Fédération
Aéronautique
Internationale

Minutes

of the Annual Meeting of the

FAI Astronautic Records Commission

held in Lausanne, Switzerland
on 4 April 2008

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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 4 APRIL 2008, STARTING AT 09h15

MINUTES

Present:

M. Segismundo SANZ FERNANDEZ de CORDOBA	President
Mr. John F MILES	United Kingdom
Mr. Gregory T. OLIVER	USA

In attendance :

Mr Max BISHOP	FAI Secretary General
Mr Robert HUGHES	FAI General Projects Manager (partial attendance only)

Apologies:

Prof Antonio CASTELLANI	Italy
M. Christian MARCHAL	France
Mr. Ulf MERBOLD	Germany

1 WELCOME BY THE PRESIDENT

M. Segismundo SANZ FERNANDEZ de CORDOBA welcomed those attending, especially the new US delegate, Mr Oliver, whose first meeting this was.

2 APPROVAL OF THE MINUTES OF THE LAST MEETING

The minutes of the previous meeting (27 April 2007) were approved without correction.

The following matter arose from those Minutes:

Para 2: "Gold Space Medal" : It was pointed out that nominations for the Gold Space Medal might not arrive at FAI Headquarters each year until well after the date of the annual ICARE Meeting. The FAI Secretary General pledged that in such circumstances, all nominations would, in any case, be distributed to ICARE delegates for prior screening so that the collective views of ICARE could be passed on to FAI Vice Presidents before they took a final decision.

3. FAI GENERAL CONFERENCE

The ICARE President's report to the Santiago FAI General Conference, October 2007, is at **Annex 1**.

The FAI Secretary General's summary of main decisions taken by the last General Conference is at **Annex 2**.

4. ASTRONAUTICS ACTIVITIES AND PROJECTS

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

Spain: The ICARE President reported that ESA is suffering from funding problems, with the withdrawal of several military forces' backing. The Galileo project is progressing slowly due to disagreement over financing and control.

UK: Mr Miles reported that the "Starchaser" project was still active and had established a base in New Mexico (USA). More information was available on the "Starchaser" website at http://www.starchaser.co.uk/ Mr Miles described Starchaser's successful outreach programme, including school visits in the UK and New Mexico. **(Annex 3)**

USA: Mr Oliver reported that expeditions 14, 15 and 16 had been successfully completed, as well as space shuttle missions STS-115, STS-116, STS-117, STS-118, STS-120, STS-121, STS-122 and STS-123. He confirmed to delegates that eleven more shuttle flights were planned until the retirement of the shuttle fleet in 2010. Shuttle's replacement Constellation is due to enter service in 2013/14, and during the intermediary period Soyuz will be the only mechanism for ISS transfers. One of the planned Shuttle flights is to perform extensive maintenance on the Hubble telescope, in the expectation that Hubble will provide many more years service. NASA is preparing to re-visit the Moon in 2017 with the aim of creating a semi-permanent base there. **(Annex 4)**

5. FAI SPORTING CODE SECTION 8 (ASTRONAUTICS).

Simplification of Section 8.

It was noted that amendments made in 2006/7 had not yet been incorporated in FAI Sporting Code, Section 8. The FAI Secretary General agreed to produce an up-to-date copy of Section 8, to be dated 1 January 2008, which could then be used by Mr Miles as the basis for his work of simplifying the presentation of the document.

Mr Miles explained that the work would consist essentially of concentrating in Chapter 2 all definitions and conditions for the setting of records, as well as the revised equations and detailed calculations worked out by M. Marchal **(Annex 5)**

In addition, Mr. Miles, with M. Marchal's assistance, would clean up chapters 3, 4 and 5. He would pay a visit to Paris for discussions with M. Marchal,and would circulate a draft revision of the Section 8 to ICARE delegates in due course.

The ICARE President thanked Mr Miles for this work, and asked that a mention of the 100km boundary be placed in Chapter 6.

