SIMULATION TRAINING AND THEIR ROLE IN THE OPERATING INSTRUCTION OF FIGHTING SQUADRON

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Abstract: *„If network simulators and its inherent value is appreciated quickly, then today`s (current) and tomorrow`s (future) warriors will step into potential battles with the great advantage of improved flying ability, reflexes and „seeing" the big picture while working their own luck along the way. The network simulators has a future and is destined to be cornerstone of air and space dominance in the future"*, *Michael R Oakes*

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1. INTRODUCTION

A continuing concern of the military aeronautical community is how to improve pilots training programs from the perspective of using flight simulators or simulator networks to develop and improve pilots' combat capabilities and to develop new tactics to use in air combat.

The recent development of the battle technique has led to the emergence of new tasks during missions and, implicitly, to new challenges in the formulation of pilots' training programs.

If in the past flight simulators were used only to improve piloting techniques or to learn how to operate systems and equipment on board the aircraft, it has recently become insignificant in relation to the training needs required by the new conditions and tactics opponent's struggle.

The training opportunities offered by the virtual environment, the technical capabilities of reproduction of the modern battlefield, characterized by a multitude of both terrestrial and airborne threats and the need to train pilots to operate in more and more crowded airspace, Approaching a new vision whereby training given to combat aircraft pilots must ensure the success but at the same time survival in the battlefield.

2. THE IMPACT OF TRAINING SIMULATION ON THE OPERATIONAL ENVIRONMENT

Under the conditions of modern wars, the actions performed with isolated aircraft are almost excluded, and the new battle tactics of aviation are addressed to the formations of at least two aircraft, which has led to the emergence of new training needs for the pilots, to develop their ability to understand responsibilities In the struggle structures to ensure the success of the mission.

These new training challenges have resolved with the networking of advanced simulators and represent a new step in the field of virtual training that offers unlimited possibilities to generate highly complex scenarios designed to reproduce the environment as faithfully as possible real flight and develop pilots' skills in making the best decisions to accomplish their missions.

Flight simulator interconnection and simulator network development has facilitated the development of new tactics, techniques, or procedures for aviation use in combat, and allowed them to be validated before being used in real combat, and last but not least, provided solutions for remodeling the pilot training programs in line with the new requirements.

However, the simulators also have some limitations, determined by the graphical possibilities of visual representation, the quality of the sensors and the accuracy of the information received from them, the number of variables processed for real flight simulation, the realism of the scenarios used, the lack of environmental psychological factors Real flight, the fidelity with which the aircraft cabin is reproduced, and, last but not least, the software / hardware capabilities. All these limitations can have a negative effect on the training processes on how to carry out tasks and missions, or may prove to be critical in the development of misconceptions that are difficult to identify and corrected later on.

Analyzing both the benefits and limitations set forth above, and judging each task or mission according to its peculiarities, the decision on the need for virtual training, complementary to in-flight training, ultimately belongs to the comrades and is based on the analysis of the following indicators:

- Utility of simulator training;
- Effectiveness in acquiring the knowledge required to operate on-board systems and equipment, interpreting sensor input and decision making, tactical situation management, weapon use, etc.
- Influence of simulator training on pilots' performance in real flight.

In order to demonstrate the usefulness of simulator training, the study by the US Air Force Research Laboratory, involving pilots qualified for the mission and using a network of two F-15 simulators (full view) and two tactical simulators (for Simulation of opponents / interactive threats) as well as a Weapons Director. In addition to the interactive threats, controlled by the two tactical simulators, the scenario was complemented by constructively generated threats, increasing in this way the degree of complexity and realism.

After one training week, pilots were asked to assess the usefulness of the simulator training relative to the flight instruction in the base units. The outcome of the study not only demonstrated the usefulness of simulation training but also highlighted many tasks for which it proved to be more beneficial but also more efficient due to the following:

- Training costs much lower than those generated by in-flight training;
- The advantage of repeating certain tasks or assignments for a better student understanding without additional fuel or time;
- The possibility of analyzing an event immediately after it has occurred gives the opportunity for immediate feedback, and it is not necessary to complete the debriefing mission;
- It is possible to record the mission performed and can be used later as a reference in assessing progress in training or as a future scenario.

