AOC is the interface between the operational art of war and tactical execution, operators are expected to be versed in professional knowledge gained from professional military education and reading. Joint and aerospace doctrines are also required knowledge areas for AOC operators.

Finally, the AN/USQ-163-1 Falconer system, the formal designation of the AOC weapon system, consists of over 40 systems and applications which are used by the various operators. Training on these systems, and some of the required knowledge, is currently provided by the Command and Control Warrior School (C2WS) at Hurlburt AFB FL. The C2WS courses are being transitioned into a Formal Training Unit (FTU) course, which will be the standard preliminary requirement for all personnel assigned to an AOC position. The FTU is designed to certify AOC operators for initial qualification status and represents the first step in developing a robust AOC operational training pipeline.

One of the greatest challenges for consistent, effective

and efficient AOC operations has been the frequent influx and outflow of personnel. By the time AOC operators are comfortable working in the AOC, they are returning home and handing their job off to others, who are often as ill-prepared for the jobs as they were when they started months earlier. Formal training, now made possible by the weapon system designation, will be an essential element in reducing the transitional slow-downs inevitable when personnel enter and exit the AOC arena. The challenge is to develop training that can be targeted at an individual's specific training needs, and provide that training in a manner which will raise the proficiency level of the individual rapidly. In this way, AOC personnel can contribute effectively to the mission more quickly during their compressed assignment cycle.

The weapon system designation presents the Air Force with the responsibility of developing a training system that adequately prepares AOC warfighters with the knowledge and skills necessary to perform their mission. Air Combat Command (ACC) developed the Ready Aircrew Program (RAP), which enables ACC to produce the most capable combat pilots in the world. A fully capable training system includes Initial Qualification Training (IQT), Mission Qualification Training (MQT), and Continuation Training (CT), which are all hallmarks of RAP. It will take a substantial effort to develop and implement an equally successful training program for the AOC arena. In a similar vein to RAP, ACC is currently looking to the MEC process as a possible foundational construct for developing a robust training program for AOC personnel. The MEC process provides a level of detail and analysis necessary to address the complexity of AOC operations, and such a training program would help alleviate the problem of personnel influx and outflow by reducing the learning curve associated with initial exposure to a real-world AOC.

In developing an approach to AOC training we considered a highly successful MEC process which was developed to improve aircrew training. ACC wanted to take a competency-based approach to training needs analysis to help optimize the already successful RAP through the use of advanced simulation. Combat mission readiness has traditionally been defined in RAP in terms of the number of hours and training missions individual pilots have completed. However, recently ACC/DRAT realized it needed to operationalize readiness in terms of the performance required of aircrews under combat conditions, and in specific mission contexts. With the current emphasis, ACC conceived the Mission Essential Competencies as context-specific, maximal performance standards. AFRL/HEA, cooperatively with their commercial partners, the Group for Organizational Effectiveness and ACC/DRAT, developed the MEC methodology and defined the associated outcomes for understanding performance requirements for aircrew operations. This paper describes the extension of the MEC concept from aircrew tactical employment to the operational art of command and control and discusses the methodology used to define MECs for AOC operators.

MEC Background

MECs are a collection of statements written at different levels of abstraction. At the highest level are the MECs proper – such as the statement from the air-to-air (F-15) MECs: *"Intercepts and targets factor groups."* Statements indicating a starting point, purpose, and end point clarify and define the original statement. The Starting Point occurs when intercepting and targeting starts at the commit. Geometry and contact ranges may cause the two parts of this phase to blend together. Very short commits may not have an intercept portion and flights may have to go directly to targeting. As with detection, targeting may be a repetitive action if multiple entities and waves are involved. The Purpose is to arrive with a positional advantage, a position to employ ordnance, and to deconflict shots. The End Point is when engagement criteria are met in terms of weapons parameters, ROE, and target identification.

