ANALYSIS OF DEPLOYED TRAINING REQUIREMENTS IN THE F/A-18 COMMUNITY

Maureen L. Bergondy[1], Jennifer E. Fowlkes[2], Danielle C. Merket[1] and Laura M. Milham[2]
[1]Naval Air Warfare Center Training Systems Division
Orlando, FL
[2]University of Central Florida
Orlando, FL

Naval aviators are limited in their opportunities to practice critical mission skills while deployed for reasons that include fiscal, operational and safety constraints. Efforts have been initiated that specifically address simulation technology requirements associated with deployed training. These efforts contribute to the development of deployed training capability by providing simulated environments in which to practice and refresh critical skills. However, to focus simulation requirements, deployed training needs, in the form of missions, tasks, and skills, should be identified. The specific objective of this effort was to begin to delineate potential deployed training needs and approaches for F/A-18 pilots. A deployed training requirements survey was administered to 38 pilots from three squadrons aboard the *USS Kitty Hawk* representing carrier air wing 5 (CVW5). The results across the ratings and free response survey items were consistent in indicating a clear need for deployed training. Air-to-air, smart weapons, electronic warfare, and integration were the mission areas with tasks that received the highest ratings and rankings in terms of need for deployed training. In general, these tasks are not practiced on every mission, are critical to perform, and have a high skill decay index. These factors combine to make them prime candidates for deployed training. In terms of deployed training strategies identified by respondents, simulation was mentioned most frequently. Besides simulation, a variety of additional and complementary training approaches were mentioned including computer-based training, video demonstrations of effective performance, and an organic TACTS capability. Future work should consider the tradeoffs between these many alternatives.

MAUREEN L. BERGONDY is a Senior Research Psychologist in the Training Technology Development Branch of the Naval Air Warfare Center Training Systems Division. She is currently performing research in aviation team training and deployable aviation training system development. Ms. Bergondy is also a member of the integrated product teams for the Joint Strike Fighter and the Aircraft Carrier of the Future (CVX). Over the last 13 years she has served as Principal Investigator for projects in the areas of visual displays for training, tactical aviation training, aviation electronic warfare training, and aircrew coordination training. Ms. Bergondy did her graduate studies in Experimental Psychology at Vanderbilt University.

JENNIFER E. FOWLKES is Research Psychologist with the Team Performance Laboratory at the University of Central Florida. She has over twelve years of experience in areas of human factors and training which includes team training and performance, training effectiveness evaluations, simulator sickness research, and performance test battery development. Most recently, her research has focused on measuring team performance in distributed training environments. Dr. Fowlkes holds a Ph.D. in Experimental Psychology from the University of Georgia.

DANIELLE C. MERKET is a Research Psychologist in the Training Technology Development Branch of the Naval Air Warfare Center Training Systems Division. Her R&D experience includes 4 years in the Aviation Team Training Laboratory where she has performed research related to teams and team training. She is currently pursuing her M. S. in Industrial/Organizational Psychology at the University of Central Florida.

LAURA M. MILHAM Laura Martin Milham is a Graduate Research Assistant at the Team Performance Laboratory (TPL) where she has worked for 3 years. She is currently pursuing her Ph.D. in Human Factors Psychology at the University of Central Florida. She has worked on team situation assessment and computer based training. Her major research interests are the use of cognitive strategies to enhance training effectiveness.

ANALYSIS OF DEPLOYED TRAINING REQUIREMENTS IN THE F/A-18 COMMUNITY

Maureen L. Bergondy[1], Jennifer E. Fowlkes[2], Danielle C. Merket[1] and Laura M. Milham[2]
[1]Naval Air Warfare Center Training Systems Division
Orlando, FL
[2]University of Central Florida
Orlando, FL

OBJECTIVES

Naval aviators are limited in their opportunities to practice critical mission skills while deployed. Resource limitations, peacetime training rules, technical constraints, and security restrictions either individually or collectively have an impact on the availability of training. Because of the perishability of aviation skills, limitations in deployed training opportunities threaten aviators' proficiency in the aircraft, as well as overall mission readiness.