Thus, two categories of tasks were identified, differentiated according to the assessments received, as shown in the table:

Better Trained in Simulator	Highly Valuable Simulator Training
Multibogey selection	All-aspect Defense
Reaction to SAM	BVR Employment
Better Trained in Simulator	**Highly Valuable Simulator Training**
Dissimilar Air Combat Tactics	Radar Sorting
All-Weather Employment	Reaction to Air Interceptors
Communication Jamming	Missile Employment
Chaff&Flare Employment	Egress Tactics
Escort Tactics	
ECM Employment	
Tactical Electronic Warfare System Assessment	
Work with WD	

[1] **Source:** Adapted from Michael R. Houck, Gary S. Thomas, and Herbert H. Bell, *Training Evaluation of the F-15 Advanced Air Combat Simulation* (Williams Air Force Base, AZ: Armstrong Laboratory, Aircrew Training Research Division, September 1991), table 6,10.

To identify the contribution of the simulator instruction to improving pilots performance, according to the results of the study conducted by AMSTRONG LABORATORY at AFB Wlliams, Arizona, where 40 MR and FL pilots and 23 wing man pilots were tested Through the 36 exits executed in advanced network-connected simulators, there was a significant improvement in pilots performance in 2v2 missions and less for 2v4 missions (due to the increased complexity of missions performance improvement was not so obvious). The study was conducted in the framework of a comprehensive research program to "identify the potential of simulator networks in piloting a Situational Awarness (SA) pilot during combat operations. To measure pilot performance, 22 indicators were used, grouped as follows:

Category	Behavioral Indicators
Tactical Game Plan	Developing plan Executing plan Adjusting plan on-the-fly
System Operation	Radar Tactical electronic warfare system Overall weapons system proficiency
Communication	Quality (brevity, accuracy, timeliness) Ability to use controller information
Information Interpretation	Interpreting vertical situation display Interpreting threat warning system Ability to use controller information Integrating overall information Radar sorting
Information Interpretation	Analyzing engagement geometry Threat prioritization
Tactical Employment-BVR	Targeting decisions Fire-point selection

Tactical Employment-General	Assessing offensiveness/defensiveness Lookout Defensive reaction Mutual support

[2] **Source:** Adapted from Wayne L. Waag et al, "Use of Multiship Simulation as a Tool for Measuring and Training Situation Awareness," in AGARD-CP-575, *Situation Awareness: Limitations and Enhancement in the Aviation Environment,* (Neuilly-Sur-Seine, France: Advisory Group for Aerospace Research and Development, January 1996), table 1, 20-2.

3. CONCLUSIONS

Despite the fact that the virtual training environment imposes certain limitations on the reproduction of the flight environment and the real battlefield, these limitations can not prevent the development of well-designed training programs where combining flight and simulation training can provide training Efficient use of all the benefits offered by flight simulators and eliminating the potential negative effects of virtual training in flight training.

Simulator training can significantly improve pilot training if it is properly integrated and effectively complements flight instruction.

For future combat pilots, information processing skills will be more important than motor skills. New emerging combat planes in the United States and Europe will be easy to fly but hard to manage, so pilots will have to be trained to carry out tasks different from those during the Cold War.

The qualities of older generations, such as flying skills, though still relevant, will be less important in new aircraft that will have a digital environment and require situational and tactical capabilities to manage the available information. Information management in digital cabinets will be much more complex, with much more information, and a larger volume than it does today.

REFERENCES

[1] Michael R. Houck, Gary S. Thomas, and Herbert H. Bell, *Training Evaluation of the F-15 Advanced Air Combat Simulation* (Williams Air Force Base, AZ: Armstrong Laboratory, Aircrew Training Research Division, September 1991),

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