Can UAS Training be Done Without Live Flight?

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ABSTRACT

Operators of the Army's Unmanned Aircraft Systems (UAS) (Raven, Shadow, Hunter, and Gray Eagle) are all initially trained with a combination of simulated and live flight. The balance of live training on these systems currently ranges from 100% for Raven to 40% for Shadow. Requiring live flight is both expensive and can have a significant impact on training throughput. Given that UAS's are controlled using computer interfaces, it seems reasonable to ask whether live flight training is necessary at all. This paper examines the optimal balance between live and simulated initial operator training for Army UAS's. To do this, we examined the current programs of instruction, Training Aids, Devices, Simulators, and Simulations (TADSS), and we interviewed both students and instructors about training challenges they faced. It was clear from this effort that there is not a one size fits all answer for all UASs. Several factors were found to be critical determinants of an optimal balance including the capabilities of the TADSS, the instructors' ability to leverage the full capabilities of their TADSS, the cost of constructing or improving TADSS, the tasks required to be trained within the POI, and frequent changes to the UAS operational software. In developing these recommendations, we wanted to avoid reducing the quality of the training or shifting training from the institution to the unit. We concluded that the current TADSS for Shadow, Hunter, and Gray Eagle are good enough to reduce live flight training by about 10% to 20% depending on the UAS. This would save from 40 to 112 man-days of training time per class (assuming 20 student classes). Cost-benefit analysis of Raven training, on the other hand, indicated no benefit of reducing live flight training.

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INTRODUCTION

The question raised in the title of this paper is one that has been asked many times by many different people. The question seems justified because Unmanned Aircraft Systems (UAS) operators fly their aircraft remotely, sitting on the ground in a control station. From their console keyboards they operate, not pilot, the aircraft. There are no stick or rudder flight controls. They set altitude, airspeed, headings and mission waypoints and the aircraft controls the flight automatically. There is no tactile feedback and the only indications they have are data reported by the aircraft. Whether sitting in the control station or the simulator the operator should not notice major differences between the two. So, on the surface, it would appear that given sufficiently accurate simulators, UAS training should be able to be accomplished without live flight.

We believe the question is more complex than would first appear. First of all, it is important to differentiate between initial operator training and unit training. In initial operator training, the focus is on the basics of aircraft operation and crew coordination. In the unit, those individual and crew skills must be maintained, but collective tasks which involve both the ground crew and ground units that are supported by the UAS mission must also be trained. Training these collective tasks using simulation would require a complex live-virtual-constructive training system that might be more expensive than using live flight. Second, use of the actual equipment during live flight gives maintainers and operators the opportunity to identify problems with their equipment and provides practice for repair and maintenance skills. Finally, there are intangible factors such as confidence in both skill and equipment that can only be built by live flight, no matter how good the available simulators are.

In this research we approached this question from the standpoint of doing a gap analysis. Specifically we examined the capabilities and limitations of the existing simulators to train operators of the current Army UAS. Our focus was on the training conducted at the schoolhouse and to a lesser extent at the unit.

Background

UAS are major combat enablers in the current operational environment and the demand for these systems is growing. These systems provide situational awareness and intelligence information to leaders which enable them to make better decisions, and alert ground Soldiers and units regarding potential threats. Though initially used for surveillance and intelligence gathering, these systems are increasingly being used to track, designate, and/or engage targets on the ground.

Increasing combat roles for UASs have resulted in a high demand for the aircraft as well as qualified crews to operate them. However, there are frequent training bottlenecks at the schools. This occurs when more students await training on the aircraft than there are aircraft available. There are often restrictions on flying the UAS at many Army posts. The use of simulations then is becoming increasingly important for UAS training. Consequently it was critical to systematically examine the simulation capabilities needed to prepare and sustain UAS operator proficiency.

Scope

The scope of this research was the Training Aids, Devices, Simulators and Simulations (TADSS) supporting the training of Army UAS operators. Army National Guard UAS operators were not included in this study. The primary objective of this study was the evaluation of the TADSS to support institutional training. TADSS for unit training were evaluated to a lesser extent. The research was limited to training of the basic UAS operation skills. Advanced flight skills and Tactics, Techniques, and Procedures were not evaluated.

