GRADE Practice for Designing Pilot's HMI and Experimental Procedures for General Aviation Enhanced Terminal Operations Based on GNSS

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***Abstract*—The GRADE project aims at demonstrating through real-time simulations and live flight trials the operational feasibility and the acceptability, from both Air Traffic Control Officer's and Pilot's perspectives, of implementing some SESAR-1 Solutions on General Aviation aircraft and rotorcraft. Those Solutions, specifically for General Aviation, exploit Satellite Based and Ground Based Augmentation Systems for enabling the execution of precision approach segments and Category II/III procedures relying on GNSS signals and applicable for approach to airports not equipped with Instrumental Landing System. The feasibility of these precision procedures requires, beyond the availability of enabling technologies, a twofold development activity: the design of a pilot Human Machine Interface to integrate with current General Aviation equipment and the design of operational procedures applicable to such aircraft. It will allow the use for General Aviation aircraft of airports not equipped with Instrumental Landing System also in Instrument Meteorological Conditions, simultaneously improving airport capacity and aircraft environmental footprint. The paper discusses the methodological approach applied in GRADE for the development activities above described. This approach exploits both real-time simulations and live flight trials to implement an iterative and user-centred design process, to evaluate pilot and Air Traffic Control Officer's performance, and finally to assess the effectiveness of designed pilot's human machine interface and experimental operational procedures.**

Keywords – Human Centred Design; General Aviation; Global Navigation Satellite System; Human Machine Interface; Human Performance; Precision Approach Procedure

I. Introduction

Global Navigation Satellite System (GNSS) technology, supported by Ground and Satellite Based Augmentation Systems, represents an affordable alternative to the Instrumental Landing System (ILS). Furthermore, it also contributes to augment accessibility and safety for all airports (including regional and small ones) for General Aviation (GA) and Rotorcraft not equipped with ILS airborne devices. Indeed, GNSS technologies improve aircraft navigation accuracy, thus allowing the reduction of separation between arriving aircraft (improving airport throughput) without negatively affecting safety and human performance, especially in poor weather conditions [1],[2]. Some innovative SESAR solutions exploit this technology to enable enhanced terminal operations with localizer performance and vertical guidance up to Category I decision height and precision landing in low visibility conditions up to Category II/III decision height. These innovative solutions require navigation performance from 1 to 0.3 Nautical Miles and include Radius to Fix curved legs and Continuous Descent operations, which increase flexibility in procedure design, allowing shorter approach paths that result in fuel savings, and may be exploited to avoid environmentally sensitive areas (e.g. populated areas with noise restrictions) [3]. The procedures have been already validated for Commercial Aviation in the SESAR research programme. Their applicability to General Aviation aircraft shall still be proven and could provide further benefits to the Air Traffic Management (ATM) system, by facilitating the integration of GA with Commercial aircraft into the terminal maneuvering area of big airport and improving the accessibility of GA aircraft to regional and small non-instrumented airports [4].

The capability of GA aircraft to exploit those solutions requires dealing with the design of suitable pilot's Human Machine Interface (HMI) and operational procedures. The development of pilot's HMIs has the purpose to investigate the optimal way to provide GA pilots with needed information for precision landing approaches in nominal and non-nominal conditions. It is worthy to highlight that the on-board equipment of GA aircraft is usually very basic. To perform the solutions

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under analysis, it shall be supplemented with non-certified and affordable devices that improve the pilot's situational awareness in several manners: by showing procedures, visual information and cues, by providing performance monitoring, by integrating alerting functions for the safe conduction of the flight. The definition of the operational procedures, which include both curved and continuous descent legs, aims at investigating the optimal way to allow the maximum possible benefit from the use of these SESAR solutions, as a trade-off with GA aircraft performance limitations and ATCOs acceptability of such procedures and their integration with current ones. The fully design of this kind of procedures is a long and strongly regulated task and is out of the scope of the GRADE project. Notwithstanding, preliminary analysis on relevant design parameters of these procedures can be carried out. Indeed, specific tests with human (i.e. pilots and ATCOs) in the loop on the radius of curved approaches and the speed for their execution (or, differently considered, the time for the approach execution) can be performed in order to assess the best solution and confirm the feasibility of the proposed procedures.

The following sections of this paper present the GRADE approach to the design (section II) and the obtained HMI (section III) and experimental procedures (section IV). Next, section V focuses on the applied human performance evaluation method, whereas section VI presents results of both real-time simulations and flight trials. A section of conclusions ends the paper.

