LEGAL AND TECHNICAL IMPLICATIONS OF THE SAFETY RECOMMENDATIONS ISSUED IN THE FINAL REPORTS OF THE CIVIL AIR ACCIDENTS AND INCIDENTS INVESTIGATIONS

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Abstract

The necessity of issuing technical reports including the findings obtained during the technical investigation of civil air accidents and incidents is stated in the article nº 26 of the Convention of International Civil Aviation (CICA).Following the contents of the articles nº 26 and 37 of the same Convention, the ICAO approved the Annex 13 entitled "Aircraft Accident and Incident Investigation" in 1951, which last edition was published in 2010. The Annex 13 includes the procedure that must be followed for conducting the technical investigation of the civil aircraft accidents and incidents, and also it refers to the safety recommendations concept.
The proposed work will try to present a deep analysis of the twofold effects of safety recommendations showing the great importance of issuing adequate instructions which take properly into account the juridical implications derived, as well as the technical instructions that may affect to the design/airworthiness, maintenance and use (operations) of the affected aircraft.

1 Investigation Principles. The Safety Recommendations

The main principle in the investigation of civil aviation accidents and serious incidents is to improve aviation safety and to prevent the occurrence of accidents and incidents in the future. The sole objective of safety investigations should be the prevention of future accidents and incidents without apportioning blame or liability. So the investigation is preventive, non-punitive. But there are other principles that guide the technical investigation. These principles are explaining following:

- Responsibility of States

According to art. 26 of International Civil Aviation Chicago Convention and Annex 13 to this Convention, the investigation of accidents and serious incidents is to be conducted under the responsibility of the State where the accident or serious incident occurs, or the State of Registry when the location of the accident or serious incident cannot definitely be established as being in the territory of any State. A State may delegate the task of conducting the investigation to another State or request its assistance. The same rule is applied in the European Union, where the Regulation (EU) nº 996/2010 establishes the regime. In this sense, every State has to warrant the necessary financial support to these activities.

In Europe, EASA carries out on behalf of the Member States the functions and tasks of the State of Design, Manufacture and Registry when related to design approval, as specified in the Chicago Convention and its Annexes. Besides the State in where the accident or serious incident occurs, it can participates the State of Design (in the European Union the European Aviation Safety Agency carries out on behalf of the Member States the functions and tasks), Manufacture and Registry when related to design approval, the State which contributes with information, installations or advisors, and the State which nationalities are death in the event.

- Scope of the investigation

Every accident or serious incident should be investigated. Obviously it is impossible to have funds to investigate every accident with the same depth, so the regulation defines the concept of accident and establishes that only the more serious incidents have to be investigated. The concept of accident is more or less clear, but it does not happen the same with the concept of incident. There are a orientate list in the attached C of the Annex 13. Rules (International and European) contain an exception: aircraft with a maximum take-off mass less than 2 250 kg [art. 5.3 Regulation (EU) 996/2010].

- Independency of the investigation.

The independency of the investigation means in relation to other aviation authorities (General Direction of Civil Aviation, European or Spanish Air Safety Agency…) and in relation to judicial authorities (judges and prosecutors).

- Cooperation between national technical authorities.

Technical investigation is based on cooperation between nations. In Europe, besides, this cooperation should be provided free of charge [art. 6.1 Regulation (EU) 996/2010]. To promote this goal, recently, it has been created the European Network Civil Aviation Safety Investigation Authorities (ENCASIA).

- Protection of the proofs and information in relation to the technical investigation.

It is necessary a double protection, on the one hand, against disclosure of sensible information. This is the point of an ICAO task force (constituted in May 2011): Safety Information Protection. The work of this group probably will conclude with a remarkable change of ICAO Annex 13. Arts. 14 y 15 of Regulation (EU) nº 996/2010 has represented a big step forward. On the other hand, is very important to keep the proof inalterably. See in this sense "preservation of evidence" [art. 13 Regulation (EU) nº 996/2010].

- Publicity of the final report and safety recommendation: transparency and pro-activity.

