fSECURITY IN THE CIVIL NUCLEAR AND AVIATION SECTORS – IDENTIFYING TRANSFERABLE BEST PRACTICES

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Abstract

The World Institute for Nuclear Security has conducted a major benchmarking research project comparing the evolution and future security challenges faced by the civil nuclear and aviation sectors with the purpose of identifying transferable best practices between them. The research study, funded by the MacArthur Foundation, has comprised a comprehensive analysis of the publicly available information on aviation and civil nuclear security - both the IAEA and ICAO publish extensive information as do the various trade associations that represent the aviation and, to a lesser extent, the civil nuclear sector. However, in the case of nuclear security, this is supplemented by the work of a significant number of non-governmental organisations that monitor and comment publicly on the work of the IAEA and the state of global nuclear security generally. WINS has also worked with experienced practitioners in both sectors and interviewed countless individuals with responsibilities for aviation and nuclear security, at all levels. Taken together, this research programme is the most comprehensive effort ever undertaken to benchmark security in these critical sectors, and to identify root causes for any differences and opportunities for cross-sector improvement. The paper summarises the overall conclusions of the research that is to be published by WINS prior to the ICONS 2020 conference, and provides an indication of where further work could be undertaken to identify cost-effective and achievable opportunities for cross-sector improvement.

1. INTRODUCTION – WHY BENCHMARK?

On first inspection one might ask what the civil nuclear industry and the civil aviation sector have in common and why benchmarking their security arrangements is at all relevant.

On the one hand, commercial, civil aviation is a very public activity, transporting billions of people each year between airports – currently estimated at over 4 billon/year and forecast to reach over 8 billion/year by 2030. It is a highly dynamic and competitive international sector, where time is money, and where customer satisfaction is a high priority. On the other hand, nuclear power plants (and associated fuel cycle facilities) are some of the most robust, static structures on earth with control points that prevent unauthorised public access. Security at these plants is often characterised by the phrase “guns, guards and gates”; in strong contrast to the welcoming, public image that airports are trying to achieve.

Yet there are some very important similarities between these two sectors.

The first is that in both the nuclear and aviation sectors it is the State that is accountable and responsible for ensuring that security is effective; there is no difference in that fundamental regard. However, both sectors have dedicated UN-affiliated international organisations; the International Atomic Energy Agency (IAEA) for the civil nuclear sector, and the International Civil Aviation Organization (ICAO) for civil aviation. Both of these organisations consist of a large number of Member States (ICAO calls them Contracting States) – the IAEA has 171 States as Members and ICAO has 193. Both organisations are over 60 years old – the IAEA was established in 1957 and ICAO some years earlier in 1944 – and both have a legal foundation (IAEA Statute on the one hand and the Convention on International Civil Aviation on the other) that require them to promote the peaceful and safe expansion of their respective sectors. However, and very importantly, “security” is not mentioned in the legal foundation of either organisation because security was not considered to be an issue that needed any specific attention when these organisations were established. Both organisations and their Member States have had to

come to terms with how to address security issues in a world where the security threats are now globally important to both sectors, but have done so in very different ways as described in this paper.

Both organisations have a governance structure consisting of a Board of Governors chosen from the Member States, with the IAEA Board of Governors/ICAO Council consisting of 35/36 Members respectively. These bodies are responsible for approving the key strategic documents of the organisations, including their strategic plans for aviation and nuclear security.

Moving to the national level, both sectors have National Competent Authorities (Regulators) that are responsible for developing and enforcing national legislation and regulations based on the international frameworks of standards, recommendations and guidance published by IAEA/ICAO, and national requirements based on their specific National Security Strategy. Both sectors are usually considered to be part of a State's critical national infrastructure, and both sectors are of concern politically and publicly in respect of possible terrorist attacks.