II. The GRADE Approach and Methodology

GRADE (GNSS Solutions for Increased GA and Rotorcraft Airport Accessibility Demonstration) project has been aimed at performing demonstrations in a close-to-operational environment of SESAR Solutions #51 [5], #55 [6], #103 [7] and #113 [8], integrated into standard GA and rotorcraft cockpits, using affordable non-certified avionic equipment, which also include portable PFD for information display to the pilot during the demonstration. One implementation has been provided for Solutions #113, applicable to rotorcraft, whereas two different implementations have been developed for Solutions #51, #55 and #103. This paper focus on these last solutions, applicable to General Aviation.

The overall GRADE demonstration activity aimed at delivering results that, other than demonstrating the feasibility of proven concepts and technologies, can facilitate and accelerate the transition phase towards their full exploitation and use in real world. Therefore, all planned testing activities and the whole design process for both Portable Flight Display HMI and procedures followed the Human Centred Design (HCD) approach [9]. HCD is an iterative design methodology based on the involvement of end users – in this case ATCOs and Pilots - in the design process since the earliest design stages. It requires also cyclic test sessions of the intended designed system, to ensure that all needed technical and non-technical features of a product or a service are taken into consideration to provide the maximum benefit for all direct and indirect users. For this reason, GRADE demonstration strategy has included a set of real time simulation campaigns, the results of which have supported the validation by preliminary testing of procedures, prototypes and HMI, helping to identify the required changes before the execution of the in-flight trials. This iterative approach to demonstration activities allowed highlighting all the aspects of the on board devices' HMI, designed procedures and testing scenarios. On the one hand, it was needed for the scientific robustness of experimental measurements and results and, on the other hand, would have been able to provide meaningful data for the smooth deployment and acceptance of tested solutions by industry, regulators and real end users. In fact, the HCD process has been purposely applied with the aim to properly address the socio-technical ATM complexity, as key strategy to significant decrease deployment costs once demonstration steps are successfully achieved [10]. The operational scenarios consolidation, including the identification of all the involved actors, their role and responsibility, the applicable on-board technologies and procedures, the surrounding traffic complexity, the specification of the suitable and quantifiable validation objectives with respect to technological and procedural aspects, represented the founding stone of the project. The use of narrative scenarios, especially during the focus group sessions during RTS, allowed to describe in natural language the expectations and needs of stakeholders, who imagine and narrate some of the main uses, impact and problems that a technology or procedure may have [11]. Furthermore, the overall GRADE approach has been integrated with the E-OCVM methodology. E-OCVM is currently the reference methodology for the validation activities performed in the SESAR Programme, and its application has ensured an easier presentation of the obtained results to SESAR institutional stakeholders and a faster integration of the solution proposed into the SESAR ConOps. The performances of tested solutions have been assessed using relevant KPAs of the ATM Performance Framework [12], as defined by ICAO and assumed by SESAR, with the inclusion of the Human Performance area. Specific Key Performance Indicators (KPIs) have been selected in order to obtain quantitative performance evaluations of the operational concept and to measure its impact; following KPAs have been considered:

- safety
- capacity
- cost efficiency
- human performance.

Performance assessment and lessons learnt represent the main outcome of the project and will be made available to support regulation, standardisation and certification activities, as well as the integration of GA and rotorcraft with commercial aviation. Finally, a further relevant aspect of the methodological approach proposed in the GRADE project is to base the approach on the principle of apply the same human centered design procedure on as much differentiated as possible design case. Two different airports have been selected for precision approach procedures design and test, Capua airport (ICAO code LIAU) and Braunschweig airport (ICAO Code EDVE). Two different pilot's HMIs have been designed, both have been tested in RTS and in-flight on two different GA aircraft, a TECNAM P92 and a CESSNA 172N, involving 5 experimental pilots. Procedures have been tested in different nominal and non-nominal conditions, by changing the level of (simulated) approaching traffic to the runway, visibility conditions, GNSS system failures modes and involving 4 professional ATCOs.

III. PILOT'S HMI SOLUTIONS

Two pilot's HMI solutions have been developed and tested within GRADE, based on a different design approach and denoted as CIRA/NAIS HMI and TUBS HMI.

