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TYPE CERTIFICATION AND AIRWORTHINESS CERTIFICATION PROCEDURE OF UNMANNED AIRCRAFT

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Abstract: *The paper describes the Hungarian certification procedure of Unmanned Aircraft Systems as state air vehicle. The UAS consist of the aircraft and ground control station as well as communication system. The article shows the Hungarian type certification and airworthiness certification requirements of UAS.*

Keywords: *unmanned aircraft system, type certification, airworthiness*

1. INTRODUCTION

Today, as in the various countries of the world in Hungary growing number and many different configuration unmanned aircraft systems (UAS) are used both civil and state aviation.
Application of these special air vehicle beside the high quality technical design essential the adequate aviation legal background too.
Before deployment or integrate the UAS into the conventional aviation traffic different certification and validation procedures must be performed on the UAS.
The positive outcomes of this certification contribute for the safe operation of UAS as well as increase the flight safety.

2. UNMANNED AIRCRAFT SYSTEM

The UAS is composed of aircraft (fix wing, rotor wing etc.) and ground control station as well as communication link.
You should not forget the operators of aircraft and ground control unit and maintenance experts who are important part of the whole system. The safe operation of an unmanned aircraft system requires the air, ground and communication subsystems reliable working both separately and together.
Beside the above it is important that the quality of system components and parts are appropriate and their operations shall be trusty. However, in this case the reliable cooperation of the subsystems should be more relevant.

3. UAS OPERATION ENVIRONMENT

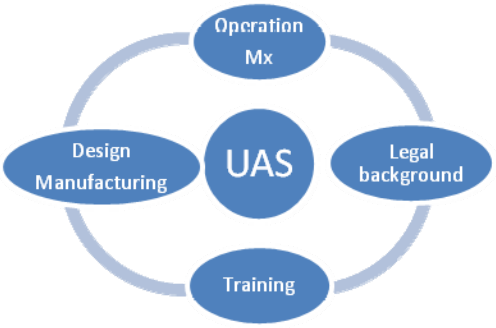

Fig.1 Unmanned Aircraft System full operational environment

The legal background of the certification and licensing procedures are developed in several national and international working groups by aviation experts.
A major challenge is for the policy-makers that unmanned aircraft have numerous configurations, geometries and weights. Beside that they are operated in much different environment with special flight task.
Development of unified regulatory environment is a complex task.

In Hungary the National Transport Authority / Aviation Authority responsible for the different validations, certifications and registration of state air vehicle.
For the operation of Unmanned Aircraft Systems as state aircraft required the following certifications:

- authorization of UAS design and manufacturer company;
- licensing to the operator crews;
- authorization of UAS holder, operator and training organizations;
- type certificate for the UAS (contains the aircraft, ground station and communication link);
- frequency spectrum licence;
- airworthiness certificate;
- registration certificate;

4. TYPE CERTIFICATION

The purpose of the type certification to certify that unmanned aircraft system suitable for the safe flying.
In Hungary presently more unmanned aircraft systems are applied in the state aviation.

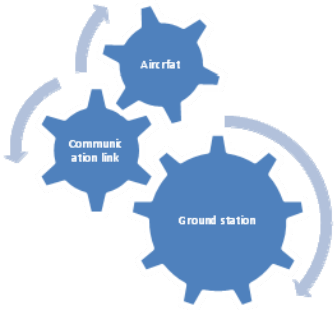

Fig.2 Unmanned Aircraft System

The depth of the type certification depends on the category of UAS and its required operating environment.
During the certification process beside the air vehicle the ground station and the communication system are examined too.
The authority experts together with the designer and manufacturer engineers develop the detailed certification procedure which contains the necessary documents, static and dynamic load tests, test flight programs.
Since the beginning of the UAS designing the Authority engineers have monitored the development of the UAS manufactured in Hungary.
After checking the aircraft plans the static load tests of fuselage, wing, horizontal and vertical stabilizers as well as the ailerons, elevators, rudders are accomplished.
The engine (electric, gas, jet) of the aircraft is checked by the experts.
The production environment of the engine and quality of the main components and the fuel system are examined.

