

IFATCA Vision Document

(Towards the 21st Century)

THE IFATCA MISSION STATEMENT

To protect and safeguard the interests of the air traffic control profession

The International Federation of Air Traffic Controllers' Associations (IFATCA) is a non-political, non-industrial organisation with a membership of over 40,000 air traffic controllers. IFATCA was founded in 1961 by air traffic controllers from 12 European countries. Subsequently, it was grown in stature and now represents more than 100 Member Associations world-wide. (A full list of the countries can be found at the end of this document).

The aims and objectives of the Federation were formulated in Amsterdam in 1961, and have remained the foundation of IFATCA.

THE FEDERATION OBJECTIVES

Safety

To promote safety, efficiency, and regularity in international air navigation.

Assist Development

To assist and advise in the development of safe and orderly systems of air traffic control and new procedures and facilities.

Promote Knowledge

To promote and uphold a high standard of knowledge and professional efficiency among air traffic controllers.

Co-operate with Authorities

To closely co-operate with international and national aviation authorities and institutions concerned with air navigation.

Sponsor Legislation

To sponsor and support the passage of legislation and regulations which will increase and protect the safety of air navigation.

World-wide Representation

To strive for a world-wide Federation of Air Traffic Controllers' Associations.

WHY THIS VISION DOCUMENT?

In this Vision Document, IFATCA promotes its views on the important aspects of the implementation of the International Civil Aviation Organisation (ICAO) Communications, Navigation, Surveillance/Air Traffic Management (CNS/ATM) systems and the effect which it will have on the controllers who will be in the front line as the current system of ATC moves to the future ATM system.

With the realisation that the introduction of satellite-positioning systems would play a significant role in the future air navigation and consequently on the traffic control systems, there has been no shortage of ideas and concepts being propounded to take advantage of the benefit that will accrue from the use of satellites. The lead has come from ICAO Future Navigation Systems (FANS) committee which presented its final report at the end of 1993. Since then, the emphasis has been on planing and the implementation of the ICAO CNS/ATM systems against the timescales determined by FANS committee. IFATCA participated in the FANS forum from its inception, and has emphasised the importance of the role of the controller in the future ATM system. Also, IFATCA has put towards its case in other associated ICAO panels and working groups as well as other international forums. IFATCA is committed to continued participation in these ICAO bodies.

The rapid developments in technology have heightened IFATCA's concern that the influence of the systems' designers and engineers is overshadowing the requirements and demands of the front-end users such as controllers and pilots for the future CNS/ATM systems. The transition from the current ATC system is universally recognised as an evolutionary process. However, the emphasis on the use of technology is nothing short of revolutionary.

IFATCA believes that this is a need to ensure that the weight of operational expertise and judgement must be projected in a more public forum to counter-balance some of the more aggressive thrusts of the commercial and technical approaches to future technology.

COMMITMENT TO REGIONAL DEVELOPMENT

IFATCA is well represented in the international forums involving ICAO and others. However, IFATCA accepts the widely-held view that, although ICAO CNS/ATM is a global system, implementation will take place regionally and that the pace of progress will be dictated by political, geographical, economic and social factors. Therefore, IFATCA has been active in all ICAO regions through its own regional organisation. Examples of IFATCA participation are:

- **The European Air Traffic Control Harmonisation and Implementation Programme (EATCHIP)**
- **The Informal South Pacific ATS Co-ordination Group (ISPACG)**
- **The CAR/SAM Regional Planning and Implementation Group (GREPECAS)**
- **The African Planning and Implementation Regional Group (APIRG) CNS/ATM Task Force**
- **The Asia/Pacific Air Navigation Planning and Implementation Group (APANPIRG)**

Participation in these and other regional groups and committees is important, particularly so that IFATCA can compare developments and monitor the progress to ensure that the ultimate objective of a global seamless ATM system remains on track.

IMPORTANT ISSUES

- **The transition from present to future systems**
- **The controller' role**
- **IFATCA's vision of the future; and most importantly**
- **Improving safety**

To place the role of the controller in perspective, IFATCA believes the underpinning principle to be that controllers are "users" of the Communications, Navigation, and Surveillance *CNS) systems and "providers" of the Air Traffic Control element within Air Traffic Management (ATM); the other two elements being Airspace Management (ASM) and Air Traffic Flow Management (ATFM). Thus, IFATCA considers that controllers are customers of CNS and therefore have specific requirements which must be taken into account. The development of the future ATM system, in which we are a major stake-holder, must incorporate the expertise and knowledge of the **operational** controller. IFATCA believes these positions to be fundamental in the development of the future CNS/ATM systems because the changing culture of the provider is oriented to the adoption of a more customer-driven service.

THE TRANSITION TO CNS/ATM

The Current ATC System

IFATCA opposes the notion that the introduction of new technologies can, by definition, successfully replace the old and tried methods of control without a full detailed evaluation and validation. Failure to complete this evaluation represents a major threat to safety.

It is appropriate to analyse the present ATC system so that the issue arising from the transition to, and implementation, the ICAO CNS/ATM system can be identified and paced in perspective. The present system is based on terrestrial navigation with a fixed-route structure. The exception is long-distance oceanic tracks, where in the North Atlantic user-preference, traffic demand, and weather determine twice daily route structure, and in the Pacific where Dynamic Airborne Re-Routing Procedures are being developed to avoid weather.

Aircraft separation and expedition are functions of the ground-based ATC organisation, using either radar or non-radar method. This system has restrictions on the number of aircraft which can fly through a particular portion of airspace at any particular time, leading to a reduction of capacity. As demand rises and the system cannot provide the capacity to absorb it, air traffic flow measures become necessary to restrict the numbers of aircraft to prevent controller overload and retain the safety integrity of the system. Controller workload becomes the significant factor in the capacity equation, and the number of factors contribute to this increase in workload such as traffic complexity resulting in RT congestion and high levels of co-ordination.

However, there are strengths to the present system which must not be overlooked. It has been proven over many years that the established high standards of training for controllers and engineers have created confidence in a system which is dependant on human decisions - thus making it both flexible and error tolerant. Also, the system is capable of increasing capacity though the introduction of new controller tools to reduce workload, improved airspace design and sensible traffic management. Provided that the system is regarded as a holistic entity, improvements can be made to accommodate enhanced runway capacity right through to the en-route stage by eliminating choke-points. The key to a successful transition to the fully-fledged and mature CNS/ATM system is maximising the capacity of the existing system by utilising its strengths and by innovative thinking to overcome weakness.

There are potential dangers to increasing capacity of the existing system inherent in the deployment of Airborne Collision Avoidance Systems (ACAS) is a case in point. The concept of an independent device to act as a last-ditch warning to the pilot to avoid a collision is an essential tool. However, this system is also seen in some quarters as a separation device. Apart from maintaining the independence of a system designed to avoid collisions, there are many other issues that arise which have implications for the future developments, not the least of which is introducing cockpit-derived separation into a ground-based separation environment.

The introduction of new and advanced ATC systems (initially terrestrial based) in a number of countries has been dogged by failure and delay. The implementation of the most far-reaching and radical change of ATC systems must use all necessary resources to avoid history repeating itself.

The experience of IFATCA is that current operational knowledge and judgement must be called upon from the inception of any major ATC project.

BENEFITS OF THE CNS/ATM CONCEPT

The FANS concept is considered as two elements. The first part, CNS, is the infrastructure which the second, ATM, requires to perform its function. IFATCA has certain criteria for the various constituents of CNS. However, the organisation purposes that the use of satellites for navigational and communication purposes will bring major benefits to global ATM particularly in the areas poorly served by the existing system.

The prime example of where these benefits will be derived early is the Pacific Ocean where until now HF, when available, was the main communication channel and there was no navigational support. The use of satellites for communications and navigation will achieve an increase in capacity through a flexibility of routes and reduced separations.

Free Flight

IFATCA recognises that Free Flight may be feasible in certain airspace. There are, however, other airspace environments that are incompatible with the introduction of Free Flight. The implementation of Free Flight will also be dependant on the development and development of certain enabling technologies, such as datalink and conflict/resolution tools.

The increase in airspace capacity and its associated flexibility produces major user benefits, including reduced costs and increased safety, although this latter is subject to qualification. It is against this background of benefits that the concept of Free Flight has been allowed to flourish and gain a level of credibility. Effectively, Free Flight is a user-preferred flight profile which allows the operator to have the option of his choice of route rather than the imposed fixed ATC route of today's system.

GNSS (Global Navigation Satellite System)

IFATCA requires that the safety, integrity, and reliability of GNSS be guaranteed before GNSS achieves a "sole means" status of navigation.