At the next level are Supporting Competencies. These are both more general than the MECs proper, and reflect areas of competence needed in carrying out the MECs. For example, SCs identified as important for air-to-air include:

- Adaptability: adapts to changes in the mission environment (e.g., adjusts timeline/gameplan, reacts to threat maneuvers and tactics, and adapts to other changes in the environment)
- Communication: clear, concise, and correct transfer of information

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

- ROE: knows theater Rules of Engagement, areas of non-combatants and political situation
- Anticipates problems: predicts what will happen and anticipates problems early

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

- Restricted weapons load (e.g. due to previous employment, incomplete reload, WRM

limits).
- Limited fuel remaining (e.g. due to increased fuel consumption, low fuel remaining, lack of tanker support, or inability to inflight refuel)

The MEC Process

The MEC process is a unique work analysis in that it links the knowledge and skills required to do a job, and the application of those knowledge and skills to perform duties within the realistic context of a work environment. In short, MECs fill the gap between knowledge and skills and actual job experience.

The MEC process involves detailed interviews with subject matter experts (SMEs) selected by the operational customers, data gathering from the broader operational community, and detailed analysis and organization of the results. The initial set of draft MECs are developed in a series of two workshops wherein SMEs provide information about work structure, knowledge and skills, experiences which are then analyzed to form the basis of the MECs. All data gathered in the first workshop is compiled and organized prior to the second workshop, wherein the question is asked, "Is this what you meant/said?" The second workshop in essence provides a validation of the findings from the first workshop and allows us to delve deeper into the more detailed knowledge, skills, and experience components of the MEC construct. Following the second workshop, an extensive database of expert knowledge about a career area exists. This information is organized into survey questionnaires which are presented to the broader operational community for that particular weapon system. For example, for the AOC, it will be necessary to bring the surveys to the numerous AOC units around the world in order to determine the validity and thoroughness of the data collected. Additionally, these surveys gather data about operator opinions on training needs and gaps based on the initial MEC construct. After compiling the data, a comprehensive analysis of the weapon system and associated career field training status is performed that can help determine how important certain competencies are to high performance in a particular career field or weapon system. Additionally, the ranked training needs data will allow for specific prioritized training recommendations to the operational customer. With this knowledge, a more efficient and effective training program can be developed that will target the areas identified as most important. Additionally, the knowledge gathered in the MEC process will provide detailed performance requirements data to enable customized training to target specific deficiencies an individual may have in a particular area.

An initial challenge associated with applying the MEC process to the AOC is that of scope. In previous MEC efforts the SME workshops were held at the major weapon system level which encompassed no more than a handful of Air Force Specialty Codes (AFSCs). The AOC weapon system, however, utilizes operators in dozens of AFSCs. Additionally, the variety of positions, operators, processes, tasks, and responsibilities further complicated the problem of dividing the AOC into manageable pieces suitable for defining meaningful MECs. If we were to analyze the AOC as a whole and try to define MECs suitable across the entire weapon system, the resulting MECs would be too broad and generalized to provide information useful in defining AOC training requirements for the individual operators. Conversely, to define MECs for the AOC one team at a time, would require a protracted effort and would yield results too slowly for the operational customers. Our approach was to analyze each division separately. We felt this would allow us to analyze the processes at a level of detail which would yield meaningful results for the customer to define targeted training requirements, yet still provide results in a timely manner. Additionally, divisions would be addressed in a staggered fashion which would allow us to assess results as we progress through the divisions and adjust the process if required. We started our analysis of the AOC with the Combat Plans and Combat Operations divisions. We discuss our progress and interim results with these two divisions in more detail later in this paper.

Relationship of the MEC process to other job and task analysis approaches

MEC workshops are not modeled after any one job or task analysis approach, but encompasses elements of several. Comparisons can be made between the MEC process and other job analysis methods.

One distinction that can be made among job/task analysis methods is whether they are *task oriented* or *worker requirements oriented*. In task analysis, detailed task lists are created and grouped into categories, such as "Communication with others", or "Development tasks". Ratings for task frequency of performance, task importance, and task difficulty are usually obtained and analyzed.

