Memorandum of Understanding

For Collaboration in the Integration, Testing and Operation of the AMS Experiment between the Participating Institutions/Funding Agencies

Preamble

(a) The AMS Collaboration is a partnership of physicists and engineers belonging to Institutes, supported by Funding Agencies (Annexes 1, 2 and 3), whose objective is designing, constructing, testing and operation of the AMS-02 detector. This is a state-of-the-art precision magnetic spectrometer (Annexes 4, 5 and 6) that will use the unique environment of space to advance knowledge of the Universe and lead to scientific results regarding the matter-energy balance of the Universe, its origin and evolution. More precisely, the science objectives of AMS-02 are to search for primary cosmic anti-matter (i.e. anti-helium or heavier elements), dark matter (i.e. supersymmetric particles) and measure the relative abundance of elements and isotopes in primary cosmic rays to understand its propagation and confinement in the galactic space.

(b) The different partners have secured the support of their Funding Agencies to enable them to participate in the AMS Collaboration. They approved the experiment, which includes a precursor flight in June 1998 on the shuttle Discovery (AMS-01) and a flight on the International Space Station (ISS). The Memorandum of Understanding (MoU) among the parties for the precursor flight (AMS-01) is included in the present document (Annex 7). It is foreseen to transport AMS-02 to the ISS with the UF-4 flight, scheduled for the fall of 2007.

(c) The NASA/DOE Implementation Plan (Annex 8) reflects an implementing agreement between the US Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA) with respect to the AMS experiment.

(d) In 1997 the European Organization for Nuclear Research (CERN) accepted the AMS experiment as a “Recognized Experiment” (CERN/DG/RB 97-261). On December 2003, CERN and the AMS Collaboration have signed a new MoU (Annex 9) with a duration of five years renewable. It foresees the establishment at CERN of the Payload Operations and Control Centre (POCC), the Science Operations Centre (SOC), assembly and testing areas, office space and secretarial support.

(e) Agreement to this collaboration is effected through the present MoU between the participating partners. It defines the Collaboration and its objectives, and the rights and obligations of the collaborating Institutes.

(f) This MoU is not legally binding, but the signatories recognise that the success of the Collaboration depends on all its members adhering to its provisions. Financial contributions are subject to availability of budgetary funds. Financial decisions will be dealt with, in the first instance, by the Collaboration. The escalation line starts with the Financial Review Board, which eventually elevates to the RIB, then to the Spokesperson. (see Article 3).

Article 1: Purpose

1.1. This MoU defines the phases of integration, testing, operation and exploitation of the AMS detector. Its purpose is to define the programme of work to be carried out and the distribution of the charges and responsibilities for its execution. It sets out organisational, managerial and financial guidelines to be followed by the Collaboration.

1.2. These phases comprise the transportation, assembly, and commissioning of the complete detector at CERN, the final testing stages at ESA ESTEC (Noordwijk), transportation to the Kennedy Space Centre (KSC) and the final installation on board of UF-4. This is followed by the initial operation at the NASA (KSC and JSC) and CERN headquarters and the running and exploitation of the experiment conducted through the POCC and SOC at CERN.

Article 2: Parties

2.1. The Parties shall be all the legal entities (Institutions/Funding Agencies, as appropriate), of the Collaboration with the authority to sign up this protocol. They and their duly authorised representatives are listed in Annex 1. A legal entity may be an Institute, a Funding Agency or an established institution acting on behalf of one or more funding agencies. Annex 2 shows the Institutes/Operative Units with the relevant contact persons.

2.2. The **Collaborating Institute(s)**/**Operative Units** and the AMS Collaboration will hereinafter be referred to as “Institute(s)” and “Collaboration”, respectively.

2.3. The names of the scientists/engineers currently participating in the Collaboration are listed by country and Institute in Annex 3.

2.4. The Institutes set up the Institution Board (IB) (see Annex 0). This body endorses all the important decisions related to AMS technical construction and scientific conduction. It also endorses the financial requests for common items which will be presented to the Finance Review Committee (FRC). It is chaired by the Spokesperson of the Collaboration.

