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Conceptual and Procedural Training for Situation Awareness and Performance in an Instrument Holding Task

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PSYCHOLOGICAL ASPECTS OF THE ORGANIZATION OF INFORMATION AT THE INSTRUCTOR'S FLIGHT SIMULATOR WORKPLACE

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This Paper presents a critical analysis of the classical procedure of training pilots on Full Flight Simulators (FFS), and developed new version of the procedure of instructor's actions during simulator training. The developed procedure will change an instructor's position as person, who sets parameters before and during performing exercise, to a person as involved participant, who is waiting for a forthcoming training flight circumstances together with the crew. This developed procedure implies a rearrangement of specific operations from the instructor on the software, and also the availability of an alternative monitor, on which the most significant events (selected for specific exercises and situations) of training flight will be displayed. The developed procedure of instructor's actions is aimed to reduce the quantity of processed information and actions, which will lead to increase of instructor's work efficiency, as a result of lowering of a level of fatigability.

To understand the classical procedure of an instructor's actions it is necessary to consider a brief review of the current approaches in the design of an instructor's workplace interface.

Analysis of the development of instructor's workplace interface from the 90's of 20th century reveals the relative immutability of approaches of instructor's workplace organization and a structure of the interface. The main type of instructor's interaction on station is touchscreen. Grouping of elements with wide and narrower categories is the main type of interface design.

The information model of instructor's workplace is considered on the example of a workplace inside the cockpit of a FFS for aircraft Antonov-148, as a typical representative of a current generation of flight simulators.

Man–machine interface IOS is based on the principle of grouping information with themed frames, which gives the opportunity to work in a touchscreen mode. Each frame contains a number of parameters, which ideologically belong to a particular group of management and control of a training process, operating mode of a simulator. Frame is the main screen of an instructor's workplace program, which is divided into two sections:

1) the field of an active frame;
2) quick access panel.

Quick access panel is presented all the time, regardless which frame is currently displayed in the active frame field. This panel allows to move to the desired frame, but the panel doesn't contain all possible frames, but only those that, according to the developer, are most

needed for quick access. The remaining frames, those which were not included in the quick access panel, are needed to be called in the active frame field using the main button "list of frames", which, when is clicked, opens a list of all frames, including those, which are presented in the quick access panel. Example: In order to display the frame of high-lift device failure, you can choose the button "input failure "(broad category) both on the quick access panel and through the full list of frames, and then choose a narrower category - "high-lift device". To change the parameters of the equipment it is necessary to call a list of frames (broad category) and select a frame "equipment settings" (narrow category), because there is no such frame on the quick access panel.

If we generalize the concept of the formation of the instructor's station, the following options can be marked out:
1) graphical interface;
2) grouping of information in the form of frames;
3) interface is optimized for the touch screen work;
4) Grouping by category: wide categories include narrow categories, which are related to the certain systems of the simulator.

The advantages of this instructor's station are in the fact, that with the help of considered categorization of parameters and touchscreen, it quickly gives access to the necessary information any time you need. It is also possible a scaling of parameters, i.e. inclusion of any number of monitors for parallel operation (control / input parameters) of instructor.

The disadvantage of this station is instructor's overload as an operator. Because of the large flow of information, which he must have time to register, then he needs to change the parameters during performing a training flight, and at the same time he needs to monitor the actions of the crew, that performs this training flight. Increased productivity can be achieved by changing the classical procedure of instructor's action. Instructor, being in the same involvement position as a manned crew, will be removed from the task to set parameters before and during performing training flight.

The developed procedure of the instructor's action

The procedure aims to maximize the involvement of instructor in the situation of the training flight, by his minimal distracting to other parameters and circumstances, which are not directly related to his primary task - evaluation of psychophysiological potential of the piloting crew. According to the psychophysiological concept of simulator's training (Gorbunov, 2001) FFS should not only keep track of skills working off of emergency situations (for which procedural simulators can be used) but should determine the level of psychophysiological load of manned crew. Psychophysiological load characterizes the efforts that are involved in the successful implementation of the task, which will adequately assess a degree of the pilot's qualification, from the standpoint of human factors (Gorbunov,2000).

Deep instructor's involvement in the situation of the training flight is needed for the evaluation of quality of work for each member of the crew, by identifying the procedural errors and psychophysiological assessment of pilot's readiness. An important task of training flight on

FFS is to measure the psychophysiological potential, that pilot uses to solve a particular problem. Instructor's task is to be the finest instrument for the measure of the psychophysiological potential of each member of the crew, because in the modern practice there is no hardware's way of its measuring. For the decreasing of instructor's distracting level on secondary tasks it is necessary to get rid from large data flows and shift a part of the instructor's operations to the software.

The procedure will allow instructor to allocate resources in the most effective way. These resourses are: time, physical and psychological capability of the organism. Two significant improvements were added for the implementation and testing procedure into the design and software of the existing FFS:
    - Possibility to switch to "Batch training" mode;
    - Installation and using of alternative instructor's station (IOS-A);

"Batch training" mode

For the increase of automation's degree and exclusion of the majority of operations that instructor performs, each type of training has been formalized in the form of "training programs", which includes a series of "exercise". Each exercise is a part or a whole training flight for which specified:
    - All initial conditions (position and condition of the aircraft, the state of the environment);
    - All the failures that must occur in flight and the conditions of their occurrence;
    - Exercise's completion criteria;

Thus, instructor, who distinctly follows the training program, just starts the next exercise, and after its completion will start the next exercise, or repeat current.

IOS-A

Another necessary step was to develop and connect instructor's station which provided the mode "batch training". Station connects to a host of simulator and the information is displayed on the relatively small monitor (which is installed in the area of instructor's workplace). The entire interface is composed of several frames, including the frame of the selection of Training Program. The main frame is the "Message Output Area", where in the course of exercises appeare text messages about the events, which are related to the training flight and the most useful for assessing by instructor the correctness of effectuation of a crew's flight task. This "instrumental" evaluation provides instructor with information, which is required to produce an instructor's main assessment - psychophysiological load of each crew member.

The Figure 1 shows an example of IOS-A during the exercise, which is aimed to practice takeoff, when an engine fails. Instructor's station screen is divided into the main frame (Message Output Area) , and the two panels (Actual Massage Region and Control Panel). On the main frame messages about situational events of training flight for this particular exercise are showed. Message№5 is the last message that appears at the bottom of the main frame, and after a while climbs up to the previous one (to the Message History Region). All messages are classified

into: errors, warnings, special situations and notifications. Color of the message's text matches to the category of messages.

Panel "Message mask" is intended to ensure, that at the end of exercise instructor has the possibility to filter events according to the categories on the main frame. Control panel has the following capabilities:

1) To suspend the exercise ("Pause" button), thus a time in pause mode is displayed;
2) To repeat the current exercise (button "repeat current");
3) Forcibly stop the exercise, (button "force complete");
4) To move to the next exercise (button "next exercise");
5) To obtain an information about the status of implementation of the program and the name of the exercise (information field on the Control Panel).

Figure 1. An example of IOS-A.

Conclusion

The base of the "batch training" is currently updated and testing of the developed technique to confirm the hypothesis about enhancing of productivity through reduction of a flow of information to instructor. Initial testing showed the perspective of this approach.

Acknowledgements

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