AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

THE CASE FOR INCREASING PRODUCTION IN THE AIR BATTLE MANAGEMENT CAREER FIELD

by

William E. Roach, Major, USAF

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Advisor: Lt. Col. David A. Kirkendall

Maxwell Air Force Base, Alabama

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Abstract

The CSAF has directed 100% manning for all operational platforms, and, Air Liaison tours requiring ABMs are increasing each assignment cycle. There is also a CAF-wide shortage of ABM USAFWS graduates available to commanders. Track training Undergraduate Air Battle Managers offers benefits of speedy transition to the Combat Air Forces (CAF) but costs in time, labor and foundational knowledge base. If Headquarters Air Force (HAF) directed an increase in UABM Total Production Required (TPR) to 400, how might AETC best execute the directed increase in TPR to most efficiently train the UABM, while still teaching foundational core competencies as outlined by ACC and demanded by weapon system Mission Essential Task Lists? Although training today is thorough and complete, future drawdowns and losses in simulator capability only compound the difficulty. Research indicates fits and starts in UABM training are nothing new, nor are the changes in complexity of training. By drawing a line for training to start (FY13), this paper analyzes the operating environment at Tyndall and details requirements for training by tying USAF requirements to current training Tyndall AFB. This analysis reveals a training system that is already "tracked" to the level it should be. It further exposes the need, and details recommendations for up-to-date, high-fidelity training systems preparing the future UABM for complex operational environments.

Part 1

Introduction

The CAF is faced with a shortage of rated aircrew and the CSAF has directed 100% manning for all operational platforms, UPT, UNT, UABMT units (where initial training is conducted), and remotes rated and staff assignments.[1]

Further, Air Liaison tours requiring ABMs are increasing each assignment cycle.[2] There is also a CAF-wide shortage of USAFWS graduates available to commanders.[3] These facts, coupled with the demand to fill other test, training, exchange and staff assignments, filled from the CAF leaves these units with a reduced experience base with which to continue UABM training, war fighting and continuation training missions.[4]

Currently, the 325th Air Control Squadron produces approximately 154 graduated ABMs to the CAF annually. As a HAF requested study, this paper examines and provides an option available if Headquarters Air Force (HAF) directed an accession Total Production Required (TPR) increase from the current 154 to 400. How might AETC and the USAF best execute the directed increase in TPR while retaining training efficiency, teaching foundational core competencies, and still quickly transition the graduated officer to the CAF for primary weapon system training?

Historical Context

From the inception of the first aircraft controller's course in 1947 to today's Undergraduate Air Battle Management Flying Training, annual TPR has fluctuated between a low of 40 (not including a two-year shut down in officer training in 1992 and 1993) to a high of 1,700.[5] As TPR has fluctuated, the level of detail in provided training has been both in-depth and scant. Today, the TPR is stable at approximately 150 graduates annually. An examination of past training is important to understand where UABM training stands today.

In the earliest days of controllers (1941 to 1947), there was only on-the-job training. Controllers would acquire technical manuals associated with their ground radar systems and learn by doing the mission at the job site.[6] Tactics teaching was sporadic, by pilots, usually because the pilot recognized there was a gap between formalized training and what controllers were able to provide. From 1947 and 1949, the Basic Weapons Controller School (BWCS) training focused only on close-control intercepts. Controller students conducted intercept training with live aircraft, executing 200 intercepts before reporting to their assigned operational units. Due to the comprehensive training controllers received, they required very little time to achieve mission ready status.[7] Between the 1950s and 1960s, undergraduate controller training began to favor low fidelity simulators to train intercepts as a cost saving measure for live flying training. This wane in live flying training had a very negative impact from the beginning. Two-hundred live-fly intercepts lessened to 80 but 150 intercepts in a simulator would take the place of live-fly control. Number of live intercepts continued to decline to roughly 25 live-fly and 80 simulations by the end of 1969.[8] Interestingly, between the 1940s and the late 1960s, ability for a controller to be "mission ready" went from just a few days to over a month.[9] ADC, TAC and PACOM recognized this shortfall.

From the mid 1960s through the 1970's, the Instructional Systems Development model of training took hold in the USAF and controller training suffered as a result. Students learned the bare minimums through videos, self-paced books and simulator use. Live intercept training was practically eliminated. By 1975, three live-fly close-control missions were all that remained; one 110 degree beam intercept, one 160-180 degree hot intercept and one stern.[10] The simulator was for "practice" only. There were no formal lectures.[11] The result was an ineffective controller training foundation. In an effort to stem this shortfall in high fidelity accession training, a World Wide Air Defense Enhancement project (put forth by ADC) sought to train controllers on all potential control systems in one place (Tyndall AFB), remove training requirements from the CAF and the commensurate amount of training resources from the other MAJCOMS.[12] Meanwhile, mission ready delays increased from one month by the end of the 1969 to three months by 1975 to ten months by the end of the 1970s.[13] The effect of a poorly trained career-field and training delays was across all weapon systems: ground control, the EC-121 (phased out in 1978) and the new AWACS. [14,15] While basic controller training was almost non-existent, the control system used by the controller in the field was also different from Tyndall AFB requiring even further "difference" training. In particular, the AWACS mission and control system was an added complement to the many other control systems (BUIC, SAGE, MCE, etc.) used during the period but had its own training requirements. Further, resources available for training (aircraft to control) in the CAF struggled to meet the demands of initial and continuation training for both new and experienced controllers as these resources and dollars were largely reduced or removed from the CAF from the earlier WWADE Project to allegedly "fix" the problems that continued to persist.