And at an operational level, both sectors have a combination of public (i.e. government) and private sector ownership - exact figures are difficult to establish (because of complex ownership structures) but in broad terms the ownership in both sectors is split about 50/50 between government and privately operated entities. The key point is that neither aviation or nuclear operators are wholly owned by either government or private companies at an international level, though the arrangements vary from country to country. What is the same is that aviation and nuclear organisations almost always state that "safety is their number 1 priority", and some also include "safety and security" in their statement of corporate priorities. Nuclear and aviation operators both need to be high reliability organisations.

Other operational similarities are that both sectors, including their regulators and civil society, are deeply concerned over the threats from physical assaults, cyber-attacks on critical systems, and insiders. In terms of physical protection, nuclear sites and airports usually have a very large footprint with very similar perimeter protection systems to prevent unauthorised access, have security guards that conduct patrols supported by various technologies, and may rely on offsite armed response forces to support onsite security assets. Both sectors are concerned with the increased use of drones (unmanned aerial vehicles – UAVs) and their threat potential to nuclear and aviation operations. Cyber-attacks are increasing, and just as nuclear operators are concerned with attacks on both their IT and digital control systems, airports are concerned about the same threats to IT and flight control and air traffic control systems. Insiders pose a serious potential problem for both sectors and efforts to improve the security culture are evident in both sectors. And Security Management Systems, that try and emulate the success of Safety Management Systems, are increasingly being promoted, as is a convergence of safety and security management and an adoption of an "integrated risk approach" to the management of safety and security concerns.

Clearly, therefore, the similarities are evident and an obvious opportunity for benchmarking, to try and identify transferable best practices between the sectors at international, national and operational levels. But to our knowledge there has never been a concerted effort by the IAEA and ICAO Secretariats or Member States to engage in meaningful discussions or benchmarking, nor is there a cross-sector regulatory forum in operation, and operators in the two sectors tend to stick to their own communities and conferences. Major conferences on security are widespread in both sectors, examples being the ICAO Global Aviation Security Conference held in Montreal in September 2019 and this IAEA International Conference on Nuclear Security in February 2020. Cross-sector representation at these conferences is a wonderful opportunity to identify and support enhancements to security in both sectors and we therefore recommend and encourage personnel in both sectors with responsibilities for security to take this opportunity.

2. SCOPE OF THE WINS BENCHMARKING REPORT

The subjects covered in the full WINS report (see www.wins.org for details) include:

- A comparative analysis of the civil nuclear and aviation sectors, the threat landscape and analysis of events and incidents over the last 50 years,
- The role and evolution of the IAEA and ICAO in establishing their security strategy, security guidance, recommendations and standards (where relevant), and their interface with key stakeholders, including industry,

— The implementation of international security recommendations and standards and guidance,
— The IAEA and ICAO technical support programmes for security (i.e. IAEA Integrated Nuclear Security Support Plans – "INSSPs" – and the ICAO "No Country Left Behind" programme),
— International peer review and audit for aviation and nuclear security,
— Comparative approaches to security training, professional development and capacity building,
— The development and sharing of best operational security practices within the two sectors,
— The development of Security Management Systems, regulatory approaches and the interface between safety and security,
— A comparative analysis of how insider threats, human reliability programmes and cybersecurity are being addressed in the two sectors, and
— Future challenges and issues for security in the aviation and nuclear sectors.

This paper provides a summary of the overall conclusions of the research that we believe could lead to demonstrable and sustained improvements in security.

3. KEY FINDINGS AND OBSERVATIONS

3.1. Major Security Incidents in the Nuclear and Aviation Sectors

Over the last 50 years there have been 9 significant attacks on nuclear installations worldwide that resulted in 6 fatalities but in no case was there a radioactive release. The majority of the attacks took place in Europe on reactors that were under construction and were one aspect of a much broader European terrorism campaign during the 1970/1980s. Over the same period, significant numbers of radioactive sources and some nuclear materials have been stolen, lost or in some other way gone outside regulatory control, but there has never been a radiological device dispersed or exploded.