6. PROPOSALS FOR FAI AWARDS

a. Yuri Gagarin Gold Medal: A nomination had been received from USA for this medal to be awarded to the crew of International Space Station Expedition 16 (citation attached, **Annex 6**). ICARE unanimously approved this award.

b. Komarov Diploma: Two nominations had been received from the USA delegate for the Komarov Diploma to be awarded to the crews of STS Mission 117 and International Space Station (ISS) Assembly Mission 13A and Increment 15 (Citation attached, **Annex 7**); and to the crews of STS Mission 118 and ISS Assembly Mission 13A and Increment 15 (**Annex 8)**. ICARE unanimously

approved both nominations, subject to NAA approval and the redrafting of the citations to meet the requirements of FAI By Laws.

c. Korolev Diploma: A nomination had been received from USA for this Diploma to be awarded to the crew of STS-120 / International Space Station Increment 16. (Citation attached, **Annex 9**). ICARE unanimously approved this award, subject again to NAA approval and the redrafting of the citations to meet the requirements of FAI By Laws.

7. INTERNATIONAL ASTRONAUTIC FEDERATION

The ICARE President reported that no ICARE representative had been able to attend the 2007 IAF Congress in India, and that there was therefore no report to present to ICARE. The duration of the congress made it difficult to attend, as there had to be a commitment to be present for the whole duration of the event. The 2008 Congress was due to be held in Glasgow. The ICARE President was nominated to represent FAI, but advised that he may not be able to attend. The Vice President, Mr Miles offered to attend the FAI General Conference in St Vincent/Aosta (held at the same time of year) if the ICARE President so wished.

8. WORLD RECORDS

ICARE took note that the following records had been ratified since the last meeting:

a. Absolute Record - General Category

Assembled mass of spaceships linked in flight : 342 622.5 kg

Date of flight: 22/08/2007
Astronaut(s): STS-118 and ISS 13.A.1. crews members (International), Scott KELLY (USA), Charles HOBAUGH (USA), Tracy CALDWELL (USA), Rick MASTRACCHIO (USA), Alvin Drew (USA), Barbara MORGAN (USA), Dave WILLIAM (Canada), Fyodor YURCHIKHIN (Russia), Oleg KOTOV (Russia), Clay ANDERSON (USA)
Course/place: NASA Kennedy Space Center, FL (USA)

Spacecraft:
Space Shuttle Orbiter "Endeavour" & International Space Station

ratified on 14/01/2008 | Database ID 14790

b. Absolute Record - General Category

Total duration of flight of spaceships while linked : 10 days 21 h 52 min 15 sec

Date of flight: 07/11/2007
Astronaut(s): STS-120 and ISS 16 crews members (International), Pamela A. MELROY (USA), Peggy WHISTON (USA), George ZAMKA (USA), Scott PARAZYNSKI (USA), Doug WHEELOCK (USA), Paolo NESPOLI (Italy), Daniel TANI (USA), Clayton ANDERSON (USA), Yuri MALENCHENKO (Russia)
Course/place: Kennedy Space Center, FL (USA)

Spacecraft:
Space Shuttle Orbiter "Discovery" & International Space Station

ratified on 31/03/2008 | Database ID 14856

ICARE also noted that the following claims were awaiting ratification:

Absolute Record
General Category

Assembled mass of spaceships linked in flight : 367 964 kg

Date of flight: 25/03/2008
Astronaut(s): STS-123 and ISS 16 crews members (International), t.b.a.
Course/place: Kennedy Space Center, FL (USA)

Spacecraft:
_to be advised

preliminary record claim received | Database ID 15004

Absolute Record
General Category

Total duration of flight of spaceships while linked : 11 days 20 hours 35 minutes

Date of flight: 25/03/2008
Astronaut(s): STS-123 and ISS 16 crews members (International), t.b.a.
Course/place: Kennedy Space Center, FL (USA)

Spacecraft:
_to be advised

preliminary record claim received | Database ID 15010

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, reported that he would represent ICARE at the FAI Aviation and Space Education Commission (CIEA) meeting in Lausanne later in April.

10. ELECTIONS

The following were re-elected for 2008/2009 :

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 17 April 2009 at 09h15.

FEDERACION AERONAUTICA INTERNACIONAL

VICEPRESIDENTE

PRESIDENTE DE LA
COMISION INTERNACIONAL DE RECORDS ASTRONAUTICOS (ICARE)

REPORT FROM ICARE PRESIDENT
101st FAI General Conference, Rhodes, Greece, October 2007

1.- General Activities of ICARE Committee 2005/2006

The ICARE Committee held its annual meeting on April 27, 2007, 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, Lausanne on May / June 2007.

