FLIGHT SIMULATION GROUP
NEWSLETTER
SUMMER 2017

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.

FSG Chairman's Welcome

Welcome to the relaunched FSG Newsletter, which is intended to bring members of the simulation community up to date with what the Group is doing, and what is planned for the future.

We would also be keen on hearing what aspects of simulation you are interested in, and what sorts of topics you would like to see us tackle in our conferences and events.

FSG Mission Statement

The Royal Aeronautical Society (RAeS) Flight Simulation Group (FSG) aims to be impartial and open to anyone sharing and supporting its objectives; recognised internationally and continually striving to improve its provision of a readily accessible centre of excellence for civil and military, fixed and rotary wing, simulation and training matters.

FSG Annual Report: Summary

The FSG has enjoyed an active and successful year. We remain one of the busiest Specialist Groups within the Society, with a full range of activities, independently and in co-operation with other groups. In the last 12 months we have delivered two conferences and two prestigious Named Lectures. All were to the FSG's usual high standards, and were well supported and well received. A similar schedule is arranged for the next year, and more details of the November 2017 Conference, and the possible themes for the Spring 2018 Conference, are set out below.

We intend that the FSG remains a very active Specialist Groups within the Society, and our activities in support of international bodies, such as ICAO, IATA, ARINC FSEMC and the national regulatory authorities, will continue. We will be addressing how we best engage and offer an effective contribution wherever flight simulation technology and flight training device standards have impact. FSG members also play a significant part in the International Pilot Training Association (IPTA),

FSG Diary Dates

2017

Meeting 3/16 Mon 25 September

IFCTC Tue/Wed 26-27 September

Meeting 4/16 Mon 13 November

FSG Conference: Modelling and Simulation in Air Traffic Management Tue/Wed 14-15 November

2018

Meeting February TBC: site visit Boeing Facility, Fleet, UK

Spring Conference 12-13 June

Autumn Conference 13-14 November

The structure of the FSG Committee, with a full complement of Full and co-opted members, plus portfolios led by individual Committee members, continues to serve us well, the majority of the Committee leading or supplementing a specific office. It is also encouraging that a number of new members have joined the Group over the year, complementing and in some cases replacing long-serving members.

Looking Forward

Flight Simulation remains a diverse and fascinating industry, which continues to pose challenges to simulator manufacturers, training providers, and the user communities.

'Traditional' flight simulation, particular the high-end full flight simulators, has matured and has served commercial aviation extremely well over recent years. However, emerging technologies, largely driven by consumer and recreational hardware and software developments, increasingly provide interesting, and potentially game-changing, alternatives, and open up possibilities for simulation to play a much more significant role in other aviation sectors. In addition, these developments are helping to change the ways in which the younger

generations, 'digital natives', interact with and use them to collaborate, compete, and learn, raising issues for instruction and training delivery. The FSG's closer links with the Young Persons Committee will help us keep abreast of these developments, and indicate ways we can continue to serve the flight simulation community into the future.

WORLD SIMULATION and TRAINING NEWS

Ian Strachan, the media member of the FSG, has for many years reported on the simulation industry, including an annual simulator census.

His World Simulation and Training News report is now published under the auspices of the FSG. Ian's Report can be accessed via the FSG website

FSG Meetings

The February 2017 FSG Committee Meeting was a site visit, hosted by CAE Aircrew Training Services at the Medium Support Helicopter Aircrew Training Facility (MSHATF) at RAF Benson. Members enjoyed a tour of the Facility, and the opportunity to fly the Dynamic Mission Trainers for the Chinook, Merlin, and Puma which deliver operational training for the RAF and a number of other helicopter forces.

The FSG AGM was held after Day 2 of the June Conference, and featured the elections to committee places, and welcomed the new Chairman, Stefan Sandberg, into his position. A summary of committee members is attached below.

The next committee meetings will be held on Monday 25th September, ahead of the International Flight Crew training Conference, and on Monday 13th November, the day before the FSG November Conference. This event is described below.

Next year's site visit will be held in February 2018 at the Boeing Facility at Fleet, Hampshire.

Flight Simulation Group Universities Seminar 2017

The FSG holds an annual seminar with universities. The aim of the seminar is to foster flight simulation in universities by bringing together the FSG and universities with an interest in flight simulation, to brief universities on the work of the FSG and to encourage cooperation and collaboration between the FSG and Universities. It is held round the country at university campuses and other relevant sites. The seminar this year was held on 19 April 2017, hosted again by Thales Training & Simulation at their Manor Royal site at Crawley, Sussex and supported by L3 Commercial Training Solutions. Both companies are major producers of flight simulation training devices for civil and military users.

