INSTYTUT LOTNICTWA
Al. Krakowska 110/114 02-256 Warszawa
Tel.: 22 846 00 11 Fax.: 22 846 44 32

AB 792

CONSTRUCTION AND MATERIALS RESEARCH LABORATORY SECTION

CONSTRUCTION TESTING LABORATORY
Acredited by Polish Acreditation Centre
Acreditation Certificate No. 792

RESEARCH REPORT

Durability static test of an UL helicopter blade NACA 23012 part made of carbon composite

Report No: LM1/RPT/51227.07/01/16 **Number of pages::** 10

Research conducted by:

……
mgr inż. Robert Klewicki

Laboratory Section Manager:

……
dr inż. Krzysztof Kawalec

Authorized by:

……
mgr inż. Janusz Wlazło

Warsaw, April 2016

	Static durability test of a helicopter blade part UL NACA 23012 made of carbon composite	Report no. LM1/RPT/51227.07/01/16 ISSUE: I

SUBJECT OF TESTING: static durability

RESEARCH FACILITY: a blade fragment made of composite carbon, Ident. GT/CB/23012/T6

TYPE OF WORK: testing

PRINCIPAL: Ilot - CKTP / Gyro-Tech sp. z o.o.

ILOT ORDER NO 51227.07

REPORT CONTAINS: 10 pages

DATE OF START / END: April 2016 / April 2016

SYMBOLS OF WORK RELATED: See page 10

KEYWORDS: helicopter, blade, composite, static tests, durability

FILE: LM1_RPT_51227-07_01_16

The report was prepared by:

mgr inż. Robert Klewicki

Verified by:

mgr inż. Janusz Wlazło

Performers:

Robert Klewicki

Mirosław Kozera

Janusz Wlazło

Dariusz Wyleziński

SUMMARY

The report contains description implementation, progress and results of tests of a helicopter blade fragment made of carbon composite.

Prepared	Date	Verified	Date	Construction Testing Laboratory
Robert Klewicki	19.04. 2016	Janusz Wlazło	25.04. 2016	

Distribution:

Copy 1 – ILOT CKTP/KZPP

Copy 2 – Gyro-Tech sp. z o.o.

Copy 3 – ILOT CBMS/LM1

Table of contents **page**

1. Introduction

The studies have been carried out in the framework of the ILot order:
Analytical and research works commissioned by Gyro-Tech sp. z o.o. company (51227.01-08)

2. Object of research

The object of the research was part of a blade made of composite carbon with mounting nodes, designed and made by the Principal: a version with 7 mounting bolts.
Trade name of the helicopter blade: Carbon Blade NACA 23012 Twisted 6°, designation:
GT / CB / 23012 / T6.

3. Purpose of research

The aim of the study was to determine the static durability of the blade fragment and to provide a set of measurement data for further durability analyses.

4. Basis of the study

- Testing procedure JPB.03 / LM1 [1]

5. Testing station

The tests were carried out on the AVIATA durability frame equipped with suitable facilities, allowing adding required loads to the tested element.

Fig. 1. The tested blade fragment mounted on the testing station.

6. Measuring and testing facilities, uncertainty measurement

The load in the test was carried out by using electro-hydraulic cylinder which is part of the AVIATA durability frame along with a controller in the following completion:
- Hydraulic cylinder R-580-150
- MTS 407/01 Controller S / N M402246L

The force, displacement and deformation were recorded by using a measuring system "System 5000" from Vishay MicroMeasurement equipped with appropriate analog-digital cards.

Calibration of measuring channels contain protocols [2], [3], [4].

Force measurement

For measurement and control used was a force transducer 1232-450kN / 01 with amplifier MTS 407.12 DC Conditioner S / N 1467366F (part of the controler MTS 407).

