

Royal Aeronautical Society Flight Simulation Group

Newsletter

October 2009



New Readers – please register as FSG members on the FSG website (<http://www.raes-fsg.org.uk/>) to ensure that you receive this newsletter via the FSG mailing list.

Editorial

The scope and diversity of the activities in the pages of this newsletter are indicative of a very enthusiastic, dedicated and busy group in the Royal Aeronautical Society. The Flight Simulation Group (FSG) has played an influential role in international regulations and in coordinating initiatives involving the major participants from industry, operators, regulators and academia. The FSG continues to make a positive and significant impact in both the flight simulation industry and in the aerospace industry. Its recent paper 'The Impact of Flight Simulation in Aerospace', presented at CEAS 2009, summarizes this contribution, which will be further emphasized in the Spring Conference in June 2010, when the FSG reflects on 40 years since its first symposium.

In the previous newsletters, we have encouraged short articles on topics relevant to flight simulation and this edition includes an article by Sunjoo Advani on the role of the 'International Committee for Aviation Training in Extended Envelopes' (ICATEE).

David Allerton

Spring 2009 Flight Simulation Conference: Flight Simulation – Towards the Edge of the Envelope, 3-4 June 2009.

Readers are directed to an excellent review article on this conference by Ian Strachan in the October 2009 issue of Aerospace International.



Professor David Allerton of Sheffield University explains about wake vortex encounters.

Annual RAeS International Flight Crew Training Conference – A Training and Regulatory Environment for Tomorrow, 23-24 September 2009

The fourth Annual International Flight Crew Training Conference was held at the Headquarters of the Society 23-24 September 2009 and demonstrated that this is now a very well established event. The topic 'A Training and Regulatory Environment for Tomorrow' proved timely, and the Conference attracted about 90 delegates from some 14 different nations. The Conference was very stimulating, with some very lively discussion periods, and was most successful.

Excellent keynote addresses were given by Mr Michael Smethers, Chairman EASA Management Board, and Capt Florian Hamm, Chief Executive Officer, Lufthansa Flight Training. Subsequent sessions dealt with flight crew licensing, which included papers on the Multi-Crew Pilot Licence from several different perspectives, and resource and risk training, in which evidence was provided on the safety-critical nature of the pilot despite automation and the need for broad-based training to equip pilots for the unexpected. A session on the optimisation of flight simulation training devices included an update on the RAeS International Working Group on FSTDs, and the Conference concluded by considering future flight crew training strategies. An Open Forum panel session facilitated a wide-ranging discussion and encouraged delegates to propose ways whereby the key issues might be taken forward. The recurrent theme throughout the Conference was the need to improve safety still further and the importance of flight crew training in achieving that improvement.

Preparations are already well in hand for next year's International Flight Crew Training Conference which will take place on 22-23 September 2010. The chosen topic is: 'The Global Market Place - The Challenges for Flight Crew Training'.

Peter Barrett

Autumn 2009 Flight Simulation Conference: Fixed Wing and Rotary Wing FSTDs

The conference will be held at the Headquarters of the RAeS 18-19 November 2009.

Spring 2010 Flight Simulation Conference: Flight Simulation Technology – 40th Anniversary of the First RAeS International Symposium

The Royal Aeronautical Society's Flight Simulation Group Conferences are both well established and highly successful. In 2010, it will be 40 years since the first such international symposium. To mark that anniversary, a special conference will be held to examine the latest flight simulation technology and to review future opportunities. The Conference will begin with a session reviewing that first international symposium and discussing progress over the past 40 years - expectations dashed and expectations fulfilled. Subsequent sessions will discuss modelling, visual and motion cueing requirements, environmental representation, simulator testing and maintenance, mission simulation and training and interoperability.

The Conference will be held at the Headquarters of the Royal Aeronautical Society in London on Wednesday 9 and Thursday 10 June 2010. This informative and wide-ranging two day conference will examine flight simulation technology - the art and the science - from the perspectives of fixed-wing and rotary-wing aircraft manufacturers and operators, makers and users of training systems, training providers, airspace managers, researchers, and regulators. The Conference has a very broad agenda and seeks both to ensure that appropriate work is taken forward and also to determine how the Royal Aeronautical Society might best facilitate progress.