We studied four Army UASs. These were the RQ-7B Shadow, MQ-1C Gray Eagle, RQ-5/MQ-5B Hunter, and the RQ-11 Raven. The first three have dedicated aircraft and payload operators with a Military Occupational Specialty (MOS) of 15W. The Raven operators are designated and come from different MOSs within the Army.

TADSS Evaluated

Shadow, Gray Eagle, and Hunter UAS initial operator training is conducted at Ft. Huachuca, AZ. This includes live training and virtual simulation via training simulators. The primary TADSS for these UAS are the Institutional Mission Simulator (IMS). Training at the unit is supported with Embedded Trainer (ET) in the Ground Control Station (GCS) of the operational systems and with Portable IMS (PIMS). The simulation capabilities for the Shadow, Gray Eagle and Hunter, and the base simulation software for each UAS are common across the IMS, ET, and PIMS.

Operator training for Raven is conducted at Ft. Benning, GA and relies heavily on live-flight training. The Raven UAS has an ET which is the primary simulator in use at the time of this study. A separate simulator has been developed and was being deployed during our study. This is the Visualization and Mission-Planning Integrated Rehearsal Environment (VAMPIRE) simulator.

METHODOLOGY

In performing our gap analysis, we identified several questions to be addressed. First, what individual and crew tasks are trained for UAS operators? To answer this question, we performed a critical task analysis for each UAS (Shadow, Hunter, Gray Eagle and Raven). Second, how are these tasks trained? To address this question we examined the programs of instruction (POIs) and Aircrew Training Manuals (ATMs) for each UAS. Additionally, we conducted interviews with students and instructors at the UAS Training Brigade and with operators and leaders in units. Third, are there skills for which simulator training is underutilized? To address this final question we examined the capabilities of the simulators and reviewed our observations with the simulation software developers at the Joint Software Integration Laboratory (JSIL) at Redstone arsenal.

It should be noted that all the simulators evaluated were accredited for flight training. These accreditations were performed by the Directorate of Simulation (DOS) at Fort Rucker. While our study follows many of the same DOS accreditation processes it is not intended to replace the DOS accreditation. Our study was to examine areas to improve the available TADSS and training methods.

Critical Task Reviews

The UAS individual Critical Task Lists (CTL) were first reviewed to identify the critical tasks that fall within the scope of this study. The tasks were then grouped by functional areas. The functional areas are groups of like tasks that support a logical function. The functional areas were Communications, Emergency, Emplace/Displace, Flight, Inspections, Launch/Recovery, Mission, Payload, Pre-Flight, and Weapons. The grouping of tasks was done primarily for reporting purposes. There were between 69 to 83 critical tasks for the Shadow, Gray Eagle, and Hunter and 24 for the Raven.

The study started in August 2010 by reviewing the individual UAS CTLs available at the time. As evidence to the rapidly changing nature of UAS new CTLs for Shadow, Gray Eagle, and Hunter were released in March 2011.

Individual Critical Task Analyses

As described above, we performed an individual critical task analysis to address the first question in our gap analysis. The individual task analyses were reviewed identify the task training requirements. These requirements were used as the baseline for evaluating simulator capabilities to support training the critical tasks. The individual critical tasks analyses to determine all training factors needed to support training the tasks. These include the task conditions, performance steps, and performance measures. These also detail the training cues, knowledge and skills to be trained, the required supporting tools and equipment, and reference materials needed for each task step.

Available critical tasks analyses were accessed from the Automated System Approach to Training (ASAT) and the Training Development Capability (TDC) websites for evaluation. ASAT, and its replacement TDC, contain the current approved task data. The 2011 CTL contained several new tasks that were titles only. This was understandable as the Army identified new required skills. For these tasks the researchers conducted a task analysis to determine the task function and requirements. The analyses were performed using the Systems Approach to Training principles. Using the current training as a basis the researchers developed likely task steps and performance measures needed for these tasks.

Aircrew Training Manuals

To address the second question in our gap analysis, we examined the Aircrew Training Manuals (ATMs), POIs, and conducted interviews with Instructors, students, operators, and leaders. The ATMs standardize Aircrew Training Programs (ATPs) and flight evaluation procedures by providing specific guidelines for UAS aircrew sustainment training at the unit. These establish crewmember qualification, refresher, mission, and continuation training and evaluation requirements. The ATMs also provide the performance standards and evaluation guidelines so that crewmembers know the level of performance expected. Each task listed in the ATMs has a description of how it should be done to meet the standard (Department of the Army, 2007 and 2009).