Representatives from 7 universities participated: City, Glasgow, Hertfordshire, Leeds, Liverpool, Salford and the University of the West of England (UWE). Many more universities make use of flight simulators and we would like to see a larger representation.

Barry Tomlinson, from the FSG, opened the seminar by giving an introduction to the role and work of the Flight Simulation Group. Neil Sears (FSG & Thales) followed with an outline of the simulation industry in military applications, and Chris Hunter (FSG & Hunter Simulation) in civil training.

After a tour of the Thales and L3 factory floor, presentations were given by Liverpool University; and the University of the West of England. Three students from Liverpool University (Daniel Newton-Young, Gilbert Tyrer and James Varney) talked about the university's simulation society and the changes under way with their fast-jet combat aircraft, Jetstream41 and PA-38 Tomahawk simulators. These include fitting a new visual system to their Jetstream simulator, with a curved screen and three projectors to provide 210 degrees field of view. A fourth-year project, supported by GARTEUR Action Group 23, will explore the effect on helicopters of air wakes from wind turbines. They are also improving their ATC simulation, to help students learn about RT communication. Pritesh Narayan, Programme Leader for Aerospace from the University of the West of England, talked about how they use their Merlin simulator to demonstrate aircraft behaviour to students. He has created new models in Simulink but is frustrated he can't play them through the Merlin.

In the general discussion, the consensus was that this seminar was very helpful to universities and encouraged cooperation. There is still a challenge to reach non-aerospace departments, such as human sciences or electronics, where work related to simulation may be going on.

Regarding the next seminar, Thales having hosted it for two years running, the 2018 seminar will probably be held at Liverpool University, date to be decided. Offers for future years are welcome.

Barry Tomlinson

Merlin Simulation Competitions

This year's competition in the USA on 8th April was once more at the University of Dayton Ohio The results were:

First prize: The University of Manchester A two person short range VTOL aircraft with electrical propulsion system.
Second prize: The University of Dayton Boeing 757-200.
Third prize: The University of Dayton, Crop duster.
Prize for the Most Innovative Design: The University of Manchester Hybrid aircraft with better performance and efficiency compared with a B757 or the A321neo.

Prizes for the Best Project Presentation
First: The University of Manchester VTOL aircraft
Second: The University of Manchester Hybrid aircraft
Third: The University of Dayton
Aerobatic aircraft

The UK competition was held at Manchester University on June 8th. Our former FSG colleague, Raymond Teunissen who is now a lecturer at the Amsterdam University of Applied Sciences (HvA) came over with two competing teams who did rather well. Another colleague, Mike Southworth, also attended as presentation judge.

The results were:

First prize: HvA Unmanned blended wing body cargo freighter
Second prize: HvA Electrically sustainable propelled aerobatic racing aircraft
Third prize: Manchester University A light, closed wing aircraft.
Prize for Most Innovative Design: Mike Hartman HvA

Best Presentation Prize The University of Dayton Ohio

June 2017 FSG Conference

The 2017 Spring conference, titled **Striving for Effectiveness in Flight Simulation,** was held on 13 June 2017 - 14 June 2017

In order to establish the true fidelity of flight simulators, to standardize their characteristics, and to improve their performance, it is essential to perform proper benchmarking. By objectively comparing simulator characteristics, it is possible to assess their real contribution to their intended goal, whether it be training, engineering, or basic research.
The Conference posed the questions "how can we truly benchmark a simulator, given its intended role?" What is the true norm to which we must measure the device, whether it be the actual aircraft or a simulator standard? Which parameters do we measure? And how do we continue to improve the standards themselves? To answer these questions, the conference put together a strong selection of good quality presentations and panel discussions, and the conference final session was in the form of themed breakout groups.
After a session examining the concept of benchmarking itself, presenters addressed measuring training effectiveness, whether training or technology should drive change, and FSTD validation. Motion had a dedicated session, and featured in a number of other presentations. A very varied set of perspectives were offered, contrasting objective motion with the importance of perception, and looking at how the effectiveness of motion and vibration could be assessed and validated. There was also a short session on rotorcraft simulation which developed the motion theme for helicopter cueing, a field of growing interest and importance.
The breakout sessions assigned conference participants into discussion groups, tasking them to identify and define each group's most pressing issue, and propose follow-up action. The results of the breakout groups are set out at the end of the Newsletter.

