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The helicopter`s MI-26T tail and fin booms stressed state under static loading

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Abstract

Were have carried out investigation of the helicopter MI-26T used in industry, construction studies and technical resources to determine the status of the helicopter. We have analyzed the elements of the force helicopter tail of local-controlled helicopter, and found defects in the resource and the safe zone. The obtained test results allowed to identify the critical elements of a helicopter tail sites and resources, and to adjust for the repairs. On the basis of the mathematical model a possible flaw location has been found. The results obtained allow to increase the helicopter Ми-26T secure resources, provided the use of the model formulated by the force helicopter tail elements of the repair and strengthening of the planned repairs at the time of the force elements of the planned repairs.

Key words: strain measurement, stress diagram, tail boom, fin boom

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Introduction

„Ми-26T" helicopter is one of the largest helicopters in the world, having a great load-carrying capacity. The weight of freight carried commercially constitutes above 20 tons. The helicopter is basically used at the bridge buildings, for the industrial enterprises, heavy equipment transportation and mounting, during the construction of derricks and electric power lines in distant and difficult-to-reach regions. A combination of the significant load-carrying capacity and the high cruising speed makes this helicopter's application profitable economically in various branches of the economics. The biggest number of these helicopters were manufactured in the seventies-eighties of the last century. Therefore the vital matter is the investigation of a possibility to increase the helicopter's service life limit. To day it is very topical and urgent to solve this problem. As it is known, one of the weakest components of the helicopter's design is the tail boom. In this article there some results of Ми-26T helicopter tail boom stress investigation under static loading are given. This research has been performed in "AVIATEST LNK" Science & Research Centre (Riga, Latvia Republic).

Testing stand

The testing stand enables to carry out dynamical, static or repeatedly-static loading of the helicopter's tail and fin booms. During various loading programs the helicopter is freely-resting on the landing gear inside the testing stand. For the realization of assumed loading forces three "active" and three "compensatory" loading control channels are used (see Fig. 1).

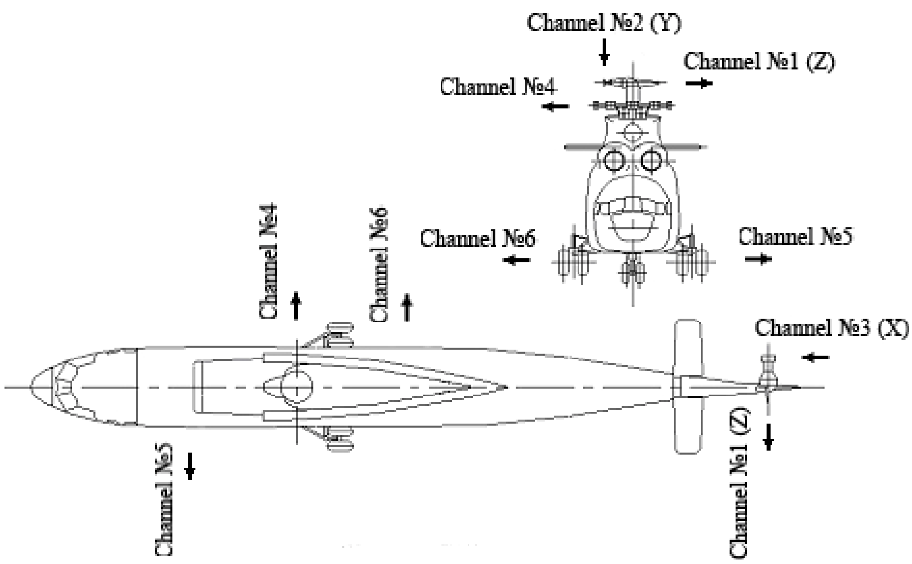

Fig.1. **The impression of the "active" and "compensatory" forces to the helicopter in the testing stand**

Three “active” loads are imposed to the simulator of helicopter’s anti-torque rotor hub: along axes X – Channel № 3, Y – Channel №2, Z – Channel №1 and are used for simulation of various flight modes loads (e.g. “takeoff”, “hovering”, “horizontal flight”, etc.). “Compensatory” loads (channels №4, №5, and №6) are used for the compensation of “active” forces to prevent the rolling-turn of the helicopter during loading.

Investigation of tail and fin boom’s stressed state

To investigate the stressed state, more than 200 single strain gauges were bonded on some specified elements of the tail and fin boom (stringers, ribs, frames, the skin). There the strain gauges of 1-LY6/350 type, having 6mm base and 350 Ohm resistance were used. The strain gauges signals were fixed by the MGCplus acquisition system (manufactured by HBM Firm), with the CANHEAD strain-measuring units connected to it. The strain gauge signal interrogation frequency is 150 Hz. The loads to the helicopter were imposed synchronously with three forces Px, Py, Pz , step-by-step, by 10% of maximal the assumed loads. [1-3]. The point and directions of the impression of the forces, also the maximal values of the loads imposed are given in Fig. 2.