Thus, there has been a long-standing need to provide naval aviators with deployed training systems. Currently, there are a number of deployed simulation development efforts aimed at filling this need. However, there is little information available to focus these efforts in terms of the missions and tasks these systems should support. Such information could be used to focus the identification of simulation requirements and instructional features, tailoring simulation development around critical areas identified as the most susceptible to decay. The present effort was performed in order to help guide deployed training efforts. Specifically, the objectives of the present effort were to 1) begin to delineate deployed training needs for the F/A-18 community, and 2) to identify potential deployed training strategies. Although our focus was limited to F/A-18 aircrews, the methodology we employed is applicable to other aviation communities.

BACKGROUND

Aircrews are required to sustain a variety of motor, procedural and cognitive skills while on deployment to maintain combat readiness. It can be argued that, to operate the F/A-18, the entire repertoire of tactical and aviation skills are needed. The F/A-18 is a multi-role aircraft, performing both air-to-air and air-to-ground missions, often as part of a large team. The aircraft's dual role and mission diversity are demanding for the aviators who fly it. Moreover, the skills required for optimal mission performance are heavily weighted to the procedural and cognitive ones—the skills that are most at risk for decay.

It is well documented that flight skills decay rapidly during periods of nonuse (e.g., Childs & Spears, 1986; Mengelkoch, Adams, & Gainer, 1971), which is not surprising given their heavy procedural and cognitive components. Adams and Hufford (1962) documented marked forgetting (from 95% correct to 5% correct) on a bomb delivery sequence over a ten month interval. Childs and Spears (1986) described research which documented that certified pilots, over a period of nonflying, forgot tasks such as acknowledging air traffic control and correct entry procedures for stall maneuvers. They hypothesized that "Loss of proficiency may occur because pilots undergo a decline in recognizing and organizing the cues that are necessary for safe and efficient flight" (p. 236).

Historically, simulation has been employed to offset the restrictions and limitations described above and it is a prime training medium to support deployed training. In the Navy, simulators have been used to train a variety of skills, including those pertaining to stick and rudder skills, combat maneuvering, instruments, and aircrew coordination. The use of simulation for these purposes has been shown to be effective for training flight and combat skills of naval aviators. For example, regarding combat skills, research has shown positive training transfer from the simulator to the aircraft for conventional weapons delivery in the TA-4J (Hagin, Dural, & Prophet, 1979; Lintern, Sheppard, Parker, Yates, & Nolan, 1989) and air-to-air combat skills for pilots transitioning to the F-14 (McGuinness, Bouwman, & Puig, 1982; Payne, Hirsch, Semple, Farmer, Spring, Sanders, Wimer, Carter, & Hu, 1976). Technologies supporting networked simulations are becoming increasingly reliable, thus opening the door to the training of a host of combined arms and joint integration skills.

Besides simulation, there are other potential approaches to maintaining skill levels in aircrews

while deployed. These include interactive computer-based training and technologies supporting distance learning. If well chosen, simulation and other technologies are likely to be highly cost effective. It is well known that refresher training can return skills to their original levels in a fraction of the original learning time (e.g., Healy & Sinclair, 1994). Moreover, retraining only selected task aspects can also be highly effective in restoring the original skill. There is also a history of research suggesting that even mental rehearsal can be used to maintain skill levels and that it has a greater effectiveness for complex tasks (e.g., Driskell, Copper, & Moran, 1994; Perry, 1939).

Other training strategies may be combined with deployed training approaches to maintain skill levels. An overview of research in this area is provided in Table 1. An example of a supporting training strategy might be to vary shore-based training prior to deployment. In their review of the research pertaining to skill maintenance, Healy and Sinclair (1994) concluded that a systematic alteration of practice which encourages different types of information processing may improve skill retention. These include varying practice schedules, reinforcement schedules and the content of practice sessions.

Thus, there are many training technologies and strategies that may support the maintenance of aviation skills while on deployment. The key is to utilize a systematic approach in the determination of what skills need to be maintained so that the intelligent selection of training approaches can be made. Therefore, determination of deployed training requirements for F/A-18 aircrews was the primary focus of this research. In an initial effort (Bergondy, Fowlkes, & Baker, 1998), observations pertaining to deployed training were made in connection to the tryout of the Boeing F/A-18 CV WST aboard the *USS Independence*. During this effort, interviews with 15 pilots were conducted to provide a framework for the assessment of deployed training needs. In addition, observations were made of how pilots used the CV WST. These data indicated that a deployed training system would be heavily used and would support practice of a variety of missions and tasks. The present effort provided a more standardized assessment of deployed training requirements using a larger sample of F/A-18 pilots.

Table 1. Training Approaches to Improve Task Retention

Training Approaches
• Retention improves as a function of task repetition during initial or refresher training (Hagman & Rose, 1983).

• Task performance during acquisition is a predictor of retention; however, many forms of practice that do not facilitate acquisition performance improve transfer and retention (Hagman & Rose, 1983; Healy & Sinclair, 1994). These include:
  • Random rather than blocked scheduling, and
  • Variability of practice.

• Overtraining during acquisition improves task retention (Schendel & Hagman, 1982).
• Better retention results when the procedures used during task performance are retrieved from memory during acquisition training (Healy & Sinclair, 1994).
• Summary feedback appears more conducive to retention than feedback provided after every trial, especially when summary feedback is introduced to the training situation gradually (Healy & Sinclair, 1994).
• Tasks to be learned should be related to previous experience (Healy & Sinclair, 1994).
• When learning new material, active generation (e.g., self-produced) during training is better than passive presentation (Healy & Sinclair, 1994).

METHOD

Participants

Thirty-eight F/A-18 pilots, representing three squadrons deployed aboard the *USS Kitty Hawk* completed the deployable training requirements survey (although data were initially collected from 39 pilots, one questionnaire was incomplete and could not be used). Table 2 provides relevant experience variables from this group. It can be seen that the sample represented a wide range of experience, from relatively inexperienced (low flight hours, no deployments) to highly experienced (one aviator had been on ten deployments) aviators.

DEPLOYED TRAINING REQUIREMENTS SURVEY

Survey Development

The purpose of the Deployed Training Requirements survey was to systematically collect input from F/A-18 pilots regarding deployed training requirements and potential deployed training strategies and issues related to deployed training. The content of the survey was based on several sources:

- F/A-18 Training & Readiness Matrix. The F/A-18 Training and Readiness Matrix was used to anchor the missions and tasks included in the survey to the most operationally pertinent training analysis.

- F/A-18 skill analysis. A Center for Naval Analysis F/A-18 skill analysis (Brobst & Brown, 1996) was also used as a source for skills included in the survey.

- Interviews. Interviews with 15 F/A-18 pilots from the *USS Independence* provided preliminary information on deployed training needs.

- SME input. At every phase in the development of the survey, subject matter expert (SME) input was incorporated. Prior to administration, the survey was pilot tested and revised to incorporate SME comments.

Survey Content

The survey consisted of three main sections:

- Section 1: Demographics. The initial section of the survey collected demographic information such as rank, flight hours, number of carrier deployments, and training experiences.

- Section 2: Aviation Skill Ratings. The majority of the survey listed F/A-18 missions/tasks and skills. Survey participants rated each of these skills on a five-point scale in terms of "Criticality," "Difficulty to Learn," "Difficulty to Maintain," and "Need for Training While Deployed." In addition, for each mission/task and skill, pilots indicated the percentage of missions flown in which the task or skill was used. Finally, pilots indicated the frequency with which each mission/task and skill should be trained while deployed.

- Section 3: Free Response. In the final section of the survey, pilots were asked in a free response format to identify 1) key deployed training issues, 2) their top ten deployed training requirements, and 3) potential deployed training strategies.

PROCEDURE

A NAWCTSD researcher administered the survey to deployed pilots in three squadrons aboard the *USS Kitty Hawk*. The survey was administered to pilots during all officers meetings and took approximately one hour to complete. The NAWCTSD researcher was present as pilots completed the survey, and was available to answer any questions they had.