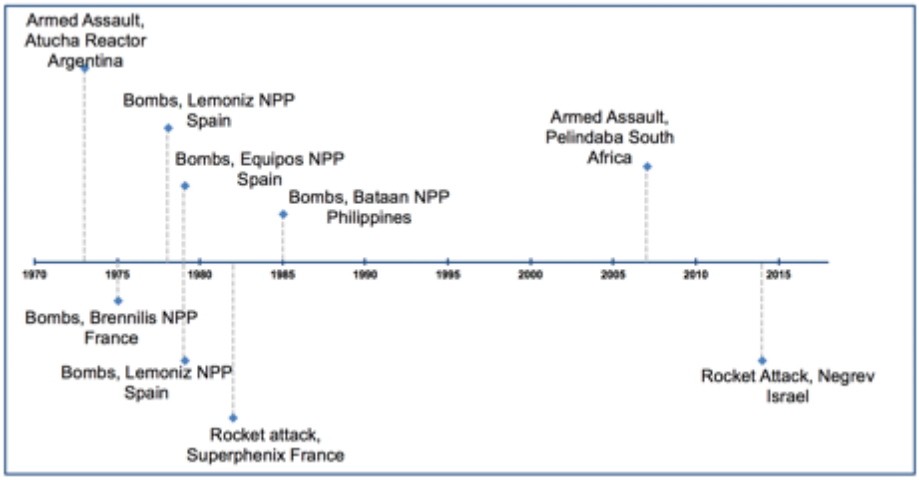


FIG. 1. Significant attacks on nuclear facilities since 1970

Comparative data for the aviation sector since 1950 indicates 8,631 fatalities as a direct result of significant security incidents and, of these, approximately half involved attacks at airports rather than on aircraft. Physical attacks and bombings where the most common form of aviation security incident, but high-jackings and using the aircraft as missiles were also prevalent. WINS has compiled full databases of these nuclear and aviation incidents as part of the benchmarking study and these can be made available for further research.

So, what do we conclude from these statistics?

— Security in the nuclear sector is much more effectively implemented, from the IAEA down to operators?
— Nuclear facilities are too heavily defended to make them an attractive target?

— There are many more potential aviation targets (airports and aircraft) around the world?
— Public access to the airports and aircraft is the deciding factor?
— Terrorists are simply not interested in attacking nuclear facilities?
— Something else?

Undoubtedly, there are many more airports than nuclear facilities (40,000 airports worldwide including over 10,000 commercial airports, compared to about 1,000 nuclear sites) making the attack surface bigger, and we believe that public access and the difficulty with protecting the public side of airports are both contributory factors, making airports softer targets than nuclear facilities. But we also conclude, with the exceptions shown in Figure 1, that terrorists have shown little interest in attacking nuclear-related sites or in detonating radioactive devices, because they have had ample opportunity to do so and not done it. Given the number of radioactive sources that are unaccounted for and the availability of explosives it is quite astonishing that a dirty bomb has not been exploded and the only credible explanation is a lack of desire to do so. We must not think that our nuclear security systems are so effective and robust that we can relax or allow complacency to dominate our thinking and actions.

3.2. The Role and Evolution of the IAEA and ICAO

The full WINS report provides a detailed analysis of the evolution of the IAEA and ICAO with respect to their involvement in security issues, given that neither organisation has security mentioned in their legal foundation. It is clear from interviews and analysis that the IAEA is considered a much more political organisation than ICAO, no doubt because of its statutory role in verifying non-proliferation and the political complications and issues that arise from that role. The IAEA has also concentrated much more on nuclear safety, given the internationally significant safety disasters at Chernobyl and Fukushima Dai Ichi, and the lack of significant security events.

The consequence of this is that the IAEA, in security terms, is roughly where ICAO was some 20 years ago, prior to the events of 11 September 2001 which galvanised political support for ICAO to have a wider international remit for aviation security. Within six months of the 9/11 attacks (i.e. March 2002) the ICAO Council and its Contracting States gave authority to ICAO to enhance the already mandatory Aviation Security Standards and Recommended Practices (SARPs), to develop a Global Aviation Security Plan, and commence mandatory Aviation Security Audits in all ICAO States.

