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I. – INTRODUCTION

Aviareto Limited, based in Dublin (Ireland), was established for the sole purpose of developing and operating the International Registry for Aircraft Equipment (hereinafter: IR), pursuant to the Cape Town Convention (CTC) and Aircraft Protocol (AP), jointly referred to hereinafter as "the Treaty".[1]

In March 2006, the IR went into operation with six ratified States and five employees. By the end of 2011, Aviareto had eleven staff supporting nearly fifty ratified countries. By that date, 313,000 Registrations and 245,000 Searches had been performed.

The IR is operated on a not for profit basis, and has unlimited liability under the Treaty. The IR has been a success based upon the view of its customers, the high level of ratification by States and the risk profile of the business in the eyes of its insurers.

As well as managing the growth in activity levels, the initial period of operation was an opportunity to learn and to develop insights into the operation of the IR and, more generally, the operation of Electronic Registries. This paper explains how the IR operates but also seeks to share what Aviareto has learned in its role as Registrar.

The IR is an electronic system for recording and hence establishing the priority of financial interests in Aircraft Equipment pursuant to the Treaty. All such registered interests are searchable by the public. The IR is an online,

* This article is based on Cowan's (Managing Director, Aviareto Ltd., Dublin (Ireland)) contribution to the international seminar held at the seat of UNIDROIT in Rome on 30 November 2011 to commemorate the 10th anniversary of the adoption of the Cape Town Convention and Aircraft Protocol and the subsequent work of Gallagher, a Registry Official at the IR.

1 *Convention on International Interests in Mobile Equipment*, signed at Cape Town (South Africa) on 16 November 2001) (the Cape Town Convention); *Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Aircraft Equipment*, signed at Cape Town (South Africa) on 16 November 2001.

notice-based registry system.[2] The online and notice-based aspects of the system have been key factors in its success. These factors, while individually important, have combined very effectively and we believe that there is a general lesson in that.

II. – PRINCIPLES OF AN ELECTRONIC REGISTRY

The IR, as an electronic registry, differs substantially from a paper-based registry. Everything on the IR is accomplished electronically; user applications and approvals, registrations, amendments and discharges are consented to electronically, and the electronic record is definitive.

One challenge facing the Registrar, and all electronic registries, is the need to evolve in line with technological advances. The records on the IR must be available in the long term and certainly well beyond the date by which the technology in use today becomes obsolete. The Registrar must ensure that record-keeping methods develop in line with technological advances, ensuring records are maintained and accessible regardless of the technology in use. The records must be written in *electronic stone*.

Electronic registries provide many benefits over paper-based equivalents, primarily, speed, accessibility and anonymous searching. With these benefits come new and varied security risks and regulatory challenges.

1. ACCESSIBILITY AND ANONYMITY

The IR provides an unprecedented level of accessibility to the public. Traditional registries are accessible only at their physical location within their business hours. The IR is available 24 hours a day seven days a week, to anyone with access to an internet-connected computer. That a person can access the IR remotely at any time is clearly beneficial for users, that they can do so anonymously, however, raises concerns for the security of data held on the IR. The IR has two main types of information, *i.e.*, contact information for entities or system users and registration information.

Clearly, making the latter available is the *raison d'être* of the IR. However, due to its electronic nature, a user having access to volumes of registration information could develop market intelligence and other commercial insights. Therefore, controls are necessary. In a paper-based registry, there was a natural control due to the active role of the Registrar. A user would have to

2 Art. 17(2)(i) CTC.

convince a Registry Official to release a large volume of data and would then have to process it manually. With an electronic registry, electronic controls are necessary so users (who are not present and may be unknown to the Registrar) are not permitted to download large volumes of registration data in bulk and must pay for the most detailed information.

However, of most concern from a security view is contact information for entities or system users. This information is necessary to allow users to make registrations and generally make use of the system. A paper-based registry had the same natural controls noted above. The problem, for an electronic registry, is more complex.

Without proper controls, such data could be used for illegitimate purposes. A 2010 report by Symantec [3] states that the price achieved in 2010 for email addresses on the black market ranged from $1 – $20 per megabyte file. For full identity information, the price ranged from $0.50 – $20.00 per record. The Registrar has put in place measures to protect the information held on the IR, and has attempted to strike a balance between protecting data and allowing users access to information. The information accessible to guests (those not logged in as an approved user) is restricted. Further, the administrator of an entity can opt to limit the information about their entity made available to users.