Worker requirements oriented job analyses, on the other hand, are not designed to gather information about tasks which are specific to any one job. Rather, information about job dimensions (e.g., "error checking") are collected. The Position Analysis Questionnaire (PAQ) (McCormick, Jeanneret, & Mecham, 1972) is a questionnaire with 194 worker-oriented statements such as the above. These are grouped into six major categories: Information Input, Mental Processes, Work Output, Relationships with Other Persons, Job Context, and Other Job Requirements. The MEC process is neither only task-

oriented, nor requirements-oriented. The Supporting Competencies are worker requirements, while the knowledge and skills often include knowledge of particular tasks.

Another comparison can be drawn between MECs and Functional Job Analysis (FJA; Fine & Wiley, 1971). The MEC process is probably most similar to FJA than to other job analysis methods, because of the wide range of levels of outcomes. However, it is also different from FJA in that specific developmental experiences are identified, where FJA specifies only some training requirements. Further, FJA may specify tasks at a detailed level, while the MEC process does not. However, for U. S. Air Force jobs, the Training Task Lists (TTLs) fulfill that function.

In another type of job analysis, Cognitive Task Analysis (CTA), the focus is on mental representations or processes of the worker. The MEC process is different than CTA. However, to the degree that the MECs themselves capture the mental model of the way the F2T2TA "kill-chain" is realized in a particular platform, MECs and CTA would overlap in terms of philosophy and outcomes.

Table 1 briefly summarizes this comparative analysis among job analysis methods (from Colegrove & Alliger, 2003).

Mission Essential Competencies for the Combat Plans Division

Two MEC workshops have been conducted for the Combat Plans Division of the AOC. This section of the presentation describes the process and outcomes of these two workshops. Although our experience is that the draft products obtained by the end of the second workshop are fairly stable, they are still subject to change; in addition, the MEC process necessarily takes a slightly different form in the AOC than in previous aircraft and platforms. The nature and reasons for this difference were mentioned earlier and will be discussed in more detail later.

Job Analysis Method	Major Functions?	Detailed Tasks?	Human Requirements?		Develop-mental Experiences?	Training Require-ments?	Cognitions?	
			Knowledge/ Skill	General Abilities			Detailed Task or Decision Cognitions?	Overall Mental Model?
FJA	**Y**	**Y**	**Y**	**Y**	**N**	**Y**	**N**	**N**
CTA	**N**	**N**	**N**	**N**	**N**	**N**	**Y**	**Y**
Task Analysis	**N**	**Y**	**N**	**N**	**N**	**N**	**N**	**N**
WRO Analysis	**N**	**N**	**Y**	**Y**	**N**	**N**	**N**	**N**
MEC Analysis	**Y**	**N**	**Y**	**Y**	**Y**	**Y**	**N**	**Y**

Key:
FJA = Functional Job Analysis
CTA = Cognitive Task Analysis
Task Analysis = Traditional task analysis (e.g., obtaining Frequency/Importance/Difficulty ratings)
WRO Analysis = Worker Requirements Oriented Analysis, yielding broad requirements by the job of a worker (e.g., Positional Analysis Questionnaire)
MEC Analysis = Mission Essential Competency Analysis

Table 1. A Comparison of Various Job Analysis Methods

First workshop process and outcomes. Like all MEC workshops, the first workshop was a facilitated, SME-centered session. SMEs attended who were very familiar with the work processes, manning, and products of the AOC Plans division. The workshop proceeded, after introductions and description of objectives, by eliciting from the SMEs a) the structure, makeup, and outcomes of the teams in Plans, b) the knowledge and skills required for each of the major positions identified. Also identified was an initial list of supporting competencies.

The expertise-elicitation process in this first workshop typically requires expert elucidation of several aspects of the job, including identification of the missions, simple, mid-range and most complex; clarification of the names and duties of positions/sections/teams; identification of tasks required to do each mission for each position; identification of knowledge required for each position; identification of skills required for each position; and identification of supporting competencies. In the case of the AOC, these general targets were met, with the exception that the AOC performs only a single, overarching C2 mission, so that the identification of simple versus complex missions was not required.

