



***SAT-Rdmp Kick-off Meeting***

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# **Towards the Future Air Transport System**

**EREA, ARG, ACARE – positions, SRA next**

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**This presentation is elaborated basing on**

***„EREA vision for the future – Towards the future generation of Air Transport System” - EREA***



## EREA

**The Association of European Research Establishments in Aeronautics created in 1994 with the objectives of ;**

- **Intensifying the co-operation between its members**
- **Increasing integration activities in the field of civil, military and space relating aeronautics**
- **Improving co-operation with third parties in the field of aeronautics**
- **Facilitating an integrated management of joint activities**

## Full Members :

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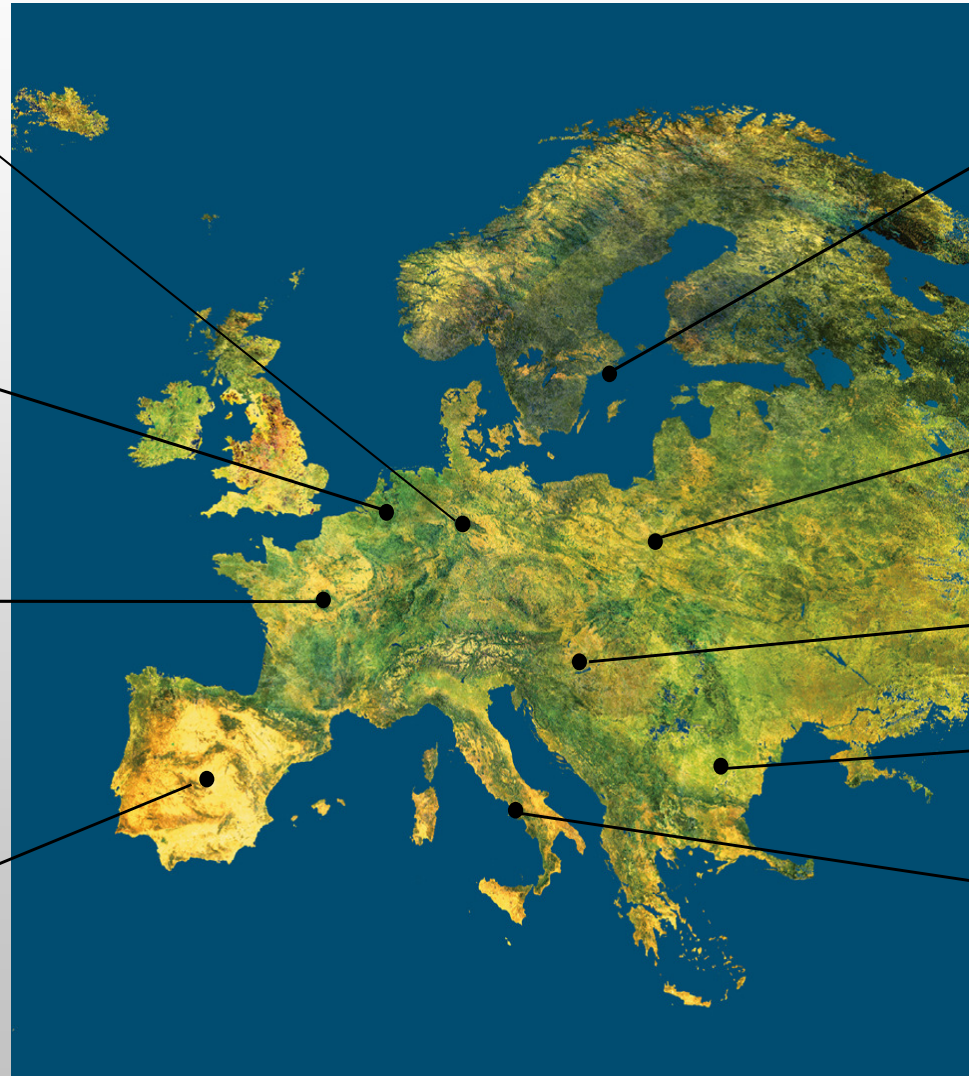
## Associate Members

<b>AIT</b>	<b>A</b> ustrian <b>I</b> nstitut of <b>T</b> echnology
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## **Towards the Future Air Transport System**

## **THE MAIN QUESTIONS:**

**How will ATS look till 2050 ?**

**What kind of challenges should we expect in next decades ?**

**What research is needed to pave the way of ATS till 2050 ?**

## **Four 2050 AVIATION SCENARIOS** **have been investigated**

- 1. „Unlimited Skies” ( ULS )**
- 2. „Regulatory Push & Pull” ( RPP )**
- 3. „Down to Earth” ( DTE )**
- 4. „Fractured World” ( FW )**



## **The first scenario: „Unlimited Skies” ( ULS )**

**World will be not fundamentally constrained  
by energy availability**

***Aviation undergoes explosive growth, with the development  
of many different types of aircrafts***

## „Unlimited Skies” ( ULS )



## The second scenario: „Regulatory Push & Pull” ( RPP )

**World will be constrained by energy availability**

**( cost and availability of fossil fuels becomes a deterrent )**

**Constrains are primarily in terms of energy and the environment**

***World will be dominated by electricity produced by nuclear plants, wind and solar power and any other technologies using natural resources***



## „Regulatory Push & Pull” ( RPP )



## The third scenario: „Down to Earth” ( DTE )

**There will be a political commitment  
to eliminate fossil fuels usage.**

***These fuels are not necessarily depleted , but society has decided to stop  
tapping nature and freezing remaining reserves as they are.***

