Fédération
Aéronautique
Internationale

Minutes

of the Annual Meeting of the

FAI Astronautic Records Commission

held in Lausanne, Switzerland
on 27 April 2007

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FEDERATION AERONAUTIQUE INTERNATIONALE
FAI ASTRONAUTIC RECORDS COMMISSION (ICARE)

MINUTES OF A MEETING HELD AT THE FAI HEADQUARTERS
24 AVENUE MON REPOS, 1005 LAUSANNE, SWITZERLAND
ON FRIDAY 27 APRIL 2007, STARTING AT 09h15

MINUTES

Present:

M. Segismundo SANZ FERNANDEZ de CORDOBA	President
Mr. Mike COLLINS	USA
M. Christian MARCHAL	France
Mr. Ulf MERBOLD	Germany
Mr. John F MILES	United Kingdom
Mr Valery KORSUN	Russia

In attendance :

Mr Thierry MONTIGNEAUX	FAI Asst. Secretary General

Apologies:

Mr. Yuri TARASOV	Russia
Mr. John GRUBBSTROM	Sweden

1 WELCOME BY THE PRESIDENT

M. Segismundo SANZ FERNANDEZ de CORDOBA welcomed all those attending.

2 APPROVAL OF THE MINUTES OF THE LAST MEETING

The minutes of the previous meeting (21 April 2006) were approved without correction.

The following matters arose from those Minutes:

Para 6(a) “Gold Space Medal” : Mr. Montigneaux reported that the 2006 FAI General Conference had agreed that both FAI Gold Medals should be of equal status. As a result, the By Law concerning the Gold Space Medal had now been moved from Chapter 12 (awards made by Commissions) to Chapter 11 (awards subject to the approval of Vice Presidents). Mr. Montigneaux pointed out to delegates that a practical implication of this decision was that nominations for the Gold Space Medal would from this year on be submitted directly to FAI Vice Presidents for approval. Although there was no formal requirement for prior screening by ICARE, the views of ICARE would be of special interest to Vice Presidents, and would be passed on by the Secretariat.

Para 9(a) “simplification of Section 8”: see follow-up discussion in para 5(b) of these minutes.

Para 9(c) “significance of Karman Line”: The ICARE President reported having discussed the matter with other FAI Commission Presidents at the May 2006 Air Sport Commission

Presidents' meeting in Lausanne. These discussions showed that no other FAI Commission was recognising or using the Karman Line in their sporting code rules. He concluded, and delegates agreed, that no further action was necessary at this stage on the matter.

3. FAI GENERAL CONFERENCE

The ICARE President's report to the Santiago FAI General Conference, October 2006, is at **Annex 1**.

Mr. Montigneaux reported on the official opening at the Conference of the bidding process for the 2009 World Air Games (*Minutes note: Since the ICARE meeting took place, the organisation of the 2009 World Air Games was awarded in early June 2007 to the city of Turin, Italy).* He advised delegates that FAI had reached an agreement with Red Bull Air Race under which Red Bull Air Races would be conducted under the safety supervision of the FAI, starting with the race in Abu Dhabi (United Arab Emirates) on 6 April 2007.

4. ASTRONAUTICS ACTIVITIES AND PROJECTS

a. Progress report by FAI and Delegates from Member Countries.

France: M. Marchal distributed a printout of the ESA web pages, and pointed delegates to the ESA web site at http://www.esa.int, which was giving a good account of the activities of the past year.

UK: Mr Miles reported that the "Starchaser" project was still active and had now set up a company in New Mexico (USA). More information was available on the "Starchaser" website at http://www.starchaser.co.uk/ .

Russia: Mr Korsun reported that Russia's main goal remained the International Space Station, with the aim of having six people simultaneously onboard.

USA: Mr Collins reported that expeditions 12, 13 and 14 had been successfully completed, as well as space shuttle missions STS-121, STS-115 and STS-116. He confirmed to delegates that sixteen more shuttle flights were planned until the retirement of the shuttle fleet. He also presented to delegates an overview of NASA's vision for future space exploration activities.

Spain: The ICARE President reported a huge interest in the Galileo programme, with the main issues centering around control and management matters.

5. FAI SPORTING CODE SECTION 8 (ASTRONAUTICS).

a. Delegates debated M. Marchal's proposals and reached the following decisions:

Para 4.2.1.4: it was agreed to delete this paragraph.