The papers, some of which will be novel and contentious, will be presented by leading experts in their fields and some 150 delegates are expected from Europe, North and South America, the Middle East and Indian sub-continent, China and the Far East. Regardless of whether you are involved with management, manufacturing, training, regulating, airspace, or any other aspect of operations, this Conference provides a unique opportunity to become involved, discuss the issues and influence the work required to resolve them.

Peter Barrett

CEAS 2009

The Council of European Aerospace Societies (CEAS) held their conference in Manchester 26-29 October. A paper entitled 'The Impact of Flight Simulation in Aerospace' was presented at the conference. The paper was based on the Specialist

paper produced by the FSAG. Copies of the CEAS paper and the presentation can be downloaded from the FSG website.

The Rotary Wing Data Document

Issue 1A of 'The Rotary Wing Data Document (Data Requirements for Design and Performance Evaluation of Rotary Wing Synthetic Training Devices)' has been produced.

The RAeS Rotary Wing Data Document is an equivalent document to the Fixed Wing IATA Flight Simulator Design and Performance data and is designed as a guide for:

- Helicopter Simulator Operators' procurement organisations to establish the Data Package acquisition process;
- Helicopter Simulator Manufacturers, Helicopter Manufacturers;
- Helicopter Simulator Users and vendors of Helicopter Equipment.

The Data document will be useful for purchasers of helicopter simulators and also provide a reference for the qualification of simulators. The document has a generic aspect, covering a large range of civil and military helicopter types, helicopter equipment items, simulation devices FSTD, FMS, FTD, FNPT and CPT. It is recommended to those involved in both civil and military rotary wing simulation as a comprehensive guide to what data is required to provide a good simulation of rotary wing aircraft. It can be purchased from Emma Brown at the Conference Department of the RAeS (emma.brown@aerosociety.com).

Murph Morrison

Joint Cranfield/RAeS Flight Simulation Short Course

The annual 'Introduction to Flight Simulation' short course took place at Cranfield University, Cranfield from 25th to 29th October 2009. Run by Cranfield University, this course is co-sponsored by the Royal Aeronautical Society.

Universities Seminar

The second seminar for Universities will be held at the Headquarters of the RAeS shortly after Easter 2010 - date to be confirmed.

IWG Regulatory Workshop

On September 22nd 2009, the ICFQ ran a workshop for FSTD regulators, operators and other interested parties. The aim of the workshop was to brief the industry on the content and status of ICAO 9625 Rev. 3 and to promote a discussion on how the advantages of these international standards can be used to obtain mutual recognition between

regulators and a harmonisation of approval processes.

It was attended by 40 delegates from 12 different countries, including 9 different national regulators. Members of the ICFQ gave presentations on ICAO 9625 Rev. 3, a summary of the current problems facing FSTD operators and the perceived opportunities and benefits of mutual recognition.

Following a lively debate, the status of National Authorities with the implementation of 9625 Rev. 3 is set out in Table 1, on page 8. The release of Rev. 3 will require patience on the adoption in Europe as the various European NAAs establish their new processes and regulations with EASA. Also the principle of mutual recognition for many other issues does have some opposition within EASA.

Peter Tharp

International Working Group for Rotary Wing FSTD Qualification (IWG-H)

The last meeting of the IWG-H was held in Cambridge to coincide with Helitech from 16th to 18th September. The full minutes and copies of the Presentations made during this IWG-H Meeting are to be posted on the RAeS Forum.

The current status in summary is that the Group has completed about 90% of their Phase 2 with a number of Joint Training & Technical sub-WG meetings to define Simulator Features, Training Matrix and the subsequent Definition of ICAO Standard rotary wing FSTDs. They are scheduled to enter Phase 3 the Drafting of ICAO Doc. 9625 Vol. 2 by the entire H-IWG with a further meeting 8-10 Dec 2009 at FSI's facility in Lafayette, Louisiana, particularly to evaluate differing visual solutions. FSI were prepared to support this by making available simulators with both direct view and collimated images, during the evenings. The IWG-H agreed to this experimentation to take place after the regular meetings during the day. The meeting is also planned to include a validation test task team meeting and possibly also an environment task force meeting.

Looking further ahead, July 2010 is targeted as the draft posting of Parts 1 & 2 on the RAeS Website in a forum for entire industry, publicly accessible, where comments can be received. This schedule suggests that the draft Doc 9625 Vol. 2 will be ready to present to the RAeS in Oct / Nov 2010. If the draft is endorsed it could then be offered to ICAO the following month with any required adjustments having been made. Should all of this prove possible it would suggest that, based upon the experience of Vol. I., the Helicopter document could be published by the summer of 2011.