A. CIRA/NAIS Pilot's HMI

The CIRA/NAIS HMI implements a portable Primary Flight Display (PFD), able to provide pilots with visual assistance when performing critical maneuvers, such as approach procedures, with integrated terrain awareness and supporting pilot decisions and operations. The PFD collects a complete and heterogeneous set of instruments to support the pilot during the final approach following specific GNSS and RNAV procedures. To accomplish these requirements the HMI includes the following functionalities:

- 3D Synthetic Vision with terrain orography.
- Attitude Indicator that shows information about the aircraft roll, pitch and yaw with indications about current altitude and speed.
- Informative panels reporting the current GPS status (SBAS, GAST_C, GAST_D and GPS) and accuracy (required and actual), the next waypoint and its distance, the reliability level of the displayed information (Normal, Caution, Warning).
- Tunnel in the Sky (TiS), drawn over the Synthetic Vision, representing the visual indication of the optimal flight path to be followed by the pilot.
- Flight Director (FD), drawn over the Attitude Indicator, that shows the attitude required to follow the optimal flight path.
- 2D Moving Map with representation of the selected procedure and the aircraft position.
- Vertical Profile representation and projection of the aircraft position over the chart.
- Virtualization of aircraft instrumentation (HSI, Vertical and Horizontal Deviation Indicator, Vertical Speed Indicator).
- Management bar, for procedure engage/disengage and missed approach activation, and pilot supporting functionalities enabling (TiS and FD).

The following Figure 1 shows the pilot HMI with Tunnel in the Sky enabled.

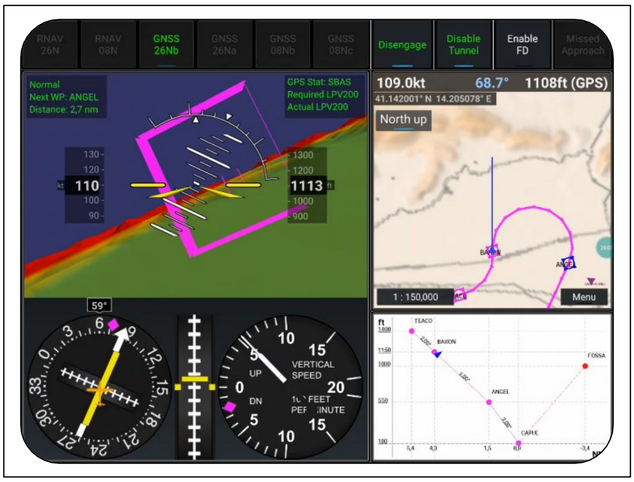

Figure 1. CIRA/NAIS pilot's HMI: management bar (top), synthetic vision, attitude indicator, informative pannels and tunnel in the sky (top left box), moving map (top right box), aircraft instrumentation (bottom left box), vertical profile (bottom right box)

The flight Management System (FMS) includes navigation algorithms that feed the HMI, providing the data needed for the Tunnel in the Sky and Flight Director representation, which could be enabled alternatively or simultaneously by the pilot, depending on its preferences. The FMS also provides an autopilot functionality able to autonomously track the optimal trajectory and leaving to the pilot only the control of the throttle [13].

B. TUBS Pilot's HMI

The TUBS HMI is also available on a portable display, but the design approach is different from the CIRA/NAIS one. Indeed, this HMI is complementary to the aircraft instrumentation, suitable to conduct "easy" instrumental approaches. The navigation prototype relies on GNSS position data solely. It supports the pilot showing a map display and a course deviation indicator. For the final approach, the pilot is additionally supported by either GBAS or SBAS information delivered by commercial off-the-shelf (COTS) receivers, displayed on a cockpit-mounted CDI. The following Figure 2 shows the cockpit of the experimental CESSNA 172N used for the demonstration, which includes the navigation prototype on portable display pilot HMI and the additional COTS instrumentation.

Figure 2. Cessna 172N cockpit installations with navigation prototype on portable display TUBS (left) and COTS instrumentation

IV. EXPERIMENTAL PROCEDURES SOLUTIONS

Two different airports have been selected for precision approach procedures design and test. For each test airport, two different scenarios have been defined: reference scenario, based on current approach procedures, and solution scenario, which implements the innovative SESAR solutions GNSS based.

These procedures allow evaluating the following human performance indices:

- Procedures flyability, in terms of precision requirements compliance achievability in manual execution of the procedures;
- Pilot workload in executing a precision approach procedure, compared with a visual approach;
- Air Traffic Controllers workload, in integrating such GNSS General Aviation aircraft with airliners;
- Air Traffic Controllers situational awareness, in managing both GNSS and RNAV precision approach procedures of different classes of aircraft.

The curved continuous descent procedures are also expected to improve aircraft footprint near the airports and the airports capacity, thanks to reduced time to land and path length they requires.