Essential part of the type certification work is the examination of the flying control system of the aircraft.

During the certification process for the specific tests external expert organizations are involved by the Aviation Authority.
It should be noted that the flying control system is the most important part of the unmanned aircraft system related to the aviation safety. This subsystem together with the communication link has fulfilled preprogrammed commands by the actuator. Furthermore this subsystem is responsible for targeting of the aircraft on the pre programmed waypoints.
UAV flying in Hungarian airspace can be implemented only in segregated/closed airspace available for dedicated, adequately insured for the operation under conditions prescribed by law!

In the under 20 kg maximum take off weight unmanned aircraft's many components and parts (for example: different electronic items, cameras, servos, receivers, electric motors, electronic speed controls, jet engine etc.) can be purchased from commercial market.
High priority of the quality management system of the UAS manufacturer organizations is to certify the „civil" components and parts suitable for the installation into an air vehicle.
During the type certification these parts are investigated within different special tests.

Beside the aircraft the operation and reliability of the ground unit has to be checked in different operating modes.

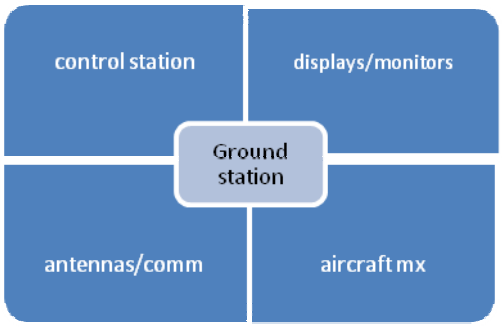

Fig.3 Main parts of Ground Station

The ground station consists of the following parts:

- control station for the aircraft direction and navigation;
- different displays to project the aircraft video signs;
- several antennas for the transmission the radio, video signs;
- maintenance part where the different checks (preflight, rout waypoint loading) related to the aircraft are accomplished;

The operation flight tests processes start after the design examination and ground tests.
During different special flight test programs the structure and maneuverability, stability and load test of aircraft are examined in several speed.

We can get many different real time telemetry (flying speed, altitude, direction, g-load) details and video signs through multiple communication system.
The test flight period is followed by the evaluation and summarize of the flying parameters.
The continuous communication without interference is essential for the reliable operation of unmanned aircraft systems. Number of real time data exchange required

between aircraft and ground station. During the operation radio signals of different frequencies are used for GPS and to communicate with other aircraft as well as ground station.
During the type certification the frequency and performance of applied radio signals have to be checked to meet the relevant legislation.

After the successful type examination the Aviation Authority issues the type certificate with data sheet.
The data sheet contains the parameters of the unmanned aircraft system including the aircraft, ground station and communication system. Operation restrictions are contained in the data sheet too.

5. AIRWORTHINESS CERTIFICATION

Beside the type certificate the airworthiness certificate is an essential document of the unmanned aircraft system.
The airworthiness certificate is an individual document of the aircraft so each air vehicle has one.
The airworthiness document certifies that the unmanned aircraft suitable for the air traffic.

Fig. 4 Main fields of airworthiness certification

Before issuing of airworthiness certificate on each unmanned aircraft system an airworthiness examination have to be performed.
During the airworthiness examination it is necessary to check the technical condition of the system which means the ground and air operability as well as the documentation of the system.
Functional check flight program is used for examining the air operability of the unmanned aircraft.

6. CONCLUSIONS & ACKNOWLEDGMENT

Parallel to the conventional air vehicle the usage of unmanned aircraft systems in many countries is also spread.
But as long as the conventional aircraft must not be operated without any type certificate and airworthiness certificate in some countries there is no any certification requirements for the small category unmanned air vehicle.
Based on the last years of practical experiences can be stated that in unmanned aviation it is important and significant to develop the appropriate operating environment and legal background.
Similarly usage of conventional air vehicles to operate an unmanned aircraft system should be the number one priority the flight safety.

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