Over the same 20 year period, the IAEA has had none of these powers given to it and despite a significant budget for nuclear security (much greater than ICAO's) and a large and dedicated staff of over 100 security staff, the IAEA can only respond to "requests from Member States." This generates enormous frustration within and outside the IAEA, makes it impossible for the IAEA to behave proactively or develop strategic plans of any substance, and is a terrible waste of public resources and opportunities. Instead of establishing security policies that allow the IAEA to have a meaningful role in nuclear security, its Member States (some, not all) fall back on excuses for why the IAEA should not have a wider mandate in security; excuses, in our view, with two motivating sentiments:

i. It's easier for States to procrastinate and "do nothing" rather than risk giving the IAEA more authority that could have negative implications for their State, and to take the risk on behalf of civil society that ineffective international oversight will not be the cause of a significant security incident, and
ii. Civil nuclear energy is still inextricably and inexcusably linked in some States to its origins in nuclear weapons' development, and remains within the State system of secrecy that applies to its national security apparatus. In consequence, overbearing and unjustified restrictions on the responsible sharing of information continue to be enforced; it all being "State" controlled.

One needs to ask whether there is any real justification for Member States denying the IAEA more authority; as noted earlier, the security arrangements and challenges at airports and nuclear facilities have so much in common that it is false to think that there is any justification for one sector to be subject to State secrecy and the other to be part of an international framework of cooperation, information sharing, common goals, progressive

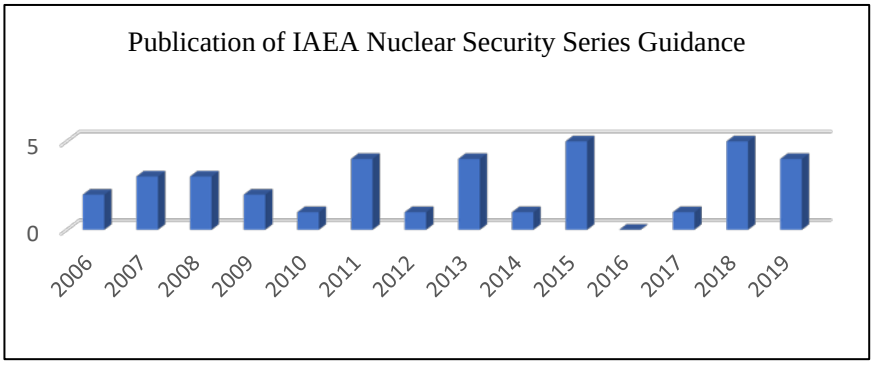
polices and oversight. How can it be possible for nuclear energy to help combat climate change when some States still wish to hide information about nuclear energy behind State secrecy? How can civil society ever accept or have confidence in an industry when States behave in this way?

3.3. The Implementation of International Standards, Recommendations and Guidance

As a consequence of the political obstacles to giving the IAEA a meaningful role in nuclear security oversight, the IAEA has been restricted to producing generic guidance on nuclear security; guidance that States can choose to ignore if they so wish. The IAEA's Nuclear Security Series was launched in 2006 and is updated by the IAEA Secretariat in cooperation with officials from its Member States. The series comprises four sets of publications:

- **Nuclear Security Fundamentals**, which establish the fundamental objective and essential elements of a State's national nuclear security regime (1 document),
- **Recommendations**, which set out measures that States should take in order to achieve and maintain an effective regime (3 documents),
- **Implementing Guides**, which provide guidance on how States can implement the Recommendations (18 documents),
- **Technical Guidance**, which provide more detailed guidance on specific methodologies and techniques for implementing security measures (10 documents).

Because of the sheer number of separate nuclear security documents (over 30) that the IAEA produces, the drafting, revision, approval and translation process has become a major burden for the IAEA Committee of Member State officials that oversees their production (the Nuclear Security Guidance Committee). It is not uncommon for new documents to take 3 years before they are translated into the official UN languages and published. Currently, the average age of the documents is seven years and only one of them has been revised and the revision published since 2006.