Peter Tharp

International Committee for FSTD Qualification

With the publication of ICAO 9625 rev.3 for aeroplanes at the end of July the work of the IWG-A has effectively been handed over to the FSG-led International Committee for FSTD Qualification.

This Committee held its second meeting at the headquarters of the RAeS on 21st September. A main activity was to prepare for the next day's Regulatory Workshop.

Remaining items discussed included:

- (a) The completion of the tests for objective Motion Criteria to complete Attachment F;
- (b) The status and content of the associated RAeS Simulator Evaluation Handbook (see later article);
- (c) Representation with EASA;
- (d) Development of an ICFQ Website and Forum.

Peter Tharp

FSG Challenges

Following the FSG Committee meeting on 8th September, the following day was spent reviewing the status and in further discussion of the 'FSG Challenges'. As a reminder the Challenges had been introduced by the FSG to:

- (i) Focus the FSG's attention on technical issues, identifying and investigating difficult areas in flight simulation;
- (ii) Provide FSG-led open discussion forums on the web;
- (iii) Identify priorities and collect ideas and material for conferences;
- (iv) Provide a useful reference for the simulation community.

The first part of the meeting discussed the operation of the Forum and ways to encourage more people to contribute. It was agreed that there is a strong case for it to have an owner and champion! Volunteers will be welcome.

Barry Tomlinson gave a short presentation on the result of the university seminar, whereby the Universities could refer to the challenges on the forum to identify issues which might attract research grants, and which FSG support would help justify. An FSG-produced reference document available to universities would add weight to the challenges, and make it easier for universities to refer to. The document should be a living document, where future challenges can be added, and obsolescent challenges be removed. It was noted that not all challenges are relevant for research work, e. g. military procurement.

Each relevant challenge of the forum, which could form part of the document, should be described in a one page summary, laid out with bulleted paragraphs with sufficient detail to identify the key points, stating:

- Topic title,
- FSG point-of-contact,
- The Issues,
- Key challenges for research,
- What the impact will be if the research work is successful.

Other progress to report:

- Upset Recovery Training has been added to the Challenges
- Stefan Sandberg gave a short presentation on Database Generation which he uploaded immediately to the forum. His work on the discussion paper is ongoing, and he will publish it shortly.

Peter Tharp

Simulator Evaluation Handbooks

After almost a two-year activity, Malcolm Blackwood and his supporting team are ready to release the latest revision, the 4th Edition of Volume 1 at the FSG November Conference.

This 4th Edition is a major expansion of the Handbook aligning the tests with the increased content of ICAO 9625 Rev. 3. For the first time the Handbook also addresses Lower Order devices as well as the Full Flight Simulator evaluations.

Malcolm and his team are to be congratulated on an excellent result and thanked for all their hard work.

Volume 2 of the handbook covering Functional and Subjective tests is just starting a similar major revision led by Simon Wood. A draft introduction and test template is being discussed and a team of contributors will be put in place before the end of the year. There have been no updates to Volume 2 since the original release in 1995 and there is much work to be done to cover the advances that have occurred since then and reflect latest standards.

Peter Tharp

Regulations Update

1 National Qualification Requirements

JAR-FSTD A & H were published on 1st May 2008 and, although an effectivity date of 1st August 2008 was published, the individual European National Aviation Authorities (NAAs) have been implementing the requirements at different times.

The UK CAA has an implementation policy for JAR-FSTD (A and H) pending final transition and the adoption of the EC regulations. From 1st September 2009, JAR-FSTD (A or H) has been the sole means for the CAA qualification of FSTDs.

With the cessation of the JAA the European NAAs are developing a process to continue the principles of mutual recognition.

The so-called ‘catch up process’, which addresses the approval to use devices (which currently do not hold a JAR-FSTD Qualification but that have a FAA Qualification) within the Type Rated Training Organisations located in North America and Canada, has been completed by evaluating the devices and the Operator’s Quality Systems. Those devices that have been considered suitable have been given a special qualification that is revalidated annually by an evaluation with a team consisting of NAA representatives appointed by EASA. It is understood that this process will continue until the EASA Implementing Rules are in place (envisaged to be 2012), when EASA will have full responsibility over the qualification of devices located outside the EU.

2 European Aviation Safety Agency

Regulation 216/2008 sets the framework for the extension of EASA’s remit to cover Operations, Personnel Licensing and third country aircraft.