The SME input was then collated and edited. This yielded a draft of the knowledge and skills and the supporting competencies. Also, the draft MECs were generated, via the same process of induction used for previous MEC initiatives. For the AOC, then, the first workshop proceeded in much the same way as first MEC workshops for aircraft platforms such as F15, AWACS, and Joint Stars.

Second workshop process and outcomes. The second workshop was attended by some of the SMEs in the first workshop, augmented by SMEs who had not attended the first workshop (this is typical for the MEC process). In this workshop, the draft MECs, supporting competencies, and knowledge and skills were presented to the SMEs for critiquing, editing, and revision. As is typical, the wording of the MECs changed somewhat at this stage. The draft supporting competencies were also revised. The knowledge and skills were revised, and mapped onto relevant positions in the Plans Division. In addition, a list of AOC developmental experiences was developed. These results are only preliminary and are presented in Table 2.

It can be seen that these competency statements meet the original definition of MECs: "A Mission Essential Competency (MEC) is a higher-order individual, team, and inter-team competency that a fully prepared pilot, crew or flight requires for successful mission completion under adverse conditions and in a non-permissive environment." The one emendation would be to add the word "team" to "pilot, crew or flight."

Interpret Commander's Guidance and Intent: Translate Commander's guidance and intent into operational plans, using effects-based analysis and incorporating an understanding of capabilities, limitations, mission purposes, and risks.
Gather, Process, and Analyze Information: Collect information from planning documents (e.g., JFC Guidance, OPLAN, JAOP, AOD, ROE, SPINS, ACP, ADP), operational units (e.g. sortie availability), other AOC divisions/teams; process information by evaluating reliability, currency, and relevance; sort and prioritize information to prepare for analysis; and analyze information. Identify information shortfalls and request additional information from appropriate sources. Share information with appropriate planners.
Identify and Nominate Targets: Refine the draft Joint Integrated Prioritized Target List which includes inputs from participating components and detailed targeting data (e.g., DMPIs). If required, set cut line on JIPTL to reflect current capabilities. Obtain approval from JFC or designated representative.
Develop Air Attack Plan: Allocate available kinetic and non-kinetic weapons to targets using JIPTL, apportionment guidance, information on weapons and weapon systems capabilities and limitations, and information on component unit current capabilities and constraints, and current information on weather and intelligence. Include C2, ISR, and other support assets.
Establish and Maintain Command and Control: Establish and maintain command and control by establishing communication and airspace/air defense control requirements and procedures through coordination with appropriate agencies.
Produce and Distribute Products: Assemble products (e.g., ATO, ACO, SPINS, RSTA Annex, TACOPDAT, OPTASK LINK) by compiling input from planning teams and according to appropriate formats; distribute products using most efficient means available.

Table 2. Mission Essential Competencies for AOC Combat Plans Division (DRAFT)

Of further interest is the fact that there are two MECs ("Interpret Commander's Guidance and Intent," and "Gather, Process, and Analyze Information") that overarch the teams of the AOC Combat Plans division. The other four MECs map onto particular teams ("Identify and Nominate Targets" – GAT, "Develop Air Attack Plan" – MAAP, "Establish and Maintain Command and Control" – C2, "Produce and Distribute Products" – ATO Production) while the competencies they discuss are not limited to any one team. Indeed there are specialty area positions that do not fall exactly within the purview of any one team, yet reflect these competencies constellated in various ways.

A sample of the supporting competencies (there are 12 in all) for the Combat Plans Division include:

Collaboration/Coordination: Ability to actively share and transfer information between all appropriate parties to enhance and support mission planning and execution

Interpersonal Communication: Ability to communicate in clear, concise, and timely manner

Negotiation: Ability to identify and balance needs and requirements of various parties and obtains consensus on solution.

Quality Control: Ability to assess accuracy, completeness, and timeliness of various processes and products

Projection: Ability to conceptualize future actions and events based on relevant factors.

