USING METHODS OF THERMOVISION IN AERONAUTICAL MAINTENANCE

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Assessment of the state of quality machinery and equipment sector is technically necessary in due to ensure the smooth operation and security of the individual sectors. Just NDT in the aerospace industry has considerable use in order to save time and cost. One more method of NDT is also an infrared method IRT.
The keywords: Diagnosis, defect, aircraft maintenance, thermograph

1 INTRODUCTION

The time in which we live, could be characterized as a time of ever-increasing demands, and for every type of industry. Naturally, the world of technology did not avoid such a trend. Technical Diagnostics is the same part of the diagnosis, which is dedicated to the issue of technical direction. Among one of the highly advanced diagnostic methods used in practice in the field of research and development, as well as monitoring and control of production processes, the method based on sensing temperature fields. Capture and subsequent display, but also evaluation of such fields helps us to better understand the issue. This is the constant task of leading manufacturers TIC technical equipment.

2 ANALYSIS OF AIR TRAFFIC DEGRADATION MATERIALS IN OPERATION

Aircraft in its entirety is composed of multiple components, and each of these components has a different function and thus adapted to the material from which it is made. Used materials are metal, as well as non-metallic character.

More and more material is used in aviation is a composite non-metallic character. Composite material is a heterogeneous material consisting of two or even more phases.

Degradation can be defined as the product was defective (e.g., forging, welding, casting, etc.), we can describe the change in weight, dimensions, appearance and other characteristics differing from given specifications. For a more precise definition of disorders there are multiple aspects on which they are divided. Disorders in a large number affect the strength properties of the material. A significant dependence for this is the size, shape and nature of degradation. Character disorders divided into planar and spatial.

Between planar failures to include cold joints, cracks, doubled component and insufficient adhesion. Between spatial disturbances are those of safety less threatening strength properties of the material. They are pores, bubbles, cavities and foreign mixed elements. In these cases it is necessary to define the so-called characteristic of dimension disorders.

It provides for maximum and minimum dimensions corresponding to the failure group.

In practice, there are cases where it is not possible to unambiguously determine the nature of the problem, because it is formed from the transition between the two main groups. For example, line breakage, shrinkage, pore line and many more. The most frequently occurring faults require corrosion and cracks that may develop until fracture.

The occurrence of corrosion has various technical and other consequences (health, safety, economic etc.). A frequent result is corrosion loss of material, which has the effect of reducing the strength of the product. Such damage occurs to building structures, vehicles or airframe, where there may be dangerous failure, collapse or explosion. Sometimes there is a strong violation of the mechanical properties without significant loss of the materials.

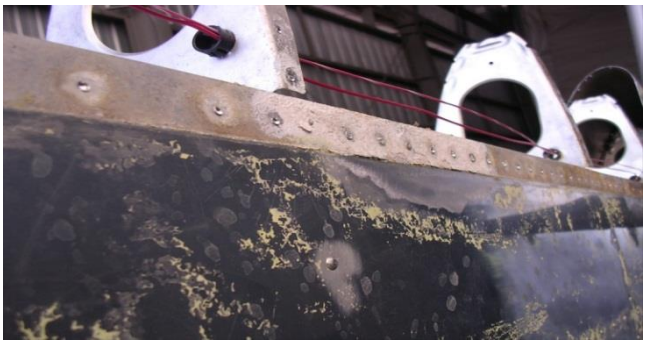

Fig. 1 Effect of corrosion on the wing of a small transport aircraft

The fracture is irreversible processes, which can be defined as cohesive failure of the product throughout its entire cross-section. This solid is divided into two, possibly more parts. Starting of the process of fracture can have many causes. One of them when there is a breach; it is already at voltages smaller than the calculated (theoretical) stress. Therefore, to achieve real strength values should include the impact of other mechanism. V today fracture process is divided into two parts: the germ of the quarry and its subsequent spread. The germ is the point where the entire process of creating triggers and may arise in the process of production and action of plastic deformation.

