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(English text at the bottom)

IFALPA POSITION PAPERS – GEOMETRIC ALTITUDE & SATVOICE FOR AIR TRAFFIC CONTROL OPERATIONS

Gentili Colleghi,
condividiamo con voi due interessanti position paper di IFALPA che affrontano aspetti relativi al possibile sviluppo tecnologico nel modo dell'aviazione.

Il primo riguarda la possibile transizione futura dall'altitudine barometrica all'altitudine geometrica.
Con il crescente equipaggiamento del Global Navigation Satellite System (GNSS) nel trasporto aereo commerciale e il costante aumento della costellazione dei satelliti, il futuro utilizzo dell'altitudine geometrica per tutto il profilo di volo potrebbe essere possibile e porterà vantaggi aggiuntivi come una ridotta separazione verticale e una traiettoria complementare nei percorsi di volo.
Il documento tratta approfonditamente i benefici e le eventuali carenze che ne deriverebbero.

Il secondo affronta il tema del SATVOICE (Satellite Voice Communications), come strumento per la comunicazione tra aerei e stazioni a terra come unica fonte di sistemi di comunicazione a lungo raggio (LRCS).
La discussione sull'espansione delle comunicazioni vocali via satellite (SATVOICE) nel mondo delle comunicazioni si sta evolvendo.
Su questo secondo aspetto la posizione di IFALPA è ancora prudente, in quanto SATVOICE non soddisfa i requisiti di performance delle attuali comunicazioni vocali.
Sono state identificate molte carenze e le specifiche per lo sviluppo di un nuovo sistema devono risolvere queste carenze prima che SATVOICE possa essere approvato come mezzo di comunicazione sostitutivo.

Di seguito i due position paper.
Buona lettura.

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English Version

IFALPA POSITION PAPERS – GEOMETRIC ALTITUDE & SATVOICE FOR AIR TRAFFIC CONTROL OPERATIONS

Dear Colleagues,
we share with you two interesting IFALPA position papers that address aspects relating to possible technological development in the aviation world.

The first deals with the possible future transition from barometric altitude to geometric altitude. With the increasing equipage of Global Navigation Satellite System (GNSS) in commercial air transports, and the growing constellation of GNSS, the future use of Geometric Altitude throughout the flight profile might be possible and will bring added benefits such as reduced vertical separation and complementing trajectory flight paths.
The document deals in depth with the benefits and deficiencies that would arise from its implementation.

The second deals with the Satellite Voice Communications (SATVOICE) into the realm of Direct Controller - Pilot Communications (DCPC) and as a sole source of Long Range Communications Systems (LRCS) is evolving.
On this second aspect, IFALPA's position is still cautious, as SATVOICE does not meet the performance requirement of current voice communications.

Many shortcomings have been identified and specifications for new system development needs to resolve these shortcomings before SATVOICE can be approved as a substitute means of communication.

Here below the two position papers.
Enjoy the reading.

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Geometric Altitude

POSITION

IFALPA supports research into a possible future transition from Barometric Altitude to using Geometric Altitude for sub transition level en route, and approach operations.

With the increasing equipage of Global Navigation Satellite System (GNSS) in commercial air transports, and the growing constellation of GNSS, the future use of Geometric Altitude throughout the flight profile might be possible and will bring added benefits such as reduced vertical separation and complementing trajectory flight paths. Geometric Altitude might be introduced above 15,000 metres because all aircraft able to reach these levels are GNSS equipped, but biggest benefit is seen during approach and departure.

PREAMBLE

a. Use of barometric altitude has several well-understood and accepted shortcomings.
   - Position Error
   - Mechanical Error
   - Density Error
   - Hysteresis Error
   - Reversal Error

   These contribute collectively to Altimeter System Error, the greatest component of which is Density Error.

b. The inaccuracy of Barometric altimetry is known and documented. Absolute accuracy at cruising levels is no better than 500m. A similar value can be found when considering very low temperature error correction at 5000 ft. This is nonetheless adequate for the purposes of vertical separation (because neighbouring users experience very similar errors), but undesirable for approach operations as it reduces terrain clearance.

c. With the commercial industry's increased use of GNSS for lateral positioning, these errors would be eradicated if vertical positioning were also derived and used from satellite data. Note that GBAS (Ground Based Augmentation System) has already been proved to meet Cat I minima, i.e. 16m horizontal and 4 m vertical accuracy requirement.

