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INTERNATIONAL CIVIL AVIATION ORGANIZATION

Biometrics:
The Linchpin of Worldwide e-Passports and Identity Management Programs
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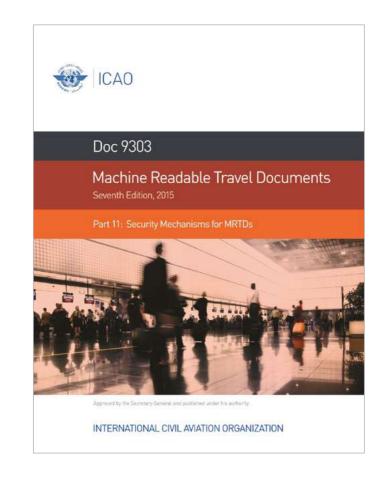
INTRODUCTION AND BACKGROUND

Life for many of us has never been the same since the events of September 11, 2001. Much of the world has awakened to the very harsh reality of the threat of international terrorism. Travel documents, particularly passports, were identified by the US Commission that examined the events of before and after the 9/11 tragedies as "at least as dangerous as a bomb in the hands of terrorists." The international travel document community, coalescing within the standards-setting ability of the International Civil Aviation Organization (ICAO), has answered this challenge by developing and deploying what informed experts consider to be the most secure passport documents in history. This article outlines a few examples of the ways in which biometrics has served as the galvanizing factor that has brought so many diverse countries together in the unified and cohesive worldwide partnership that has made this possible.

BRIEF SUMMARY OF THE E-PASSPORT HISTORY

Today's generation of passports did not spring up overnight, nor is the e-Passport a product of US legislation; the work on the travel documents that are currently being issued, generally called e-Passports, goes back to over two and half decades. The starting point for this multilateral effort is best defined by the establishment of the ICAO New Technologies Work Group (NTWG) in 1992. While that Work Group was created with a rather broad frame of terms of reference and

scope, the fundamental purpose of the NTWG was to explore the ways in which technologies could be adopted or created to allow for the inclusion of human biometric information to be stored in travel documents. (For purposes of this article, the term "travel documents" centers primarily on passports.) The exploration of more powerful data carrying media, culminating with the selection of contactless chips, had its genesis in the quest for greater storage capacity to allow for biometric data. This was due to the fact that the international community acknowledged that the only way a document could be reliably linked to its rightful owner was by having that owner's biometrics inherent in the document itself. Thus, biometrics became the fulcrum around which revolved the global effort to enhance the security and functional integrity of international travel documents. Other seminal milestones in reaching the point of today's travel documents include the issuance of the ICAO Biometric Selection Technical Report in late 2001, the May 2003 adoption of the ICAO "blueprint" for incorporating biometrics into travel documents and the publication of the Sixth Edition of ICAO 9303 Part 1, Passports, in late 2006 (now succeeded by the Seventh Edition.)
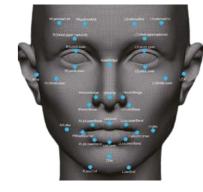

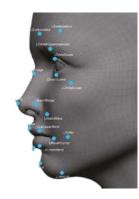## ICAO AND THE ROLE OF INTERNATIONAL TRAVEL DOCUMENT SPECIFICATIONS

As the above suggests, ICAO and the development of international standards have been the vehicle and framework, respectively, for countries to develop sovereign concepts of operations to move forward with enhanced passport issuance and inspection programs. Only through this extensive and comprehensive multilateral cooperation could the over-arching requirement of global interoperability be accomplished. Just as biometrics has been the linchpin to inspire and motivate the world's passport authorities to take decisive action, the development and application of standards on which these technologies reside defines the foundation for countries to feel confident that they are headed in the right direction and doing the right thing overall. While the work has involved many critical initiatives and areas of close technical examination, there are three major events that have occurred that have had especially significant impact.