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

2.- Gold Space Medal

The Commission was informed that, at the FAI General Conference in Santiago, Chile, it was decided to unify the procedures for the awarding of both, the Gold Space Medal and the Gold Air Medal as the highest awards to be presented by FAI. Consequently the Gold Space Medal awarding will require always, from now on, the favourable vote of the majority of the Vice Presidents of FAI, and the ICARE Commission will no longer present as such Commission a candidate for the award as it was done in the past.

The Commission thanks the Statutes Working Group for the implementation of this modification.

2.- The 100 Km altitude (Karman line) separating Aero & Astronautics

Meetings with the Presidents of Aeronautical Sports Commissions demonstrated those Commissions are unwilling to limit Aeronautical Records to flights never surpassing the Karman line. So they may, as they have done in the past, award Aeronautic records for flights surpassing at some point that 100 Km altitude line.

ICARE, by our own rules (that we are unwilling to change) is only awarding records for Space flights, i.e. flights surpassing at some point the 100 Km altitude boundary between Aeronautics and Astronautics, as defined in our Sporting Code.

Most Space flights have a part of it under the Karman line (both for take off and re entry). This was not very important in the past, when that part of the flight was insignificant compared with the total flight. However, the current interest for sub orbital missions (interest opened by the flight of SpaceShipOne), with a significant part of the flight in Aeronautical (atmospheric) conditions, has opened a way for the same flight and the same performance being candidate to both, an Aeronautic and an Astronautic Record. Our Commission considers this is not the best way to go ahead.

Consequently, our Commission is moving towards the objective of limiting our records to just the part of the performance above the Karman line at least when the atmospheric part of the flight may significantly change the record.

FEDERACION AERONAUTICA INTERNACIONAL

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As an example, distance records for Astronautic sub orbital flights, was up to now measured between the place of take off and land on Earth's surface. This was sensible when sub orbital flights were basically parabolic. Nowadays, there may be a significant part of that distance covered by gliding in atmospheric conditions. Thus we are changing the record to the distance travelled outside the Karman line, leaving the rest to possible Aeronautic records.

We are moving carefully, to make sure that significant performances are not left unrecognised just because aeronautics and astronautics are starting to get closer and not so well separated as they were in the past. But we think this is the way to go ahead if we want to keep our prestige as a sound record registering authority.

Dr. S. Sanz Fernández de Córdoba
ICARE President

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FAI SECRETARY GENERAL'S REPORT REPORT TO ICARE – LAUSANNE - 4 APRIL 2008

FAI GENERAL CONFERENCE – RHODES, GREECE, OCT 2007

Main decisions:

1. Establishment of a new Technical Commission:

FAI Navigation and Airspace Commission (NAVAC)

This Commission held its first meeting on 19 March in Paris. Its main roles will be to collect information from all member countries about the impact of regulatory decisions on air sports, suggest ways of influencing regulatory processes, and determine FAI policy positions on matters concerning electronic navigation and anti-collision devices and access to airspace.

2. Creation of a new Working Group:

Unmanned Aerial Vehicles (UAV) Working Group

This Group will work on defining what a UAV is, by comparison with a model aircraft, and on defining a FAI policy for how sporting and recreational aircraft of all kinds can share airspace with UAVs.

3. Decision to offer a once-only **5% discount** to all FAI Members on 2008 FAI Scale of Subscriptions. This discount was made possible by FAI's signature of a service contract with the **Red Bull Air Race** organization. FAI provides safety supervision of these races.

4. Decision that the central **FAI Sporting Licence Database** would become **mandatory** from **1 January 2009.** After that date, Sporting Licences would not be recognized unless the basic details of the licence-holder (name, date of birth, licence number) had been up-loaded onto this database.

5, FAI **Commissions** are now authorized, if they so wish, to elect their **Bureau** (President, Vice-Presidents, Secretary) for a **two-year term** instead of a one-year term, provided that the Commission Plenary so decides by a two-thirds majority.

6. It was confirmed that, in Commission meetings, a **secret ballot** must be held to elect each officer, **even when there is only one candidate for a post**. However, the Statutes Working Group is tasked with reviewing this rule.

7. The **2008 General Conference** will be held in the **Aosta** Valley, not far from the site of the 2009 World Air Games in Turin. The **2009 General Conference** will be in **Incheon, Korea.**

8. A **new CASI President** was elected: Henk MEERTENS, an Australian glider pilot and NAC President.

WORLD AIR GAMES

2009:

A launching Press Conference was held in Turin on 4 February. All Liaison officers are in touch with their Italian counterparts and planning is proceeding.