As can be seen from this sample, SMEs identified as important for Plans competencies that support teamwork and production.

Finally, this first second workshop permitted the SMEs to a) revise the wording of the knowledge and

skills (including deleting whole statements, or adding new ones), and b) indicate, for each major position in the Plans division, the level of knowledge or skill required for effective performance (not applicable, basic, intermediate, advanced).

Table 3 (next page) shows an example of the outcome of this process. As can be seen, the SMEs were able to identify, for major positions, the level of knowledge or skill required for effective job performance. This kind of scaling will facilitate training needs analyses that indicate training gaps.

A rather unexpected benefit of the second workshop was the opportunity for SMEs to review and reconsider the major positions for the teams listed from the first workshop. While reviewing the knowledge and skills in relation to specific positions, it became apparent that several of the positions were somewhat redundant in relation to the knowledge and skills needed when performing their functions. As a result, where appropriate, we assumed that certain positions were essentially knowledge- and skill-redundant. It should be noted that this "redundancy" does not imply that any individual within the AOC is not required for optimum functioning of his/her team; rather, the redundancy refers simply to the fact that multiple positions can reasonably be categorized as one as far as their knowledge and skill requirements. We also, based on SME recommendations, chose to disregard the component representatives because the Air Force does not train them. It was also acknowledged that certain specialty functions and positions were not included. We kept record of those positions for use in a future workshop focused towards specialty teams and positions.

Finally, in addition to MECs, supporting competencies, and knowledge and skills, potential developmental AOC experiences were generated and mapped to teams. Developmental experiences were explained to the SMEs to be any experience that could occur during the operation of an AOC that could potentially benefit members of the AOC. This benefit could occur via any of several actions: for example, by providing practice in stimulus recognition, task performance, or error correction; by causing unusual difficulties that need to be addressed through duty backup or manual operation of ordinarily automated tasks, etc. The SMEs generated such experiences as "coordination problems," "poor target list," "late arrival of TNLs." Each team that could potentially benefit from each experience was indicated, so that partial results are as illustrated in Table 4 (next page).

The next step, after completion of all second workshop products, will be to develop training needs analysis questionnaires for distribution to a wide AOC MEC audience.

Missions Essential Competencies for the Combat Operations Division

Interim Results: Two MEC workshops have been conducted with the Combat Operations Division of the AOC. The structure of these meetings and associated outcomes were similar to that of Combat Plans (see First workshop process and outcomes and Second workshop process and outcomes above). One notable difference was the increased time necessary to map knowledge and skills to specific positions for Combat Operations due to the larger number of teams and positions within teams. All other aspects of the MEC process conducted thus far have generalized very well between AOC divisions. Below you will find an edited draft version of MECs, supporting competencies, and knowledge and skills for Combat Operations. Again, **the results in Table 5 are preliminary and should not be considered as anything other than a draft.**

The MECs for Combat Operations also meet the original definition of MECs in that they are each a "higher-order individual, team, and inter-team competency that a fully prepared pilot, crew or flight requires for successful mission completion under adverse conditions and in a non-permissive environment." While the MECs for Combat Plans contained two overarching MECs with the other four MECs mapping onto particular teams within Plans,

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

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

Table 3. Sample Knowledge and Skills for AOC Combat Plans Division (DRAFT)

	A	B	C	D	E
1	Experiences	GAT	MAAP	ATO Production	C2 Planning
2	Red Flag	X	X	X	X
3	Blue Flag	X	X	X	X
4	Green Flag		X	X	X
5	Mass package air	X	X	X	
6	Crisis Action Planning	X	X	X	
7	Senior level briefing	X	X	X	X
8	Joint/Combined/Coalition operations	X	X	X	X
9	Requirement for leadership	X	X	X	X
10	Time demands	X	X	X	X
11	Late arrival of JIPTL		X		
12	Late arrival of TNLs	X		X	
13	Late completion of data inputs			X	
14	Late arrival of SPINS inputs				X
15	Guidance problems – unclear, vague	X	X	X	X
16	Poor target list	X			
17	JFC/JFACC/AOC Director/CCP micromanagement	X	X	X	X
18	Coordination problems	X	X	X	X
19	Equipment problems: Manual JPITL generation	X			
20	Equipment problems: Manual MAAP generation		X		
21	Equipment problems: Manual ATO generation			X	
22	Equipment problems: Manual C2 planning				X
23	Work-arounds & back-ups	X	X	X	X
24	Interaction with other AOC functional areas	X	X	X	X
25	Late interjection of new targets	X	X		
26	Late interjection of new requirements of inputs				X

