Summary
The purpose of this working paper is to make a systematic review of IFATCA policies related to TCAS II (ACAS).

1 Introduction

1.1 Discussions held during the production of a working paper (WP) for this conference (Gran Canaria 2014) reviewing IFATCA policy for TCAS RA Down-linking to CWPs (Controller Working Positions) raised concerns that many of the TCAS-policies of the Federation were either outdated and/or not entirely correct. As a result the need to perform a systematic review of the TCAS policies of the Federation was seen as a "must". IFALPA have also reported several issues with the current TCAS-procedures – for example the responsibility for separation provision on termination of a TCAS RA-maneuver.

1.2 This WP will make a review of all the Federation’s TCAS – policies – excluding all those related to TCAS RA Down-Linking to CWPs (which is covered in a separate WP – that is due to be presented at the IFATCA Conference of 2014 in Gran Canaria (Spain).

1.3 Throughout this whole WP the term “TCAS” will be used quite frequently. It must be understood that ACAS and TCAS are basically the same systems (both are last-ditch airborne anti-collision systems), but ACAS (Airborne Collision Avoidance System) is the general ICAO-designation of such an airborne safety net, whereas TCAS (Traffic Collision Avoidance System) is currently the only ICAO-approved (and certified) airborne anti-collision system that is in operational use. Future systems are currently under development - for instance ACAS-X in the US - but a lot of work is still needed before this new - not yet flight-tested system - is ready to put into operation.

2 Discussion

2.1 Some TCAS policies in force are over 15 years old. During this time TCAS has evolved from version 6.04A to version 7.0 – and now version TCAS 7.1. The last version of TCAS (V7.1) is slowly but surely entering operations world-wide. ACAS or better TCAS II has evolved from a rather “imperfect” system in the late 1980s to an airborne anti-collision system that has achieved a certain degree of maturity, with good
robustness and excellent stability. But the system still has limitations and imperfections, some of which cannot be totally eliminated (due to the design-limitations of the system itself). This is one of the reasons that the development of a new-generation airborne anti-collision Safety Net (SNET), such as ACAS-X has started.

2.2 Despite all the improvements made, TCAS procedures continue to be far from perfect, as all the system issues cannot be resolved. One well known issue is the crew reactions and the less than perfect compliance of air crews to TCAS RA-maneuvers. This continues to be of great concern as TCAS-monitoring shows that about 50% of all the TCAS RAs are not followed, or are not followed correctly – and that opposite direction and opposite sense maneuvers continue to occur frequently. TCAS II is a coordinated system (TCAS-TCAS coordination), meaning the safe functioning of the system depends heavily on the correct compliance by all involved parties during a TCAS RA-maneuver.

2.3 The existing IFATCA policy will be analysed paragraph by paragraph, and amendments are recommended as required. The language used in some of the policies is outdated, and in need of updating. Despite this it can also be said that the policy statements are - generally speaking - still valid - as they continue to address areas of concern for IFATCA and for the operational ATCOs that it defends. Additionally, many changes have been made in the mean-time to TCAS II, including ICAO’s TCAS-procedures that were adapted and improved, the last time in 2007 (changes linked to the mid-air collision of 2002 over Germany).

In the Technical Manual of IFATCA, under AAS 1.1 Airborne Collision Avoidance Systems (ACAS), it is written that:

**IFATCA Policy is:**

*IFATCA recognises that the development of airborne collision avoidance systems should be encouraged. However it must be accepted that the primary means of collision avoidance within a controlled airspace environment must continue to be the air traffic control system which should be totally independent of airborne emergency devices such as ACAS. TCAS devices should not be a consideration in the provision of adequate air traffic services.*

2.4. The first sentence of this policy-paragraph must be changed so that it becomes a much stronger affirmation. The proposed wording is:

**IFATCA fully supports and encourages the development and operation of airborne anti-collision systems.**

There is no doubt that airborne anti-collision systems and airborne Safety Nets (SNET) nowadays form an integral part of the modern ATM-system. There is also no doubt that these systems have a positive effect on the overall safety of the ATM-system; it is simply not conceivable any more to operate a modern ATM-system without having an airborne anti-collision device being present in the system. The proposed reformulation of our TCAS policy is pointing clearly to the fact that IFATCA is fully committed to the development and the continued operation of such airborne anti-collision systems in the ATM-system.