Para 5.2.1.4: the decision of the 2006 meeting, that the words *"Length travelled along the trajectory measured from…*" should be deleted and replaced by "*Distance travelled from…*", was confirmed.

Delegates discussed the note published in para 3.9.4 and agreed to amend it by deleting the words *"…measured along the path of light between the point of linking and the*

point of separation or termination of flight, whichever happens first…" and replacing them by "*…measured in the Galilean set of axes*".

Delegates then debated at some length the second part of M. Marchal's document (comments; computation of the distance in outer space).

b. Simplification of Section 8.

A discussion followed on the subject of simplification of Section 8. The ICARE President opened that discussion by summarizing the present structure of the document as follows:
- Chapter 2 presents definitions and conditions of the records
- Chapters 3, 4 and 5 define the records available
- Chapter 6 deals with measurement of record performances
- Chapters 7 and 8 contains rules for the administration of the records.

The ICARE President then moved on to propose that definitions in chapter 2 be reviewed and updated with the aim of making them more understandable.

Mr. Miles, seconded by Mr. Merbold, agreed to the idea of initiating a process of cleaning-up of Section 8. Mr. Collins made the suggestion that formulas be moved to an annex to Section 8. Mr. Korsun supported the idea.

The question was asked if any feedback on the present organisation of Section 8 had been received over the years from outside FAI. Mr. Montigneaux explained that no comment had been received to his knowledge from outside FAI, but that Section 8 had sometimes been found to be a confusing document to work with within FAI.

Mr. Collins suggested reversing the order of chapters, with those defining the records coming first in the document. The ICARE President pointed out that this idea had already been considered and dropped the last time Section 8 was revised.

At the end of the discussion, delegates agreed to proceed as follows:

- Move all definitions to chapter 2 and clean them up (Mr. Miles to look into the matter);
- Publish equations in chapter 2 (M. Marchal; *his subsequent paper sent to delegates after the meeting is attached as* **ANNEX 2**)
- Clean up chapters 3, 4 and 5 (M. Marchal with the assistance of Mr. Miles)

6. PROPOSALS FOR FAI AWARDS

a. Delegates formally put on record their acceptance of the decision made in 2006 by email vote to award the Gold Space Medal for 2005 to Mr Dmitry I. Kozlov.

b. Yuri Gagarin Gold Medal: A nomination had been received from USA for this medal to be awarded to the crew of Mission STS-114/Expedition 13 (citation attached, **ANNEX 3**). ICARE unanimously approved this award.

c. Komarov Diploma: Two nominations had been received from USA for this Diploma to be awarded to the crew of International Space Station Expedition 12. (Citation attached, **ANNEX 4**) and the crew of STS-115 (**ANNEX 5)**. ICARE unanimously approved this award for both nominations.

d. Korolev Diploma: A nomination had been received from USA for this Diploma to be awarded to the crew of STS-116 / International Space Station

Expedition 14. (Citation attached, **ANNEX 6**). ICARE unanimously approved this award.

e. Mr. Collins advised delegates that the US FAI Member would make a nomination for the FAI Gold Space Medal.

7. INTERNATIONAL ASTRONAUTIC FEDERATION

The ICARE President reported that no ICARE representative had been able to attend the 2006 IAF Congress, and that there was therefore no report to present to ICARE. The duration of the congress – 10 days – made it difficult to attend, as there had to be a commitment to be present for the whole duration of the event. The 2007 Congress was due to be held in India. The ICARE President was nominated to represent FAI, but advised that he would most probably not be able to attend.

8. WORLD RECORDS

Mr Christian Marchal reported that no new record had been processed since the last ICARE meeting. One dossier for a new record claim was collected while at the meeting. Mr. Collins expected that a new record might be set in the near future by STS-118.

All space records can be consulted on-line at the FAI web-site at <http://records.fai.org/astronautics/>.

9. ANY OTHER BUSINESS

a) ICARE representation in CIEA. The UK delegate, Mr Miles, noted that FAI Air Sport Commissions could nominate representatives to FAI Technical Commissions. He expressed an interest in representing ICARE in the FAI Aviation and Space Education Commission (CIEA). ICARE unanimously approved this nomination.

b) Mr. Collins advised ICARE that this was the last meeting he was attending as he was about to retire from NASA. He had enjoyed his involvement in the commission and expressed his thanks to everyone for their support over the years. The ICARE President thanked Mr. Collins on behalf of ICARE for his commitment and work, and wished him a happy retirement.