2.5. Representatives of the Parties constitute the Finance Review Committee (FRC). This body reviews and endorses all the important financial matters for common items for AMS.

Article 3: Funding

3.1. All cost figures in this MoU are expressed in Swiss Francs, based on estimates valid on January 2004.

3.2. Any Institute that wishes to join the Collaboration during the period of validity of this MoU will be expected to make an appropriate contribution to the funding of the experiment. In the event that the detector assembly is already fully funded, the new Institute will have to make a special contribution to be negotiated with the IB.

3.3. Integration, Testing and Operation costs (see Article 6) shall be participated by the Parties through transfer to a Common Fund that will be established via a dedicated account at CERN or in kind contributions (Annex 0). The Common Fund will be managed and operated by the Resource Manager. All Common Fund operations will be monitored by the FRC.

3.4. In the event of cost overruns or lack of funds for Common Items, these will first be brought by the Institute(s) concerned to the attention of the IB. The IB will propose ways of accommodating such overruns, including descoping if other ways cannot be found, and seek the endorsement of the FRB.

Article 4: Duration and Extensions

4.1. This MoU is valid for the assembly period and first operation of the AMS detector, plus three years of operation.

4.2. It may be extended at any time by mutual agreement of the Parties.

4.3. Any Institute/Funding Agency may withdraw its support from the Collaboration by giving notice in writing to the Spokesperson of the Collaboration. In such an event, a reasonable plan of disengagement from the Collaboration will be negotiated through the IB.

Article 5: Detector Construction and sharing of responsibilities for its execution

5.1. The subsystems for the AMS experiment are listed in Annex 4.

5.2. The total construction work for the detector is divided into sub-system build-ups, which will be the responsibility of one or more Institutes.

5.3. The technical and financial participation and the responsibility of the Institutes in this task is set out in Annex 5.

5.4. An overview of the foreseen construction and integration schedule is presented in Annex 6.

5.5. The Institutes, supported by their Funding Agencies, will make their best efforts to design, produce final prototypes, construct, calibrate, transport, assemble, install, integrate and commission the deliverables, within the limits of their resources including funding.

Article 6: Integration, Testing and Operation, Science Management Plan

6.1. This comprises the contributions to the AMS02 infrastructure including restructuring of space at CERN for the AMS-02 experiment; pre-operation costs, computing support relevant to the POCC and SOC facilities.

6.2. Contributions to this item will be made by the Parties via the Common Fund. They are specified in Annex 10.

6.3. The responsibilities for operation of the AMS detector will be laid down in a separate document.

6.4. The scientific data collected by the AMS-02 experiment will be initially analysed by the AMS Collaboration. They will then be released and made available to the scientific community after a time and with a format described in a separate document.

Article 7: Obligations

7.1. The general obligations of the Parties are listed in the document “General Conditions applicable to Experiments Performed at CERN” (addendum within Annex 9.).

7.2. Regulations and rules regarding the safety of personnel and the insurance of damage are set forth in 0Further details regarding the insurance of AMS scientific equipment brought to CERN are laid out at CERN’s DG letter dated December 15, 2003 (DG/LM/sm/2003-3045, addendum to Annex 11).

7.3. All equipment brought to the CERN site must comply with CERN's safety regulations. If relevant, the design, test criteria and testing of equipment should be discussed well in advance with CERN's safety officials.

7.4. All equipment integrated into the AMS experiment will comply with NASA safety regulations. If relevant, the design, test criteria and testing of equipment should be discussed well in advance with NASA representatives.

Article 8: Rights and Benefits

8.1. The Institutes participating in the Collaboration are entitled to join the operational phase of the project and to participate in the scientific exploitation of the data acquired.

Article 9: Amendments

9.1. This MoU may be amended at any time with the agreement of two thirds of all the signing Parties. Any such amendments shall be circulated to the Collaboration in a Call-For-Comments process, then elevated to the IB for approval in the terms indicated above.