A. Capua Airport Procedures

The Capua airport (ICAO Code LIAU) is a small airport for sport and leisure activities, normally not supporting IFR operations. Neither previous RNAV nor RNAV-GNSS approach procedures exist, and both have to be designed "by scratch". It is worthy to remark that the design of actual approach procedures is not in the aim of the GRADE project. However, on the one hand it has been dealt with in terms of application of HCD methodology to define experimental approach paths by taking into accounts, from the beginning, pilots and ATCOs performance measures. The experimental approach paths shall allow, on the other hands, the qualitative and quantitative evaluation of the most relevant KPIs of the SESAR performance framework applicable to the GRADE project. In particular, one RNAV (reference scenario) and two GNSS (solution scenario) precision approach procedures have been designed for each of the two runways (08 and 26) of the LIAU airport. All the GNSS approach paths are curved with continuous descent trajectories. Curvature radius, flying velocity, location of approach fixes have been assumed as parameter to be changed among the four procedures in order to allow human performance indices assessment. These procedures are used for real-time simulations and flight trials. An example of the precision GNSS curved and continuous descent approach path is depicted in the Figure 3.

B. Braunschweig Airport Procedure

Flight trials for the fixed-wing demonstration exercises at Braunschweig airport consist of reference scenarios (standard instrument RNAV arrival and approach procedures as published in AIP) and solution scenarios designed for the flight exercises in the GRADE project. Figure 4 shows, from left to right, the reference scenario for the runway 08, the solution scenario route for runway 08, solution scenario route for runway 26, and the reference scenario for runway 26. The solution scenarios use a short final approach, radius-to-fix and continuous descent approaches.

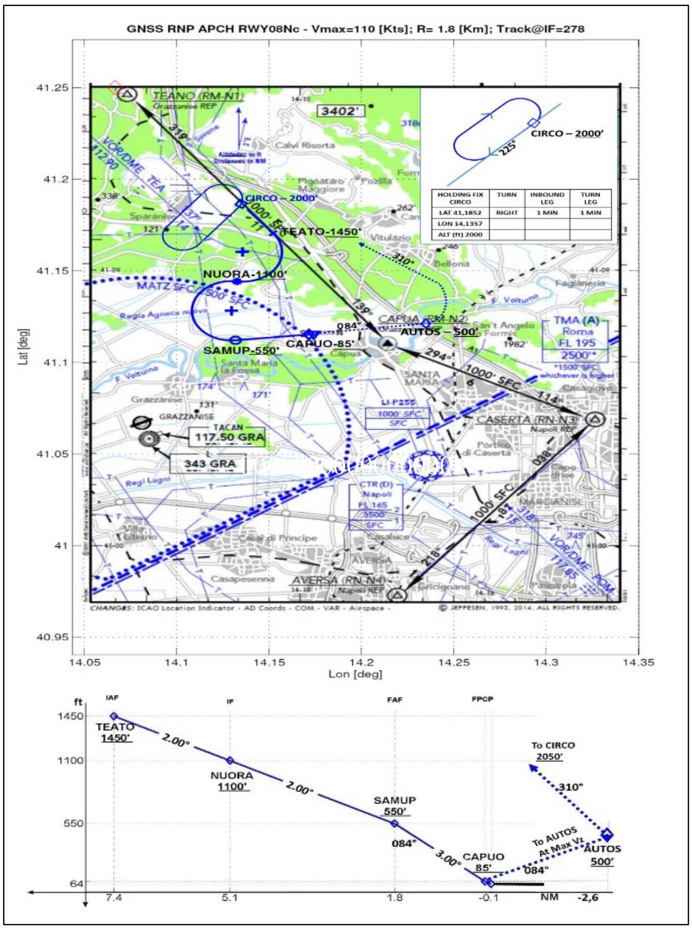

Figure 3. Capua airport procedure: GNSS precision approach to runway 08

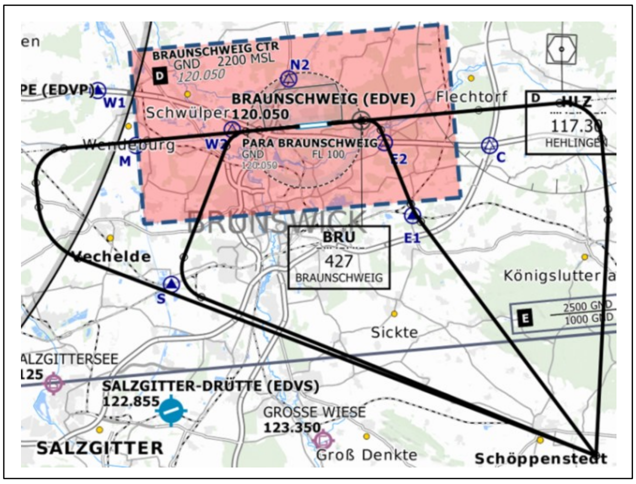

Figure 4. Braunschweig airport procedures: reference and solution scenario routes

V. The Human Performance evaluation method

Under the Human Factors (HF) perspective, tested technologies and procedures could impact current working methods of pilots and controllers, affecting the human component of the overall system performances. The latter are also linked to usability of the HMI related to:

- each single technology/tool integrated into the system,
- the overall system interface resulting from the whole of integrated technologies/tools which are provided to human actors.

