E4U Workshop #1
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TASK 4
UAS Air Traffic Insertion

Task4 Team: Claude Le Tallec (ONERA) + FOI and DLR

EREA Association of European Research Establishments in Aeronautics

UAS Air Traffic Insertion

Task 4 – Transversal issues (ONERA)

- T4.1 - Ground Station and Human machine Interface (DLR)
- T4.2 - Radio bandwidth allocation (FOI)
- T4.3 - Cyber security (Onera)

T4.1 - Ground Station (**RPS**) and Human machine Interface (DLR)

- Parallel tasks to be performed
- Special HMI required, situation awareness
- No copy of aircraft cockpit
- No computer station
- Mission and flight hardware oriented
- Use of generic modules

T4.1 relevant projects

- PPlane, OPARUS
- USICO
- MidCAS

T4.1 relevant results (so far)

- Analysis of current RPS, their advantages and disadvantages
- Definition of RPS modules and units
- Definition of RPS hardware elements
- Definition of HMI elements and necessary improvements
- Operational experience feedback

T4.1 Current challenges

- Ergonomic and intuitive HMI
- Stable and manipulation-resistant data links
- Stream down bandwidth requirements
- Emergency Systems with efficient planning and error detection capabilities
- Taxi Manoeuvres on the airport area

T4.1 Current challenges

Only 1 sense?

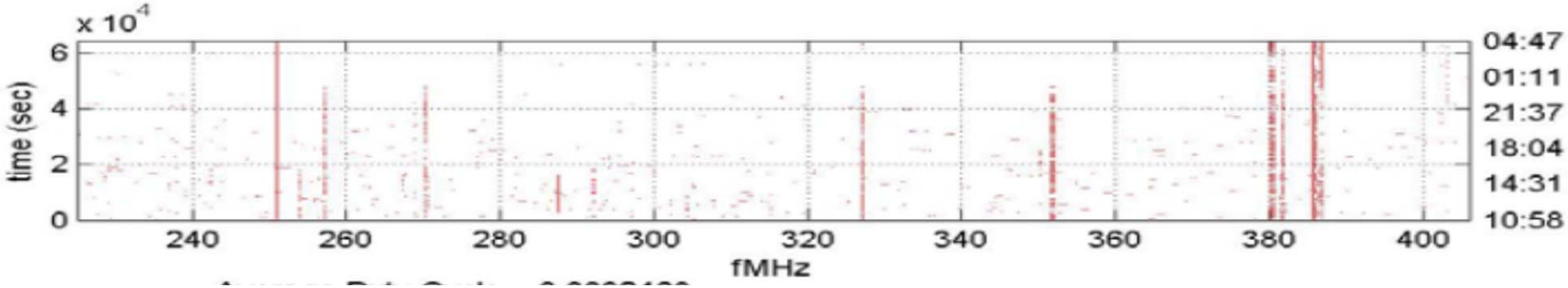
- You ***can't hear*** the engine rpm fluctuating
- You ***can't feel*** vibrations, accelerations or motion
- You ***can't smell*** the fuel leak
- You ***can't taste*** the electrical fire
- AND, you ***lose vision*** in one eye, 30º FOV!
- WELCOME to UAS flying!