In 1975, testing occurred that proved aircraft under active control were much more effective than those without. Testing was with experienced controllers controlling F-4Es against MiG-21s and F-15Cs against F-4Es as lessons learned recognized Russian controllers gave MiG-21s an advantage in Vietnam. F-4E versus MiG-21 engagements determined "effective GCI increased the kill ratio almost 2.5 to 1."[16] Further, if an F-4E managed to enter a multi-MiG fight alone, it was "completely ineffective without GCI."[17] F-15Cs had similar results even with their improved radars and maneuverability: "The probability of obtaining a fighter airborne radar contact on a bandit with no GCI/AWACS information is extremely low."[18] One pilot who flew 26 engagements in the F-4E against F-15Cs would note, "With effective GCI, the F-15C could enter a 1v4 engagement and win consistently."[19] Unfortunately, this classified testing did not make it to those who trained controllers of the day. Indeed, there is no evidence to support the correlation between the testing and the increased focus on tactics training at the squadron level. Historical documents including training syllabi from the Air Force Research agency reveal BWCS students achieved only between 12 and 30 hours of academic and live-fly training.[20] Training would not show a significant increase in fidelity and level of detail until the late 1990s as the 407L, BUIC, SAGE and MCE finger-on-glass systems were retired.

From the 1980s until today, Tyndall AFB slowly transitioned to the AWACS Mission Simulator (AMS), teaching ABMs on a single system; the very system 84% of all new accessions would use in the field. Yet the time between PCS and mission ready status still increased from a low of 4 months to an all-time high of over 12 months in 2006.[21] ABMs must execute air-to-air, air-to-ground and air defense operations, utilizing multiple weapons systems in a highly complex and demanding environment. Further, the ABM skill set is perishable. Delays between initial training and final mission check only compound the volatile balance between resources, training retention and ABM combat capability. Training continues to be difficult to emulate and train. In late 2006, the 552d Air Control Wing Commander commissioned an outside study that determined a solid "get well" training game plan to reduce the backlog of trainees waiting at Tinker AFB.[22] The 552d OG instituted this plan and, through a series of efforts, by 2009 the 552 ACW would report it had reduced the backlog of students and reduced mission ready time to a steady state of not more than three months. The "get well" plan was effective. Today, the 325 ACS is installing a new common control system, which may help reduce training timelines for both UABMT and IQT/MQT as weapon control systems across the CAF become more standardized. Further, the 325 ACS is transitioning to a new syllabus updating the basics of UABM training.

With a historical context of controller and UABM training, one can recognize the volatility a change in content, format and throughput has on the resulting capabilities of the initial UABM graduate. Doubling TPR while minimizing the training timeline at the UABM course without a reduction in core skill set competency is the primary objective of the following chapters. Training and TPR changes must be carefully weighed to minimize lack retention and fidelity lost due to time and resource availability. This paper does not assess future expansion concerning responsibility or merging of career fields.

Part 2

Training Requirement

When an officer starts UABM training, the training provided must establish a baseline of basic airmanship fundamentals such as ground training, flight line operations, and basic aircraft systems. The Mission Essential Task Lists (METL) for the E3, E8, CRC and AD define what is required of the graduated ABM. Despite distinct mission types such as air-to-air, air-to-ground, surveillance and air defense, they fall into three core competencies each focused on attrition or affecting enemy actions. Figure 1. The nine month (170 training day) UABM training teaches the core competencies detailed above to a basic level.

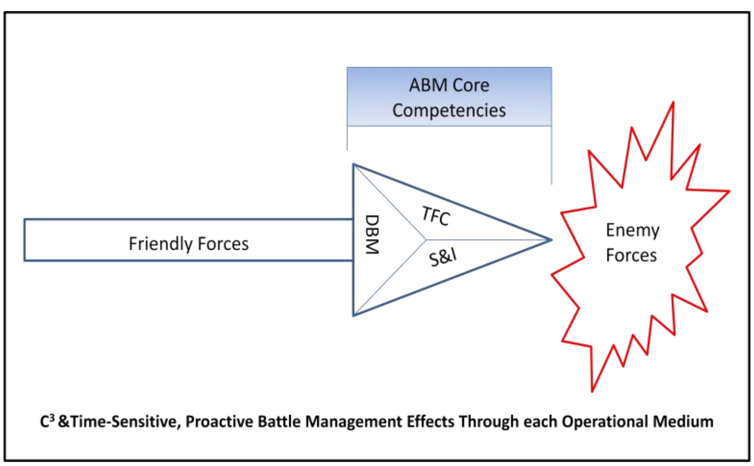

Figure 1. Effects of ABM Core Competencies.

ABM Core Competencies[23]

1. **Tactical Fluid Control (TFC).**[24] Control of weapons systems requires a detailed knowledge of joint friendly and enemy weapons capabilities and their tactics. This knowledge is the foundation for efficiently placing friendly systems in a place and time, which will most efficiently defeat a threat and/or protect friendly assets. ABMs must understand and integrate friendly data links; ensuring battle space information is correct and shared as appropriate. Beyond this, the ABM must have a thorough working knowledge of Airspace Control Measures (ASCM) and Fire Support Control Measures (FSCM). This knowledge serves to deconflict joint fires in real and/or near real-time. Tactical Fluid Control ensures the enemy is fully and correctly targeted, friendly assets protected and the kill-chain is as short as the operational pace/tempo requires.

2. **Dynamic Battle Management (DBM).**[25] Battle Management minimizes the chaos and dramatic fog and friction caused by simultaneous offensive operations. The ABM synchronizes and integrates joint air and ground assets and the weapon systems of coalition forces to minimize this chaos. DBM accomplishment occurs by making timely kill-chain decisions through execution of the Air Tasking Order (ATO), Air Combat Order (ACO) and Special Instructions (SPINS) at all levels. They must correctly marshal forces in ~~a~~ time and space, which assures operational success. The ABM must understand and be able to perform all phases of the joint targeting cycle. Finally, the ABM must be able to actively problem solve through the chaos caused by asset fallout, enemy force changes and changes in mission priorities. Through Dynamic Battle Management, the ABM ensures a seamless and effective joint command and control operation for the Joint Forces Commander.