GRADE validation activities have addressed a series of Human Factors validation objectives, investigating:

- the acceptability of tested operations by ATCOs and Pilots in normal and abnormal operating conditions,
- the accurate, efficient and timely completion of operations,
- cognitive workload,
- situational awareness and shared situational awareness for ATCOs and Pilot,
- the capability of HMI to provide pilot with clear and complete information to execute landing procedures with a sufficient level of confidence and precision.

Therefore, the HF approach to the validation activities combined human-system performance assessment (situation awareness, human error, workload, etc.) with usability assessment (covering aspects such as comprehensibility, readability, visibility, perceptibility, etc.). Human Factors data have been collected by subjective (both qualitative and quantitative) tools using, namely:

- 2 post flight questionnaires (1 for ATCOs and 1 for pilot),
- 2 post session questionnaires (1 for ATCOs and 1 for pilot),
- 2 semi-structured collective debriefings (1 post flight and 1 post session),
- 1 collective session for procedures co-design to refine procedures, phraseology and scenario details.

Same post flight mission questionnaire were used for both real time simulation campaign and flight trials.

VI. Application of the methodology to the GRADE project

A. *Real-Time Simulations Results*

The GRADE Real-Time Simulation (RTS) at CIRA have been carried out in a time period of two weeks, the first on the 15th -19th of October and the second one in the period 19th-23rd of November 2018. Both the CIRA/NAIS and the TUBS pilot's HMI were tested. By applying the HCD iterative methodology, preliminary approach procedures have been defined according to typical GA aircraft performance envelope. A range of such allowable procedures have been submitted to pilot and ATCOs evaluations in Real-Time Simulations. Objective and subjective measures have been analysed and procedures refined for the second RTS campaign and for the final assessment in flight trials. A total of 75 different approaches and about 17 hours of simulated flight have been performed, involving different expertise: 2 experimental pilots; 4 Air Traffic Controllers and 1 ATC Supervisor; 2 human factors experts; 2 pseudo-pilots; 6 engineers.

Several different approach procedures and conditions have been tested, both nominal and contingency operations, with different piloting mode and technological prototypes. In some test scenarios meteorological visibility conditions and/or traffic conditions and/or GNSS off-nominal behavior were simulated to require aborting the nominal approach procedure.

Three different levels of traffic conditions were used during the RTS: low (a dozen of aircraft per hour), medium (18 aircraft per hour) and high (till to 25 aircraft per hour) density traffic approaching the runway.

Data related to GA navigation precision capabilities, GNSS working status, traffic conditions have been collected. Furthermore, Audio-Video recording of pilot-NAV prototypes and ATCOs-CWP HMI have been saved and questionnaires have been filled by Pilot and ATCOs for Human Performance Analyses.

As expected by the HCD methodology, questionnaires and interviews have been largely applied to improve the design of both procedures and pilot HMI, starting from the first RTS campaign, also supported by co-design sessions of GNSS based procedures.

The in-depth analyses of ad hoc questionnaire items together with qualitative feedback gathered in co-design sessions allowed to identify and prioritize improvements to be introduced for Flight Trial sessions. As far as the procedures design is concerned, three main points arose:

- to suitably separate the RNAV path from the GNSS one, in order to implement an efficient management of the traffic,
- to specify, in the procedure description, the time required by the aircraft to complete the GNSS approach,
- above all, to add to the procedures the stacked holding patterns, in order to allow the management of very different aircraft paths and speeds during approaches, without negatively affecting the ATCOs workload.

As far as the pilot evaluations of HMI are concerned, from the first RTS campaign, pilots noticed some critical issues, mainly referred to situational awareness improvements, which highlighted the need:

- for the representation of the vertical profile of the approach procedure,

- to simplify alert and warning messages relating precision navigation issues, to make them more quickly graspable,
- to make HMI more customizable, allowing the selection of information to be displayed, especially in those cases when data visualization was offered in multiple ways.