Recommendations can be issued in any moment of the investigation, not always when the investigation is ended. If any hazard is discovered, the Authorities of Technical Investigations have to do the most they can immediately. The final report is public, and usually Authorities load them in a website, so everybody can consult it. The same happens with the recommendations, although every recommendation has a particular addressee.

2 Legal National and International Framework

The investigation of civil aviation accidents was regulated internationally in the first instance by ICAO, through the existing Convention on International Civil Aviation signed in Chicago in 1944[1], and its Annex 13, which provides detailed "International Standards and Recommended Practices for Civil Aviation Accidents Investigation". Annex 13 [2] regulates the reporting of accidents and incidents, the institution, the organization and conduct of investigation, the participation in the investigation, the presentation and dissemination of results, and a series of actions aimed at promoting the prevention of accidents. Since then, ICAO has produced manuals and guidance material to advise States on the conduct of aviation accident investigations [3-5].

The Member States of the European Union closely cooperate and provide mutual assistance in the field of air accident and incident investigation. The EU has also established common basic obligations through various Council Directives establishing the fundamental principles governing the investigation of civil aviation accidents and incidents [6-8. In December 2011, the New European Union Regulation No 996/2010 on the "Investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC"[9] was issued. This regulation addressed specific problems remaining in the old regulatory Framework, such as lack of uniform investigating capacity [10-12], [13]; tensions between investigations. [13-16]; ill-defined role of the Community in safety investigations; protection of victims' rights; and specifically weaknesses in the implementation

of safety recommendations. Table 1 resumes main weaknesses in the implementation of safety recommendations and the improvements included in the new regulation Nº 996/2010.

The new regulation established the following requirements. Each safety investigation shall be concluded with an investigation report that shall contain, where appropriate, safety recommendations. The report shall be forwarded to safety investigation authorities and civil aviation authorities of the States concerned, to ICAO, to the addressees of safety recommendations contained in the report and also to the Commission and EASA.

Weaknesses in the implementation of safety recommendations (SRs)	***Improvements by 996/20120***
- No monitoring of the implementation of safety recommendations (SRs). - No consistent approach to the gathering, processing and implementation of SRs. - Lack of co-ordination between authorities at the national and Union level. - Concern about the level of data protection. - Increase in the number of SRS addressed to the Commission and EASA. - Lack of the recognition of a Union wide dimension to the implementation of SRs: • aviation safety regulated at EU-level, • individual States may be unable to implement safety recommendations in a uniform manner. • safety recommendations which are addressed to just the national aviation authority or a national airline, may be of relevance to others. • no mechanism exists to allow for identification of such safety recommendations on a regular basis.	- Establish community database of safety recommendations. - Ensure that every recommendation is assessed and a reply given in a timely and transparent process. - Ensure a mechanism identifying recommendations of EU wide relevance.

Table 1. Weaknesses and improvements in the implementation of safety recommendations at European level.

The new regulation established the following requirements. Each safety investigation shall be concluded with an investigation report that shall contain, where appropriate, safety recommendations. The report shall be forwarded to safety investigation authorities and civil aviation authorities of the States concerned, to ICAO, to the addressees of safety recommendations contained in the report and also to the Commission and EASA.

At any stage of the safety investigation or on the basis of studies or analysis of a series of investigations or any other activities, the safety investigation authority shall recommend any action that it considers necessary to be taken promptly for the prevention of accidents or incidents. It should be highlighted that a safety recommendation shall in no case create a presumption of blame or liability for an accident, serious incident or incident.

The addressee of a safety recommendation shall acknowledge receipt of the transmittal letter and inform within 90 days, of the actions taken or under consideration, and where appropriate, of the time necessary for their completion and where no action is taken, the reasons therefore. Within 60 days of the receipt of the reply, the safety investigation authority shall inform the addressee whether or not it considers the reply adequate and give justification when they disagree with the decision to take no action.

Safety investigation authority shall implement procedures to record the responses to the safety recommendations it issued and the addressee of a safety recommendation shall implement procedures to monitor the progress of the action taken in response to the safety recommendations received. All safety recommendations and their follow on shall be recorded in the central European repository.