The first of these watershed moments had its origin in the initial Request for Information (RFI) which the ICAO issued in 1995. This was a request published for the world's travel document technology companies to present to the international community current and emerging technologies in the areas of physical security features, data carrying media and biometrics. Interest in the first two areas, as noted, was primarily to serve as enablers for the use of biometrics in the travel and border control functions. One of the companies selected and invited to make presentations in Geneva in February of that year was a small company called Visionics,

with its then-CEO Dr. Joseph Atick chosen to carry that out. While some of the representatives of the Governments in attendance had a bit of exposure to the field of biometrics, the discipline was still something of a mystery and an unknown quantity. In what can only be described as a brilliantly understandable and tangibly impressive presentation, Dr. Atick demonstrated that the use of biometrics, in this case facial recognition, could indeed accomplish that crucial but elusive missing link in traveler identity verification, linking the bearer of the passport with that document as its rightful and legitimate owner. Dr. Atick provided the initial inspiration that has carried the travel document community through the following years of hard work.

Since the Governments of the world had concluded, after the Geneva presentations, that the use of biometrics in travel documents was useful, viable and practical, the next step was to determine which biometric would best serve
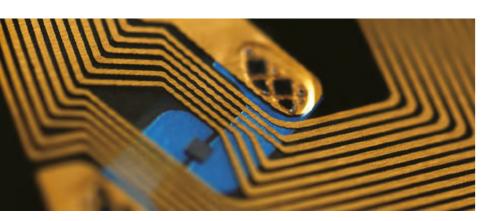
the purposes and requirements and, in an extraordinarily complex international milieu, be socially, politically and legally acceptable across myriad national boundaries. The work to accomplish this, leading to the publication and issuance of the ICAO Biometric Selection Technical Report, is the second major event exemplifying the pivotal role of international standards. This Report, nearly five years in gestation, demanded that a wide range of often conflicting and emotionally-charged considerations be brought together to reach a globally acceptable consensus. The development of evaluation criteria on which to assess all of the various forms of biometrics took over one full year to develop and reach agreement. The process of applying these criteria to a wide range of practical functional demands in a variety of disparate national settings consumed months of difficult and sometimes agonizing collaboration and discussion. Not only did this process lead to the agreement of the Technical Report and the choice of facial recognition as the globally interoperable biometric, it also brought the world's travel document decision makers closer together and galvanized their focus for the many additional technical choices that lay ahead.

With a common sense of direction and purpose with regard to the biometric data that needed to be captured and conveyed on the passport document, those working toward the next generation of biometric-enabled documents could more intelligently and pragmatically focus on the data carrying media. Some of the technologies thought to be viable

candidates, such as barcode, were proving to be inadequate for the requirements as they had evolved. Such requirements were beginning to define themselves more clearly, for example the need to store a facial image rather than the template to insure interoperability. This, then, forms the conditions for the third example of watershed events that charted the course of travel document development. At that point in time of early 2002, Malaysia had been issuing traditional paper book passports that incorporated a contactless chip and the antenna array. After careful examination, the Malaysian experience demonstrated that the idea of chips in books was in fact viable and worthy of further review and consideration. The concept of contactless IC's in passports was then well on its way to adoption by the international community for global interoperability applications.

THE IMPACT OF BIOMETRICS ON LEGISLATION

The development of globally interoperable standards for passports involved the substantive participation of a large number of countries. All of these countries acknowledged the need to utilize biometrics in travel documents in order to better assess the validity of both the documents as well as the bearer of those documents. A number of countries needed legislative change to use biometrics. Other countries chose to incorporate biometrics into overall identity management programs that either needed to be or could be facilitated by legislation. Additionally, many countries undertook legislative initiatives to enhance the supporting foundations on which biometrics needed to reside. This is particularly evident in a wide variety of privacy and individual rights legislation.

Either at the center of origin for spawning legislation or directly and intimately related, biometrics has been fundamental to a wide variety of enacted and under-consideration legislation. Countries and entities that have moved and are moving in these directions are numerous and include Argentina, Australia, Canada, the European Union, Germany, Japan, Malaysia, New Zealand, Singapore, Sweden, Switzerland, United Kingdom and United States, among many others. Many of the deliberations surrounding the consideration and passage of these laws have surfaced numerous areas of related focus, falling generally in the category of identity management, in particular, fighting the insidious spread of identity theft. All of these enhancements owe their legislative origin to the tool of biometrics.

