EUROPEAN COMMISSION UAS PANEL

5th Workshop on Research & Development

Discussion paper

This paper was produced by the European Defence Agency on request by the European Commission in preparation for the EC UAS Panel's 5th Workshop. Written comments and contributions are welcome and can be supplied by e-mail to: entr-uas@ec.europa.eu and 5thworkshop-uas-2012@eda.europa.eu.

Background

1. In order to achieve air traffic insertion of UAS, there is first a need for public awareness about the benefits of UAS and political understanding of the UAS potential in terms of its economic, technological and industrial impact. To that end, the European Commission and EDA co-organized the European high-level conference on UAS in July 2010, which was attended by a large number of senior government officials and industry representatives. The conference called for a joint European approach to develop common Unmanned Aircraft System capabilities, in order to maximise efficiency in public spending and to ensure that alternative European platforms become available within the coming years. The conference conclusions also recommended the establishment of a High-Level Group on UAS, as a discussion platform to European stakeholder communities in order to ensure coherence, improve sustainability and competiveness.
2. In 2011 DG ENTR and DG MOVE launched the EC UAS Panel process which comprises a series of workshops, each of them prepared by an EC Panel member with strong expertise in the topic. At the end of this process, a Strategy for UAS in Europe will be developed. The previous workshops discussed UAS industry & market issues, air traffic insertion, safety and the societal dimension of UAS. They were attended by various stakeholders from Member States, international organisations, NGOs, industry, SMEs and researchers. This 5th workshop completes the picture and shall provide the state of play and way ahead for UAS R&D.
3. For EDA, UAS Air Traffic Insertion has been a priority since its establishment in 2004. The Agency's first work programme of 2005 already made reference to UAS. In May 2007, the Defence Ministers tasked the agency to prepare a common Road Map and a subsequent implementation plan for UAS integration, outlining the way to achieve the common target. Several major work strands have been initiated in EDA and have already delivered concrete results in the area of technology demonstration, certification and standardization. These will be presented during the workshop. Military and civil UAS markets are highly interdependent with technology developments inevitably driving both.

State of play – UAS usages

4. The current generation of Unmanned Aircraft has proven its added value in defence-related operations for many years in segregated airspace. However, the increased use of UAS for military operations as well as the extension of their use to security-related, scientific and environmental monitoring missions is increasingly incompatible with the present requirement to use UAS in restricted airspace only.
5. The range of applications for UAS is expected to grow and to include capabilities such as asset monitoring and critical infrastructure protection. This will further drive the need for the next generation of long range systems, the development of efficient ways to manage them beyond line of sight in the non-segregated airspace and in the assigned area of operations.

Comply with regulations today and shape those of tomorrow

6. The main challenge leading the scope and definition of the UAS work consists in the integration of existing and future planned systems into the European Air Traffic Management System and the Single European Sky (SES). The solution lies in civil/military agreements leading to a seamless regulatory framework which is flexible enough to develop certified technology solutions meeting the regulatory demand and, at the same time, being cost effective for civil as well as military users.

7. The principle on which the regulatory infrastructure needs to be based is that civil and state Unmanned Aircraft flying over Europe will need to comply with common UAS-specific European safety objectives, including rules for operational control, qualification of ground operators, certification, and standards for secure communications links for data transfer and control.

Industrial policy considerations

8. European UAS producers have made significant progress in the development of critical technologies and in the systems integration expertise required to field mature and globally competitive UAS systems. When evaluated against the track record of Israeli and US manufacturers, studies have pointed out that European UAS producers have significant work to do to increase competitiveness in the global market (Frost and Sullivan, 2007). Furthermore, significant investment and incentives are needed from European governments to encourage and support the development of the UAS European market and a globally competitive industrial capability.

9. European industry is currently trying to catch up with non-European companies in the development of Unmanned Aircraft. Long endurance UAS will account for more than half of the expected world market until the end of the decade. Recent market forecasts estimate that UAS spending "will more than double over the next decade from current worldwide expenditures of $4.9 billion annually to $11.5 billion, totalling just over $80 billion in the next ten years" (total of ~63 bn euros for this decade; Teal Group 2010).

10. The market for UAS is by more than two thirds dominated by overseas manufacturers. This means that only a small market niche is available to the dozen European suppliers already active in the domain. Further European companies get ready to offer service based approaches, which does not necessarily imply investing in European technologies. This in turn will result in a "loss" in key technology development. Thus, Unmanned Aircraft have been identified as key drivers to the future of European industry and the European Defence Agency's *Future Air Systems work strand* is currently addressing this area.

11. Studies of the European UAS industry and market situation in Europe (Frost&Sullivan, 2007) have highlighted that the fragmentation of the European market into small national markets with favoured suppliers has inhibited innovation and weakened the business case for European companies to invest and fully commit to the development of UAS. This is particularly apparent when it comes to the civilian sector. There have been few European multi-national

investments in UAS procurement. Instead, multiple smaller national programmes have been the most popular means of procurement.