OTHER MATTERS

New Staff Member: A new member of staff (General Projects Manager) started work in Lausanne on 3 March 2008 – Mr Rob Hughes.

IAOPA Cooperation: Attempts are being made to improve cooperation at ICAO between FAI and IAOPA on matters affecting sporting aviation.

Brazil: The Executive Board has withdrawn international sporting powers from Brazil pending resolution of the internal battles being fought there.

TV Coverage: Following the successful distribution in 2007 of a 13-part series featuring FAI Championships , agreement has been reached with Flying Aces in London for a further such series in 2008.

Max Bishop 7 April 2008

John Miles

From: Steven Bennett [sbennett@starchaser.co.uk]
Sent: Thursday, April 03, 2008 3:17 PM
To: John Miles
Cc: 'Paul Young'; 'Adrienne Bennett'; 'Brown, Michael'
Subject: Starchaser Statement

Dear John,

Further to your recent request, please find our short statement with regards to plans for Manned Spaceflight as follows;

> Starchaser Industries (Starchaser) is a privately held, high technology company that specialises in the development, operation and commercialisation of space related products and services.
>
> Starchaser Industries has been one of, possibly the only, European space tourism related company to achieve significant private venture investment and significant commercial sponsorship which has funded real development and tests of technology. In 2007 Starchaser successfully bid for, won and delivered a €150,000 European Space Agency Study Contract entitled "Study of European Privately-Funded Vehicles for Commercial Human Space Flight".
>
> Starchaser's many projects to date have included the development of reusable liquid and hybrid propulsion systems and return to origin space capsule ram air parachute systems. Starchaser is currently working on the development of a reusable, low acceleration liquid propellant vehicle that would be offered for sounding rocket and space tourism applications.

Best regards,

Steve Bennett

UNITED STATES HUMAN SPACE FLIGHT ACTIVITIES FOR 2007

Mission: STS-117/ISS-13A

Shuttle Crew:

Commander:	Rick Sturckow
Pilot:	Lee Archambault
Mission Specialist:	Patrick Forrester
Mission Specialist:	John "Danny" Olivas
Mission Specialist:	Jim Reilly
Mission Specialist:	Steven Swanson
Expedition 15/16 Crew (Up):	
Flight Engineer:	Clayton Anderson
Expedition 15 Crew (Down):	
Flight Engineer:	Sunita Williams

Orbiter:	Atlantis
Launched:	8 June 2007
Landed:	22 June 2007

Primary Mission Objective:
The mission delivered the second and third integrated truss segments (S3/S4) and a pair of solar arrays to the International Space Station. Expedition 15 Flight Engineer Sunita Williams returned to Earth from the Space Station aboard Shuttle mission STS-117. This flight carried Expedition 15/16 Flight Engineer Clayton Anderson to the Station.

Mission: STS-118/ISS-13A.1

Shuttle Crew:

Commander:	Scott Kelly
Pilot:	Charles Hobaugh
Mission Specialist:	Alvin Drew
Mission Specialist:	Barbara Morgan
Mission Specialist:	Tracy Caldwell
Mission Specialist:	Rick Mastracchio
Mission Specialist:	Dave Williams (CSA)

Orbiter: Endeavour

Launched: 8 August 2007
Landed: 21 August 2007

Primary Mission Objectives:
Space Shuttle Endeavour's STS-118 mission was the 22nd Shuttle flight to the International Space Station. Space Station construction was continued with the delivery and installation of an integrated truss segment (S5). Four space walks were conducted, including one to replace a failed Control Moment Gyroscope used to maintain the Station's orientation. Barbara Morgan served as the first educator mission specialist on this flight.

Mission: STS-120/ISS-10A

Shuttle Crew:

Commander:	Pamela Melroy
Pilot:	George Zamka
Mission Specialist:	Scott Parazynski
Mission Specialist:	Stephanie Wilson
Mission Specialist:	Doug Wheelock
Mission Specialist:	Paolo Nespoli (ESA)

Expedition Crew 16 Crew (Up):

Flight Engineer:	Daniel Tani

Expedition Crew 15/16 Crew (Down):

Flight Engineer:	Clayton C. Anderson

Orbiter: Discovery

Launched: 23 October 2007
Landed: 7 November 2007

Primary Mission Objectives:
STS-120 launched the Node 2 connecting module, Harmony for installation on the Station. This module serves as a passageway between the U.S. segment of the Station to the European and Japanese modules. As part of the assembly task for this mission's five space walks, STS-120 astronauts also relocated the Port 6 truss element and solar arrays to a permanent position.