Table 2. Pilot Experience Variables

Experience Variable	Mean	SD	Minimum Value	Maximum Value
Number of deployments	3.5	2.6	0	10
Total Flight Hours	1625.8	1327.2	400	4500
F/A-18 Flight Hours	721.5	546.4	130	2500

RESULTS

Need For Deployed Training

Need for deployed training was represented by pilots' ratings of "Need for Training While Deployed" on a one to five scale, where one indicated "not needed" and five indicated "very much needed." In addition to these data, a skill decay index was computed based on the methodology described by Swezey, Owens, Bergondy, and Salas (1998). The skill decay index combines difficulty to maintain[1], need for training while deployed[2], and total missions used[3], resulting in a score ranging from three to nine, where higher scores indicate a greater potential for skill decay during periods of nonuse. Skills or tasks rated high on the need for deployed training, as well as having a high skill decay index, are expected to be prime deployed training candidates.

The results across the ratings and free response questionnaire items are consistent in indicating a clear need for deployed training. Figure 1 shows the average "Need for Training While Deployed" rating by the major mission categories sampled in the survey. The highest average rating was obtained for the air-to-air mission category. However, with the possible exception of the mining and combat search and rescue (CSAR) categories, deployed training is also indicated as a need for the other mission categories. The results are further broken out in Figure 2 which summarizes the results for the tasks within each mission category. Each "bulleted" item indicates tasks with both a high "Need for Training While Deployed" rating (3.0 or above) and skill decay index (above the median, 6.6).

In viewing Figure 2, it can be seen that over half the tasks were rated high on both indices used. These data illustrate the variety of tasks for which deployed training may be indicated. Air-to-air, smart weapons, electronic warfare, and integration are mission areas with tasks that received the highest ratings in terms of need for deployed training. In general, these tasks are not practiced on every mission, are critical to perform, and have a high skill decay index. These factors combine to make them prime candidates for deployed training.

The general cognitive skills such as communication, situational awareness, and decision making generally received lower skill decay index scores. This is because they are used on all missions flown. It is important to note that these skills are generally rated as highly critical.

Top Ten Deployed Training Needs

Table 3 presents the results for the aviators' rankings of the top ten deployed training requirements. Shown in the table are the top eleven responses. It can be seen that aviators view tasks related to air-to-air, electronic warfare and smart weapons mission areas as key deployed training needs, in agreement with the ratings data.

Deployed Training Issues

Sixty-three percent (24 out of 38 pilots) of the respondents completed the survey section pertaining to the identification of deployed training issues. Comments from these aviators clustered into three main issues which are described below.

- Skill Perishability. Eight of the 24 pilots indicated they needed more training because some of their skills were highly perishable.

- Lack of Training Opportunities. A second category pertained to the lack of training opportunities because the air wing was forward deployed. Eight of the 24 pilots indicated that they did not have the same training opportunities as contemporaries in the continental US.

- Integrated Training System. Seven of the 24 pilots indicated a need for an integrated system of training. They indicated that there were many systems available, but that these did not have common objectives or training goals. These pilots argued for a formalized program of training, a way of developing a common approach to the many systems they have.

Deployed Training Approaches

Fourteen (37%) of the 38 pilots responded to the Training Approach section. Overall, there were

[1] "Difficulty to maintain" was recoded as follows: 1 and 2 recoded as 1; 3 recoded as 2, 4 and 5 recoded as 3.

[2] "Need for training while deployed" was recoded as follows: 1 and 2 recoded as 1; 3 recoded as 2, 4 and 5 recoded as 3.

[3] "Total missions used" was recoded as follows: 0 to 33% recoded as 1; 34 to 66% recoded as 2; 67% and higher recoded as 3.