The participating Funding Institutions/Agencies declare that they agree on the present Memorandum of Understanding for the AMS experiment.

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

CHINA **DENMARK**

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

Michel Spiro
IN2P3/CNRS, FRANCE

FINLAND

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

B. Rauhut
GERMANY

Roberto Petronzio
INFN, ITALY

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

KOREA **MEXICO**

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

NETHERLANDS **PORTUGAL**

Done in _____ **Done in** _____

On _____ **On** _____

By _____ **By** _____

Marius-Ioan Piso
ROMANIA

RUSSIA

Done in	_____	**Done in**	_____
On	_____	**On**	_____
By	_____	**By**	_____
	Salvador Ordoñez **MEC, SPAIN**		**SWITZERLAND**
Done in	_____	**Done in**	_____
On	_____	**On**	_____
By	_____	**By**	_____
	TAIWAN		**USA**

Future inclusion of additional participating Institutes and their corresponding Funding Agencies in this Memorandum of Understanding will be effected by means of Appendices.

Annexes

Annex 1. **List of Parties: Institutions / Funding Agencies and their Representatives**

Annex 2. **Institutes and Operative Units in the AMS Collaboration and Names of their Contact Persons**

Annex 3. **Members of the AMS Collaboration**

Annex 4. **List of the AMS detector subsystems**

Annex 5. **Overview of the Participation in Detector Construction and**

Annex 6. **AMS Detector Assembly and Testing Schedule**

Annex 7. **Memorandum of Understanding for the AMS precursor flight**

Annex 8. **Implementing Agreement between NASA and DOE with respect to the AMS experiment**

Annex 9. **Memorandum of Understanding between CERN and the AMS Collaboration**

Annex 10. **Integration, Testing and Operation Common Fund**

Annex 11. **Annex 11. Regulations regarding Safety of Personnel and Insurance against Damage**

Annex 12. **Annex 12. Regulations of the AMS Collaboration**

Annex 13. **Annex 13. Publication Rules of the AMS Collaboration**

Annex 1. List of Parties: Institutions / Funding Agencies and their Representatives

CHINA

XXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYYYY

DENMARK

XXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYYYY

FINLAND

XXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYYYY

FRANCE

IN2P3 / CNRS
Represented by Dr. M. Spiro

GERMANY

Univ. Der RWTH Aachen
Represented by Prof. Dr. B. Rauhut, Rektor

ITALY

Istituto Nazionale di Fisica Nucleare (INFN)
Represented by Dr. R. Petronzio

ASI tbd

KOREA

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

MEXICO

Universidad Nacional Autónoma de México, UNAM,
Represented by Dr. A. Menchaca-Rocha

THE NETHERLANDS

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

PORTUGAL

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

ROMANIA

Romanian Space Agency (ROSA)
Represented by Dr. Marius-Ioan Piso, Chief Executive Officer

RUSSIA

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

SPAIN

Ministerio de Educación y Ciencia
Represented by Dr. S. Ordoñez

SWITZERLAND

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

TAIWAN

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

USA

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Represented by Dr. YYYYY

Annex 2. Institutes and Operative Units in the AMS Collaboration and Names of their Contact Persons

CHINA

Beijing Institute of Satellite Environment Engineering (BISEE)
Represented by Xiang Shuhong

China Academy of Launch Vehicle Technology (CALT)
Represented by Wang Yi

Institute of Electrical Engineering (IEE), Chinese Academy of Sciences
Represented by Kong Li

Institute of High Energy Physics (IHEP), Chinese Academy of Sciences
Represented by Chen Heshen

Shandong University (SDU)
Represented by Cheng Lin

Shanghai Jiaotong University (SJTU)
Represented by Ye Qinghao

Southeast University (SEU)
Represented by Luo Junzhou

Sun Yat-sen University (SYSU)
Represented by He Zhenhui

DENMARK

University of Aarhus
Represented by J. Madsen

FINLAND

Helsinki University of Technology, Metsahovi Radio Observatory
Represented by A. Mujunen

