"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE RELATIONSHIP BETWEEN THE UAV FLEET OF EUROPEAN COUNTRIES AND THEIR GEOPOLITICAL POSITION

Melih Cemal Kushan*

*Faculty of Engineering and Architecture, Eskisehir Osmangazi University, Eskisehir , Turkey

Abstract: *Parallel to the conventional weapons technology, the usage of Unmanned Aerial Vehicles/UAV's in many countries is also increased widely. Because UAVs were the fastest-growing segment of the aerospace sector in 2008, with a worldwide value of more than $3.4 billion (USD). More than 42 countries have gone on record as producing at least one UAV airframe, and nearly 1,000 systems exist today, worldwide. So many different type of UAV are developed by many companies all over the world. While some of them are state of the art the others ones are very primitive. Nevertheless, all of them are used widely as usefull vehicles in civil and also military applications. In this study, the subject is the usage of UAV fleet of Europian Countries with their special causes problems and geopolitical positions especially.*

Keywords: *UAV,Unmanned Aerial Vehicle, Air Forces of Europian Countries*

1. INTRODUCTION

UAV use in Europe has been slower to emerge than in the US and in Israel. However, experience of using mature UAV systems on operations in Iraq and in Afghanistan has dramatically improved the European perspective on their utility, and the military market is growing at a significant rate.

Whilst it has been the major European military powers of UK, Russia, France, Turkey, Germany and Italy who have taken the lead in the procurement of military UAVs, there are growing signs that their popularity is reaching a wider market. In the EU accession state, Romania is gaining significant experience on UAV operations; Hungary has experimented with UAVs in civil applications such as fire fighting and a number of SMEs with an interest in the area are emerging.

Military procurement was initiated principally by the conflict in the former Yugoslavia and, as a result, European forces have focussed on the tactical level UAV such as the Sperwer and Phoenix rather than choosing to acquire the full spectrum of UAV systems. The experience of using these tactical systems has been instrumental in shaping requirements for a broader range of UAVs, and in the development of CONOPS in their use. Over time, however, European military forces have progressively expanded their inventory of UAV systems to include mini-UAVs (in the case of UK, France, Germany, Sweden, Italy), and MALE UAVs (in the case of UK, France and Italy). They have also been examining the potential for weaponising current UAV models as well as for acquiring UCAVs – Unmanned Combat Aerial Vehicles.

2. UNMANNED AERIAL VEHICLE

The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs are currently used for a number of missions, including reconnaissance and attack roles. For the purposes of this article, and to distinguish UAVs from missiles, a UAV is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine. In addition, a cruise missile can be considered to be a UAV, but is treated separately on the basis that the vehicle is the weapon. The acronym UAV has been expanded in some cases to UAVS (Unmanned Aircraft Vehicle System). The FAA has adopted the acronym UAS (Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles.

2.1. UAV Types

Target and decoy - providing ground and aerial gunnery a target that simulates an enemy aircraft or missile

Reconnaissance - providing battlefield intelligence

Combat - providing attack capability for high-risk missions.

Research and development - used to further develop UAV technologies to be integrated into field deployed UAV aircraft

Civil and Commercial UAVs - UAVs specifically designed for civil and commercial applications.

2.2. Degree of Autonomy

Some early UAVs are called drones because they are no more sophisticated than a simple radio controlled aircraft being controlled by a human pilot (sometimes called the operator) at all times. More sophisticated versions may have built-in control and/or guidance systems to perform low level human pilot duties such as speed and flight path stabilization, and simple prescripted navigation functions such as waypoint following.

Autonomy technology that will become important to future UAV development falls under the following categories:

Sensor fusion: Combining information from different sensors for use on board the vehicle

Communications: Handling communication and coordination between multiple agents in the presence of incomplete and imperfect information

Motion planning (also called Path planning): Determining an optimal path for vehicle to go while meeting certain objectives and constraints, such as obstacles

Trajectory Generation: Determining an optimal control maneuver to take to follow a given path or to go from one location to another

Task Allocation and Scheduling: Determining the optimal distribution of tasks amongst a group of agents, with time and equipment constraints

Cooperative Tactics: Formulating an optimal sequence and spatial distribution of activities between agents in order to maximize chance of success in any given mission scenario

Under the NATO standardization policy 4586 all NATO UAVs will have to be flown using the Tactical Control System (TCS) a system developed by the software company Raytheon.