The Registrar has put in place steps to verify the details of users of the IR, and has limited what can be done by those logged in anonymously (guests). Guests are limited in what they can undertake on the IR to searching registrations, viewing the available documentation, and making an application as administrator for an entity. Only approved users can avail themselves of the full services available on the IR, after their identity has been verified using Public Key Infrastructure (PKI), which is discussed in more detail later.

2. NO INTERMEDIARY REGISTRY STAFF

The Registrar has no involvement in the registration process for an individual registration. Once a user is approved, that user may complete registrations in accordance with the Regulations for the International Registry (Regulations) and the Procedures for the International Registry (Procedures).[4] The Registrar

3 Symantec Corp., *Internet Security Threat Report*, Vol. 16, at 111.

4 See Section 5 Regulations (4th ed.) and Section 12 Procedures (4th ed.). A Transacting User Entity (TUE) administrator is automatically authorised to effect registrations on behalf of that TUE. A TUE user or a Professional User Entity (PUE) administrator or user must be

has no administrative input in making registrations, thus eliminating the risk of data entry errors by IR staff. Further, this ensures greater efficiency for registering parties as there is no delay in processing registrations once submitted, other than any delay in waiting for another named party to consent to the registration. Once the IR receives final consent, registrations go live and become searchable worldwide.

Many paper-based registries and some partially-electronic registries require the registering person to submit the data to an official and it is the official who enters the data. This can lead to liability for the Registrar. With a notice-based electronic registry system, this is no longer necessary if adequate non-repudiation technology is used. The IR uses PKI for non-repudiation, which is considered the gold standard for electronic signatures.

DATA INTEGRITY

Of fundamental concern for a Registry is protecting the integrity of the data held. It is submitted that an unauthorised addition, deletion or modification of a record is more difficult to detect in an electronic registry than in a paper-based registry where missing or extra pages are easily noticed, as are records which have been overwritten or altered. To the human eye, an electronic record which has been tampered with is indistinguishable from one which retains its integrity. As a result, more sophisticated safeguards are required by an electronic registry to protect against unauthorised changes. The IR has put in place a Tamper Check [5] alarm that alerts the Registrar to any unauthorised interference with the IR databases. Independent of this, each party to a registration must confirm their consent to a registration by applying their digital signature, which is stored as an integral part of the registration data, thereby ensuring the integrity of each individual record, or group of records.

III. – THE REGISTRAR'S ROLE

The Registrar's role is essentially mechanical in nature. The Registrar can explain how something can be done or discuss technological limitations but is

authorised by the administrator of a TUE in order to make registrations on behalf of that TUE. Authorisation must be sought in respect of each specific aircraft object. Only a TUE can be a named party in a registration. PUEs, when authorised by a TUE, may make registrations on behalf of a TUE.

5 Tamper Check is a bespoke software component, using PKI technology, developed by SITA SC, for the IR.

neither qualified nor in a position to advise on whether or why something should be done or whether a registration is valid. A *laissez faire* approach has been adopted by the Registrar rather than the, alternative, paternalistic option. The users of the IR are assumed to be sophisticated or at least to have access to sophisticated advisors. The asset value is high and the legal framework is complex. They make their own decisions.

The Registrar performs its duties in accordance with the Convention, Protocol, Regulations and Procedures for the International Registry. The operation of the IR is governed by the terms of the Regulations and the Procedures issued by the Supervisory Authority,[6] the Registrar can and does make suggestions regarding changes to the regulations and to the functionality of the IR Website to the Supervisory Authority. Such suggestions arise from the Registrar's experience and deep engagement with the Industry and the advice of its advisory board (the IRAB).

1. SERVICES PROVIDED BY THE REGISTRAR

In operating the IR, the Registrar provides support as described below.

(A) TECHNICAL SUPPORT

To access the IR, a user must have a computer with Internet access, an up-to-date browser and Java[7] support. Technical issues sometimes arise with a user's PC, network, firewall or security settings and Registry Officials provide guidance for users although, beyond a certain level of complexity, a user must resolve their own local issues.

Issues to do with the operation of the IR website fall fully within the purview of Registry Officials. Registry Officials provide guidance to users on applying for and renewing accounts, requesting authorisation and performing searches. Registry Officials also develop help material in the form of Quick Guides, Frequently Asked Questions and User Manuals. Work is progressing on providing support through video tutorials.