3. **Air, Surface and Ground Surveillance and Identification (S&I).**[26] **S**urveillance and identification information across all domains affords a correct, integrated and common operational picture. To do this, the ABM must have a solid working knowledge of active and passive sensors capabilities and properly integrate their information. Using these sensors the ABM will detect and identify targets (based upon commander intent). The fusion of these sensors allows the ABM to provide timely and accurate threat warning, develop and evaluate effects-based targets for placement into the joint targeting cycle, execute and refine identification criteria and properly execute rules of engagement.

Six Effects of Air Battle Management[27]

Beyond the tactics, techniques and procedures (TTPs) of air/ground engagements and air defense, UABM training teaches a wide range of skills from friendly/enemy aircraft capabilities and employment tactics to close control, refueling procedures and battle space management in a large force employment operation. UABM training teaches multitasking in a highly dynamic environment. Another way to understand these core competencies is by the effects they provide in an operation:

1. **Orient Weapon Systems** through area of operations updates, battle management and the synchronization of Intelligence and Surveillance assets, the result is enhanced command and control.[28]

2. **Pair Weapons Systems** via active air-to-air commits, air-to-ground assignment of targeting (either Interdiction or CAS) and joint fires deconfliction, resulting in clear, concise and correct dynamic battle management.[29]

3. **Solve Problems** such as asset / capability fallout management, airspace and fire support control measure conflicts, refueling management, asset reroll management (such as an

Interdiction Mission to meet a Troop In Contact (TIC) request), and the conduct of Airborne Mission Commander for Combat Search and Rescue and Personnel Recovery, all of which results in timely, adaptive effects-based execution. [30]

4. **Bring Order** to the dynamic battle space environment through ID collaboration among sensors, manage kill boxes, apply and manage ASCMs and FSCMs, marshal forces or stack CAS assets and account for all assets via a check-in and check-out function resulting in controlled application of effects and asset survivability.[31]

5. **Speed Decisions** through long-range identification of forces, decentralizing the clearance of fires through effective ASCM and FSCM management, relay of TIC info pre CP, and proactive acquisition of CAOC targeting permission resulting in time-sensitive targeting or reroll of paired assets.[32]

6. **Shared Battle Space Assessment** at all levels of command by quickly orienting and pairing weapon systems (such as Patriot and/or Low Altitude Air Defense Teams) in cases where an enemy asset may impinge beyond organic defensive counter air assets.[33] Other examples include quickly reporting potential high payoff targets for integration into the joint targeting cycle, refinement of enemy type, orientation and size, and passage of confirmed destroyed targets via real-time sensor analysis or an enemy's movement despite a destroyed target (such as rebuilt or floating bridges to move across a river). Such assessment sharing results in an informed command better able to apply strategy to task.

Armed with an overview of the wide aperture an ABM is required to operate across, it is no surprise undergraduate training is detailed. As noted, changes to training can significantly influence follow-on positional qualification in the primary weapon system. Unforeseen changes to the training environment, whether reduction in flying hours to support live operations, or changes in ABM requirements affects the capability of the graduate. Reduced student to instructor ratio with the proper balance of instructor experience is crucial to UABM success. The 325 ACS, responsible for UABMT receives inputs from a number of stakeholders concerning controller training. These inputs and regulations are refined into a Training Task List with required proficiency levels defined. Tyndall training represents the minimum acceptable competency for continuation to the final weapon system. Gaps in capability upon graduation from UABMT become a training requirement by the end-user (the CAF) and extends follow-on mission ready training. Training in its entirety, vetted from the CAF and MAJCOM through to the training squadron ensures the capability of the graduated UABM is in accordance with and at the level of the Training Task List as defined by the stakeholders. Because of this incredibly detailed process, with checks and balances at all levels, to pick apart training is tautological. MAJCOMS and end-users expect these minimums in a graduated ABM. Figure 2. Further, the system should not dictate ABM training, rather, that each MWS will take the shared ABM core competencies and build or shape them to suit their specific needs.

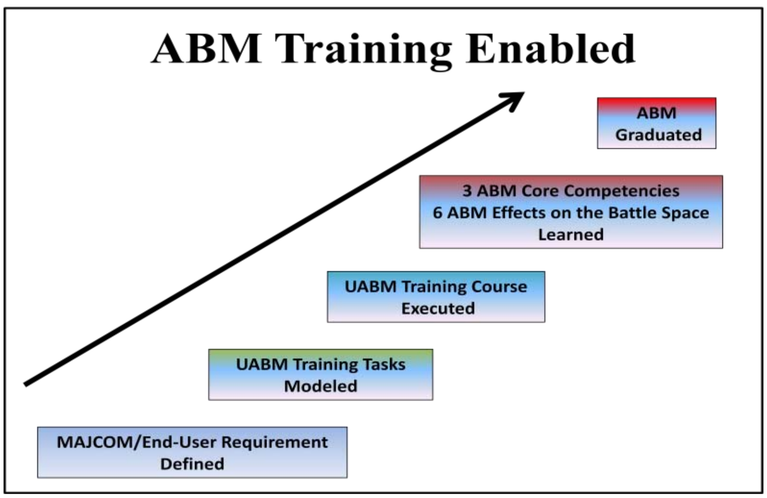

Figure 2. Roadmap of ABM Training.