The implementing rules (IRs) for Operations & Licensing contain the relevant ‘parts’ for device qualification and Organisation approval; Part Authority Requirements (AR) and Part Organisation Requirements (OR).

The acceptable means of compliance (AMC), guidance material (GM) and the certification specifications (CSs), which are based on JAR-FSTD A & H, are contained within PART-AR and PART-OR.

The draft document was published for review in the form of NPA 22-2008 ((a) to (e)). The closing date for comment has now passed and the comment response document (CRD) is due to be published in August 2010. The presentation to the commission is scheduled for February 2011 with publication sometime after.

The draft implementing rules for Air Operators and Community Operators has been published as NPA 2009-02 Part OPS. The closing date for comment has also passed and the CRD is due to be published in October 2010. The presentation to the commission is scheduled for April 2011 with publication sometime after.

3 Federal Aviation Administration

As of May 30th 2008 14 CFR Part 60 became effective for FSTD initial (& continuing) qualification and use. The FAA is developing a process to initiate directives. Directive 1, which addresses visual airport model fidelity for training, testing and checking was published in change 1 to Part 60.

New Statements of Qualification (SOQ) are being issued for new FSTDs to meet Part 60 requirements. The SOQ includes a detailed configuration list and a list of qualified tasks.

Guidance bulletins published in 2009 include:
(09-01) - NSP Guidance on the Application of 'Non-Flight test' tolerances to Engineering Simulation Validation Data.
(09-02) – draft: Visual Database Modelling Guidelines - Enhanced Taxiway Markings.
(09-03) – draft: Cockpit Ambient Lighting Requirements.
(09-04) – Windshear Training and Simulator Requirements
Peter Barrack

Edwin A Link Lecture

The third Edwin A Link Lecture, in honour of Edwin Link, inventor of the "Link Trainer", will be held on at 7pm Thursday 19 November 2009 at the Rotunda in the British Embassy, Washington DC. A presentation entitled "Warfighter Readiness Enhanced by Simulation Advancements" will review advancements in both manned and unmanned simulation, and a look at what the future holds. The lecture will be given by Mr. Robert Birmingham, President of L-3 Communication's Simulation & Training Group.

Details may be obtained from Washington Branch Secretary, Alan Hickling, at hickling3903@aol.com. The 2010 lecture is scheduled to be held at the Society HQ, probably in Farnborough week in July.
Barry Swainston

Merlin Flight Simulation Competition

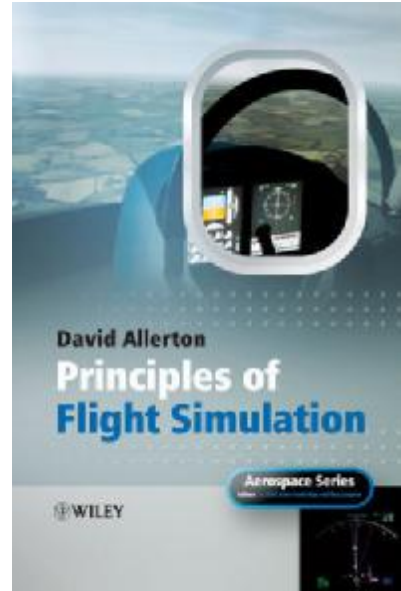
The 2009 Merlin/RAeS Aircraft Design and Handling Competition was held at the Society's headquarters on June 12th. By general consensus, this was the most successful event so far. The standard of all ten entries was very high. In addition to the regular contributions by John Farley, former Harrier Chief Test Pilot, and Dave Southwood of ETPS in 'flying' the various designs, we were fortunate to have an excellent presentation by Capt Eric 'Winkle' Brown, describing his experience of flying German WWII aircraft. All present, particularly the young competitors, found this illuminating.

Judging was made difficult by the exceptionally high standards of the entries but the eventual overall winner was Charlotte Collins of Coventry University with a simulation of the Hunter FGA6.

NEWSFLASH The 2010 competition will be held at Coventry University.
Barry Swainston

New Book

It's now over twenty years since John Rolfe and Ken Stapes published their book on Flight Simulation, which has become a standard text on the subject. A new textbook on the subject has recently been published by John Wiley and Sons. Further details are available from the John Wiley website <http://eu.wiley.com/WileyCDA/>



Contact Us

We would welcome feedback on this newsletter and contributions for future editions. Please feel free to contact us via the FSG Forum <http://www.raes-fsg.org.uk/cgi-bin/yabb1/YaBB.pl>

The FSG Forum provides opportunities to contribute to discussions on the major challenges facing the simulation and training community. You will be welcome to contribute.

