UNMANNED AIRCRAFT SYSTEMS (UAS)

PRIDA ABIDJAN MARCH 19-21 2024

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Objective

To understand the operation of Unmanned Aircraft Systems (UAS) with emphasis on Remotely Piloted Aircraft (RPAS)

Introduction

- Unmanned aircraft system (UAS) is an aircraft and its associated elements which are operated with no pilot on board.

- UAS are all aircraft flown without a pilot on board that operate as part of a larger system and includes, Remotely Piloted Aircraft System (RPAS), autonomous aircraft and model aircraft.

- Autonomous aircraft do not permit intervention of a human pilot and model aircraft are for recreational use.

- RPAS can be remotely controlled from another place (ground, another aircraft, space) or be pre-programmed to conduct autonomous flight.
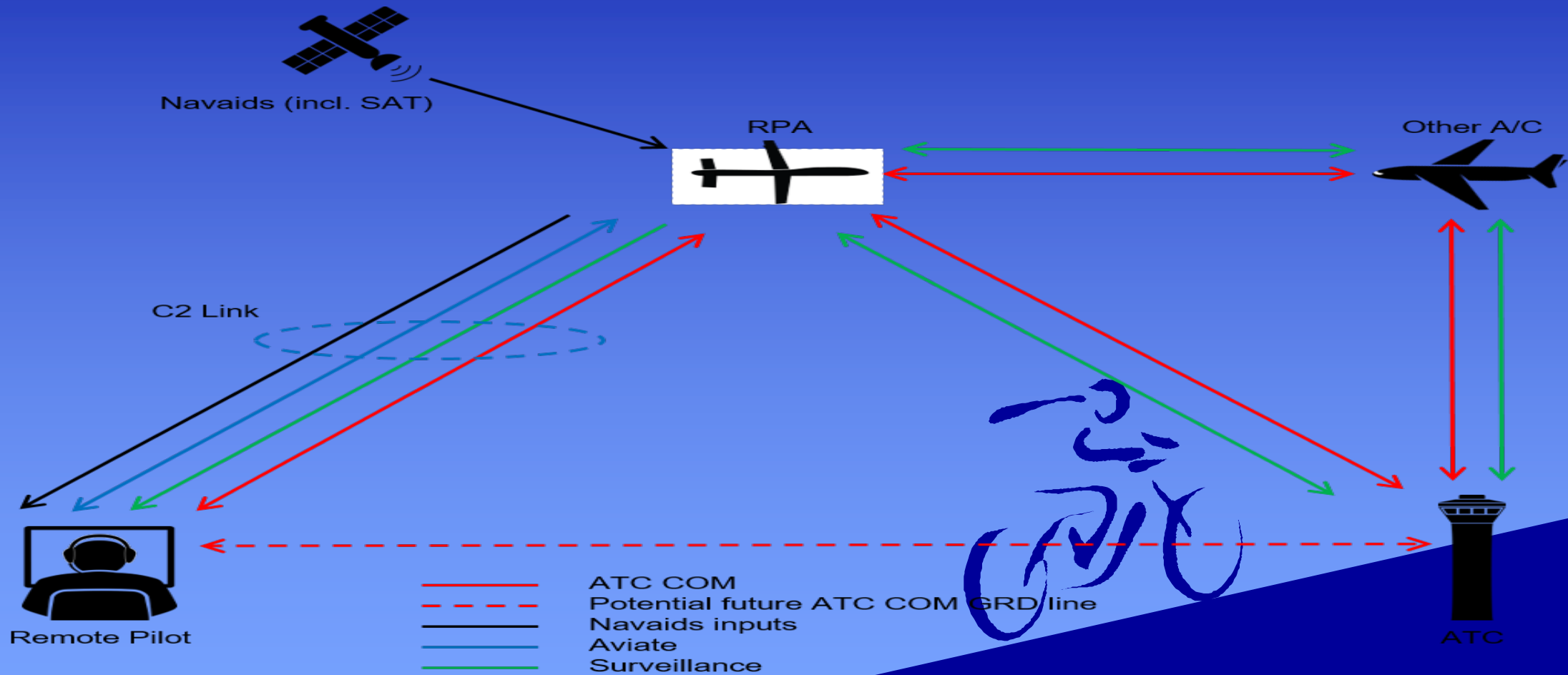
Introduction

- Safely integrating UAS in non-segregated airspace - similarity with manned aircraft requires a link to air traffic control (ATC).

- The performance, transaction time, continuity of the communications link and timeliness of the aircraft's response are important.

- RPA - should have a licensed "remote pilot" situated at a "remote station" external to the aircraft who has responsibility over UAS, monitor all the time and responds to instructions via voice or data link.

- RPA - various types of auto-pilot technology but allows remote pilot to intervene at any time .

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Components of UAS

Navaids (incl. SAT)

RPA

Other A/C

C2 Link

Remote Pilot

ATC

|	ATC COM
	Potential future ATC COM GRD line
	Navaids inputs
	Aviate
	Surveillance

Components of UAS

- RPAS comprises an RPA, its associated RPS, the required C2 links and Software, health monitoring, ATC equipment, a flight termination system, and launch and recovery elements as necessary

- Detect and avoid (DAA), command and control, ATC Communications, and prevention of harmful interference ensure safety.

- The RPS consists of the equipment used to command, control and monitor flight of the RPA- range from simple hand-held devices to complex, networked, multi-console systems.

- Radio line of sight (RLOS) has transmitter(s) and receiver(s) within mutual radio link coverage and thus communicate directly or through a terrestrial network and forms Visual line-of-sight (VLOS) operations.

