Unmanned Aerial Vehicles in the Hungarian Defence Forces

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Abstract: The history of research and development of unmanned aerial vehicles and unmanned aerial systems in Hungary goes back more than 25 years. It could be a major advantage, but unfortunately there is no Hungarian made UAV in the Hungarian Defense Forces until now. The leaders of HDF have decided to purchase short range UAV to protect the missions such as in Afghanistan. This paper describes this process and the results of previous researches and developments.

Keywords: Unmanned Aerial Vehicle (UAV), Unmanned Aerial System (UAS), UAV research and development, UAV tender

1 Introduction

The theoretical studying of unmanned aerial systems has taken place in processing parallel with the experiences of local wars from the ‘70s in Hungary. The electronic warfare and air defence trainings of military educational institutions widespread engaged UAV’s application possibilities.

Practical research and development started in Military Technology Institution in cooperation with Warsaw Pact countries. Czech-Hungarian cooperation was established to develop a new UAS, called Soyka III.

In the 90s intensive programs has began in many countries all around the world due to the technical progress. In Hungary, the work started on the bases of modellers’ experiences and it achieved good results in particular development on target aircrafts.

The PhD scientific research themes of Zrínyi Miklós National Defense University include many UAV topics. There is numerous PhD degree acquired in these themes. The research and development works expanded towards international cooperation, especially with joining to EU civil UAV research programs.

Based on Hungarian Defence Forces experiences in different missions such as Iraq or Afghanistan a decision was made to procure short range UAV (SUAV). In that

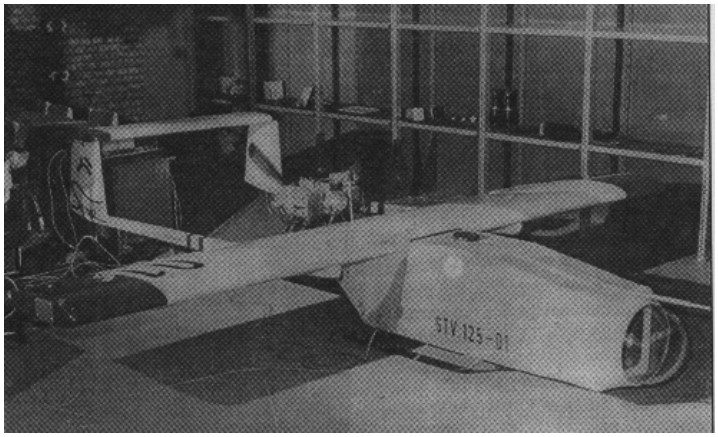
time the Hungarian research and development's result did not fulfil the requirements of the purchasing tender, therefore an international procurement tender were kick off. However, the first winner of the tender did not meet the requirements, so a second round took place.

The training and deployment process is running now, so there is too early to report any experiences yet. The practical research and development will continue. Higher military institutional bases have been created to add to the undergraduate training. This is an appropriate system to prepare the military leaders, engineers, and the personnel to use the UAVs.

2 Military Technology Research and Development

2.1 The Soyka III Program of Military Technology Institution

The multi role Soyka III unmanned aerial system was developed in a Czech-Hungarian military technical cooperation. [1]



Picture 1
The Soyka III/TV UAV [1]

The basic version of Soyka-III/TV (shown in Picture 1) had many modifications:

- Sector and circular visual reconnaissance UAV equipped TV camera;
- NBC reconnaissance UAV;
- ELINT and radar jamming UAV;
- COMINT and radio jamming UAV;
- Visual reconnaissance UAV equipped infrared camera.

Modes of control could be manual and semi-automatic - using autopilot and autonomous operation - on the basis of a computer program. The computer program allowed the simultaneous control of four unmanned aircrafts. In this case, three pre-programmed flight route passed, and one was managed by the operator. The take off was executed by launchers and the landing by parachute.

If the management system of the device had encountered an awkward situation, it had operated an emergency system, which stopped the engine and opened the parachute landing.

The whole unmanned aerial system included airplane, ground control station, launcher, and shipping container and research vehicle.

The maximum flight distance was 100 km on altitude of 2000 meters. The flight time was up to 3.5 hours. The minimum flight altitude was 50 meters and the maximum was 3000 meters. Maximum speed of Soyka was 220 km/h. Total take of weight was 145 kg, payload weight max. 20 kg.