Programs of Instruction

The POI covers the school's course of instruction. These provide a description of course content, duration of instruction, and methods and techniques of instruction. These list resources required to conduct the training, detailed data on which tasks are trained, how the tasks are trained, the instructor guides, student guided, practical exercises, simulators, and presentation materials. These detail how the training is to be conducted at the school. The tasks that are to be trained at the school are listed in the CTL. The POI is the document that shows how these tasks are to be trained at the school.

School and Unit Interviews

There were two interview populations used for this study. The first were active duty Army Shadow and Raven operators assigned to UAS units. The second interview populations were the Shadow, Gray Eagle, Hunter instructors and students at the 2-13th Aviation Regiment, Fort Huachuca, AZ. Unit interviews were conducted at Fort Bragg, NC and Fort Carson, CO. As all the Hunter units were deployed the researchers were unable to coordinate Hunter unit interviews. Also, at the time of this study there were no Gray Eagle units fielded. In both groups, the purpose of the questions was to ascertain the degree to which simulators prepared operators for live flight.

The questions covered several aspects of the simulator use in training. Aside from the demographic questions we developed two main sets of questions. The first sets of questions were on the simulator capabilities and training issues. This provided data on the operators' overall impression of their simulator capabilities and limitations. It also gathered data on their simulator's simisms. Simisms are the quirks or differences between operating on the simulator and flying the aircraft. The second set discussed how well the simulators performed in each of the functional areas. These questions focused in on specific simulator performance in functional areas such as pre-flight, takeoff, and landings. These also included a question on their recommendation for overall simulator to live training ratio.

At total of 82 UAS personnel were interviewed for this study. Table 1 contains the interview demographics.

Table 1. Interview Demographics

Position/Rank	E1	E2	E3	E4	E5	E6	E7	Civilian	W3	Subtotal
School Interviews										
Gray Eagle Instructor								8		**8**
Gray Eagle Student				3	8	6	1			**18**
Hunter Instructor				1	1		1	3		**6**
Hunter Student	1	2	3	1						**7**
Shadow Student	3	5	3	1						**12**
Shadow Instructor				2	2			8		**12**
Unit Interviews										
Raven Operator			3	4						**7**
Shadow Operator			1	5	3	2			1	**12**
									Total	**82**

Simulator Evaluations

The unit and school interviews provided data on the UAS operators, instructors, and students evaluations on how the simulators were used and on how well these simulators supported training. We then evaluated the simulator capabilities on operational IMSs. The results of these evaluations were objective assessments on the simulator capabilities and limitations to support institutional training of critical tasks.

For the Gray Eagle evaluations the researchers used the simulator at the researcher's facility. This simulator is used by the researchers to develop Gray Eagle operator training. The researchers also supported the DOS simulator accreditation and the Directorate of Training and Doctrine training verification and validation with this IMS.

The Shadow and Hunter IMS were evaluated at the 2-13th Aviation Regiment and at the JSIL. The JSIL personnel demonstrated the Shadow and Hunter IMS capabilities to the researchers.

The Raven VAMPIRE simulator was evaluated during the visits to the 2-29th Infantry Regiment, Fort Benning. The researchers were able to observe operator training with this simulator on several occasions. Because the VAMPIRE was introduced late in this study the researchers were not able to collect interview data on its performance.

FINDINGS

Our first question was to determine what individual and crew tasks are trained for UAS operators. Analysis showed that about 65% of the Shadow, Gray Eagle and Hunter tasks could be trained via simulation. Those that could not be trained include the tasks in the emplacing/displacing equipment and inspection functional areas. Adjusting the analysis for the remaining functional areas showed that about 94% of the flight related tasks could be trained via simulation (93% Shadow, 94% Gray Eagle, 95% Hunter, 96% Raven). This analysis does not mean that the existing simulators could support task training. The analysis was based on an evaluation of the task characteristics and therefore indicated what should be trainable on simulators.