Table 4. Sample Developmental Experiences for AOC Combat Plans Division (DRAFT)

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

Table 5. Mission Essential Competencies for AOC Combat Operations Division (DRAFT)

this was not the case for Ops. For Combat Operations, all seven MECs appear to be higher level and to apply across the teams (offensive, defensive, integrated ISR, and specialty/support). This is not to say that each MEC applies equally across teams or positions, only that in a general sense these MECs apply across teams. One particular challenge in deriving MECs for Combat Operations was trying to capture higher order skills needed for a dynamic and circular process and to report them in a linear fashion. You'll note that the SMEs required the use of language such as "constantly" as a way to emphasize this dynamic and circular process.

Some DRAFT supporting competencies (there are 12 in all) for the Combat Operations Division include:
Decisiveness: Ability and willingness to make timely decisions based on available information.
Adaptability: ID and adjust to environment changes.
Multi-tasking: Ability to effectively perform multiple responsibilities simultaneously.
Interpersonal Communication: Ability to communicate in clear, concise, and timely manner.
Situational Awareness: Ability to assimilate information to develop/maintain perception of current operations scaled to individual responsibilities.

The SMEs representing Combat Operations identified competencies emphasizing the need for maintenance and awareness of a dynamic, fast-paced, and changing environment and the need to be able to function well within that environment.

Experts also identified the appropriate level of Knowledge and Skills (KSs) for Combat Operations. In addition, they were able to map these KSs to individual positions (Table 6, next page). Not every position requires every knowledge and skill. Certain positions were considered essentially knowledge- and skill-redundant based on feedback from the SMEs. We assumed that for a given officer position, the associated technicians should have the same KSs in their supporting role. For example, the SODO, SADO, and DMT techs were considered redundant and were always tied to the TMDO. In addition, there were some specialty functions that were not covered and will need to be revisited in future workshops. Those include, but are not limited to the following: Operations Support, Offensive Counter Information Team, Offensive Counter Information Chief, Psychological Operations Planner, IW Targeteer, IW Deception Planner, Electronic Warfare Officer, Links and Nodes Analyst, Defensive Counter Information Chief, Defensive Counter Information Planner, Operations Security/Electronic Systems Security Assessment Planner, OSI Investigation Agent, Computer Network Defense and Information Assurance, Electronic Protection Planner, Counter Psychological Planner, Counter Deception Planner, Information-in-warfare Chief, Information-in-warfare Collection Manager, and Information-in-warfare Analysis, Signal Intelligence Assessment Analyst, Counter Information Chief, Defensive Counter Information Planner, Operations Security/Electronic Systems Security Assessment Planner, OSI Investigation Agent, Comp. Network Defense and Information Assurance, Electronic Protection Planner, Counter Psychological Planner, Counter Deception Planner, Info-in-warfare Chief, Info-in-warfare Collection Manager, and Info-in-warfare Analyst, SIGINT Assessment Analyst. Just as for Plans, developmental experiences were also generated for Combat Operations and mapped to teams. Table 7 (next page) is a partial table.