- Beyond visual line-of-sight (BVLOS) operations use Beyond Radio line of sight (BRLOS) - satellite systems or an RPS communicates with one or more ground stations via a terrestrial network.

UAS Operations

- RPAS in international airspace under Instrument Flight Rules (IFR) should allow Safe, seamless and efficient end-to-end operations for all

- RPAS conducting IFR operations must communicate with ATC while in controlled airspace.

- Traditional air-ground VHF radio or other means, such as satellite or terrestrial relays, data communications or internet-based systems are used for consistency.

- Prior to 2024, IFR capable RPA were accommodated in controlled airspace using specialized, enabling techniques.

- RPAS operations are expected to begin integration by 2025.

- Pilots utilize a command and control system, data links and other elements to connect the RPS to the RPA.
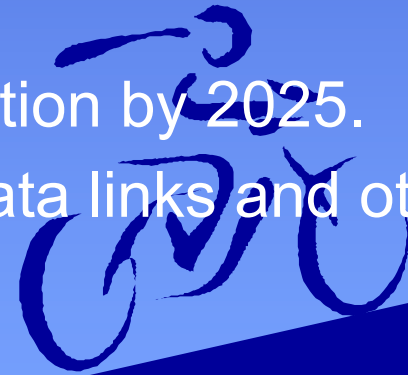
C2 Frequency bands

- 5 030 – 5 091 MHz allocated to AM(R)S and AMS(R)S may be used for provision of both the terrestrial and the satellite C2 Link.

- Systems providing satellite service are not currently available in this band.

- A number of frequency bands in the FSS are also being considered for the provision of the C2 Link.

- The FSS has an abundance of satellite networks in these non safety of life frequency bands.

- The ITU WRC-15 developed Resolution 155, allocating the FSS for use by the RPAS control and non-payload communications (CNPC) , subject to a number of conditions.

- Aeronautical proponents were uncomfortable to use non safety of life bands for C2 whereas the FSS world feared being limited so as to accomodate Safety of life operations.

UAS Applications

- Commercial, scientific and security applications e.g. Border and maritime patrol, search and rescue, fishery protection.

- Forest fire detection, natural disaster monitoring, contamination measurement, Airport and Road traffic surveillance, power and pipeline inspection, earth observation, agricultural fertiliser, chemical application, small package and bulk cargo transport.

- Emergency response, delivery of medications and medical equipment.

- Enabling data communication and broadcast of information in remote areas.

- Photography, videography, cinematography and cartographic survey.

UAS Regulation

UA are subject to the provisions of Article 8 of the Chicago Convention on ICAO:

- " No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization.

- Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".

- Remotely controlled and uncontrolled (autonomous) aircraft were already in existence at the time of the First World War, operated by both civil and military entities.

- RPAS regulations address the protection of society from mid-air collisions (MACs) and crashes.

UAS Regulation

- For integration into non segregated, existing aviation system:

- RPAS operator must hold an RPAS operator certificate and have obtained special authorization from all affected States;

- RPA must hold a valid certificate of airworthiness for the approved type design and must be compatible to civil aircraft;

- RPA must meet the Communications, Navigations and Surveillance (CNS) requirements for the airspace in which it flies and use compliant flight plans.

- Remote pilot(s) must hold valid licences appropriate to the RPA and RPS .

- RPAS must meet the DAA capability requirements for the airspace in which it flies and the operations to be performed.

- In order for RPAS to be widely accepted, they will have to be integrated into the existing aviation system without negatively affecting manned aviation.

UAS Regulation

- For integration at non-segregated aerodrome, the remote pilot must be licensed and only one RPA may be controlled by an RPS at any given time.

- Processes and procedures applied to manned aircraft: type design and production approval, continuing airworthiness, modiifications or alterations of aeronautical products are applicable to RPAS.

- The RPA must comply with existing ATM procedures or new ones should be considered by the aviation authorities in consultation with the RPAS operator and other airspace user groups.

- Any new ATM procedures should be consistent with those for manned flights to minimize disruption of the ATM system.

- Integration of RPA into aerodrome operations will require the remote pilot to identify, in real-time, the physical layout of the aerodrome and associated equipment so as to manoeuvre the aircraft safely and correctly.
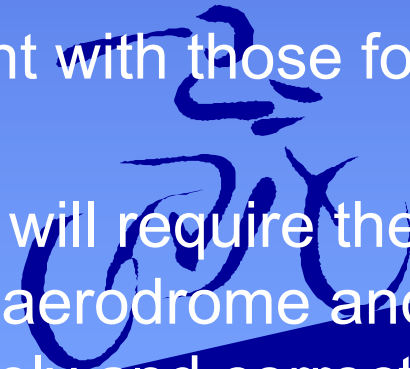
Conclusion

- UAS have been in operation for many years but were segregated from manned Aircraft.

- Increase in numbers and uses has forced all stakeholders to consider the need for integration of UAS into operational Airspaces.

- ICAO and ITU have been involved in the facilitation and regulation of UAS driven by industry, by discussing regulation and frequency allocations to allow unsegregated Airspace operations to make it more economical for RPAS.

- The integration of RPA in non-segregated airspace will be a gradual process that builds upon technological advances and development of associated procedures.

- The process begins with limited access to airspace, and while some RPA may eventually be able to seamlessly integrate with manned flights, many may not.

References

- ICAO RPAS Concept of operations
- ICAO DOC 4053 and 10019 Manual on RPAS
- ICAO Circular 328 on UAS
- ICAO Annex 2 Rules of the Air
- ICAO Annex 8 Airworthiness of Aircraft
- ITU Radio Regulations

THANK YOU