Human Factors

research and technology division

Studies in Air Traffic Control Message Comprehension

Objective

Airline safety depends on accurate communication between pilots and air traffic controllers. A laboratory task was designed in collaboration with the U. of Colorado that simulated communication between air traffic control (ATC) and flight crews, to study the factors that influence message comprehension under flight conditions. Oral repetition of directions provided a measure of immediate memory for the directions, and the implementation of the directions provided a strict test of both message memory and comprehension.

Approach

Participants heard directions like those given by air traffic controllers. They immediately repeated the directions aloud, as pilots are expected to do, and then followed the directions, navigating in the simulated space displayed on the computer.

The number of directions was varied in the messages, to determine the optimal number that could be understood, remembered, and followed. Also, in some experimental conditions the readback requirement was removed or readback was abbreviated by requiring participants to recall only the key words of the messages.

Impact

The results of the studies showed that messages with three or fewer elements can be read back and followed with few problems, but errors increase substantially when four or more elements are given in a single message. Increasing the number of words in an element generally does not lead to an increase in errors.

To maximize comprehension and to minimize the opportunity for error, it was found that air traffic controllers should limit a given message to no more than three elements at a time. Instructions do not need to be shortened and there is no performance penalty for redundancy or additional words that clarify the message.

POC: Immanuel Barshi, Ph.D.

E-mail: Immanuel.Barshi@nasa.gov

URL: http://humanfactors.arc.nasa.gov/