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VOICE-CONTROL INTERFACE

Voice/data transition in air traffic management used as an add-on to existing digital flight strips solutions reduces controllers' workload efficiently and provides increased safety

With increasing air traffic and the number of sectors being raised, passenger and cargo capacity is becoming stretched. Digital data communication is on the horizon but cannot reasonably be expected to be in general use before 2010 or 2015. One major topic is now on for discussion in the air traffic community: What should we do in these interim years? How should we handle the growing numbers of passengers, especially in restricted airspaces like Europe, and maintain safety standards?

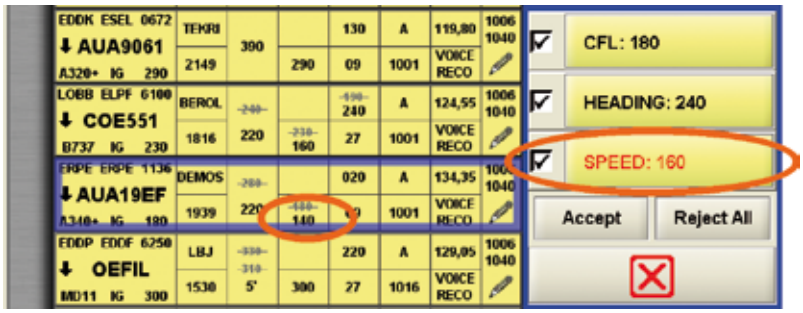
We all know how laborious a controller's job can be. They ensure safe separation between all aircraft within their area of responsibility; an average of up to 10 targets at a time is controlled via spoken commands that are sent to all aircraft via analog radio; each clearance is written on a flight progress strip; the pilot-cleared values are verified by read-back to assure a common understanding.

Speaking, writing, listening and cross-checking are time-consuming tasks. Yet they only represent the documentation and communication part of the duty that controllers really have to perform: ensuring safe separation of all aircraft.

In a few years, workload will drastically decrease through data communication. Ground systems will communicate with aircraft systems directly without requiring spoken words (humans in the loop will still

Smart strips HMI with voice-recognition functionality

"Austrian one niner echo foxtrot, descend flight level one eight zero, turn left heading two four zero, reduce speed one six zero knots."



control and check each command). The drawback is that it is unlikely that this technology will be implemented in the next five years. Nonetheless the number of aircraft will continue to increase while the number of aircraft per controller cannot – because of the inability to bring in these new technologies sooner.

The conditions

A set of strict rules is defined to harmonise control worldwide. Additionally the scope of language and words allowed for use is restricted. ATC radios are sensitive to background noise and there can be great variation in pronunciation between controllers.

Moreover controllers today are trained experts in situational awareness. No matter how many aircraft are on their screen, they are specialized in identifying those that require action and issue clearances in demanding priority. Thus a system that supports them in their work today must not conflict with their routine, as full automation would do, where aircraft are only displayed on the screen when a problem is developing, leaving the controller devoid of 'normal situation' data.

The idea

In analysing the user's tasks we notice that there is one main redundancy: each spoken word also has to be written down. It is obvious that workload could be saved at this point if the system could accept the controller's voice commands as direct input.

Speech is the only real-time data available today - why not use it as an additional tool to add content to the system? This works in both directions: voice commands are sent automatically according to the controller's corresponding action, such as putting the flight strip into a transfer bay at sector handover. A text-to-speech algorithm sends these commands by means of synthetic voice. The objective is to provide perfect situational awareness by simultaneously reducing human input to a minimum.

The solution

The solution is voice recognition as an add-on for digital flight strips. Presenting clearances in the order spoken allows the controller to cross-check the pilot's read-back with his own notes. Values are displayed immediately after being spoken out loud and are listed in a separate window attached to the referring strip. Thus the controller can accept or reject values, correct them or deselect them as desired. If the read-back matches the strip data, the controller confirms and values are committed to the strip. It simply takes one click to do this.

Voice recognition is an option to reduce the workload of documentation, so it has to be controlled via the HMI, enhancing the set of features that modern electronic flight strips solutions already offer. The content of the spoken words is made available by the voice communication system to RDP, FDP and ODS providers. This way of exchanging data requires less coordination between adjacent sectors. Changed values are entered once and are instantly available to all units concerned, provided in a meaningful format. Additional communication in informal colloquial language is suppressed. Consistency checks are performed to help reduce errors – for example, "descend flight-level 410" to an aircraft at flightlevel 370 is most probably an error. RDP, FDP or ODS can make use of the data as if it came from an additional human interface such as a mouse, keyboard, etc.

The future

Voice recognition is not intended to be a substitute for taking notes. It is seen as an aid to reducing the amount of manual input. Accuracy to 95 percent for 80 percent of all possible clearances seem to be sufficient to drastically reduce controllers' workload. This works in particular if the system is not handled as legal input, but simply as an add-on to mouse, keyboard and touch screen.

Given the chance to reduce workload on redundant activities and to focus on guiding aircraft and applying safe separation, the operator will instantly feel able to increase capacity. Performance will rise without compromising safety.

Voice recognition therefore offers a solution that can be easily implemented into existing systems. With today's technology, the voice-control interface fills the current gap on our way to full data communication. ❖