In the project Soyka III the airframe, servos and flight control devices were supplied by the Czech partner.

The on-board guidance system and its ground elements, the navigation system, the controlling computer terminal, and various types of payload development were Hungarian made.

The dissolution of the Warsaw Pact ceased by mutual agreement of the project, however the countries have continued the development independently. Today, the Soyka services in the Czech Army. [2]

Picture 2
The Soyka UAV in the Czech Army [3]

2.2 Development of Target Unmanned Aerial Vehicles

The Hungarian Defence Forces required small target unmanned aerial vehicles to use in different training tasks.

The Hungarian Aero-Target Ltd. was one of the target UAV manufacturers. This company produced the Meteor target drone, which was used in air defence training for a long time. [4]

Picture 3
The METEOR-1 target drone [4]

The control of the aircraft was based on human visibility at the beginning. Since the technical development could support on-board pilot which was based on GPS. The fully automatic control became possible when a member of the Aero-Target Ltd. Miklós Koncz has built his flight autopilot unit that was his PhD research theme as well.

This autopilot controlled the Meteor-3 target drones, which were successfully shot down by the 12. Air Defence Division on “Lendülő Kard – 2005” military training exercise, in June 2005, in Poland. [4]

Picture 4
Modernised Meteor-3 with autopilot

2.3 PhD Scientific Research Topics

The Department of Electronic Warfare of Zrínyi Miklós National Defence University lead by Professor Imre Makkay has collected the PhD researchers who were interested in robotics, especially in unmanned aerial vehicles. From the middle of the '90s a new school has borne which has many research fields:

- Airframes and materials of unmanned aerial vehicles;
- Processes of on-board autopilot systems;
- Civilian and military use of unmanned aerial vehicles;
- Safety and security questions of unmanned aerial vehicles;
- Operation methods of special construction;
- Special requirements of unmanned aerial vehicles;
- The application of GIS tools for flight.

The results of the researches were published in different conferences, many papers and proceedings were made, hundreds of publications have appeared.

The defended PhD dissertations in chronological order were as follows:

- András MOLNÁR: New processes and technical solutions in the civilian and military unmanned vehicles development [5]
- Péter SZEGEDI: Computer-aided analysis and synthesis of controllers of flight control systems [6]

- Mátyás PALIK: Applicability of unmanned aircraft systems for air reconnaissance in operations of air force flying units [7]
- Tibor WÜHRL: Safety technology of micro size unmanned air vehicles [8]
- Ágoston RESTÁS: Research and development of the aerial reconnaissance and extinguishing of forest fires [9]
- Antal TURÓCZI: Onboard flight control system of an unmanned quad-rotor helicopter [10]
- Miklós Tamás KONCZ: Application and electronic systems of the Meteor-3R target drone [11]
- Zoltán HORVÁTH: Application of a Digital Terrain Model; Increased safety of small and middle-size unmanned aerial vehicles; Development of its capabilities [12]

These results of the researches will be most directly useful in practice, so those interested in the subject useful to consult them.

2.4 Joining into International Researches

Our research group was involved into the military unmanned aerial vehicle research and development as well as civilian R & D activities. [13]

In 2001, the European Union lunched a thematic network under Framework Five, and ran for 3 years, with an extension for 1 year. It was called UAVNET. [13]

UAVNET was a knowledge network for the promotion of strategies and scientific research for enabling civil unmanned vehicle applications. The UAVNET alliance comprised representatives of research institutes, universities, industries, government agencies, end users and operators who were presently involved or intended to become involved in UAS. These organizations were located either in a European Union member state or in an associated country as defined by the European Commission. Civil UAS applications relate to scientific, commercial and civil security information collection both on a routine basis and during emergencies, safety inspection, communication signal transmission and both passenger and cargo transport.

The Department of Electronic Warfare of Zrínyi Miklós National Defence University has taken part in this activity since 2002.

The UVNET regularly organized workshops. In September 2004 the National Defence University was the hosts of the 11th workshop. 75 persons attended on this meeting from 16 countries. There were 17 lectures and many special professional debates. We invited many Hungarian partners were very good

professional cooperation with. On this meeting were two lectures presented by our PhD students with greet success.