Just as biometrics from a technical perspective enhanced the ability to protect identity and enhanced the integrity of the use of passports, it also drove nations to make needed legal changes. These legislative initiatives have grown in number and scope, insuring technical success as well as comprehensive acknowledgment and protection of those affected by biometrics.

ISO STANDARDS AND THE INDUSTRY PARTNERSHIP

In addition to the standards development work carried out within the ICAO community, the activities of the ISO/IEC (International Standards Organization) have also been extremely important in defining the technical underpinnings of machine-readable travel documents. Since 1988 there has been a close and very effective working relationship between ICAO and ISO/IEC SC17 (Standing Committee 17), the people associated with cards and personal identification and, specifically, SC 17 Work Group 3 (WG3), the entity designated as the liaison for ISO with ICAO. During this period of time in which travel document technologies were being considered for the next generation of passports, ISO gave birth to SC37, a new body established specifically to develop standards for

biometrics. Since this new group was charged with establishing international standards for the use of biometrics, it was clearly important for the ICAO work already accomplished and that underway to be carefully coordinated with SC37. This, the collaboration and highly effective cooperation between the ICAO work effort and the standards being developed by SC37, is the fourth example of the close nexus of biometrics and today's e-Passport initiatives.

The fifth example of the pivotal and catalytic effects of biometrics on the travel document program development is that which has been underway and that which continues in the areas of testing and test methodology. Just as those who had been hard at work in deploying chip-based biometric-enabled passports had found about the performance of chips, so are they discovering previously unknown performance characteristics with regard to the biometric technologies in and of themselves. Early on in the work of integrating the ISO/IEC 14443 chip standards into the travel document functional requirements, it became clear that a great deal of open-ended performance variables remained. These required extensive testing and substantial drafting of travel-document-specific definition and amplification for 14443. These testing and examination efforts resulted in very substantial contributions to the body of science associated with contactless chips as well as the attending infrastructure of readers and enabling IT configurations. In the area of biometrics, with facial recognition as an example, the quality of the image has been found to be crucial to effective performance. The work with travel document programs has sharpened and defined a variety of image quality issues that have contributed substantively to the overall effectiveness of facial recognition biometrics and thereby to the credibility of biometrics as a whole. Currently, major work of high priority is underway in developing test regimes for both electronic behavior and performance of chips as well as the biometric performance factors for which the chips are intended. There is no question that this work will continue to contribute new and meaningful insight into the science underlying these technical disciplines.

The sixth and final example of the nexus of biometrics and the deployment of passport and identity management initiatives takes the form of what can be characterized as a case study: the Hong Kong Special Administrative Region (SAR) and its private industry partnerships. Due in large measure to the vision, prescience, leadership and effective management of Mr. Raymond Wong, then-Assistant Director of the Hong Kong Immigration Department, the uses of biometrics and other aspects of identity management are proof positive and unequivocal that these tools are, indeed, the wave of both the present as well as the future in both the security as well as the facilitation of the world's traveling public. Not that long ago, there were border control authorities saying that some of the things that Raymond Wong and his staff and private industry team are doing were impossible. That is until Raymond did them. The tangible proof of the veracity of biometrics as a means to smooth the movement of people more securely can be seen at the e-channels of Lo Wu, the automated vehicle lanes at Lok Ma Chau, and the work completed and in progress on Hong Kong's e-Passport. The accomplishments of Hong Kong, of which this discussion barely scratches the surface, serve as models for the rest of the world to emulate.

SO, WHAT HAS BEEN HAPPENING LATELY?

The landscape of focus since those early successes (leavened by a number of mistakes/lessons learned) has revolved around efforts to create, enhance and fortify the integrity of the enabling and facilitating systems of travel document issuance and inspection. At the time of writing this there are more than 130 countries that are issuing ePassports. Note that there are additional countries that "claim" to issue ePassports, but these are not totally ICAO compliant and therefore are not counted in this total. There are more than a billion ePassports in circulation. Far less impressive are the countries that are currently USING the "e" in ePassports. While there are a laudatory 63 states that are members of the ICAO PKD (Public Key Directory), there are, arguably, only 37 states that use the electronic tools that the ePassport embodies for validation and verification. To expand this critical metric, ICAO is engaging in a number of initiatives to accomplish broader inspection and border management leverage in using the ePassport virtues. This will be discussed more specifically later in this article.

