Chapter 13

Artificial Intelligence Methods in Aviation Specialist Training for the Analysis and Transmission of Operational Meteorological Information

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ABSTRACT

The authors present methods for the application of artificial intelligence for operational meteorological information (OPEC). The means of communication for distribution of meteorological data using information technologies are presented. Practical courses for aviation specialists (pilots, air traffic controllers, operators of unmanned aerial vehicles) are considered in which artificial intelligence methods are used: datamining, deep learning, machine learning, using information technologies.

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BACKGROUND

The measures for centralization and automation carried out within the framework of meteorological authorities led to the development and implementation of automated pre-flight systems information. Flight crew members, operators and other personnel involved in flight operations, may receive pre-flight information, self-instruct, advice and flight documentation through an automated pre-flight information system. Through these systems. Some of these systems are solely for the above purposes, and others serve as an integrated information system, which may not be limited to meteorological part of preflight planning. There are several systems that provide users with coordinated unified access to the AIS and MET pre-flight information. Automated pre-flight information systems can be part of a multi-purpose system (Annex 3, 2016).

The primary means of communication for distributing OPMET information outside the airfield is served by the AFTN network and satellite broadcasting systems within the framework of the artificial intelligence in aeronautical fixed service (AFS). Both the network itself and broadcasting are part of the service.

AFS, which covers telecommunication systems used for international air navigation, except for transmissions on one-way ground-to-air channels. International Databases ICAO’s OPMET, which can be reached through the AFTN network, can provide interregional and regional OPMET information exchanges and dissemination (Annex 3, 2016).

The purpose of OPMET information with the help of artificial intelligence is to provide aviation meteorologists and assistants with a basic understanding of the significance each item of information used in pre-flight planning has in the preparation for a flight. Although some re-planning is often carried out in flight (e.g. when considering the acceptance of a different flight level, an alternative airway routing offered by air traffic control or a change of destination), the use made of the meteorological information required for such re-planning is similar to that in pre-flight planning. Flight preparation has three phases: the take-off and climb to cruise altitude; the cruise to the top of descent; and the approach and landing. These phases are not treated separately as they are interdependent, but for explanatory purposes, it is convenient to consider the specific use made of meteorological information in each of the three phases (Doc. 8896, 2011).

It is the pilot’s duty to optimize the performance of the aircraft, in order to maximize the economics of the operation while at the same time complying with all the requirements for take-off (including take-off minima) specified by the operator and approved by the State of the Operator and by the authority responsible for the aerodrome. The planning for the take-off and climb-out phase includes calculating, by the pilot, the maximum permissible take-off mass (standard operating mass + passengers + cargo + fuel, etc.) given the constraints at a particular aerodrome. These constraints include runway length, runway slope, climb-out gradients (which ensure clearance of obstacles with one engine failed), aerodrome elevation, and current meteorological conditions, i.e. surface wind (specifically headwind component and limiting tailwind and crosswind components), temperature and pressure. Humidity, although theoretically also affecting aircraft performance, can be neglected as its effect is minimal. Runway contamination (snow or slush covered, wet, icy, etc.) also plays an important role, but is not usually regarded as “meteorological information”. Where aircraft take-off mass is not limited by aircraft performance considerations in the prevailing meteorological conditions, temperature has an effect on take-off speeds and on engine power settings and on the possible need to initiate engine and airframe anti-ice procedures.