Part 3

CURRENT TRAINING MODEL

As mentioned earlier, UABMT training spans a 9-month period, covering 170 training days. A new student class consisting of up to 12 students starts roughly each 3 weeks, which equates to a throughput capability to graduate 204 ABMs not accounting for attrition. Attrition based upon the 2008 syllabus averaged between 5 and 7%; I will base my discussion assuming that will remain relatively constant for the approved 2010 syllabus depicted in Figure 3 below.

Day	Block	#Days
1 to 18	Basic Military Aviation (BMA)	18
19-34	C2 Fundamentals (CCF)	16
35-41	Data link & Surveillance (DS)	7
42-58	Controlling Fundamentals (CF)	17
59-78	Air-Air Employment (AAE)	21
79-105	Tactical Fluid Control (TFC)	27
106-121	Air-Ground Employment (AGE)	16
122-139	Large Force Employment (LFE)	18
140-170	Integration (INT)	30
	TOTAL	170

Figure 3. 2010 UABM Flying Training Syllabus.

The FY10 costs to send each student through UABM training is $61,810 based upon SECDEF Deputy Comptroller Letter, dated 9 June 2009. Regardless of final assignment on the E3, E8, CRC or AD platforms, each student completes nine blocks of training.

Current Training Factors

There are challenges based on fiscal constraints, live fly training reduction, manpower and facilities should the need arise for an increase in TPR above the current level. Figure 4. First, UABM training has an approved $7.1M MILCON project to provide a new training facility based upon the current TPR but can support up to 204. This facility, scheduled to be operational by May 2011,

UABM Training Factors

- **New $7.1M Facility (Supports TPR of 204)**
- **2x F-15 Squadrons Retired by FY11**
- **F15 Mission Simulator No Longer Available by FY12**
- **No FMT connectivity for 4-ship training**
- **No F-22 Simulator connectivity**
- **Hands-On High-Performance A/C Familiarization not Available by FY12**
- **WTT sought for higher fidelity large force employment training**
- **UABM training will transition to HMI-compliant system by EO FY11**

Figure 4. Summary of UABM Training Factors.

provides up to 24 consoles for live-fly training, 3 simulator rooms, each consisting of 12 consoles for simulation training, an additional simulation "driver" room with 12 consoles for low-fidelity training, 15 brief and debrief rooms and a brief/debrief auditorium. As will be detailed later, this does not necessarily mean the facility cannot meet the needs of an increase to

400. Next, by the end of FY11, the final two F-15C training squadrons on Tyndall will close. This reduction in live fly opportunities coupled with inadequate manning and simulator facilities will have a negative impact on UABMT. As a historical perspective, at the end of FY05, the 1 FS retired with some aircraft and personnel moving to the other two active squadrons (95 and 2 FS), other units across the CAF, and others elsewhere. UABM training operated under the 2004 Flying Training Syllabus and required each student to complete 13 live-fly missions. Despite only two active F-15C training squadrons, the 325 ACS quickly integrated the new F-22 squadron (43 FS) into the UABM syllabus. However, due to F-22 TTPs, three less missions per mission-type were available for UABM training. Further, a reduction in F-15C student production at the remaining two squadrons further lowered the missions available for UABM training. Thus, what was once a readily supportable requirement for 13 live-fly missions per student, or 2,080 missions total dropped to eight live-fly missions (a 38% reduction) per student, or 1,280 missions total based on the same TPR (then 160). Later, connection to a single bay of the F-15 Mission Trainer (FMT) allowed for higher fidelity training with real pilots as opposed to enlisted simulator technicians simulating the same tactics. However, this too has limitations as currently, the UABM facilities connect to a single bay, with a limited classification level. Much like the past, simulations made up the difference in training with successful results at Tyndall. Reductions in live fly missions trained did not detract from student capability at the UABM level as student simulation training increased in number and intensity to make up for the difference. However, with a significant backlog of graduated ABMs awaiting follow-on training in the CAF, a portion of the newly gained knowledge was certainly lost and required retraining.

Effects on the CAF

Because of continued reductions in available training assets, UABM training is once again lowering high-performance live-fly training (F-15, F-22) requirement, filling the void with more detailed low-performance live-fly training (MU-2), and more high-fidelity simulation missions utilizing the FMT. Unfortunately, UABM training only has use of the FMT until FY12. This raises yet another issue as UABM training utilizes the FMT for hands-on familiarization of pilot workloads during each phase of the intercept. By watching pilots execute in the FMT and by also "sitting the seat" for engagements, UABMs derive a significantly better understanding of the pilot's decisions, switch-actions, timelines for those decisions, the visuals and communication cues which lead to those decisions. Most importantly, UABMs witness first-hand how their communication affects the decision-making process. Finally, as training at Tyndall continues the transition to a new common control system, training no longer emulates the E3 weapons system. This will change training at Tinker AFB, but overall the improved common control system will resolve several problems in training.

1. **E-3 AWACS.** The E3 is no longer the primary system for training at Tyndall. The counterpoint, however, is that UABM training should familiarize students with dynamic battle management skills regardless of system. The effects realized by maximized understanding and execution in the three core competencies should be the focus. The new Tyndall system affords just that capability. In a 2-part AWC paper prepared by Col. Roger Brown and Col. Joseph Rossacci in 2006, training redundancies under the AFSO-21 umbrella brought to light, examined and described a savings of up to $1.07M in 2006 dollars by elimination of training deemed identical or almost identical to that of Tyndall. These redundancies are quickly becoming moot as the teaching of system use complemented with complex tactical engagements in the E3

community, cement system utilization knowledge and BMC2 capability without thinking about actual system use (specifically, the meaning of menu lines and positioning/order of switch-actions). E3 mission-ready training must now execute in the same manner as the E8, CRC and AD weapon systems by including difference training (a point in Col. Rossaci and Col. Brown's research noted as already taking place), as E3 system emulation no longer takes place at Tyndall.