10. ELECTIONS

The following were re-elected for 2007/2008 :

President : Dr Sanz Fernandez de Cordoba
Vice President : Mr John Miles (UK)

11. DATE AND PLACE OF NEXT ICARE MEETING

It was agreed that the next meeting would be held in Lausanne on Friday 04 April 2008 at 09h15.

ANNEX 1

FEDERACION AERONAUTICA INTERNACIONAL

VICEPRESIDENTE

PRESIDENTE DE LA
COMISION INTERNACIONAL DE RECORDS ASTRONAUTICOS (ICARE)

REPORT FROM ICARE PRESIDENT
100th FAI General Conference, Santiago, Chile, October 2006

1.- General Activities of ICARE Committee 2005/2006

The ICARE Committee held its annual meeting on April 2006, at the FAI Headquarters in Lausanne, Switzerland. The President was also present at the joint Air Sport Commission Presidents / Executive Board Members held at the Olympic Museum, Laussanne on May 2006.

Besides the normal business, in both meetings came out matters that may be of interest for the General Assembly. I detail them separately.

2.- Annual Meeting: Gold Space Medal

Thea Gold Space Medal ranks, according to present rules, with the Gold Air Medal as the highest award to be presented by FAI. Accordingly, the merits to be demonstrated by the candidates are parallel to those of the Gold Air Medal.

However, there is a difference in the awarding method currently recognised in our By Laws. While the concession of the Gold Air Medal requires always the favourable vote of the majority of the Vice Presidents, this vote is not required if the ICARE Commission agrees on just one candidate for the award of the Gold Space Medal.

This difference has strong historical background. While different Commissions in Aeronautic Sports have deep knowledge of their own discipline, other disciplines in aeronautics are not unfamiliar to them, and they know well the people involved. Thus, in most cases, they are in good position to assess the merits of the different candidates to the Gold Air Medal.

However, the knowledge of other Commissions on Astronautics, was not that general. Astronautics was a very specialised subject, and traditionally most involved with military activity not always fully reported in public. Consequently, it was thought not advisable to submit the Gold Space Medal to a general voting procedure as a rule.

Things however are changing. Private people are entering the Space Age, and ICARE is most aware of it. Thus, probably, we may have to change the rules in the near future. Being prepared for those changes is a must for us.

FEDERACION AERONAUTICA INTERNACIONAL

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On the advice of the Secretary General, which gave us two choices in the way to proceed, it was decided "to allow the Statutes Working Group to recommend how this change should best be implemented" in the future. We would be most thankful to the Statutes Working Group to report ICARE in the way this modification must be implemented in the future.

2.- Joint Air Sport Commission Presidents / Executive Board Members

Besides many interesting aspects discussed in the meeting, for the ICARE Commission there was a very important aspect.

ICARE, by our own rules, are only interested in flights surpassing the 100 Km boundary between Aeronautics and Astronautics, as defined in our Sporting Codes.

Nevertheless, in the year 2004 a flight surpassing the 100Km boundary (SpaceShipOne, in a trial flight) was awarded an aeronautical record. This was not a problem for ICARE, but we thought it may be a problem for other records. The separation of Astronautics from Aeronautics seemed to be a good solution when altitude, duration, speed, et al, of aeronautic machines could obviously not compete with astronautical machines (see the 100Km boundary for astronautics in the FAI Astronautics web page).

Most Commission Presidents at the referred meeting felt there was not a problem for their Commissions. In spite of ICARE President position on recommending Aeronautic Commissions to limit aeronautic records to flights which in no part go beyond the 100Km altitude boundary, it was felt by other Presidents that the distinction was unnecessary.

As a consequence, all flights are open to aeronautic records, no matter whether they go partially over the 100Km altitude. These are welcomed news. Time seems ripe for the start of scrapping differences between aeronautics and astronautics.

Dr. S. Sanz Fernández de Córdoba
ICARE President

ANNEX 2

Christian Marchal
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Thursday, Mai 10, 2007

Mr Sanz Fernandez de Cordoba
Mr Max Bishop
Mr Thierry Montigneaux
All ICARE delegates.

Dear Friends

Please find herewith the analysis of the paragraphs 2.14 and 2.5.1 of the section 8 of the sporting code that we already discussed during our last meeting of April 27.

I propose the following :

Paragraph 2.5.1

Distance to Earth

The distance reached at the maximum separation between the Earth centre and the spaceship at any given moment of the mission after discounting the equatorial radius of Earth. It shall be measured in the Galilean set of axes of the Solar System between the Earth centre and the spaceship location.

