

DEVELOPMENT OF COMMON ATC SIMULATION TRAINING ASSESSMENT CRITERIA BASED ON FUTURE PAN EUROPEAN SINGLE-SKY TARGETS (ATCOSIMA): A PROJECT OVERVIEW

by

Dr. Cem Çetek, Dr. Biljana Juričić, Dr. Thomas Feuerle, Dr. Tomislav Radišić



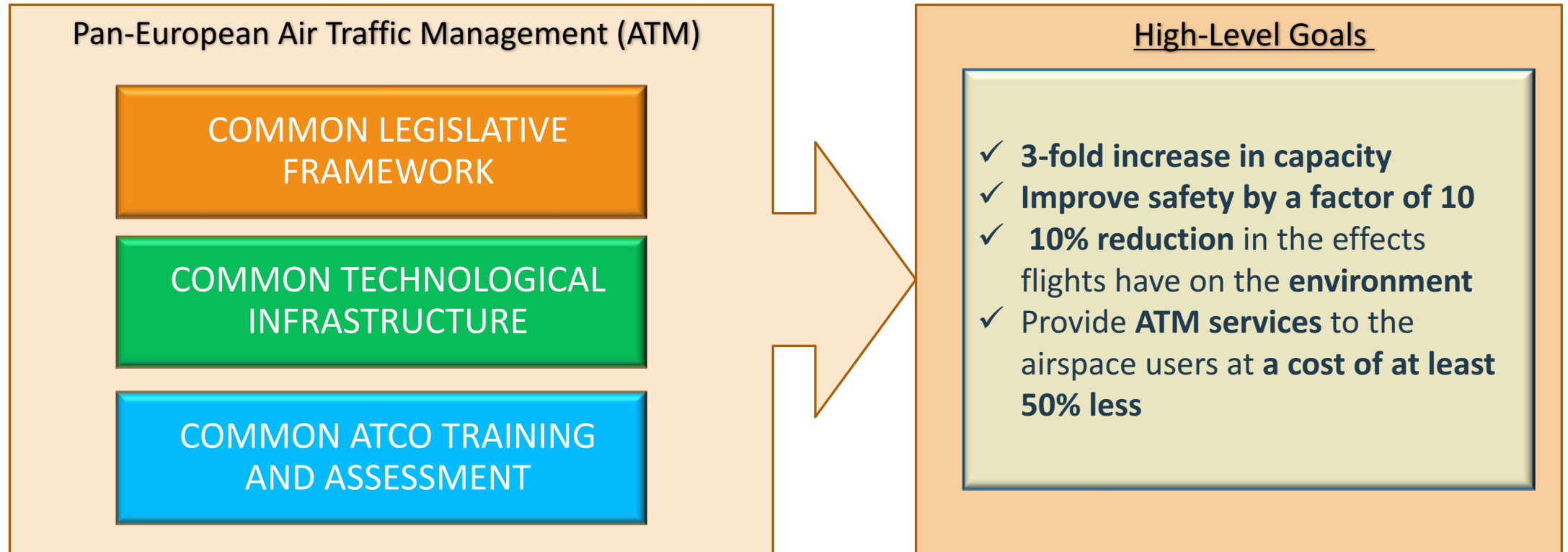
Introduction

- ✓ European Airspace accommodates one of the densest air traffic volumes in the world:
 - ✓ More than 11 million flights in EUROCONTROL NM Area in 2018*
 - ✓ Expected to be multiplied by 1.2 to 1.8 by 2025**
 - ✓ Handled by 37 ANSPs
 - ✓ ‘Fragmented’ structure leads to deficiencies in air traffic flow and capacity management.
- ✓ In 2004, European Union (EU) launched Single European Sky (SES) initiative which aims to organize European Airspace according to air traffic flows rather than national boundaries***.
- ✓ SES provides a legislative framework towards integrated airspace and air traffic management (ATM) across the Europe.
- ✓ Supported by Single European Sky ATM Research (SESAR) Joint Undertaking focusing on the technological dimensions of integrated European ATM system through coordinating and conducting innovative research and development efforts.



