REVIEW
of the thesis work of I.A. Pirmanov
""Development and study of the methodology for designing digital training models of helicopter repair processes", submitted for the PhD degree in the specialty D105 - Aviation equipment and technologies

The aviation industry is one of the promising areas of economic growth of the Republic of Kazakhstan and includes a complex of enterprises implementing technological processes: production, maintenance and repair of aircraft, helicopters and aircraft equipment.

Repair of helicopter equipment is accompanied by a number of problems: the obsolescence of technology, low level of automation, high requirements for compliance with workplace safety. But the most difficult is the procedure of training organization, because as a result the trainees need to assign practical and qualitative competences with minimum costs and maximum self-training without discontinuing the production of the instructor-mentor, as well as to provide control of mastering the training material, considering the risk of actions on the repair site.

In the thesis work of I.A. Pirmanov very important and relevant research is carried out, aimed at developing a methodology for designing digital training models of helicopter repair processes.

The main purpose of the work is to develop theoretical and methodological approaches, scientific and practical recommendations for digitalization and improving the quality of theoretical knowledge and practical competencies in training based on advanced 3D-modeling technology and VR-virtual reality on technological processes of repair of helicopter equipment.

The results of the presented dissertation research allow us to propose new effective technologies for repair of transport equipment of wide profile, as well as to develop decision support systems for human personnel, aimed at reducing the risk of errors and increasing attention.

The proposed structure of the digital training model and training complex allows you to effectively implement in practice the process of digital processing of 3D-models and the development of VR applications - virtual reality for further training and application in intelligent methods of information processing.

The comprehensive approach to digitalization and improvement of the quality of theoretical knowledge and practical competence in technological processes of helicopter repair presented in the thesis research can be applied in other spheres of human activity related to the operation and production of complex technical systems with man-machine interfaces.

The proposed training complex "Repair of helicopter equipment" has the ability to expand its functionality, including building databases, forming expert opinions, to include various quantitative and qualitative characteristics.

The main results of the dissertation research were approbated at the operating enterprise, as well as reflected in the proceedings of international conferences, international scientific journals, peer-reviewed in the Scopus database.

Dissertation research has internal unity and is a logically complete scientific work. All results and conclusions are logically interconnected.

However, I believe the following observations should be made:

1. Not all the notations and abbreviations in the text of the thesis are placed in the appropriate structural element "Notations and Abbreviations".

2. In the figures and in the text of the thesis, there are also signs in English, which are not considered and translated in the text of the thesis.

However, the comments made are not of principle nature and do not affect the main provisions, conclusions, and scientific results of the work.

I believe that, in general, thesis of I.A. Pirmanov on "Development and research of methodology for designing digital training models of helicopter repair processes" submitted for the degree of Doctor of Philosophy (PhD) in specialty D105-"Aviation equipment and technology" on the relevance of the problem, the volume of research, the novelty of the results correspond to the requirements for thesis works for the degree of Doctor of Philosophy (PhD).

Reviewer
Director of Aviation Security
Aviation Administration of Kazakhstan JSC **D.M. Katyshev**

Signature of D.M. Katyshev, I certify: