The Quarterly Bulletin of the CEAS

COUNCIL OF EUROPEAN AEROSPACE SOCIETIES

3AF – AIAE – AIDAA – CzAeS – DGLR – FTF – HAES – NVvL – PSAA – RAAA – RAeS – SVFW – TsAGI – VKI

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October

15 JUNE 2013

14JUNE 2013

A SUMMER 2013 RICH IN HIGH LEVEL TECHNOLOGY ACHIEVEMENTS, AMONG WHICH :

- 14 JUNE: SUCCESSFUL FIRST A350XWB TEST FLIGHT
- 15 JUNE: SUCCESSFUL DOCKING OF ATV-4 TO THE ISS

WHAT IS THE CEAS ?

The Council of European Aerospace Societies (CEAS) is an International Non-Profit Association, with the aim to develop a framework within which the major Aerospace Societies in Europe can work together.
It presently comprises 15 Member Societies: 3AF (France), AIAE (Spain), AIDAA (Italy), CzAeS (Czech Republic), DGLR (Germany), FTF (Sweden), HAES (Greece), NVvL (Netherlands), PSAS (Poland), RAAA (Romania), RAeS (United Kingdom), SVFW (Switzerland), TsAGI (Russia), VKI ((Von Karman Institute, Belgium) and EUROAVIA.
Following its establishment as a legal entity conferred under Belgium Law, this association began its operations on January 1st, 2007.
Its basic mission is to add value at a European level to the wide range of services provided by the constituent Member Societies, allowing for greater dialogue between the latter and the European institutions, governments, aerospace and defence industries and academia.
The CEAS is governed by a Board of Trustees, with representatives of each of the Member Societies.
Its Head Office is located in Belgium:
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www.ceas.org

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- A well-found structure for Technical Committees

High-Level European Conferences
- Technical pan-European events dealing with specific disciplines and the broader technical aspects
- The CEAS European Air and Space Conferences: every two years, a Technical oriented Conference, and alternating every two years also, a Public Policy & Strategy oriented Conference

Publications:
- Position/Discussion papers on key issues
- CEAS Aeronautical Journal
- CEAS Space Journal
- CEAS Quarterly Bulletin
- Aerospace Events Calendar – www.aerospace-events.eu

Relationships at a European Level:
- European Commission
- European Parliament
- ASD (AeroSpace and Defence Industries Association of Europe), EASA (European Aviation Safety Agency), EDA (European Defence Agency), ESA (European Space Agency), EUROCONTROL
- Other European organisations

European Professional Recognition:
- Directory of European Professionals

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- Annual CEAS Gold Medal to recognize outstanding achievement
- Medals in technical areas to recognize achievement

Young Professional Aerospace Forum

Sponsoring

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- General Functions: President, Director General, Finance, External Relations & Publications, Awards and Membership.

- Two Technical Branches:
  – Aeronautics Branch
  – Space Branch

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EDITORIAL

EUROPEAN AEROSPACE: A SUMMER 2013 RICH IN HIGH LEVEL TECHNOLOGY ACHIEVEMENTS

Editor-in-Chief
Jean-Pierre Sanfourche

This summer 2013 has seen many important technology achievements in European aerospace, which in my opinion are not sufficiently brought to the knowledge of the general public by the media.

Two examples

I have chosen two examples in this bulletin to illustrate my statement: the maiden flight of the A350 XWB and the Automated Transfer Vehicle (ATV). They are highlighted in the front page and I have dedicated a short dossier to each of them.

14 June: the Airbus New-Generation A350XWB's first flight

On 14 June took place in Toulouse, France, the first test flight of the A350 XWB, the Airbus all-new aircraft integrating the latest available technologies. At 14:05 local time, the first development aircraft named 'MSN1' landed back at Toulouse-Blagnac Airport after having successfully completed its first flight that lasted four hours and five minutes. The complete flight test programme will total 2,500 flight hours with five development aircraft for certification and an entry into service in the second half of 2014. Already in mid of July, after the first 92 flight test hours it could be announced that the flight envelope was opened and that the key systems' tests had been successfully performed, which allows to expect the calendar objectives to be reached.

15 June: Amazing Automated Transfer Vehicle (ATV)

On 15 June at 14:07 hour UT, ATV-4 'Albert Einstein', Europe's supply and support ferry , docked the International Space Station at the end of a delicate and automated procedure with an accuracy never seen up to now: 11 millimeters!

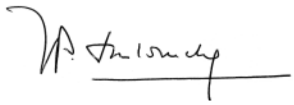
The favourable context of aerospace: an attractive perspective for our students

The promising perspectives as well in aviation and aeronautics as in space should strongly encourage our students to orientate their career towards this activity and it is the role of the seniors to undertake campaigns of information in the different schools and universities.

The CEAS 2013 Conference dealt with this subject

The CEAS European Air & Space Conference 2013 which was held in Linköping (Sweden) on 16-18 September was a great success, with more than 400 delegates and 200 presentations. A particular session precisely dedicated to Education allowed to deepen the question of how to proceed with a view to informing and encouraging the broadest range of students susceptible to choose a career in aerospace. The decision was taken to establish a programme and to undertake as soon as possible practical actions.

Jean-Pierre Sanfourche



CONTENTS

THE CEAS 2013 CONFERENCE WHICH WAS HELD IN LINKÖPING FROM 16 TO 19 SEPTEMBER WAS VERY SUCCESSFUL

By Roland Karlsson and Petter Krus

Roland Karlsson, President of FTF, was chairman of the Organising Committee for CEAS 2013 Conference.[1]

Petter Krus, President of the CEAS 2013 Programme Committee, is Professor in Fluid and Mechatronics Systems Department of Management & Engineering Linköping University.

The fourth CEAS European Air & Space Conference took place in the wonderful Concert & Congress Centre of Linköping (Sweden) from 16 to 19 September 2013, hosted by the Swedish Society of Aeronautics and Astronautics (Flygtekniska Föreningen, FTF). This conference also incorporated the regular FTF conference which is arranged every third year since 1992, on the same topics.
We were proud to welcome so many delegates and guests from all over Europe, the United States, Southern America, and from Asia.

Having chosen the theme 'Innovative Europe' for this event, our aim was to promote the strong creative and innovative forces that are available in the aeronautics and space industries and academia in Europe. The programme focused on recent achievements and trends in research, development and production, and it was structured around nine parallel sessions in order to allow researchers and industry representatives to lengthily exchange results and experiences.

As regards military affairs, the programme included an Air Power Session aimed at discussing the way to develop the future European combat aircraft which will come after the Gripen, Rafale and Eurofighter aircraft era.
Education was also a major centre of interest in the programme, with two main axes of work: how to better harmonize education and training in Europe, on the one hand, and how to attract our best students towards aeronautics and space, on the other hand?
The success of CEAS 2013 has in fact exceeded the expectations of the organisers with more than 200 presentations and some 400 delegates were gathered in Linköping. It has to be noted that the Programme Committee had received a large number of abstracts and that the careful selection process only retained those of very high quality. The best papers will be recommended for the CEAS Aeronautical Journals.

Today, one of Europe's greatest challenges is that of independence. One challenge is about to keep and maintain capabilities within the complete set of technologies necessary as a foundation for creative and sustainable aeronautics and space industries. Moreover it is fundamental for Europe to be an attractive partner in projects conducted on the international level. The success of CEAS 2013 allows us to think that we have usefully served this case.

Acknowledgements: we wish to express our gratitude:

- *to the personalities who have participated in our conference: Brigadier General Johan Svensson from the Swedish Armed Forces, Engineer-in-Chief (Col.) Philippe Koffi from the French Armament Procurement Agency, Rudoph Stroehmeier and Giuseppe Pagnano from the European Commission, Deputy Mayor of Linköping Andreas Ardenfors, Linköping University Vice Chancelor Helen Dannetun, Saab Vice President Dan Jangblad;*
- *to the Gripen's pilot Captain Peter Fällén for his quite remarkable and exciting in-flight demonstration on Tuesday evening 17 September;*
- *to the management of the Swedish Air Force Museum: Mikael Parr.*

1. Roland Karlsson is Flight Captain, ret. SAS, with 37 years experience as airline pilot on airliners from Douglas DC3 to Airbus 321. Radioastronomer and astrophysicist, he holds a Ph. Licentiate from Stockholm University with current research work on kinematics and molecular physics of molecular clouds at the Galactic Center. He is aircraft accident investigator at the Swedish Accident Investigation Authority, former chief pilot, flight safety inspector and quality assurance auditor in Estonia and SAS, respectively.

LINKÖPING, 16-19 SEPTEMBER 2013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1. Monday morning 16 September: arrival of the participants in the Konsert & Kongress , one of Sweden's largest conference facilities.
2. Brigadier General Johan Svensson, Swedish Armed Forces, during the keynote speech he delivered at the beginning of the Air Power Session.
3. Engineer-in-Chief (Col.) Philippe Koffi, French Armament Procurement Agency, presenting the French vision about the Future European Air Combat Systems.
4. Nine parallel sessions of 400 researchers and industry representatives took place in different side rooms: here one of them, "challenges in national and international R&T collaborative projects".
5. On Tuesday 17 September evening, the Conference Dinner took place in the famous Swedish Air Force Museum, Malmen Airbase. The aircraft in the centre of the picture is the Saab J 39 Gripen.
6. An entertainment was given at the beginning of the dinner with a marvellous group of three singers – dancers.
7. Various exhibition stands were present during the whole conference: here the Saab Cybaero helicopter.
8. General Saab Exhibition stand.

THE 38TH EUROPEAN ROTORCRAFT FORUM BEST PAPER AWARDS

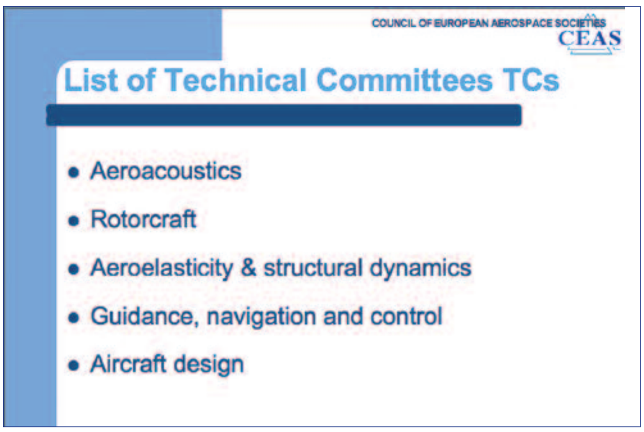
Since the 38th edition of the European Rotorcraft Forum ERF (4-7 September 2012, organized by CEAS/NVvL) in Amsterdam an additional Best Paper Award is being presented to young researchers.