When technical issues arise on the IR Website itself, the Registrar is notified through many channels. Users will call, Registry Officials will notice and automatic monitoring systems will send electronic alerts directly to the

6 The International Civil Aviation Organization (ICAO).

7 Java is a programming language and computing platform first released by Sun Microsystems in 1995. Sun Microsystems is now owned by Oracle.

Registrar and to the company that provides the technical support and hosting of the IR infrastructure. In such cases, the Registrar takes a co-ordinating role but relies on the technical expertise available to it. After the service has been restored, the Registrar ensures that steps are taken, where possible, to resolve any under-lying issues.

(B) ACCOUNT APPROVAL AND PUBLIC KEY INFRASTRUCTURE

One area of activity for Registry Officials is the approval of applications for new user accounts. On a typical day, twenty applications are received from users wishing to become Administrators for their entity. In all such cases, the Users must complete an application form on the IR Website, pay the appropriate fee and provide the Registrar with certain documentation. During the process the user must select a password.

The RO checks the documentation and verifies the contact information before approving the account. Precision in the naming of entities is vital to ensure there is no confusion. The name applied for must match the legal name of the entity, including any punctuation in the name.[8] In some cases, a simple comma in a name can differentiate it from another entity. The IR operates in an international context, and the entities registering with it are in many jurisdictions, governed by different business registry rules, practices and naming conventions. As such, the approval of entity names is not a trivial matter. Applications are often declined due to a lack of precision in the entity name. While this may frustrate users, such precision is necessary.

The Registrar seeks to provide clarity for users of the IR and minimise any risk of confusion. However, there is a balance to be struck. This balance is achieved by remaining connected to the Industry and listening to its concerns. Without that feedback loop, the Registrar would risk becoming a bureaucratic burden on the industry, which was certainly not the intention of the Treaty.

The key technology used on the IR is Public Key Infrastructure (PKI). The PKI technology is provided by VeriSign (now owned by Symantec Corporation), one of the most respected and trusted suppliers in an industry that is essentially about trust.

PKI allows a user to sign data (ensuring non-repudiation) and to encrypt data (ensuring privacy). PKI is a complex system that requires a high level of security. This technology allows the Registrar to confirm that registration data

8 Section 10.1 Procedures (4th ed.) states that the name applied for must be the correct legal name.

was signed by the parties to the registration and that the data has not changed since it was stored. Effectively, PKI allows the registration records to be relied upon to a level of evidence which would be acceptable in a court of law. The disadvantage of using such technology is that it can seem cumbersome to users.

In the balance of security versus usability, PKI leans towards security.

For instance, if users forget their password, it is technically impossible for the Registrar to recover or reset that password. A new digital certificate must be issued. Users often find it difficult to understand why the Registrar cannot just reset their password as happens with other on-line systems. However, the IR is a system where each record must be looked upon as potential evidence in a future court case and, as such, higher standards of security apply. Some other electronic registries do not use PKI, relying instead on a simple password. This may be appropriate where the asset value is lower or where the legal regime is different, but the use of PKI is appropriate for the IR.

(C) DATA INTEGRITY AND ELECTRONIC EVIDENCE

Data integrity is maintained through technological means based upon PKI and digital certificates. Registration data is stored in a manner to allow detection of any tampering such as,

- An individual registration or data within a registration being altered
- The insertion of a registration
- The removal of a registration

The design of the IR system also ensures that registration data is digitally signed by the users and by the Registrar. This means that a user cannot repudiate the data, *i.e.*, claim not to have submitted or consented to it.

A registration is deemed to be complete when it is searchable.[9] Therefore, users and relying parties should confirm that a registration is complete by performing a Priority Search and obtaining and verifying the data on a PSC (Priority Search Certificate) in order to satisfy themselves that a registration is complete. Simply entering the data or receiving an automated email from the IR system saying that the registration is live, is not sufficient. The requirement to search to confirm a registration is to deal with cases where

9 Art. 19(2) of the Convention states: "A registration, if valid, shall be complete upon entry of the required information into the International Registry data base so as to be searchable."

registration data is submitted, but due to a technological failure, is not stored in the IR database. Once a user confirms, by way of a PSC, that the data is searchable, that user may rely on the Registrar to ensure the data never changes and retains its priority based upon the time of registration.

Searching to confirm a registration is complete is more than best practice, it is essential to protect the registering parties' positions. The Regulations and Procedures state that any party wishing to confirm that a registration has been correctly made may undertake a priority search.[10]

(D) MSN

Another important activity carried out by Registry Officials is receiving object identification information (MSN files) from manufacturers and uploading it to the IR so the data is available for users to select when making registrations or requesting authorisation to work on aircraft objects.