2.3.UAV Endurance

Because UAVs are not burdened with the physiological limitations of human pilots, they can be designed for maximized on-station times. The maximum flight duration of unmanned aerial vehicles varies widely. Internal combustion engine aircraft endurance depends strongly on the percentage of fuel burned as a fraction of total weight (the Breguet endurance equation), and so is largely independent of aircraft size. Solar electric

UAVs hold the potential for unlimited flight, a concept championed by the Helios Prototype, which unfortunately was destroyed in a 2003 crash.

Many people have mistakenly used the term Unmanned 'Aerial' System, or Unmanned 'Air Vehicle' System instead of Unmanned Aircraft System [2].

3. OVERVIEW OF THE CURRENT SITUATION IN EUROPE

Military procurement was initiated principally by the conflict in the former Yugoslavia and, as a result, European forces have focussed on the tactical level UAV such as the Sperwer and Phoenix rather than choosing to acquire the full spectrum of UAV systems. The experience of using these tactical systems has been instrumental in shaping requirements for a broader range of UAVs, and in the development of CONOPS in their use. Over time, however, European military forces have progressively expanded their inventory of UAV systems to include mini-UAVs (in the case of UK, France, Germany, Sweden, Italy), and MALE (medium-altitude long-endurance) UAVs (in the case of UK, France, Turkey and Italy). They have also been examining the potential for weaponising current UAV models as well as for acquiring UCAVs – Unmanned Combat Aerial Vehicles (see Table 1).

Table 1: UAV fleet of military in Europe

	Krunk	Hermes 450	RQ-5 Hunter	Skylark	Searcher	Raven	Harfang	Global Hawk	Heron	Pegasus	Predator	Reaper	Shadow	PCHELA-1T	Reis	Ranger	Gnat 750	Anka	Desert Hawk	Total
Armenia	15																			15
Azerbaijan		10																		10
Belgique			6																	6
Cyprus					2															2
England												5							1	6
Estonia						1														1
Finland																1				1
France							4													4
Georgia		7																		7
Germany								5	3											8
Greece										5										5
Hungary				9																9
Italy											4	2								6
Romania													7							7
Russia					5									10	5					20
Serbia		2		6																8
Sweden				1									1							2
Swiss																24				24
Turkey									10		1	4	6				18	1		40
∑ UAV																				181

The success of UAVs in providing real-time information to commanders on the battlefield has contributed to both mission effectiveness and in protecting personnel. It is their effectiveness in these roles which has encouraged European countries to commit to the use of military UAVs to an extent that will support rapid market growth during the next ten years. In many respects, it is this successful operational use that is causing problems for the development of the UAV industry in Europe. The industry has suffered from a lack of research investment in a context where customers want mature, battle-proven equipment at low cost and in a short time frame, and national governments as well as

Europian institutions have often not done enough to support UAV development activities, especially in the civilian sector. This has encouraged European industry to focus on partnerships with Israeli or US companies at the expense of developing a native, European alternative. This trend has broad implications for the further development of expertise within the European skills base and the competitiveness of European companies in the emerging global marketplace.
A notable characteristic of the rapid growth in the procurement of military UAVs over the forthcoming ten years will be the shift towards MALE category platforms. This shift poses a significant threat to European industry, which has tended to focus on the tactical level. Between 2008 and 2016, the European Military UAV market is expected to see procurement of:

- Up to 600 tactical UAV aircraft
- Up to 200 MALE UAV aircraft
- 5 HALE UAV Aircraft
- ~10, 000 Mini-UAV aircraft

This corresponds to an estimated market value of around €8 billion up until 2016 (see Fig.1 and Fig. 2) [1].