For many years the Ian Cheeseman Award for the ERF Best Paper is being presented to the authors who prepared and presented the most significant technical paper at the Forum. During the 38th ERF, the paper entitled 'Handling qualities studies into the interaction between active sidestick parameters and helicopter response types', presented by Thorben Schönenberg (DLR) has been selected as best paper. As part of the award price, Thorben has presented the paper at the 69th Forum of the American Helicopter Society AHS in Phoenix, AZ. During this event the award plaque was handed over by Joost Hakkaart as representative of the 38th ERF organising committee, together with Michael Smith, AHS Forum technical Chair.

In addition to the Cheeseman Award, now also the so-called Gareth Padfield Award has been established to recognize the best young author(s), up to 30 years. The very first edition of the Padfield award has been won by the paper 'Helicopter miniaturized and low cost obstacle warning system', presented at the Forum by Tim Waanders, Eurocopter Deutschland. The Padfield Award plaque was handed over to Tim by Michael Stephan (Eurocopter Deutschland) and Klausdieter Pahlke (DLR) on 2nd July 2013 in Donauwörth. Michael and Klausdieter are the national German representative in the ERF International committee.

AN OVERVIEW OF THE CEAS AERONAUTICS BRANCH IN 2013

On 18 september at the Board of Trustees Meeting which took place in Linköping, Christophe Hermans presented an overview of the Aeronautics Branch, whose he is chairman. The here after slides summarize his presentation.

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Rotorcraft TC
ERF Cheeseman & Padfield awards hand-over
Poland has joined International Committee as 7th nation
European Rotorcraft Forum 2013 in Moscow, Ru (Russian Helicopters, JSC), Sep. 3-6
119 Presentations, 230 attendees, visit a.o. to Mil Moscow Helicopter Plant
MoU with AHS signed
ERF 2014 in Southampton UK, Sep. 2-5


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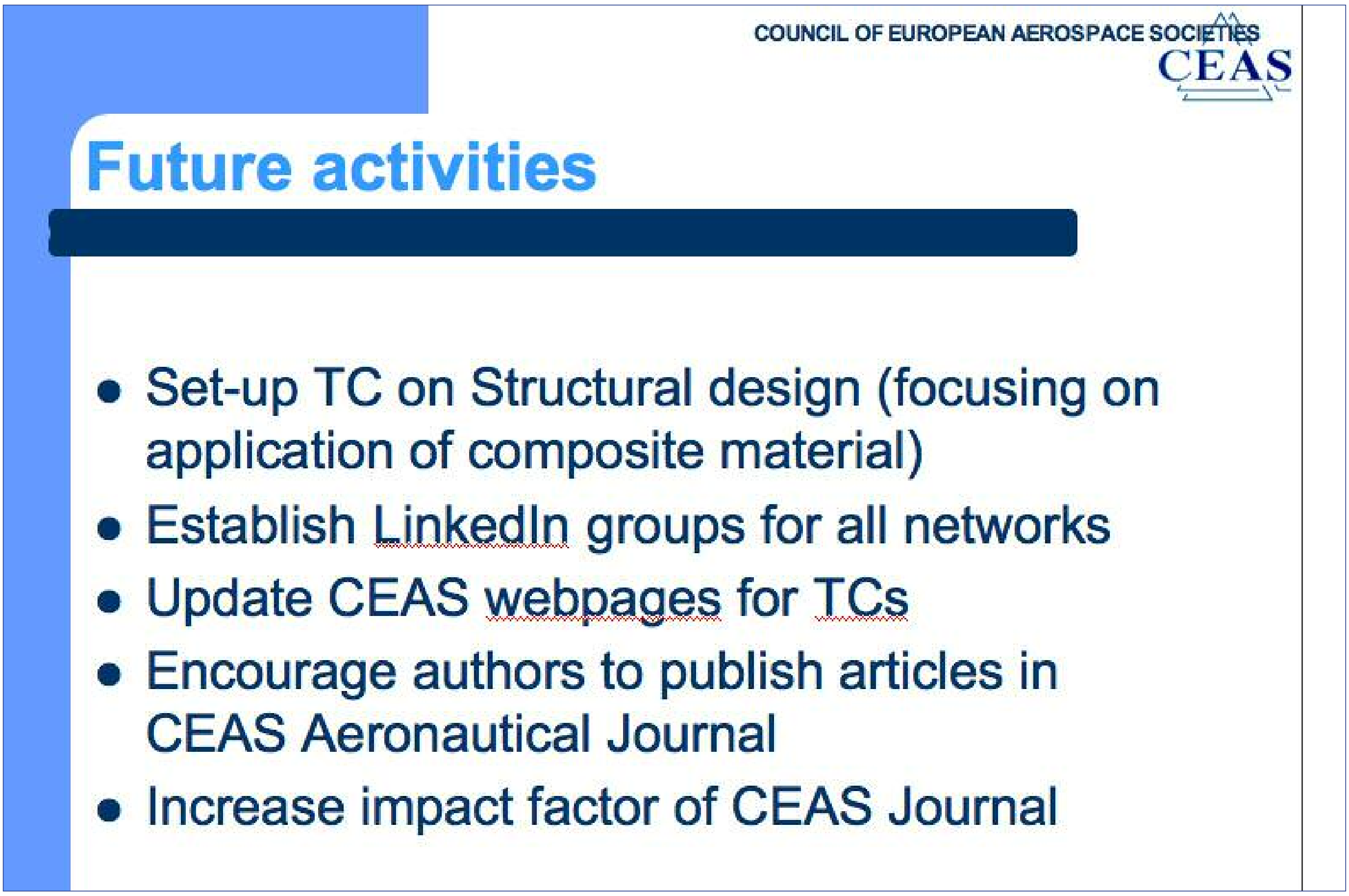
IFASD 2013
Aeroelasticity & Structural dynamics TC
International Forum of Aeroelasticity & Structural Dynamics 2013, Bristol, 24-26 June
155 Presentations, 3 keynotes, best paper award
252 Attendees
Visit a.o. to Airbus & National Composite Centre
RAeS Aeronautical Journal (special edition), selection of papers
IFASD 2015: St Petersburg (R), IFASD 2017: Como (I)


COUNCIL OF EUROPEAN AEROSPACE SOCIETIES
CEAS
Guidance, Navigation and Control TC
Combined aeronautics & space
2nd Guidance, Navigation and Control Conference (EuroGNC 2013), Delft 10-12 April 2013
94 papers & 6 keynote lectures
1 Springer edited book, 137 Attendees
EuroGNC 2015: Toulouse (F)
EuroGNC 2017: Warsaw (P) tbc
EuroGNC 2013


COUNCIL OF EUROPEAN AEROSPACE SOC
Aircraft design TC
11th European Workshop on Aircraft Design Education (EWADE 2013), Linköping (Sw) integrated in CEAS 2013 conference
3rd Symposium on Collaboration in Aircraft Design on 19 & 20 Sept 2013 (Linköping University) & first TC meeting
Appr. 35 presentations, 70 attendees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Future activities
Set-up TC on Structural design (focusing on application of composite material)
Establish LinkedIn groups for all networks
Update CEAS webpages for TCs
Encourage authors to publish articles in CEAS Aeronautical Journal
Increase impact factor of CEAS Journal

INTERVIEW WITH PATRICK GOUDOU

Jean-Pierre Sanfourche, Editor-in-Chief of the CEAS Quarterly Bulletin, has interviewed Patrick Goudou, Executive Director of the EASA (European Aviation Safety Agency) since its creation in September 2003 until 31 August 2013

Patrick Goudou

Jean-Pierre Sanfourche. – You have created and developed within the past eleven years the EASA, which is now recognized as the key pillar of the air safety in the EU: could you recall us the major milestones which marked the road of this remarkable achievement?

Patrick Goudou. – The EASA was created by Regulation (EC) 1592/2002 of the European Parliament and of the Council of 15 July 2002. I personally joined the Agency on September 1st 2003. I was its first employee. I left it on August 31st 2013 after two five year terms as Executive Director.

The first main milestone was September 28th 2003, when, by law, the Agency was entrusted with the responsibility of certifying all aircraft, engines and parts and appliances used by European Operators. At that date I was still the only employee of the Agency. With the help of the Member States National Aviation Authorities the transition between the Joint Aviation Authorities system and the EASA system went very smoothly. All certification processes were continued and completed in time. The Agency recruited progressively all the experts needed to discharge itself its responsibility. The more prominent examples are the successful certification of the Airbus 380 in December 2006, of the Dassault Falcon 7X in April 2007 and of the Boeing 787 in August 2011.

The second main milestone is obviously the move of the offices from Brussels to the official seat of the Agency in Cologne on November 1st 2004 followed by an Opening Ceremony in December 2004.

The third main milestone relates to the extension of the Agency responsibilities in two steps: a) The Regulation (EC) 216/2008 of the European Parliament and of the Council of 20 February 2008 gave power to the Agency in matter of air operations, including foreign operators operating in the EU and flight crew licensing; b) The Regulation (EC) 1108/2009 of the European Parliament and of the Council of 21 October 2009 extended its responsibilities to aerodromes, air traffic management and air navigation services. Obviously a number of very important regulations were drafted by the Agency during these 10 years, starting with all the Implementing Rules for the execution of the EU Regulations, but also specific rules like OSD (Operational Suitability Data).

J.-P. S. – What are the main obstacles you have encountered?

P. G. - These ten years were not always a "lit de roses". As a new player in an old system the Agency has been confronted to the reluctance of airworthiness authorities to give up their tasks. By the way there are still attempts from some of them to get back more certification activity than the Agency wants to outsource. A partnership between the Agency and National Authorities can only be build based on mutual confidence, respect of the other and clarity of roles. By the way the same difficulty has been encountered with the European Commission some of their staff not recognizing the Agency competence and independent role. An important obstacle was also the absence of a governance which would have involved sufficiently high level people knowledgeable in aviation. No real strategic discussions took place at any moment which could have led to agreement and commitment of all stakeholders to support the Agency development in a given direction.

On top of that the bureaucratic burden imposed on all Agencies by the European institutions has dramatically increased during these ten years and the last proposals made by the Commission are still going in the wrong direction…

And of course the resources allocated to the Agency have always been very scarce. How many activities have been purely and simply not funded or dramatically underfunded? How difficult was it to get the acknowledgement that the first Fees adopted in 2005 were grossly under evaluated? How many specific actions were requested by the Commission according to the "support to the Commission" role of the Agency without resources? Why would the Agency have to decrease next year its staff paid by the industry to comply with a bureaucratic horizontal rule when it has an increased certification activity?