It is important, from the perspective of safety and public policy, that an efficient and transparent process is been put in place to ensure that every safety recommendation is always assessed, and corrective measures implemented where required. However, currently the implementation of safety recommendations is not mandatory. It is up to the addressee to assess its validity and the most cost efficient way of implementing it.

The first Spanish regulation on civil aviation accidents investigating was published in 1972 (Decree 959/1974 of 28th March)[17]. This was repealed by Royal Decree 389/1998 of 13th March [18], which regulated investigation of accidents and incidents in civil aviation and included an article devoted to reports and recommendations. More recently Spanish Law on Air Safety (LSA) 21/2003, of 7th July [19], contained a provision on the publication of reports and recommendations, stating that,

"concluded the technical investigation, the Accident Investigation Board shall approve a report and shall make, when necessary, proposals or recommendations aimed at aviation safety and at the prevention of future accidents and incidents". It also imposed to publish such reports and recommendations by procedures appropriate to the nature and seriousness of the incident investigation, and stated that the Board could require to the safety recommendation addressee information about safety precautions that had been adopted as a consequence. This law has been reviewed and updated in 2011, Law 1/2011 [20], referring to European Regulation on what the investigation of accidents concerns.

3 Legal Implications of Safety Recommendations: Publicity and Monitoring

Investigation Authorities are not coercive legal entities. There are other institutions that are in charge to change rules, to inspect subject in the aeronautical world, or to do any other things to ensure the fulfillment or the improvement of safety rules.

However, the last Regulation has enforced the role of this institution establishing the follow-up to safety recommendations and safety recommendations database in its art. 18. Anyway, the legal implications depend on national rules. In Spain, for example, art. 50.2.4 of Safety Air Law says that it constituted a serious administrative offense the non-fulfillment of the duty of give information about the measures adopted or the reasons why not be adopted in relation to the recommendations issued by the national technical investigation authorities. The fine in this case is from 45.001 to 90.000 euros (art. 60). The last amendment of Air Safety Law introduces the control of the Spanish Parliament (they are annually informed about the follow-up of the recommendations issued).

It should be mentioned here also the Commission Regulation (EC) nº 1321/2007, of 12 November 2007, laying down implementing rules for the integration into a central repository of information on civil aviation occurrences exchanged in accordance with Directive 2003/42/EC of the European.

4 Technical and Operational Implications of Safety Recommendations

As has been analyzed, the primary purpose of safety recommendations is to prevent future accidents. To do this, in many cases it is necessary to undertake reforms in regulations that are used to issue certificates of airworthiness of aircraft and aeronautical products and improve existing regulations on the operational procedures. Ultimately it would be amendments to existing codes (either improving certain requirements and/or introducing new requirements) that are the responsibility of the civil aviation authorities.

4.1 Issue and control of Safety Recommendations

As seen in section on the Legal Framework of the Safety Recommendations, when analyzing the recommendations issued by an authority responsible for the safety investigation of a state it is usual to find that there are different audiences for the recommendations. Typically, they are sent to the national civil aviation authority and/or other CAAs abroad, to aeronautical manufacturers, navigation services providers, operators, pilots, maintenance centers and training centers.

Considering that in accidents/serious there is danger to human life, time is an essential factor in the process of issuing recommendations. As a result of this, the safety investigation authorities issue safety recommendations as soon as they identify a security problem without having to wait until the investigation is completed and have been determined the causes of the accident.

Additionally, the development of the research process conducted by the investigating authorities as a result of an accident or incident may reveal the existence of situations in which safety cannot be guaranteed, leaving the door open for some event may occur in the future. If such is the case then the investigating

authorities issued safety recommendations in order to correct such situations, although they come motivated by different circumstances of the accident, although the majority of the issued safety recommendations are related to the direct causes or to the contributing factors of the accident/incident.

On the other hand, from the standpoint of control of the recommendations, each authority responsible for safety investigation has procedures to record the responses to safety recommendations issued and analyze them. Afterwards there are different organizations who publish the status of the responses to those recommendations. The majority of these organizations are investigation commissions (for instance, NTSB) but also there are airworthiness authorities, as EASA.