One important benefit of CNS is the declaration that GNSS becomes the "sole means" of navigation and communication which will make the terrestrial navaids obsolete. Therefore, many of the existing ground aids could be removed eradicating the major cost of their maintenance and replacement.

Advancing Technology

The global membership of IFATCA includes member associations from countries from each end of the economic spectrum. IFATCA is aware that some countries are unable to fund the necessary improvements in ATC for both social and political reasons. Therefore, the enthusiasm for an advanced global ATM system must be tempered by the knowledge that many countries have financial priorities ahead of aviation. On a regional, and ultimately global basis, this means that the efficiency and capacity of the ATM system is only as good as its weakest link.

Therefore, it is vitally important that States recognise the necessity for adequate investment in

ATC and ensure that charges made to the system users are re-invested in the air traffic control infrastructure.

While IFATCA supports the progress in advanced ATC technology, it remains particularly mindful of the major inadequacies of ATC in many of the less-developed countries.

The immediate benefits from the CNS/ATM developments can be accrued from applying them to those nations with a less developed ATC system and the sparsely populated areas with few or no navigational facilities giving them a quantum leap in the provision of air traffic services.

TRANSITION ISSUES

IFATCA's concern is directed at the potential impact of this transition on the ATC system and the controller.

The transition to the mature ICAO FANS CNS/ATM system on a global basis must be both regional and evolutionary. There will no "big bang" changeover, a long gestation period has been already mapped out by FANS committee. The evolutionary process implies that existing and replacement ATC system will operate for varying periods (dependant on regional factors) in parallel.

IFATCA does not envisage a massive recruitment of controllers for reason of cost and training time. Therefore, controllers will be expected to migrate from one system to the other.

Datalink

IFATCA does not accept that datalink communications can replace all voice communications.

IFATCA believes that direct controller-pilot voice communications must be available for all non-routine and emergency messages, and for all tactical separation messages in continental high density and TMA airspace.

The primary enabling technology for ATM is the use of datalink. The replacement of voice communication with datalink messages is a key element of the system. This change has fundamental issues for controllers and pilots alike. In the present system, the voice has been the medium for interchange of information and instructions. It is immediate and, subject to various nuances of intonation, convey levels of urgency and inquiry. The subtlety of voice gives the ability to identify mistakes or omissions. To replace this complex communication channel with the impersonal datalink will require a culture change in the cockpit and on the ground. For this reason and others, such as high traffic density and ground/cockpit workloads, voice communications will be required for the foreseeable future.

This raises questions of adequate and appropriate training, which will be addressed later, and that of the cockpit/ground interface.

In any datalink system used for ATS, ATC messages from the controllers who have jurisdiction over the flight, must have the highest unassailable priority over any other use of the system (for example AOC messages).

Direct Controller Pilot Communications (DCPC), as used for voice or datalink, requires that no third party is involved in the set up and/or delivery of these communications. Any set up by either the pilot or the controller must be minimal and nearly instantaneous.

IFATCA believes that financial concerns must not lead to any loss of safety benefits.

Automatic Dependant Surveillance

If Datalink is the enabling technology, the Automatic Dependant Surveillance (ADS) will provide the wherewithal to introduce the CNS/ATM concept. "ADS is a service for use by air traffic services in which aircraft automatically provide, via a datalink, data from on-board navigation and position fixing systems" (ICAO). The difference for controller between a radar target (determined by an independent source, i.e. the radar head) and an ADS target is that the aircraft communicates its position from its internal navigational system to the ADS display. Aircraft on radar are fixed relative to each other through the independent sensor, whereas aircraft ADS positions are not relative to each other apart from accuracy of the information transmitted from air to ground.

IFATCA believes that controllers must have the appropriate ratings and training for an advanced, sophisticated ADS environment before transitioning from any other type of control environment.

IFATCA accepts that ADS is an advanced non-radar tool which will allow the current generous procedural longitudinal and lateral separation standards to be reduced progressively. As already stated, it is areas which have lacked radar surveillance which have most to gain from the introduction of ADS. This will be a huge leap in ATC terms in by-passing radar operations. Ironically, it has been identified that "older" controllers need to be trained to trust the system, whereas "younger" controllers need to be trained to distrust the system.

IFATCA believes that separation standards using ADS must only be reduced below the present minima following an assessment of risk quantified by an approved ICAO method and supported by operational judgement to account for those factors that cannot be modelled.