2. **E8 JSTARS.** Since the inception of the E8 mission, follow-on training from Tyndall has largely led to a "start anew" mentality. Because UABMs learned on E3-like systems and trained in A/A engagements almost exclusively, follow-on training as an ABM for their mission seemingly started from scratch as the focus of the E-8 is ground centric. The new Tyndall system will reduce this gap as its capability affords simple A/G engagement emulation. Interviews of ABMs returning from deployments bolsters this position. In November 2009, 22 ABMs were asked to rate the application of their training at Tyndall with the missions they actually executed on the E-8. Their experience base varied from instructors with four deployments to ABMs awaiting final mission checks in their operational squadron. The four still in training noted a lack of connection between Tyndall training and their JSTARS training, in particular, citing brevity code words as, "not applicable" and procedural control deemed, "totally different." They felt they were starting from scratch. In contrast, the instructors and operational squadron ABMs appear united: ABM training applied to JSTARS for problem solving, communication cadence and brevity terms common to A/A and A/G assets. There was a foundation of friendly and enemy TTPs from which each ABM could draw from to "know what questions to answer" during operations. The comments went on to include radar theory knowledge, data link interoperability, and the ability to apply battle management concepts. In short, seasoned and even new ABMs who deployed easily made a connection between Tyndall

training and their role as an ABM on a platform seemingly unlike their first-trained system. The end result is that training will remain relatively unchanged in the E-8 community as difference training is inherent and expected.

3. **CRC.** Initial active-duty assignments from UABMT are mandated to flying assignments. Thus, the CRC community receives officers with experience in the E-8 and/or E-3 community. Thus, training from Tyndall is integrated with another weapon system. Any additional training is hands-on in the set-up, tear down and operation of the various systems supporting the CRC. In short, the CRC expects core competencies to be already trained; ABMs are not new and merely need to show proficiency in physical responsibilities, TTPs of the system itself and proof of proficiency during mission execution and they are largely mission ready.

4. **Air Defense.** ABMs assigned to the Eastern Defense Sector (EDS) and Western Defense Sector (WDS) have no different skill set requirement than that of their counterparts in the other platforms. Again, the difference is in the system used and the particular mission conducted. Most UABMs proceeding to these guard units come with other rated experience or enlisted controller experience and spend most of their time on active duty. Those with other rated experience typically perform at a level affording early graduation. Enlisted controllers rarely incur difficulty with the TFC portion of training, but learn much from the battle management training. Those direct-hires with no experience enjoy the same training as new active-duty accessions and subsequently the same attrition rate. Regardless, all graduates find their core competencies utilized immediately; qualification is a matter of proof of proficiency for the mission conducted on that weapon system. Training which is conducted at the gaining unit.

The first three parts of this research provided a backdrop for the requirement from the customer, the MAJCOMS and end-users of the ABM. From these requirements, three core competencies overarched six effects ABMs provide on the battlefield. These requirements, competencies and effects define UABM training yielding a basic qualified ABM ready for follow-on training in their first operational weapon system. Interestingly, by examining ABM training from inception at Tyndall to conclusion and CMR status in the CAF, realizing the new Tyndall system standardizes training for A/A, A/G and AD training, it is easy to recognize that track training of ABM training already takes place. Indeed, the new syllabus teaches the basics and effects of ABM execution exclusive of the final platform executed. Taking into account factors that affect training, including the transition to a new control system, Part 4 details a plan of attack for training 400 students annually.

Part 4

ONE-YEAR PLAN

Issues associated with increasing TPR falls into three categories: Manning, Console availability, and high-performance asset availability. To frame the problem, consider that 17 classes of 12 normally start every three weeks. For 400 students to complete full 9-months of training, the training pipeline requires starting two classes consisting of 12 students each (408 TPR) every three weeks or a single class of 22-24.

Manning Requirements

An instructor teaching 12 students in an academic classroom forum, they can just as easily teach 22-24. If students are conducting simulation or live-fly missions, however, an instructor/student ratio applies. For instance, in the CF block of instruction the student to instructor ratio is 2:1 and lasts up to 10 hours for each student each day depending on mission type and platform controlled. The AAE block (MU-2 A/A engagements) transitions the student to a 4:1 student/instructor ratio. The AGE, TFC, LFE and INT blocks highlight the problem of instructor/student ratio, however, as the demands of training TTPs appropriately requires a 1:1 ratio. An unofficial work force study conducted by the manpower office at Tyndall using the

2010 syllabus and a TPR increase to 400 showed a need for an additional 113 instructors. This is beyond the 146 currently authorized.

Console Availability

Recognizing the new facility being built for use in 2011 was not acquired with the idea of increased throughput in mind, the 2010 syllabus will keep it operating at near capacity from 0600L to 1800L. Figure 6 depicts the planned 2010 control facility-operating schedule. Indeed, for a TPR of 204, there are only two extra consoles available for less than half the duty day. To increase console availability, more console positions are required, or training will need to transition to a 24-hour workday. One can accomplish the first option near-term by installing new consoles in the old facilities (Bldg 1270 and 1282) and cancelling their demolition of 1270 in addition to the new equipment in the new facility. Each console costs $1500. To add another 48 consoles would cost $72,000. This does not include software development and maintenance. To integrate the 48 consoles with the 48 already in place will require one to three developers between $189-$225 an hour. Total time to complete the integration would be between one and four months. Assuming 3 engineers are used, paid at $225 for a 120 day period,