University of Turku, Space Research Laboratory
Represented by J.Torsti

FRANCE

Groupe d'Astroparticules de Montpellier, Université Montpellier II, IN2P3/CNRS
Represented by A. Jacholkowska

Laboratoire d'Annecy-Le-Vieux de Physique des Particules, Université de Savoie, IN2P3/CNRS
Represented by J.P. Vialle

Laboratoire de Physique Subatomique et de Cosmologie (LPSC)
Represented by M. Buenerd

GERMANY

I. Physikalisches Institut, RWTH Aachen
Represented by St. Schael

Max-Planck-Institut für Extraterrestrische Physik
Represented by J. Truemper

University of Karlsruhe, Insitute for Experimental Nuclear Physics
Represented by W. De Boer

ITALY

University of Bologna and INFN-Sezione di Bologna
Represented by F. Palmonari

Istituto di Ricerca sulle Onde Elettromagnetiche, Firenze
Represented by G. Castellini

University of Milano Bicocca and INFN-Sezione di Milano
Represented by P. G. Rancoita

University of Perugia and INFN-Sezione di Perugia
Represented by R. Battiston

University of Pisa and INFN-Sezione di Pisa
Represented by F. Cervelli

University of Roma "La Sapienza" and INFN-Sezione di Roma I
Represented by B. Borgia

Agenzia Spaziale Italiana, Roma
Represented by S. Di Pippo

University of Siena and INFN-Gruppo Collegato di Siena
Represented by P. S. Marrochesi

Center for Advanced Research in Space Optics, Trieste
Represented by P. Trampus

KOREA

EWHA Womans University
Represented by J. Yang

Kyungpook National University
Represented by D. Son

MEXICO

Universidad Nacional Autónoma de Mexico
Represented by A. Menchaca Rocha

THE NETHERLANDS

European Space Agency, European Space and Technology Centre ESTEC
Represented by M. Zell

National Aerospace Laboratory (NLR)
Represented by J. Van Es

National Institute for Nuclear Physics and High Energy Physics (NIKHEF)
Represented by B. Verlaat

PORTUGAL

Laboratory of Instrumentation and Experimental Particle Physics
Represented by F. Barao

ROMANIA

Institute of Microtechnology, Institute for Space Sciences and University of Bucharest
Represented by A. Mihul

RUSSIA

Institute of Theoretical and Experimental Physics (ITEP)
Represented by Y. Galaktionov

Russian Research Centre, Kurchatov Institute
Represented by N. Chemoplekov

Institute for Space Research, Russian Academy of Sciences
Represented by I. Mitrofanov

Skotbeltsyn Institute of Nuclear Physics, Moscow State University
Represented by M. Panasyuk

SPAIN

Centro de Investigaciones Energéticas, Medioambientales y Tecnolgicas (CIEMAT)
Represented by M. Aguilar-Benítez

Instituto de Astrofísica de Canarias (IAC)
Represented by R. García-López

SWITZERLAND

ETH-Eidgenössische Technische Hochschule Zürich
Represented by F. Pauss

Université de Genève, D.P.N.C.
Represented by M. Pohl

CERN, Geneva
Represented by J. Allaby

TAIWAN

Institute of Physics, Academia Sinica
Represented by Shih-Chang Lee

Chung Shan Institute of Science and Technology (CSIST)
Represented by Yuan-Tzu Ting

National Central University
Represented by Yuan Hann Chang

National Cheng Kung University
Represented by Chin E. Lin

National Chiao Tung University
Represented by C. Y. Chang

National Space Program Office (NSPO)
Represented by Lou-Chuang Lee

USA

Florida A&M University
Represented by R. O'Neal

John Hopkins University
Represented by A. Pevsner

Massachusetts Institute of Technology
Represented by U. Becker

NASA Goddard Space Flight Center
Represented by S. Breon

NASA Johnson Space Center
Represented by S. Porter

University of Maryland, IPST and Department of Physics
Represented by E. S. Seo

University of Maryland, East-West Space Science Center
Represented by R. Sagdeev

Yale University, Department of Physics
Represented by J. Sandweiss

Annex 3. Members of the AMS Collaboration

I. Physikalisches Institut B, RWTH Aachen, D-52056 Aachen, Germany
C.H. Chung, P. v. Doetinchem, H. Gast, J. Hattenbach, Th. Kirn, W. Karpinski, K. Lübelsmeyer, S. Schael, A. Schultz von Dratzig, G. Schwering, Th. Siedenburg, R. Siedling, W. Wallraff, M. Wlochal