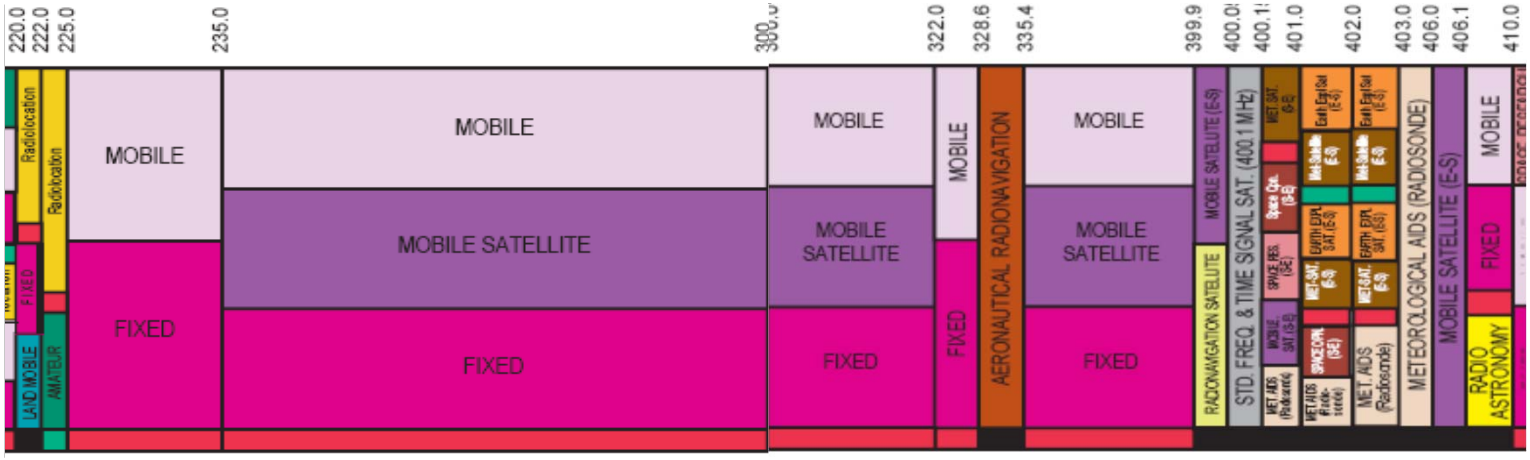
Mark Pestana, NASA Flight Research Center

T4.2 Radio bandwidth allocation (FOI)

- Frequency spectrum limited (physical, econ., adm.)
  - Mobile data comm. require more bandwidth
  - Military and other non-commercial uses threatened
- Existing system use the allocated spectrum inefficient

T4.2 Radio bandwidth allocation
Usage between 220-410 MHz





usage = 0.92% !

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T4.2 Radio bandwidth allocation (FOI)

- A UAS link demands high capacity, long distance and robust transmission → much bandwidth
  - Hard to allocate
- Dynamic Spectrum Access (DSA) might be the answer
  - Unexplored on airborne platforms

T4.2 relevant projects

- Air4All
- SIGAT
- Faradays (Radar usage)

T4.3 Cyber security (Onera)

- UAS will have to use specific and open world communication means for the links
- To protect the UAS against malicious attacks, cyber security functions have to be developed and implemented on onboard servers and routers and in the remote pilot station
- As onboard systems are operating remotely, without system operator to monitor the situation, specific protections have to be developed
- They can be derived from current manned aviation systems such as VPN, segregated users access and coded communications

T4.3 relevant projects

- Eurocae WG73 SG3
  - **Radio Spectrum Requirements**
    - *protocol overhead factors*
    - *Packet header lengths*
    - *Encryption overhead*
  - **Requirements for Providing a Safe and Secure Communication for UAS (mostly jamming)**
    - *Produce a trade-off of necessary effort vs. advantage for secure communication in assumed scenarios*
    - *Show the most efficient ways to achieve Communications Security under the assumed scenario*

T4.3 relevant projects

- SIGAT
  - Projected security requirement to be allocated to UAS Data-Link
  - Encryption overhead needs
    - Digital signature algorithm
    - Advanced encryption standard
    - Internet Protocol Security
  - Transmission security

T4.3 relevant projects

- IDEAS
  - BLOS terminal features to minimize jamming

T4.3 relevant results (so far)

- Eurocae WG73 SG3
  - Standard including security requirements (date?)
  - Budget to be considered to secure data link
- SIGAT
  - Budget to be considered to secure data link

T4.3 Current challenges

- Make data link secure in the current context of higher rates of cyber attack
- UAS may be particularly victims of cyber attacks due to high media impact