Determination of measuring point	Converter	Range	Amplifier	System 5000 Card	Card Channel	Estimated measurement uncertainty *)
F	1232-450kN/01	450 kN	407.12 DC Conditioner 1467366F	HL5130/04	2	+/- 0.2 kN

**) Expanded uncertainty (with a confidence level of p = 95%)*

Displacement measurement

The resulting displacement of the cylinder piston loading of the AVIATA machine was measured by LVDT transducer integrally built in the cylinder.

Determination of measuring point	Converter	Range	Amplifier	System 5000 Card	Card Channel	Estimated measurement uncertainty *)
F	R-580-150	150 mm	407.14B AC Conditioner 0423852D	HL5130/04	1	+/- 0.24 mm

**) Expanded uncertainty (with a confidence level of p = 95%)*

7. Test course and results

Before carrying out the test, a representative of the Principal confirmed the compliance of the tested object with the documentation. The representative of the Principal was present during the tests.

It was agreed with the Principal that the load will be proceeded with a fixed elongation speed: 2 mm / min.
During execution of an attempt, measured were: the loading force and displacement of the cylinder piston.

The test was carried out on 05.04.2016 [5].

The course of force against displacement is presented in the chart - Figure 1, while the form of destruction is presented in the pictures Pic.2 and 3.
The maximum recorded load (destructive power): **442.6 kN.**
Form of destruction: shear of bolts attaching the blade to the handle.

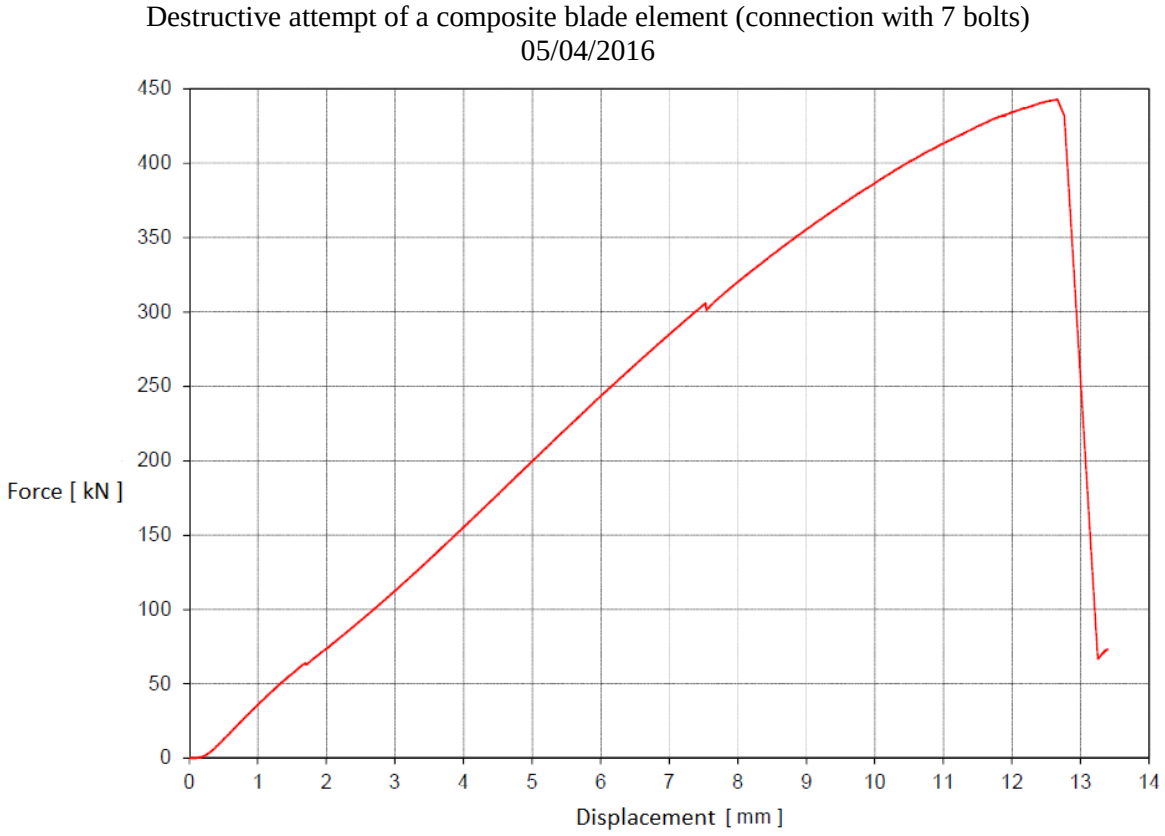

Fig. 1. The load course.