Usually the receiver of the recommendation answer to the issuing authority establishing if accepts or not the recommendation, and the means to implement it. Then, the issuing authority evaluates the response and label the recommendation as open (the response is not acceptable), closed (the response is not acceptable) and open/in course (the response is being implemented but not finished). Usually these responses are published in the annual reports of the investigating authorities.

4.2 Changes in airworthiness certification codes

The relation between recommendations and/or changes to the rules previously mentioned, has a "historical" precedent in the various accidents that happened to Comet-1 aircraft in the early 50's. The de Havilland Comet DH.106 was the first jet commercial aircraft, besides being the first civil aircraft with a pressurized and conditioned cabin, necessary for high altitude flight. The first series production aircraft took flight on 9 January 1951 and 22 January 1952 year received the airworthiness certificate without restrictions in passenger operations, allowing the regular service.

The first accident occurred on October 26, 1952, when the Comet 1 G-ALYZ conducted an unfortunate take-off in Rome and was damaged beyond repair, while the crew and 42 passengers were unharmed. On May 3, 1953 something happened to the CF-CUN CPA at maximum weight while taking off from the warm Karachi airport. This time, however, killed everyone on board. The causes rested on in the proper takeoff without reaching the rotational speed.

Being much more harmful the accidents due to the explosive decompression of the cabin (G-ALYV 1953; G-ALYP 1954; G-ALYY 1954) and be a turning point in the structural design criteria (life of the structure/material fatigue), for the purpose of this study more relevant were those of Rome and Karachi and which resulted in the realization of the relationship between accident investigation/ changes the rules. The G-ALYZ accident occurred during the takeoff phase, just as the crash of Karachi. As stated in the Final Report of the AIB UK (Accidents Investigation Branch, Ministry of Civil Aviation, UK): "*...the accident occurred due to error of judgment of the captain not being aware of the excessive rise nose of the airplane during takeoff ...* ".

However during the investigation of CF-CUN a series of test on aircraft of this type were performed and found that the Comet-1 airplane had a stall speed on the ground or close to it significantly higher than the corresponding without ground effect. This fact together with the sequence of speeds during takeoff in certification standards applicable at that time left the pilot with a margin of only 3 knots above the stall speed.

These accidents highlighted the narrow margin of safety established by those older codes during take-off leading to a change in the codes that has remained up to nowadays. Speeds during take-off contained in the older codes were: V_{S1}, V_{MC}, V_1 and V_2. After the change the new introduced speeds are: V_{MU}, V_R, V_{LOF} and V_{2min}, along with their interrelations with stall speed, resulting in an ordered sequence of speeds which the crew must reach in order to perform a safe takeoff.

Since that time there have been numerous accidents that have resulted in the issuance of safety recommendations by the investigating authorities which have produced a change of

codes of airworthiness certification of aircraft. However, as the cases have been numerous, an actual example is the safety recommendations issued after the accident happened to a Boeing 777-236 ER, G-YMMM at London Heathrow airport on January 17, 2008.

During the approach to the airport from London (Heathrow) from Beijing (China) at an altitude of 720 ft above the runway, the airplane's right engine B777-236 registration G-ER YMMM ceased operations in response to autothrottle demand control to increase the power, reducing it to a value of 1.03 EPR (engine pressure ratio - engine pressure ratio). Seven seconds later the left engine reduced its power to 1.02 EPR. This reduction resulted in a reduction of the speed of the aircraft, which made contact with the runway about 330 meters before the paved surface of the airport runway 27L Heathrow London. The investigation identified the thrust reduction was due to a reduction in fuel flow coming to both motors. The most likely cause of the restriction was the formation of ice within the fuel system. The certification requirements applied both to the airplane and engines did not consider this phenomenon as the risk was unknown. Throughout the investigation were issued 18 safety recommendations by the AAIB. Among these safety recommendations, four are closely related to the cause of the accident and certification standards for transport airplanes.