The distance h from a spaceship to the Earth is precisely defined as :
$h = r - a$ (see 2.4. for the explanation of symbols).

Practically, space distances are measured by electromagnetic signals. An electromagnetic signal is sent from some radiotelescope of Earth to the spaceship at the time t_o, it is received by the spaceship at some time t_1 (in the proper local time) and immediately returned to the Earth where the return signal is received at the time t_2 . The measure is independent of t_1, but it is affected to that time t_1 . The corresponding measure of distance D is of course : $D = c(t_2 - t_o)/ 2$, where c is the theoretical velocity of light in vacuum : 299 792 458 m/s (with small corrections for the crossing of the atmosphere) and the relation between D, r and h, take account of the geographical position of the radiotelescope.

Paragraph 2.14

DISTANCE IN OUTER SPACE (for suborbital missions).

The distance D traveled in outer space by a suborbital spacecraft or aerospacecraft is measured along the Von Karman ellipsoid (ellipsoid at 100 km altitude) in the geocentric set

of axes rotating with Earth. That distance is measured between the point of entry into outer space (latitude φ_1 , longitude L_1) and the point of exit (latitude φ_2 , longitude L_2).

The latitude and longitude of a point of space are defined as those of the point of the Earth surface at the vertical of which is the space point of interest, and, because of the small dissymmetries of the geoid, errors up to 400m are possible. Hence the following computations will be limited to the hectometric accuracy.

The distance D is a function of the three angles φ_1, φ_2 ,($L_2 - L_1$) and the semi-axes A and B of the Von Karman ellipsoid :

A = equatorial semi-axis = a + 100 km = 6 478 137m

B = polar semi-axis = b + 100km = 6 456 752.3 m

We will need :

A) The "pseudo-latitudes" ψ_1 and ψ_2 that are proportional to the distance to the equator along the Von Karman ellipsoid.

$$\psi_1 = \varphi_1 - (0°.1421) \sin 2\varphi_1 \quad ; \quad \psi_2 = \varphi_2 - (0°.1421) \sin 2\varphi_2$$

B) The angle α, the usual angle of spherical geometry between the directions ψ_1 ,L_1 and ψ_2 ,L_2 :

$$\cos \alpha = \sin\psi_1 \sin \psi_2 + \cos\psi_1 \cos\psi_2 \cos (L_2 - L_1) \quad ; \quad 0° \le \alpha \le 180°$$

C) The inclination i (on the equator) of the corresponding great circle :

$$\cos i = \cos\psi_1 \cos\psi_2 \left| \sin (L_2 - L_1) \right| / \sin \alpha \quad ; \quad 0° \le i \le 90°$$

D) The distance D is then given by the following expressions, within the hectometric accuracy and **with the angle α in radians**.

D 1) If $\alpha \le 168°$:

$$D = \alpha \times [(3A + B) + (A - B) \cos 2i] / 4$$

that is :

$$D = \alpha \times (6\,472.79 + 5{,}35 .\cos 2i) \text{ km}$$

D 2) In all cases :

$$(A + B) \alpha / 2 \le D \le \alpha \times [(3A + B) + (A - B) \cos 2i] / 4 \le A \alpha$$

that is :

$$\alpha \times 6\,467.44 \text{ km} \le D \le \alpha \times (6\,472.79 + 5{,}35.\cos 2i) \text{ km} \le \alpha \times 6\,478.14 \text{ km}$$

The largest possible value of D is between antipodal points and is 20 318.07 km. It corresponds to the lower limit of the final expression for $\alpha = \pi$ (and also to that expression when i = 90°).

Sincerely yours

C. Marchal

ANNEX 3

U.S.A.
Nomination for the Fédération Aéronautique Internationale
Gagarin Gold Medal

Nominee: **The STS-121/Expedition 13 Crews**

Steven W. Lindsey, Shuttle Commander, *NASA Astronaut*
Mark E. Kelly, Pilot, *NASA Astronaut*
Piers J. Sellers, Mission Specialist, *NASA Astronaut*
Michael E. Fossum, Mission Specialist, *NASA Astronaut*
Lisa M. Nowak, Mission Specialist, *NASA Astronaut*
Stephanie D. Wilson, Mission Specialist, *NASA Astronaut*
Pavel V. Vinogradov, ISS Commander, *Russian Cosmonaut, RSC Energia*
Jeffrey N. Williams, Flight Engineer, *NASA Astronaut*
Thomas Reiter, Flight Engineer, *ESA Astronaut*

Affiliations: As shown above.