## „Down to Earth” ( DTE )



## **The fourth scenario: „Fractured World” ( FW )**

**The World will be divided into very distinct blocs following major political and economic crises.**

***Caused by inequality in relation to the consequences of „global warming” and access to the energy .***

***All scenarios should be considered ( depends of blocs/areas )***



## „Fractured World” ( FW )





## How&Where should we drift ?

1. **Achiving full automation and 4D (3D + time), contract, as the only way to prevent the saturation of growing air traffic**
  - Each aircraft linked by a 4D contract with the control authority or in free flight is cotrolled by automated system
  - People will not be out of the loop
  - Enabling managing the unforeseen situations
  - No longer pilots in commercial airplanes ( onboard only responsible person )
  - PAT – full automation type management ( occupants choose a destination )
  - Aircraft designed without cocpit

### Advantages:

- Increasing in safety within traffic expansion ( traffic more predictable )
- Reducing fuel consumption
- Make air transport more cost-effective
- For PAT – helps shift some traffic from jammed roads to individual aerial vehicles

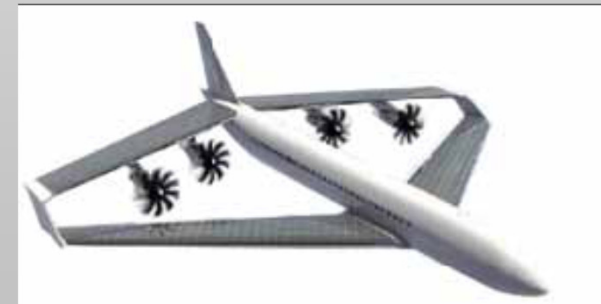
## How&Where should we drift ?

### 2. Developing new radical and revolutionary configurations

- Blended Wing Body, ultra-fast rotorcraft, tiltrotors
- Airplanes with rhombohedral wings, trisurface or infinite aspect ratio wings
- Morphing structures ( adopting structure geom. during different flight phases )
- Application of smart and elastic, aging-tolerant materials
- Application of MEMS ( eg. active airflow control devices )
- Application of micro-intelligent sensors
- Application of nano-technologies

#### Advantages:

- Better aerodynamic properties
- Reducing consumption of fuel
- Better mix of passengers and freight
- Decreasing of weight of the aircraft's structure
- Decreasing noise emission



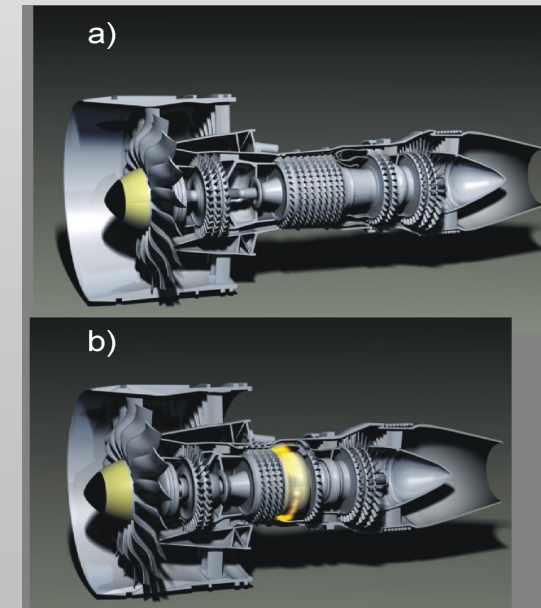
## How&Where should we drift ?

### 3. Developing new revolutionary propulsion systems

- Applying source that does not release CO<sub>2</sub> and NO<sub>x</sub>
- Developing technologies enabling the use hydrogen-based fuel
- Developing technology for production hydrogen and easy capturable
- RDC engines
- High-efficiency electric motors ( super conductors needed)
- Propeller-based propulsion ( contra-rotating layouts)
- Fuel cells

#### Advantages:

- Reducing CO<sub>2</sub> and NO<sub>x</sub> emission
- Reducing consumption of fuel
- Reducing of noise emission
- Reducing non regulated Hn Cm ( hydro-carbons )
- Reducing contrails



## How&Where should we drift ?

### 4. Developing new airports infrastructure

- Point to Point or Hub & Spoke .....or Mixed System
- Emission neutral, especially for CO2
- Construction without using „dirty” techniques and materials
- Airports within a multimodal transport network including roads and railways
- Local energy production for the entire platform
- Location away from city centers but well connected with them
- Airplanes should avoid taxing to reach the runway ( eg. automated tractors )
- Take-off assistance systems
- Boarding via integral passenger modules
- More efficient distribution of payloads between passengers and freight

### Advantages:

- Emission friendly airports
- Reducing consumption of fuel
- Increasing time efficiency
- Ensuring passenger satisfaction and safety

# How&Where should we drift ?

## 5. Personel Air Transport System

- Integration with Commercial Air Transport and other Transportation Systems
- Very short or vertical take-off and landing
- Free flights cotrolled by automated system
- Shifting passengeres from cars to PAT
- 4D contracted flights
- No pilot required
- No cocpit
- New configurations of structures
- New technologies / materials / acquisition systems
- Electric / hydrogen / other / propulsion systems
- Counter rotating open rotors



### Advantages:

- improvement efficiency of ATS
- improvement of users satisfaction

## Areas in which research works are needed:

- 1. The electric aircraft*
- 2. Innovative aircraft configurations*
- 3. Towards environmentally friendly propulsion systems*
- 4. Towards carbon-neutral and emission friendly airports*
- 5. The complete automation of Air Traffic*
- 6. Net-centric acquisition system*





BEZZAŁOGOWY SAMOŁOT  
STRATOSFERYCZNY

**Thank you for your attention**

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