3 APPLICATION OF FUNDS IN OPERATION AND MAINTENANCE OF AVIATION TECHNOLOGY

Infrared technology as science is not currently in the traditional sense so renowned, as are other methods using radiation for the measurement process. Perhaps this is due to the fact that it is a relatively new diagnostic method, which is about thirty years. However, despite the short time you have found your application in several scientific and industrial sectors, which can be recorded temperature differences. Areas which thermograph is used in practice, e.g. energy, construction, engineering, medicine and veterinary care, ecology, special applications, aviation, etc...

3.1 Avation

It is widely thermograph has taken off in the maintenance of aircraft. Aircraft are devices consisting largely of components characterized by different working temperatures. An incorrect way of working of individual parts, or upon the occurrence of degradation in them, their working temperature change. This way you can monitor the status of individual components and evaluate it on satisfactory or unsatisfactory. Inspections are normally performed in a short time immediately after the aircraft has landed and taxiing down the runway. Then the airframe accumulated thermal energy created rapid movement of aircraft in the atmosphere. It usually consists of stop faces, such as learning-wing area, the front of the fuselage, tail surfaces clamming surface and below. Checks are also temperature program after landing, but even the possibility that the exhaust gases from the engine in any way affect the thermal environment of the engine. Thermal imaging is also used in motor control, whether on an airplane or in a laboratory.

Fig. 2 Scanning at an aircraft taxiing down the runway

The latest generation transport aircraft mainly consists of modern high-performance composite materials. These composite materials consisting of carbon fibre (CFC), as compared to aluminium much easier and more robust, thereby widening the hope of reducing fuel consumption and thus emissions released. When using such materials, it is necessary to select an appropriate method for checking the condition. There currently plays a key role in non-destructive testing (NDT), where one of them is infrared thermograph (IRT).

IRT method has long been applied for studying surfaces of airplanes made of metal but for composite materials, the methodology differs. The use of this technology for composite materials is difficult because of the more complex structure of the material. Until recently the results are effective and safe way for complete and reliable assessment of the degradation of the materials. Measuring progress pulsed thermograph, where the surface slightly Heat the heat source (e.g. halogen bulb) and then we measure the surface temperature. The failure to spot heat does not spread consistently for the in homogeneity and consequently has a different temperature value. Active thermograph offers many advantages. One of them is the ability to capture a relatively large amount of space (0.25 to 0.5 square meters) at the same time. Another advantage is its use in the workshops, but also directly to the fuselage using mobile units.

The method works only in 4 mm thick, which allows considering about 80% of the airframe Boeing 787. For routine use in aviation technology is needed reliability methods and certification in practice, thus this technology under legislation approved by the Air Force.

Fig. 3 Implementation of measuring the fuselage

4 DRAFT EXPLOITATION THEROMOVISION IN THE MAINTENANCE OF AERONAUTICAL PRODUCTS

4.1 Experimental Motion of experimental simulation

The proposal is based on the following principle. We take into account that this is a classic airliner that has the drive unit located on the wings. In this case, the amount of pass-wing elements, such as transmission. Cabling, water hydraulics, fuel and hot air. Hot air is an ideal example of the use of thermal imaging technology. Hot air is withdrawn from a certain degree of compressor (depending on type) and led the wing to the fuselage; where after treatment (temperature and air purity) is admitted into the cabin for their heating. Drawn by the temperature of the air is about 300 to 500 ° C in dependence on the motor type. Thus a constant flow of hot air, which is also kept under pressure, can result in

damage to the transmission lines as well as attachment points such as flanges. Hot bleed air leak affects the distribution as well as the surrounding skin of the aircraft itself. It is this fact is the reason for proposing the use of thermo vision in aviation maintenance technology.

4.2 Methods used in the simulation

Simulated the case where part of a wing was blowing hot air stream. Material of the cover is made wings are often used in aviation, and it is called aluminium alloy (Al-Mg-CU4). Even though the vast majority of aluminium itself is up to 95%, only 4% copper and magnesium less than 1%, the alloy as alloy much better features. Stream of hot air has been simulated with the help of hot air. Gun brand Bosch PHG 500-2 1600W power and has two levels of heat output temperatures of 300 and 500 ° C.