The cost of the IAEA Nuclear Security Series document production programme is not available from the IAEA but WINS has estimated that each document probably costs in the region of $1-2 million if the time of Committee Members and IAEA officials is properly taken onto account. Currently, the IAEA has no information or feedback on the extent to which these documents are actually used by Member States or downloaded from the IAEA website. There are plans in 2020 to begin to monitor these factors.

Even with Conventions such as the Amended Convention on the Physical Protection of Nuclear Material, States have very wide discretion over how this international legal instrument can be interpreted and implemented, and two States with very different policies and practices can both claim to be compliant – not that there is any oversight mechanism to check the claims. In short, there are no internationally agreed minimum standards for nuclear security in any form whatsoever and no international oversight mechanism.

By contrast, and since 1974, ICAO has established obligatory aviation security minimum standards. ICAO distinguishes between Standards and Recommended Practices:

- ***Standard**:* Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States ***will conform*** in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38 of the Convention.

- ***Recommended Practice**:* Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized ***as desirable*** in the interests of safety, regularity or efficiency of international air navigation, and to which Contracting States ***will endeavour*** to conform in accordance with the Convention.

The ICAO Aviation Security Manual (Doc 8973 – Restricted) assists its Member States in implementing Annex 17 to the Chicago Convention by providing guidance on how to apply its Standards and Recommended Practices (SARPs). Annex 17 and Doc 8973 are constantly reviewed and amended in the light of new threats and technological developments that have a bearing on the effectiveness of measures designed to prevent acts of unlawful interference in aviation. The current version was fully revised in 2017.

FIG. 2. Key ICAO documents relating to Aviation Security

The approach taken by ICAO in consolidating the aviation security guidance and requirements in publications such as the Aviation Security Manual has the obvious advantage that the information is more accessible, more frequently updated (approximately every 2 years) and avoids the tedious repetition of individual security guidance documents.

3.4. International peer review and audit for aviation and nuclear security

The IAEA operates a well-respected review programme known as the International Physical Protection Advisory Service (IPPAS) that provides its Member States with the opportunity to volunteer to have an IPPAS "Mission" to assess its national security arrangements for nuclear material under regulatory control. Typically, the Mission is planned over a period of months in consultation with the Member State that decides on the scope of the review, the facility/ties to be reviewed and the personnel and information that will be made available to the IPPAS team. The composition of the IPPAS team has to be approved by the Member State and there is no requirement for team members to be "accredited" as IPPAS reviewers.

The recommendations from the review are confidential between the IAEA and the Member State, and are not published unless the Member State decides to do so; in recent years some States are choosing to publish redacted versions of their reports which is a positive development. As of 2018, and since 1992, the IAEA had conducted 85 IPPAS missions in 50 States and performed 20 follow-up missions, giving an annual average since

1992 of approximately 4 missions/year. The IAEA does not publish any consolidated information about security observations, trends or other recommendations as a result of the IPPAS Missions.

ICAO's mandatory Universal Security Audit Programme (USAP) has evolved in a number of phases since 2002 when it was first approved, and is implemented by the ICAO Aviation Security Audit Section.

— **Phase 1** between 2002 - 2007; the first cycle of audits were designed to determine the degree of compliance of a State in implementing Annex 17 Standards, and the extent to which a State's implementation of its aviation security system was sustainable through the establishment of appropriate legislation, national policies and an appropriate aviation security authority, provided with inspection and enforcement capabilities. A programme of follow-up visits was initiated in 2005 and completed in 2009 to validate the implementation of States' corrective action plans (CAPs) to address the recommendations resulting from the first cycle of audits.

— **Phase 2**: January 2008 - June 2013. The primary objectives of the second-cycle audits were to assess whether the Critical Elements of an aviation security oversight system had been implemented effectively and to determine the degree of compliance with Annex 17 Standards. Aviation security performance is assessed on the basis of two indicators:

a) an *oversight indicator*, which represents the State's capacity to establish and implement an effective and sustainable aviation security oversight system; and
b) a *compliance indicator*, which provides an indication of the level of the State's compliance with Annex 17 – Security Standards.