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Motivation



Air Traffic Controllers (ATCOs)

- ✓ ATCOs are responsible for:
 - ✓ Maintaining safe, orderly and expeditious air traffic flow within the airspace
 - ✓ planning, monitoring, controlling, coordination, communication, aircraft conflict detection and resolution tasks
- ✓ ATCO is considered as one of the most stressful professions in the world*
- ✓ The nature of their role switches dramatically from:
 - ✓ A labor-intensive one to a more technology-intensive one with increasing automation,
 - ✓ But they will remain as the key component of this integrated ATM system



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ATCO Training

CONTENT

- ✓ A combination of intensive theoretical and practical training
- ✓ Consists of three phases: **Initial training**, **Unit training** and **Continuation training**
- ✓ Initial training includes **basic training** and **generic rating training** stages to prepare ATCo candidates for next and more specific training stages at operational ATC facilities.
- ✓ **Basic training** stage in the initial phase has a special importance:
 - ✓ Imparts fundamental knowledge through theoretical classes
 - ✓ Develops the required skills through practical classes using **ATC simulators**
 - ✓ The main elements of course, content and methods are defined within EUROCONTROL Common Core Content* and EU REG 2015/340 document**

PROBLEMS

- ✓ The basic training practices differ in every country in terms of:
 - ✓ Study mode i.e.: vocational vs academic training
 - ✓ Training hours, frequencies and percent shares, number of exercises, depth and breadth of theoretical and practical parts
 - ✓ No commonly agreed framework for assessment criteria especially for the practical parts of ATCo basic training
- ✓ Basic training documents:
 - ✓ No standard metrics and scoring for the assessment process especially for simulation training
 - ✓ Not address how to improve training and assessment to comply with SES targets regarding efficiency and economics of traffic flow.



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Previous Studies

✓ Wickens et al (1997):

- ✓ Evaluations of skills regarding air traffic separation, control judgement, implementation of methods and procedures, equipment usage, communication and coordination
- ✓ Based on the safety and controller work-load precepts such as number and duration of airborne conflicts, occupancy, number and duration of ground-to-air communications etc.

✓ Manning (2000)

- ✓ The performance measurement of ATCo candidates based on over-the-shoulder (OTS) rating scale, count of mistake and counts of actions that would be required to move aircraft from the sector at the end of the scenario

✓ Several projects (BENT-PAC, CAST etc) in 1990s-2000s

- ✓ Addressed requirements and guidelines for the initial training of future ATCo candidates according to change in the task due to technological advancements in ATM

✓ Updegrove and Jafer (2017):

- ✓ Made recommendations regarding the inclusion of instructor support technologies such as intelligent tutoring systems to expedite adaptation of trainees to more complex traffic scenarios

✓ Coyne et al (2017):

- ✓ Evaluated perception of students on the use of ATC simulations to provide feedback to FAA authorized Air Traffic Collegiate Training Initiative (AC-CTI) Programs.

✓ Chhaya et al (2018):

- ✓ Proposed a scenario exploration technology platform to allow trainees and instructors to exercise wide range of simulation scenarios.

✓ Falkland and Wiggins (2019)

- ✓ examined the role of cross-task cue utilization in the situational awareness such that perception, comprehension and prediction skills of students for initial stages of ATC simulation training.

✓ Bernhardt et al (2019)

- ✓ studied workload and engagement metrics of ATCo students during radar approach simulations across different scenario difficulties and experience levels using EEG and pupil diameter measurements



Project Description

Funded by the Erasmus+ Program of the European Union within the KA2 Cooperation Innovation and the Exchange of Good Practices/KA203 Strategic Partnership for Higher Education.

- ✓ The primary objectives of ATCOSIMA:
 - ✓ Develop common assessment criteria for simulation training courses within the ATCo basic training in order to improve students' competencies regarding working effectively and in harmony within the integrated Pan-European air traffic system;
 - ✓ Improve metrics and scoring tools for the evaluations of students according to SESAR's future targets and provide guidelines and recommended practices for enhanced ATCo training across the Europe.
- ✓ The project has been conducted by three higher education institutions including Faculty of Aeronautics and Astronautics at Eskisehir Technical University (ESTU), Faculty of Transport and Traffic Science at University of Zagreb (ZFOT) and Institute of Flight Guidance at Technische Universität Braunschweig (TUBS).
- ✓ The project proposes an innovative approach to measure the performance of ATCo trainees in radar approach simulations based on integrated **ATC radar and flight cockpit** simulations.