Although the Registrar is not liable for data it receives, some high level checking of the data for gross errors is carried out and consultations are held with manufacturers. Manufacturers are not liable for the information they provide and such information can only be used subject to acceptance of the Manufacturers' disclaimer which is posted on the web site.

On average, forty manufacturer files are received and processed monthly. Where manufacturer data is not available, registering parties may enter the object identification data manually (sometimes called free text). The Regulations favour manufacturer-supplied data over data which is free texted [11] into the system and many users seek help from the Registrar in asking manufacturers to provide updated files. The Registrar recognises and appreciates the support of the manufacturers.

2. SERVICES NOT PROVIDED BY THE REGISTRAR

Having set out above what services are offered by the Registrar, it is appropriate to look also at what the Registrar cannot do.

10 Section 6.2 Regulations (4th ed.) and Section 12.5 Procedures (4th ed.).

11 Section 5.1 Regulations (4th ed.).

(A) LEGAL ADVICE

The Registrar cannot provide legal advice.[12] Frequently, users will contact the helpdesk with queries that Registry Officials are not in a position to answer. These include:

– Registration Information: Registry Officials cannot provide any information on what data should be entered in a registration, or what type of registration should be made.
– Advice on analysing Priority Search Certificates: PSCs set out, in chronological order, all registrations made against a specified aircraft object, including amendments and discharges. Each interest, amendment, and discharge will be assigned its own unique file number.

While the Registrar cannot offer legal advice, there are useful publications, as well as the CTC and AP texts, for practitioners in the area. Most notably Professor Sir Roy Goode's Official Commentary [13] and the Aviation Working Group's Practitioner's Guide;[14] both provide information on the IR and legal analysis.

(B) MEDIATE

The Registrar does not provide mediation, or adjudication, in respect of disputes arising between users of the IR. The Registrar will remain impartial and will not become involved in such disputes under any circumstances.

(C) CONFIRM VALIDITY OF REGISTRATIONS

The IR is a notice-based registration system. No documents are submitted on the IR, nor is the existence or validity of the interest verified by the Registrar. The primary concern of the Registrar is the integrity, as opposed to the accuracy, of the data.

12 Section 9.5 Procedures (4th ed.) "The help desk is for technical support only and cannot provide support on other matters, including legal questions."

13 Professor Sir Roy GOODE CBE, QC, *Official Commentary to the Convention on International Interests in Mobile Equipment and Protocol thereto on Matters specific to Aircraft Equipment*, UNIDROIT, rev. ed. 2008) (hereinafter: the "Official Commentary").

14 The LEGAL ADVISORY PANEL OF THE AVIATION WORKING GROUP, *The Practitioners' Guide to The Cape Town Convention and The Aircraft Protocol* (2011).

The notice-based system leads to a simplified registration system, for both registering and searching parties. It also leads to a more efficient system, as the Registrar is not exposed to the cumbersome administrative process of seeking and verifying documentation.[15]

The order of registration determines priority, but, where a dispute arises it is for the registering parties to show not only that they have priority but also that the registered interest was validly created, and is properly reflected in the registration.[16]

IV. – COURT PROCEEDINGS AND THE REGISTRAR

Article 44(1) of the Convention provides: "The courts of the place in which the Registrar has its centre of administration shall have exclusive jurisdiction to award damages or make orders against the Registrar." The courts of Ireland have exclusive jurisdiction to make awards of damages, or orders against the Registrar. In recognition of the importance of expediting cases involving the Registrar proceedings against the Registrar, other than proceedings in which only damages are claimed, may be brought in the Commercial Court.[17] The Commercial Court, a division of the High Court, promotes timely resolutions of cases and aims to minimise the costs associated with commercial litigation.

Article 44(3) of the Convention refers to circumstances where a party fails to comply with an order of a court having jurisdiction under the Convention, directing them to amend or discharge a registration. In such cases, the courts of Ireland may direct the Registrar to take the steps necessary to give effect to that order.

The Convention and the Protocol are given effect in Irish law by the *International Interests in Mobile Equipment (Cape Town Convention) Act* 2005.[18] The Act refers to the "Official Commentary" as an authority that

15 See, generally, United Nations Commission on International Trade Law (UNCITRAL) Legislative *Guide on Secured Transactions*, United Nations Publication, Sales No. E.09.V12, March 2010, ISBN 978-92-1-133675-7 (hereinafter: "the UNCITRAL Guide"). In particular, see pp. 110-113 for a discussion of "Registration in a general security rights registry".