UNITED STATES HUMAN SPACE FLIGHT
ACTIVITIES FOR 2008

Mission: STS-122/ISS-1E

Shuttle Crew:
Commander: Steve Frick
Pilot: Alan Poindexter
Mission Specialist: Leland Melvin
Mission Specialist: Stanley Love
Mission Specialist: Hans Schlegal (ESA)
Mission Specialist: Rex Walheim
Expedition 16 Crew (Up):
Flight Engineer: Leopold Eyharts (ESA)
Expedition 16 Crew (Down):
Flight Engineer: Daniel Tani

Orbiter: Atlantis

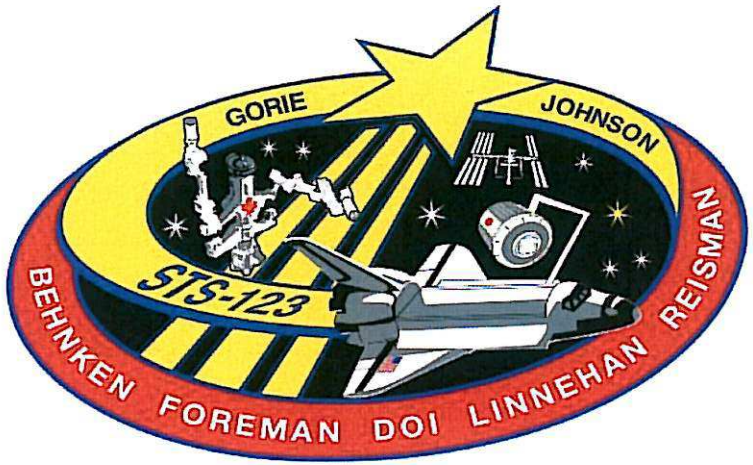
Launched: 7 February 2008
Landed: 20 February 2008

Primary Mission Objectives:
On this mission the European Space Agency's research module, the Columbus laboratory, was delivered to the International Space Station, attached to the Harmony node, activated and outfitted for use. Shuttle astronauts performed three space walks during the STS-120 mission, including one to replace a nitrogen tank used to pressurize the Station's ammonia cooling system.

Mission: STS-123/ISS-1J/A

Shuttle Crew:

Commander:	Dominic Gorie
Pilot:	Gregory Johnson
Mission Specialist:	Mike Foreman
Mission Specialist:	Rick Linnehan
Mission Specialist:	Takao Doi (JAXA)
Mission Specialist:	Robert Behnken
Expedition Crew 16/17 (Up):	
Flight Engineer:	Garrett Reisman
Expedition Crew 16 (Down):	
Flight Engineer:	Leopold Eyharts (ESA)



Orbiter: Endeavour

Launched: 11 March 2008
Landed: 26 March 2008

Primary Mission Objectives:
Endeavour's 16 day flight has been the longest Shuttle mission to the International Space Station to date. Five space walks were conducted, during which the first pressurized component of the Japanese Kibo laboratory, the Experiment Logistics Module, was attached to the Station. The Dextre Robotics System for the Station was assembled and installed during this mission as well.

INTERNATIONAL SPACE STATION EXPEDITIONS FOR 2007

Expedition 14: The Commander and First Flight Engineer were launched to the International Space Station on ISS Soyuz 12. This expedition lasted 215 days. The Commander and First Flight Engineer returned to Earth on ISS Soyuz 13.

Crew:

Commander:	Michael Lopez-Alegria
Flight Engineer 1:	Mikhail Tyurin (Roscosmos)
Flight Engineer 2:	Thomas Reiter (ESA)
Flight Engineer 2:	Sunita Williams

Launched:	18 September 2006
Docking:	20 September 2006
Mission End:	21 April 2007

Expedition 15: The Commander and First Flight Engineer were launched to the International Space Station on ISS Soyuz 14. This expedition lasted 195 days. The Commander and First Flight engineer returned to Earth on ISS Soyuz 14.