   Active stations exist in the US and Europe. SBAS (Satellite- Based Augmentation System) utilizes additional satellites such as EGNOS (European Geo-Stationary Navigation Overlay Service) to enable enroute RNP 0.3 in serviced areas and CAT I approach minima, but without the requirement of the ground pseudolite. SBAS is a key component of Europe’s SESAR and the FAA Next Gen projects.

d. Altimeter Setting Error, a failure to set the altimeter’s subscale correctly, should be eliminated.

SAFETY AND OPERATIONAL BENEFITS

a. In any area with multiple airfields each on different QNH's, using Geometric Altitude would place all aircraft on a common datum.

b. The use of Geometric Altitude by aircraft and other airspace users such as UAS could provide a common datum reference, which could be a prerequisite for the safe integration of such airspace users.

c. In airspace where use of forecast regional pressure settings is utilised, using Geometric Altitude would place all aircraft on a common datum.

d. Current altimetry procedures require the use of transition altitudes meaning that the gap between the lowest usable flight level and the next lower altitude is more than 1000ft, and can be as much as 2000ft, resulting in wasted airspace capacity. These transition-procedures also increase the complexity of the operation for pilots.

e. The requirement to calculate Cold Temperature Error Correction for all approaches would be eradicated.

f. Altimeter Setting Error would be eradicated.

g. RNAV approaches currently constructed as Baro, while being retained as standby approaches could be upgraded to APV type.

h. Barometric pressure sensing systems require stringent and comprehensive maintenance to ensure accuracy and reliability. GNSS systems less so.

DEFICIENCIES

1. Aircraft performance is based on atmospheric conditions only, thus still relying on actual pressure altitude, which should be considered, especially during cruise. Impact might lead to:
    - Significant differences between geometric and pressure altitude, leading to possible exceedances of the operating envelope,
    - Deviations of fuel consumption,
    - Cabin altitude will change frequently.
2. Definition of master source when position information is diverging
3. Security issues (GPS spoofing)
4. Contingency and failure procedures, especially in remote airspaces
5. Accuracy

a. GNSS is already in widespread use determining clearance over obstacles, as an input to TAWS (Terrain Avoidance Warning System). GPS is also used to determine Altimeter System Error for height monitoring purposes. For example, GPS uses WGS84 ellipsoid as an approximation to the MSL, which could have errors between -100m and 70m with respect to the geoid, depending on location on the globe. The geoid is the best definition of the MSL, which is used as the reference for pressure altitude.

b. Since 2008 the Performance Standard for User Equivalent Ranging Error (UERE) has been 4m RMS, with the actual achieved figure being now less than 1m. This is an order of magnitude better than barometric altimeters can achieve. Since the major errors in geo height are common to all receivers in the same area (ionospheric and geometry), there is every reason to expect that the relative accuracy would also be orders of magnitude better than is currently possible with barometric altitude.

c. To reduce the effects of space weather, all new GPS satellites broadcast should provide ranging signals for civil on two frequencies, instead of just one. Multi-constellation GNSS availability will also increase accuracy, with the combination of multi-constellation and multiple frequencies providing adequate Receiver Autonomous Integrity Monitoring (RAIM). The use of SBAS available globally will further enhance the vertical accuracy and the integrity of GNSS.

d. It is acknowledged that even the use of multiple frequencies remains vulnerable to hostile interference. Therefore, some elements of today's current navigation procedures would be required as a backup to such interference.

SYSTEM REQUIREMENTS PRIOR TO IMPLEMENTING GEOMETRIC ALTITUDE

a. Define transition and procedures for non-compliant aircraft/areas.

b. Access to multiple constellations must be available to aircraft systems.

c. Global SBAS availability.

d. Aircraft systems and flight procedures for all aircraft on a global level would need to be in place prior to any such transition.

e. Backup systems and flight procedures for all aircraft on a global level would need to be implemented as well.

f. All terrain maps, obstacles, airfield elevations, would need to be evaluated at the new Geometric Altitude values.

g. Technology would be required to ensure that the GNSS signals are protected from hostile interference and possible harmful effects of space weather fully mitigated.

h. Ensure high altitude performance operating limitations, including maximum operating altitude for the current ambient conditions, would need to be developed.