— **Phase 3**: In 2012 the ICAO Assembly requested the ICAO Council to assess the feasibility of extending the Continuous Monitoring Approach (CMA) being applied by the Universal Safety Oversight Audit Programme (USOAP) to the Universal Security Audit Programme (USAP) after the conclusion of the second cycle of audits. The objective of the USAP-CMA was to promote global aviation security through *continuous auditing and monitoring of the aviation security performance* of Member States, rather than by periodic, scheduled audits. The Council and Assembly formally approved the USAP-CMA and the transition plan and full implementation of the USAP-CMA began on 1 January 2015.

In the 16 years between 2002 and 2018 ICAO conducted a total of 449 mandatory audits and 172 follow up audits at national level - about six times as many as the number of voluntary IAEA IPPAS and follow-ups missions over the 26 years from 1992-2018.

In complete contrast to the IAEA, ICAO publishes the overall results of the audits in two ways - by reference to (i) the effective implementation of the eight Critical Elements (CEs) of the aviation security oversight system and (ii) the effective implementation of the aviation standards defined in ICAO Annex 17. The data are published on both a regional and global basis and examples are shown in the following figures that depict the global percentage effective implementation rating for each indicator in 2018.

FIG. 3. Global Average Effective Implementation of Critical Elements, 2018

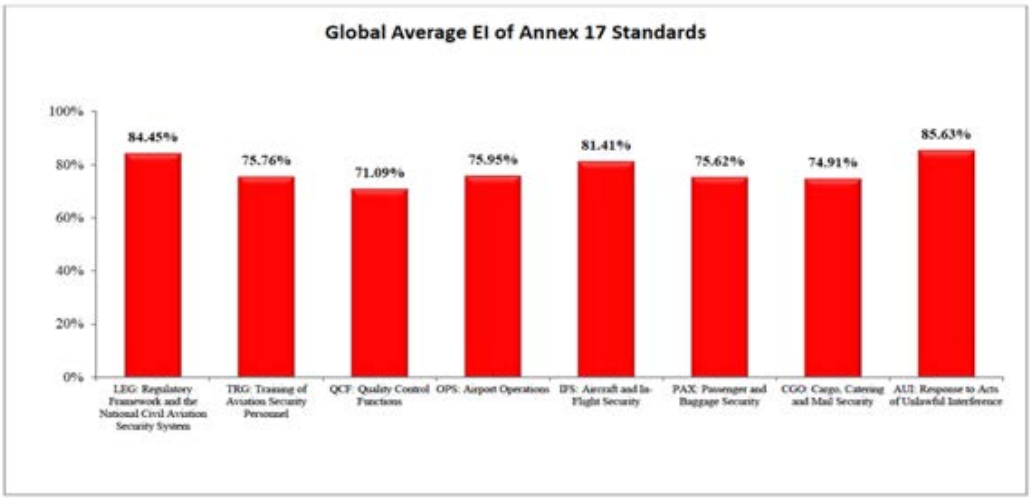


FIG 4. Global Average Effective Implementation of Annex 17 Standards, 2018

Additionally, ICAO publishes global and regional trends in these indicators over time in order to assess the effectiveness of its Global Security Programme, and has set "Aspirational Targets" for global aviation security implementation in 2023 and 2030. The overall global trend in the implementation of ICAO Critical Elements since 2008 is shown in Figure 5 below. The inspiration global targets for 2023 and 2030 are 80% and 90% respectively.