	CCO	Offensive Operations					Defensive Operations						Integrated ISR					Speciality and Support								
Knowledge or Skill	CCO	SODO	SODO Tech	ODO (several)	TST Chief	ATO Change Tech	SADO	DDO	SADO Tech	TMDO	TMDT	ICO/ ICT/ TDC	SIDO	Analyst	TST Analyst	Collection/ISR Manager	Targeteer	Combat Reports	Wx	IW Team	ato	Space	IM	C4I Systems	JAG	CSAR
Understands combat operations processes, functions	A	A	I	I	A	B	A	I	I	I	I	I	A	B	B	A	B	B	B	A	A	A	B	I	I	I
Understands the operational kill chain (find, fix, track, target, engage, & assess)	A	A	B	B	A	_	A	I	B	_	_	B	A	A	A	A	A	_	B	A	_	A	_	_	A	A
Understands how to monitor the battlespace (INDIVIDUAL POSITION)	A	A	I	I	A	B	A	I	I	A	A	A	A	A	A	A	A	B	I	A	I	A	_	I	I	A
Understands how to adjust to battlespace dynamics	A	A	I	I	A	B	A	I	I	A	A	A	A	A	A	A	A	B	I	A	I	A	_	I	I	A
Understands ATO change process and procedures	A	A	I	A	A	A	A	A	I	_	_	B	A	B	B	I	I	B	B	A	I	A	_	B	B	A
Understands how offensive operations puts acceptable ordnance on the target in a timely, effective, and efficient manner	A	A	I	A	A	B	A	I	B	_	_	B	A	B	B	B	A	B	B	A	B	B	_	_	I	B
Understands C2 authorities and the decision making process	A	A	B	B	A	_	A	A	B	A	A	B	A	_	_	I	_	_	_	A	_	A	_	_	I	B
Understands how to coordinate with TACS units	A	A	B	I	A	_	A	A	A	B	B	I	I	I	B	B	_	B	B	B	B	B	_	_	B	A
Understands the data link architecture	I	I	_	_	I	_	A	I	I	A	A	A	A	B	B	A	_	B	_	I	B	A	_	I	_	B

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

Table 6. Sample Knowledge and Skills for AOC Combat Operations Division (DRAFT)

	A	B	C	D	E	F
1	Experiences	CCO	Offensive Operations	Defensive Operations	Integrated ISR	Specialty and Support
2	Red Flag	X	X	X	X	X
3	Blue Flag	X	X	X	X	X
4	Green Flag	X	X	X	X	X
5	Mass package air planning	X	X	X		X
6	Crisis Action Planning					
7	Senior level briefing	X	X	X	X	X
8	Joint/Combined/Coalition operations	X	X	X	X	X
9	Leadership	X	X	X	X	X
10	Time demands	X	X	X	X	X
11	Late arrival of JIPTL					
12	Late arrival of TNLs					
13	Late completion of data inputs	X	X	X	X	X
14	Late arrival of SPINS inputs					
15	Guidance problems – unclear, vague	X	X	X	X	X
16	Poor target list	X	X		X	X
17	JFC/JFACC/AOC Director/CCP micromanagement	X	X	X	X	X
18	Coordination problems	X	X	X	X	X
19	Equipment problems: Manual JPITL generation					
20	Equipment problems: Manual MAAP generation					
21	Equipment problems: Manual ATO generation					
22	Equipment problems: Manual C2 planning			X		X
23	Work-arounds & back-ups	X	X	X	X	X
24	Need to work with other AOC functional areas	X	X	X	X	X
25	Late interjection of new targets	X	X		X	X
26	Late interjection of new requirements of inputs	X	X	X	X	X
27	Change of target priorities	X	X		X	X
28	Change of mission priorities	X	X	X	X	X
29	Manning problems: Insufficient or extra	X	X	X	X	X
30	Security issues – Multi-level requirements	X	X	X	X	X
31	Security issues – Classification issues	X	X	X	X	X

Table 7. Sample Developmental Experiences for AOC Combat Operations Division (DRAFT)

