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DESIGN & PRODUCTION CRITERIA AND AUTHORITY REQUIREMENTS FOR THE HUNGARIAN DEFENSE FORCES OPERATED UAS

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Abstract: *In my article I aimed to present the Hungarian designed & manufactured and Hungarian Defense Forces (HDF) operated Unmanned Aerial Vehicle and -Systems (UAV/UAS)'s design and production criteria. Furthermore I would like to introduce the certification environment, auditing procedures and applicable standards which were used by the Hungarian military aviation authority during the certification and authorization procedures of the UAS.*

Keywords: *TUAV, RS UAV, Organization Exposition, AQAP, MAWA, EMARs, Site Survey, Airworthiness*

1. INTRODUCTION

The Hungarian Defense Forces (HDF) has been operating different type of Unmanned Aerial Vehicle (UAV) and Unmanned Aerial Systems (UAS) since 1960s.
Early aerial vehicle in terms of their level of technology were considered rather flight model as UAV's. Their flight control during their missions was generally performed with radio-controllers in direct way; they fly as a remote controlled aircraft model. The aircraft were used by the HDF, on the one hand as Target - UAV (TUAV) with training tasks to the air defense units of HDF; on the other hand, there was improved different type of aircraft for reconnaissance and surveillance missions equipped with special payload (cameras, microphones, etc.).

1.1 Target - UAV (TUAV): The traditional asset demand of air defense missile systems for long remained satisfied with this primitive model aircraft, because of the more powerful anti-aircraft systems, training of operators of conventional aircraft were still used.

The philosophy change in the Hungarian UAS application was happened on the basis of the cost effective solution seeking. After all, the cost of a small robotic aircraft operating hour substantially below a conventional military aircraft flight hours cost (e.g. the operation cost of a Mi-24 combat helicopter: ~ 10,000-15,000 EUR / flight hours), while the cost of the flight hour of TUAV is less than 10-fold.

To replace the traditional military aircraft, in connection with the training of air defense units, with modern TUAV systems the flight range of the aircraft and the effective radar surface of the plane had to be increased significantly.

In order to increase the flight range initially used two pilots, one pilot made the first take-off and led to the aircraft to the flight level, the other pilots in the target area in a bunker carried out the flight. This method required a high degree of co-pilots and pilots endangered the physical safety as well.

These disadvantages and hazards in GPS-based flight control system were developed for the TUAVs, which have acquired an autonomous task execution, i.e. pre-stored flight plan is to fly along capability.

Fig. 1. METEOR-3MA TUAV [1]

1.2 Reconnaissance and Surveillance UAV (RS UAV): In connection with the RS UAVs the need for autonomous flight capability has been present since the beginning of the execution of the tasks because of the detection distances and large flight areas.

The appearance of the autonomous flight capability, the increase of the aircraft size and its performance data (e.g. Wingspan $\geq$ 5m, $v_{flight} \geq 200$ km/h) and the jet engine usage on the aircraft board finally take the unmanned flight a new foundation. With special regards the above mantioned fact it was desirable, such as the HDF and manufacturing companies too, in the controlled aircraft design, manufacturing and operating environment into.

Fig. 2. SZOJKA-III. RS UAV [2]

2. DESIGN & PRODUCTION CRITERIAS

To determine the corner stones of the new way in the field of the UAV development and production only the rethinking of the aircraft manufacturing could help us. Rethinking on the basis of the international quality management standards (ISO 9001:2008, AQAP 2000, AS 9100) and rebuild the whole manufacturing system based on the special points of the standards in connection with the aerospace- and military systems. Furthermore, the Hungarian UAV manufacturers started to work together with the HDF, the supervisory bodies, like the Military Aviation Authority, and the scientific UAV mater experts to create a reliable and acceptable quality and high flight safety UAS. During the inspection of production circumstances a significant problem occurred. The previously assembled aircraft were built up largely retail elements (engine, body, two-way radio, camera, etc), which elements essentially have been developed hobby purposes. Thus, the precise equipment life and reliability was not known to the manufacturer.