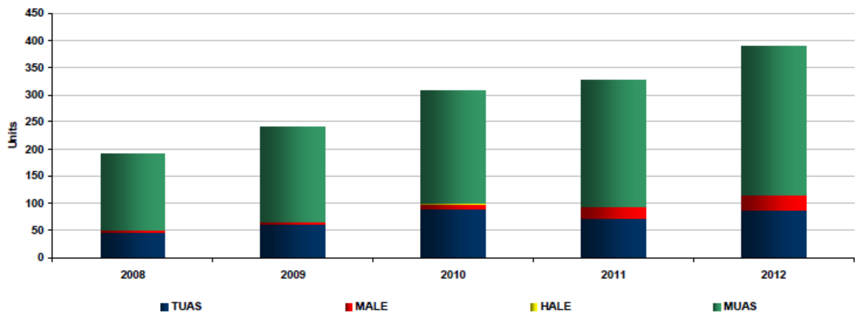
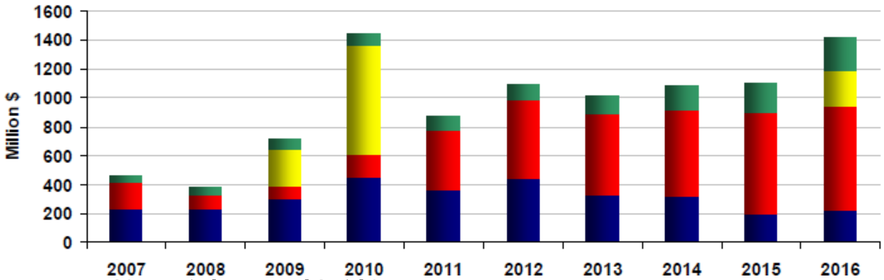


Figure 1: European UAS Procurement, 2008-2012 [1].



TUAS – Tactical Unmanned Aerial System
MALE – Medium Altitude Long Endurance
HALE – High Altitude Long Endurance
MUAS – Mini Unmanned Aerial System

Figure 2: UAS Market Revenues (Europe), 2007-2016 [1].

3.1.The Role of the European Countries on the Global UAV/UCAV Market

The global market for UAVs has grown dramatically in the last 10 years and is expected to maintain high growth rates in the coming decade when existing possessors expand their use of UAVs and when more countries acquire them. This opens up possibilities for Europian producers to improve on their previously poor track record and export their products to non-Eurpian countries. As Figure 3 shows, only a small proportion of global UAV acquisitions from foreign sources in the last 10 years concerns European producers exporting to other countries. An estimate for 2006 gave EU producers only a four per cent share of the global market, almost all from national or intra- European sales. Most of the global export market is covered by the US [3] (in 2006, US producers accounted for some 60 per cent of the total global market - including the huge US market [4]) and Israel (IAI's MALAT division pronounces that it 'leads the market in UAV experience, technology and reliability', and has over 29 customers.

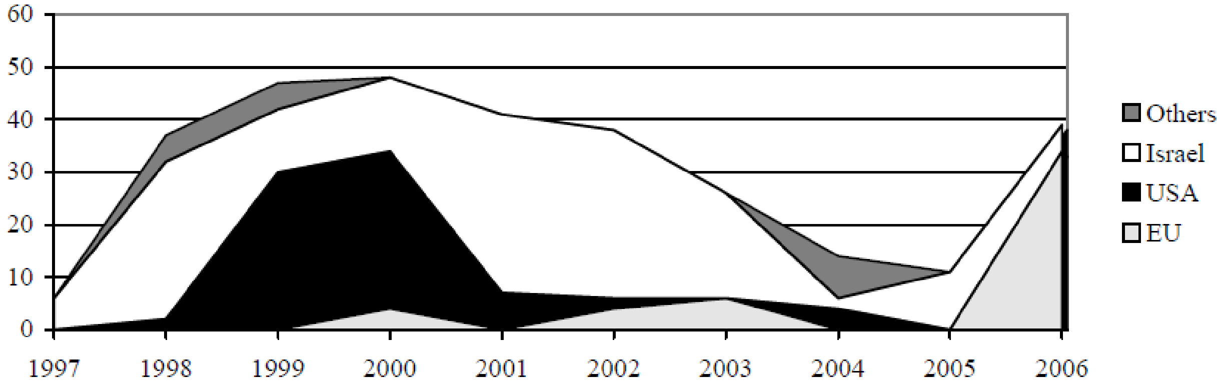


Figure 3: Global exports of UAV 1997-2006 [3]