If you are aware of anyone who might like to receive a copy of this newsletter, can you please forward their email address?

SPECIAL FEATURE

International Committee for Aviation Training in Extended Envelopes (ICATEE)

1 Introduction

The contribution of upset-related incidents to aviation safety is significant. Of all the hull losses during 2009, approximately 33 percent of these can be attributed to upsets or related causes. There is no single root cause to this problem - it can be attributed to human error, systemic error, or atmospheric conditions.

Regardless of the cause, the last stop is always the flight crew who are confronted with a situation for which critical decisions must be made very quickly. This decision may also include *no* intervention, allowing the automated systems to maintain control.

On 3-4 June 2009, the Flight Simulation Group (FSG) of the Royal Aeronautical Society organized a conference entitled *Flight Simulation - Towards the Edge of the Envelope*. The conference subject was related to a growing need to address aviation safety issues through better training and simulation beyond what is currently covered in flight and in ground-based flight simulators. The conference identified the need to improve aircraft upset training, the shortcomings in basic education and readiness of commercial pilots in reacting to upsets, and the technical challenges of upset training.

As a result of the conference, the RAeS FSG was requested to form a Committee to explore the formation of an International Working Group (IWG) to identify follow-on steps and to invite participation from other interested parties. This Working group has been named as the International Committee for Aviation Training in Extended Envelopes (ICATEE).

2 Industry Needs and ICATEE

Concepts have been proposed for better training of crews to firstly identify upsets and, secondly, to deal with them well after they have been encountered. The former is well supported within the current training framework as training systems and processes are able to provide reasonable information to the candidate on the entry approaching the upset.

One could also argue that, although current hardware capabilities support this conclusion, the methodology employed by the vast majority of airlines and training providers is not appropriate to meet the training objective; in other words, in equipping flight crews to both identify impending upsets, and full recovery from such upsets. The current training methodology of traditional “maneuver-based training” for upsets develops rote skills but falls short when it comes to replicating the “startle effect” of an actual upset in a LOFT type environment. One of the objectives of the ICATEE is to explore the best training methodologies to meet the training objective.

Beyond the initial stages of an upset, the results can vary widely due to non-linear external forces and moments on the aircraft, the dynamic coupling among the three aircraft axes, and the subsequent dynamic interaction between the pilot and the aircraft. It is this lack of determinism that makes it challenging to define, develop and to qualify adequate training solutions for upsets.

There are arguments supporting current training methods even though they may be a rough approximation of some upset situations. These arguments are based on evidence that the human pilot is able to adapt to a situation if a basic level of training is provided in representative situations.

Then, there is another argument regarding realism. Current upset recovery practices may be teaching pilots to apply control inputs that, if repeated in reality, could severely damage the airframe. The lack of realism in the simulator, due to several technical and organizational shortcomings, may eventually prove to have negative value in the transfer of skills.

Clearly, the subject has a wide scope, as well a sense of immediacy. There is no single solution or symptom, and there cannot be one approach to addressing the problem as there are cost and opportunity implications of providing a minimum level of upset recovery training for the numbers of aircrew likely to require it. Utilising the right expertise, developing a consensus on priorities, and establishing a mechanism of implementation is therefore essential. These are the primary purposes of the ICATEE.

3 State-of-the-Art

There are several programs already underway to enhance pilot training in extended flight envelopes. These range from educational tools, such as the Upset Recovery Training Aid, to simulator-based and in-flight training using conventional or fly-by-wire aircraft. There is no one consistent standard and, perhaps, there will always be different possible methods required in order to provide the level of skill required of pilots.

Much research has been conducted over the past years deals with the technical and training aspects of extended envelope flight operations. These studies cover areas such as:

- Human factors of extended envelope operations
- Modelling and simulation of high angles of attack, large angles of bank and yaw, and dynamic effects of the stall-regime
- Analysis of training methodologies.

Research programs currently under way include those at NASA Langley Research Centre, TNO Human Factors (SUPRA project), Embry Riddle Aeronautical University, University of Toronto Institute for Aerospace Studies (UTIAS), CALSPAN, and others. The inputs from these organizations will be of great value to ICATEE.