Replacement of Terrestrial Navaids

To move towards the use of satellites as sole means for navigation implies a system which ensure a high level of reliability, accuracy and integrity. The current system (GPS/GLONASS) has known deficiencies which are being addressed. For instance, geostationary satellites become ineffective in the Polar Regions which means alternative procedures are required since ADS can not be used. These systems are subject to natural temporary degradation and unserviceabilities. Since these deficiencies can be forecast, there is a requirement for a NOTAM service to report these degradations to provide relevant information to pilots and controllers.

IFATCA believes that until fail-safe procedures have been proven and installed, the removal of terrestrial navigational aids is neither feasible nor safe and would therefore be highly premature.

Automation

The advanced technology being developed to gain maximum benefit from the use of satellites will have a direct impact on the controller. The expected increases in capacity will only be achieved provided that the workload of the controller is constrained within manageable proportions. The achievements of this increase will require the use of automation and appropriate enabling tools. However, IFATCA believes that certain principles are applicable.

To summarise these:

The purpose of automation is to assist the controller with his task of decision-making, not to reduce him to the position of being merely a system monitor. Ultimately, the role of automation should enhance controller performance with consequential benefits in increased safety, capacity and efficiency.

The level of automation must be compatible with the controller's ability to execute or manage the task while at the same time ensuring that in the event of system failure, the controller has the facility to safely revert to manual operation.

IFATCA acknowledges the requirement for the progressive introduction of automation.

System design incorporating automated tools should be based on the controller being at the centre of the control process and retaining the overall control function of the system. Safeguards must be in place to ensure that the controller remains an active manager, rather than a passive monitor of an automated system.

The Holistic Approach

Air Traffic Management is developing into a highly complex, interactive system. The role of all components, including airports, apron service and aircraft handling, must be examined to ensure the efficiency of the whole system is maintained. To benefit from an increase in ATC capacity, ground facilities and personnel must be in place to ensure that bottlenecks and check-points are not just moved from one area to another. The three parties concerned with this aspect, airport authorities, airlines and ATC providers must meet with a common aim: to optimise the available capacity and to avoid overloads so that safety standards are not compromised.

Controller Training

IFATCA believes that all controllers must be trained at approved instructional establishments to ICAO-recognised standards and, on successful completion of that training, should be licensed in accordance with ICAO regulations.

Given that the human will remain at the centre of the control process it follows that the training of the controller must encompass all elements of the task to be accomplished.

Furthermore, controllers must receive appropriate training before using new or advanced tools or procedures in an operational environment. This is particularly relevant automation is introduced, and specific emphasis should be placed in training on system failure and manual reversion techniques. The maintenance of controller competency is essential in the changing ATM environment. Controller continuation training (including emergencies) and assessment programmes should be in place to ensure that the performance of the human is maintained at the appropriate level.

IFATCA recognises the importance of all parties working together to achieve the common objective of increasing capacity without compromising safety standards.

SAFETY - THE PRIORITY ISSUE

Safety Regulations

IFATCA supports the ultimate objective of achieving global harmonisation in safety regulation.

The changing nature of the present ATM system involves many facets ranging from the status of the ATS providers to the reduction of separation standards. However, there is one constant in the process and that is safety. There is a need to establish a common baseline from which standards can be applied. At the same time, the application of safety standards must be transparent to all parties so that confidence is created.

It is essential that the responsibility for safety regulation should be totally divorced from the provision of ATS. It no longer remains an option for the ATS provider to be the regulator of the same environment. The commercial elements of ATS are not necessarily compatible with safety requirements, which should be mandated by an independent State authority.

There are various ways of applying safety regulations. Whichever method is used, it is essential that the system of safety regulation adopted by States in any particular region must be harmonised because the effectiveness of one system will interact with that of its neighbours and any weakness in one will impact throughout the region.

The need for integrated and independent safety regulation is important for two fundamental reasons. First: new technologies and operating systems can impact, as single integral systems, on all aspects of the provision of ATM. Second: failures in safety management and in human factors represent a high proportion of the prime causal factors in aviation accidents and incidents. Such failures, and the associated chain of events which lead to them, are rarely limited to a single aspect of air transport.

With some notable exceptions, few States regulate the safety of their ATM services. Where they do, such safety regulatory functions are small in size, limited in scope and at an early stage of development.

