Full mission simulator application in Polish Air Force pilot candidates selection

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Polish Air Force pilot candidates selection programme was initiated in 1992 based on the full mission simulator of fighter training plane I-22 Iryda. The performance scores were assessed for a set selection flights. The flight data were recorded simultaneously with psychophysiological parameters. A comparison was also made with similar records in real flight conditions. The correlations between performance measure and some physiological parameters were made.

Keywords: Simulator; Pilots selection

In 1992 a complex flight simulator of a jet training aircraft I-22 'IRYDA' became operational in the Polish Air Force Institute of Aviation Medicine in Warsaw. The aircraft is, at present, becoming a part of the armament of the Polish Air Force. The simulator has been provided with a moving platform with six degrees of freedom, its cockpit is a complete mock-up of a cockpit of the I-22 aircraft. Both the simulator and the aircraft were designed and produced in Poland.

In the same year, alongside with simulator-based examinations performed by the medical board for certification purposes, a research project was initiated aimed at creating a complex system of evaluation of suitability of candidates for the Polish Air Force. Evaluation of pilot-simulated flight task performance was taken as the main element of the system. An assumption was made that a simulator-based test should be a highly integrated psychomotor task and that the subject performance scores would allow the evaluation of subject psychomotor abilities.

Preliminary flight plans were designed based on the following assumptions:

The candidate has no aviation knowledge,
four flight tasks of increasing difficulty will be performed by each subject,
- in each succeeding task the elements of the previous one will occur,
- increase in task difficulty will not exceed the learning abilities of candidates,
- automatic evaluation of flight task performance based on analysis of recorded flight data will be possible.

The last three assumptions had a hypothetical character and a special effort was made by flight manoeuvres designers to meet these requirements.

In autumn 1992 the flight tasks were designed and verified during 240 h of simulated flight. The procedure for task performance evaluation was worked out in a form compatible with the score system used in the Polish Air Force training program. The syllabus included four 30 min flights in the course of two consecutive days, the fourth flight being a replay of the second one but with the moving platform activated. The simulator was additionally equipped with a specialized measurement system allowing the registration of chosen flight parameters and simultaneous measurement of the following physiological parameters: heart rate; breath rate; strength of squeezing the stick, measured with the EMG method; skin resistance – galvanic skin response (GSR).

These parameters were registered against the background of the following flight parameters:

horizontal speed; vertical speed; relative duration of flight; the three angles defining the aircraft position in space; height of flight; deflection of control surfaces (ailerons, rudder, elevator).

To perform a proper flight the candidate had to appropriately coordinate indications of the following instruments: 1. on-board clock (flight duration); 2. speedometer (level velocity); 3. altimeter; 4. variometer (rate of climb); 5. artificial horizon (roll and pitch of the aircraft); 6. throttle position; 7. position of flap, undercarriage and airbrakes switches; 8. compass and radio compass (flight course and direction).

Due to the initial assumption that the candidates had no aviation knowledge, it would not be possible to perform the flight programme without initial theoretical preparation. Therefore, a training programme including an instruction film and printed manuals on the basic rules of piloting and cockpit elements, was prepared. The programme proved to be sufficient and candidates could easily learn the rules presented in it.

At the beginning of 1993 a group of 8 candidates from the Polish Air Force Aviation Academy underwent test flights. Afterwards, an additional 15 min introductory flight with the instructor was added to the flight programme. The flight was not recorded or evaluated; it was aimed at decreasing the information shock that most candidates suffer after taking their place in the cockpit, as it allowed the subject to become familiar with the new work environment.

In the summer of 1993 the programme was verified on a group of more than 80 officer cadets during their flight practice in Air Force school units. Next, in the autumn of 1993 the actual cycle of flights were started with officer cadets newly admitted to the Aviation Academy jet aircraft department prior to actual training flights.

About 80 officer cadets participated in the programme performing the full programme of flights and their parameters were recorded in the computer database. All flights (about 400) were evaluated according to a specially prepared criterion and each officer cadet was ranked according to flight performance scores. What is worth pointing out is the fact that the programme of simulated flights was not sensitive to differences between the candidates having glider flight experience and those having no flight experience at all, due to properly adjusted flight tasks difficulty.

During research there were also a set of psychological tests not used so far in the process of enrollment or in a parallel LBNP chamber or in a human centrifuge. The results of the research are expected to create in future a new selection tool allowing the evaluation of acceleration tolerance of the candidates.

A comparison of the psychological test results and the results attained by a candidate showed unexpectedly high predictive power of some psychological tests. The psychological personality test scores can discriminate with high accuracy the candidate groups with the lowest and the highest simulated flight tasks performance scores.

The results of comparative analyses of simulated flights with and without the moving platform (in some cases there occurred regress in performing the flight task after putting on the moving platform, flights 2 and 4 differed only in having the moving platform on) revealed interesting differences in performance scores, which possibly can also be used for selection purposes.

The next stage of research was the examination of congruence between the scores of all the laboratory tests, including also the simulator test, and with the actual training scores and selection during training in the Air Force Academy.

A special system of evaluation of selection flights performance was worked out (in the Polish Air Force officer cadets in the first year of training perform 20 h of selection flights on jet and turboprop aircrafts) and this was compatible with the results obtained on the simulator. The results of performing the selection

flights will be completed by the end of September 1994. Results obtained so far show high correlation of the scores from real flights on actual combat trainers with the notes from the simulated flights in the group of the worst performers. A comprehensive evaluation will be done after performing complex and detailed analyses at the end of 1994. Next it is planned to correct the flight task on the simulator and then test subsequent classes of candidates.

While introducing the training programme in the Polish Air Force aircrafts I-22 IRYDA and PZL 130 ORLIK, on board, recorders of the basic physiological parameters of a student pilot such as heart and breath rate were also installed. It gives a chance to compare the parameters of a student recorded during simulated flights and during real flight. The recorder of physiological parameters has been designed and produced in our Institute and its size is so small that it can be installed even in the cockpit and it has the necessary aviation certificates.

Soon a complex flight simulator of the PZL 130 ORLIK aircraft with recorders identical to those on the plane will be ready for use, thus creating a basis for widening the selection tests to all types of aircrafts used for cadet officer training in the Polish Air Force.

Conclusions

1. The selection programme gives a chance for radical decrease of the costs of training.
2. It allows one to introduce completely new qualification tests.
3. It allows one to conduct comparative studies on pilot performance during simulated and real flights.
4. Experiments conducted so far have proved the validity of most of our hypothesis.
5. We are ready to enter into cooperation with foreign pilot recruiting centres for further research in this field.