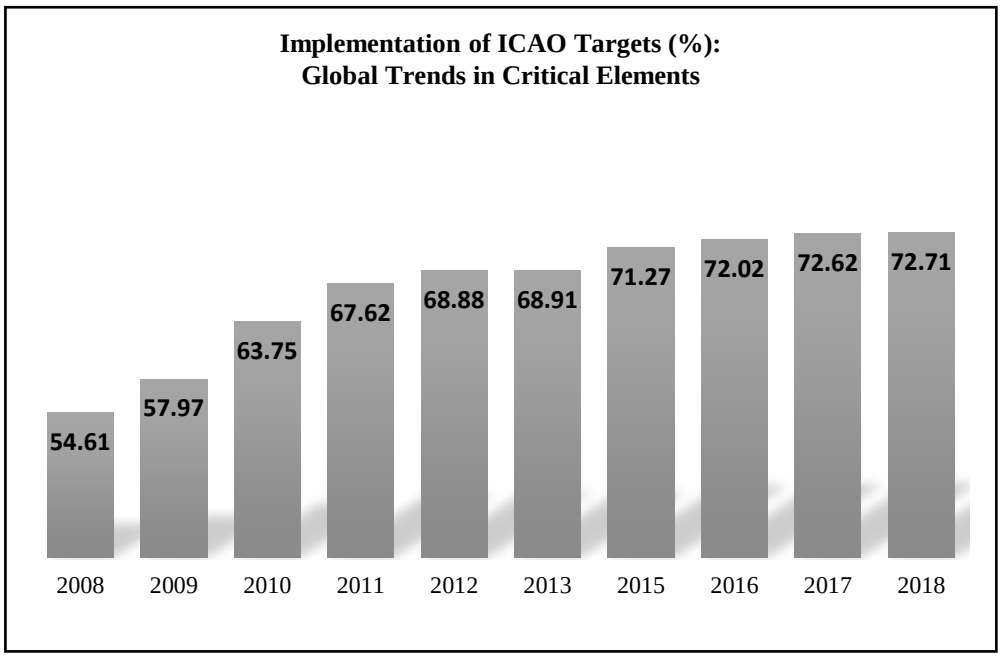


FIG. 5. Implementation of ICAO Targets (%): Global Trends in Critical Elements

A very important thing to note about ICAO is that despite it having the authority to set minimum aviation security standards as described earlier, it does not have any power of enforcement. Aviation security, just like nuclear security, remains the accountability of the State – and the only supra-national exception is the European Union which has both the power to set standards and to enforce them in European Law. In every other case ICAO relies on peer pressure from its Member States and the aviation industry to help enforce minimum security standards, and by ICAO promoting a range of initiatives to encourage and support compliance. These include certified professional development courses to promote the global competence and capacity building programme, and a programme known as "No Country Left Behind".

3.5. "No Country Left Behind" and Capacity Building through Professional Development

In many respects, the ICAO "No Country Left Behind" (NCLB) programme has the same objectives as the IAEA's Technical Cooperation programme but whereas the IAEA manages its nuclear security programme as a separate entity, ICAO appears to have a more integrated "one-house" approach. There could be opportunities here to re-assess the effectiveness of the IAEA's approach to their support programmes and whether a more integrated approach could bring benefits. At the level of the individual security support programmes to Member States there is less of a difference in approach. Both organisations use a questionnaire-style format to identify where additional support is required by the State (the IAEA refers to theirs as Integrated Nuclear Security Support Plans - INSSPs) but a major difference is that ICAO has the results of aviation security audits on which to base a much more thorough and systematic approach of the security "gap analysis" and its resolution through additional and voluntary State support and funding.

There are major differences between the IAEA and ICAO's approach to, and involvement in, security training programmes whose purpose is (should be) to enhance professional competence for security. In the case of the IAEA some $4Million/annum is spent on national and regional nuclear security training courses. The courses are organised and funded by the IAEA but there is very little by way of any formal structure to the courses, their outcomes or their contribution to global capacity building. This is because the courses are only loosely based on IAEA guidance, there is no catalogue of approved courses, there is no requirement for the trainers to be assessed for their competence (certification) and course participants are not assessed for what they have learned from attending the course. In consequence there is virtually no evidence, despite best intentions, that the IAEA's nuclear training courses contribute anything to global nuclear security capacity building other than promoting "an increased sense of awareness of the issues."