2.5. In the second sentence starting with "However it must accepted……." there are several points that require attention. TCAS II is not only a very useful system in a "controlled
airspace environment” (which is either offering a full separation-service, or only a partial separation service, according to the airspace classification in force). But TCAS also offers additional safety benefits in non-controlled airspace’, (classes F and G-uncontrolled airspace types). This must be reflected and be considered in the policy statements of IFATCA.

2.6. This particular policy was written at a time when the ICAO-airspace classification scheme was not well-established. It is important for IFATCA that in its policy statements, it makes clear that TCAS has a primary role to function as an airborne anti-collision system that operates as a back-up (as an add-on) that is independent of the ATM-System. The required safety-levels of the ATM-system, including the ATC-separation service offered must be achieved without taking into account the presence of TCAS.

It is proposed to change the second sentence of the IFATCA-policy statement, so that this view is fully reflected. The current IFATCA policy should be changed to read (proposal):

The primary means of collision avoidance for flights for which a separation service is required, must be the air traffic control system. This system must achieve the required safety levels totally independently from any airborne anti-collision devices, such as ACAS.

2.7. In this context the distinction between controlled and uncontrolled airspace environments is clearly not relevant any more, as even in uncontrolled airspace types the advantages and the additional safety afforded by the presence of TCAS II cannot be denied. This view is also reflected in the Global Air Traffic Management Operational Concept of ICAO, Doc 9854 (first edition of 2005), where the role of the airborne SNET ACAS is explained, including the three layers of conflict management of our ATM-system.

2.8. The last sentence of this paragraph reads:

TCAS devices should not be a consideration in the provision of adequate air traffic services.

This Policy-statement is still valid in 2014. It is proposed to leave it unchanged. The comments made above make it clear that this particular policy statement remains correct.

2.9. The TCAS policy statements continue to say:

The use of automatic airborne collision avoidance systems should allow for safe operation within different types of airspace, with different ATC procedures and with different aircraft equipment capabilities – without detriment to the ATC service or to the aircraft not fully equipped.

This TCAS-policy statement is old, but correct. But current ICAO SARPS (Doc 4444 15.7.3.1) and PANS are in force ensure that this is guaranteed. If IFATCA agrees with current ICAO SARPS and – PANS, then there is no need to restate it again in policy-statements. The deletion of this part is proposed.

2.10. The next paragraph states:
The inevitable changes in ATC procedures, techniques and phraseologies resulting from the introduction of airborne collision avoidance and traffic alert systems should be compatible, not only with a controller's responsibilities for providing positive separation, but also with a controller's ability to discharge them.

Comments: This particular policy statement is valid, but again, the current ICAO provisions in ICAO Document 4444 (PANS-ATM) and ICAO document 8168 (PANS-OPS) fully cover all that is mentioned in this policy statement. The paragraph above is therefore proposed for deletion, as we are in full agreement with ICAO here.

2.11. Continuing with the policy statements:

Guidelines and procedures shall be established in order to prevent incidents arising from the use of false or misleading information provided by Airborne Collision Avoidance Systems.

Comment: Again an IFATCA policy statement that is fully covered by the provisions of ICAO document 4444 (PANS-ATM) and document 8168 (PANS-OPS). IFATCA is in full agreement with what is laid down by ICAO - therefore a deletion of this policy is proposed.

