TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 4: Optimum capacity and efficiency – through global collaborative ATM
4.2: Dynamic management of special use of airspace

GERMAN ACTIVITIES RELATED TO REMOTELY PILOTED AIRCRAFT SYSTEMS (RPAS)

(Presented by Germany)

1. INTRODUCTION (INCLUDING LEGAL GROUNDS/CONDITIONS IN GERMANY)

1.1 In Germany, the civil operation of remotely piloted aircraft systems (RPAS) in principle requires permission of the authorities according to the German Aviation Regulation's provisions on RPAS published in January 2010 (German Aviation Regulation (LuftVO) Article 15a, 16 and 16a) and is regulated as follows:

a) RPAS may be operated in Germany if the maximum weight does not exceed 25 kg and the RPA is operated in the visual line of sight of the operator. To qualify as the visual line of sight, the operator must have an unaided view of the unmanned aircraft. Optical instruments (e.g. binoculars) are not allowed. The individual aeronautical authorities of the German Federal States are responsible for granting permission for the operation of RPAS in the visual line of sight. It is the responsibility of these authorities to define additional requirements (e.g. not flying over populated areas) for the permission to operate; and

b) additionally, RPAS weighing more than 25 kg, or those operated outside the visual line of sight may be operated in segregated airspace and in an aerodrome traffic circuit if the following requirements are met. These flights require an additional permit from the responsible Federal State authorities. Additionally, permission must be granted by the aerodrome operators and/or the authority responsible for the segregated airspace (e.g. military authorities). As RPAS flights are generally prohibited in Germany, it has not yet been necessary to develop regulations for certification and type design. The Ministry of Transport, Building and Urban Development in Germany and the individual Federal States will coordinate further procedures with the aim to assure that common rules for operating RPAS apply throughout German airspace.

1.2 At the beginning of 2012, the German Aviation Act (LuftVG) was amended to include RPAS as aircraft in Article 1 giving RPAS a legal status as one class of airspace user. The German law defines RPAS as unmanned aircraft, which are not operated for the purpose of sport or recreational activity, meaning, in particular, that their use is connected to other civilian –especially commercial – purposes (see Article 1, paragraph 2, sentence 3 LuftVG).This change opens the door for further activities to be started so that RPAS have the same rights and obligations as manned aircraft. Based on this change of the aviation act, subsidiary laws and regulations can be adapted to provide the legal background for the future integration of RPAS into national airspace and for certification and type design issues. However, to

allow the medium- or long-term adaptation of laws and regulations, the experience with the operation of RPAS is not yet large enough in order for them to include the requirements for their safe operation. Hence, the close cooperation of the manufacturing industry is required and it should propose harmonized recommendations of standards on the technical and operational requirements for the safe operation of RPAS.

2. ACTIVITIES

2.1 Civil perspective (including research projects such as SAAFu)

2.1.1 Over the past few years, the Federal Republic of Germany has conducted intense research on the topic of RPAS with the support of various ministries. Technical questions about the development of RPAS were looked into as well as questions as to how these aircraft would be integrated into airspace beyond segregated areas. Other topics that were investigated were sensor systems, collision warning and avoidance and encounters with large flocks of birds.

2.1.2 Investigations carried out in collaboration with the German ANSP, DFS Deutsche Flugsicherung, soon focussed on the airspace integration issues. This research was used both as preparation for the purchase of the military RPAS Euro Hawk (German version of the US Global Hawk) as well as for possible integration of RPAS used for civilian purposes.

2.2 Military perspective

2.2.1 After the contract for procurement of the Euro Hawk Full Scale Demonstrator (FSD) was finalized, the risk assessment process was started. Initiated by a series of civil-military workshops, a full-scale safety analysis managed by an experienced contractor was conducted over a period of more than three years. One of the major risks identified was the violation of the restricted airspace established for approach and departure procedures of RPAS below Flight Level 100. In this respect, the civil research project Sense and Avoid Function (SAAFu) System provided an opportunity to mitigate this risk. For the procedural integration of SAAFu, Germany used the ICAO provisions established for ACAS Resolution Advisories in the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) to define the responsibility of ATC personnel when a SAAFu initiated avoidance action is taken by the pilot. In addition to airborne collision avoidance system (ACAS), SAAFu is also capable of displaying information based on purely primary radar data as well as providing lateral and vertical avoidance information.

2.2.2 Procedures for regular flight operations as well as contingency measures for the Euro Hawk were laid down in a Letter of Agreement signed by all stakeholders (ANSP, regulatory authorities, manufacturers and military operators). These stakeholders remain in constant contact as part of a formalized lessons learned and improvement programme. Any changes to established procedures have to be approved by all civil and military parties before being incorporated into the Letter of Agreement.

3. INTEGRATION OF RPA INTO GERMAN AIRSPACE USING THE RPAS EURO HAWK AS AN EXAMPLE FOR CIVIL MILITARY COOPERATION

3.1 General

3.1.1 The Safety Case for the RPAS EURO HAWK is Germany’s initial step to develop procedures concerning the integration of an unmanned aircraft in the complex and rather dense German airspace. This safety case will also serve as a baseline to enable the integration of other civil and military

RPAS. It will not preclude the necessary law making process or the alignment of German regulations with those developed by European or other international bodies.