Suggested Citation:

For the successful completion of the STS-121/Expedition 13 mission to test new equipment and procedures, to restore the International Space Station (ISS) to a three person crew, and to focus on assembly preparations, maintenance, and microgravity science.

Justification:

Expedition 13 began on March 29, 2006, with the launch of crew members, Commander Pavel Vinogradov and Science Officer and Flight Engineer Jeffrey Williams, on the Russian Soyuz TMA-8 from Baikonur, Kazakhstan. Space Flight Participant Marcos Pontes from the Brazilian Air Force also joined the crew. STS-121 launched on July 4, 2006, to join the Expedition 13 crew in the highly successful joint portion of the mission. STS-121 landed July 17, 2006, at Kennedy Space Center, Florida. The Expedition 13 crew remained on board the ISS. Their mission concluded with a predawn landing on September 29, 2006, near Arkalyk, Kazakhstan.

As Commander of both the ISS and the Soyuz vehicle, Pavel Vinogradov was responsible for the overall safety and mission operations of the crews. Jeffrey Williams was responsible for all systems in the U.S. segment and the conduct of the U.S. science program. Thomas Reiter launched with STS-121 and joined the Expedition 13 crew as the third crew member, restoring the ISS to a three-person crew after the Columbia tragedy. Thomas Reiter was responsible for experiments on behalf of a number of European institutions and research centers. Pavel Vinogradov and Jeffrey Williams performed a space walk utilizing the Russian Orlan spacesuits. During this space walk, they were able to repair a vent for the Space Station's oxygen-producing Elektron unit which required the crew to re-route Elektron's hydrogen vent line to a vent also used by the Vozdukh carbon dioxide removal system and install a nozzle on the neck of a valve.

Thomas Reiter and Jeffrey Williams performed a subsequent space walk which was critical to the safety of future ISS space walkers. The crew installed a floating potential measurement unit, a device designed to measure the electrical potential of the Space Station. The crew also began setup for the test of an infrared camera designed to detect any damage in a Space Shuttle's Re-enforced Carbon-Carbon (RCC) thermal protection. The camera is designed to detect damage by variations in temperature between damaged and undamaged RCC test sections.

During their 6-month tour of duty aboard the ISS, the Expedition 13 crew saw the arrival of two Space Shuttle missions, resumed construction of the orbiting laboratory, and restored the ISS to a three-person crew..

STS-121 was the second return-to-flight mission. The crew transferred 7,400 pounds of supplies and equipment from the multi-purpose logistics module, Leonardo, to the ISS. They also performed three space walks for a total of more than 21 hours to restore the Space Station's mobile transporter to full operation and to test Thermal Protection System (TPS) repairs. The crew installed a blade blocker on the S0 truss in the zenith Interface Umbilical Assembly (IUA) to protect an undamaged power, data, and video cable. They re-routed a cable through the IUA in order to move the mobile transporter rail car and replaced the trailing umbilical system that had a severed power and data cable, which had previously been inadvertently cut by a blade.

The crew also demonstrated techniques for inspecting and protecting the Space Shuttle's TPS. The extravehicular activity crew tested the combination of the Space Shuttle robotic arm and a 50-foot robotic boom extension as a platform for astronauts to repair a damaged Orbiter if ever needed. They also conducted repairs on the TPS RCC panels. Through the crew's efforts, the safety of the Space Shuttle fleet was significantly improved.

The success of the combined STS-121 and Expedition 13 joint mission was extremely important in the history of the ISS Program and will contribute greatly to future human exploration. The crews of STS-121 and Expedition 13 showed that through teamwork, humans could continue to live and work aboard the ISS during this prolonged period of reduced logistical support. The hard work, adaptability, and tireless devotion to duty exhibited by the crews during this groundbreaking mission reflect most highly upon themselves and demonstrate that they are very deserving of the Gagarin Gold Medal.

ANNEX 4

U.S.A.
Nomination for the Fédération Aéronautique Internationale
Komarov Diploma

Nominee: **The International Space Station Expedition 12 Crew**

William S. McArthur, *NASA Astronaut*
Valeri I. Tokarev, *Russian Cosmonaut, Roscosmos – Gagarin Cosmonaut Training Center*

Affiliations: See above.

Suggested Citation:

For the successful completion of the twelfth expeditionary mission to live and work on board the International Space Station (ISS), completion of U.S. and Russian Extravehicular Activities (EVAs), and docking their Soyuz to all ports of the ISS.