IMPLICATIONS

"Scaling" of the MEC process

One implication for the current work relates to whether the MEC process of job/work analysis, which was developed initially for smaller work entities (i.e., aircraft platforms), would "scale up" in such a way that we could develop useful outcomes for a much larger, more complex organization such as the AOC. Overall, our preliminary findings do suggest that the MEC methodology continues to generalize across settings. One way to explain this is to show that we have answered several specific questions successfully. The first question that can be asked is: "Will the process take the same amount of time? Will a full MEC analysis of a large, multi-division organization take about the same amount of time as an aircraft such as AWACS or Joint Stars?" The answer is no. The process takes somewhat longer. First, it is necessary to take each division separately. Second, we found that for the first two divisions, the second workshop should be 3 rather than 2 days in length. As a result of both these factors, the total time to perform the MEC process for the AOC, surveying and data analysis aside, should be estimated at least 3 weeks. Another question that can be asked about the MEC process is, "Will the general process structure hold up?" That is, will the same processes (workshops, surveys) and outcomes (competencies, knowledge and skills, experiences) be useful or occur in a large organization? The answer here so far has been yes. Some modifications have been made (see below), but in general the process and outcomes are the same. For example, the number of MECs per division is roughly the same as those found for a large platform such as AWACS. A third question that could be asked is "Will it be possible to map knowledge and skills onto a large number of positions?" Here again the answer is yes. SMEs have had little trouble mapping the knowledge and skills to a larger number of positions. One observation, however, is that this mapping was time-consuming, due both to the number of positions and to discussion needed to reach consensus among SMEs.

Outcomes of the MEC process for the AOC

Another implication that can be discussed relates to possible outcomes for the AOC from the MEC process. Integration of training programs (e.g., Distributed Mission Training and the Ready Air Crew Program) for some aircraft platforms is one previously realized outcome from the MEC process. Another is simulation exercise and syllabi development based on the MEC model. Yet another relates to measures of performance. For the AOC, expected outcomes relate first to training needs analysis, with an eventual impact on syllabi and performance measure development.

Training needs analysis

The training needs analysis will be accomplished via surveys that have as their basis the information in the MEC model, including MECs, knowledge and skills, and experiences. These surveys will be administered in facilitated sessions with personnel from AOC's around the world. The result will be an indication of training gaps in knowledge and skills, as well as maps of developmental experiences to MECs, and estimates of the appropriateness for using experiences in differing types of AOC training.

Syllabi development

Using the information gathered from the MEC process, and from the training needs analysis, and from further possible analyses, existing syllabi and training materials for training AOC personnel can be modified, or new syllabi and training materials created. For example, the MEC process may be used, via a mapping of developmental experiences onto knowledge and skills, in the development of simulation scenarios that can be tailored to stress particular MECs and/or Supporting Competencies and/or knowledge and skills. Such scenarios can be part of a larger AOC syllabus. Additional analyses could frame requirements for large scale exercises of which the AOC is a part.

Measure Development

In order to build an effective training system, it is necessary to be able to measure performance based on the competencies, knowledge, and skills to be trained. The MEC process defines the competencies required for success in the environment, and identifies the knowledge and skills (KSs) that underlie these competencies. These fundamental competencies and associated KSs, define the goals for training—i.e., what is to be learned—and directly feed the performance measurement process. A systematic process for developing competency-based performance measures for simulation-based training has been applied to develop observer-based rating scales that are constructed from the Air to Air MECs (Schreiber, MacMillan, Carolan, & Sidor, 2002). The measure development process involves continued input and refinement from SMEs. Starting with the training goals (e.g., MECs, KSs), scenario events in the training simulation that engaged several KSs simultaneously were identified. Working with SMEs, behaviorally anchored measurement scales that are focused around these events in the scenario were created. These measures were tested to ensure that they could be reliably assessed– i.e., that SMEs were consistent in the ratings they gave to a team.

Because the measures provide a reliable assessment of team performance and are linked to specific KS requirements, they can be used to indicate how well the air-to-air crews are developing the Mission Essential Competencies that define the goals for the training system. It is assumed that, in a similar fashion, reliable and valid measures of individual and team performance based on MECs will be developed for the AOC, enabling individuals, teams, and instructors to identify and address performance issues.

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