Thanks to the above design recommendations, between first and second RTS campaigns, improvements have been implemented to increase the usability of HMI and the manageability of procedures under the operational perspective. Such improvements fostered the soundness of simulated scenarios. The iterative and progressive improvement of the HMI and procedures, allowed to largely overcoming all these issues, to deliver the final HMI configuration used in the second RTS campaign and in the flight trials. The TUBS HMI did not present relevant shortfalls in RTS; therefore, changes were not required. However, the tests confirmed its effectiveness when integrated with other aircraft instrumentation. The improvements brought on the HMI design from the first to the second RTS campaign, and then to final HCD-based design are easily recognizable by comparing the following Figure 5 with previous Figure 1, where the HMI design that has to be used in flight tests is depicted.

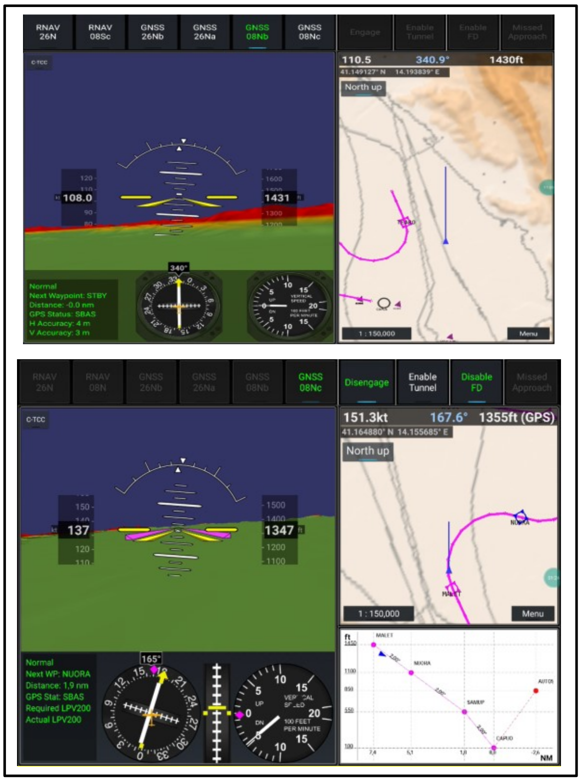

Figure 5. CIRA/NAIS pilot's HMI for first RTS campaign (top) and the second RTS campaign (bottom).

As far as procedures are concerned, the usefulness of the inclusion of holding patterns, stacked at different altitudes separated each other of 1000ft, is showed in the Figure 6 below, where the overall set of flown trajectories at Capua airport for runway 08 are sketched.

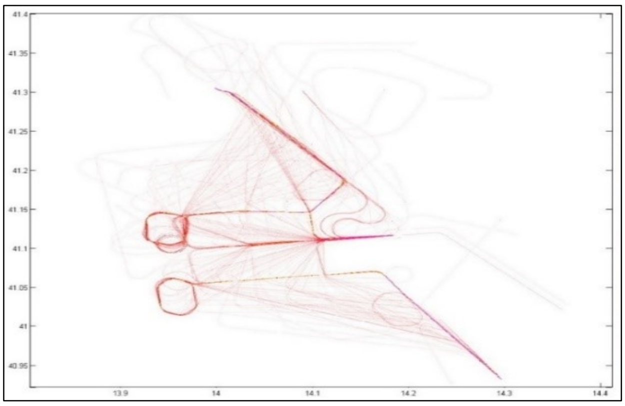

Figure 6. Flown trajectories at Capua airport runway 08

As intermediate results to be confirmed from flight tests, with reference to the Human Factors perspective, the second RTS campaign results demonstrate that tested procedure do not have negative impacts on ATCOs and Pilots in normal and abnormal operating conditions, as confirmed by Figure 7 and Figure 8. Considering simulation technical constraints, benefits that are more significant can be expected in the reality.

Workload and situational awareness levels were considered satisfactory and overall cooperation between pilot and ATCO was good with no negative impact on overall traffic management even in case of technical failures experienced. Figure 9 presents the completed RTS results about pilot situational awareness.