Justification:

As Commander of the ISS and the U.S. Science Officer, William McArthur was responsible for the overall safety and mission success of the crew. Valeri Tokarev, as the Soyuz Commander and ISS Flight Engineer, was responsible for all phases of Soyuz flight, the operations and maintenance of all systems in the Russian segment, and the conduct of the ambitious Russian and European science program.

Valeri Tokarev and William McArthur, with visiting crew member (American) Greg Olsen, docked their Russian Soyuz TMA-7 to the Space Station Docking Compartment on October 3, 2005. They relocated the Soyuz to the FGB in November 2005 and to the Service Module in March 2006 becoming the first crew to dock a Soyuz to all three ports.

In November 2005, William and Valeri became the only two-person crew to ever perform a U.S. EVA. All other American EVAs had been done with three or more people on board. During the EVA, they jettisoned the Floating Potential Probe from the top of the P6 truss and worked or translated on the P1, S1 and S0 trusses and Lab nadir. During the Russian EVA in February 2006, they deployed a retired Orlan spacesuit configured as RadioSkaf (SuitSat), and photographed the Service Module aft. Thus, the Expedition 12 visited all six points of the "ISS compass."

Expedition 12 was reduced to two crew members six weeks prior to launch due to changes in the Space Shuttle schedule. The crew worked diligently through two EVAs, Soyuz and Progress operations, and repairs, maintenance, stowage, and Space Shuttle packing ahead of schedule. The crew's efforts yielded excellent results for science, exceeding the prelaunch requirements.

The crew used the amateur radio to reach people around the world - setting contact records for schools, states, countries, and continents. William McArthur was the first to confirm logging over 1,800 radio contacts with amateur radio operators worldwide, including all 7 continents, over 90 countries and all 50 states. The crew also set an amateur radio record of communicating with 38 schools worldwide. The crew conducted nine education demonstration activities, a record number, on such topics as "Living in Space" and "Food and Sleep." The crew reached over 17 million viewers via its live, in-flight education downlinks, the largest number of participants ever during a Space Station increment.

After completing 190 days in space, the Expedition 12 crew turned the ISS over to the Expedition 13 crew and returned to Kazakhstan in their Soyuz on April 9, 2006, along with visiting crew member (Brazilian) Marcos Pontes.

This was the fourth flight into space for William McArthur and the second flight into space for Valeri Tokarev. It was the second trip to the ISS for both. Valeri Tokarev first flew to the ISS on Discovery, STS-96, in 1999 activating the Zarya Control Module and preparing the ISS for further assembly. William McArthur's first space flight was on board the Space Shuttle Columbia, STS-58, in 1993 conducting biomedical research. In 1995, he was a crew member on board Atlantis, STS-74, the second Space Shuttle to dock with the Russian Space Station Mir. In 2000, on board Discovery, STS-92, William McArthur and his crewmates installed the first element of the ISS Integrated Truss System and the third Pressurized Mating Adapter during four EVAs on consecutive days.

The success of the twelfth expedition was an extremely important event in the history of the ISS Program and will contribute greatly to the future human exploration of the Solar System. The crew of Expedition 12 showed that through teamwork, humans could continue to live and work aboard the ISS during this prolonged period of reduced logistical support. The hard work, adaptability, and tireless devotion to duty exhibited by the crew during this historic mission reflect most highly upon themselves and demonstrate that they are very deserving of the Komarov Diploma.

ANNEX 5

U.S.A.
Nomination for the Fédération Aéronautique Internationale
Komarov Diploma

Nominee: **The Crew of STS-115**

Brent W. Jett, Commander, *NASA Astronaut*
Christopher J. Ferguson, Pilot, *NASA Astronaut*
Daniel C. Burbank, Mission Specialist, *NASA Astronaut*
Heidemarie M. Stefanyshyn-Piper, Mission Specialist, *NASA Astronaut*
Steven G. MacLean, Mission Specialist, *CSA Astronaut*
Joseph R. Tanner, Mission Specialist, *NASA Astronaut*

Affiliations: See above.

Suggested Citation:

For the successful completion of the STS-115 Space Shuttle mission which resumed assembly of the International Space Station (ISS) after a hiatus of four years.

Justification:

The STS-115 mission began with a successful launch on September 9, 2006. The original launch date had been slipped by several weeks because of weather and technical problems. In spirit of strong international partnership, the Russian Space Agency agreed to delay their pending Soyuz launch in order to accommodate NASA's STS-115 launch. The time between Atlantis' undocking and the Soyuz's arrival with the Expedition 14 crew was the shortest turnaround in ISS history.