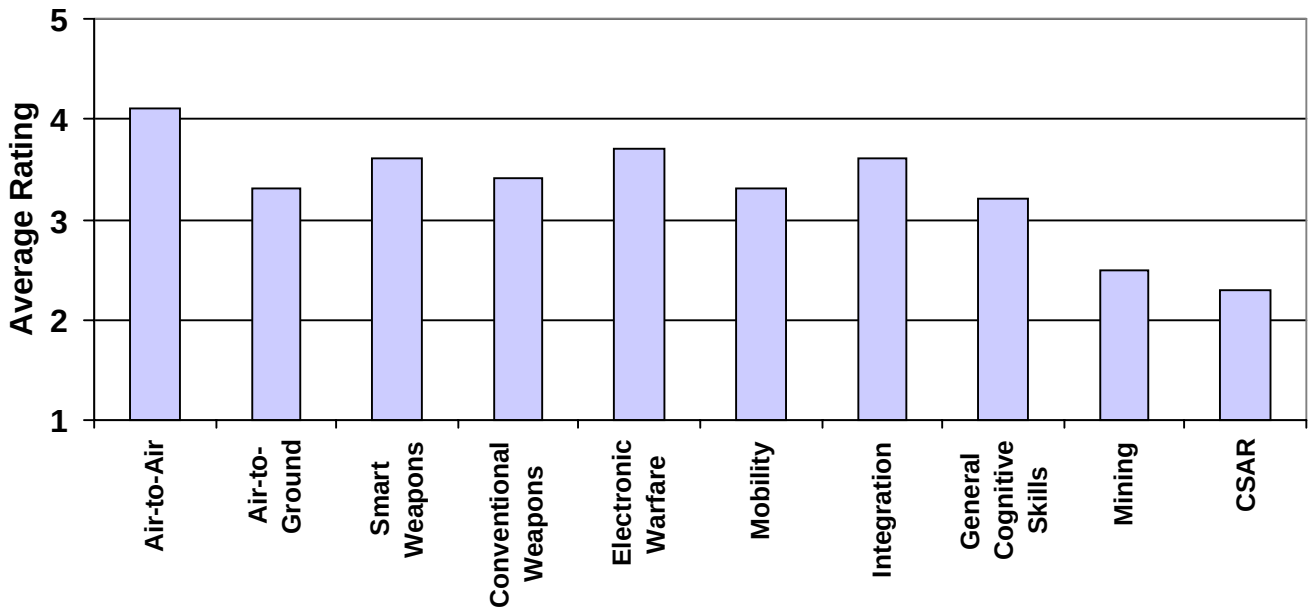

Figure 1. Average ratings for "Need for Training While Deployed" across mission areas sampled in the survey.

Air-to-Air
- ➢ -Beyond visual range (BVR)
- ➢ -Air Combat Maneuvering
- ➢ -Basic Fighter Maneuver
  -AAMRAM
- ➢ -Sidewinder
- ➢ -Sparrow
- ➢ -Guns

Smart Weapon Employment
- ➢ -LGB
- ➢ -Laser Self-Designation
- ➢ -SLAM
- ➢ -Maverick
  -Walleye
- ➢ -JSOW
- ➢ -JDAM

Other
-Coordinated Mining Ex.
-Mining
-CSAR

Air-to-Ground
- ➢ -HARM
- ➢ -Target Acquisition
- ➢ -Close Air Support
  -Harpoon
  -NVD Low Level

Mobility
-Instruments
- ➢ -Emergency Procedures
- ➢ -Day Carrier Landings
- ➢ -Night Carrier Landings
- ➢ -NATOPS Checks

General Cognitive Skills
-Communication
-Situational Awareness
-Mission Analysis
-Adaptability
-Decision Making
-Assertiveness

Electronic Warfare
- ➢ -EW RHAW Gear
  Responses
  -Expendables/Chaff
- ➢ -ECCM

Integration
- ➢ -Data Link
- ➢ -Coordination with Air Wing
- ➢ -Coordination with E2
- ➢ -Coordination with AWACS
- ➢ -Mutual Support
- ➢ -Integration with Support

Conventional Weapons Delivery
- ➢ -Weapon Delivery
  -Low Level Navigation

"➢" Indicates tasks with both a high "Need for Training While Deployed" rating (3.0 or above) and skill decay index (above the median, 6.6)

Figure 2. A summary of potential deployed training needs across missions and tasks.

seven training approaches identified which are summarized in Table 4.

The most commonly suggested deployed training strategy was simulation (10/14 pilots). Computer-based training was reported by six of the 14 pilots as potentially addressing many deployed training needs including RHAW gear responses, the SFTI academic syllabus, smart weapon delivery, HARM employment, and air-to-air BVR training.