4. EUROPEAN COUNTRIES, THE CAUSES OF UNMANNED AERIAL VEHICLE OF SERVICE IN EUROPEAN COUNTRIES

Allowing routine and safe access of UAVs to civil airspace involves numerous issues that touch on nearly every aspect of the aviation technical, operational, and legal system. Presented here is a framing of those issues organized into five major groupings: safety, security, air traffic, regulatory, and socio-economic. Within these groupings are specific issues. Each contains a discussion of the issue, potential mitigating factors (i.e., research), and an assessment of the issue relative to the overarching goal of full integration into civil airspace. At the end of each assessment is a table containing a summary of the safety criticality, technical complexity, socio-political risk, and economic cost, rated on a scale of high, medium and low.

4.1 Safety

Successful integration of UAVs in civil airspace will require assurances that they can safely operate within the constructs of a commonly shared aviation system and environment. As such, UAVs must demonstrate that they do not pose an undue hazard to other aircraft or persons on the ground. They must, in short, provide for an equivalent level of safety to manned aircraft. But defining this equivalency in terms of requirements is difficult. UAVs operate differently from manned aircraft. And because the pilot is no longer at risk in a UAV accident, the question arises as whether UAV systems can or should be held to the same safety standard as manned aircraft.

4.2 Security

UAVs may present unique security issues. The wide variation in flight environments, missions, and vehicle sizes make the secure control of UAV flights a challenge. Security requirements of the ground control station, data link infrastructure, vehicle and even the data must be a fundamental consideration in system design and operational policies and procedures of UAVs. In addition to being vulnerable to security breaches, UAVs themselves are also a potential security threat. And as the cost of UAV systems fall and the capabilities increase, a proliferation (or at least wide availability) of highly capable UAVs could further exacerbate security concerns.

4.3 Air Traffic

Assuring the safe and efficient integration of UAVs into air traffic operations will require UAVs to operate within the constraints of the evolving air traffic system. Assessing the potential impact of UAVs on air traffic operations will depend on the UAV types, numbers, operating environments, frequency of flights, performance characteristics, and equipage levels as they relate to the air traffic infrastructure and operations—current and planned. Because operations of UAVs to date have been limited in numbers and have purposefully remained clear of air traffic, it is difficult to assess impacts other than through analysis, modeling, and simulation.

4.4 Regulation

Regulatory requirements will ultimately define the operational boundaries of UAV certification, flight operations, and operator qualifications. To date, there are only a few countries having regulations pertaining specifically to UAV operations. Whatever regulatory structure is implemented, it will be a major defining factor in the evolving UAV market and its affect on air traffic operations.

4.5 Socio-Economic

Economic, political, and social issues simultaneously drive and restrain the UAV market. Demand for government use of UAVs (e.g., military, homeland security, law enforcement, and scientific research) is influenced mostly by the availability of fiscal resources and political will. Commercial markets, on the other hand, are dependent on the business case, which is linked to consumer demand, regulatory approval, airspace/airport restrictions, and public acceptance [5].

4.6 Geopolitics

To remain credible, and to prevent the disintegration of their own system, the European Countries will have to integrate, develop and refine their military assets – especially naval capabilities and long-range and unmanned combat aircraft (UAV) – far more rapidly and effectively over the next two decades than they have over the last. In particular, new overseas military installations may be required, especially in those areas where new energy transmission pipelines from foreign gas fields and commercial distribution routes from distant manufacturing centres are built to supply the European economy. Accordingly, as Map 1 shows, new European military stations may be required in the Caucasus and Central Asia, the Arctic region, and along the coastlines of the Indian Ocean. The intention behind these installations would be to contribute to a comprehensive 'forward presence': firstly, by representing – *á la* Mahan – a certain determination on the part of the European Union to exercise a latent but permanent power within the 'Grand Area'; secondly, by exerting a calming influence throughout the zone to encourage expectations of peaceful change on the part of local governments; and finally, to discourage the encroachment of larger external powers into the region, whose intentions may be predatory and/ or antithetical to the European agenda and the general peace[6].