J.-P. S. – Are you considering that the financial resources allocated to this institution are satisfactory, presently and for the next future?

P. G. - The financial resources allocated to EASA have always been very scarce. The advantage of this situation is that it has imposed a strict management and clear prioritization. But there was always a gap between ambition and aspiration explained by the political masters and the money available. With the global economic crisis in which many European countries are it is clear that the European subsidy which pays for rulemaking, standardization and safety strategy at large will not increase in the future. New funding mechanisms should be searched to compensate it. On the industry side I am confident that their cost benefit analysis is demonstrating it is worth paying fees…

J.-P. S. – Could you say some words about the EASA's relationships with ICAO, FAA, National Authorities in Europe, EC, ESA, other organisations, and the European aerospace industry?

P. G. - I must say that the relationship with ICAO, the FAA, TCCA (Canada), ANAC (Brazil) and IAC (Interstate Aviation Committee) have always been very friendly and constructive. The expertise of EASA is very well recognized and not disputed. We have all of us in common the objective to protect flying people and improve safety when necessary. Some divergent views could arise but they are discussed at technical level and then solutions are easily agreed by the respective managements. The relationship with industry at large, associations, companies in all domains have been very good when based on a real and open dialogue between knowledgeable professionals. Common sense, good will without compromise to safety and mutual respect of the interlocutors is the recipe. This recipe worked also with the two last partners I had to work with, EUROCONTROL and the European Defence Agency (EDA).

J.-P. S. – What are in your opinion the priority subjects on which efforts must be focused in order to continue improving safety in commercial aviation on the one hand and general aviation on the other hand?

P.G. – For both commercial and general aviation the key element to improve safety is professional training: pilot training, ATCO (Air Traffic Controllers)' training, mechanist training… The deployment of new technologies is essential because they generally have a positive impact on safety but the different actors have to be trained accordingly.

A second key element is simplifying the regulatory framework. The difficulty of rulemaking in the past ten years has been to put in place one single regulatory framework for 32 states with very different cultures and starting points. The result is very complex but it was not avoidable. Now rulemaking shall focus on simplifying rules in order that each and every actor knows perfectly well those rules which affect its activity.

J.-P. S. – Do you see the development of the UAVs as a new big difficulty as regards ATM/ATC?

P.G. – Firstly the vast majority of today UAVs are small things flying low and slow and not interfering with "aviation". The introduction of big and fast UAVs in the airspace constitutes today a major risk. Some disturbing incidents have been reported now and then. But for sure UAVs will develop in the coming years therefor they have to be taken into account. I believe that solutions to mitigate safety risks like loss of control link will come from the technology. The objective will certainly be that UAVs behave like airplanes to ensure their safety and safety of their environment.

J.-P. S. – Closer and closer links are being set up between military and civil aviation in Europe: what your wishes and expectations in this matter?

P.G. – The military have the wish to adopt and adapt civilian regulations and processes to ensure safety. They have already "copied" a number of parts. I have invited them to rulemaking advisory groups for them to be aware of any change in civilian rules. Military is explicitly outside EASA scope of work. It is not to EASA to certify military aircraft. But it should be possible to find a way to cooperate between EASA and EDA in order to leave the leadership and the responsibility of certification to EDA, EASA providing against payment its expertise in non-military domains. The expertise is scarce and expensive. The objective is to avoid its duplication. It is the sense of the cooperation agreement I have signed with EDA in Le Bourget in June.

J.-P. S. – How could you synthesize your present vision and hopes regarding the SESAR project?

P.G. – SESAR is "the" prominent technological programme to allow aviation development in the future. Its development is a huge challenge. The main points are: a good cooperation with the US NextGen (only one box onboard by function); rigorous business cases demonstrating economic benefits; convincing technical and safety testing of concepts or equipment; critical mass of implementation (synchronization); careful management of EU public money (avoidance of windfall effect; careful attention to public interest to choose projects …

It will be difficult but very promising: industry have already shown exciting things at the last International Paris Air Show in June… dreams for pilots and ATCOs of the future!!!

J.-P. S. – The 4-year Rulemaking Programme was recently issued: could you express your major wishes regarding its implementation?

P.G. – Great efforts have been made to improve the 4-year rulemaking programme. For instance priorities and timescales are better defined. Even if the volume has been reduced over the years, it is still very ambitious. If I had a wish, it would be that EASA rulemaking officers and all stakeholders contribute to the simplification of the rules via the implementation of the rulemaking programme, instead of adding rules on the top of rules, for example by deleting obsolete or useless provisions.

J.-P. S. – What are the main advices and recommendations you have given to Patrick Ky your successor?

P.G. – My successor Patrick Ky is experienced and skilled enough. There was no need to give him advices! I am sure he is well aware of the success factors for EASA: the first ones are credibility and recognition by the global aviation community, which are built on internal expertise and independence. Decisions shall be based on EASA staff professional technical judgment without interference of politicians or industry. The second one is humility: EASA exists only to serve flying citizens and to facilitate aviation industry safe development.

THE AIRBUS A350 XWB: A MODERN EFFICIENT AIRCRAFT FAMILY

By Jean-Pierre Sanfourche in cooperation with Airbus Communication Directorate

On 14 June 2013, the first Airbus A350 XWB successfully completed its first flight test. This maiden flight marked the beginning of a rigorous test flight campaign involving five test aircraft around 2,500 flight hours. This campaign is presently running quite well and it will culminate in the aircraft's certification followed by its entry into service in the second half of 2014 with first operator Qatar Airways. Considering the importance of the event, the CEAS decided to publish in this issue of its Quarterly Bulletin a short dossier on this promising Airbus New Generation Airliner.

Figure 1. A true family covering the market with a single aircraft: with one aircraft in three different sizes, airlines can best match their A350XWB fleets to route capacity demands, guaranteeing optimum revenue potential. Pilots can fly all three versions with the same certification, further maximising airlines profitability. Credit Airbus

A350 XWB: ONE MARKET-MATCHING FAMILY

The A350 XWB (XWB = eXtra Wide Body) Family consists of three passenger versions (figure 1):

- A350-800 > 270 seats – 15,750 km range
- A350-900 > 314 seats – 15,000 km range
- A350 -1000 > 350 seats – 15,600 km range

A350 XWB Basic Technical Data

Airbus Aircraft Family janv.-12 **Metric units**

Metric Units - see reverse for Imperial Units	A350 XWB		
	A350-800	**A350-900**	**A350-1000**
CAPACITY			
Typical Seating Configuration / Cargo load (tonnes)	270	314	350
First + Business + Economy	16+44+210	18+50+246	24+62+264
Certified Maximum Seating Capacity	440**	440**	495**
Number of LD3 cargo containers	28	36	44
RANGE			
With typical passenger load (km) (cargo load for A300-600F, A330-200F)	15 750	15 000	15 600
POWERPLANTS			
Number of engines	2	2	2
Choice of engines	Trent XWB	Trent XWB	Trent XWB
Engine nameplate thrust (kN)	334	374	432
AIRCRAFT SPECIFICATIONS			
Fuselage diameter (m)	5.96 (horiz)	5.96 (horiz)	5.96 (horiz)
Overall length (m)	60,54	66,89	73,88
Wingspan (m)	64,75	64,75	64,75
Overall height (m)	17,05	17,05	17,08
Wing area (sq m)	443	443	443
Wing sweep (degrees)	31,9	31,9	31,9
Typical cruise speed (Mach)	0,85	0,85	0,85
Maximum operating speed (Mach)	0,89	0,89	0,89
Maximum cruise altitude (m)	13100	13100	12600
WEIGHTS AND FUEL (Standard and highest option)			
Maximum take off weight (tonnes)	259	268	308
Maximum landing weight (tonnes)	190 193	205	233
Maximum Zero Fuel Weight (tonnes)	178 181	192	220
Maximum fuel capacity (litres)	138 000	138 000	156 000
DATES			
Launch date	déc.-06	déc.-06	déc.-06
First Flight	2015	2013	2016
First airline delivery	2016	2014	2017

Notes: (1) Some figures rounded. (2) Weights and ranges are for aircraft currently offered. (3) Performance varies slightly among engine t
**Subject to certification
A320neo, A350 XWB range - subject to flight test confirmation

A COMFORTABLE AND EFFICIENT CABIN

The A350 XWB offers a very quiet and comfortable cabin. At 220 inches (5.58 m) from armrest to armrest, the cabin provides a wide 18 inch (46 cm) seat in-line with the best comfort standards: 5 inches (12,7cm) wider than the Boeing 787.

Passengers will appreciate more headroom, wider panoramic windows and larger overhead storage space. Crews will be able to relax when off-duty in very comfortable crew rest compartments located in the crew area (figure 2).

Figure 2. Passenger will enjoy more headroom, wider panoramic windows and larger overhead storage space. Credit Airbus

A TECHNOLOGICALLY ADVANCED COMMERCIAL AIRCRAFT FAMILY

ECO-EFFICIENT BY DESIGN

A lighter aircraft burns less fuel and therefore emits less CO_2.

- Over 70% of the A350 XWB's airframe is made from advanced and lighter materials combining composites (53%), titanium (fully recyclable) and advanced aluminium alloys.

- The weight-efficient aircraft's Carbon Fibre Reinforced Plastic (CFRP) fuselage results in lower fuel burn as well as easier maintenance.
- With 5 additional years of technology development the A350 XWB benefits from simpler and often lighter systems compared to the Boeing 787. For example 2 hydraulic circuits, instead of 3, or a much simpler electrical architecture that requires therefore less power.
- The Trent XWB engine of Rolls-Royce is a step ahead of any other engine in this category guaranteeing low fuel burn, reduced emissions and high performance characteristics.
- The A350 XWB aerodynamics was designed using advanced computational fluid dynamics methods proven on the A380. The use of variable camber and differential flap setting optimises the shape of the wing throughout the entire flight, providing complete load control and eliminating the need for heavy structural reinforcements.

ECO-EFFICIENCY: FUEL CONSUMPTION

The A350 XWB saves up to 25% fuel burn compared with the Boeing 777 and around 8 to 9% compared with the Boeing 787.
With the A350 XWB, 10.5 million litres of fuel will be saved per year, which corresponds to 27,300 tonnes of CO_2 produced per year (the CO_2 absorption of almost 2 million trees per year).