Fig. 2. The destroyed bolts connection in the tested element on the testing station.

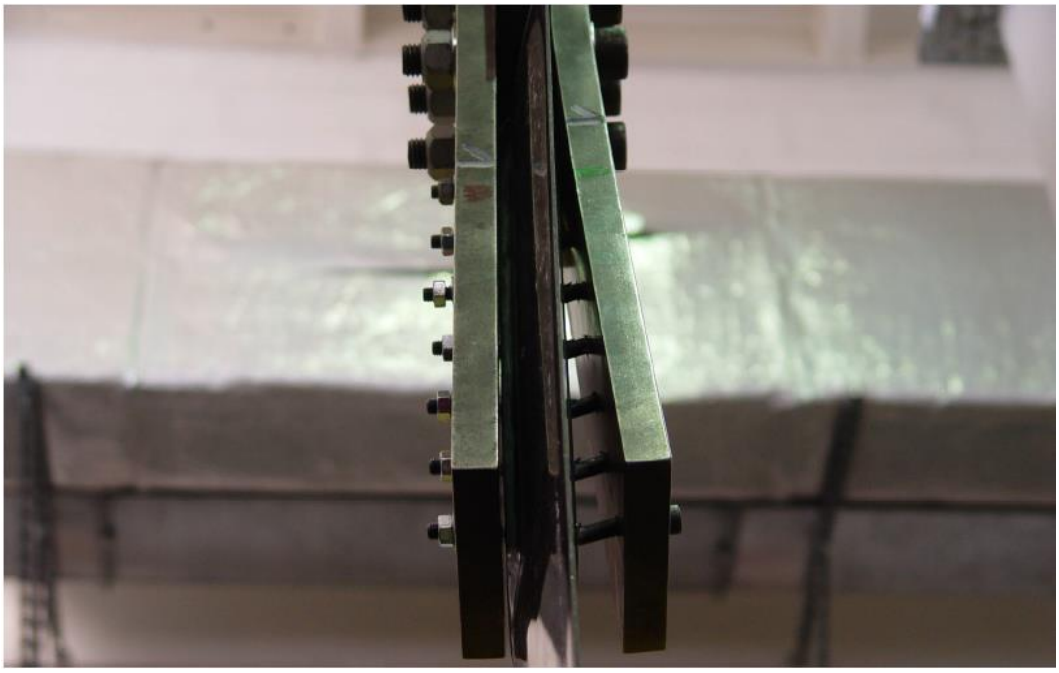

Fig. 3. The destroyed bolts connection in the tested element.

8. References

[1] J. Wlazło, Static and quasi-static research on complete mechanical constructions, their assemblies or components or construction parts. Research Procedure No JPB.03 / LM1; Ilot, Warsaw 2010

[2] Minutes of force measuring channel calibration: force transducer Interface, model 1232ACK-450kN-B amplifier 407.12 Conditioner DC controller MTS 407/01, No WPB / PRT / 12/16; Warsaw 04.01.2016

[3] Minutes of displacement track calibration of the AVIATA hydraulic machine cylinder, No. WPB / PRT / 13/16; Warsaw 04.01.2016

[4] Minutes of verification of measurement cards High Level Model 5130B System 5000 No WPB / PRT / 03/16; Warsaw 26.01.2016

[5] Research Work Card LM1/KPB/03/16

- END OF REPORT –

Prepared	Date	Verified	Date	
Robert Klewicki	19.04. 2016	Janusz Wlazło	25.04. 2016	Construction Testing Laboratory