To solve this problem, according to the applicable standards and comply with their basic principles, the manufacturer developed a kind of custom test body and an internal testing process for the small trade items. As a result of the testing procedure, the appropriate qualified items may have been used as components of UAVs and could then be integrated into the board of the aircraft.

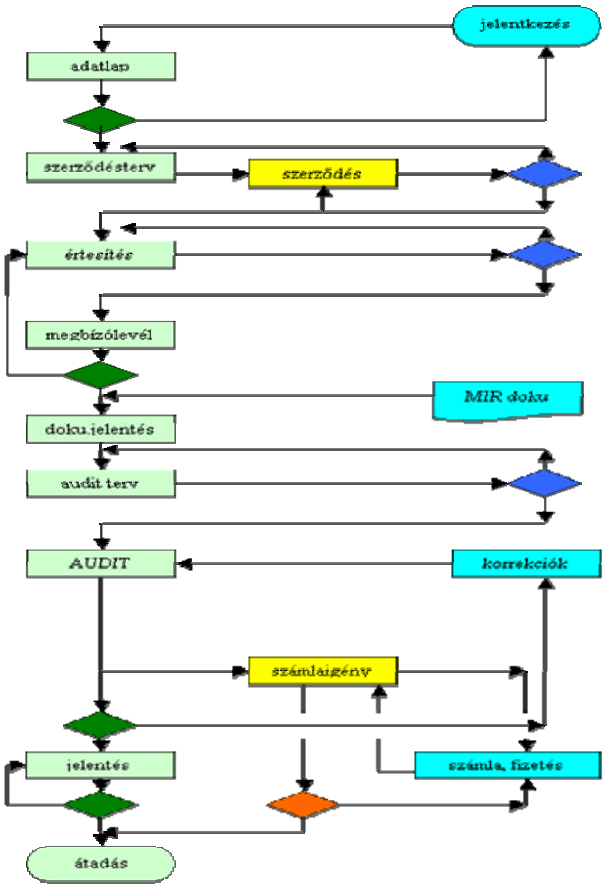

Fig. 3. NATO AQAP tanúsítási eljárás [3]

3. AUTHORITY REQUIREMENTS

In Hungary, the National Transport Authority Aviation Authority (NTA/AA), as the law designated, first instance military aviation authority responsible for the state aviation which covers the military-, police, disaster management aviation.

The Authority, according to the Hungarian air navigation law and the legal background, carries out the certification of the aircraft manufacturer (design & production organization), the type design investigation and validation of the aircraft, the airworthiness inspection on the each individual aircraft within the type design, and finally take the certified aircraft into the Hungarian State Aircraft Register.

As the unmanned aircraft, considered a special kind of aircraft and therefore difficult to interpret the traditional concepts used airplanes and legal norms. For example, an ultra light category (MTOW: 15 kg.) RS UAV, which is shipped to the theatre in a bag in disassembled form, *non - airworthy* status, will be assembled and prepare for its mission by the operator. After the carrying out its mission the UAV will be disassembled again and lose the airworthiness again.

Accordingly, the legislation is necessary to apply a systemic approach, which requires the assistance of experienced professionals, state of the art control and regulation systems for tracing and application consideration. Considering the above mentioned things, to find the best practice within the certification procedure, during an UAV manufacturer certification process, the domestic regulatory background as well as the international regulatory system had been applied together, for example the civil aviation regulatory requirements for Design & Production organization like EASA Part 21.

Furthermore, the future common European military aviation regulations (EMAR: European Military Aviation Regulation) were used by the NTA/AA as a baseline during the audits.

3.1 Common Military Aviation Regulations: In 2008, under the auspices European Defense Agency EDA, a number of EU national MoD representative formed the Military Airworthiness Authorities (MAWA) group with the objective of the single European military aviation regulatory system (EMARS) formulation and to establish the EASA model European Joined Airworthiness Authorities Organization (EMJAAO) [4].

The MAWA and its working groups, during its operation, have created a number of common European military regulations regarding the aircraft type certification, design and production certification (EMAR 21), which regulations were used by the NTA/AA during the type or type design certification procedures in connection with the domestic or foreign UAV manufacturers.