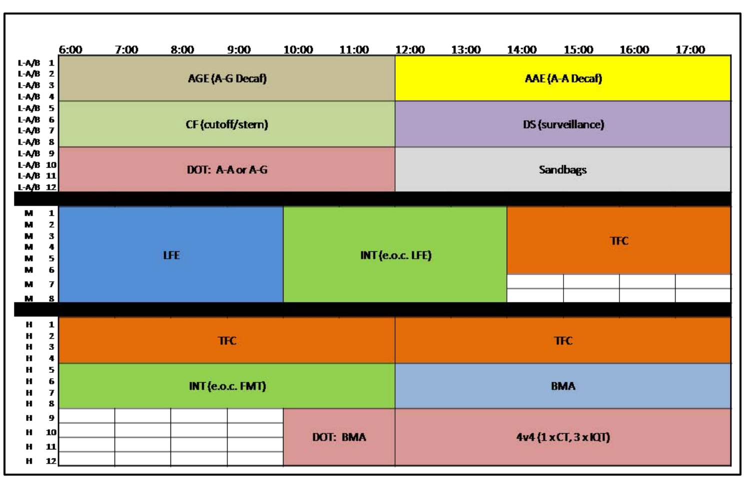

Figure 6. Daily Operations Control Facility Requirements.

integration labor would run $648,000. Total cost to fund enough consoles utilizing building 1270 and/or 1282 would be on order of $720,000 (for four additional operations rooms). A missing cost to consider is the cost of a renegotiated contract. The current contract costs $5.8M spread over a 5-year period which includes initial parts and labor for the first 48 console build-up in 1270 and tear-down/build-up again in 2011 once the new facility is ready to accept the equipment. There is a negligible opportunity for some cost savings by leaving the 1270 facility populated with the original consoles (4 operations rooms totaling 48 consoles) and simply adding new equipment in the new facility as mentioned earlier. There is no question additional consoles will require additional maintenance costs by the contract. The ability to determine total costs is beyond the scope of this paper. However, a starting point for estimating total cost would be to add ½ the current value of the contract over a 5-year period. Thus, total contract price to run 96 consoles over a 5-year period could run as high as $8.7M. Whether initial parts and labor were included in this number (as it is now) would have to be part of the contract negotiations. Costs could be higher if there is yet another new facility requirement. Other potential facilities may be available as two entire F-15 squadrons depart. However, their facilities are on the other side of the base and have no initial connectivity to the FMTs, or local radar facility, thus, they require the same electrical, security and network wiring demands as a new facility.

Asset Availability

The final critical limitation to execute a successful one-year plan is that of high-performance aircraft availability for live-fly training. High-performance aircraft are an essential part of the UABMT syllabus as they prepare ABMs through several missions that serve as a baseline for the core competencies. Air Combat Maneuver (ACM) missions are typically controlled on one side; the UABM controls the “blue” side of a mission with no adversary or "red air" controller. Tactical Intercept (TI) and Air Combat Training (ACT) missions will have two sides for each mission. That is, each mission has both a blue and red air controller. Currently, assuming 180 students make it to the high-performance phase of training, there are four missions required per student. Seven-hundred twenty mission sides (mission execution as a blue or red controller constitutes a single side of a mission) are required. A TPR of 400 yields a requirement for 1,600 mission sides or 800 TI/ACT missions. The final F-15 squadron will close prior to the FY12 start date of this analysis and, therefore, not used in computations.

The F-22 squadron provides approximately 580 to 830 sides annually. Up to 480 sides are available at the 114 FS in Klamath Falls, Oregon (August 2008 numbers). Thus, total sides available for UABM training is still short of the target at 1,060 to 1,310 sides available. There are 290 to 540 sides short for 400 students to complete training. This equates to approximately one mission per student. In essence, by dropping the live requirement by one more (from 4 to 3), Tyndall training has the potential to execute a plan of training up to 400 UABMs per year. Certainly, the drop is not unprecedented, as the requirement for live mission control has dwindled from 13 live-fly missions in 2005 with the drawdown of the first F-15 squadron, to a new low of four live-fly missions controlled in preparation for the drawdown of the final two F-15 squadrons. Fortunately, the 2010 syllabus increases the number of simulator syllabus events required as well as the intensity…just as in 2008 as training integrated the FMT. Keep in mind, however, the closure of the FMT training facility is concurrent with the F-15 squadron drawdowns. Interestingly, to date, there is no perceived reduction in capability reported from the training squadrons in the CAF.[34] In each of these reductions, there was some means of high-fidelity replacement training. Future reductions will not have this luxury and will have to look beyond the boundaries of Tyndall AFB for a solution.

Overall, the perceived good news by meeting side counts required is not without costs. A primary reason for UABM training at Tyndall AFB is to execute in a face-to-face brief/debrief environment. An important facet of mission execution all too quickly lost in the CAF as ABMs execute from separate locations from the pilots they control. The F-15C and F-22 fulfills this role, as does the FMT. These briefs/debriefs allow the UA BM to learn the art and science of intercepts from the pilot perspective in detail, similar to the lessons learned from the 40's and 50's, thus affording a greater degree of understanding and ability to be proactive rather than reactive during an operation. With the FMT scheduled to close at the end of FY12, squadrons drawing down locally and the near zero interaction between combat pilots and ABMs once graduated ABMs move to the CAF, other opportunities such as dedicated and fully linked fighter simulation systems manned by pilots could be sought to close this vacuum.