TRANSITION TO GEOMETRIC ALTITUDE

a. If and when the transition to Geometric Altitude becomes a reality, all stakeholders should be included in the procedures to be developed.

b. The change to Geometric Altitude should occur in stages, perhaps using Geometric Altitude above current RVSM levels in the first stage, allowing some time to evaluate the effect of the change, in the area where barometric altimeters experience the greatest errors. Initially altitudes above 15,000 metres might be used with a Transition Level above RVSM pressure levels introduced. Eventually all altitudes should be included.

c. Guidance should be sought from the Separation and Airspace Safety Panel (SASP) and the Navigation Systems Panel (NSP) of ICAO.

d. Considerations should be made regarding the implementation of Geometric Altitude, making provisions for both aircraft equipped and non-equipped throughout all stages.

The Global Voice of Pilots
IFALPA

POSITION PAPER

20POS07
2 December 2020

The Use of Satellite Voice Communications (SATVOICE) for Air Traffic Control Operations

The discussion of expanding Satellite Voice Communications (SATVOICE) into the realm of Direct Controller - Pilot Communications (DCPC) and as a sole source of Long Range Communications Systems (LRCS) is evolving. Many shortcomings have been identified and specifications for new system development needs to resolve these shortcomings before SATVOICE can be approved as a substitute means of communication.

The limitations of current systems must be accounted for and the risks mitigated. The areas include Human Machine Interface (HMI), DCPC, ATC Vectoring, Call priorities, Satellite limitations, avionics limitations, flight plans, and Short Code implementation.

1. **Satellite Voice Communications (SATVOICE) should not be supported as a primary means of communication between the pilot and controller until its Actual Communications Performance meets the equivalence with current DCPC VHF Voice Communications.**
   - SATVOICE does not meet the performance requirement of current voice communications, a value yet to be defined, but faster than the defined RCP240.
   - We are far from the technology needed and CSP/SSP (Communication Service Providers/Satellite Service Providers) still have issues. SATVOICE should be part of the Long-Range Communications Systems (LRCS) along with HF radio as it currently is.
   - Operators may use it to help Minimum Equipment List (MEL) dispatch in remote areas i.e. one HF radio operating if SATVOICE operational, 2HF w/ no SATVOICE, allowing relief of equipage requirements in remote areas to safely operate the aircraft.

2. **IFALPA supports the system human machine interface (HMI) development to ensure transparency to the flight crews and controllers of means of communications.**
   - IFALPA should be part of that process of working with the ANSPs, controllers, regulators, operators, and manufacturers to develop and safe and useful future SATVOICE interface.
   - This research requires much future development of the SATVOICE communications HMI to be able to replace or augment current DCPC.

3. **SATVOICE shall not be used for VECTORING in procedural airspace until it meets the equivalence performance of DCPC VHF voice.**
   - Vectoring can only be safely accomplished if DCPC-VHF-Party line type comm is used. This may be counter to the current use of CPDLC application of vectors and lateral instructions. The difference is the layer of surveillance performance in the airspace.

- A major issue with the reduced separation standards is the "Uncleared Weather Deviation Contingency". Under these circumstances (19NM Lateral, and next year 15NM) there is a possibility that deviating aircraft will be crossing another track at +/-300' vertically of other traffic. It is the approved contingency procedure, but there are risks when you consider:
  - Altimetry error,
  - PBCS filed a/c without PBCS approval,
  - RVSM filed a/c without RVSM certification,
  - Wake turbulence, and convective turbulence.

  The only way to mitigate this is for ATC to have the ability to vector traffic to keep them from conflict. Presently, unless the reliability and performance requirement are met, IFALPA is opposed to the use of SATVOICE to vector traffic.

4. **Air to Ground SATVOICE calls priority. SATVOICE calls from Air to Ground should not be overridden by ATC calls. Background:**
   - The SATVOICE system includes call priority where ATC is normally the high priority and therefore prioritized from other communication when the SATVOICE line is busy.
   - In emergency/urgency cases such as System failure or Medical Diversion, company communication and coordination should not be overridden by ATC calls.
   - The balance between ATC communication and company communication is important therefore it is necessary that the Priority is clarified and evaluated from a system perspective.