One of the objectives of the ICATEE is therefore to identify in an objective manner the current processes used to develop the cognitive and manual skills for extended envelope awareness, identification and recovery.

In order to do this, the ICATEE will involve industry, regulatory, training and academic experts who are involved in defining and providing this training. Another aspect is to review the work that has been going on in research centres, universities and in industry. Much of this research is targeted at modelling aircraft in the extended flight regimes, from stall buffet, full stall, deep stall, spin, etc.), and exploring different ways of presenting this information in Full Flight Simulators. Modelling in itself poses many challenges, due to the non-linear and less predictable behaviour of airplanes outside normal flight envelopes.

Research centres like TNO, NASA Langley, UTIAS and NLR are involved in research targeted specifically at modelling flight vehicles under large, unsteady disturbances, human perception, and the implementation of these models into various flight simulation devices.

4 Main Issues and Possible Mechanisms for Resolution

The complexity of flight simulation under normal situations in terms of matching technical requirements with the appropriate training media has been demonstrated during the recent revision of the ICAO 9625 document. In the areas that are beyond the normally-qualified flight simulation regimes, the problem can become even more complex. Therefore, prioritization and careful selection of appropriate and suitable - perhaps not perfect - solutions need to take place. It is also imperative to consider if there are situations or conditions that lead to inappropriate or negative training of upset scenarios, based on current knowledge and technical limitations.

The issue we are mostly dealing with is human pilot interaction with the vehicle. Recognition, reaction and interaction with the vehicle are all important functions required of the pilot. Part can be learned with training aids (classroom, CBT, etc); part is through experience for the purpose of identification and recognition in order to prevent the situation from worsening; part is interaction with the aircraft during and following the upset.

5 International Working Group

Nearly thirty organizations and individuals will participate in ICATEE, including:

- Aeronautical Industry/Scientific Bodies
- Airline pilots associations
- Airline operators
- Transportation Safety Associations
- Civil Aviation Regulatory Authorities
- Airframe and systems manufacturers
- Simulation manufacturers and providers
- Training providers
- Research agencies

The main activities of the Working Group are:

- To review current practice in extended envelope training
- Identify the main shortcomings
- Identify the data and training media requirements and further research required
- Recommend the areas that need immediate improvement in flight training
- Examine essential and desirable training elements and methodologies
- Suggest how standards can be established through improved guidance materials.

The main workflow is expected to entail the following activities:

- Data Gathering and Collation
- Definition of Upset Training Scenarios
- Development and Validation of Best Practice Upset Recovery Responses
- Identification of Appropriate Training Media and Methods
- Validation and Accreditation of Upset Recovery Training Packages

6 Organization and Execution

The FSG has established an ICATEE steering group consisting of Dr. Sunjoo Advani (chair), Capt. Gordon Woolley (co-chair) and Mr. Peter Tharp (co-chair). This group will set up and confirm the plan of the Working Group, assign tasks, request the support of the participants to fulfil these responsibilities, establish the time lines, and report the findings outside the group. It will also prepare the Committee's Constitution and Terms of Reference.

The Working Group will bring in further capabilities and expertise from a cross-section of interested parties by invitation.

The working group is expected to meet approximately seven times during the coming two years, with the initial meeting scheduled for 16 November at the RAeS headquarters in London.

The intention is to present the findings of ICATEE at an RAeS Conference in the first half of 2011.

Sunjoo Advani

NAA-	Country	IWG Member	Formally Briefed ?	Supportive ?	Implementation Status
ICAO ANC	ICAO	P	YES	YES	Published 9625 Edition 3 in July 2009
EASA (UK CAA LBA, Fr DGAC)	EU	P	YES	YES	TBA – awaiting conclusion of current NPA22 process before taking steps to adopt edition 3.
FAA	USA	P	YES	YES	Draft update to Part60 work in progress. Complete in 2010?
CASA	Australia	P	YES	YES	
TC	Canada	P	YES	YES	Drafting into regulations is work in progress
CAAC HKCAD	China	P	YES	YES	
NZCAA	New Zealand	P	YES	YES	Stated intent to incorporate in 2010
CAAS	Singapore		YES		
GCAA	Gulf States		YES		
JCAB	Japan			YES	Stated intent to incorporate in 2010
KCAA	Korea				Stated intent to incorporate

Table 1 The status of National Authorities with the implementation of 9625 rev. 3