The Table 1 shows that there are 5 countries in Europe which have got more then 10 UAV. These countries; Azerbaijan (10), Armenia (15), Russia (20), Swiss (24) and Turkey (40). Azerbaijan and Armenia can search mountanious borders eachother via their UAV fleets which so cheap and effective method; thus, both of them have got too many UAV for their security. Swiss also have got remarkable number of UAV although it is a little country in Europe. Because also it is former disconnected country and peter of world. Swiss must be achieved its border security effectively and the best method is the UAV control for board for this.

Turkey is the biggest UAV fleet country all of the Europe with its 40 vehicles. Because Turkey has been affected the influence of terrorist groups for years. And, Turkey needs to acquire more and smaller unmanned aerial vehicles (UAV) to prevent large-scale attacks by the outlawed Kurdistan Workers Party (PKK) against Turkish military units near the borders with Iraq and Iran [7]. So, it is necessary to have a strong UAV flet because of its effectively mission and cheap running coast.

5. CONCLUSIONS & ACKNOWLEDGMENT

In spite of the generally accepted notion that adapting military platforms for civil use is likely to be a key driver for the industry in the near future, most of the current market players believe that they have no choice but to concentrate most of their efforts on military UAS (unmanned aerial system) applications due to the bad visibility of what the future civilian market may hold.

This has in many cases shifted efforts away from areas of development that can be considered strategic for the civil side. European efforts to transform military capabilities have had to occur in the context of expensive and longterm acquisitions, and ongoing operations with constrained budgets, with the following results:

1. MoDs (Ministry of Defence) have often encouraged industry to shift towards utilising Commercial-Off-The-Shelf (COTS) technology;
2. Urgent Operational Requirements (UOR) have shortened acquisition cycles that favour companies with existing mature solutions;
3. European Primes have sought partnerships with international suppliers, to speed up delivery of mature capability and to reduce investment costs and cost to the customer.

Therefore, in many cases the current civil/military technological synergy stems from necessity rather than choice. This is expected to change once the technological development for sense-and-avoid and other required solutions finally reaches a level where they will be generally applied and demand for civilian UAVs crosses a significance threshold. Once that happens, the majority of solutions will come from dedicated, civil-orientated sources and will possibly even be re-adapted for military purposes.

NATOs work on STANAG 4671 (UAV operations) and STANAG 4670 (UAV training) have been extensively used as precursors for application of guidelines within the civilian sector. STANAG 4671 was based upon work originally sponsored by France's DGA to develop USAR (UAV Systems Airworthiness Requirements) for fixed-wing UAVs.

These efforts indicate that insertion of UAVs into non-segregated aerospace is now of equal priority to civil and military institutional players, and the response from industry indicates that they now share this view. Therefore, the efforts by EDA should continue and must be encouraged.

Funding on the security side can be channelled through existing institutions such as FRONTEX or EUROPOL and directed towards specific areas of research. For example, FRONTEX could play a role similar to EDA in terms of both equipment procurement support and support for border security-specific sensors and equipment development. It can serve as a channel to voice Member States' requirements and to inform the relevant actors of new technological developments. Finally, FRONTEX could pool UAS and other resources already available to Member States and direct them to EU border areas where they are most needed at that point in time[1].

REFERENCES

1. Europian Commission, Enterprise and industry directorate – General, *Study analysing the current activities in the field of UAV* [online]. Available: http:// ec.europa.eu/enterprise/ policies/ security/ files/ uav_ study_ element_1._en.pdf (March, 2012).
2. *The UAV* [online]. Available: http:// www.theuav.com/ index.html (March, 2012).
3. Wezeman, S., UAVs and UCAVs: Developments in the european union. *European Parliament briefing paper*, October 2007.
4. Dickerson, L., UAVs on the rise, *Aviation Week & Space Technology*, 15 January 2007.
5. DeGarmo, M., T., Issues Concerning Integration of Unmanned Aerial Vehicles in Civil Airspace, *Mitre Coorporation Center for Advanced Aviation System Development*, November 2004.
6. Rogers, J., A new geography of european power, *Egmont Royal Institute for International relation*, January 2011.
7. Mortimer, G., More UAS for Turkey, *sUAS News*, [online]. Available: http://www.suasnews.com/ 2011/ 10/ 9365/ more-uas-for-turkey/ (March, 2012).