1.10.24. TECHNOLOGICAL ASPECTS OF DEVELOPMENT OF DIAGNOSTICS AND NON-DESTRUCTIVE TESTING IN SPACECRAFT PRODUCTION AND OPERATION

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New generation of aerospace engineering is created according to new operational conditions and regulations. New and stricter safety, lifetime and ecological requirements are forming and at the same time the ideas of conditional and safety operation in case of hardware damage and self-diagnosis are introduced. New requirements and regulations result the fact that costs for aircraft operational and airworthiness maintenance exceeds costs for design engineering and production.

That is why the development of modern technical diagnostics, non-destructive testing, and adaptive conditional operation systems methodology is a very important and topical problem. JSC "NIAT" attacked a number of problems related to engineering support of diagnozability and non-destructive testing of aircraft hardware and engines. First of all, to our view it is necessary to rapidly develop 3D methods of hardware damaging modeling and creation of virtual realizations of crush-tests and dynamic hardware mapping.

In JSC "NIAT" a modeling center called "Virtual reality" has been created where using the 3D visualization it is possible to analyze terminal conditions of hardware objects and technological processes which impacts on technological inheritance of hardware. Residual tensions, micro cracks and other changes in initial condition of hardware and materials are being visualized and assessed. Optimization of these perturbations are performed on the basis of EETM (electronic engineering-technological models), thus BD in RDM must have an EETM subsystem, technological inheritance assessment, maximum damaging zones terminal conditions assessment in VR&VS (virtual reality) environments. In parallel JSC "NIAT" carry out research in the field of assessment technologies and technological aids development. We offer a certified technology and equipment for laser optical-acoustic flaw detection, which has shown good defects detection sensitivity in composite hardware and welded constructions: sensitivity ≈0.5 mm; productivity 5 – 9 m^2/h. Registration and processing are full automated. For complicated integral hardware we developed a digital radioscopy system with digital processing and a manipulator. These systems make it possible to maintain defects detection sensitivity at the level of the tape radiography i.e. 0.7% from the controlled thickness with a productivity of 7.0 – 20 m. w.j./h. or 10 – 15 m^2 casting/h.

For adhesive binding we offer a system of thermal testing: defects detection sensitivity – 2–7 m^2/h. Good results in detection of microcracks in elements of GTE (gas-turbine engines), disks and flaps; are provided by a microfocus radiographic tomography. The latter provides a 3D model of a defect in internal contents.

Taken as a whole the full list of necessary means and methods is far more extended and a special program on technological aids of diagnostics and non-destructive testing is needed as a part of the National Technological Basis (NTB) program.