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A COMPREHENSIVE APPROACH TO IMPROVING THE ANTI-ICING SYSTEM OF THE HELICOPTER MI-8MT

КОМПЛЕКСНИЙ ПІДХІД ЩОДО ВДОСКОНАЛЕННЯ ПРОТИЗЛЕДЕНІЛЬНОЇ СИСТЕМИ ВЕРТОЛЬОТУ МИ-8МТ

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Flight safety issues are closely connected with protecting an aircraft from icing, as it leads to a significant deterioration in its aerodynamic characteristics, stability and controllability. In addition, icing can cause malfunctions in a lot of critical components and instruments and most dangerously, disrupt engine operations.

Icing on the cockpit glass leads to poor visibility of its space. Ice formation on helicopter rotor blades leads to a significant deterioration in controllability, which is significantly felt by crew members and passengers.

According to meteorological observations in Ukraine, 80% of the total time in the winter-autumn period, the ambient temperature is below 0^0 C, when moisture is formed at first, and then, with lowering temperatures, ice on metal surfaces of the aircraft [1, p.182].

According to EASA data, over the past 10 years, icing has caused 80 aviation accidents worldwide with 263 deaths [2, p.141]. Consequently, it necessitates the development and installation of modern helicopter ice protection systems on board modern helicopters, as well as the research of the ways to improve existing anti-icing systems, and comparison of various technical solutions and approaches to building anti-icing systems for helicopter structural elements.

Anti-icing systems (AIS) installed on our airplanes and helicopters were developed more than 40 years ago. The analysis of modern de-icing systems, primarily those used on foreign aircraft, shows that in the frames of the overall improvement, a deep modernization of de-icing systems is required, which consists in updating all components of these systems – from sensors and alarms to electronic control units and software mechanisms, along with the development of duplicate systems.

As for the Mi-8 helicopter, if we consider the protection of the engine inlets from ice, both electric heating and hot air blowing from the engine compressor are used. However, the parts of the de-icing system responsible for protecting the main and rudder propeller blades and the cockpit glass from ice formation do not have duplicate systems. First, it is necessary to define specific requirements for anti-icing systems, namely – the independence of actions from changes in atmospheric air parameters, especially at the temperature of the protected surface of 268–273 K (-5°C – 0°C) and relative humidity of 85-100%, at which the maximum possibility of icing is observed [2, p.142]:

– minimum energy consumption;

– quick readiness for actions and, if possible, automatic switching on and off from special signalling devices at the beginning and finishing of icing.

Secondly, to select modern sensors that use different physical principles of operation, such as thermal, vibration, optical (optoelectronic), acoustic and capacitor alarms.

Thirdly, it is necessary to develop structural and principal diagrams of advanced systems [3, p.67]. The review of recent studies shows that the problem of high power consumption of the AIS, as well as the problem of its inability to function in case of failure of one of the two alternating current generators СГС-40ПУ, needs to be solved.

Thus, in order to ensure the requirements for the AIS of modern aircrafts and to solve this range of problems, the following measures are suggested, namely:

– the installation of a liquid system for washing the cockpit glass as a duplication of the electrical part of the В8БП system for protecting the windows of the crew compartment from ice;

– the replacement of the brush-collector unit of the current collector with a contactless transformer with a rotating magnetic field, which will increase the reliability of the main rotor AIS;

– it is proposed to build a control automation for a 6-section anti-icing system based on a combined water formation meter (vibration sensor and thermistor);

– to reduce the power consumption of AIS screws, new schemes for connecting the heating elements of the screw sections and cyclograms for their switching on were suggested [4, p. 41];

– the replacement of the thermostat units and the ПМК-21 software mechanism with Arduino Uno R3 CH340G microcontrollers.

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