16 See Section 3.2 Regulations (4th ed.) "Since the International registry merely provides notice of registrations, the facts underlying any such registration or registered interest shall determine whether it falls within the scope of the Convention or the Protocol."

17 The Rules of The Superior Courts in Ireland were amended to facilitate this. See Statutory instrument No. 31/2008 – Rules of the Superior Courts (Cape Town Convention) (2008) – available at <http://www.irishstatutebook.ie/2008/en/si/0031.html>.

18 Available at <http://www.irishstatutebook.ie/2005/en/act/pub/0015/index.html>.

courts, or any other person interpreting the Convention and Protocol, should refer to. Given the status afforded to the "Official Commentary" by the legislation, in the jurisdiction which enjoys exclusive jurisdiction to make orders against the Registrar, this is undoubtedly the leading authoritative text in relation to the Convention and the Protocol. At the time of Cowan's presentation, the Registrar had not been a named party in any court proceedings.[19]

V. – STATUS

As of the date of this article, the IR is recognised as a success. This was noted many times and by many speakers at the diplomatic Conference for the adoption of the draft Space Protocol (27 February – 9 March 2012 in Berlin (Germany)). Users of the system, through an independent customer satisfaction survey carried out in late 2011, provided overwhelmingly positive feedback and scored the IR with a weighted average score of 7.89/10 for its performance. This was the fifth such survey and each one has shown increased customer satisfaction and acceptance. With fifty States having ratified or acceded to the Convention and forty-six to the Protocol, it is clear that their analysis is that the CTC and AP provide tangible economic benefits.

Enhancements to the IR Website have been carried out since its inception. Further software enhancements, in the form of Generation II, will provide a much improved user interface and more efficient and speedy workflow including the introduction of a Closing Room, which is a truly innovative redesign of the system to match the practices of users and which will allow multiple registrations to be effected on multiple objects by multiple parties simultaneously. Beyond that, the IR will be further enhanced to include computer-to-computer interfaces and, perhaps, to make it more accessible for mobile devices. Generation II represents a further milestone in the development of the IR website.

VI. – HOW REGISTRATIONS ARE EFFECTED

It is interesting to note that the practical realities of how the IR system works, combined with the nature of the organisations wishing to make registrations,

19 The Registrar has been named as a respondent in a case which is due before the Irish High Court (Commercial Division) before the end of 2012. The matter arises between the Applicant, PNC Equipment Finance LLC and the respondents Aviareto Limited and Link Aviation LLC.

shapes the approach taken when using the IR. There are three main approaches.

– Transacting User Entity (TUE) makes registrations directly through an employee or legal advisor, *i.e.*, a directly controlled administrator
– Professional User Entity (PUE) makes registrations on behalf of one or more TUEs having being authorised, on a per-object basis, by the TUE or TUEs
– Professional Administrator (PA) makes registrations directly on behalf of a TUE having being contracted to do so, *i.e.*, controlled through a contract for professional administration services

1. TUE WITH A DIRECTLY CONTROLLED ADMINISTRATOR

A TUE may appoint an administrator, often an employee or a legal advisor, to make registrations directly on the IR. The benefits are control, speed and reduced costs. This approach (Approach 1 above) is most likely where the complexity of the transactions is within the professional capabilities of the company. As the IR becomes simpler to use, with the introduction of Generation II, the use of this approach may grow at the expense of the other two approaches.

2. PUE AUTHORISED BY A TUE

Many of the larger aircraft-owning firms, such as airlines, prefer to use the standard Professional User Entity approach (Approach 2 above) and authorise a PUE to make registrations on their behalf on a per-object basis. This works well for them as they have in-house legal expertise, and often engage legal advice on structuring a deal and then use the PUEs to co-ordinate the registrations.

One key benefit of using PUEs is that they can co-ordinate a complex set of registrations. Several TUEs sometimes appoint the same PUE to make registrations. This allows the parties to agree the order and details of the registrations and the PUE can execute the registrations on the IR as required. Without that co-ordinating role, the sequential nature of the IR can be a challenge for deals involving more than two parties. The Closing Room in Generation II will help to resolve this co-ordination problem and may, therefore, affect the PUE business. However, it is the Registrar's role to make the IR as efficient as possible and, as we have seen previously, the industry will adapt and may use the system in ways which are not now foreseen.