Other training approaches listed included networked simulation, practice in the aircraft, having lectures/going to schools, videos on switchology, and an organic TACTS capability. Thus, it appears that pilots would be responsive to a variety of deployed training approaches.

CONCLUSIONS

The goal of the present effort was to begin to delineate deployed training needs and strategies for the F/A-18 community. The identification of deployed training needs is important given the varied and complex skills used by naval aviators, the documented perishability of such skills, the criticality of the missions they perform, and the limitations of on board flight training opportunities.

Deployed Training Needs

Both the ratings and free response items indicate a need for deployed training across a variety of missions and tasks. The ratings items were based on operational documents such as the F/A-18 Training and Readiness Matrix and F/A-18 pilot input—as such they represent a best attempt to put in front of the pilots relevant tasks for each mission area. The free response items allowed pilots to raise unforeseen issues and to identify tasks that were missed. Both types of data point to similar findings, increasing our confidence in the conclusions. The results were also consistent with those obtained from the earlier phase of this effort in which pilots were interviewed regarding deployed training needs.

Table 4. Recommended Deployed Training Approaches

Training Approach
Simulator - 71% (10/14)
Computer Based Training/Laptops – 43% (6/14)
Networked Simulators – 21% (3/14)
TACTS systems – 21% (3/14)
Practice in aircraft – 14% (2/14)
Lectures/ Schools – 14% (2/14)
Videos on switchology – 7% (1/14)

Table 3. Top Ten Deployed Training Needs (Number of Pilots Providing Rankings)*

	Total	Ranking									
Task	**Pilots**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Air-to-air BVR	27	9	4	2	3	1	3	5			
Performing target acquisition/detection	26	5	1	5	3	4	2		3	1	2
"Smart" weapons delivery	24	4	5	1	1	2	7		1	2	1
EW – RHAW Gear Responses	22		2	5	4	5	2			1	3
LGB	21	2	8	5	2	1	1			2	
Conventional Weapons	19	1	2	4	2	4	2	2	1	1	
HARM Employment	18	2	1	1	2	2	1	2	2	3	2
BFM	16	2	2	2	1			3	5	1	
Air-to-air ACM	15	1	3	1	2		1	1	4	2	
Night carrier landing	15	5	2			2		4			2
Emergency procedures	11	2	1			1	3		1		3

*35 of 38 aviators responded to this survey item.

Although this work established a need for deployed training across a variety of mission areas, the specific components of the mission tasks still need to be identified through techniques such as individual, collective, and cognitive task analyses. Once specific deployed training tasks have been identified, a host of potential training solutions should be considered, weighting factors such as training effectiveness, cost, space optimization, and time requirements.

A limitation of this effort is that the results were obtained for forward deployed squadrons and, as such, may not be representative of other F/A-18 squadrons. For example, the squadrons responding to the questionnaire are deployed with the air wing, which offers opportunities for interactions that other squadrons do not have. Consequently, the ratings obtained for integration and coordination tasks may be somewhat lower than those obtained from other squadrons. As another example, forward deployed squadrons do not have access to training offered to stateside squadrons (e.g., air wing weapons detachments to the Naval Strike and Air Warfare Center, weapons systems trainers). Consequently, their ratings in some areas may have been higher.

Deployed Training Strategies

The training approach most commonly suggested by pilots to address deployed training needs was simulation. Simulation is a prime training medium to support deployed training because of its capability to offset the operational restrictions and limitations, in addition to its general training effectiveness (e.g., Bell & Waag, 1998; Hagin, Dural, & Prophet, 1979; Lintern, Sheppard, Parker, Yates, & Nolan, 1989). Moreover, networked simulation, another strategy mentioned by pilots, creates opportunities for the training of a host of combined arms and joint integration skills. There are several efforts that specifically address simulation requirements associated with deployed training. These are the Boeing F/A-18 CV WST, the NAVAIR/NAWCTSD/ONR Deployed Training Technology Demonstration at Atsugi, Japan, and the 6.3 R&D Transportable Strike/Assault Rehearsal System (TSTARS).