Our review of the UAS course POI and lessons showed that the school simulators to flight training ratios are Shadow 60% / 40%, Gray Eagle 50% / 50%, Hunter 40% / 60%. The Raven flight training is 100% live. These seem low based on estimate that over 90% of the flight tasks were trainable on a simulator.

How the Tasks are Trained

Our second question was to determine how these tasks are trained. Examination of the POI's and interviews indicated that in the schoolhouse, certain tasks could not be trained well by the simulators. Interestingly in almost all cases, simulation improvements by the JSIL fixed these deficiencies.

In the units, it is a different story. The ET has not been able to provide simulation training capability for a couple of reasons. First, updates in the operational software (that used to operate the UAS) typically precede updates in the ET software. During those periods when the ET software needed to be updated to match the operational software, the embedded trainer was often unusable. For a variety of reasons, there were long periods of time when the ET software was unusable. Second, the rapid operational tempo of these units meant that the GCSs were often enroute to or from the operational theater and unavailable to the operators for training.

Our research showed that the training was conducted using a crawl, walk, and run approach. In the crawl the tasks were introduced in classroom training with demonstrations on the equipment. For walk the tasks were trained with simulator flights. And the run was the live flight training. The instructor interviews responses noted that they normally followed the course instruction. There were deviations noted for, as one instructor noted, "The occasional software/hardware issues" or to explain what are often referred to as "simisms". Simisms are behaviors unique to the simulators that deviate from the behavior of the UAS. The Gray Eagle instructors reported the most software and simism issues. One Gray Eagle instructor stated they deviated "25%, software issues happen so often that we learned when to comment on the issue and continue on with training". However, the Gray Eagle software was updated frequently during the research. Because of this its simulator software often did not match the system software. This was the probable cause for many of the reported Gray Eagle simisms. The Shadow and Hunter system software are mature and stable. The simulation software developers for Shadow and Hunter UAS have been able to maintain currency between simulator and the UAS software.

Figure 1 is the summary of how well the Shadow, Gray Eagle, and Hunter interviewees reported simulators supported their training. There were training issues reported in all functional areas but the main problem areas reported were with communications, emergencies, payload, and weapons. The mission functions were supported well but there were specific training gaps noted with control station transfers, air data relay (ADR), and man-unmanned teaming (MUM-T). It is very important to note that since the interviews were conducted, the simulators have been updated to address most of these issues.

Figure 1 data is from the question "How well do you feel the simulators/training aids/devices training prepare students for the live flight training in the following areas?" We categorized the comments as good, okay, or poor. Most of the responses categories were obvious. The "Good to go" and "Excellent", a simple OK, or the direct "Non-existent on the IMS" and "Not even close" comments were easy to categorize. There were many "Adequate" responses which we categorized as Okay. We also considered the comments caveats so comments like "Pretty good, but problems are…" were rated Okay or Poor depending on the number and severity of the caveats.