The 2017 Edwin A Link Lecture

The 2017 Edwin A Link Lecture was delivered on 13th June by Admiral P A Chivers OBE FRAeS and was entitled "Flight Simulation - A Military Regulators Perspective". Admiral Chivers reviewed the Military Aviation Authority's scope of regulation, particularly the benefits of risk-based regulation, and looked at the increasing use of the synthetic training environment and the proposed way forward. It was a useful and informative overview, and the

FSG looks forward to working with the MAA on issues of mutual interest.

FSG November 2017 Conference

The FSG November conference will be a joint FSG/AIAA event to be held on 14 and 15 November 2017, titled **Future Air Traffic Management: Modelling and Simulation Promises and Challenges**

This conference seeks to review the challenges associated with future air traffic management through the lens of their associated modelling and simulation solutions, as they converge with live deployable systems. It aims to share progress, facilitate discussion, and open the possibility of new or improved modelling and simulation derived solutions for system concept development, deployment, training and support.

Key challenges faced in air traffic management include continual pressure on global airspace to accommodate traffic growth; increasing demands for efficiency and reduction in environmental impact; surging use of “drones” or Remotely Piloted Aircraft Systems (RPAS); and rapidly changing geo-politics. Major modernisation programmes have been launched to develop and evolve future air traffic management systems to meet these challenges, and whilst much has been achieved there is still a long way to go before today’s vision becomes tomorrows reality. Modelling and simulation plays an increasingly central role in this process as concepts are developed through to live systems with associated performance optimising tools and training systems.
The programme is now being finalised, and will be issued shortly.

Future Conference Themes; Make your voice heard.

The FSG is now discussing themes for the 2 2018 conferences, with the aim of agreeing and defining the topics at the September 2017 committee meeting.
We are always interested in hearing from the simulation committee about what topics, issues, problems they think important, as well as those emerging from technological progress, changes in training concepts and delivery, and how to meet the training needs of the aviation industry. The breakout group outcomes – see below - from the June 2017 Conference provide some interesting themes, and we are keen to hear your views on these.

Please address your ideas to John Cook jc@parydon.com or any committee member.

Reports of interest

Regulatory Affairs report

Flight Simulation Regulatory Affairs update
Update to EASA RMT.0196 Update of flight simulation training devices requirements
The NPA should be published after completion of the EASA internal process prior to publishing. It is planned that the NPA will be available for comment for a 2-3 month period from the date of publishing. EASA are aware that July and August may be a quiet period for some organisations, and are therefore requesting that as many avenues as possible are used to make people and organisations aware of the impending NPA. The RAeS is included in this request. In the meantime, activity on the work package 2 elements as defined in the Terms of Reference has commenced.
UK CAA Personnel Change
Andy Gillbard has now left the UK CAA and Andrew Bell has been appointed as Principal FSTD Technical Inspector, and Graham Wheeler as the group manager.
RNP Approaches
As reported last time the FSTD Evaluations Reports had been updated to include the following approaches –
• RNP APCH LNAV
• RNP APCH LNAV/VNAV
• RNP APCH LPV
• RNP AR APCH
These approaches are now being tested at each Recurrent and Initial evaluation. For information the following is reviewed during the evaluation and should be considered by the Operator prior to the evaluation –
• The aircraft type must be certified for the evaluated approach category.
• The FSTD must replicate the version of aircraft certified the evaluated approach category.
• The FSTD databases must be up to date, i.e. -
    o FMS/FMGC
    o Radio-navigation
    o Visual scene
• The list of airports maintained by the operator must be accurate and up to date (GM3 ORA.FSTD.100 (d)(11)).
• The visual scenes where the training will be performed, must have accurate representation of terrain in accordance with EGPWS information. A statement is expected from the operator to demonstrate the accuracy.
• The fidelity and integration of all systems involved (FMS/FMGC, GPS, Autopilot,

EGPWS/TAWS…), especially in case of simulated or re-hosted avionics is checked.
• Normal and abnormal approaches are performed.
• The IOS must have the capability to induce an "UNABLE RNP" alert or other alert message that would cause a missed approach. The following malfunctions are examples -

- o FMS failure
- o GPS failure
- o Autopilot failure
- o RAIM information, loss of RNAV capability or RAIM alarm;
- o Altimetry failure;
- o etc.

For LNAV/VNAV (BARO), the capability of the FSTD to support COLD WEATHER training must be evaluated.

ARINC 450 Simulator Data Documents

In 2016, the FSEMC reached an agreement with IATA for the copyright to the IATA Data Document. ARINC IA has converted the document to their format and published it as **ARINC Specification 450:** *Flight Simulation Training Device Design & Performance Data Requirements.*
The FSEMC has now initiated the FSTD Data Document (FDD) Working Group. This working group, chaired by Mike Jackson, FedEx, aims at updating the data documents to the latest industry requirements.