Fig. 4 Secured measured object and used hot air gun

Duralumin plate was stationary because of the location and impact of high temperatures clamped in a vice. Subsequently, a heat gun plate placed at a distance of 70mm. On the other hand, measured perpendicular to the plate was placed infrared camera NEC TH9100WB with a resolution of 320x240 pixels. Thermal provides several measurement ranges. Two of them were used to measure at the lower initial temperature range -40 ° C to 120 ° C. This level was insufficient for higher temperatures, and was changed from 0 ° C to 500 ° C.

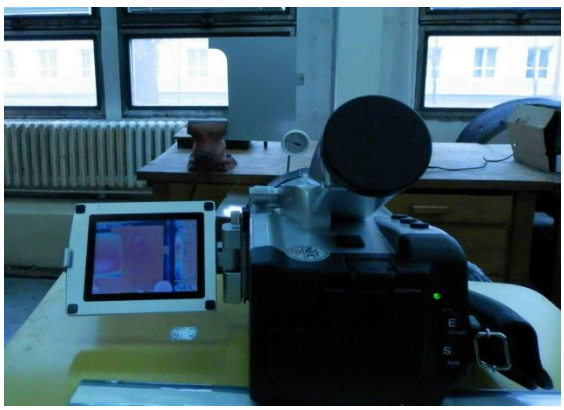

Fig. 5 Position of the thermal imager NEC at measuring

4.3 Practical implementation of an experimental simulation

Measure number 1.

The first measurement has been made after fulfilling all the necessary requirements. The first shot was at zero time, at the time when he was starting his own plate temperature. Turning hot air temperature at the first stage (indicated by the manufacturer 300 ° C) were also running stopwatch. The first measurement was made out 12 images, each one minute intervals. The evaluation consisted of selecting the two different selected points from the heat, to which the hot air is blown directly. The largest increase in temperature, as expected, occurred in the first minute, and then increases the temperature in the intervals longer until sometime flat. After 12 minutes, the heat gun to detect low-paid and how the process of cooling for the duralumin plate.

Fig. 6 Heating process at the first measurement

Measure number 2

The measurement is then repeated twice more on the same sheet, the shape has been altered by physical disruption. The second measurement was performed under identical conditions, but the sheet around his mid-bender bent at a small angle. Due to the stagnation temperature over time the measurements were reduced to 10 minutes and images were created as in the previous case in minute intervals. In this case the sheet scanned to heating. As is shown in Fig. 37 see broken part - bending can be seen in the picture as red tape. In evaluating the images we precede analogously as in the previous case and we chose two points equidistant from the heat. In addition, these points were located precisely bending, thus degraded panned temperature of plate.

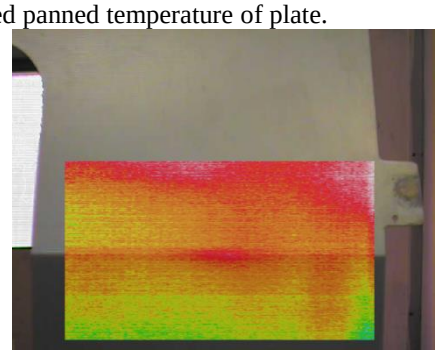

Fig. 7 Sightings of bending material at the second measurement

Measure number 3

Third measurement took place by analogy with the second. This time was chosen as a material failure of a small hole (hole) in diameter 2mm. Gun to the keyhole was coaxially placed, in which case it would have been clearly more heat leakage. In evaluating the selected one point directly in the keyhole and the other side at the same distance from the heat.