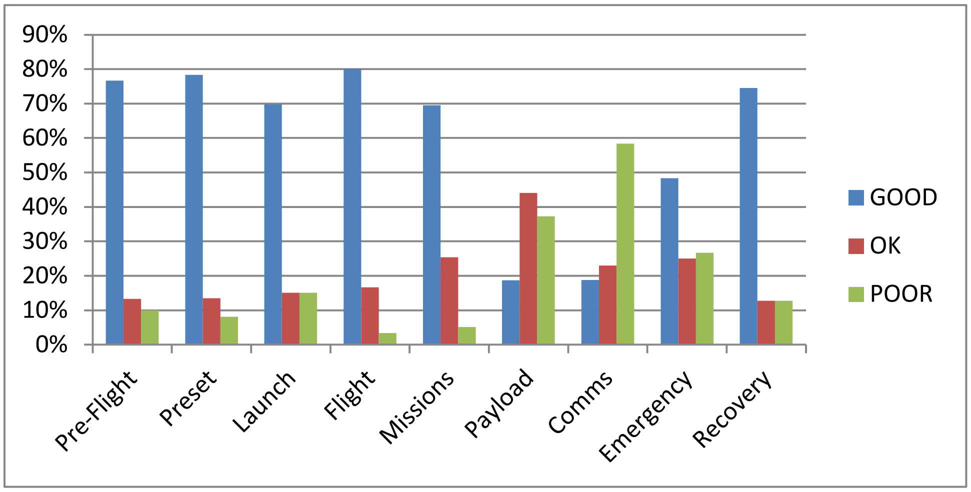

Figure 1. Reported Simulator Training Capability

Poor simulated communications was an oft reported issue. The fact is these simulators do not simulate real time communications with the air traffic control, other aircraft, or ground troops. In training, these communications are role played by the instructors. This is an effective training approach, although it did not have all the background chatter that the operators monitor. The instructors noted that the operators were frequently confused the first time they performed communications with the Air Traffic Control (ATC). However, the instructors also noted that the students adapted quickly. Since the interviews were conducted the JSIL developed an ATC communication simulation. This is the Regional UAS Air Traffic Simulator (RUATS). RUATS provides background communications and canned ATC responses. Using a menu system, the instructor selects an appropriate response and plays it back at the correct time. We would expect that use of RUATS would mitigate some of the difficulty UAS operators have when initially communicating with real ATC controllers.

Instructors reported problems training emergency procedures. The reports were that the emergencies were difficult to inject into the simulation. Additionally, instructors indicated that for some emergency conditions, the indications were not correct and taking corrective actions did not always clear the emergency. Instructors mitigated these problems by explaining these simisms to the students. Emergency training is a prime function of flight simulators. It is difficult and dangerous to cause actual emergencies with the aircraft in flight. So it is understandable that the instructors require these be faithfully replicated in the simulators. The JSIL recognizes this and has worked to improve the emergency simulations. Emergencies are now easily injected and were faithfully replicated. These have improved to the point that DOS has accredited these simulators for training emergencies.

There are training gaps with control station transfers, ADR, and MUM-T. These issues are being addressed but are team tasks requiring interaction between control stations or aircraft. Due to the equipment requirements training these skills with the equipment is also difficult to perform at the school and are currently unit training.

Attitudes toward Simulators

The U.S. Army UAS Center of Excellence (USAUCE) simulation strategy for simulators is that "…UAS training devices must look, feel, and behave like the operational real world." The requirement for high operational fidelity operator controls and synthetic environment is imperative (USAUCE, 2008).

During the research and interviews we found this requirement pervasive among the instructors and operators. The desire for perfect fidelity is understandable because if the simulator is indistinguishable from the actual aircraft, there is no reason that the simulator could not be used for all training. Unfortunately, this often erroneously leads some to believe that training can't be done on a simulator unless it has perfect fidelity. Low fidelity simulators, it is often argued, will lead to negative habit transfer. Negative habit transfer is aviation training jargon that infers that low fidelity simulations will decrease performance and increase unwanted behaviors (Stewart, Johnson & Howse, 2008). As described above, the instructors at the schoolhouse had to deal with fidelity issues (i.e., simisms). Most typically, the instructors would simply call attention to the simism and then tell the students how the actual aircraft would behave. All indications from both student and instructor interviews were that these simisms did not pose problems for students as they transferred to live flight training.

Instructor Training

As noted, there are rapid changes to the UAS software and functionally. This means that the simulator software and functionality must change to match the aircraft. As with any software modification, there are bound to be unforeseen software bugs and usability problems that will emerge. To cope with these concerns, the JSIL and the school developed a process for gathering and reporting these problems back to the JSIL for correction/improvement. Approximately every six months, the school would receive a new simulator software build which both corrected problems and introduced new functionality to improve training. As a consequence, of these frequent software changes, instructors were not always aware of the full capabilities of the software. Understandably, these software changes cannot be incorporated into the lesson plans overnight. It takes time to understand the differences, develop new lesson plans that leverage the improvements, and then train all instructors on the changes. Maintaining instructor currency on these simulators will continue to be a challenge to the school and units for the foreseeable future.

Recommendation on Simulator Flights

In the instructor, student, and operator interviews we asked "…if you could change the balance of live vs. simulator training, would you increase simulator training or increase live training?" The results were mixed with about 17% wanting more simulators, 38% no change, and 45% wanting to increase live training. The minority that wanted more simulator thoughts are summed up with one student's remark "More simulator training on checklist procedures. Operators need to be well drilled and familiar with these before getting on the equipment."