Parallel with UAVNET another research project was set up called CAPECON. CAPECON was an acronym for Civil Applications and Economical Effectivity of Potential UAV Configurations. CAPECON was also an RTD project submitted to the EC Fifth Program Call, Growth 2001. The Vision of the program was that "Within 10 years UAVs will be operated within Civilian Airspace on behalf of many Civilian & Commercial Missions". Twenty organizations were participating in the Program, including industries, institutes and universities – from eight European countries.

The UAVNET cooperation with the CAPECON presented the findings of the European Civil and Commercial UAV Roadmap entitled "25 Nations for a European Breakthrough".

The Civil Unmanned Air Vehicles Roadmap was prepared as a Pan-European effort in order to benefit Europe strategically, socially, economically and technologically.

The UAVNET was formally over in the end of 2005, but it still exists in informally way as a UAVNET community. The partners seeking the opportunity to take part in EU's program in the future.

3 Procurement Procedures

The Hungarian Defence Forces has made a decision to procure UAV to support the protection of Hungarian units in foreign missions in 2006. The main aim was that the UAV's reconnaissance data could be use in protection of convoys and camps.

The tender was kicked off in September 2006, and it includes the following requirements:

- Altitude 100-1000 m (above sea level at least 4000 m), min. 90 minutes duration, flying on a pre-programmed route with optical (electro-optical) or passive infra red reconnaissance;
- It must consist of an emergency landing system, and an immediate return operation mode;
- The UAV be able to lunch by hand-hold or catapult (from short airstrip) and it must has an automatic landing system;
- The pre-flight preparation and preparation for new mission does not exceed more than 20 minutes with two persons;

- On ground control station (planning and operation terminals) must handle the GIS based software with the actual position of UAV, the payload data, be able to plan further routes, planned returning point (take-off place), and telemetric data;
- The communication asset between the UAV and ground control station must be NATO FMSC preferred 4,4-5 GHz radio link.

There were three candidates in the first round:

- The WB Electronics with SOFAR mini UAV;
- The Israeli ELBIT with the SKYLARK, and
- The Israeli IAI. [14]

3.1 The SOFAR System of WB Electronics

The winner in the first round of the tender was the Polish WB Electronics Company, which started the technical installation, transportation, and the Hungarian personnel theoretical and practical training.

Picture 5
The SOFAR mini UAV [15]

The installation and staff training was intensive, the system presented a number of occasions, and it even flight in military training exercise „Bevetési Irány 2007" seen by military and state leadership as well. [16]

However, for technical reasons, the military takeover did not happen, so the contract has been terminated for the WB Electronics Company. A new procurement process followed, as the device is necessary in the operations area.

3.2 Skylark-1LE from the Elbit Systems Ltd

The Israeli Elbit Systems Ltd has been involved into the second purchase program.

The training of the UAV personnel started in Israel and it was followed a Hungarian training.

The maximum range of this UAV is 15 km. Maximum flying time is 3 hours. Wingspan is 290 cm, length is only 145 cm. It has electric propulsion system, and the maximum take-off weight is 1 kg. The payload usually is a video camera.

The reconnaissance mission could be solved from 300-500 m height; the daylight camera's has 10 x zoom, and it transmit coloured motion pictures to the ground units. The UAV's night camera is able to detect the heat of human body and vehicles. The night camera is heavier than the daylight, thus the UAV is able to flight only 2 and a half ours with it. This UAV's weight is 6 kg, flying speed is between 45 and 90 km/h. A special catapult is needed for the take-off, the landing executes by an airbag. [17]

Picture 6
The Skylark-1LE mini UAV [17]

Conclusions

Hungary made serious steps in the research and development on the field of unmanned aerial vehicles.

However, the end user's requirements did not appear for long time, thus there were very limited budget for the development.

When you need a device to obtain a specific task, it is too late to start the development; the market should be choosing from among the existing versions.

However, the procurement procedures mentioned above also demonstrated how difficult and expensive the foreign supply, training, servicing and the maintenance.

Therefore, it is necessary to find national research sources for the domestic development, which results would be able to fulfil the requirements of next tender. It would have many benefits for the whole Hungarian defence industry, small and larger enterprises.

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