Analysis of the data obtained has displayed, in general, the linear change of strains in the structure’s elements, depending on the load applied in the assumed range of loading [4, 5]. According to the results of strain measurements the most stressed parts of the structure were discovered – this is the tail and fin booms jointing (tail boom frame №10 and fin boom rib №1). Sketches of these areas, the strain gauges set points and diagrams of the maximal stresses at 100% loading, are presented in Fig.3a and Fig.4a.

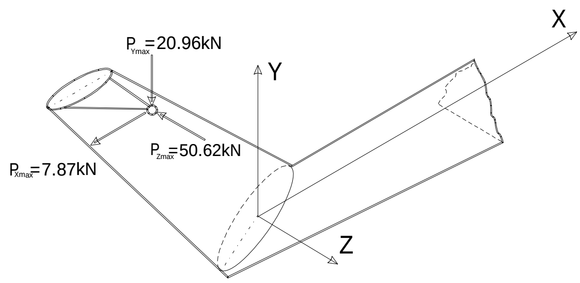

Fig.2. **Load imposition point and their maximal values**

The stresses are given in kg/mm^2, for the calculation there was used Young’s module E=7200 kg/mm^2.

According to the results of stress measurements the design-technology documentation by OAO “МВЗ им.М.Л.Миля” for carrying out some field changes in the structure of the boom was prepared. On the helicopter tested this structure modification were carried out by specialists of the OAO “Росвертол”. After the structure modification the comparative investigation of the structure stressed state was carried out.

The comparative analysis of the strain measurement results showed that after carrying out the field changes the measured values of the mechanical strain of the structure have significantly decreased (see Fig. 3b and Fig 4b).

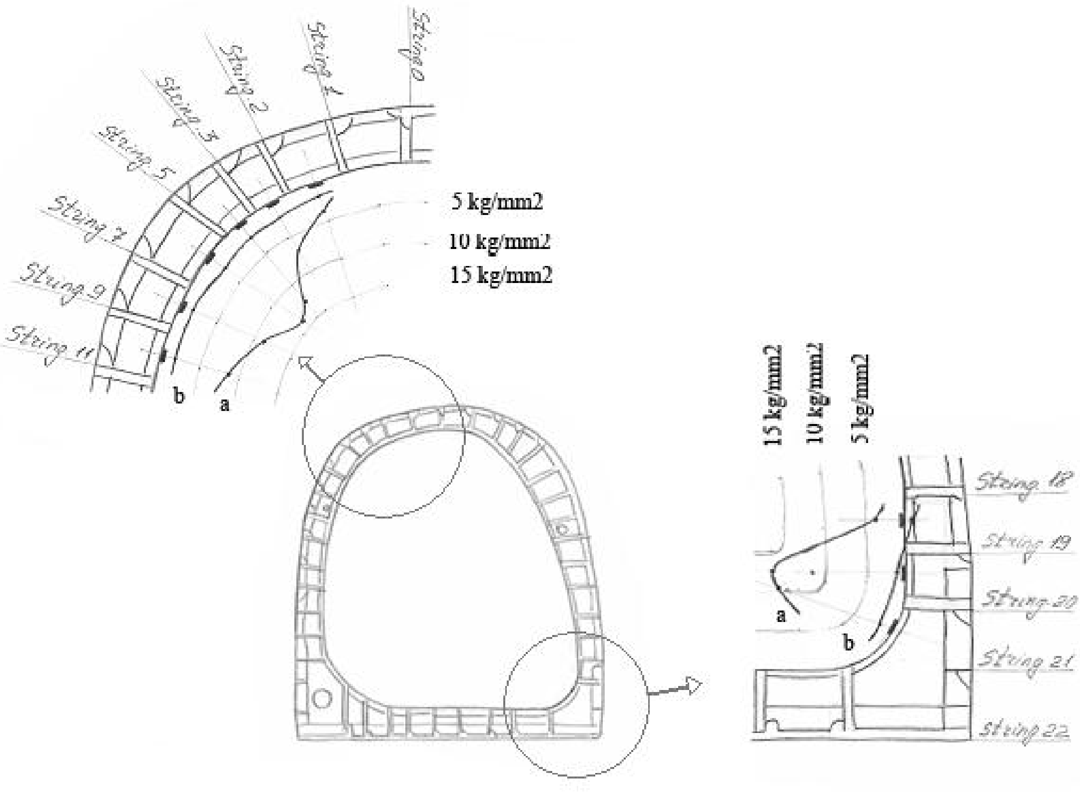

Fig.3. **The frame № 10. Along the flight view: a – diagram of strains before the structure modification, b - diagram of strains after the structure modification**