3. TUE WITH A PROFESSIONAL ADMINISTRATOR

When the IR went live in 2006, it was anticipated that entities wishing to be named parties in registrations would take either Approach 1 or 2 above. A compromise approach, which some saw as the best of both worlds, developed (Approach 3 above) whereby entities established TUE accounts but appointed what could best be described as Professional Administrators (PAs) to administer these accounts.

The term "Professional Administrator" is not an official one and is not to be found in the Regulations and Procedures. When we use this term here we refer to a professional, appointed as administrator for an entity but who is not an employee of or legal advisor to, that entity. A PA represents the entity solely for the purposes of making registrations on the IR and sometimes also for making local filings, for example with the Federal Aviation Authority in the United States of America.

Several firms, particularly in Oklahoma (USA), have developed a line of business where they provide PA services to hundreds, and in some case thousands, of TUEs. The TUE agrees a contract with the firm providing the service and confirms to the Registrar that the PA is entitled to act as administrator for their TUE. This means that the TUE does not have to authorise registrations on a per-object basis. However, there is a loss of control, as the PA is empowered on the IR system to make all registrations on behalf of the TUE. If a disagreement arises, the TUE, often through their nominated Back-Up Contact,[20] can request that the account be disabled and can then appoint a replacement administrator.

If a TUE decides to use a PA, it should satisfy itself that it has adequate contractual protection covering, *inter alia*, how the PA will manage and use the account on the IR, that the process for instructing the PA to make registrations is formally agreed, that the PA is required to inform it of any notices it receives from the IR and that the firm providing the PA service has adequate insurance and expertise. It may also be useful to include arrangements in the contract for the PA to assist in transferring the account to another administrator if necessary, to ensure that the PA will comply with the Regulations and Procedures and, most importantly, will maintain a secure IT infrastructure (including anti-virus, anti-spam and backup of the digital certificate.)

20 This is a person appointed by the entity pursuant to the Procedures, section 5.12.

One useful and free way of ensuring that the TUE is informed of registrations as they are being made is to require the PA to add the TUE email address to the notification list for each registration it makes. This ensures that many of the IR notices will come directly to the TUE as well as to its PA. It may also be useful to appoint the Back-Up Contact from within the ranks of the TUE, allowing direct control over the account in the case of a disagreement.

It is important to ensure that arrangements have been agreed, including who pays, when a PA leaves the employment of the firm providing PA services as there is a fee for replacing an administrator. The decision to use a PA should not be taken lightly, although it has proved successful for many TUEs when managed properly.

As noted at the start of this section, the practical realities of how the IR system works combined with the nature of the organisations wishing to make registrations shapes the approach taken when using the IR. As the IR changes, so too will the approaches adopted by users.

VII. – RISKS TO THE IR

Understanding the risks associated with operating the IR is important; however, there is very little objective data. This lack of data, in itself, may provide information, in that the IR has not been sued, nor has it been called upon as an expert witness since its inception.

In considering the risks associated with operating the IR, this paper focuses on management's experience and insights. These will evolve as cases arise and as problems present themselves. Management believes that the three main risks to the IR are complacency, human error and unknown technology assumptions.

The nature of the data stored in the IR database means that unrecognised errors are of most concern, the "unknown unknowns". The worst type of issue that could arise would be a systemic error which does not come to light for an extended period of time. For instance, should the technical mechanism of the IR for signing data and ensuring non-repudiation be invalid, this might not be obvious until a legal case arose and an expert witness was able to identify systemic errors in the implementation of that technology. Should that happen, all registrations could be called into question and this could undermine the IR. The IR has taken steps to mitigate these risks, such as employing expert security consultants to confirm that the implementation is adequate and that it

remains so, and using the best in class provider of PKI technology. However, complacency must be avoided.

(A) COMPLACENCY

The IR is an institution established under an international treaty. It has long-term objectives. Complacency is a risk. IR staff and management must remain constantly alert to risks and must not allow standards to slip. In fact, management must constantly improve standards and ensure that the company culture is one of progress and quality improvement. The risk of losing the contract,[21] regular external security reviews, annual customer surveys and regular ISO audits all help to ensure complacency does not arise. Leadership is also important in setting an expectation that standards must continuously improve.