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Expected Contributions

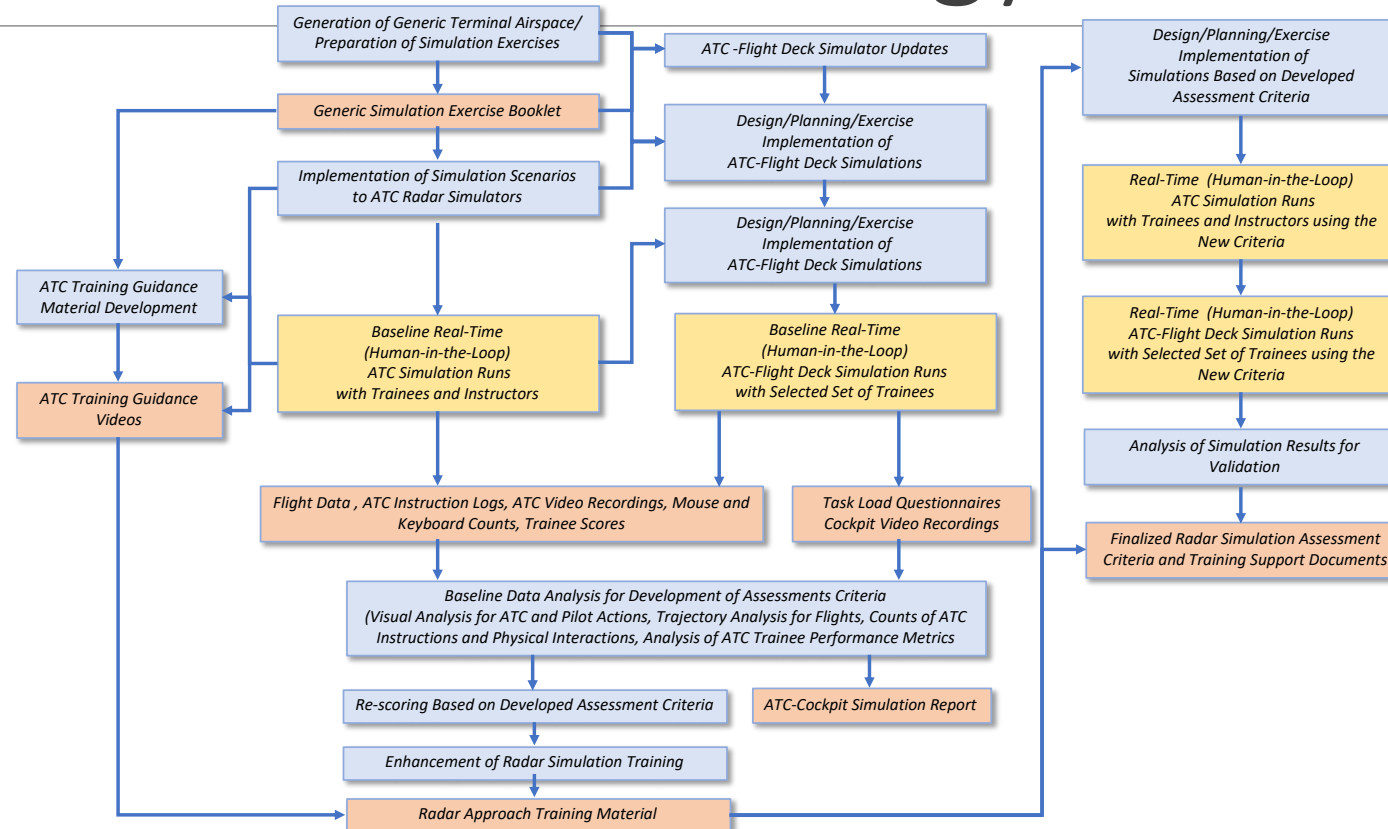
The development of the common assessment criteria:

- ✓ shortened adaption times of new ATCos to operational environment,
 - ✓ reduced times and costs of advanced ATCo training at operational ATC facilities
 - ✓ improved the overall quality of air traffic services for the airspace users in Europe.
 - ✓ increased the transparency and recognition of the skills, qualifications and competencies for learning, employment opportunities and labour mobility across Europe.
 - ✓ improved the level of coordination and harmony between ATCo's trained in different countries.
- ✓ enhanced their skills required by the targeted integrated European ATM such that effective communication with pilots, recognition of pilot intentions, effective use of airspace and flight efficiency.
 - ✓ improved overall quality of ATCo training in the higher education across Europe through the promotion of common awareness of aviation safety and efficient and economic air traffic flow management concepts of future operations.
 - ✓ increased cross-border cooperation between higher education institutions, ANSPs and vocational training organizations involved with basic ATCo training in Europe.
 - ✓ possible policy revisions and improvements in the international reference documents.