With regard to the issuance functions of ePassports, the recent past has been characterized with an acknowledgement that the integrity of the document issuance systems themselves is of singular consequence in forming the foundation of global trust and confidence on which the ePassport relies. When all factors are forthrightly considered, ALL issuance systems labor under vulnerabilities and weaknesses and are prey to a multitude of threats. The urgency of acknowledging these needs has been a bedrock issue to convey in all of the capacity building sessions that have been conducted over past years. Regional workshops and seminars in every part of the planet have reinforced this common theme, most often citing the evidence of identity as the "weakest link" in the spectrum of entitlement decisions that every country is faced with. This area of concern, known as Evidence of Identity (EoI), has formed a large component of priority attention from ICAO and other concerned partners such as IOM (International Organization for Migration), OSCE (Organization for Security and Cooperation in Europe), UNCTED (United Nations Counterterrorism Executive Directorate), and others. Several sets of guidelines have been published that offer advice on best practices and suggested alternatives to better effect this pivotal foundational responsibility. These guidelines are generally in the form of both helpful suggested ways forward as well as self-administered assessment materials to help states identify more tangibly the needs in their own specific environments. As awareness has been heightened regarding the needs for broadened sources of identity verification, beyond that provided by breeder documents alone, important corollary work has been underway to develop and shore up the all-important complements of social footprint infrastructure with an emphasis on a sound civil registration resource. While much needs to be done to bring a consciousness of the importance of civil registration to many parts of the world, partially pulled along by the technological strength of the ePassport and the inherent need for sharper tools of identity management, far more than merely raising awareness has been accomplished in institutionalizing direct support for identity management infrastructure such as civil registration programs.

As promised earlier, the substantive involvement and close participation of the inspection, law enforcement and border management communities are a major top priority. Over the years, those who examine and inspect travel documents have not been as directly and intimately involved in the travel document standards deliberations as the standards developers would have liked. The broadening of the ICAO MRTD (Machine Readable Travel Document) responsibilities inherent with the advent of ICAO TRIP (Traveller Identification Programme) now clearly identifies border management as a fundamental focus. In response, efforts are well underway to reach out to the border authorities for them to better know and understand the role and purpose of the development of standards and specifications and to see for themselves the urgent global need for their contributions and participation. A recent initiative workshop held in February in Warsaw where the issuance, inspection authorities and others directly involved in travel document standards development and definition came together. More such opportunities are already planned as a systematic effort to bring the various component perspectives together.

The implementation of the chip-based, biometrically enabled ePassport has spawned several attending initiatives that in themselves bear special note. Enhanced approaches to biometrics, strengthened physical security features, cryptographic and algorithmic data protection measures are examples. In particular, especially for the benefits to both security and facilitation, the growing use of Automated Border Control (ABC) tools is having noticeable impact and undoubtedly will have more. The use of stand-alone, traveler self-serviced kiosks and eGates increasingly demonstrates the virtues and benefits of the use of such automation approaches. When properly carried out, the machine assistance of an ABC can add measurably to both security and facilitation, by augmenting the human inspector as well

as speeding the traveler through more efficient assessment and scrutiny of the traveler's representations. In coupling these mechanisms with frequent traveler programs and other traveler shred-out initiatives that capitalize on already known traveler data, efficiencies and economies are emerging. Note that I extol the virtues of ABC "when properly carried out" and "augmenting the human inspector". This does not mean to replace the human element altogether nor to have immigration by vending machine. Quite the contrary. Where ABC has been most effective has been where machine assistance and human intervention are carefully balanced.