Crew:

Commander:	Fyodor Yurchikhin (Roscosmos)
Flight Engineer 1:	Oleg Kotov (Roscosmos)
Flight Engineer 2:	Sunita Williams
Flight Engineer 2:	Clayton Anderson

Launched:	7 April 2007
Docking:	9 April 2007
Mission Ended:	21 October 2007

Expedition 16: The Commander and First Flight Engineer were launched to the International Space Station on ISS Soyuz 15.

Crew:

Commander:	Peggy A. Whitson
Flight Engineer 1:	Yuri Malenchenko (Roscosmos)
Flight Engineer 2:	Clayton Anderson
Flight Engineer 2:	Garrett E. Reisman
Flight Engineer 2:	Daniel M. Tani
Flight Engineer 2:	Leopold Eyharts (ESA)

Launched:	10 October 2007
Docking:	12 October 2007
Mission End:	Spring 2008

REMAINING SPACE SHUTTLE / INTERNATIONAL SPACE STATION MANIFEST FOR 2008

Date	Flight	Vehicle	Element(s)
31-May-08	STS-124/ISS-1J	Space Shuttle Discovery	Kibo Japanese Experiment Module; Japanese Remote Manipulator System
28-Aug-08	STS-125	Space Shuttle Atlantis	Fifth and final servicing mission to the Hubble Space Telescope
16-Oct-08	STS-126/ISS ULF-2	Space Shuttle Endeavour	Multi-purpose Logistics Module
4-Dec-08	STS-119/ISS 15-A	Space Shuttle Discovery	Fourth starboard truss segment

Note: Russian Progress and Soyuz flights, (and ESA ATV Flights) to the International Space Station are not listed.

Interesting web sites:

http://spaceflight.nasa.gov

http://spaceflight.nasa.gov/realdata/sightings/index.html

ANNEX 5

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33 1 46 73 49 52 or 33 1 47 83 60 49
<christian.marchal@onera.fr>

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 :

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

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

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

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 $\alpha \leq 168°$:

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

that is :

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

D 2) In all cases :

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

that is :

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

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

Expedition 16 (USA 2007)

The crew of Expedition 16, Commander Peggy Whitson, NASA Astronaut, Soyuz Commander Yuri Malenchenko, RSA Cosmonaut and Flight Engineer Dan Tani, NASA Astronaut for their record setting activities which were crucial to the continued construction of the International Space Station (ISS).

Justification: The Expedition 16 crew was instrumental in the installation of the Node 2 Harmony module to its permanent location on the front of the US laboratory, the inspection and data gathering of critical samples to understand the anomaly found on the Solar Alpha Rotary Joint (SARJ) and finally, the critically timed Bearing Motor Roll Ring Module (BMRRM) repair.

The increment stage operations started with the arrival of STS 120 which included the addition of the Harmony module to the ISS and the relocation of the P6 Solar Array. During this mission, the Expedition 16 crew was thoroughly involved with the nominal tasks as well as the contingency tasks which occurred as a result of the torn solar array. Peggy Whitson and Pam Melroy identified the solar array tear and worked hand in hand with the control teams to determine the extent of the damage and the repair options. Dan Tani was instrumental in the success of the extremely complex robotic operations which involved the first time use of the Candarm2 and the Orbital Boom Sensor System (OBSS) as an EVA platform for the solar array tear. That was just the start of a very demanding stage.

Shortly after the STS 120 mission, Peggy Whitson and Yuri Malenchenko performed the first of three planned Extravehicular Activities (EVA, space walks) to prepare the Harmony module to move to its permanent location on the front of the US laboratory. This flawless EVA was followed by extensive robotic arm operations for the module reconfiguration. Dan Tani and Peggy Whitson used the Canadarm 2 to remove the Pressurized Mating Adapter (PMA) 2 from the US Laboratory, connect it to the Node2, and then the Node2 and PMA2 were moved together to the front of the US laboratory. Subsequently, Peggy Whitson and Dan Tani performed the second and third EVAs to transfer two Node 2 electrical trays to the interface between Node 2 and the US Laboratory to provide permanent power, data and thermal connections.