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General Methodology



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Simulations and Data Collection

AIRSPACE

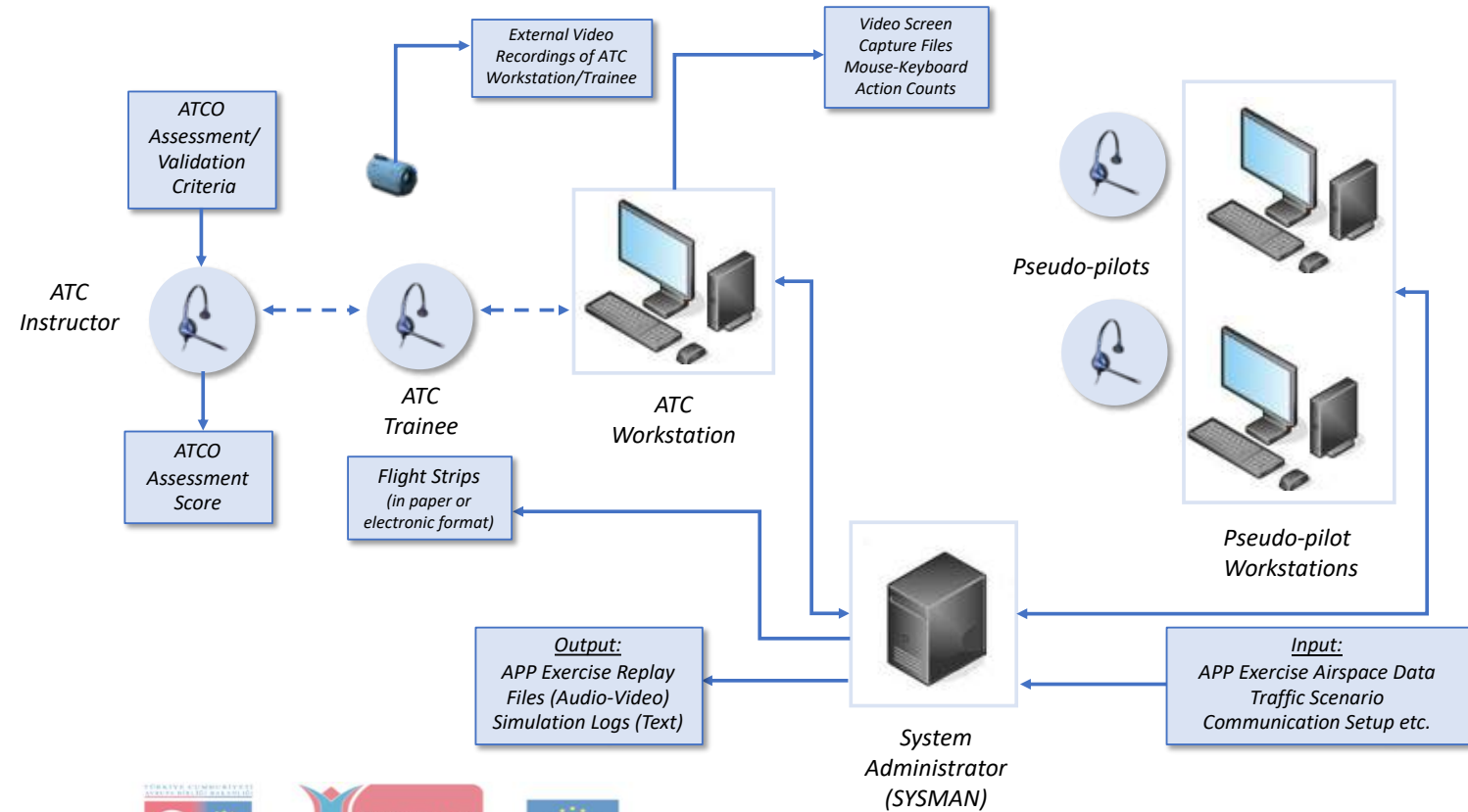


EXERCISE SCENARIOS

Exercise Number	Number of Aircraft		Exercise Characteristics	
	Arrival	Departure	Duration (min: sec)	Difficulty Level
1	5	0	23:30	1
2	6	2	25:30	2
3	6	3	24:30	3
4	6	4	26:00	4
5	7	3	27:00	4
6	7	4	27:30	6
7	8	3	28:00	8
8	8	4	30:00	9
9	9	3	31:00	9
10	9	4	30:00	8