12. Contributions during the 1st UAS Panel workshop describing the economic importance and market opportunities for UAS have shown that Europe has the potential to create a strong UAS industrial (manufacturing & services) base within this strategic market if appropriate action to unlock the full potential of UAS operations is taken and supported at EU level.

The opportunity of R&D collaboration for UAS at the European level

13. Individual Member States (MS) are engaged in several multinational and national UAS development initiatives, ranging from low level Research and Technology work to Research and Development for specific UAS programmes. However, no MS can address the full range of Air Traffic Insertion activities and even so it would generate a fragmented regulatory approach leading to inefficiency. A European lead initiative should therefore be preferred. Until full UAS integration (meaning also the integration of UAS into the 'Single European Sky' concept) is not achieved, the full potential of Unmanned Technology and its applications is not fully exploited and the market for UAS will not evolve.

14. Some multilateral and joint initiatives have already been started to address the related R&D requirements on UAS. However the investments made are yet too small to effectively meet the needed work.

15. The European Commission (EC) and the European Defence Agency (EDA) already paved the way for a shared understanding on the needed UAS technologies and future concrete steps. Coordination activities between European Defence Agency and the European Space Agency (ESA) have been agreed. Several initiatives in technology development and demonstration have been set up by European Defence Agency, such as Air4All, MIDCAS, SIGAT, and EREA for UAS.

16. UAS Air Traffic Insertion as key enabler: UAS Air Traffic Insertion is a very general notion that can be realized in different ways, that is, with different UAS types, for different mission/types. The combination of UAS type and mission type is usually indicated with the term Scenario. The first step into building a system-level objective driven approach and finally programme towards ATI involves the definition of common Goals (either ultimate, or intermediate, in case a stepwise approach is chosen), each of them allowing to realise ATI in a certain number of scenarios (put another way, each goal shall involve Air Traffic Insertion at EU-level of a certain UAS type in a number of operating conditions/mission types).

17. Europe's UAS R&D action is an opportunity to strengthen the global competitiveness of its aerospace, defence and security industry sector through the development and implementation of 'break-through' technologies in an otherwise conservative aviation business. To guarantee this on a long term basis, the UAS effort should also to include the support of the highly capable European aerospace, defence and security research.

18. A civil/military approach for the coordinated R&D (covering dual use UAS for e.g. reconnaissance, surveillance and communications) presents a significant opportunity for

Member States and for the Union to address both civil and military capability needs in a coordinated, financially effective and efficient approach to the satisfaction of all stakeholders.

The need of political guidance and a shared European vision

19. There is a clear need for a political guidance if Europe is to take a position on UAS. Synergies are to be created beyond and across the traditional structures,

    - covering the use of UAS in Europe for military, civil governmental and commercial purposes,
    - shaping the European Supply side (beyond national),
    - enabling development of necessary technologies and standards to support certain market and regulatory requirements
    - creating a common European and international regulatory frame work (embedded in the 'Single-Sky' concept and coordinated internationally on this common European basis),

20. Positioning Europe in this emerging UAS market should have a global impact for the whole EU aviation sector, raising the level of competitiveness of our industry. The effects of this approach are the efficient use of existing industry capabilities and capacities, a reduction of overall development costs for UAS, the support of a long-term perspective for the European UAS market position, the support of the commercial of the shelf idea, and, finally, the ability to satisfy short notice demands for any customer or potential user.

The 5th UAS panel workshop on R&D

21. Building on the outcome of the four preceding workshops, this final workshop aims at presenting, and discussing on-going initiatives in the field of R&T&D, and taking steps in shaping a common way forward for the development and operation of UAS in Europe. The workshop will address the research and technology gaps, issues related to current UAS research priorities and subsequent investment schemes with a view to EU level coordination. This can:

    - strengthen the global competitiveness of European aerospace industry sector and create new sources of growth, as seen in the first workshop,
    - facilitate the safe and seamless insertion of UAS into European airspace as outlined in the second and third workshops
    - address the societal dimension of UAS, as presented during the fourth workshop.

22. While the production and use of UAS is no longer in its early stages, the landscape of UAS still looks like the development of aircraft one century ago: many platforms are being developed and tested all around the world. Therefore, the workshop sets out with a landscaping session listing the variety of applications of UAS and their related research needs.

Session 1: SETTING THE SCENE ON UAS APPLICATIONS IN THE NEAR FUTURE AND CORRESPONDING RESEARCH NEEDS

23. Session 1 shall make the link between civil uses of UAS, their operational limits and the corresponding research needs. There are a great number of potential applications of UAS which have not yet been envisaged. However, the current applications can be classified in the following three categories:

- **UAS for civilian use**

  The market has the potential to be as large as the one which emerged with the civilian air transport, and could lead to growth as seen in other areas of high technological developments, such as PCs and smartphones. Their use can vary from crop or farm monitoring, terrain cartography, goods transport, etc. It is expected, that a commercial market can rather quickly be developed. Such an opening of the market would however only be possible if appropriate investment in R&D will be made available and regulatory action taken.