In addition, during the STS 120 mission, it was noticed that there was some unexplained damage to the starboard SARJ. Further investigation during the STS 120 mission was deferred in order to accommodate the complex torn solar array EVA. As a result, an additional EVA was added to the Increment 16 stage to investigate the source of the metal shavings on the SARJ. Peggy Whitson and Dan Tani performed the fourth stage EVA to open panel covers and take shaving samples on the SARJ and remove the Trundle Bearing Assembly for further investigation.

With the starboard solar array not free to rotate, power available for the ISS was degraded. This situation became critical when one of the four Beta Gimbal Assemblies (BGA) on the port side failed. With only one of three solar array wings fully operational, there would not be enough power available for additional modules to be added, which would halt further ISS construction and addition of International Partner modules on future Shuttle flights. It was imperative that the BGA be removed and replaced.

A fifth contingency stage EVA for the BGA removal and replacement was designed by the ground team and flawlessly performed by Peggy Whitson and Dan Tani. Although neither of them had practiced these tasks prior flight, this highly choreographed BGA removal and replacement was performed with enough time for them to perform further inspection of the starboard SARJ. This record number of stage EVAs could have only occurred with the expert assistance of Yuri Malenchenko from inside during each EVA, while simultaneously monitoring and ensuring normal operations of the entire ISS.

Their stage work together was unquestionably the most difficult and demanding to date and allowed the ISS to be returned to a configuration for additional modules to be added. These three crewmembers performed tirelessly to ensure the necessary growth of the International Space Station, paving the way for the European and Japanese modules. For their true international efforts to establish the International Space Station as a permanent outpost and their unique contributions to the exploration of space, the National Aeronautic Association is proud to nominate the Expedition 16 stage crew for the Yu A. Gagarin Gold Space Medal.

2007 **Crew of STS Mission 117 (International)**

The crew of STS 117:
Rick Sturckow, Commander NASA Astronaut
Lee Archambault, Pilot, NASA Astronaut
Patrick Forrester, Mission Specialist, NASA Astronaut
Steve Swanson, Mission Specialist, NASA Astronaut
James Reilly, Mission Specialist, NASA Astronaut
Daniel Olivas, Mission Specialist, NASA Astronaut
Clayton Anderson, Mission Specialist, NASA Astronaut
International Space Station (ISS) Assembly Mission 13A along with the Increment 15:
Fyodr Yurchikhin, Commander, RSA Cosmonaut
Oleg Kotov, Flight Engineer, RSA Cosmonaut
Sunita Williams, Flight Engineer, NASA Astronaut
The success of the STS-117/Increment 15 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.

Justification: The STS-117 mission began with a successful launch on June 8, 2007. While en-route to the International Space Station, the Atlantis crew executed multiple techniques to inspect vehicle's thermal protection system for any damage. During the inspection and through photography from the ISS along with imagery from flight day 1 it was determined that there had been damage to the port OMS pod blanket.

Immediately after docking with the ISS, the Shuttle crew used the Space Shuttle's robotic arm to lift the mission's primary cargo, the S3/S4 truss from its berth in the payload bay and maneuvered it for handover to the Space Station's Canadarm2. Subsequently, this arm was utilized to install the S3/S4 integrated truss. Four space walks were accomplished to install the S3/S4 integrated truss, deploy the S4 solar arrays, and prepare them for operation along with retracting the P6 2B channel solar array so the Solar Alpha Rotary Joint (SARJ) could be rotated. A fourth spacewalk was added during the flight in order to fix a blanket on the OMS pod and install a hydrogen vent line. Without the extraordinary skill of these astronauts during these space walks the STS-117 mission would not have been a success and future construction of the ISS would have been in jeopardy.

The STS-117 mission was completed with a nominal landing at Edwards Air Force Base in California after two attempts for landing at the Kennedy Space Center, Florida. This outstanding mission is highly deserving of the Komarov Diploma.

2007 **Crew of STS Mission 118 (International)**

The crew of Space Shuttle Mission - STS 118
Scott Kelly, Commander, NASA Astronaut
Charlie Hobaugh, Pilot, NASA Astronaut
Tracy Caldwell, Mission Specialist, NASA Astronaut
Rick Mastracchio, Mission Specialist, NASA Astronaut
Barbara Morgan, Mission Specialist, NASA Astronaut
Dave Williams, Mission Specialist, CSA Astronaut
Alvin Drew, Mission Specialist, NASA Astronaut
International Space Station (ISS) Increment 15 crew:
Fyodor Yurchikin, Commander, RSA Cosmonaut
Oleg Kotov, Flight Engineer, RSA Cosmonaut
Clayton Anderson, Flight Engineer, NASA Astronaut
The success of the Space Shuttle STS-118 mission in concert with the ISS Increment 15 crew was extremely important in returning to the normal assembly operational sequence for the International Space Station and contributed greatly to the future of human space flight operations.