The STS-115 mission involved one of the busiest timelines in the history of the Space Shuttle Program. Before Atlantis docked, her crew used the Orbiter boom sensor system, a 50-foot-long extension for the Space Shuttle's robotic arm, to inspect the reinforced carbon-carbon panels along the leading edge of Atlantis' starboard and port wings and the nose cap. Approaching the Space Station, Commander Brent Jett flew Atlantis through an orbital back-flip 600 feet below the ISS. This new rendezvous pitch-around maneuver allowed the Expedition 13 crew to photograph the Orbiter's heat shield from on board the ISS. During the mission, it was decided that a second focused inspection was required and Atlantis' crew once again performed this all-day task after undocking from the ISS. After orbital debris was spotted floating near Atlantis, the crew performed an unprecedented third on-orbit inspection to verify that the vehicle was in good health prior to re-entering Earth's atmosphere. These inspections provided ground controllers with the most thorough views of a Space Shuttle in space in the history of the Program.

Immediately after docking with the ISS, Christopher Ferguson and Daniel Burbank used the Space Shuttle's robotic arm to lift the mission's primary cargo, the P3/P4 truss from its berth in the payload bay and maneuvered it for handover to the Space Station's Canadarm2. After hatch opening, Steven MacLean and Expedition 13 Flight Engineer Jeffrey Williams used the Canadarm2 to take the truss from the Space Shuttle's robotic arm. Steven MacLean was the first Canadian to operate the Canadarm2 in space. Later in the mission, the crew also performed a highly complex "double walk off" of the Canadarm2 robotic arm, moving it from the Mobile Base System to the Destiny Lab in an inchworm-like procedure.

Three space walks were accomplished to install the P3/P4 integrated truss, deploy the solar arrays, and prepare them for operation. A new procedure called camp out was implemented in order to reduce the prebreathe time required prior to a space walk. The spacewalking astronauts spent the night in the Quest airlock before each space walk at a reduced atmospheric pressure. This purged nitrogen from their bodies in order to avoid the condition known as the bends. This was the first time that camp out was used, and it will serve as a model for future crews to greatly improve their efficiency, freeing up many hours of invaluable crew time. The first camp out was begun only hours after docking—another example of their extremely condensed timeline.

The first space walk was performed by veteran Joseph Tanner and rookie Heidemarie Stefanyshyn-Piper. They made multiple connections between the new P3/P4 truss and the existing ISS truss and released restraints on the solar array blanket boxes. Because of their extremely efficient work, they were able to complete all of their tasks in addition to several get-ahead tasks which enabled the second space walk to be completed on time. The second space walk was performed by first-time space walkers Daniel Burbank and Steven Maclean, who was also only the second Canadian to ever walk in space. They released launch locks on the solar alpha rotary joint and during this procedure one of the locks became stuck. It was only after extraordinary effort that this bolt was freed, allowing the P3/P4 module to operate. The third space walk was again performed by Joseph Tanner and Heidemarie Stefanyshyn-Piper, during which they deployed the radiator for P3/P4 and also replaced a communication antenna for the ISS. Without the extraordinary skill of these astronauts during these space walks the STS-115 mission would not have been a success and future construction of the ISS would have been in jeopardy.

Continuing in the spirit of international partnership, Atlantis' crew took part in several events with the Canadian and Ukrainian Heads of State through video and electronic correspondence. The highly successful STS-115 mission was completed with a nominal landing at the Kennedy Space Center, Florida, on September 21, 2006.

The success of the STS-115 mission was extremely important in returning to the normal assembly operational sequence for the International Space Station and will contribute greatly to the future of human space flight operations. This outstanding mission is highly deserving of the Komarov Diploma.

ANNEX 6

U.S.A.
Nomination for the Federation Aeronautique Internationale
Korolev Diploma

Nominee: **The STS-116 / Expedition 14 Crews**

Mark L. Polansky, Shuttle Commander, *NASA Astronaut*
William A. Oefelein, Pilot, *NASA Astronaut*
Joan E. Higginbotham, Mission Specialist, *NASA Astronaut*
Robert L. Curbeam, Mission Specialist, *NASA Astronaut*
Nicholas J. M. Patrick, Mission Specialist, *NASA Astronaut*
Sunita L. Williams, Mission Specialist, *NASA Astronaut*
Christer Fuglesang, Mission Specialist, *ESA astronaut*
Michael E. Lopez-Alegria, ISS Commander, *NASA Astronaut*
Mikhail Tyurin, Flight Engineer, *Russian Cosmonaut, RSC-Energia*

Affiliations: See above.