The RAeS has also given its permission for the use of the Rotorcraft data document, "Data Package Requirements for Design and Performance Evaluation of Rotary Wing Synthetic Training Devices" which was published in 2004, and it is the Working Group's intention to incorporate rotorcraft into the Specification.

For further information contact:
Sébastien Bolduc (sebastien.bolduc@cae.com) or Nick Giannias (nick.giannias@cae.com), helicopter subgroup of the FDD working group, or Sam Buckwalter (Sam.Buckwalter@sae-itc.org) the executive secretary of the FSEMC.

Former Chairmen's Lunch

On April 18th, former Chairmen of the FSG gathered at the RAF Club to enjoy an excellent lunch and review the changing roles and status of the Group. Our thanks to former chairman Peter Barrett for organising the event.

The Jeet Aerospace Institute, Pune, India

An unscheduled addition to the FSG June Conference was a short but stimulating and inspiring presentation by Captain Anil Gadgil, an Ex-Indian Air Force and Ex Air India pilot and Fellow of the Royal Aeronautical Society, on one of the key initiatives of the JEET Aerospace Institute, a mobile flight simulator. The presentation described the impressive progress made with the simulator since Capt Gadgil first introduced it to the RAeS at a conference in 2007.

The Mobile Simulator

The idea behind a mobile flight simulator is to travel with it to various places and get people, who may have dreamed of the idea of flying but had no way of furthering that idea, to experience the thrill and adventure of flying. By exposing and involving a large segment of people, it aims to enthuse the youth about considering aviation as a career option and putting right many misconceptions about the profession. The flight simulator is an accessible and extremely cost effective means to attract, make popular, and offer the exhilaration of a flying experience at zero risk, an illustration of how effective low cost simulation can be in outreach and recruitment, particularly in a region where the potential growth of aviation is projected to outstrip the industry's means to provide trained manpower to meet demand.

In the Cockpit

'Flight Simulation for All' is the motto of the Institute, and the proof of the effectiveness of this initiative is the fact that several hundred pilots, civil and military, have successfully gone on to complete flying training.

You can read more about this terrific project at jeetaerospace.org/index

June Conference Breakout Results

Rotorcraft Group

Starting points

1. Helicopter operators are a diverse industry with many types and often limited resources and funds
2. High accident rates requiring better training
3. Simulator training relatively costly and poor accessibility for most small operators

Goal

Identify and specify a cost-effective and widely accessible simulator-based training capability to achieve the training goals necessary to inculcate the competencies and behaviours needed to mitigate the accident and incident causal factors identified by the Helicopter safety teams for helicopter crews undertaking flights and missions in representative environments and situations.

First Steps

Describe what training is needed for the crew to achieve the desired results in the aircraft and avoid undesired outcomes

Identify target audience for training

Identify simulation characteristics and fidelity needed to deliver the training outcomes.

Who might be involved and what do?

Rotorcraft Group and FSG joint conference to better define the issues

Simulation for Flight Test and Training Effectiveness Group

Training Effectiveness Goal:

Better align training device qualification to allow competency based training

First steps

- Form international working group to investigate how we qualify training devices to enable competency based training and establish an alignment
- Which competencies can be trained in different [existing/future] devices?
  - Start with ICAO 9625 basis
  - Examine competencies from ICAO 9995 (Evidence Based Training)
    - Relating the competencies to the training tasks [that are used in Doc 9625], and thereby what is needed to train a competency
      - Weighting the different training tasks for the different stages of a pilot's career.
    - Output from working group(s) e.g. EASA RMT-0595, RMT-0599, RMT-0196

        - Relating training credit (flight crew licensing) to training devices used for competency based training

    - Start with a simple competency – such as Automation Management – and determine how training devices support that competency training
        - What needs to be changed in the device?
        - How do we measure competency effectiveness in the training?
        - Considering the Instructor tools as well?
        - Measurement improvement in the device to assist Instructors?
        - Each device [that is used], starting with...
            - OTD [e.g. Tablet/Smartphone]
            - Lower Level Device
            - FFS Level D / Type VII

    - Pick a challenging competency, say decision-making, and determine how, or if, philosophical simulator changes are necessary to better support that competency training.
        - What needs to be changed in the device?
        - How do we measure competency effectiveness in the training?
        - Considering the Instructor tools as well?
        - Measurement improvement in the device to assist Instructors?