IFATCA believes that the many diverse processes of implementation taking place globally demand independent safety regulation.

IFATCA believes that sufficient resources should be directed towards establishing robust and independent safety regulation at national, regional and global levels to encompass ATM equipment, procedures and personnel.

Safety Standards

IFATCA believes that safety standards must be clearly defined at an international level (ICAO) and must be adopted on a regional basis.

This is already happening with the established standards. However the CNS/ATM concept challenges these existing standards with its objective of increasing ATM capacity and flexibility. Whilst undue delay caused by unnecessary bureaucracy is not acceptable, neither is it acceptable to impose changes with minimal data, little consideration of other operating environments, poor training and so on. Where possible, process of establishing safety standards should be supported by objective evaluation and validation. The involvement of all parties is an important requisite for the acceptance of any safety standard.

IFATCA believes that the establishment of a safety standard is predicated on the successful completion of verification, evaluation, and validation procedures and processes.

The objective of these processes is to produce satisfactory data and results to support the proposed safety standard. As the development of safety standards increasingly becomes a global exercise, there is a corresponding requirement to define guidelines on the conduct of trials, particularly live trials. It is important that the front-end users/operators involved in such trials are fully aware of the trial objectives, the safeguards that are in place and contingency arrangements for an unexpected failure. Equally, appropriate training for pilots and controllers must be undertaken and parameters for the trial must be clearly established. For example, trials involving datalink may well encounter problems of communication saturation. Therefore it is of paramount importance that the personnel involved are fully aware of what is happening and well versed in manual reversion procedures.

System Integration and Design

Recent aircraft accidents have highlighted possible problems with pilots relying on their automated systems on the flight deck, and the difficulty of reverting to their primary flying skills and understanding in an unusual situation. Although the degree of automation provided for controllers is not yet a similar level, future automated tools are being developed which will raise the level of automation dramatically.

The "nightmare scenario" is that this automated ATC system will probably be pushed beyond its capability at the worst possible time, during periods of high traffic loads and/or adverse weather conditions. This means that the controller, whose abilities may have atrophied due to lack of use, will be required to resume human (non-automated) control under circumstances that require the highest level of skill.

IFATCA is concerned that new technologies may be deployed merely because they are available, rather than because they meet a valid operational need. Decisions on new equipment must be based on sound operational and safety-related needs, and not on mere availability or novelty of equipment.

Therefore, at the forefront of the system designers' planning must be the integration of the human with both ground-based and air-based systems. Failure to resolve the interface and integration problems of these systems will be a safety critical issue. A complete understanding of the complex control process must be a prerequisite for a system designer, necessitating the incorporation of the various disciplines within that design team.

Proliferation Issues

Developing technologies are proliferating with the unfortunate result that it is possible to have a number of technologies available for particular or similar function e.g. MLS/GNSS. The result is that variations complicate the ATC environment, increase controller workload, and impact on safety by making procedures unnecessarily implicated - thereby introducing the possibility of errors and misunderstandings.

Whenever possible, one global compatible system for each function must be specified. To achieve stability within the ATC system and the consequent benefits of safety, efficiency, reliability, and economy, equipment life-span should be as long as possible. The introduction of new equipment is often complex and costly, with problems of unreliability. The consequential

effect on ATM safety means it is important to reduce the number of equipment changes to an acceptable minimum.

IFATCA supports the CNS/ATM philosophy that the responsibility for separation remains with the ground-based organisation and that the human remains at the centre of the control loop.

THE FUTURE ATM SYSTEM

The Controllers' View

IFATCA is a major stakeholder in the ATM system and is committed to the inclusion of the controllers' viewpoint in all future developments of the ATM system.

IFATCA's objective is to firmly establish that operational experience and judgement must be taken into full account in system design and evaluations. The Federation believes in a co-operative and pragmatic approach to the development of the future ATM system. IFATCA recognises the great debt owed to the United States and Russia in making their respective global navigational satellite systems available to the civil aviation world. Without them, the FANS CNS/ATM concept would be nothing more than that - a concept! The development of the CNS system is well under way towards transforming the concept into reality. However, this is a long way to go before CNS is recognised as a mature system. The demand for early cost benefits has initiated the introduction of interim systems such as FANS-a and FANS-A, which are proving to be test-bed for the use of satellite systems for CNS. Not surprisingly there have been problems during implementation, but what is demonstrably clear is that the navigation performance is well in advance of the communications and surveillance performance. Additionally, FANS-1 has major limitations which may be acceptable in the low density oceanic areas but not in the busier regions of the world.