It is to be noticed that as part of Airbus' alternative strategy, certified alternative fuels is compatible with the A350 XWB, with no change at all to the engines or the aircraft architecture.
Compared to current regulation of the Committee on Aviation Environmental Protection (CAEP6) the A350 XWB achieve comfortable margins: 99% below Hydrocarbon (HC) limit, 86% below Carbon monoxide (CO) limit, 60% below smoke limit, 35% below Nitrogen Oxide (NOx) limit.

ECO-EFFICIENCY: EXTERIOR NOISE

Exterior noise levels will be as much as 16 EPNdB (Effective Perceived Noise Decibel) below ICAO Chapter-4 requirements.

Use of hazardous substance dramatically reduced

Environmentally friendly, biodegradable or recyclable materials are privileged:

- Chromates are removed as much as possible from the industrial processes and products;
- Outside the aircraft, chromate free primer paint is used;
- In the aircraft, water-based paint is used wherever possible.

END OF LIFE

More than 20 years before recycling an A350 XWB, the process to recycle composite materials is being developed, using recycling feasibility studies led on composite parts of the A380.

A NEW FINAL ASSEMBLY LINE (FAL) FOR A COMPLETELY NEW AIRCRAFT

The A350 XWB Final Assembly Line (FAL), named "Roger Béteille", has been set up close to the A330 Final Assembly Line in order to optimise the industrial processes associated with a new FAL by making the most of Airbus' existing long-range installations (figure 3). It covers 7.4 hectares. The part dedicated to the aircraft halls represents 53,000 m^2 and in addition are 21,000 m^2 of ancillary buildings housing the supply chain services, stores, workshops and offices as well as 20,000 m^2 of taxiways and runways.

Figure 3. The future Final Assembly Line of the A350XWB. Credit Airbus

The building is 300 m large, 125 m long and 35 m tall.
The FAL "Roger Béteille" is the greenest Assembly Line ever built by Airbus:

- Natural lighting is used as extensively as possible in the aircraft halls to improve working comfort;
- The use of artificial lighting is used to a minimum, reducing electric consumption;
- The windows, polycarbonate panels and vaults have a surface area of more than 6,300 m^2.
- An energy management system has been implemented in order to optimise the use of liquids and power according to the needs and working hours.
- Half of the flat part of the roof (44,000 m2 / 2= 22,000 m^2) is fitted with photovoltaic solar panels: it is estimated that this building can produce 55% of its own energy, therefore avoiding production of 150 tonnes of CO_2.

A NEW ASSEMBLY PROCESS FOR A NEW AIRCRAFT

The final assembly process has been thought out of with efficiency in mind in order to reduce the assembly time and to allow a more effective pre-delivery check-out compared to current programmes. It will enable a more effective test programme.

- Stable production target: 10 aircraft per month.
- Major structural sub-assemblies:
  - Front & Centre fuselage (Saint-Nazaire);
  - Aft fuselage, Forward fuselage and Vertical Tail plane (Hamburg) ;
  - Wing build in Broughton (equipped in Bremen);
  - Horizontal Tail plane (from Getafe/Illescas);
  - Pylon and Nacelle (from Toulouse).

- Sequence: a streamlined assembly process
  - Station 59: Section preparation. The large cabin monuments such as galleys, crew rest compartments, and toilets are first of all installed inside each of the 3 fuselage sections, before aircraft final assembly begins. Sections arrive equipped and tested.
  - Station 50: final assembly starts with the joining together of the forward, centre and aft fuselage sections inside which the fitting out tasks can be carried out while the sections are being assembled. The nose landing gear is also installed at Station 50.
  - Station 40: during wing-fuselage-junction and the installation of the tail plane (horizontal and vertical fins), tail cone as well as main landing gear and engine pylons, the first phase of cabin fitting out is also conducted? The aircraft has its first power-on, enabling the functional tests to begin before the end of wing-fuselage mating.
- Station 30: assembly continues with ground testing of mechanical, electrical and avionics systems, and furnishing the cabin (seats and pieces of equipment) (figure 4).
- Station 18: the aircraft is then moved to the A330 FAL where the external tests are performed (cabin pressurization, communication systems, calibration and testing of the fuel gauges, cargo and passenger doors).
- Paint. The next step consists of painting the aircraft. The paint used complies with environmental regulations: low polyurethane paints and low Volatile Organic Compound (VOC) solvents; electrostatic pulverization.
- Station 20: the last step consists in this station of cabin furnishing completion (in-flight entertainment, curtains, safety equipment, special seats …) as well as cockpit fitting out and engine + auxiliary power units (APU)installation.
- First flight: the aircraft then makes its first flight, before being delivered to the customer airline at the "Henri Ziegler" Delivery Centre in Toulouse.
- Total duration the complete process, from the beginning of final assembly through to delivery to the customer = 2 and a half month when A350 XWB production reaches full capacity. This duration represents a 30% time-saving compared with the other programmes.

A350 XWB TEST PROGRAMME

- A350-900 Flight Test programme will last around 12 months (2,500 flight test hours).
- A350 XWB static airframe (ES) was the first assembled (completed October 2012); it will not fly, and used for static structural tests in a dedicated facility.
- A350 XWB will have five flight test aircraft:
  - **MSN1**
  - No cabin, heavy flight test installation for 1st flight.
  - Initial handling qualities, natural icing campaign.
  - Systems and power plant testing.

THE BEGINNING OF FLIGHT TESTS

14 June 2013: first flight in Toulouse. It lasted 245 minutes (10:00 take-off – landing 14:05 Toulouse time) (figure 5).
15 July 2013: Flight envelope opened and key systems tests successfully performed (figure 6).
On 15 July, the A350 XWB MSN1 had already achieved 92 flight test hours since first flight. These early phase of test flights performed by ten Airbus experimental test pilots resulted in the clearance of the entire flight envelope and initial testing of all key systems. These include: engines, electrics, Ram Air Turbine, landing gear and braking, fuel and cabin pressurization as well as a preliminary assessment of the auto-pilot and auto-land functions.

– MSN2
- Assembly started early 2013
- No cabin, heavy flight test installation
- Performance measurement
- Hot and cold weather campaigns
- Systems and power plant testing

– MSN3
- 1st cabin for testing all cabin related systems
- Partial evacuation test on the ground
- Early long flights
- In-flight entertainment (IFE)
- Cabin hot and cold tests
- Medium flight test installation

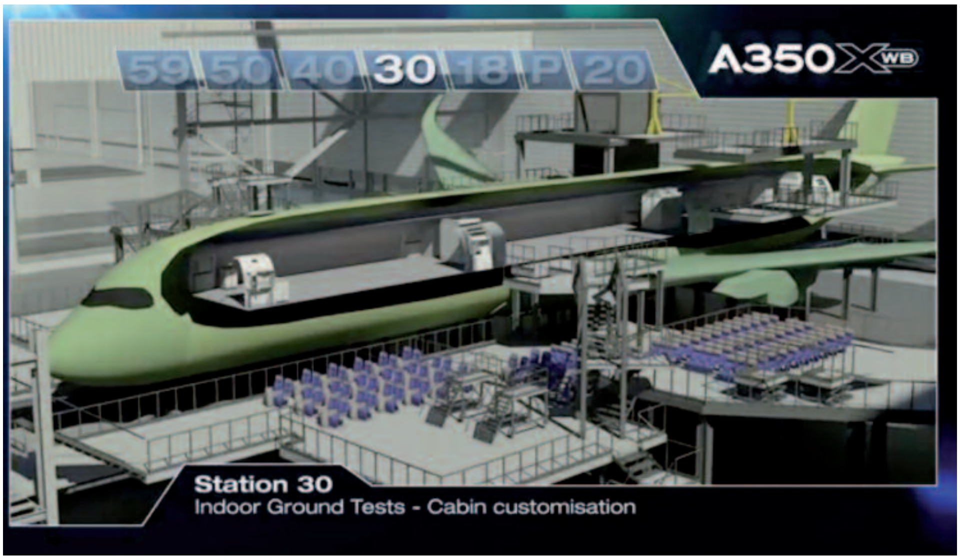

Figure 4. Station 30: indoor ground tests and cabin customisation. Credit Airbus


Figure 5. A350xwb first flight : take off 14 June 2013 -10:00 (Toulouse)


Figure 6. A350xwb first flight : landing 14 June 2013 -14:05 (Toulouse)

– **MSN4**
– Light flight test installation
– External noise tests
– Lightning test
– Avionics development and certification
– Pilot training for first customer & maintenance teams
– **MSN5:**
– Full cabin installation
– Cabin operability, training
– Route proving
– ETOPs certification
– Light flight test installation

OPTIMISED AIR TRAFFIC MANAGEMENT AND OPERATIONS

Several flight management functions are included as standard on the A350XWB reducing journey time, fuel burn, emissions and noise:

– Automatic Noise Abatement Departure (NADP) optimises the thrust and flight path to reduce the noise over crowded areas;
– Required Navigation Procedure (RNP) optimises and shortens tracks;
– Continuous Descent Approach (CDA) allows the aircraft to descend continuously to the destination airport with no intermediate steps and to stay longer at higher altitude, reducing fuel burn and CO_2 emissions.

A350XWB FAMILY SCHEDULE

- A350-900: Enter into Service in the second half of 2014
- A350-800: Enter into Service in mid 2016
- A350-1000: Enter into Service in mid 2017

COMMERCIAL SITUATION

TO DATE (EARLY OCTOBER 2013), A350XWB HAD RECEIVED:

764 Firm Orders from about 40 customers:
– A350-800: 89
– A350-900: 499
– A350-1000: 176

IN THE FUTURE

Airbus forecasts a demand over the 20 years for some 7,000 new twin-aisle passenger aircraft.

Catalogue price in US$ million (January 2013)
- A350-800: 255,3
- A350-900: 287,7
- A350-1000: 332,1

Employment
12,000 people are currently employed on the A350XWB programme worldwide and this is expected to increase to 16,000 people at maximum production.

CLEAN SKY 2 TAKES OFF

On 10 July 2013, the European Commission has issued its innovation investment package that paves the way to the continuation of the Clean Sky Joint Technology Initiative (JTI) within the EU Horizon 2020 Framework Programme. Clean Sky 2 involves € 4 billion of research: € 1.8 bn invested by the EU in the Clean Sky 2 Programme under Horizon 2020, building on the ? 0.8 bn to date under FP7, and helping to minimise the sector's environmental impact, and to increase its global competitiveness. Industry is committed to exceeding their matching share by bringing at least € 2.2 bn.