(B) HUMAN ERROR

Should human error affect the IR, it is likely to be gross error. The IR system is designed to avoid human error by Registry Officials. The website (IR Application) simply does not allow Registry staff to interact with registration data. However, in the background, several technical staff, in particular Database Administrators (DBAs) have, by necessity, access to the IR system directly rather than through the IR Application. For instance, a DBA could make changes to the IR database by mistake. Were that to happen, it would be noticed by the Tamper Check element of the IR application. To mitigate against these risks the Registrar only contracts with highly reputable firms. Technology and process controls seek to ensure that an individual could not cause damage and that any damage would be noticed and would be capable of being fixed. As new technologies become available, the Registrar must ensure that such risks are contained.

(C) UNKNOWN TECHNOLOGY ASSUMPTIONS

Since the IR's inception browser technology, as just one example of end-user technology, has changed significantly. It is now possible to use multiple tabs and to auto-fill fields. These options were unknown at the time the IR was developed. High-quality software development will make as few assumptions as possible but it will always be necessary to make some. Unknown

21 The Registrar operates under a five-year contract from the SA.

technology assumptions can lead to unexpected behaviours in the IR when external changes make these assumptions invalid. To avoid this, high-quality software development is important as is the constant development of the IR system which ensures that it stays current and understood by a group of experts.

UNCITRAL [22] has developed a Legislative Guide on Secured Transactions [23] (the UNCITRAL Guide). Chapter IV, section 54 of the UNCITRAL Guide deals with data integrity and preservation. This section notes the differences between paper and electronic records and points out that *"it is very difficult to re-construct a paper-based registry if the physical records are damaged or destroyed."* It goes on to state that for an electronic registry *"it is much easier to ensure the preservation of data in the registry."* [24]

Management's view at the IR is somewhat different, either due to its responsibility for ensuring data integrity or due to its experience in electronic and computer systems. It appears that lawyers have more confidence in electronic systems than engineers.

Although it is true that electronic systems can be easily backed up and that copies of the database and records can be stored at geographically separated locations, this addresses only one aspect of data integrity (large-scale physical threats). It is true that one flood or fire could not destroy the electronic records of the IR, unless that fire or flood was of biblical proportions. The physical vulnerability is small for well-designed electronic registries. However, the logical vulnerability is large. When a registration is made on the IR it is immediately replicated to a second site. In fact, due to the nature of the technology, there are several identical copies of the data on both the main and the back-up sites. Although this reduces the physical vulnerability, it provides a channel for bad data to replicate automatically and immediately from one copy of the data to another.

For instance, if malware managed to remove or alter data in the primary database, it would not need to attack back-up copies; the system, which is designed to ensure that data is always available, would finish the job for it. Similarly, a DBA could delete all electronic records in error. Although it would be possible to go back to previous backup that could be up to 24 hours old and any registrations made in the meantime would be lost. While this

22 The United Nations Commission on International Trade Law.

23 Published March 2010, ISBN 978-92-1-133675-7.

24 The UNCITRAL Guide, at 163.

paper does not seek to review all of the security aspects of operating an electronic registry, it is important that management be fully aware of the risks associated with storing data electronically. Complacency is the real risk.

By using best practice in the field of electronic registry design and operation and by remaining vigilant, Aviareto is well positioned to ensure data integrity of the electronic records over which it is custodian. However, IR management believes that the UNCITRAL Guide does not set-out fully the risks associated with electronic registries.

VIII. – SUCCESS THROUGH GOOD GOVERNANCE

The Treaty and its IR are considered a success. The volumes of transactions completed on the system, the results of annual customer satisfaction surveys along with the number of State ratifications are objective indicators of that success. Understanding this success might serve future electronic registries whether pursuant to the Cape Town Convention or not.

Aviareto believes that the key success factor has been Good Governance.

The IR must never become an ivory tower, hiding behind regulations and stifling change. The five-year contract ensures that Aviareto does not become complacent in its operation and development of the IR.

Good Governance is achieved because of shareholders' objectives, industry engagement, the expertise of the Supervisory Authority, the adoption of relevant standards and management's insistence on looking for objective views of the company's performance.

Aviareto's shareholders are SITA [25] (80%) and the Irish Government (20%). As the International Registry is not for profit, these shareholders seek something else. In both cases, it is the same thing: their objective is reputational gain. This is the reason for Aviareto's very low appetite for risk.