As a stakeholder, IFATCA fully supports the development of the global ATM system. The Federation has a practical and realistic approach to its implementation based on the inescapable fact that the introduction of the new systems will have to be processed in parallel with the contiguous operation of the current system whilst handling increasing levels of traffic.

The view of IFATCA is that there are so many variables in the development of the ATM system that it is extremely difficult to forecast the final version of the system.

IFATCA's optimism for the seamless global ATM system is tempered because of the constraints exerted by cost, time, technology, and manpower. The future ATM system requires investment both in the air and on the ground and unless early cost benefits are realised, this investment is the time it takes to equip aircraft fleets with the appropriate avionics to realise the major operational benefits of the ATM service. Estimates vary from seven to fifteen years for all aircraft to be equipped presuming that every airline has the will and finance to do so. There is an enormous amount of technology looking for business, and the danger is that it will proliferate to the detriment of harmonisation and standardisation. These factors, plus the principle that system safety must be improved to keep pace with the increase of traffic, are likely to mould the ATM development process to such an extent it is almost impossible to forecast the final outcome.

IFATCA believes that the development of interim CNS systems must not deflect from the necessity for the establishment of a fully SARPS-compliant Aeronautical Telecommunications Network (ATN) which will be the bedrock of a seamless global ATM system.

The prime objective of the future ATM system is to increase capability to allow operators the flexibility to meet their objectives safely and efficiently. IFATCA recognises that the path to the global system is through regional development and that certain regions will benefit from early CNS/ATM implementation. Examples include the low density oceanic areas such as South Pacific, poorly equipped areas in parts of Africa, and mountainous areas as found in South America. Modest reduction in separation standards can make dramatic improvements whereas in the high density areas with good radar and VHF coverage such improvements are not possible without a total overhaul and restructuring of the ATM system.

The Human Centred Concept

This principle of the human remaining in active control applies to controllers, engineers, and pilots. The development of automated tools must be on the premise of supporting the controller thereby reducing the ancillary workload for any particular task. This will allow controllers more time for the primary objective of ensuring the safe and efficient operation of aircraft under their jurisdiction.

IFATCA believes that system design must incorporate all elements of the airspace and ground infrastructure, and recognises the fact that future ATM operations must exist as a seamless total environment - in other words, the "gate-to-gate" principle.

The integration of ground and air systems into the overall ATM system is essential to realise the major operational benefits. The design of the system must take into account the performance of these systems, and ensure that the interaction between them is compatible to the controller and the pilot. This factor will define the ability of the ground separation responsibility to be delegated to the pilot under rigorous conditions. The concept of Free Flight will be predicated on close integration of the air and ground systems.

Implementation of new equipment and procedures must be preceded by appropriate verification and validation followed by a reasonable period of stability to allow system bugs to be resolved. New equipment, such as rapid-update ADS, must be proven safe and capable of supporting any proposed reduction of separation minima.

Because regional development will be uneven, it is important that the harmonisation of procedures and standards must be given priority. It is not acceptable to IFATCA that the resolution of local or regional capacity problems is resolved in isolation.

Throughout the evolving process of implementation, controllers and pilots must receive the appropriate level of training before using new procedures and equipment.

IFATCA accepts that, in certain closely-defined circumstances, separation may be delegated from the ground to an airborne responsibility for a specified period of time.

Increased capacity means more traffic with reducing separation standards. The margins for error will decrease. The risk of collision increases unless the consequent demand for continuing improvement in the safety standards of the ATM system and for independent regulation is met to the satisfaction of the fare paying passenger.

IFATCA believes that Safety is the absolute priority and that it takes precedence over every aspect of the current and future ATM system.

CONCLUSION

Many view the voiced concerns of controllers are being barriers to progress. This view point is unfounded as controllers accept the advances that the enabling technologies in CNS can bring to the way that they control air traffic. Controllers accept the technology as a progressive development in the evolution of the air transport industry.

However, to realise the advances will require co-operation:

- **co-operation in the form of consultation with the end users who have the operational knowledge with which to turn the capabilities of technology into a service;**
- **co-operation with other system users to make it happen and realise their goals;**
- **and co-operation with the system itself.**

This co-operation must be both at the level of workstation on the ground and in the cockpit. It is only by mutual co-operation with the systems and tools that will support ATM control activities that a control service can be provided with the safety and efficiency, and provide the experience to grow in the future.