- Clean Sky 2 will introduce further integrated demonstrations and simulations of several aircraft systems at the aircraft platform level.
- Innovations from Clean Sky 2 will underpin advances in the next generation of aircraft by mastering the technologies and the risks in time to meet the next market window to replace the current fleet.
- Clean Sky 2 will be a core European Programme which will be leveraged by further activities funded at national, regional and private levels.
- Clean Sky 2 will allow to fully reach the environmental targets set by ACARE (Advisory Council for Aeronautics Research in Europe) for 2020.
- Beyond that, Clean Sky 2 most advanced technologies will also start the journey to 2050 horizon which constitutes a further step of the ACARE vision.

They declared:

Massimo Lucchesini, Chairman of the Clean Sky JU:
"*The innovation investment package presented by the European Commission today re-confirms the European aeronautical sector's total commitment to innovation and to tackling the challenges facing aviation in terms of environment, mobility and competitiveness.*"

Jean-Paul Herteman, CEO of Safran and President of ASD (AeroSpace and Defence Industries association in Europe):
"*My message to President Barroso today was first to acknowledge the Commission's ongoing commitment to Europe's research and innovation policy. Indeed, faced with today's major economic and budgetary crisis, and the emergence of new players in our sectors, innovation is the only way forward. If we want to keep pace in this fast-moving world, we have to achieve real technological breakthroughs, which is the key to our competitiveness.*"

Eric Dautriat, Executive Director of the Clean Sky JU:
"*Based on the successful Clean Sky experience to date, Clean Sky 2 is well positioned to become a force in shaping innovation for aviation in the decades to come. The entire aeronautics supply chain will benefit; SMEs, research Organisations, universities and industry.*"

J.-P. S. From Clean Sky JU 10 July 2013 Press Release

ABOUT SESAR

• ENVIRONMENTALLY OPTIMISED TRANSATLANTIC FLIGHT TRIALS

A trial of environmentally optimised transatlantic flights was conducted this summer, as part of the TOPFLIGHT project being led by UK based air traffic provider, NATS. The trials were the first of two large scale flight trial campaigns, which is part of the SESAR Demonstration Programme begun in June 2012. Early analysis of the results indicates significant fuel savings and subsequent environmental benefits.

• EU AND US CONVERGE POSITION ON DATA-LINK SERVICES

The federal Aviation Administration (FAA) and the SESAR Joint Undertaking (SJU) have reached an agreement on Data-Link Standardisation, allowing both organisations to take a common position on the upcoming group standard by the EUROCAE (European organisation for Civil Aviation Equipment) and the RTCA (Radio Technical Commission for Aeronautics. With this latest agreement, FAA and SESAR JU are now exploring further ways to ensure a united front on the standardisation of several ATM aspects.

From SESAR JU e-News, September 2013

AIRBUS MILITARY A400M

THE AIRBUS MILITARY A400M ACHIEVES FIRST MILITARY STANDARD ACCEPTANCE THROUGH INITIAL OPERATING CLEARANCE (IOC)

On 31 July 2013, the A400M has received its Type Acceptance at the contractual Initial Operating Clearance (IOC) Standard from OCCAR, the Organisation for Joint Armament Cooperation in Europe, on behalf of the seven A400M launch nations (Belgium, France, Germany, Luxembourg, Spain, Turkey and the United Kingdom).

This first military acceptance was the last step prior to the aircraft acceptance of MSN7, the first serial aircraft, by the French Armament Procurement Agency DGA (Direction Générale de l'Armement) and its subsequent delivery to the French Air Force (see below).

The common basis for military certification had been approved on 19 July following a recommendation by representatives of the seven launch nations known as the 'Certification and Qualification Committee (CQC). Then Airbus Military accordingly received on 24 July the Military Type Certificate for A400M from French DGA.

From information provided by OCCAR

AIRBUS MILITARY DELIVERS FIRST A400M TO FRENCH AIR FORCE

On 1 August 2013, Airbus Military has formally delivered the first A400M new generation airlifter, which is known in French service as the 'A400M Atlas', to the French Air Force.

The first delivery of the A400M to the French Air Force on 1 August 2013 represents the culmination of 10 years of development by airbus Military and more than 5,000 flight-test hours, involving close to 40,000 people working for this major European defence programme.
Credit Airbus Military

This milestone marked the beginning of the transformation of military air transport in Europe and beyond. This delivery, just authorized by the French Armament Procurement Agency, enabled the aircraft, MSN7, to join the French air base of Orléans-Bricy where it will be based with the French Air Force.

This first aircraft delivered to France will initially be used for the continuing training of aircrew before becoming part of the French Air Force operational transport fleet.

FIRST AIRBUS MILITARY A400M FOR TURKISH AIR FORCE MAKES MAIDEN FLIGHT

First Airbus Military A400M for Turkish Air Force made its maiden flight on 9 August 2013.

On 9 August 2013, the first production Airbus military A400M new generation airlifter for the Turkish Air Force (TAF) has made its maiden flight, marking a key milestone towards its delivery.

The aircraft, known as MSN9, took off from Seville (Spain) on 9 August at 11:56 UT (13:56 local time) and landed back in Seville 5 hours and 30 minutes later. The A400M programme for the TAF is making good progress at the Airbus Military International Training Centre at Seville, where TAF pilots, loadmasters and maintenance technicians have already begun their training.

THE EUROPEAN AIR TRANSPORT COMMAND

The European Air Transport command (EATC) is a command centre that directs the use of most military fixed wing air transport assets owned by Belgium, France Germany, Luxembourg, Netherlands (Benelux, France and Germany). Located at Eindhoven Airbase (Netherlands), it aims to provide a more efficient use of the air transport capacities by means of pooling the various assets, and thereby making them available to the participating nations.
It is in the European Defence Agency's 'category A' for defence programmes between member states.

HISTORY

A Franco-German initiative

In 1999 France and Germany started a politico-military initiative to prepare the establishment of a European Air Transport Command. In the same year at the meeting of the European Council held in Helsinki, the will of the EU member states to develop collective organisations for rapid capability in the area of strategic transport was firmly expressed. In 2000, the European Air Group (EAG) recommended to establish a permanent co-ordination element managing the airlift co-ordination needs of nations in an evolutionary approach by smoothly transferring competencies from existing national structures, a multinational management structure to be developed step by step from purely co-ordination to a combined entity with command authority.

The European Airlift Coordination Cell (EACC)

In June 2001, the member states of the EAG decided to establish the European Airlift Coordination Cell (EACC) as a first step with the objective to improve the utilisation of European military air transport and aerial refuelling capabilities and hereby gaining synergic effects.

The European Airlift Centre (EAC)

In June 2003, the European Airlift Centre was established, which received an increased responsibility over the planning of air transport requests and additionally in the field of harmonisation of air transport related regulations.
On 12 October 2006, on the 7th Franco-German Ministerial Council, it was decided to create a common strategic command for airlifts.

Establishment of the European Air Transport Command (EATC)

At the end of the negotiations phase, the European Air Transport Command (EATC) was officially established on 1 July 2010. On 1 September the inauguration took place in Eindhoven, i the presence of political and military leaders of the four participating nations: France, Germany, the Netherlands and Belgium. On 22 November 2012, Luxembourg acceded to the EATC, and it is expected that Spain will follow.

MISSION

On 1 September 2010 the EATC took over the operational control of most of the participating nation's military cargo aircraft (excluding helicopters) of which the existing fleet of Transall C-160 and C6130 Hercules form the largest part. In the near future all Airbus Military A400M shall be put under the command of the EATC.

Fleet [edit source]

As of 23. November 2011 the assigned fleet consists of[10]

Country	Aircraft	Active	Retained	–	Aircraft	Not shared
Belgium	A330	1	0		Falcon 900/20	3
	C130	1	0		ERJ 145/135	4
Netherlands	KDC-10	2	0			
	G-4	1	0			
	C-130	2	0			
	F-50	2	0			
France	A340	1	1		KC-135	14
	A310	2	1		A330	1
	C-130	8	6		Falcon	6
	C-160	28	20			
	CN-235	11	8			
Germany	A310	4	1		A340	2
	C-160	43	1		A310 VIP	2
	C-160 ESS	16	8		A319	2
					CL-601	4
	Total:	131	47			

The command is rotating every two years between France and Germany.

List of Commanders[8]

#	Name	Country	Took office	Left office
1	Major General Jochen Both	Germany	July 2010	July 2012
2	Major General Pascal Valentin	France	July 2012	

List of Deputy Commanders[8]

#	Name	Country	Took office	Left office
1	Brigadier General Alain Rouceau	France	July 2010	July 2012
2	Brigadier General Joerg Lebert	Germany	July 2012	

CONCLUSION

Since 2010 the European Air Transport Command has allowed its participating countries to reduce their transport flights by exploiting other member states' spare capacities. Without touching upon European countries' sovereignty, the EATC model has increased their combined airlift capabilities through a simple coordination mechanism. Accordingly, each participating EU member state contributes with its own fleet that keeps serving national goals. However, the EATC manages incoming information about countries' transport needs.

Article written by J.-P. Sanfourche, from information data provided by EATC.

SMALL SATELLITE OPPORTUNITIES

By James D. Rendleman, JD David Finkleman, PhD
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James D. Rendleman


JD David Finkleman

The advent of small satellites has broadened options for space systems mission owners and university research and education. Technology has advanced to a point where very capable buses and payloads are available commercially to perform a wide variety of missions in small satellite system architectures. That advancement will lead to productive applications but also new problems.

There is no generally accepted definition of what constitutes a "small satellite"

The term is often reserved for spacecraft ranging in mass from a single or few kilograms up through 1,000 kilograms. Terms such as picosat, nanosat, microsat, minisat, and smallsat are often used. Several providers and national bodies, however, have conceived their own alternate definitions for small satellites. Some emphasize low cost independent of size or mass. Others focus on capability such as maneuverability or observability. Some find mass to be the most important discriminant. Indeed, most small satellites tend to cluster in the 100 to 500 kilogram range.

Small satellites are evolving to very small sizes, such as Cubesats or "Lego"-like collections of Cubesats. The National Research Council's (NRC) Space Science Board more than a decade ago stated that small satellites "will represent scheduled missions rather than 'flights of opportunity,' where the satellite is piggybacked on another mission."[1] If so, cost will increase, perhaps hampering the anticipated benefits associated with small satellite missions.