Suggested Citation:

For the successful completion of the STS-116/12A.1 mission by the STS-116 and Expedition 14 crews. Critical mission accomplishments included installation of the P5 truss segment, critical rewiring of the International Space Station (ISS), and configuring the solar arrays allowing for future assembly operations.

Justification:

The STS-116 mission began with the launch of Space Shuttle Discovery on December 10, 2006, from the Kennedy Space Center (KSC), Florida. Approaching the ISS, Commander Mark Polansky flew Discovery through an orbital back-flip 600 feet below the ISS to allow the Expedition 14 crew to photograph the Orbiter's heat shield. After docking, the crew wasted no time in getting started on the extremely challenging mission timeline. Using the Space Shuttle's robotic arm, Nicholas Patrick lifted the P5 truss out of Discovery's payload bay and handed it over to the Space Station's arm where it remained suspended overnight. The next day, during the first space walk of the mission, Robert Curbeam and Christer Fuglesang aligned and installed the P5 truss on the end of the P3/P4 truss, thereby extending the Space Station's backbone by 11 feet. The next major event was the retraction of the Space Station's P6 port-side solar array, providing enough clearance for the P4 solar array to begin tracking of the sun's motion. The P6 arrays were first deployed on the Space Station in November 2000 when they were delivered on STS-97. Fully extended, the solar array's 31 panels stretched 120 feet along a system of guide wires. The panels are designed to fold up, similar to an accordion, and retract along the guide wires into storage boxes attached to the truss. However, when the retract commands were issued, instead of folding neatly, the panels repeatedly became hung up and would not retract. After several hours, only 14 panels had been retracted, enough to allow the crew to continue the mission tasks.

The partial retraction cleared the way for the second space walk on the next flight day. During the second space walk, Robert Curbeam and Christer Fuglesang successfully reconfigured the power on Channels 2 and 3 of the Space Station's electrical system. Two days later, the third space walk was accomplished by Robert Curbeam and Sunita Williams. They were able to finish the power work on the outside of the Space Station, rearranging power on electrical Channels 1 and 4 Also during the third space walk, Robert Curbeam helped flight controllers retract six more solar array bays, leaving 11 exposed. In all, flight controllers initiated 71 commands. Commander Michael Lopez-Alegria and ISS Flight Engineer Mikhail Tyurin provided support from inside the spacecraft during the space walks and were able to replace a component of the ISS laboratory's carbon dioxide removal system to restore it to full operation during the space walks. With this activity completed, the Space Station was prepared for future additions of European and Japanese laboratory modules.

After the third space walk, only the issue of the partially retracted P6 solar array remained. Because the array needed to be fully retracted before the arrival of later Russian Soyuz modules, an additional space walk was approved to manually complete the full retraction. With still 11 of its 31 bays exposed, Sunita Williams and Joan Higginbotham used the Space Station's robotic arm to position the space walkers (Robert Curbeam and Christer Fuglesang) near the troublesome array, while Space Shuttle Pilot William Oefelein choreographed the activities outside. Robert Curbeam was on the Space Station's Canadarm2 robotic arm during the space walk. The space walkers worked on two problems believed to be experienced by the array. One was the apparent jamming of the guide wires in the grommets designed to guide them. The other was some backward, balky folding of hinges between solar panels that has been seen during attempts at retraction. As those issues were dealt with by the space walkers, crew members inside the spacecraft sent commands to further fold the array. After a 6 1/2-hour effort, the astronauts completed the job successfully accomplishing the full retraction of the solar array. In addition, the two space walkers also firmly secured some multi-layer insulation that had been installed on the robotic arm during an earlier space walk. As the only STS-116 crew member to participate in all four spacewalks, Robert Curbeam set a Space Shuttle Program record for the most space walks performed by one astronaut during a single mission.

The highly successful mission ended with a nominal landing on December 22, 2006, at KSC.

Due to their exemplary performance during the STS-116/12A.1 mission, the STS-116 and Expedition 14 crews are highly deserving of the Korolev Diploma. The assembly activities and the solar array restoration and repair on the highly demanding mission are very much aligned with the technical and engineering accomplishments required for the Korolev Diploma.