5. **Flight Deck Human Machine Interfacing (HMI) and Human Factor Concerns must be addressed and incorporated in all SATVOICE aircraft systems, these concerns include, but are not limited to:**
   - **Ringtones** – in some airframes, the SATVOICE ringtone (aural alert) is the same ringtone as other functions on the flight deck and only rings one time, it is not a constant alarm that grabs flight crew attention. This can include company calls, ACARS message, Flight Attendant calls, SELCAL, and ATC CPDLC uplink for example. (When common aural alerts are used, a visual annunciation tells the crew which function the aural alert is associated with, however, a visual annunciation might be hard to find due to the types of equipage. Some systems may indicate on the overhead, on a switch button in small font. The indication is not necessarily on front panel with large font).
   - **Aircrew Proficiency in usage** – SATVOICE use has been limited with most operators to communication with company, so flight crew education and familiarity are required to ensure best practices and standards are developed and followed.
   - **SATVOICE controls and indications** – the process to make and or receive a call can be cumbersome in some airframes.
     - The control panel may not show “SATVOICE” as part of the original flight deck design and OEM manuals may not address SATVOICE.
   - **Emergency communications** - Ideally Aircraft Communication Systems should be able to be operated the same manner as current VHF Communications. The system should be able to be configured in such a manner that when the pilot depresses the Transmit key the microphone is live, and a transmission is immediately active. Refer to **4 SATVOICE Emergency**.

- **Switching between Satellite Communication providers** - On airframes which support various Satellite Communication providers, flight crews are required to manually switch from one system to the other to ensure SATVOICE continues to be available when transiting different SSP network coverage areas. This is significant for operations in the polar regions where one SSP has coverage and the other does not. An automated method may be a better method and provide a more robust overall SATVOICE system to assist with ATCO planning.
- **Unambiguous short code identification** on the flight deck. Flight crews are not always able to identify the distinction between positions at a particular ACC. As seen below:

The outcome of this ambiguity and inconsistency are the following (but not limited to):

- Flight crews may be reluctant to use SATVOICE since additional steps maybe required to verify which short code to use.
- The time required to make SATVOICE calls may be increased.
- Flight crews may inadvertently contact the wrong address or not be able to find the appropriate contact easily.

The ICAO SATVOICE Sub-Group is working on a methodology for programming short codes that will clearly identify the expected ground user (ATC facility) of outgoing calls.

6. Satellite Service Provider (SSP) System Requirements/Limitations:

- **Onboard SATCOM receivers must have global coverage**. At the moment, not all SATCOM receivers have full polar coverage.
- **Limited numbers of incoming and outgoing SATVOICE calls need to be addressed. SATVOICE availability needs to conform to a standard, whereby it is available for greater than 99% of the time.**
- **Flight plans should include all the information required for SATVOICE operations**.
  - The appropriate SATVOICE equipage should be included in the flight plan along with an airframe's ICAO code (CODE/ followed by the aircraft address, expressed in the hexadecimal format)
  - Interoperability issues between ANSPs should be addressed particularly when transferring flight plan information (e.g. stripping out CODE/ in field 18).
  - Operator education on correct filing of flight plans is needed.
- **IFALPA supports amending Short Codes as avionics phone books are not necessarily programmed with published short codes for Air-to-Ground calls**.
  - Ambiguity on Short Codes can cause the call to circumvent the ground routing infrastructure instead of routing the call to the ATCO responsible for the aircraft.
  - Furthermore, by not using short codes the avionics phone books would require reprogramming if the PSTN (Public Switched Telephone Network) number (long code)

associated with the short code were to change. Efforts should be made to ensure the short code remains the same to avoid the need for avionics to be reprogrammed.

- **Aircraft should not have a restriction to single SSP SATVOICE system**.
  Currently airframes may have systems that are specific to one SSP or both. Depending on the flight routes, coverage may be limited to a single provider.
- **System and network availability**.
  SATVOICE should be as available and accessible as HF until such time that it has been proven otherwise. This item needs careful consideration because there are factors (i.e. Space Weather) that could affect SATVOICE as they affect HF.

7. CONCLUSION

As the expansion of SATVOICE into the realm of DCPC and as a sole source of LRCS evolves, many shortcomings have been identified before this can be approved as a substitute of established communication procedure. Specifications into the future development of the SATVOICE must incorporate these into new system development. The limitations of current systems must be accounted for and the risks mitigated. The areas Include HMI, DCPC, ATC Vectoring, Call priorities, Satellite limitations, avionics limitations, flight plans, and Short Code implementation.