Small satellite systems can be used to complement the current mix of flagship spacecraft, but optimizing that solution is no easy task

There are immense technical and management challenges associated with acquiring, operating, and sustaining large multi-sensor "flagship" class space systems with desired system lives of 15-20 years. Flagship satellites come with "big price tags, which effectively limit the type of organization that can purchase them to governments, militaries, and satellite service providers,"[2] Sadly, flagship systems often turned out to be incredible resource "black-holes." Immense integrated systems are difficult to resource; establishing and maintaining their engineering baselines is complex; and controlling their programmatic risks is often an insurmountable task. They are also burdened by equally extensive and complex ground systems. There are other maddening aspects to flying large flagship spacecraft. As noted by Paul Brooks:

When a satellite is being designed the owners look for ways to extend its mission. The designers then put more payloads on the spacecraft to deliver more value, but then the cost goes up… This creates more financial risk which then requires greater assurance that everything will work as planned. The greater assurance lengthens the lead time. You ultimately end up with very large missions and by the time the payload is launched, it is out of date. We noticed that this pattern repeated itself in the satellite industry and, unlike other technology-driven markets, there weren't huge increases in performance and large decreases in cost… [3]

Performing trade-offs between flagship and small satellite systems involve a variety of considerations. Any satellite is technically complex. Many small satellites launched into orbit fail to accomplish mission and design goals. Some become almost instant space debris. Mission designers for small satellites often feel freer to trade mission assurance for lower cost, and do. Disassembling large satellites into small, collaborating pieces suffers from programmatic and technical entropy and this has the potential to collectively lower overall mission reliability. Also, the usual use of small satellites in low Earth orbit requires deployment of large constellations in order to achieve effective 24/7 global coverage due to sensor and line-of-sight limitations. Managing and coordinating such large constellations often imposes a requirement for a significant number of ground stations as well as complex handover schemes between satellites.[4]

1. The Role of Small Satellites in NASA and NOAA Earth Observation Programs, Committee on Earth Studies, Space Studies Board, National Research Council (2000).

2. Greg Berlocher, "Small Satellite Technology: Gains Open Space to More Players," Via Satellite, August 1, 2008, http://www.viasatellite.com/via/features/Small-Satellite-Technology-Gains-Open-Space-to-More-Players_23881.html.

While small satellites offer tremendous alternatives for lower cost, resiliency, and responsiveness, this is not universally so. Despite their advantages, small satellites cannot be used to solve all technical and management challenges presented by desired space missions. For example, large, high-resolution apertures cannot be miniaturized. And sensitive, highly directional antennae, constructed to be insensitive to most jamming, cannot be miniaturized. Reducing the size of a spacecraft may make it more difficult to track and control on-orbit, and limit the ability to use sensors to aid in spacecraft anomaly resolution in the event of system hiccups.

Every kilolgram saved in payload mass decreases the need for launch vehicle propellant mass one hundred fold, but finding that savings in certain launch configurations does not end the analysis as to whether small satellites can always provide the best mission solution. Small satellites are often built and deployed as secondary payloads, consuming liftoff mass that could have served the primary mission or diminishing orbit possibilities. Secondary payloads also add risk and complexity to launch and deployment, and may increase collision risks that could generate additional debris. The launch vehicle may have to maneuver to safely deploy a small satellite secondary payload, and that maneuver may require it be loaded with additional propellant in order to achieve success. Even if launched on dedicated small boosters, such launch vehicles often suffer from greater overhead costs and are usually less mass efficient than large boosters.

The NRC's Space Sciences Board has concluded that life cycle cost trade-offs between flagship platforms and small multi-satellite architectures should be driven by the reliability and design lives of the system elements and by replenishment needs:
Small and large satellite architectures show differing life cycle cost sensitivities to sensor reliability for sustained missions. As a result, there are conditions for which large satellite architectures are most cost-effective, as well as conditions that favor small satellites. Large satellite architecture costs are more sensitive to sensor reliability because larger satellites carry more sensors, all of which are replenished if a new satellite is launched in response to a critical sensor failure. When sensor reliability is high and failure infrequent, the lower cost of deploying the payload on fewer, larger platforms outweighs the added costs of occasionally launching unnecessary sensors and provides a life cycle cost advantage to large satellite architectures. But low sensor reliability, with concomitant frequent replenishment, leads to excessive unnecessary sensor replacement with large platforms, thus favoring small satellite architectures.[5]

Despite the challenges, analytic tools, and tracking, telemetry and control systems, are being developed now to optimize missions with combinations of large and small satellites. A mixed fleet of small and large satellites could provide the most flexibility and robustness for any given mission. The exact mix depends on the particular needs driving the mission.

Small satellite systems provide flexible and agile capabilities to owner-operators

Small satellites offer a response to the drawbacks of some flagship systems and can be employed to perform a variety of missions. Component miniaturization offers resilience and cost-saving benefits, and helps satisfy flexibility, modernization, and even environmental needs, although the same advantages are available to larger satellites With 21st century technologies, miniaturization offers sophisticated capabilities and great flexibility useful for a wide variety of missions. As concluded by the Space Studies Board:
Small satellites offer new opportunities to address the core observational requirements of both operational and research missions. Small satellites, in particular single-sensor platforms, provide great architectural and programmatic flexibility. They offer attractive features with respect to design (distribution of functions between sensor and bus); observing strategy (tailored orbits, clusters, constellations); faster "time to science" for new sensors; rapid technology infusion; replenishment of individual failed sensors; and robustness with regard to budget and schedule uncertainties. New approaches to observation and calibration may be possible using spacecraft agility in lieu of sensor mechanisms, for example. Small satellite clusters or constellations can provide new sampling strategies that may more accurately resolve temporal and spatial variability of Earth system processes. (cit.om.) With advances in technology and scientific understanding, new missions can be developed and launched without waiting for accommodation on a multisensor platform that may require a longer development time.[6]

Reflecting these technical and programmatic advantages, commercial and international communities are already deploying smaller, relatively short-life, yet capable satellites with streamlined mission control architectures. These are cost-effectively satisfying mission needs.

Opportunities for cooperation

Small satellite architectures present significant opportunities for meaningful international cooperation. They will play an ever expanding role in the global space marketplace. Cooperation on such ventures should leverage resources, reduce risk, improve efficiency, expand international engagement, and enhance diplomatic prestige for the nations

3. Ibid.

4. Rizwan Mustafa Mir, "Satellite Data Networks," http://www.cse.wustl.edu/~jain/cis788-97/ftp/satellite_data/index.htm#Elbert, citing Bruce R. Elbert, The Satellite Communication applications Handbook, Artech House, Inc, MA. (1997).

5. The Role of Small Satellites in NASA and NOAA Earth Observation Programs, supra.

and organizations involved.
Small satellite systems technical attributes span the aviation and space interests of the American Institute of Aeronautics and Astronautics (AIAA) interests, and those of the member societies of CEAS. Low Earth orbit satellites really do "fly." Aerodynamic forces matter greatly at altitudes lower than 700 kilometers. While such forces are exceedingly small, so is the force of gravity, they can dramatically affect satellite orbits. Even light pressure from photons emitted by the Sun or by the Earth changes orbits. Considerable synergism between aircraft guidance and control and satellite positioning systems can be achieved by comparing notes on how to best understand and use lift and drag forces. Also, small satellites are often hard to perceive and track. Emplacing onboard transponders on the satellites may offer the most effective means to perform position and velocity estimation. Similarly, aircraft tracking is enabled through the use of transponders and not readily achieved through radar observation. Finally, small satellites may be best launched into orbit with small dedicated boosters. These share many of the issues as commuter aircraft to include relatively short ranges and limited owner-operator options if anomalies occur such as weather.
* Given the importance of international cooperation, the AIAA works to foster professionalism and improve the capacities of the global space community. It does this through sponsored and cosponsored conferences, workshops, symposiums, training and education programs, and networking events in the United States and around the globe. Many of AIAA's own International Activities Committee members are globally recognized aviation and space experts and leaders. AIAA and CEAS member societies should work together to better understand and improve the system engineering of small satellite systems.

6. Ibid.

THE AUTOMATED TRANSFER VEHICLE (ATV)

By Jean-Pierre Sanfourche, CEAS[1]

GENERAL TECHNICAL INFORMATION

MISSION CONCEPT AND THE ROLE OF ATV

The international Space Station depends on regular deliveries of experiment equipment and spare parts, as well as food, air and water for its permanent crew. Since its first voyage in April 2008, the Automated Transfer Vehicle (ATV) has been an indispensable supply ship to the Space Station. Approximately every 17 months, ATV carries 6.6 tonnes of cargo to the ISS. An onboard high-precision automatically guides the ATV on rendezvous trajectory towards the orbital outpost, where it docks with the ISS's Russian service module Zvezda. The ATV then remains attached as a pressurised module and integral part of the Station for up to 6 months. After that it detaches and reenters Earth's atmosphere, where it breaks up and burns, together with up to 6.4 tonnes of waste from the International Space Station.

Figure 1. ATV remains attached as a pressurised module and integral part of the ISS for up to 6 months.
Credit ESA

ATV CONFIGURATION

The exterior is a cylinder covered in a foil layer and meteorite protection panels.
Main figures:
- Length = 10.7 m
- Diameter = 4.5 m
- Span = 22.3 m
- Interior volume = 48 m3
- Launch mass = 20,700 kg

Characteristic X-shaped solar arrays extend from the spacecraft. Deployed 100 minutes after liftoff, the solar arrays reach a span of 22.3 m. The four arrays are totally independent and can rotate to get the best orientation to the Sun.
Inside, ATV consists of two modules: the Service Module and the Integrated Cargo Carrier (ICC). The forward part of the Cargo Carrier docks with the Station. Although no astronauts travel in an ATV, once attached to the Station, crew in normal clothing can enter the pressurised module to access the cargo.
The 'nose' of the cargo section contains Russian-made docking equipment and various kinds of rendezvous sensors.