Justification: The STS-118 mission began with a successful launch of the space shuttle Endeavour on August 8, 2007. This mission marked the first flight of Endeavour since December 2002, following a lengthy modification period.
Before Endeavor docked, her crew performed both a robotic arm inspection of the thermal protection system, as well as, performed the rendezvous pitch maneuver, enabling the Expedition 15 crew to fully photograph the Orbiter's heat shield. These inspections revealed damage to one of the thermal protection tiles on the underside of the orbiter.

During the docked period, the combined Space Shuttle/ISS crew completed four extravehicular activities (EVA's), transferred approximately 6,000 pounds of food, water and other cargo to the ISS and returned 4,000 pounds. All mission objectives relevant to ISS including, but not limited to, installation of the S5 truss segment, replacement of Control Moment Gyroscope (CMG) 3, and installation of the unpressurized carrier External Stowage Platform (ESP)-3 were completed, flawlessly.

After further inspections and engineering analysis, the decision was made land as is, versus the risk of further damaging the TPS. The management team did decide to cut the mission short by one day, in response to the potential of Hurricane Dean threatening the Houston Mission Control Center. The STS-118 mission was completed with a nominal landing at the Kennedy Space Center, Florida on August 21, 2007. This outstanding mission is highly deserving of the Komarov Diploma.

2007 **Crew of STS Mission 120 (International)**

The STS 120 Space Shuttle crew:
Pamela Melroy, Commander, NASA Astronaut
George Zamka, Pilot, NASA Astronaut
Scott Parazynski, Mission Specialist, NASA Astronaut
Doug Wheelock, Mission Specialist, NASA Astronaut
Stephanie Wilson, Mission Specialist, NASA Astronaut
Paolo Nespoli, Mission Specialist, ESA Astronaut
Dan Tani, Mission Specialist, NASA Astronaut
International Space Station Increment 16 crew:
Peggy Whitson, Commander, NASA Astronaut
Yuri Malenchenko, Flight Engineer, RSA Cosmonaut
Clayton Anderson, Flight Engineer, NASA Astronaut

The success of the STS-120/ISS 10A mission was critical in allowing the European and Japanese modules to be added to the International Space Station; while the crew responded to multiple significant ISS anomalies. The crew's exceptional professionalism and "can do" spirit contributed greatly to the future of human space flight operations.

Justification: The STS-120 mission began with the successful launch of the space shuttle Discovery on October 23, 2007. This extremely complex mission was planned for 15 days. Integrated EVA and robotic operations were used to install Node 2, Harmony module, to the ISS and relocate the P6 truss. Not only were these major objectives completed, but the mission was re-planned numerous times as discrepancies with the Solar Array Rotary Joint (SARJ) and the P6 solar array were discovered.

During EVA 2 operations, Dan Tani translated to the starboard SARJ for a contingency inspection and discovered serious debris contamination. This unexplained anomaly required a full re-planning the remaining EVAs to further investigate.

During EVA 3 truss assembly operations, the crew successfully extended the 2B solar array; however, halted extension of the 4B solar array when a large tear was observed. With the solar array partially deployed, neither the SARJ nor the Beta Gimbal Assembly could be rotated to aim the solar arrays toward the sun to generate power. Additionally, the SARJ contamination prohibited it from being rotated. With the inability to rotate the solar arrays as needed, a fix for the torn solar array became the primary focus for the mission.

On EVA 4, the robotic arms were uniquely configured to position the crew at the remote site of the damage. The home-made solar array hinge stabilizers, "cuff links", were used to successfully reconnect the sections of the array. Once the torn sections of the array were successfully reconnected, the team was able to finish the solar array deployment; regaining power generation capability.

Without the extraordinary skill of these astronauts during these space walks, the STS-120 mission would not have been a success and future construction of the ISS would have been in jeopardy.

The STS-120 mission was completed with a nominal landing at the Kennedy Space Center in Florida on November 7th, 2007. This outstanding mission is highly deserving of the Korolev Diploma.