As a result of this investigation together with the whole background of problems occurring in transport aircraft due to icing, the EASA has launched the NPA No. 2001-03, "*Large Aeroplane Certification Specifications in supercooled Large Drop, Mixed Phase, and Ice Crystal Icing Conditions*", and NPA No. 2011-04, "*Turbine Engine Certification Specifications in Icing Conditions*", as a proposed amendment to CS-25 European codes for large airplanes (called transport category in the U.S.) and CS-E for engines.

4.2 Changes in the certification of operations

Accident investigation produces a large quantity of useful information. However, is the management of this information really effective to improve safety? The main and primary objective in the investigation of civil aviation accidents is to use that information, to prevent the occurrence of accidents in the future. However, there are several accident types in which the investigation has concluded with the same common causes. Despite this fact, the same type of accidents still occurs. Apart of any other premises, aviation system and industry are not doing an excellent job in the use of the information.

In the context of the dynamic growth in worldwide air travel, projected to reach some 3.6 billion passengers by 2014, the above challenge must be achieved. The Final Report and safety recommendations issued to the authorities, manufacturers, aircraft operators, services providers, etc. (the Organizations) by any technical investigation authority from a Statey, usually are load in a website, but, in practical terms, the industry have no access to it in Database form.

Safety recommendations emitted by technical investigation authorities (some of them emitted after large periods of investigation) do not arrive to the air transportation global industry system. It would say that a global investigation system does not exist today. Technical investigation addressed to organizations, in operational and technical terms, usually have technical implications that may affect to the design/airworthiness, maintenance and operations of the affected aircraft and have a majuscule importance in impacts and changes in organizations.

Safety recommendations emitted in operational terms by investigation commissions are also, in many cases, quite descriptive and go away from the “actual operational concept”. So, it is advisable to follow a line of work so that safety recommendations are emitted through an appropriate operational language.

According to experts, safety recommendations, in many cases, are not properly valued by all stakeholders due to:

- Organizations do not know investigation sources or have no Access to them.
- Accident investigators do not use available data stored in a lot of sources, such as

electronic sources which are on board of planes and can provide "real-time" information.

- Safety recommendations have not been emitted in appropriate operational form.

More in deep, technical implications of safety recommendations can produce relevant and radical changes in each organization. Safety recommendations are normally administrated within organization by safety department. Despite of this, in many times, there is an important gap in the model application view, if the point of view is from operational department or technical department. So, it is necessary to comprehend that safety recommendations actually apply the entire operator, joint both department with others. That is where organizations have to work accurately and that is the beginning of organizational changes.

So, it is important to understand (also the Authority) that a safety recommendation applied actually the operator and, in addition, technical implications can be derivable to a change in the organization. In this situation appears again the message that safety recommendations have to be clear, accurate and technical and operational adequate.

More extended, as an example, the practical application of a safety recommendation in an operator A has promoted a change in an operational process – maintenance or engineering process (normally registered and even more if an SB or AD applies). This fact, which is applied by operator A, may not be really applied or known by operator B, which has the same type and fleet of aircrafts as operator A.

But, it is more important the fact that a Safety Recommendation affect the management of CRM or Human Resources Performances of an organization. In this case, the results are less transparent, and any others operators, such as B or C (whatever they are), have no knowledge about processes used and experiences lived by operator A, as a consequence of the safety recommendation derived from an accident investigation.

Promoting and exchanging data and information about how safety recommendations influence in the organization is the most important task to be done between organizations, in terms of safety and operational model management and certification, including the whole organization management.

Nowadays, technical investigation is based on cooperation between nations. But now, it is essential that the rest of actors, such as services providers, operator, manufacturers, etc. must participate and collaborate together in the Technical Investigation. And then, they can promote the well done practice about the implementation of their safety recommendations around their organizations and, moreover, share the knowledge and experiences of that practical implementations and its implication among all of them and other organizations. That would be the birth of a new model, which could be called Global Technical Investigation System.