The ATV Service Module

The ATV Service Module (figure 3) is not pressurised. It inclu-

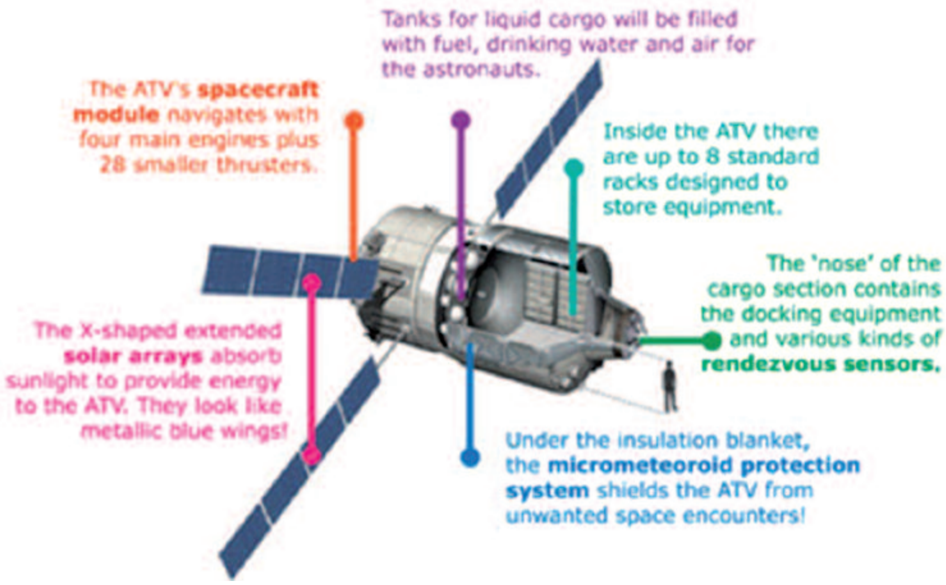

Figure 2. The general ATV configuration.
Credit ESA

Figure 3. Service Module being hosted for mating with the ICC.
Credit ESA

des the spacecraft's propulsion systems, electrical power, computers, communications and most of the avionics.
ATV's propulsion system provides the spaceship with the orbit transfer capability and the reboost support for the Space Station.
As a fully automatic spaceship, ATV navigates using 4 engines (490 N thrust) plus 28 smaller thrusters (220 N) for attitude control. All valves and thrusters are controlled by 4 control units connected to the main ATV computers.

Power system and avionics

For launch, the Service Module is mounted on Ariane 5 using a cylindrical adapter which has a locking and separation system that is jettisoned 70 minutes after liftoff. 100 minutes after liftoff, the 4 solar arrays unfold to reach the total span of 22.3 m, which provide electrical power to rechargeable batteries. The silicon-based solar cells are spread on 4 carbon-fibre reinforced plastic sandwich panels of 4 x 8.4 = 33.6 m^2. They are able to produce an average of 4800 Watts. Mounted on the service module, the four Sun-tracking arrays are totally independent and can get the best orientation to the Sun thanks to rotating mechanisms. The Service module also accommodates several rechargeable and non-rechargeable batteries.
The avionics bay, the brain of the ATV, a cylindrical ring 1.36 m high, is located in a non-pressurised part of the ATV, in the upper part of the service module; it accommodates critical items: computers, gyroscopes, navigation and control systems and communications equipment.

The Integrated Cargo Carrier (ICC)

Powered by the ATV Service Module, the integrated Cargo Carrier makes up of 60% of ATV's total volume. It is in the store room of an ATV with a maximum capacity of 6.6 tonnes of cargo (figure 4).
It is designed in two parts:

– The pressurised module, which docks to the ISS and holds the hatch connecting to the two spacecraft; this 48 m^3 section of the ICC has room for up to 8 standard racks which are designed with modular aluminium elements to store equipment and transfer bags.
– The non-pressurised part, making up to 10% of the total volume which is located at the rear.

It can carry two kinds of cargo: dry cargo and wet cargo.

Dry cargo

Up to 3.2 tonnes of dry cargo can be transported to the ISS inside the Integrated Cargo Carrier of the ATV, including food for the crew, spare parts, clothing and other items.

Wet cargo

Fluid cargo is stored in the non-pressured part of the Cargo Carrier, to the rear. Their contents are transferred though pipes to the ISS's own plumbing or through manually operated hoses. There are four kinds of fluids:

– *Propulsive support propellant*: this takes up the largest proportion of the cargo. This propellant is used to reboost

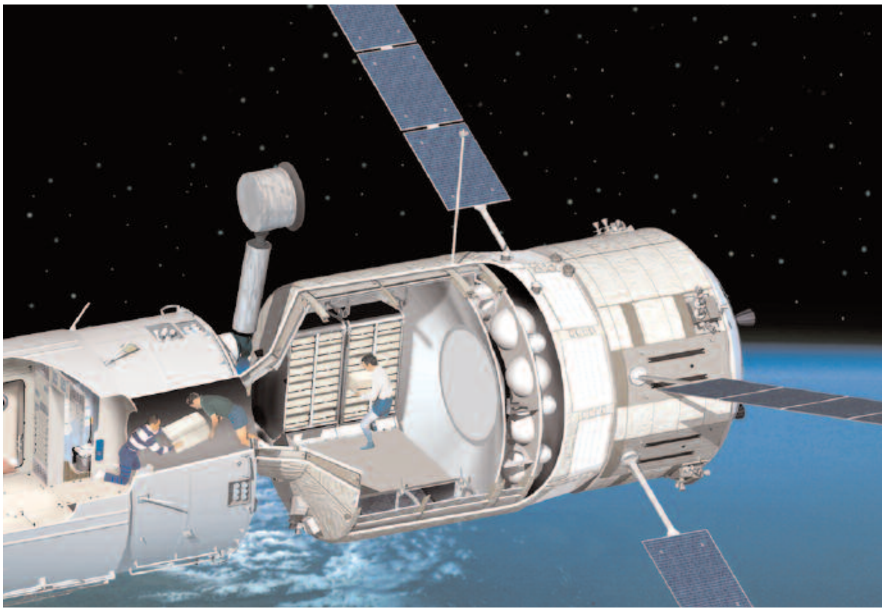

Figure 4. Powered by the ATV Service module, the Integrated Cargo Carrier (ICC) is the tore room of the ATV, it makes up 60% of ATV's total volume. Its maximum capacity is 6.6 tonnes of cargo.
Credit ESA

(see later below). It consists of monomethylhydrazine (MMH) and mixed oxides of nitrogen (MON 3).

– Refuelling propellant: once attached to the Station, up to 860 kg of refueling propellant can be transferred from ATV to the ISS. This consists of two fluids: fuel unsymmetrical dimethylhydrazin (UDMH) and the oxidiser, nitrogen tetroxide (N_2O_4). The refuelling propellant is used by the Station to perform orbit and attitude control with its own engines.
– *Potable water* (up to 855 kg): for use by the crew for drinking, food rehydratation and oral hygiene.
– *Gases* (up to 102 kg): two gases (oxygen and air) can be transported at a time to resupply the atmosphere of the ISS.

The Equipped External Bay of the ICC holds 22 spherical tanks of different sizes and colours. They are used to resupply the ISS with the above mentioned fluids.

The crew can access the contents of the pressurised part of ATV

Although ATVs are unscrewed, astronauts can access the contents of the pressurised part of ATV during its attached phase with the ISS. Up to two astronauts can work to unload supplies and conduct experiments, while the hatch remains constantly opened between ISS and the ATV. The pressurised module is designed to accommodate up to 2 astronauts working for 8 hours.

The front cone of the ICC and the docking equipment

The front cone contains avionics and propulsion hardware: 2 telegoniometers which permanently calculate distance and direction to the ISS; 2 videometers, an image processing system able to compute distance and orientation of the ISS; 2 star trackers, which are able to recognize constellations in the sky; 2 visual video targets for visual monitoring by the crew of ATV's final approach; 8 mini jets for attitude control. The front cone accommodates the 225 kg Russian docking system with its 80-cm hatch, its alignment mechanism and its one-metre-long extendible probe. During rendezvous with ISS, the ATV is the active spacecraft; it is equipped with an arrow-shaped probe mechanism. It is to be noticed that the Russian docking system, which has been continuously refined since it was originally developed in the late 1960s for the Salyut space station programme, remains the worldwide state-of-the-art in docking mechanisms.

Reboost capability

At regular intervals, ATV boosts the ISS into a higher orbit to overcome the effects of the drag of the atomic oxygen molecules above Earth's atmosphere. The ISS loses up to several hundred metres altitude a day. To perform these manoeuvres, ATV has at its disposal the 4 tonnes of propellant above mentioned. After docking, ATV can raise the orbit of the more than 200-tonne ISS at intervals of 10 to 45 days: raising the ISS's orbital altitude ATV resembles a tugboat, pushing the whole orbital outpost. In addition, ATV performs ISS's attitude control and also debris avoidance manoeuvres.

ATV FLIGHT PHASES

Launch

ATV is launched from Guyana Space Centre (Kourou) by an Ariane 5 ES and injected into a 51.6° orbit – the same as the ISS – at an altitude of around 260 km i.e. 100 km lower than the ISS. Approximately 75 minutes after liftoff, when separation with the launcher is confirmed, ATV becomes a fully automatic spaceship.

Phasing

Next, ATV enters a phasing stage of the mission. A set of orbital manoeuvres executed by the ATV Control Centre bring ATV to a distance of 39 km behind and below the ISS. If needed, ATV can hold a parked position 2000 km from the ISS.

Rendezvous and docking

When phasing is finished, ATV is ready to dock with the ISS.

ATV sets up a direct link with the ISS, allowing it to start relative and accurate navigation using GPS technology.
At a distance of 249 m, ATV's computers use videometer and telegoniometer data for final approach and docking manaoeuvres. ATV's speed relative to the ISS slows down to 7 cm/s.
As ATV gets closer to the ISS, ATV Control Centre ground controllers direct the ATV in step-by-step predefined approach. This approach requires authorization from the Russian mission Control Centre in Moscow because ATV docks with the Russian Zvezda segment in the ISS. Coordination with mission control Center in Houston is also necessary because they are responsible for the entire ISS. For each of these steps, ATV performs automated manœuvres.

Eye-like sensors

For the final rendezvous manoeuvres, ATV uses its eye-like sensors, combined with additional parallel measurement systems, which ensure an automatic docking with 1.5 CM PRECISION while the spacecraft and the ISS are circling the earth at 28,000 km/h.

Extension of the ISS

Once docked, ATV remains an intrinsic part of the ISS for up to 6 months, becoming an extension of the orbital outpost. The 48 m3 pressurised module above described can deliver its 6.6 tonnes of supply.

Destructive reentry

After 6 months of being an extension of the ISS, ATV is loaded with up to 6.5 tonnes of material no longer required on the ISS, and separates with the same safety procedures performed for the docking. ATV burns up completely during a guided and controlled reentry high over the Pacific Ocean.

SINCE APRIL 2008: FOUR ATVs HAVE BEEN LAUNCHED

ATV-1 "JULES VERNE"

– Launch on 9 March 2008 from Guyana Space Centre at 02:03 UT.
– Docking with ISS Zvezda module on 3 April 2008.
– Undocking on 5 September 2008.
– Controlled destructive reentry into the Earth atmosphere on 29 September over the South Pacific.
– Quite successful mission whose objective was to demonstrate a number of special ATV features such as attitude control, ATV control Centre's capability to perform orbit manoeuvres and collision avoidance manoeuvres.