Department of Physics and Astronomy, University of Aarhus, DK-8000 Århus C, Denmark
J. Madsen

National Institute for Nuclear Physics and High Energy Physics, NIKHEF, NL-1098 SJ Amsterdam, The Netherlands
H. Band, C. Snippe, B. Verlaat

Laboratoire d'Annecy-le-Vieux de Physique des Particules, LAPP, F-74941 Annecy-le-Vieux, France[1)]
C. Adloff, F. Cadoux, G. Coignet, L. Girard, C. Goy-Henningsen, R. Kossakowski, J. Pochon, S. Rosier-Lees, J.-P. Vialle
[1)] also supported by the French space agency CNES, the Rhone-Alpes province and the County of Haute-Savoie

Johns Hopkins University, Baltimore, MD 21218, USA
A. Pevsner

Beijing Institute of Spacecraft Environment Engineering, BISEE, Beijing, 100029, China
S.B. Bai, Y.Q. Feng, F. Gao, X.J. Han, K. Luo, F.X. Shen, R.H. Wei, S.H. Xiang, L.J. Xu, S. Yang, Z.H. Zhu

China Academy of Launch Vehicle Technology, CALT, Beijing, 100076, China
Z.G. Chen, C.M. Li, N. Li, X.B. Peng, J.G. Tang

Institute of Electrical Engineering, IEE, Chinese Academy of Sciences, Beijing, 100080, China
Y.M. Dai, N.H. Song, Q.L. Wang, Y.J. Yu

Institute of High Energy Physics, IHEP, Chinese Academy of Sciences, Beijing, 100039, China
G.M. Chen, H.S. Chen, Z.H. Li, Y.S. Lu, X.W. Tang, C.G. Yang, M. Yang, Z.Q. Yu, H.L. Zhuang

Università di Bologna and INFN-Sezione di Bologna, I-40126 Bologna, Italy
M. Basile[1),2)], V. Bindi[1),2)], L. Bellagamba[1)], D. Casadei[1),2)], F. Cindolo[1)], A.Contin[1),2)], F. Costa[1),2)], F. Giovacchini[1),2)], G. Laurenti[1)], G. Levi[1),2)], A. Margotti[1)], F. Palmonari[1),2)], L. Quadrani[1),2)], G. Sartorelli[1),2)], C. Sbarra[1)], A.Zichichi[1),2)]
1) INFN-Sezione di Bologna
2) Università di Bologna

Institute of Microtechnology, Institute for Space Science and University of Bucharest, R-76900 Bucharest, Romania
N. Dinu[1)], M. Ionica[2)], R. Ionica[3)], F. Manolescu[1)], O. Maris[1)], A.Mihul[4)]
1) Institute for Space Science (ISS) Bucharest
2) Institute of Microtechnology (IMT) Bucharest
3) University Politechnica (UPB) Bucharest
4) University of Bucarest(UB)

Massachusetts Institute of Technology, MIT, Cambridge, MA 02139, USA
R. Becker, U. Becker, P. Berges, J.D. Burger, X.D. Cai ,M. Capell, G. Carosi, V. Choutko, P. Dennet, F.J. Eppling, P.H. Fisher, M. Green, W.J. Hungerford, A. Klimentov, A. Koulemzine, A. Kounine, V. Koutsenko, A. Lebedev, B. Monreal, G. Rybka, A. Rozhkov, Samuel C.C. Ting, S.M. Ting, M. Steuer, S. Xiao, S.D. Xu, M. Vergain, T.J. Walker, X.Z. Wang, F. Zhou