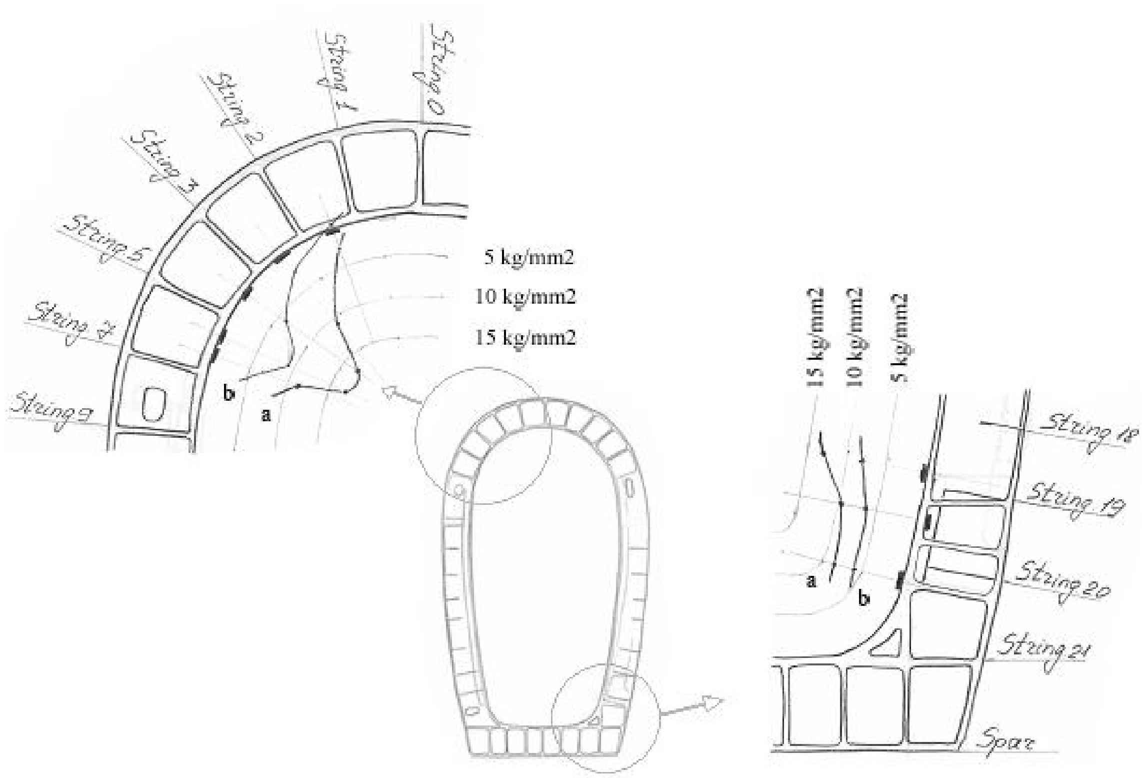

Fig.4. **The rib № 1. Along the flight view: a – diagram of strains before the structure modification, b - diagram of strains after the structure modification**

The strains on the frame №10 of the helicopter tail boom decreased by value of 70% up to 90% of the strains experienced before carrying out the field changes, and the strains on the rib №1 of the helicopter fin boom decreased by 30% up to 60% of the strains experienced before carrying out the field changes. This results obtained demonstrate high efficiency of the structure modification carried out.

Conclusion

The stressed state of the helicopter's tail and fin booms and exposed the most stressed parts of the structure was investigated.

Field changes of the structure were carried out for this parts.

The investigation of the stressed state of the tail and fin booms showed a significant mechanical strains decreasing after carrying out the modification of the structure. The experimental values of the strains correspond to designed values obtained on a mathematical model of Ми-26 helicopter tail boom, which was developed the OAO "МВЗ им.М.Л.Миля".

The results obtained enable increasing the service life limit of the Ми-26T helicopter under the condition of carrying out the field changes in the structure of tail and fin booms, during the usage or when carrying out the planned repair.

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MI-26T sraigtasparnio techninės būklės bandymai naudojant statines apkrovas

Reziumė

Buvo atlikti sraigtasparnio MI-26T, naudojamo pramonės tikslams, statiniai tyrimai techninei būklei ir resursui nustatyti. Buvo tiriami sraigtasparnio uodegos jėgos elementai ir analizuojamos tam tikros tų elementų vietos. Nustatyti sraigtasparnio kontroliuojamų vietų defektai ir saugaus ištekliaus zonos. Bandymų rezultatai leido nustatyti sraigtasparnio uodegos elementų kritines vietas ir išteklių, be to, patikslinti vietas remonto metu. Pagal parengtą matematinį modelį nustatytos galimų gedimų atsiradimo vietos.

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