Those that felt that the current simulator/flight ratio did not need to be changed commented that the simulator training allowed for student errors. Comments were that "You're able to make mistakes in the IMS and learn from them to improve" and "No loss of equipment if crashed in the sim". It was also noted that the simulators provide training when weather and equipment issues prevent live flights.

Most of the comments for increasing live training centered on simulator realism and the stress of flying the aircraft. There were several comments on how well the simulator replicated the aircraft. Comments such as "The sim isn't 100% realistic", "The sim is more like playing a game", and "You can't simulate the realisms of the actual thing" were common. The stress of live flight versus simulator was also noted frequently with comments as "Stress is also a factor that you experience in live training, but don't feel in the simulator" and "sim training doesn't compare to actual live flight training, the factor that you are now flying a million dollar aircraft hits home".

ET Availability

As mentioned above, units have a need for simulation training. Airspace restrictions, weather, and other factors often make live flight impossible. The basis for simulation training in the unit is the embedded trainer. In theory, the embedded trainer should be identical to the simulator used in the school, but for a variety of reasons, this is not the case. First of all, the ET and the GCS software have to be compatible for the ET to work properly. In practice however, upgrades to the GCS software are released before upgrades to the ET software are ready. This means that there are significant periods of time in which the two are incompatible. Another challenge comes from the availability of the GCSs for training. Prior to and following a deployment, equipment is often enroute and therefore unavailable to the unit for training.

During a deployment, the GCS is used almost continuously to support missions. The ET is an integral part of the GCS so when the GCS is being operated for mission support it cannot be used for training.

With the national airspace flight restrictions units stationed in the United States are often unable to fly their UAS. And with limited access to their ETs these units have little opportunity for flight training. To mitigate these challenges while at their home stations, UAS units would either utilize nearby sim facilities or would travel to the schoolhouse for training. This indicates that the concept of the GCS as the primary means of simulation training for units is not working and an alternative is needed.

RECOMMENDATIONS

To answer to our third question "Are there skills for which simulator training is underutilized?" we examined the capabilities of the simulators and reviewed our observations with the simulation software developers at the JSIL at Redstone arsenal. To assess the simulator capabilities we performed the training tasks to standard. We emphasized assessing simulator performance issues and concerns noted in our interviews. Our findings were that the simulators supported training for most of the tasks. Exceptions were some of the communication, control station transfers, ADR, and MUM-T procedures. These tasks require networking simulators together. This is a planned capability that was not functional at the time of this study. Another noted concern that was not fully supported was the fidelity of the payload video.

The discrepancy between our findings and the interview data is due in a large measure to improvements to the simulators and simulations. JSIL is in tune with the UAS training requirements and is continually improving the simulators. JSIL has addressed many of the training concerns raised during this study. Another reason is that our understanding of the simulator fidelity requirements differs from the school. As noted earlier, it is not uncommon for instructors and operators to feel that 100% fidelity is needed for proper training. Our approach was that lower fidelity simulators can be as effective as high fidelity simulators when effective training strategies are used (Salas, Bowers, & Rhodenizer, 1998). Simulator research has shown that more realism does not equate to better training. The training program is more important than the simulator fidelity to training success. (Stewart, Johnson & Howse, 2008).

So if an issue is "Unrealistic RPM fluctuations during recovery", we noted if the RPM readings were within the operating range. But we didn't consider variations to be a problem. If fact, we considered such issues as training points in that the operator needs to understand the correct flight parameters. The readings on the simulator may differ slightly from the aircraft, but the training point is to look for the reading and know if it is correct or not. Similarly the payload video being not a real as the aircraft's does not detract from training the payload operation tasks. Better video may support vehicle recognition and target location skills, but not how to operate the payload.

Our research indicates that the simulators are capable of training the UAS operator tasks to standards. Simulator performance has improved to the level less live flight training is required to meet the schools' standards. We also determined that the current number of simulator flights were enough to meet the training goals. It is our recommendation that the schools reduce the amount of live flight training done with the UAS. A reduction in flight hours would allow the school to schedule more classes per year which would increase student throughput. It would also reduce equipment operating costs.

While our research has shown that simulators can replace most of the flight training we recognize that there are still simulator fidelity concerns. Operators still wish for the perfect simulator. For this reason we recommend that small reductions be made to begin with. These reductions should be phased in and the schoolhouse personnel involved in process. This will allow the school to implement the change gradually and to evaluate the effects on the training program. More flight reductions can be made as the effects of the reductions on training are appraised.