2.12. Continuing with the policy statements:

All MA’s should urge their National Administrations to assemble, disseminate, administer and maintain a comprehensive ACAS training package for ab-initio and regular refresher training

ICAO has regulated this in the SARPS, PANS, its Guidance Materials and Manuals (e.g. the ACAS Manual). All ICAO States and all ANSPs must perform these actions (ref. ACAS-Manual of ICAO, ICAO document 9863, namely Chapter 6). IFATCA is again in full agreement with ICAO and so a deletion of this whole sentence of the policy-statement is proposed.

2.13. Continuing:

IFATCA is opposed to down linking of any advisories generated by ACAS.

If down linking of ACAS Resolution Advisories becomes mandated, then IFATCA can only accept this provided that the following criteria are met:

- Clear and unambiguous controller legal responsibilities;
- Downlink without delay;
- ATC system to be able to receive, process and display the down link to the appropriate control positions;
- Compatibility with all ground based safety nets;
- Nuisance and false alerts must be kept to an absolute minimum.
- ACAS should only be considered as a ‘safety net’.

Comment: As mentioned in the introduction to this WP - a separate WP is presented at this IFATCA-Conference in Spain. So, no action on this subject is proposed in this WP here.
2.14. Last policy statement to be analysed:

**IFATCA Provisional Policy is:**

*After an aircraft has departed from its ATC clearance or instruction in compliance with an RA, or a pilot has reported an RA, the controller shall not resume responsibility for providing separation, until separation has been established for all affected aircraft.*

We are aware that problems and safety issues continue to exist in this area. Parts of the policy has been fulfilled by ICAO, as the ICAO SARPS and PANS clearly state now that once a pilot has reported a TCAS RA (even when not actually maneuvering), ATC ceases to be responsible for separation provision. This was accepted by ICAO and put into document 4444 (see 2.20). Other parts of the policy statement – mainly the issues for the termination of the TCAS RA when the "Clear of Conflict" sounds in the cockpit and the crew reports this fact to ATC are not yet fully resolved.

2.15. IFALPA have made IFATCA aware that, if a crew has reported a TCAS-RA by voice to ATC, they believe that there is still ambiguity as to at which moment ATC is taking back the separation responsibility, in particular if no “Clear of Conflict” is reported back to ATC. The reporting of "Clear of Conflict" is far from being as systematic (and flawless) as it should be. IFATCA has also identified two issues and safety problems where more work (and a possible refinement by ICAO) is needed.

- The crew fails to report the "Clear of Conflict" to ATC
- The crew reports the “Clear of Conflict” to ATC, but standard ATC separation is not established.

2.16. According to current TCAS procedures the separation responsibility is handed back to ATC once the “Clear of Conflict” report is received. If this “Clear of Conflict” report is omitted (or even forgotten), this is of concern, as the situation is ambiguous. TCAS procedures require ATC to remain hands-off and not to intervene directly when a TCAS-RA has been reported by voice.

2.17. The other situation of concern is when receipt of a Clear of Conflict message in the cockpit is promptly reported by voice to ATC. However, in some circumstances, standard separation may not yet exist between the conflict pair. These particular situations mainly occur in procedural airspace where no ATS-surveillance service is available and where very large separation standards are in force; in particular big longitudinal or lateral separation standards. But IFATCA is also aware that such situations do also occur in radar airspace. It must be understood that TCAS II is a system that is designed to avoid mid-air collisions. So the TCAS-logic is trying to obtain a minimum vertical spacing via collision avoidance maneuvers (or advisories), called TCAS RAs, making sure that at the CPA (Closest point of Approach) a given (or aimed at) vertical distance is achieved. These aimed-at vertical TCAS-miss-distances are much less than standard IFR-separation.

2.18. For instance in Sensitivity Level 7 of TCAS II (the highest TCAS SL level that is applicable above FL 200) the TCAS II software is trying to achieve a vertical miss-distance of roughly 600 feet at CPA - or 700 feet for the non-RVSM airspace above FL 420. If two aircraft are following each other in procedural airspace on the same route in an organized track system (e.g. the NAT – the North Atlantic Ocean), aircraft can
report clear of conflict, but full IFR-separation does not exist when the Clear of Conflict is reported to ATC. This means that the intent (and the idea) behind the IFATCA Provisional-policy is still fully valid and so the issue is still of great concern.