According to the Hungarian and the European aviation rules, in connection with a design & production organization approval procedure the Hungarian authority, during an audit firstly study the *Organization Exposition (OE)* of the inspected organization. This is the *On-Desk* phase of the audit. After this first phase, based on the described information about the company, the authority will create a *Site Inspection Plan* and start the second, *On-Site* phase of the audit. During this phase the authority shall verify in practice as described in the descriptive document like the OE.

For example: within the organization the facilities - which designated for aircraft manufacturing - conform to national standards the extent necessary and sufficient for the national requirements. The main phase of the aircraft manufacturing processes separated enough and properly documented in all stages. The production technology and documentation is available for the staff of the organization. The organization has well trained and educated manpower for the intended work.

During the audit the authority checks the organization's quality management system, and its valid certificates issued by relevant organizations.

At the end of the On-Site inspection authority representatives create a record about their experiences during the survey and send a proposal to the management staff of the authority. The head of the authority will decide, on the basis of this proposal, to issue the *Authorization* for UAV design & production organization or not. This Authorization remains in force until its revocation.

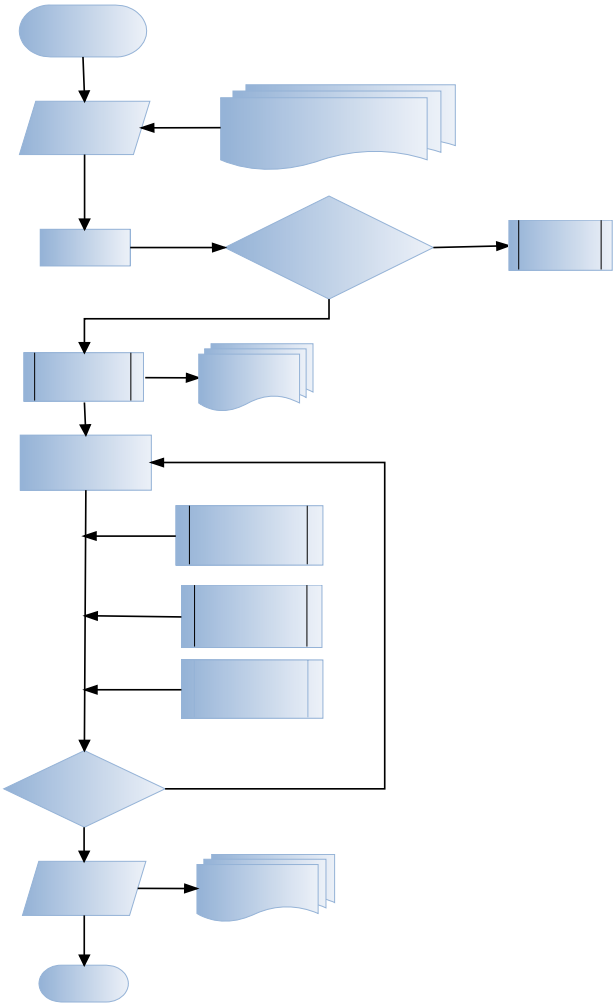

Fig. 4. NTA/AA Authorization procedure for Design & Production Organization [5]

4. CONCLUSION & ACKNOWLEDGEMENT

As I detailed in this article the design & production criteria and the special authority requirements in connection with the UAV or UAS are very incomplete at present.

To use military standards and aeronautical industry standards in the field of e.g. a small UAV manufacturing to be too strict requirement for shoring and mean a very costly quality management system. It should be further examined the appropriate UAV production and certification self-regulatory system and the possibility of developing the existing legislation should be supplemented by the production of UAVs with specific provisions.

The quality management system should seek to establish an appropriate system for seeking the most cost-efficient production structures to create the maximum flight safety in place.

To support this plan, firstly it is very necessary to categorize the UAVs and the UAS by appropriate air navigation rules and legal background so as to ensure realistic and real technical content requirements for shoring right up to the manufacturer or to the operator's body.

5. CLOSING REMARK

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Subordinated plan: „Data integration"

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