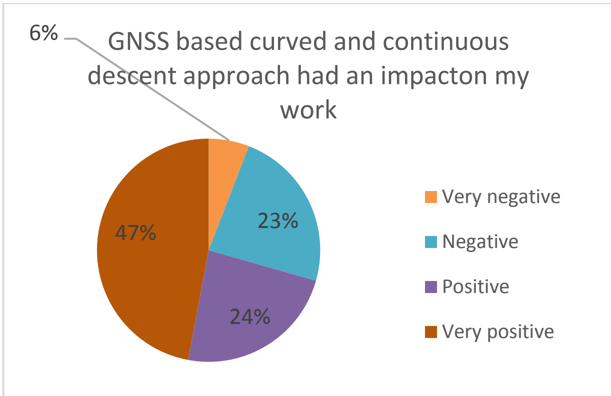

Figure 7. Acceptability of GNSS procedures by ATCOs

Figure 8. Traffic safe management by ATCOs in abnormal conditions

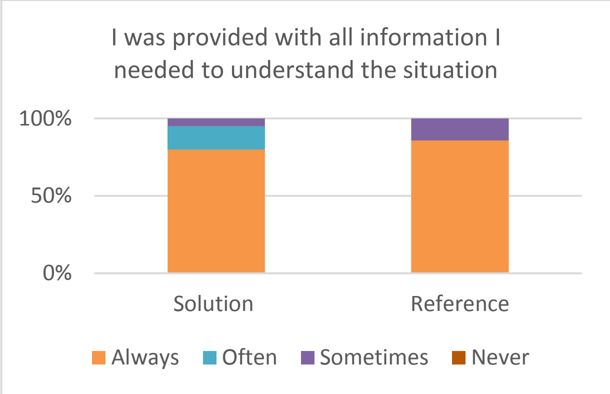

Figure 9. Pilots experienced situational awareness. The GNSS procedures increase the overall percentage of positive rates (information supporting SA was provided always or often).

Clear indications also emerged in terms of the need for familiarization with procedures and training; the pilots were indeed able in the second RTS campaign to perform manually the procedures and the manual piloting mode has been selected for the flight trials, too. This behavior recommends providing General Aviation pilots with adequate training before implementing these innovative solutions.

Concerning the other assessed KPAs, RTS provided the following results:

- Safety: the impact on this KPA is assessed by demonstrating that GNSS procedures allow improving the navigation accuracy of General Aviation, thus, reducing the risk of incident and CFIT. The measurements of the TSE, used as navigation performance indicator (and then as safety's KPI), highlighted that, in all the executed approaches, values lower than 0.3 NM were achieved. The GNSS procedure did not affect negatively the TSE with respect to RNAV procedure; rather it produced in several cases an improvement.

- Capacity: the presence of a General Aviation, which interferes with the commercial traffic, produces a reduction of the airport throughput. Generally, measured in terms of average time between two consecutive approaches. The reduction is very limited, in the order of few seconds, and it has to be confirmed in flight tests.

- Cost Efficiency: since during the test just one ATCO managed the traffic in the TMA of the Capua airport for the whole simulation duration, the KPI used to assess the airport throughput is also an indirect measurement of the number of aircraft managed by the ATCO in the considered period. Therefore, the same considerations discussed above for the capacity KPA apply to the cost efficiency KPA as well.

Finally, the GA aircraft capability to take advantage from the solutions developed during SESAR 1 for Commercial Aviation positively affects the Equity KPA, because the same opportunities are available for all the airspace users.

B. Flight Tests Results

The approach procedures at Braunschweig airport described in the previous chapter have been demonstrated in flights either by the Cessna 172 solely, or simultaneously with a research helicopter on a non-interfering approach path. Both the CIRA/NAIS and the TUBS pilot's HMI were tested. In total, 20 approaches have been performed, involving 3 experimental pilots and professional ATCOs operating the Braunschweig airport. The following figures shows the flight path of the Cessna 172 demonstration flights.

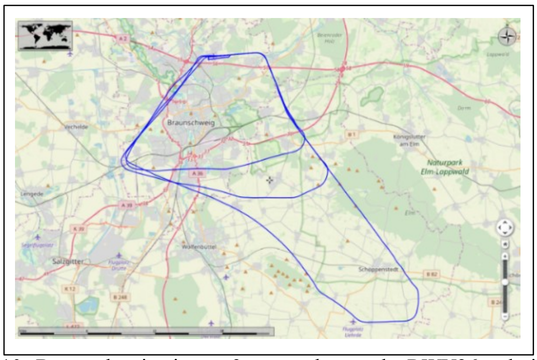

Figure 10. Braunschweig airport: 3 approaches on the RWY26, solution scenario flight path (incl. departs)