2.19. IFALPA have pointed out that even when the full ATC-separation is not yet established it must be acknowledged that the air traffic controllers are the ones with the best overview (and control) of the current traffic situation. Thus, according to IFALPA it makes sense if ATCOs issue ATC instructions or clearances without delay, even if the required separation standard is not yet re-established. Whereas this view is fully shared by many ATCOs it is of the utmost importance that the issues of responsibility for separation-provision, and also the ATCO and pilot-responsibilities in such ambiguous situation are resolved on international level.

2.20. Current ICAO-Procedures state:

15.7.3.2 When a pilot reports an ACAS resolution advisory (RA), the controller shall not attempt to modify the aircraft flight path until the pilot reports “Clear of Conflict”.

15.7.3.3 Once an aircraft departs from its ATC clearance or instruction in compliance with an RA, or a pilot reports an RA, the controller ceases to be responsible for providing separation between that aircraft and any other aircraft affected as a direct consequence of the manoeuvre induced by the RA. The controller shall resume responsibility for providing separation for all the affected aircraft when:

a) the controller acknowledges a report from the flight crew that the aircraft has resumed the current clearance; or

b) the controller acknowledges a report from the flight crew that the aircraft is resuming the current clearance and issues an alternative clearance which is acknowledged by the flight crew.

2.21. This particular ICAO provision has not resolved all uncertainty and ambiguity. For instance when taking a situation where the TCAS RA was triggered due to an unsafe ATC-instruction, having resulted in a potential loss of the required separation of the aircraft pair. So, both options proposed by ICAO – be it a) or b) can turn out to be "unsafe", as there is a need that the ATCO takes over and tries to clean-up the situation by issuing alternate clearances as quickly as possible. When the aircraft reports ‘clear of conflict’ however, there is a period where standard separation does not exist, but according to ICAO, the Controller is again responsible for providing separation (whether or not the error which led to the RA was attributable to the controller).

2.22. IFATCA experts agree that IFALPA is totally correct in pointing out that the ATCOs are in the best position to issue such alternate clearance in order to re-establish standard separation once the crew has reported to ATC “clear of conflict” (having a fuller picture of the traffic situation and so the only party which can resolve the problem). But how to bridge this gap between “clear of conflict” and until safe IFR-separation gets re-established? How can this be regulated in a satisfactory manner at ICAO-level? This is still not resolved and therefore this particular IFATCA-policy wording must continue to stand as it is. TOC believes that all the issues and problems are fully understood (and are already part of the discussion that has started).

2.23. It is proposed that:
IFATCA Provisional Policy is:

After an aircraft has departed from its ATC clearance or instruction in compliance with an RA, or a pilot has reported an RA, the controller shall not resume responsibility for providing separation, until separation has been established for all affected aircraft.

Despite the fact that further work on this subject is still on-going on ICAO-level (mainly together with our partner IFALPA), it is proposed that this policy-statement is upgraded to full policy. This is because the policy has stood for a number of years (and therefore no longer transitional), and while it could be improved as a result of the ongoing work, is still valid.

2.24. Finally, there is also Guidance Material for ACAS in our Technical Manual, which reads:

Guidance Material:

In a situation where an ACAS RA is likely to occur between aircraft under radar control, and a collision avoidance instruction need to be issued, controllers should consider horizontal movements (i.e. turns) to avoid contradictory instructions to an RA that may be issued.

This particular Guidance Material is still valid in its intent, however it is recommended the it be amended as follows for clarity;

In a situation where a TCAS RA is likely to occur between aircraft being provided with an ATC-Service supported by an ATS-surveillance system, and an ATC clearance needs to be issued, controllers should consider horizontal movements (i.e. turns) to avoid contradictory instructions to an RA that may be issued.