Human Factors

The subject of Human Factors in the Air Traffic Management (ATM) world has become one of the most important issues in air traffic control today. Historically, Human Factors belonged to the scientific world where research focused on areas such as task analysis, selection methods and job description(s). Today, its importance encompasses all aspects of aviation. The aviation system has changed a great deal over time, especially with regard to automation, but controllers are still functioning in the same role(s) as always. Although Human Factors in Air Traffic Control is not a novel item, the ICAO Flight Safety and Human Factors Programme has given a new impetus to the work in this area during the last decade. One of the more significant results is that elements of Human Factors in Air Traffic Control have migrated from the academic world to the operational domain. This results in a new appreciation for the importance of HF issues by Air Traffic Services providers.

The International Federation of Air Traffic Controllers' Associations has placed the application of Human Factors knowledge high on its list of priorities. Our goal is not simply to maintain a safe system, but improve aviation safety through education. We believe that any understanding of Human Factors issues that is limited solely to individual operators in a complex system such as aviation, whether they be controller, pilot or other vital component, is undesirable. Air traffic controllers need to be familiar with the logic behind the Human-Machine interface (HMI). It is paramount that all operators share the same basic understanding of how a system, or system component, is designed, and to have "knowledge of human performance and limitations".

IFATCA acknowledges that so-called error-free systems could conceivably be designed by automating as many human tasks as possible. We think however, this in itself will not eliminate errors, but merely change the place where errors can occur. Subsequently, it has the potential to increase the magnitude of human error.

Human Factors issues are involved in almost all accidents and incidents. "Human error" is not the end of the investigation process but rather its starting-point. Human error takes shape within the workplace and is a consequence rather than a cause. Errors require explanations, but only by understanding the context(s) that provoke error(s) can we hope to limit recurrences. We must begin at the design stage, and shift our focus from eliminating error to preventing and managing error.

IFATCA believes that by understanding circumstances from a Human Factors perspective, it is possible to introduce changes making it less likely similar errors would reoccur. The model for the analysis of breakdowns in complex socio-technological systems, as developed by Professor James Reason, is endorsed by IFATCA as a means to achieve such understanding.

The assurance of Safety in Air Traffic Services will govern the industry's direction. Each component of the aviation industry must demonstrate an ability to meet, and exceed required levels of safety. To accomplish this, we must become more pro-active in our approach to Safety Management in ATS.

It is the Federation's view that the human is the central element in our aviation system(s). As such, he/she is entitled to all available resources that will promote and facilitate functioning at optimum levels including education and training in Human Factors.

It is IFATCA's wish that Service Providers will take positive steps to provide training programs for ATC staff, in the area of Human Factors. It is IFATCA's view that Recurrent Training programs featuring gradual and systematic introduction of Human Factors knowledge to ab-initio, and already-qualified Air Traffic Controllers, are a necessity. Such program(s) should include Human Factors Specialists and operational training specialists. The ICAO document *Human Factors Guidelines for ATM Systems* is very specific in this regard. As we increase our reliance on technological tools, they are the most appropriate source for information on user preferences, knowledge of issues, procedures, and practices.

The development of a formal "education plan" for controllers will ensure Human Factors considerations is fully incorporated into system design. The plan could be a living document; tailored to specific requirements, strategies, and other program considerations.

A priority for these and other training programs must be to concentrate on Human-Machine-Interface features of new equipment, and application(s) of the new procedures. Equally important, is understanding philosophies in system design, and grasping concepts such as Situational Awareness and Error Management.

Integrating Human Factors awareness from the earliest stages will pay dividends. The resulting bonus will be a system that supports the users, removes non-essential tasks, reduces workload, improves performance and increases efficiency.

Many challenges remain in the field of Human Factors knowledge and skills. IFATCA is committed to an evolutionary improvement process that builds on the strengths of our existing, and proven aviation-system.

IFATCA's proposed solutions for ATC Human Factors issues center on efforts to convert practical expertise into written procedures, rules and regulations. The Federation believes this is the way to the future and the key to longevity. The main ingredient is a culture that focuses on the human, and Human Factors. Each and every ATS system's most valuable resource is its staff. We urge all ATS-providers to invest in their human resources. A motivated and dedicated workforce will thrive well into the future.

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