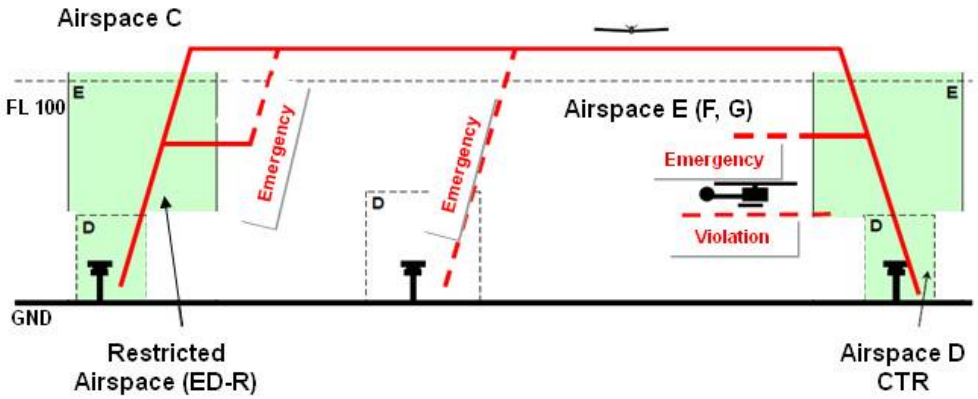
3.2 **Procedure**

3.2.1 In preparation for the purchase of the Euro Hawk, two real-time simulations with air traffic controllers were carried out, which took a closer look at the integration of RPAS into Class C airspace as well as emergency procedures for the unmanned aircraft. The investigations showed that the integration into controlled airspace is generally possible. This formed the basis for the safety assessment for the integration of the Euro Hawk Full-Scale Demonstrator.

3.2.2 In collaboration with aviation industry partners, a proposal was developed and tested to integrate civil RPAS by providing the pilot with the traffic situation on a screen in the ground station which uses radar data of the ANSP as its basis. Using radar data, a SAAFu System from the ESG Company has been successfully tested, which increases the situational awareness of the RPA pilot and assists the pilot to stay clear of other aircraft as applicable. This integration proposal has undergone a safety analysis which had positive results as well. Based on the successful test flights, the SAAFu System was used at the ground station of the Euro Hawk during the ferry flight from Edwards AFB, USA, to Ingolstadt, Germany.

3.2.3 The Euro Hawk is a high-altitude (FL 450+), long-endurance (up to 36 hrs) RPAS used to gather and analyse electronic signals (SIGINT). Until now, one flight has been conducted in German airspace when the aircraft was flown from Edwards AFB, USA, to Ingolstadt, Germany on 21 July 2011. The first operational flight test is expected to take place in the beginning of 2013. Air traffic control will treat the Euro Hawk like any manned aircraft and expects it to perform like a manned aircraft. Air traffic control services will be provided in accordance with ICAO Annex 11 for the respective airspace. Each Euro Hawk flight is conducted as an IFR OAT flight. The pilot has an IFR license and will use IFR procedures just like manned aircraft. The military unit WTD 61 ML is responsible for the airworthiness certificate and type certification. Its air navigation equipment generally conforms to the standards required for manned aircraft operating in the respective airspace classes. With the exception of certain emergency situations, there will be no purely autonomous operation; intervening action by the pilot will always be possible. Special emergency procedures, e.g. for loss of data link, have been defined. Separation from other aircraft is maintained by increased vertical and radar separation minima. The LOSTCOM procedure in case of additional failure of the pilot-controller ground to ground communication is the same procedure that applies to manned aircraft.

3.2.4 Schematic illustration of the flight profile:



3.3 Safety assessment requirements

3.3.1 The joint DFS/MOD safety assessment provides the necessary safety documentation as required by the European Commission Implementing Regulations. Furthermore, it states that an integration of the Euro Hawk into German Class C airspace may be possible, whilst achieving acceptable safety levels. The emergency situations illustrated in the diagram, which would require the RPAS to leave the airspace originally planned for operations, have been assessed to be extremely unlikely. As a result of the safety assessment, three Safety Mitigations were defined:

3.3.2 Safety mitigations:

a) separation of the Euro Hawk from VFR traffic must be maintained by establishing temporary restricted airspace in airspace Classes D to G, where VFR traffic is not permitted during RPAS operation;

b) a telephone connection between the RPAS pilot and all involved ATC units must be established and tested before each flight as fall-back for a satellite connection failure; and

c) an air situation display must be implemented during the arrival and departure phases below Class C airspace by means of the Sense and Avoid Assistance Function (SAAFu) to support situational awareness of the pilot-in-command and support evasive measures.

4. THE WAY AHEAD

4.1 The project integrating RPAS into national airspace was and still is a great challenge to everybody involved. One of the main issues has been to try to adhere as closely as possible to general provisions governing the use of airspace, particularly ICAO SARPs, at a time when provisions for RPAS did not exist yet. Germany believes that, at this point, the project has reached a degree of maturity that allows a conditional integration into non-segregated airspace which fulfils international safety requirements and is basically in line with current ICAO rules including the additional provisions mandated by Amendment 43 to ICAO Annex 2.

4.2 The central conclusion from our national safety case that allowed the integration of the Euro Hawk into Class C airspace is that - due to the general provision of ATC separation within this airspace – the lack of an additional detect-and-avoid capability was deemed acceptable. Germany will gather further experiences when the flight programme commences in 2013. Following this, the safety case in general and the assumptions of the safety case in particular have to be validated. Even though the safety case was specifically tailored to the Euro Hawk FSD, the intention is to apply the results to other RPAS as well. For this purpose, Germany will develop criteria for RPAS performance that have to be met in order to fulfil the requirements for the integration into non-segregated airspace. Our current assessment is that such a broader application of the safety case will at least be possible for HALE type RPAS. The integration of MALE type RPAS will be the next hurdle on the way towards fully integrated RPAS operations. As a more speculative glimpse into the future it is foreseen that, following a declaration of a more universal applicability of the safety case, there will be widespread interest by civil operators for a variety of civil RPAS applications.

4.3 The Conference is invited to take note of the contents of this paper.

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