Data sharing has increasingly become a globally important matter. The lack of ability to share information quickly, accurately and in a safeguarded manner has been identified as the root cause of some of the worst-flawed tragedies in recent memory. Conversely, some of the most notable success stories in averting and avoiding events have been direct descendants of sound multilateral information sharing. While not generally publicized for obvious reasons, many of these successes have been tragedy avoidance in which information shared has allowed authorities to anticipate and thwart malevolence. Also, information capture and efficient sharing are showing visible benefits in throughput and facilitation. The now-mandated use of API (Advance Passenger Information) is expected to improve these capabilities by standardizing and streamlining the form and substance of what data are shared and in what ways. A number of regional (e.g., the Caribbean entity known as CARICOM) efforts to share information regarding border crossing have clearly demonstrated the legitimacy and singular importance of impeding and eliminating the ability of bad people to travel across borders to wreak horror and carry out the nightmares of terror, trafficking and other criminal intent. The increasing availability and use of interoperable information networks are realizing handsome dividends and shows sizable expansion

capabilities. A major example of such applications is the INTERPOL SLTD (Stolen Lost Travel Document) in which issuers and inspectors can get real time feedback with regard to the veracity of a document. This is often an automatic query in issuance and inspection systems that access other watch list kinds of data sources; clearly of major security and facilitation value.

There are many other notable activities currently underway in the travel and identity document arenas that could be cited as timely undertakings. The one that I will choose to identify is the ICAO Digital Travel Credential (DTC), a work item high on the priority list of the ICAO New Technologies Work Group (NTWG). This dematerialization of the ePassport revolves around a concept of a hybrid travel document, capitalizing on both the physical as well as digital attributes of the ePassport. The statement of DTC policy has recently been approved by the NTWG and is currently the subject of selected solicited comment. Essentially, the DTC policy statement establishes the following principles to guide, now beginning, the development of the technical implementation:

1. The DTC MUST be at least as secure as an eMRTD.
2. The information contained in the DTC MUST be derived from the Travel Document Issuing Authority's data, and MAY come directly from the eMRTD.
3. The lifecycle management of the DTC must not necessarily be dependent on the lifecycle management of the eMRTD.
4. Incompatible changes must not be required in the current eMRTD standards or in the current process of issuing eMRTDs.
5. The revocation of a DTC may result in a revocation of the eMRTD associated with that DTC at the discretion of the issuing State.

6. The revocation of the eMRTD MUST automatically revoke all underlying DTCs.
7. The DTC MUST be issued by a Travel Document Issuing Authority.

Implementation of the DTC will likely see a number of related initiatives resulting. For example, there is interest in being able to use a portable device such as a smartphone to capture and convey the attending passport data.

It is hard to think of ePassports or MRTDs without Barry Kefauver's name coming up to mind as one of the key people that has dedicated a lifetime to making sure that this marvel, that is facilitating the movement of billions of people and making the world a safer please, achieves mass adoption throughout the world—in developed and developing nations alike. I had the privilege to have met Barry in the mid 1990s when the concept of ePassports was just still a dream. Over the years he inspired us all with his enthusiasm, his tirelessness and his unwavering dedication to the human cause. Many may claim a link or paternity of the ePassport. But if I had to choose one father, no one has a more legitimate claim in my eyes than Barry to the title of the father of the ePassport. His DNA is all over it. It is my honor to thank Barry on behalf of the ID4Africa Movement for the gift that he has given us, which goes long ways in realizing free and secure movement of people.

Barry Kefauver (right) and Dr. Joseph Atick (left), reminiscing about the early days of the ePassport in the mid 1990s at a recent ICAO meeting.

"From little more than a glimmer in the eyes of a small number of individuals concerned about the secure movement of travelers across the world's borders, the use of biometrics has now become a very visible and credible tool to enhance border control and a wide variety of other identity management applications. In great part pulled by the business case implications of e-Passports, the pace of biometric standards and technologies has been feverish and intensive. Performance improvements have been significant and promise to continue to be so as time passes. The concept of identity management as a holistic fabric woven of many intersecting issues has finally come of age, placing tools such as biometrics at the forefront of some of today's most vexing threats such as identity theft. Recent deployments of ePassports and a developing host of attending enabling initiatives show that the potential for much more, both in terms of security and facilitation, are no longer competing priorities but companions seeking the same ends of TRUST and CONFIDENCE". -Barry J. Kefauver