By contrast, ICAO has established a network of 35 regional training centres for security ("Aviation Security Training Centres", ASTCs) under their TRAINAIR PLUS Programme. Centres are run by a network of non-ICAO training organisations but each has to be accredited by ICAO – accreditation referring to both the course content, delivery and instructor certification, and to ensure that course participants are formally assessed. The first jointly certified programme for aviation security management was launched 15 years ago and, most recently (December 2019), the International Aviation Transport Association (IATA) became a Corporate Partner of ICAO to provide jointly certified training courses. According to the Memorandum of Cooperation, IATA and ICAO will *"jointly create and deliver courseware consistent with the provisions of the Chicago Convention, the SARPs in its Annexes, and relevant ICAO guidance material and programmes."* IATA is an industry trade association for the world's airlines (representing some 290 airlines or 82% of total air traffic) but is not the only aviation industry association to offer jointly approved security courses. Airports Council International (ACI) – the global trade representative of the world's airports – also partners with ICAO to provide aviation security courses. One example, the ACI-ICAO Management of Airport Security course, provides guidance to aviation security personnel at a managerial level on planning, coordinating and implementing airport security preventative measures and pro-active initiatives that are in accordance with national programmes and airport industry best practices.

4. CONCLUSIONS AND RECOMMENDATIONS

As noted earlier, the IAEA, in security terms, is roughly where ICAO was some 20 years ago, prior to the events of 11 September 2001 which galvanised political support for ICAO to have a wider international remit for aviation security. This conclusion is borne out by extensive comparative research and analysis of the two sectors that highlights the stark differences between what the international community judges to be acceptable in the two sectors.

On the one hand, aviation security standards are mandatory, audited, subject to high quality standards and security performance data are published by ICAO. The system looks and feels inclusive and progressive: just reading the purpose of the ICAO Global Aviation Security Plan (GASeP) makes this clear:

"The objective of the GASeP is to help ICAO, States and stakeholders enhance the effectiveness of global aviation security. The GASeP seeks to unite the international aviation security community and inspire action in

this direction, taking into account that the threats and risks faced by the civil aviation community continue to evolve."

By comparison the IAEA Nuclear Security Plan has a totally different message for the readers:

"*Through General Conference resolutions, Member States have asserted that the responsibility for nuclear security within a State rests entirely with that State and that they are mindful of the responsibilities of every Member State, in accordance with its respective national and international obligations, to maintain at all times effective and comprehensive nuclear security of all nuclear and other radioactive material."*

Of course, *individual States are accountable for both nuclear and aviation security* but the aviation sector has evolved and matured, recognising what all good law enforcement agencies know – the active support of all stakeholders including civil society is required if any security regime is to be effective.

The question then is what can be done to assist the IAEA and its Member States to hear the message and take action? One scenario is the most obvious. Wait until after a major nuclear security incident that causes widespread political, economic, environmental and public concern and then wait for its Member States to provide the IAEA with enhanced responsibilities.

A second option is to start to take action now without compromising the authority of States; to start to explore the options for a more strategic approach to nuclear security, step by step, and for the IAEA and ICAO Secretariat to commence a conversation. We are convinced that focused and proactive leadership from the IAEA could make a huge difference to international confidence in nuclear security and the efficiency of the IAEA's current processes. In that regard we would recommend:

— A working group in IAEA is established to study the implications of this research to identify potential cost-effective, achievable practices to aid efforts to enhance nuclear security, and

— IAEA and ICAO establish a joint working group to explore opportunities for cross-organizational improvements, including ways to enhance their international role in security in a much more cost-effective, outcome-based and sustainable way.

At a time when the international community has reignited the debate about the contribution that nuclear energy can make to help mitigate climate change, with major policy speeches from UN and other international organisations, including the IAEA – it seems incredible that the issue of effective, international oversight of civil nuclear security is not on the agenda. There can be no justification for this situation, or for the nefarious reasons and excuses that look backwards into the nuclear sector's history rather than looking forward to new, positive and much needed global opportunities for nuclear energy to contribute to reducing the potentially devasting impact of climate change.