This model has to provide the management of safety recommendations with:

1. Exchanging and making analysis of information from database.
2. Distributing actual experiences about practical part in an organization.
3. Studying the safety level bias through the experience of all actors.

EU directives, EASA and his ENCASIA network, NTSB Database and ICAO's goals go to the correct direction, but it absolutely necessary to accelerate the mechanisms to share information and experiences of safety recommendation applications among all organizations within the technical investigation system. In brief, step by step, organizations, authorities and the rest of actors have to work together to improve safety and operational management through Technical Investigation System. So, it is time to start up a global database.

5 Implications of Safety Recommendations on the International Regulations: ICAO

Safety recommendations addressed to the International Civil Aviation Organization (ICAO) have a special interest because they have both, legal and technical implications.

ICAO plays a key and complex role in the investigation and prevention of accidents. On one side, the investigation of civil aviation

accidents is regulated internationally by ICAO, through the existing Convention on International Civil Aviation and its Annex 13. On the other side, ICAO is responsible of the Standards and Recommended Practices (SARPs). SARPs constitute universally accepted standards that cover all technical and operational aspects of civil aviation (personnel, aircraft operation, aerodromes, etc,). This section revises trough several study cases significant safety recommendations addressed to ICAO, detailing the improvements that have resulted from this process.

5.1 Case study on changes in ICAO SARPs.

At present, most aircraft are equipped with ACAS, an on-board aircraft system that provides pilots with maneuver advice in the vertical plane to prevent a mid-air or near mid-air collision. Two types of alert can be issued: TAs and RAs. Traffic advisories (TAs) help the flight crew acquire the intruder aircraft visually and alert them for a potential resolution advisory. Resolution advisories (RAs) are avoidance maneuvers in the vertical plane provided to the flight crew.

The first conceptual research on ACAS was initiated in 1956 by Dr John S. Morrel after a mid-air collision between a DC-7 and Lockheed Super Constellation over the Grand Canyon in the USA. The 1978 collision between a Boeing 727 and a Cessna 172 over San Diego, California led the United States Federal Aviation Administration (FAA) to start the development of the first ACAS. Following another mid-air collision over Cerritos, California, in 1986, the phased-in mandate of ACAS began in the USA. The collision between a Boeing 747 and an Ilyushin 76 near New Delhi, India in 1996 triggered the process of mandating ACAS in other parts of the world. As of 2010, some 11,000 aircraft in Europe were equipped with TCAS II version 7.0.

ICAO is responsible for the standardization of ACAS since November 1993. Its definition is given in Annex 2, and its use is regulated in the PANS-OPS Doc. 8168 and PANS-RAC Doc. 4444. SARPs for ACAS II, ie technical specifications, are included in Annex 10. Annex 6 “aircraft operations” specifies that aircraft must be equipped with ACAS. ACAS Manual (Doc 9863) includes a detailed description of the system and the technical and operational aspects to facilitate proper operation, operational control and staff training. Supplementary regional procedures document Doc 7030 specifies requirements for ACAS II equipment at the regional level. [21-27]

A near-collision and a mid-air collision in the early twenty-one century showed problems of lack of consistency in the application of the ACAS procedures. On January 31, 2001, a Boeing 747-446 and a DC-10-40D from Japan Airlines almost collided in the air over Suruga Bay in Japan. On July 1, 2002 a charter flight form Russian Bashkirian company and a DHL cargo plane collided above Überlingen in Germany. In their investigation, the Japanese Research Committee and the German Federal Bureau of Aircraft Accidents Investigation (BFU), made up to 7 recommended requiring ICAO to amend ACAS standards [28-29]. As a result ICAO performed the following actions:

- Amendment of doc. 8168 PANS-OPS strengthening provisions to: need for pilots to follow RA even if they are in conflict with ATC orders; prevention of maneuvers in opposite directions to RA; prompt notification to ATC service of the actions taken by the pilot in response to a RA; pilot training guidelines.
- Amendment of Annex 2 “rules of the air" to emphasize the responsibility of the pilot in command to follow conflict advisories issued by ACAS.
- Amendment of Annex 11 "air traffic services" requiring that the ATC units were equipped with devices to record communications background and noise environment in the operating position of the air traffic controller.
- Amendment of Annex 13 "Investigation of Accidents" to assure non-disclosure of the recordings and transcripts of recordings of the ATC units.