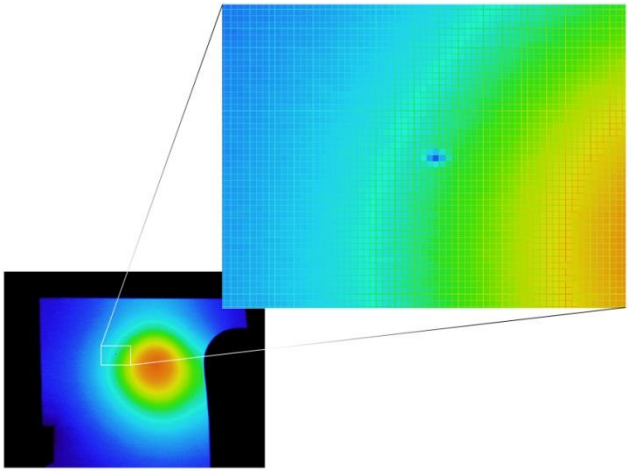

Fig. 8 Sighting hole in the material at the third measurement

4.4. Analysis of the results of experimental measurements of the thermal changes in the stream of hot air

The measured values of the individual measurements were subtracted from the thermo grams drawn using the program. Graphic values are evaluated by means of graphs. The chart shows two curves, which represent two points equidistant from the epicentre of the heat. One curve represents the first measurement, where metal was not damaged, and the other describes the change of temperature in the damaged plate. The graphs seen considerable changes in temperature.

Graph showing the heat transfer at point A in the first and second measurements.

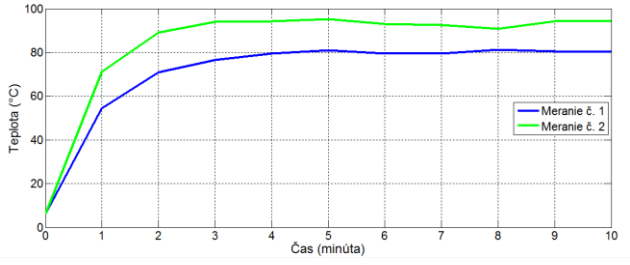

Fig. 9 Graphical representation of measured temperatures at point A

Graph showing the heat transfer at point B in the first and first and second measurements.

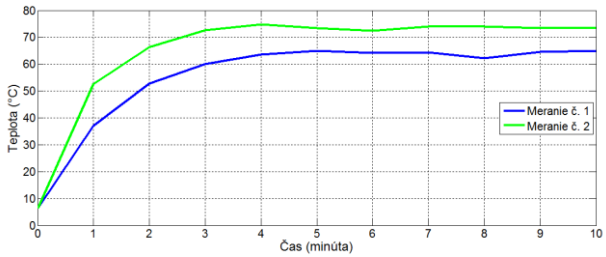

Fig. 10 Graphical representation of measured temperatures at point B

The charts are compared points A and B on the duralumin plate. The former is located at the opening (hole), and the second point was situated in classical homogeneous setting plate. In this case, point B is a homogeneous environment and point A is characterized by temperatures in accrued hole.

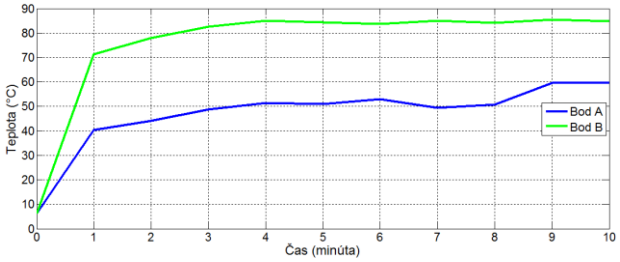

Fig. 11 The graph comparing the temperature values at point A and B

5 CONCLUSIONS

Influence of degradation is occurring in the material, which was simulated in the second measurement of small bending sheet metal, heat transfer is increased by 10 to 15 ° C, which is quite a significant amount. Analysis of the results third measurement is shown that the temperature at the opening rates were 25 to 35 ° C lower temperature than temperatures were in fault-free part of the material. Based on the analysis of selected funds operating damage was pointed out that the method of IRT aviation maintenance has its justification for the evaluation of the quality status.

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