Aviareto has engaged deeply with the industry through its advisory board (the International Registry Advisory Board, IRAB). The IRAB is composed of many world-leading experts in aviation finance and international commercial law, practitioners and academics. The IRAB has met sixteen times in the last two years to discuss changes to the IR system and to propose changes to the Regulations and Procedures. Many ideas, such as the transferrable right to

25 The parent company of Aviareto Limited, owning 80%, is Compagnie Internationale de Participations SA (CIP SA), a company incorporated in Belgium. CIP SA is owned by SITA Société Coopérative which is also registered in Belgium and is owned by over 500 of the world's airlines.

discharge and the Closing Room arose out of IRAB discussions. It is a place where modern electronic practice meets modern legal practice. The Registrar appreciates the commitment of IRAB members and the expertise and time they have dedicated, *pro bono*, to this work. They have served the public good with distinction.

The expertise of the Supervisory Authority has been critical to the success of the IR. ICAO was involved with the Aircraft Protocol from a very early stage and was heavily involved in the diplomatic Conference in Cape Town in 2001. The work of any such supervisory authority should not be underestimated. It requires expertise, high-calibre professional staff, adequate resources, an industry-focused practical approach and sound judgement.

The IR has adopted appropriate ISO standards in the operation of its business. Article 28 of the Convention sets out the Registrar's liability with the following exception:

> "except where the malfunction is caused by an event of an inevitable and irresistible nature, which could not be prevented by using the best practices in current use in the field of electronic registry design and operation, including those related to back-up and systems security and networking."

There is no definitive best practice for electronic registries so the Registrar has taken the approach of adopting internationally recognised standards, which it believes are appropriate to electronic registries. To date, two standards have been successfully adopted, *i.e.*, ISO 27001:2005 and ISO 9001:2008, the former relating to ICT security and the latter to quality management. The Registrar is audited annually by the British Standards Institute for ISO 27001 and by the National Standards Authority of Ireland for ISO 9001. This gives an independent external view of the IR. The Registrar has an interest in developing internationally recognised standards in this area, although efforts in this regard have proved unfruitful to date.

Another external view of the quality of the IR is achieved through annual security reviews by leading ICT security consultancy firms. The practice adopted by the Registrar for Registry system security is to conduct a full security audit each year and to follow that up, roughly six months later, with a review of progress on the issues raised in the Audit.

In 2007, Aviareto began the practice of seeking the views of customers through an annual, independently operated, on-line survey. This customer satisfaction survey is based on a set of 17 identical questions that allowed comparisons to be made between years.

In each of the seventeen areas, and for every year since the survey began, the performance score has improved. The weighted average score has improved annually, as can be seen in Figure 1 below. The weighted average score weighs the performance in areas that are most important to users higher than the performance score in areas of less importance to them. A ten-point scale is used and the composite score (excluding fees) is now 7.89 / 10. Each year, Aviareto management, through the ISO 9001 system, identifies actions it can take to improve the customer experience.

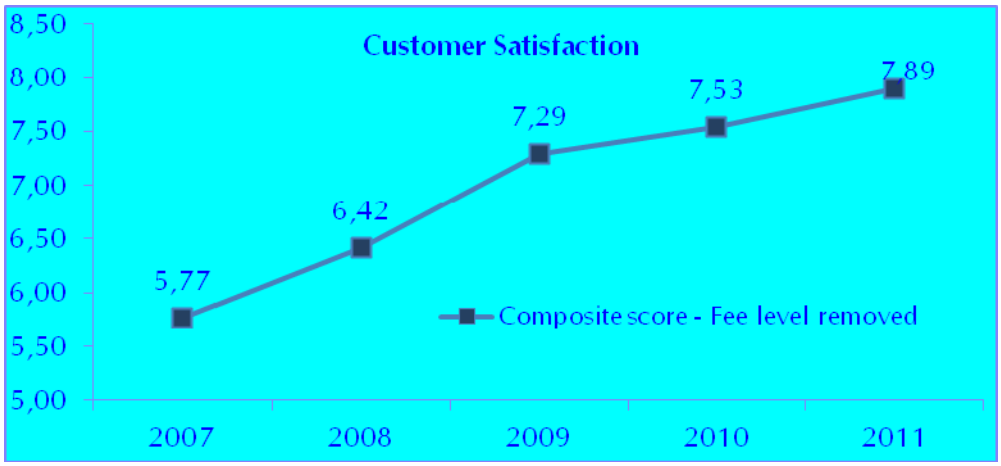

Fig. 1 – Customer Satisfaction Survey

IX. – CONCLUSION

The Registrar is responsible for ensuring electronic registrations can be made and, once made, remain unchanged forever. The Aviareto team remains focused on this simple goal but does not underestimate the complex challenges it faces.

Our work in important; we are keepers of records written in electronic stone.