Part 5

TRAINING SYSTEMS TO CONSIDER

Since the advent of radar, training has coupled to the control and battle management of assets, but generally from outside the cockpit. Despite the passage of time and significantly improved weapon systems with equally improved and complex tactics, ABM training equipment is hardly more advanced and interoperable than early 1980s technology. This fact is interesting and disappointing. The study from the mid 70's discussed in Part one proved in a test environment the importance of good C2. While no test is available at the unclassified level to show the benefits today, this test is still valid, particularly in the Engaged/Merged phase of an intercept. The ABM must be able to maximize and integrate his or her largely antiquated weapon system, be a trusted third or fifth wingman and aggressively help the pilot kill and survive. Beyond this is the requirement to appropriately BMC2 in both air and ground domains within an AO as described in Part Two. The ABM must understand fully the weapon system of his or her flight lead(s). This means also training away from the radarscope and in the simulators and/or aircraft of pilots. The result is an understanding from a human factors perspective the importance or irrelevance of every call an ABM makes on a radio in relation to what the pilot is seeing and doing in their cockpit. Following is a consolidation of options available to more fully and appropriately train the UABM.

Training Stations

1. Desktop Trainers (DTT): For approximately $75K a copy, students can execute simple switch-actions and learn the basic gauges and radar operations of today's military aircraft on a laptop and/or desktop computer.

2. Threat Stations (WTT): At approximately $2-3M apiece, these stations have touch screen LCD panels with an egg-shaped viewing area stopping roughly at the 3/9 line of the person sitting at the console. UABMs can execute learn and understand the basics of flight line operations through threat tactics against an adversary from the pilot perspective. Essentially, this is "OJT" for understanding threat aircraft dynamics and threat weapon system capabilities, these stations are most useful for understanding how weather and geography (particularly terrain masking) integrate into a pilot's mission planning and execution.

3. Experimental Common Immersive Theater Environment (XCITE) simulation[35]: Free. This system, already owned by the government and executed through AFRL is a high-fidelity threat radar and ECM simulation for aircrew training systems. Already used in DMO, this system provides a "what-if" answer to mission planning. UABMs can mission plan a scenario, load the scenario and receive critical feedback regarding their mission planning actions via visually watching an operation take place.

4. Distributed Mission Operations Integration: The CAF is moving full-steam into this virtual combat environment, which affords weapon systems and even TACP/JTACs to brief, execute and debrief together despite being in separate places around the globe. A problem with DMO from a student-training standpoint is the availability of mission types at a time suitable to the timetable of UABM training. Simply by watching a DMO large force operation with an

instructor, examining execution as it unfolds and listening in debrief, students will gain invaluable insight. As integration continues across the CAF (and particularly in the environment at Eglin with the F-35), this author argues opportunity for high-fidelity training at a time and intensity level needed for the UABM will reveal themselves. Connection to the environment is the first step.

Consolidated Training Database

By SimiGon, SimBox is a web-based product has the potential to merge the capabilities above as well as training tools already used together. This system, built upon the same source code as DMO can integrate other simulation systems such as XCITE provides a desktop of instructional materials. This is a cradle-to-grave option to training which has potential to save operating costs as it delivers a significant degree of computer based training and test measurements as well as the ability to debrief missions whether via simulator or live-fly. Interestingly, it is the training of choice used in the European F-16 market and the F-35 in a joint venture with Lockheed Martin. Costs are beyond the scope of this paper; however, a recent Academic Training Center contract was worth $2M. Exact specifications are proprietary.

Part 6

Recommendations/Conclusion

From the very beginning of radar control through today's robust BMC2, UABM training fluctuated from a high of almost 20,000 controllers during the Vietnam-era to today's approximate 1,276 ABMs. This very small number of combat ready ABMs highlights the need for an all-encompassing foundational training allowing ABMs to become BMC regardless of work environment in an aircraft, on the ground, or in an AOC. The need to fully understand the capability of today's weapon systems and threat systems drives the critical requirement for high-fidelity training systems which fills the ABMs toolkit used to minimize the chaos and maximize killing and survivability across the spectrum of conflict.

There is an argument made for "track training" a UABM like other rated career fields in order to save money and get the ABM to the CAF faster. What many fail to recognize is that track training already takes place. Further, it is at a pace maximizing both training and expediency. ABMs are graduated and delivered to the CAF ready to "track" into their primary weapon system now. Each weapon system has three core competencies and their six main effects in common regardless of whether they are in an A/G, A/A or AD role; proven by the similarity of their TTLs. There is no training courseware to speed the process without a reduction in knowledge base. The USAF and MAJCOM-driven requirement for an ABM spans beyond the purported air-centric medium of the E3 AWACS and CRCs, ground-centric medium of the E8 JSTARS, and air defense posture of the EDS and WADS. The last 12 years, in particular, sculpted a training program that does get it right. The result: The training is complex and complete. This syllabus places the new ABM in the CAF ready to learn their weapon system particulars, or "track" into their weapon system. More importantly, the graduate knows what questions to ask in mission planning regardless of operation type. Below is an overview of recommendations to fully train at the undergraduate level, preparing the UABM for the CAF while minimizing follow-on mission ready training:

1. Purchase a web-based training model such as SimiGon's Simbox. Cost: $2M+

RATIONALE: A system such as this has potential to limit or eliminate manning increase requirements and more fully standardize training. It integrates computer-based and classroom training, has inherent capabilities for supervised, but self-paced learning, and includes the ability to plug into other training systems such as FMTs, EC models, and flight mission modeling. It has potential to reduce significantly the man-hours required for hands-on teaching of airmanship basics.

2. Connect to the second bay of the current FMT and F-22 Simulator; extend the current FMT contract. Cost: $1M

RATIONALE: Affords greater than 2-ship training. Allows UABMs to witness the human factors side of training by standing in the simulator and learning the effect ABM integration (communication) has on execution in the cockpit.