ATV-2 "JOHANNES KEPLER"

– Launch on 16 February 2011 from Guyana Space Centre.
– Docking with ISS Zvezda module on 24 February 2011.
– Undocking in early July 2011.
– Controlled destructive reentry into the Earth atmosphere on 21 July 2011 over the South Pacific.

Figuye 5. ATV-4 liftoff took place on 5 June 2013. Credit ESA

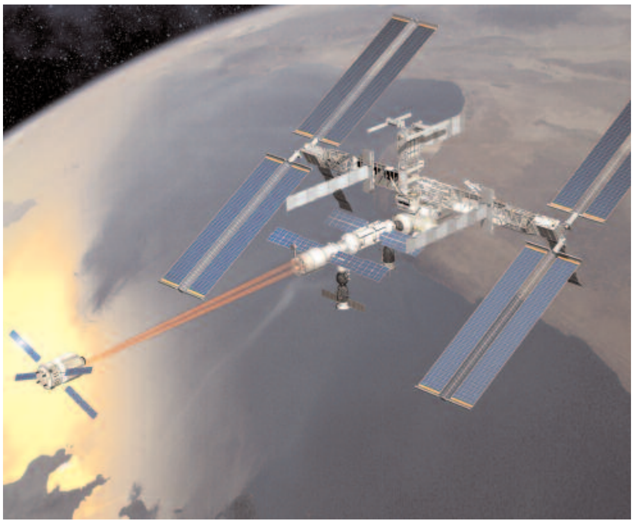

Figure 6. ATV approaching Station: a delicate and automated procedure. Credit ESA

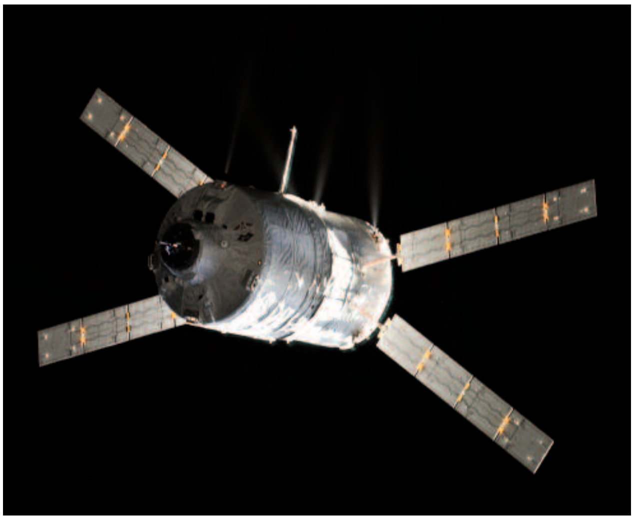

Figure 7. Amazing ATV: in this image, ATV-4 is lit by the Sun from behind as its solar cells absorb the Sun's energy. The golden lights are the sunlight shining through the solar panel hinges. The vertical antenna at the top is the proximity boom that is used to communicate with the ISS. Credit ESA

– Quite successful mission: cargo, reboost, extra module for the ISS, evacuation of ISS waste materials.

ATV-3 "EDOARDI AMALDI"

– Launch on 23 March 2012 from Guyana Space Centre.
– Docking with ISS Zvezda module on 28 March 2012.
– Quite successful mission: same as ATV-2.

ATV-4 "ALBERT EINSTEIN"

5 June 2013: the launch

The Ariane 5 launcher lifted off on 5 June at 21:52 UT (GMT) from Guyana Space Centre (figure 5) and delivered ATV-4 into the planned circular parking orbit 64 minutes later. ATV then deployed its 4 power-generating solar wings and antenna boom.
At 20,190 kg, ATV-4 is the heaviest spacecraft ever launched by Ariane 5 beating ATV-E by 150 kg.

15 June 2013: the docking

On 15 June 2013 at 14:07 TU, ATV-4 docked with the ISS to the Zvezda module at the end of the approach automated procedure (figure 6). Figure 7 shows the ATV seen from the ISS: this image reveals the exhaust plumes as the craft fires some of its 24 thrusters to adjust its approach. The docking was so precise (figure 8) that ATV-4 was ONLY 11 mm OFF CENTRE, hitting ISS without touching the surrounding cone. Russian specialists said they had never seen such precision before!

ATV-4, after over 4 months docked to the ISS, filled with waste, will undock on 28 October and then make the usual controlled re-entry over the South Pacific.
So far ATV-4's mission has been pointless, with in particular ISS orbit raising operations successfully executed in early August.

ATV-5 "GEORGES LEMAÎTRE"

ATV-5 will be the fifth and last ATV of the series initially planned: it is prepared for launch in 2014.

ESA WORKHOUSE TO POWER NASA'S "ORION" SPACECRAFT

Figure 9. Artist views of 'ORION'. Credit ESA

On 16 January 2013, ESA agreed with NASA to contribute a driving force to the ORION spacecraft planned for launch in 2017. ORION (figure 9), will carry astronauts further into space than even before using a module precisely based on Europe's ATV. This collaboration between ESA and NASA continues the spirit of international cooperation that forms the ISS. "NASA's decision to cooperate with ESA on their exploration programme in a strong sign of confidence in ESA's capabilitities", said Thomas Reiter, ESA director of Human Spaceflight and Operations.
The first ORION mission will be an unscrewed lunar flyby in 2017, returning to Earth's atmosphere at 11 km/s, the faster reentry ever.

Figure 8. ATV-4 docked to Zvezda on 15 June 2013. Credit ESA

1. From information provided by ESA.

FOURTH QUARTER 2013

15-18 October • **ESA** – The universe explored by Herschel – International Conference – ESA/ESTEC - Noordwijk, NL) – http://www.congrexprojects.com/13a12

16-17 October • **RAeS** – Civil Airworthiness Applied in a Military Context – Workshop organised by RAeS Rotorcraft Specialist Group – RAeS/HQ – London (UK) – www.aerosociety.com/Events/

22-24 October • **ESA** – ADCSS – 7th ESA Workshop on Avionics – ESA/ESTEC (Noordwijk, NL) – http://www.adcss.esa.int/

11-13 November • **ACI-EUROPE** – ACI airport Exchange & exhibition 2013 – Doha, Qatar, Middle East – Qatar Convention Centre Doha – http://www.airport-exchange.com/

20-21 November • **RAeS** – Digital Media convergence in Flight Simulation & Training – Conference – RAeS/HQ (London) – www.aerosociety.com/Events/

26-27 November • **RAeS** – Civil Airline Services: Time to collaborate. How? – Conference – RAeS/HQ (London) – - www.aerosociety.com/Events/

04-06 December • **ESA** – GALILEO – 4th international Colloquium on Scientific and Fundamental Aspects – Prague (Czech Republic) – Czech Ministry of Transport – http://www.congrexprojects.com/13c15

04-05 December • **EASA** – EASA Rotorcraft Symposium – 7th edition – Cologne (Germany) – Maritim Hotel Köln – http://www.easa.europa.eu/events

YEAR 2014

04-06 March • **ATM World Congress** – World ATM Congress 2014 – Madrid (Spain) – IFEMA Feria de Madrid – Partnership CANSO-ATCA - http://www.worldatmcongress.org/

12-14 March • **3AF/CEAS** – Greener Aviation – Conference – Brussels (Belgium) – Square Meeting Centre Mont des Arts – http://www.greener-aviation2014.com

29-30 April • **ATAG (Air Transport Action Group)** – ATAG Aviation & environment summit – Geneva (Switzerland) – President Wilson Hotel – http://www.envirosummit.aero/

20-22 May • **EBAA/NBAA** – EBACE 2014 – 14th Annual European Business Aviation Convention & Exhibition – Geneva (Switzerland) – Palexpo and geneva International Airport – www.ebace.aero/2014/

20-25 May • **BDLI/Messe Berlin** – ILA Berlin 2014 – Air Show – Berlin (Germany) - Berlin Expo Centre Airport http://www.ila-berlin.de/

26-30 May • **ESA** – 4S Symposium 2014 – Small Satellites Systems Symposium – Porto Petro, Mallorca (Spain) – Conference Centre – http://www.congrexprojects.com/2014

02-06 June • **ESA** – GNC 2014 – 9th ESA International Conference on Guidance, Navigation and Control Systems – Porto (Portugal)- Congress Centre – http://www.congrexprojects.com/14a01

10-13 June • **ESA** – 9th ESA Roundtable on Micro Nano Technologies (MNT) – Lausanne (Switzerland) – Swiss Tech Convention Centre – http://www.congrexprojects.com/14c03

16-20 June • **AIAA/CEAS** – 20th AIAA/CEAS Aeroacoustics Conference – Part of AIAA Aviation Conference 2014 – Atlanta (Georgia), USA. Hyatt Regency Atlanta – http://www.aiaa.org/events

16-20 June • – **AIAA/3AF** –ANERS 2014 – Aircraft Noise and Emissions Reduction Symposium – Part of AAC 2014 – Atlanta (Georgia), USA – Hyatt regency Atlanta – http://www.aiaa.org/events

17-20 June • **3AF** – – MD10 – International Conference: Missile Defence, Challenges in Europe – Mainz (Germany) – Rheingoldsalle Conference Centre – www.3af.fr – lisa.gabaldi@aaaf.asso.fr

THE CEAS/ASD AEROSPACE EVENTS CALENDAR

The CEAS and ASD have created an innovative tool so-called "CPMIS" (Conference Programming Management Information System), the aim of which is to facilitate the search of the different aerospace events in the world that are programmed at short and mid-term time horizon, and so allowing to optimise the scheduling of future events by avoiding possible overlapping and redundancies, but on the contrary to encourage co-operations and synergies between the actors concerned. Its role is therefore double: information on the one hand, conference programming enabler on the other.
THE ADDRESS IS: http://www.aerospace-events.eu

A search engine selects the events according to specific topics and key words. A graphic display (day, week and months view) eases the access and the view.

- 4 TYPES: Conference, Workshop, Lecture, Air Show
- 6 MAIN CATEGORIES: Aeronautical sciences - Aerospace (for events including all aspects of aviation and space) – Civil Aviation – Air power – Space – Students and Young Professionals.
- 64 SUB – CATEGORIES: aeroacoustics – aeroelasticity – aerodynamics, etc.

AUTOMATIC INSERTION OF NEW EVENTS BY THE ORGANISERS THEMSELVES:

- Go to http://www.aerospace-events.eu
- Click on the "introduction" text
- Redirected on the New Event Form, you have to click on this form and to enter your event related information, validate, click on Save and send.

CONTACTS:

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