It is also suggested that the following addition be made;

This guidance shall only be used in situations where the TCAS RA has not been officially announced to ATC (e.g. by voice). It must be absolutely clear that - once a TCAS RA is reported to ATC - air traffic controllers (ATCOs) are required by procedure to remain hands-off and so refrain from transmitting any flight path modifying instructions or clearances to the aircraft involved in this particular TCAS RA-situation.

3 Conclusions

3.1. The Federation’s existing ACAS/TCAS II policies were partially outdated and/or incorrect. As a result a systematic review of the TCAS policies of the Federation was urgently required.

3.2. This review has shown that many TCAS-policy statements can be deleted, as they are in full conformity with current and published ICAO-provisions. When IFATCA is in full agreement with ICAO, there is no requirement to have policy statements.
3.3. TCAS and the TCAS procedures have evolved significantly since its inception. IFATCA is fully involved in the process of refining and improving the TCAS-procedures at ICAO-level, and it can be said that many of the IFATCA policy statements have been implemented by ICAO and form an integral part of the official procedures and standards today.

4 Recommendations

4.1 It is recommended that:

IFATCA Policy

IFATCA recognises that the development of airborne collision avoidance systems should be encouraged. However it must be accepted that the primary means of collision avoidance within a controlled airspace environment must continue to be the air traffic control system which should be totally independent of airborne emergency devices such as ACAS. TCAS devices should not be a consideration in the provision of adequate air traffic services.

Be changed to read:

IFATCA fully supports and encourages the development and operation of airborne anti-collision systems. The primary means of collision avoidance for flights for which a separation service is set-up must be the air traffic control system. This system must achieve the required safety levels totally independently from any airborne anti-collision devices, such as ACAS. TCAS devices should not be a consideration in the provision of adequate air traffic services.

4.2. The use of automatic airborne collision avoidance systems should allow for safe operation within different types of airspace, with different ATC procedures and with different aircraft equipment capabilities - without detriment to the ATC service or to aircraft not fully equipped.

This policy statement is proposed for deletion.

4.3. The inevitable changes in ATC procedures, techniques and phraseologies resulting from the introduction of airborne collision avoidance and traffic alert systems should be compatible, not only with a controller's responsibilities for providing positive separation, but also with a controller's ability to discharge them.

This policy statement is proposed for deletion.

4.4 Guidelines and procedures shall be established in order to prevent incidents arising from the use of false or misleading information provided by Airborne Collision Avoidance Systems.

This policy statement is proposed for deletion.
4.5. All MA’s should urge their National Administrations to assemble, disseminate, administer and maintain a comprehensive ACAS training package for ab-initio and regular refresher training

This policy statement is proposed for deletion.

4.6. After an aircraft has departed from its ATC clearance or instruction in compliance with an RA, or a pilot has reported an RA, the controller shall not resume responsibility for providing separation, until separation has been established for all affected aircraft.

This policy statement is proposed to be changed from provisional to full policy.

4.7. The Guidance Material:

In a situation where an ACAS RA is likely to occur between aircraft under radar control, and a collision avoidance instruction need to be issued, controllers should consider horizontal movements (i.e. turns) to avoid contradictory instructions to an RA that may be issued.

Be changed to read;

In a situation where a TCAS RA is likely to occur between aircraft being provided with an ATC-Service supported by an ATS-surveillance system, and an ATC clearance needs to be issued, controllers should consider horizontal movements (i.e. turns) to avoid contradictory instructions to an RA that may be issued. This guidance shall only be used in situations where the TCAS RA has not been officially announced to ATC (e.g. by voice). It must be absolutely clear that - once a TCAS RA is reported to ATC - air traffic controllers (ATCOs) are required by procedure to remain hands-off and so refrain from transmitting any flight path modifying instructions or clearances to the aircraft involved in this particular TCAS RA-situation.

- END -