



**AEROSPACE INDUSTRIES**  
SP. Z O. O.

# SPATIAL DISORIENTATION TRAINING DEVICE

Spatial disorientation is defined as a false sense of position and movement in relation to the earth's surface. This impression is dependent on many different factors. Pilots unknowingly succumbing to the phenomenon of spatial disorientation, having distorted picture of reality, make the wrong decisions, which often leads to tragic events and accidents. Therefore it is very important to properly prepare pilots, i.e. to accustom them to the phenomenon of spatial disorientation, to develop their skills and proper habits of evaluation, as well as to make them to prefer the instruments indications to their own feelings.

The safe generating this phenomenon during the actual flight is practically impossible. It cannot be the cause for conventional simulators. The solution to this problem is the special equipment for training pilots in spatial disorientation, causing the illusion

of this phenomenon by appropriate motion and image effects.

ETC-PZL company, in cooperation with the Polish Air Force Academy in Deblin and the Military Institute of Aviation Medicine in Warsaw, designed and manufactured a device for carrying out training in spatial disorientation.



The device comprises the following components:

- built over, shaded cockpit,
- 7DoF motion system, comprising Stewart platform placed on a rotating table (of an unlimited number of revolutions),
- visualization system,
- instructor station with a computer system.

Inside the cockpit set on the platform there is mounted a pilot's seat with flight controls, indicators and navigation devices. An image of the external situation is presented on three panoramic monitors mounted in front of the pilot. In order to ensure universality of the device an opportunity to exchange side panels and instrument panel were provided, which allows training pilots of various types of aircraft and helicopters. Currently, the cockpits of F-16, M-28 aircraft and W-3PL Gluzec helicopter have been made, but it is possible to install a replica of the cockpit of any aircraft or helicopter.

Convenient replacement of cockpit components is ensured by large simulator door. The mere replacement of components is extremely easy and can be done by one person.



The control of an exercise is performed from the instructor station. The instructor can watch among other things on monitors: a status of flight instruments, a view of external situation, a map, and a preview of the pilot actions. The latter is possible, even with a total blackout of the cockpit with the camera pre-installed in it and the illuminator working in the infrared. Two way communication between the instructor and the pilot is also provided.

Spatial disorientation training is proceeded in two stages. The first step is to present the phenomena associated with spatial disorientation in terms of visual, vestibular illusions and desensitization to movement stimuli when the pilot, not performing the flight is subjected to stimuli that cause the loss of spatial orientation.



The second step is a pilot training in spatial disorientation in the course of the simulated flight. In this case, the pilot is flying

according to the instructions given on the multifunction displays in the form of text and spoken by the voice synthesizer. The simulated aircraft movement is reproduced by the device motion system, to ensure the development of appropriate stimuli for the trainee's balance center. At this stage, the instructor can also create his own scenarios using the graphical flight planning program. These scenarios can be controlled by time or events that happen during the flight. In addition, the instructor has the ability to selectively disable flight instruments. The disabling flight instruments can also be accomplished automatically at the right time using previously saved script.

The system is equipped with the predefined scenarios prepared to illustrate the various phenomena occurring in spatial disorientation, such as, among other: Autokinesis, Active Coriolis Effect, False Horizon, Nystagmus Effect, Black-Hole Approach.

Thanks to the wireless remote monitoring of physiological parameters with use of the medical device, the device can also be used in the study of the spatial disorientation phenomenon occurrence, its development and the factors intensifying or mitigating it.

During the flight, its most important parameters are recorded. The recorded flight and scenarios can be synchronized with medical data and the collected data is a complex material to carry out the research on various aspects of the phenomenon of spatial disorientation.