Besides simulation, a variety of additional and complementary training approaches were mentioned including computer-based training, video demonstrations of effective performance, and an organic TACTS capability. Computer-based training could support deployed training of a variety of tasks. Some of the tasks mentioned by pilots include RHAW gear responses, the SFTI academic syllabus, smart weapon delivery, HARM employment and air-to-air BVR training.

In addition, other alternatives are to consider the ways in which deployed training technologies could be combined with shore-based training to facilitate skill maintenance. Shore-based training approaches include optimizing feedback and training content to facilitate skill retention (Healy & Sinclair, 1994). Future work should consider the tradeoffs between these many alternatives.

REFERENCES

Adams, J. A., & Hufford, L. E. (1962). Contributions of a part-task trainer to the learning and relearning of a time-shared flight maneuver. Human Factors, 4, 159-170.

Bell, H. H., & Waag, W. L. (1998). Evaluating the effectiveness of flight simulators for training combat skills: A review. The International Journal of Aviation Psychology, 8, 223-242.

Bergondy, M. L., Fowlkes, J., & Baker, D. (1998). A preliminary analysis of deployed training: Issues, requirements, and evaluation (Special Report 98-019). Orlando, FL: Naval Air Warfare Center Training Systems Division.

Brobst, W. D., & Brown, A. C. (1996). Analysis of squadron aircrew training project: summary (CRM 96-0136.00/23). Alexandria, VA: Center for Naval Analysis.

Childs, J. M., & Spears, W. D. (1986). Flight skill decay and recurrent training. Perceptual and Motor Skills, 62, 235-242.

Driskell, J. E., Copper, C., & Moran, A. (1994). Does mental practice enhance performance? Journal of Applied Psychology, 79, 481-492.

Hagin, W. V., Dural, E., & Prophet, W. W. (1979). Transfer of training effectiveness evaluation: US Navy device 2B35 (Seville Research Corporation TR 79-06). Pensacola, FL: Chief of Naval Education and Training.

Hagman, J. D., & Rose, A. M. (1983). Retention of military tasks: A review. Human Factors, 25, 199-213.

Healy, A. F., & Sinclair, G. P. (1994). Long-term retention of trained skills (NAWCTSD TR 94-001). Orlando, FL: Naval Air Warfare Center Training Systems Division.

Kern, T. (1997). Redefining airmanship. New York: McGraw-Hill.

Lintern, G., Sheppard, D., Parker, D. L., Yates, K. E., & Nolan, M. D. (1989). Simulator design and instructional features for air-to-ground attack: A transfer study. Human Factors, 31, 87-100.

McGuiness, J., Bouwman, J., & Puig, J. A. (1982). Effectiveness evaluation for air combat training. Proceeding of the 4th Interservice/Industry Training Equipment Conference, 1, 371-382.

Mengelkoch, R. F., Adams, J. A., & Gainer, C. A. (1971). The forgetting of instrument flying skills. Human Factors, 13, 397-405.

Payne, T. A., Hirsch, D. L., Semple, C. A., Farmer, J. R., Spring, W. G., Sanders, M. S., Wimer, C. A., Carter, V. E., & Hu, A. (1976). Experiments to evaluate advanced flight simulation in air combat pilot training. Vol. 1. Transfer of learning experiment. Hawthorne, CA: Northrop Corporation.

Perry, H. M. (1939). The relative efficiency of actual and "imaginary" practice in five selected tasks. Archives of Psychology, 34, 243.

Schendel, J. D., & Hagman, J. D. (1982). On sustaining procedural skills over a prolonged retention interval. Journal of Applied Psychology, 67, 605-610.

Schmidt, R. A., & Bjork, R. A. (1992). New conceptualizations of practice: Common principles in three paradigms suggest new concepts of training. Psychological Science, 3, 207-217.

Swezey, R. S., Owens, J. M., Bergondy, M. L., & Salas, E. (1998). Task and training requirements analysis methodology (TTRAM): an analytic methodology for identifying potential training uses of simulator networks in teamwork-intensive task environments. Ergonomics, 41, 1678-1697.