3. Purchase additional simulation consoles to meet the 400 TPR requirements in a 12-hour workday or, commit to 24-hour training and additional staffing. Cost: $720K plus an additional 113 instructors.

RATIONALE: Additional consoles and instructors allow a 12-hour workday to continue. If the 325th ACS commits to a 24-hour workday, there is no requirement for additional simulation consoles, but the additional instructor requirement remains.

4. Double the MU-2 flying training contract. Cost: Approximately $3.2M annually RATIONALE: MU-2 flying training provides hands on airmanship training required for UABMs to understand flight basics and tactical training. Most importantly, the 325th ACS commander owns the day-to-day operation of the aircraft and can readily build a training program that fully integrates flying training. The current 4,200 hours of the contract meets the requirement for approximately 180 TPR. By doubling the number of hours purchased (8,400) and through careful scheduling, it is assessed a 400 TPR can be met.

5. Acquire high-fidelity training tools. This includes plugging into the DMO system, DTTs, WTTs, and adding greater fidelity threat training through tools such as XCITE. RATIONALE: As F-15s draw down and the FMT closes in FY12, other systems should fill the gap to maintain the fidelity of training. Cost: Up to $20M

Interestingly, this paper sought to save the USAF money and streamline training…even get the UABM to the CAF sooner. Unfortunately, this is not the case. Any training reduction at Tyndall requires an equal and commensurate amount of training in the CAF. Training to the entirety of core competencies at Tyndall collocates air-to-air, air-to-ground and air defense training such that all ABMs have a standard baseline to draw from. The simple fact is it does not matter if an ABM will transfer to the EDS, AWACS, or JSTARS upon graduation. The ABM requires a baseline of training skilled in the basics of all three. The enemy is more proficient, more complex and ever more elusive. This paper does answer the question, "If the Air Force said produce 400 ABMs annually how would you do it?" The raw, least expensive option is that the 325th ACS already can. Move to a 24-hour training day, add 113 instructors and double the MU-2 contract. However, there will still be concessions in training. The best options are above. In short, bring UABM training in line with the USAF's other weapon systems (F-22 simulator/F-35 training model) by adding DMO, WTT, DTT and XCITE which makes the rest of the US and world's aircraft and threat systems readily available for training, and package in a digestible, and easily supervised format (Simigon SimBox). These additions ensure 400 graduated ABMs will be ready to complete Mission Qualification Training in the 21st century operational environment at the fastest pace possible.

Glossary

A/A	Air-to-Air
AACS	Airborne Air Control Squadron
AAE	Air –to-Air Employment
ABM	Air Battle Manager (Air Force Career Field)
AC	Aircraft
ACC	Air Combat Command
ACM	Air Combat Maneuver
ACS	Air Control Squadron
ACT	Air Combat Training
ACW	Air Control Wing
AD	Air Defense
ADC	Air Defense Command
ADO	Assistant Director of Operations
AETC	Air Education and Training Command
AFB	Air Force Base
AFRL	Air Force Research Laboratory
A/G	Air-to-Ground
AGE	Air-to-Ground Employment
AO	Area of Operations
AOC	Aerospace Operations Center
ASCM	Airspace Control Measure
AWACS	Airborne Warning and Control System (E-3)
BMA	Basic Military Aviation
BMC	Basic Mission Capable
BMC2	Battle Management Command and Control
BUIC	Backup Interceptor Control
BWCS	Basic Weapons Controller School
C2	Command and Control
CAF	Combat Air Force
CAOC	Combined Aerospace Operations Center
CAS	Close Air Support
CC	Commander
CCF	Command and Control Fundamentals
CF	Controlling Fundamentals
CMR	Combat Mission Ready
CP	Control Point

CRC	Control Reporting Center
CSAF	Chief of Staff of the Air Force
DACT	Dissimilar Air Combat Training
DBM	Dynamic Battle Management
DMO	Distributive Mission Operation
DO	Director of Operations
DS	Data link and Surveillance
DTT	Desktop Threat Trainer
EC	Electronic Combat
EDS	Eastern Defense Sector
EO	End Of
FS	Fighter Squadron
FSCM	Fire Support Control Measure
FMT	F-15 Mission Trainer
FY	Fiscal Year
GCI	Ground Control Intercept
GTACS	Ground Theater Air Control System
HAF	Headquarters Air Force
HMI	Human-Machine Interface
INT	Integration (Phase of UABM Training)
JSTARS	Joint Surveillance Target Attack Radar System (E-8)
JTAC	Joint Terminal Air Controller
LCD	Liquid Crystal Display
LFE	Large Force Employment
MAC	Minimum Acceptable Competency
MAJCOM	Major Command
MCE	Modular Control Element
MET	Mission Essential Task
METL	Mission Essential Task List
MILCON	Military Contract
OG	Operations Group
OJT	On-the-Job Training
PACOM	Pacific Command
PCS	Permanent Change of Station
UABM	Undergraduate Air Battle Management
USAF	United States Air Force
USAFWS	United States Air Force Weapons School
SAGE	Semi-automatic Ground Environment
SECDEF	Secretary of Defense
SME	System Management Expert
S&I	Air, Ground, Surface Surveillance and Identification
TAC	Tactical Air Command
TACP	Tactical Air Control Party
TFC	Tactical Fluid Control
TI	Tactical Intercept
TIC	Troops In Contact

TPR	Total Production Required
TTL	Training Task List
TTP	Tactics, Techniques and Procedures
UABMT	Undergraduate Air Battle Management Training
WDS	Western Defense Sector
WG	Wing
WTT	Weapons Threat Trainer
WWADE	World Wide Air Defense Enhancement
XCITE	Experimental Common Immersive Theater Environment

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