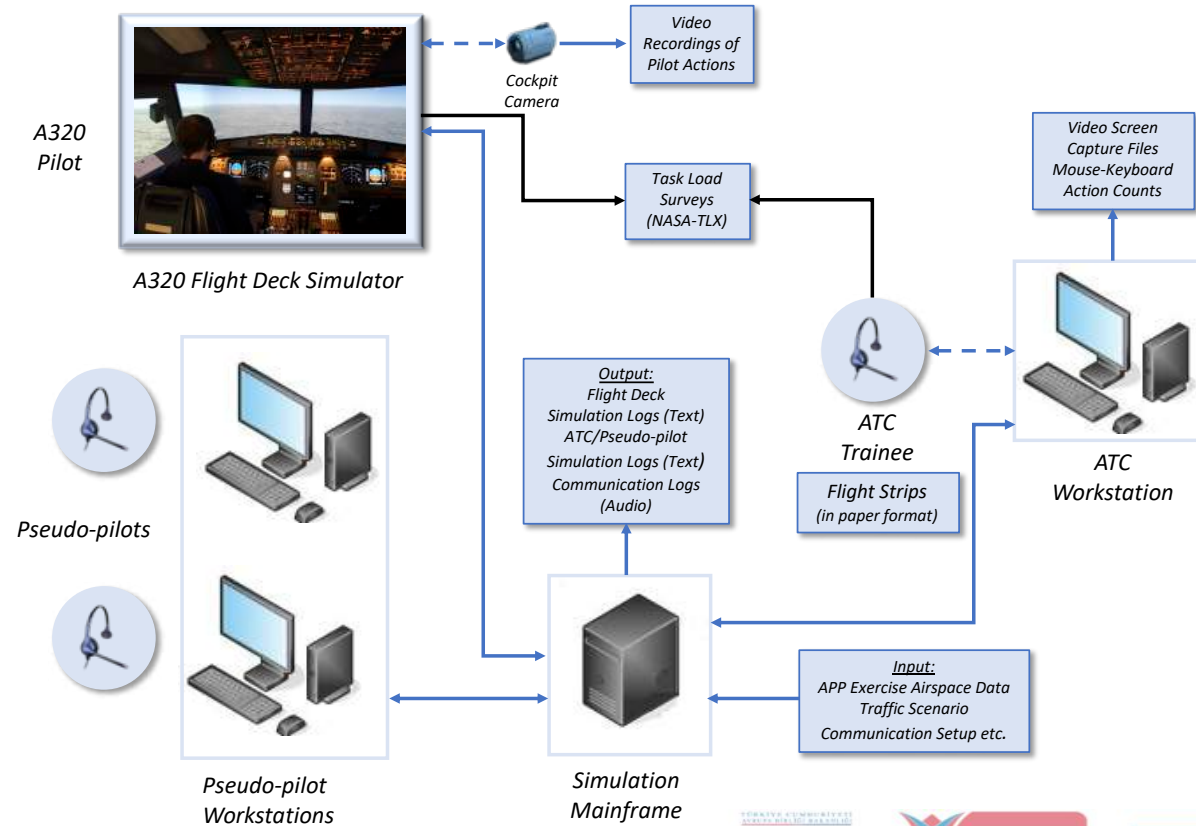
Simulations and Data Collection

ATC Radar Simulation Circuit and Data to be Collected



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Simulations and Data Collection



Integrated ATC Radar-Flight cockpit Simulation Circuit and Data to be Collected



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Conclusion

- ✓ The baseline analysis tasks of ATCOSIMA have been completed and Generic Simulation Exercise Booklet including scenario details as well as simulation files and setups for ATC and integrated ATC-Flight cockpit Simulations were prepared.
- ✓ In addition to these intellectual outcomes, baseline assessment validation criteria were adopted and instructive ATC training guidance videos were produced in order to be used as the inputs of the next steps of the projects.
- ✓ A vast amount of data set was also collected for the further analysis regarding ATCo performance, flight efficiency and pilot task load and acceptance.
- ✓ These outcomes will not only support the development of new ATC radar simulation assessment criteria but also provide a framework and database of other studies to be done in the future.
- ✓ Although the project primarily targets the instructors and students of ATCo basic training programs in higher education institutions, its outcomes will provide feedback and recommendations for the revision of reference documents.
- ✓ Therefore, the results can be reached and used by all ANSPs, Civil Aviation Authorities and vocational ATCo training organizations in Europe.



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