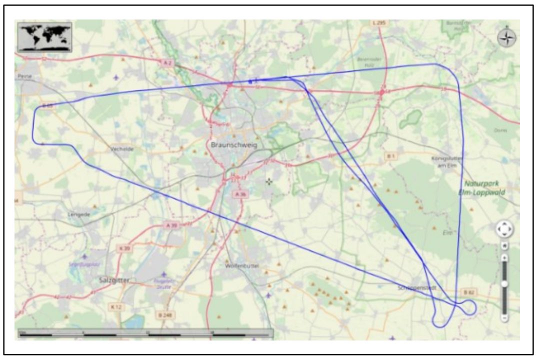

Figure 11. Braunschweig airport: reference scenario flight path (incl. ATC intervention during RWY08 approach)

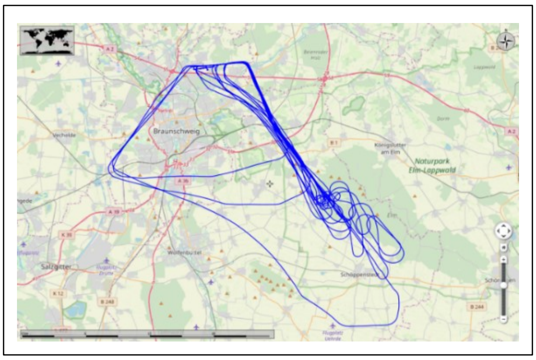

Figure 12. Braunschweig airport: 12 approaches on the RWY26, solution scenario flight path (incl. departs and holdings)

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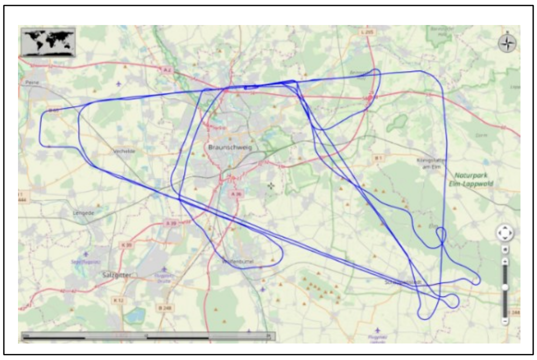

Figure 13. Braunschweig airport: 3x reference scenario flight path (incl. 1 ATC intervention during RWY08 approach) and 1x RWY08 solution scenario flight path

Detailed analyses of the flight tests are still running. A preliminary evaluation of the recorded data showed a precise flight track, i.e. a small total system error. The installed TUBS devices (the GRADE navigation display as well as the GBAS and SBAS receivers coupled to the cross deviation indicator) worked as expected. The main finding so far was that the pilot's perception is mainly driven by the user interface of the experimental navigation prototypes on the portable display. An improvement of the situational awareness could be observed.

The CIRA/NAIS HMI worked properly, too, allowing the execution of the procedures, although some minor issues, mainly due to the integration into the CESSNA set up, shall be fixed. Further suggestions from the pilots were collected, related to the visualization of the vertical profile and the management of the information about the procedure's waypoints.

Comments to the procedure layout had also been collected. No major findings had been found here so far, despite the fact that the final was quite short but manageable as it is adapted especially for relatively slow flying GA aircraft.

Recommendations for addressing safety issues related to human elements have been also provided, bringing benefits not only in terms of safety related human factors but in the widest consideration of Human Performance, mitigating the uncertainties of GRADE solutions implementation with respect to training needs, cost efficiency and workload.

Good track accuracy combined with improved situational awareness can be achieved for visual flights on General Aviation aircraft.

Finally, it is worthy to mentioning that a final session of flight trials is scheduled in October at Capua airport, whose analysis results will be delivered by the end of November 2019.

VII. CONCLUSIONS

The GRADE project dealt with several aspects of GA aircraft and rotorcraft integration with general air transportation system, namely with the possibility to execute precision approaches using low-cost equipment exploiting the satellite navigation system and its augmentation systems (SBAS, GBAS).

The paper focuses on the HCD methodology applied in the project for the simultaneous and cooperative design of pilot's HMI and the curved continuous descent precision approach paths, involving both pilots and air traffic controllers at the same time in the design process.

The project results show how the design process could highly benefit from the HCD iterative process, strongly exploiting Real-Time Simulations and Flight Test campaigns for the final assessments. Two different pilot HMI's and few precision approach procedures for two different airports have been defined in the project, this further support the project outcomes soundness, globally demonstrating the feasibility of the proposed solutions.

A similar approach was also used in the project for rotorcraft PinS and SNI approach maneuvers, not presented in this paper.

Finally, it can be observed that the reference to the HCD approach for the overall design of exercises, allowed gaining a high level of significance of RTS and Flight Trials activities and results, paving the floor to a wider range of use cases and potential users that could benefit of tested solutions.

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