5.2 Case study on changes in OCAI Manuals and Circulars.

Human factors have been recognized as a major contributing element in aviation accidents. ICAO addressed the systematic investigation of human factors in aviation accidents in the 1993 circular Human Factors Digest No 72. The circular highlighted contemporary approaches to the investigation of human factors in accidents including the application of the SHELL model and Reason's Accident Causation Model [4] to the collection, analysis and presentation of human factors information. These models suggest that human error is viewed as a symptom or effect of air transportation system issues as opposed to narrowly regarding operator error as the final cause of accidents.

The importance of Human Factors to flight safety was officially recognized by ICAO at 26th Assembly in 1986 leading to the establishment of the Flight Safety and Human Factors Programme, which has produced the seven manuals and seven circulars.

5.3 Case study on changes in the ICAO Policy

The investigation of the causes of an accident begins with gathering factual information, including the recovery of the flight data recorders CVR and FDR. ICAO has developed policies to ensure the availability of data necessary to investigate accidents.

In 2004, the 35th Session of the ICAO Assembly reiterated the importance of flight recorders for flight safety, and recognized the need to amend ICAO provisions for such systems [30]. In 2007, the ICAO Assembly, at its 36th session [31], evaluated the work of the expert group on flight recorders proposing amendment of Annex 6. The proposal included provisions s to extend the duration of the cockpit voice recorders up to two hours; implementation of solid-state recorders; increase the number of parameters to be recorded; video recording devices in the cockpit; data links recorders; combined recorders (FDR/CVR); increasing the sampling rate for the acceleration and position of the control surfaces, etc…

In 2010, ICAO held the High-Level Safety Conference (HLSC 2010) [32]. The conference discussed, among other things, safety initiatives resulting from recent accidents related to on-board data necessary for an accident investigation: the provision of search and rescue (SAR), the registrar on-board imaging (AIR), the flight data recorders and recovery; communications in oceanic areas, etc. ...One of the main topics discussed concerned the situation relating to accidents that occur at sea. On June 1, 2009, ATC communications with Air France flight AF447 were lost over the Atlantic Ocean when flying from Rio de Janeiro (Brazil) to Paris-Charles de Gaulle. The difficulties to localize and recover the rests of the aircraft led to questioning the adequacy of the current flight data recovery technology in oceanic airspace or remote areas. The HLSC 2010 produced recommendations addressing three major topics:

- securing access to flight data necessary for accident investigation,
- improvement of surveillance, flight monitoring and communications of aircraft in oceanic/remote areas,
- provision of timely and adequate search and rescue services in areas of need,

In 2010, the ICAO Assembly at its 37th session [33], followed up on the status of implementation of the recommendations of the 2010 HLSC, such as the availability of data necessary to conduct investigations, underwater locator beacons (ULB), ejection and free flotation recorders, flight data triggered continuous transmission, flight monitoring of aircraft flying over oceanic/remote areas and provision of search and rescue (SAR).

6 Conclusions

Safety recommendations are the main procedure of the states' safety investigation authorities for their prevention efforts because they are the gears that introduce changes and improvements in the safety air transport system, both nationally and internationally.

While they are recommended material, and not mandatory, the legal implications are more complex than it seems, and is currently being closely monitored by the appropriate authorities

and leading, where appropriate, the imposition of penalties if this monitoring / control is not adequate.

On the other hand these recommendations are aimed at preventing future accidents and therefore have different recipients. In this work several examples are shown which have demonstrated the importance of feedback loop that experience very different rules (airworthiness certification of aircraft operations, standards and recommended practices of ICAO, etc..) that are constantly being amended and expanded with content derived from the safety recommendations issued in the investigation reports of accidents and incidents in civil aviation. In this way the main objective of the technical investigating authorities makes real, which is none other than research to prevent future accidents / incidents.

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