- **UAS for security, environmental and crisis applications**

  UAS can be used to monitor borders, to detect drug trafficking, to fight against illegal immigration, or to intervene in natural or industrial disasters. They can also be sent to deliver rescue packages to ship crews in danger at sea. These UAS will need to be equipped with the adequate technology to enable them to fly alongside commercial airliners and to take off and land at airports. The presentation of state uses shall therefore highlight existing technology gaps with view to the efficient use of UAS for the above mentioned missions.

- **UAS for military applications**

  Military UAS were the first ones conceived, decades ago, with the purpose of conducting military missions (surveillance, reconnaissance, etc…) without having to risk the life of aircraft pilots on board. UAS for military applications already today fly in segregated airspace. However, airspace insertion of military platforms would provide some benefits, such as increased flexibility and would be more cost-efficient, because airspace closures would remain limited.

24. The size of UAS can vary from micro UAVs to large ones up to the size of an Airbus A320. Light UAS have probably the biggest commercial potential. However, these potentials cannot be developed without fulfilling strict safety and regulatory conditions.

25. This is precisely where public R&D funding is necessary, since industry will not invest in a domain where regulations have to be still set up by governments and end customers are not fully defined yet. Common standards are ideally developed at EU level; applications could be

developed by industry, where open competition will lead to more competitive and affordable products.

Questions to address- session 1:

- What are the constraints that prevent current regulation to be adapted to UAS?
- Provided that a self-standing regulatory framework is available or being developed, couldn't industry provide sufficient innovation on the commercial market without public support?
- What are, from a user perspective, the priorities regarding research and demonstration which would need to be carried out as a priority to achieve 'quick wins'?
- How could possible UAS users be involved in UAS technology development? How far are users ready to invest in the development of this technology?
- Is R&D driven by the regulatory framework, or will regulation derive from the results of present and future R&D?

Several developments have already been started, addressing the technical challenges of all categories of UAS, including their respective regulatory constraints. The second session focuses on this topic.

Session 2: ON-GOING R&D ACTIVITIES LINKED TO UAS TECHNOLOGIES IN EUROPE

26. This session will allow R&D actors in Europe to present their efforts regarding the scope of current UAS research, concrete research topics and projects, the level of funding, the level of ambition and the interest of their organisation in UAS R&D. The European Commission, EDA and ESA will give information on their current research programmes and studies. Industry presents its findings on global UAS research ambitions (especially with view to the main competitors, USA and Israel), and a national research agency will present its priorities and projects. This represents a unique opportunity to get an overview of various UAS related research initiatives in Europe and worldwide.

Questions to address- session 2

- What are Europe's ambitions regarding UAS research and development compared to global competitors?
- What is the balance between public/private investment in UAS R&D?
- Is the level of on-going research at industry, national and European level sufficient to enable the emergence of various uses of UAS in the short-mid and long-term?

For the continued development of UAS in Europe, it seems that more work is necessary. Not only in the area of technology development, but for instance with view to the training of UAS

crews and pilots etc…

Despite investments made to date, there are still technology gaps that prevent the widespread use of UAS in airspace. This is the focus of the third session.

Session 3: TECHNOLOGY GAPS

27. The technology gaps linked to the free use of airspace by UAS are long known. The most obvious limitation results from the absence of a human pilot on board of UAS: how to execute the function "see and avoid", how to secure the mission in case of malfunction? Recent studies resulted in a comprehensive view of the gaps, with EASA and SESAR/JU being stakeholders closer to regulatory issues. Industry and the EREA for UAS consortium will identify the gaps from a technological and industrial point of view.

Questions to address-session 3:

- Technology drives regulation and regulation drives technology development: Where are the most important technology gaps which need to be addressed to advance regulatory work? Where are the bottlenecks? Which gaps can be filled in the short, medium and long-term?
- How important is it to ensure traceability between technological capabilities and functional/operational capabilities, meaning that the technologies developed produce a benefit meeting a real demand from the user?
- How could these gaps be addressed in the near future? Is there a need for more European research or more coordination of various research initiatives? What are the ambitions of the military to close some of the identified gaps?

Session 4: FUTURE UAS R&D - TOWARDS A COORDINATED APPROACH

28. The last session is a Roundtable which brings representatives of the European Commission, the European Defence Agency, the European Space Agency, the SESAR Joint Undertaking and industry together to discuss the possibilities and opportunities of future UAS research carried out by the respective organisations. Here, especially the research priorities of the participating organisations as well as the prospects of a more coordinated approach towards a common objective – the insertion of UAS into airspace – shall be explored

Questions to address-session 4:

- Should European organisations invest more in the development of UAS?
- How can a successful coordination of R&D projects at European level be achieved?
- Which research areas are more relevant for public R&D investment? Which research domains are priorities for industry?
- What would be the benefits of a more coordinated approach to UAS R&D?

- How important is the co-ordination of civil and military research initiatives related to UAS and how could the European Framework Cooperation be used to improve civil-military UAS research coordination?
- Could the SESAR/JU be a model for UAS research coordination?