    - Consider what the use is for the devices
        - Training of a competency...
        - Versus application of the competency...
        - Versus checking the competency
    - Consider additional devices... application of new technologies...

- What does this look like?
    - Assessing the competencies, what is needed to train the competencies and relating that to devices
    - So, for example
        - Can a tablet be used for decision making… to what extent… how effective…?
        - How can that be integrated in the training program?
        - What can we achieve with a FFS Level D for automation management?
        - If we look at workload management, how can a low level device be used?

- Who
    - NAA's
    - Training Industry Experts
        - Training Organisations
        - Airlines
        - Training Experts, Researchers
    - Simulator Industry Experts
        - e.g. Simulation Manufacturers
    - Aircraft Manufacturer Training Experts
    - E.g. through IPTA, IFALPA, Working groups
    - …

Flight Test Goal:
Reduce flight test hours significantly, through the expanded use of flight simulation, without compromising effectiveness

- First steps
- Prioritisation of tests based on the "criticality":
  Flight Test "must do" vs Flight Simulation "ok"
  - …from a flight perspective
  - …from a validation perspective
  - …from a training perspective

- From a Flight Training perspective….
- Consider the tests in relation to the training tasks, and thereby the competencies
  - Which tests are required?
  - Can we (further) triage the existing tests?
    - What do you do well in simulation? What don't you?
    - What do you need to do in flight?
    - Are there tests you can thin down?
  - Are additional tests needed
    [e.g. with regard to new technologies and the competency training tasks]?

  - From an Aircraft Certification perspective…
    - Can we (further) triage the existing tests?
      - What do you do well in simulation? What don't you?
      - What do you need to do in flight?
      - Are there tests you can thin down?

  - Starting with…
    Take a pre-flight simulation model of a "derivative" aircraft -would be good enough to certify that aircraft without flight test? If not, what are the prioritized weaknesses?

  - Working towards further goals…
    - Reduce flight test hours for New Aircraft Certification through the expanded use of flight simulation.
    - Improve accuracy of aerodynamics and structures modeling prior to first flight
    - Reduce debugging of onboard computer systems and software

- Who
  - Aircraft Manufacturers
  - NAA's
  - Flight Test Experts
  - E.g through ARINC SCQ Working Group

Motion Group:

Three out of four Goals dealt with motion standards/specifications:

- Define objective motion specifications for the ICAO "representative" and "reduced representative" cueing motion systems
- Determine if objective motion standards need to vary with vehicle dynamics
- Determine suitable motion standards which are task/operationally dependent

Therefore, combined recommended goal:

Goal

- Determine objective motion standards and specifications for Full Flight Simulators (Levels A-D, or Types IV-VII) should address:
  - 'representative' and 'reduced representative';
  - vehicle dynamics: airplane and helicopter;
  - different Levels/Types will cover task/operational dependencies

First Steps

1. Recommend formation of IWG (academia, government regulators, industry, including chief pilot training personnel) to consider resurrecting Motion Performance Envelope Specifications (one DoF at a time, and multiple simultaneous DoF), and if OMCT should be more robust (e.g currently pitch angle only exercised ±6 degrees; should it be closer to maximum or some percent of maximum? Should frequency of OMCT only go out to 2.5 Hz, or should it go further, e.g. 10-15 Hz?)
2. Limit the above to Levels A-D and Types IV-VII, but consider if vehicle dynamics factors into Step 1 (i.e. does vehicle performance change the OMCT boundaries?)
3. More work on how to measure onset cueing in sim compared to aircraft accels/specific forces (to help pilot subjectivity)
4. Sensor measurements need to be considered (position offsets, frame time/latency, uncertainties in formulating kinematics)
5. Can a set of standardized motion critical maneuvers be chosen and compared?

- Definition of proposed benchmarking scenarios including set up, IC's etc.
  - Crosswind landing
  - OEI G/A
  - V1 cut
- Definition of *objective* parameters to be recorded.
- Selection of device(s) and pilot sample.
- Record first, benchmark, analyse.

- Participants:
  - Stage 1 (Test)
    - Research organisations (s)?
    - TDM
    - ATO / AOC
    - Pilot with a range of capabilities.
    - A/H, Military and civil.
  - Stage 2 (Measuring operational)

As stage 1 but expanded.

Benefits:

- Improved confidence in the simulator performance
- Training delivery focussed / Task focussed
- Impartial objective performance results
- Allows benchmarking of pilots within a training scenario
- Allows trend analysis of pilots
- Allows benchmarking of devices
- Scalable across a devices and devices
- No regulatory impact