Our recommendation is to reduce up-and-away flights. These flights are used to train aircraft and payload operations, and mission support. These are all areas which the simulators train very well. For the Hunter course all the local area flights should be cut. These are training flights given after the live flight check rides. These are not evaluated by the school and are only used to give the operators additional flight experience. Only small reductions were recommended for the launch and recovery flights. These are the most task intensive flights covering presets, preflight, engine start, ATC communications, taxi, launch, and recovery. While the simulators train these areas well, students are often very nervous for the first launch and recovery flights.

Modest changes in the UAS school flight training can result in significant reductions in course length. This is due to the compounding effect of many students and limited flight assets. With two UAS being used for training, one four-hour training flight for 20 students takes five days. Our recommendations are to initially cut 3 of 8 Shadow, 4 of 10 Gray Eagle, and 7 of 16 Hunter training flights. Figure 2 shows the number of training days saved for each UAS flight training module.

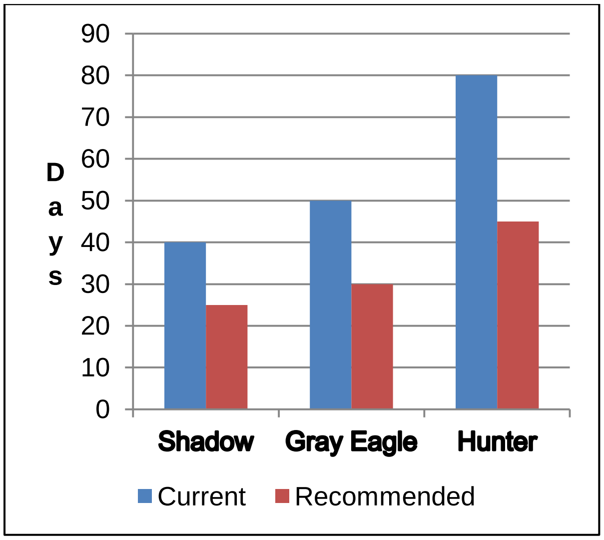

Figure 2. Flight Module Savings

Because the ET is normally not available for training we recommend that units have access to PIMS or other flight simulators. Until that occurs units must continue training with live flights.

Do not Reduce Live Flight Training for Raven

We recommend that the Raven school not reduce the number of live flights. This is because the course is short (2 weeks), there is an adequate number of UAS for training, and the equipment is inexpensive to operate. The ET was the primary Raven simulator at the time of this study. As the ET uses the UAS equipment, training with the ET prevents live flight training. With the Raven low operating there is no significant savings using the ET for training.

Though not formally evaluated by this study the VAMPIRE simulator looks to be an excellent Raven simulator. We recommend that this should be included to support current Raven flight training at the school and units.

Train the Trainers

To effectively train with the simulators the instructors need to understand the simulator's capabilities and limitations. We recommend that the 2-13th Aviation Regiment develop and implement refresher simulator training for their instructors. This training should include instruction on the simulator capabilities, theory and practice of using simulators for training, discussions on the level of simulator fidelity to training effectiveness, and in-depth training on the simulator operation. This should be required training for all new instructors and should be required lesson in the annual instructor training program.

CONCLUSION

We come back to the question raised in the title. Can UAS Training be Done Without Live Flight? Unfortunately this question was more complex than it first appeared. It cannot be answered with a straightforward yes or no. Some skills (e.g., emergency procedures) must be trained exclusively with simulation, while others are more wisely trained live (e.g., emplace/displace equipment). As simulator fidelity improves, there will certainly be less of a need for live flight, but that does not mean that it would be cost effective to pour massive resources into improving fidelity in the short term. The rapid evolution of UAS capabilities means that the training simulators will be playing catch up for the foreseeable future. As a result, the school will continue to need live flight training if for no other reason than to familiarize students with the most current operational software.

Finally, there is the issue developing confidence in the equipment and training. The responsibility of flying an aircraft that can cost millions of dollars and that must operate safely in the same airspace as manned aircraft is a stressful experience. Having some live flight experience before arriving at the unit helps to reduce this stress and gives the students confidence in their training and skill before they arrive at their duty stations.

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