National Central University, Chung-Li, Tao-Yuan, 32054, Taiwan
Y.H. Chang, C.H. Lin

IPST, University of Maryland, College Park, MD 20742, USA
A. Malinine, E.-S. Seo

East-West Center for Space Science, University of Maryland, College Park, MD 20742, USA
R. Sagdeev

CHEP, Kyungpook National University, Daegu, 702-701, South Korea
H. Ahmed, C. H. Chung, G. N. Kim, M. W. Lee, W. H. Park, J. W. Shin, D. Son, K. W. Sung, N. Tasneem

National Aerospace Laboratory, NLR, NL-8300 AD Emmeloord, The Netherlands
A.A.M. Delil, A. Pauw, G. van Donk, J. van Es, A.A. Woering

Istituto di Ricerca sulle Onde Elettromagnetiche, CNR-IROE, I-50125 Florence, Italy
G. Castellini[1),2)]
1) INFN-Sezione di Bologna
2) INAF,CNR, Firenze

Max-Planck Institut für extraterrestrische Physik, D-85740 Garching, Germany
J. Trümper

DPNC, Université de Genevè, CH-1211 Genevè 4, Switzerland
P. Bene, Ph. Bouvier, M. Bourquin, D. Haas, C. Lechanoine-Leluc, F. Masciocchi, S. Natale, M. Paniccia, E. Perrin, M. Pohl, D. Rapin, J.P. Richeux, M. Willenbrock

European Organization for Nuclear Research, CERN, CH-1211 Geneva 23, Switzerland
J.Allaby

NASA Goddard Space Flight Center, GSFC, Greenbelt, MD 20771, USA
S. Breon

Laboratoire de Physique Subatomique et de Cosmologie, LPSC, IN2P3/CNRS and Université J. Fourier, F-38026 Grenoble, France
B. Baret, A. Barrau, G. Boudoul, M. Buénerd, L. Derome, M.Mangin-Brinet, K. Protasov, M. Vargas-Trevino, O. Véziant

Sun Yat-sen University, Guangzhou, 510275, China
K.H.Guo, Z.H. He, Y.H. Huang, X.H.Jiang, T.X. Li , S.S. Lu, J.Q.Ni, X.M. Qi, S.J. Yu, N.S. Xu

NASA Johnson Space Center, JSC, and LMSO, Houston, TX 77058, USA
C.Balasubramanian[2)], J. Bates[1)], D.Blanchard[1)], K.Bollweg[2)], C.Clark[2)], M.Fohey[2)], R.Harold[2)], L.Hill[2)], W.Hungerford[2)], T.Martin[2)], P.Mott[2)], P.Nemeth[2)], S.Porter[1)], R.Sanchez[1)], T.Tinsler[2)], C.Tutt[2)]
1) NASA Johnson Space Center
2) LMSO, Lockheed Martin Space Operations

National Space Program Office, NSPO, Hsin-Chu City, 300, Taiwan
C.-R. Chen, C. Hsiao, L.C. Lee, J.-R. Tsai

Shandong University, Jinan, Shandong, 250100, China
L. Cheng, Z.Y. Guo, K. Li, Z.T. Liang, T. Luan, L.Q. Wang

IEKP, Universität Karlsruhe, D-76128 Karlsruhe, Germany
W. de Boer, F. Hauler, L. Jungermann, C. Sander, M. Schmanau, V. Zhukov

Metsahovi Radio Observatory, Helsinki University of Technology, FIN-02540 Kylmala, Finland
A. Mujunen, J. Ritakari

Laboratorio de Instrumentacao e Fisica Experimental de Particulas, LIP, P-1000 Lisboa, Portugal
F. Barao[1),2)], G. Barreira[1)], M. Pimenta[1),2)], P. Goncalves[1)], L. Arruda[1)], R. Pereira[1)]
1) LIP, P-1000 Lisboa
2) IST, P-1049 Lisboa

Chung-Shan Institute of Science and Technology, CSIST, Lung-Tan, Tao Yuan, 325, Taiwan
Y.-J. Fanchiang, H. Jinchi, Y.-T. Ting

Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, CIEMAT, E-28040 Madrid, Spain
M. Aguilar-Benítez, J. Alcaraz, J. Berdugo, J. Casaus, E. Cortina, J. De Vicente, C. Díaz, L. García-Tabarés, E. Lanciotti, G. Martínez, C. Palomares, C. Maña, J. Marín, M. Molla, E. Sánchez, S. Sanz, I. Sevilla, F. Toral, A. Torrento, C. Vazquez

Instituto de Fisica, Universidad Nacional Autónoma de México, UNAM, Mexico D. F., 01000 Mexico
R. Alfaro, E. Belmont, V. Grabski, A. Menchaca-Rocha, A. Martinez, A. Sandoval

Università di Milano-Bicocca and INFN-Sezione di Milano, I-20126 Milano, Italy
G. Boella[1),2)], M. J. Boschini[1)], G. Cartegni[1)], M. Gervasi[1),2)], D. Grandi[1)], S. Pensotti [1),2)], P.G. Rancoita[1)] , G. Volpini[1)]
1) INFN-Sezione di Milano,
2) Università di Milano-Bicocca

Groupe d'Astroparticules de Montpellier, GAM, IN2P3/CNRS-Université Montpellier II, F- 34095 Montpellier, France
J. Bolmont, A. Falvard, A. Jacholkowska, M. Sapinski, C. Zurbach

Institute of Theoretical and Experimental Physics, ITEP, Moscow, 117259, Russia
E.Chumilov, Yu.Galaktionov, V.Plyaskin, A.Suvorov

Institute for Space Research, IKI, Russian Academy of Sciences, Moscow, 117810, Russia
I. Mitrofanov

Kurchatov Institute, Russian Research Center, Moscow, 123182, Russia
N. Chernoplekov , A. Grechko, S. Vostrikov

Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, 119992, Russia
V. Galkin, N. Kuznetsov, M. Merkin, S. Nazarov, N. Nikolaeva, M. Panasyuk, V. Petrukhin, T. Roganova, V. Zhukov

Southeast University, Nanjing, 210096, China
J. Gong, G.Q. Gu, J.Q. Li , Q. Li , J.Z. Luo, Q. Meng, L.G. Shuai, H. Yi, C.R. Zou

Physics Department, Yale University, New Haven, CT 06520, USA
A. Chikanian, E. Finch, R. Majka, J. Sandweiss

INFN-Sezione di Perugia and Università Degli Studi di Perugia, I-06100 Perugia, Italy
L. Accardo[1),2)], B. Alpat[1)], G. Ambrosi[1)], P. Azzarello[1)], E. Babucci[1),2)], R.Battiston[1),2)], B. Bertucci[1),2)], S. Bizzaglia[1)], M. Bizzarri[1),2)], S. Blasko[1),2)], W.J.Burger[1)], F.M. Cardano[1),2)], F. Casinini[1)], A. Damiano[2)], L. Di Massso[1),2)], G. Esposito[1),2)], E. Fiandrini[1),2)], E. Fiori[1),2)], S. Haino[1)], M. Menichelli[1)], A. Oliva[1),2)], A. Papi[1)], M. Pauluzzi[1),2)], A. Piluso[2)], G. Scolieri[1)], P.Zuccon[1)],
1) INFN-Sezione di Perugia
2) Università Degli Studi di Perugia

INFN-Sezione di Pisa and Università di Pisa, I-56100 Pisa, Italy
F. Cervelli[1)], St. Di Falco[2)], St. Galeotti[1)], M. Incagli[1)], T. Lomtadze[1)], E. Pedreschi[1)], M. Piendibene[1)], F. Pilo[2)], F. Spinella[1)], C. Vannini[1)]
1) INFN-Sezione di Pisa
2) Università di Pisa

Agenzia Spaziale Italiana, ASI, I-00198 Roma, Italy
F. Bracciaferri , S. Di Pippo

INFN-Sezione di Roma 1 and Università di Roma "La Sapienza", I - 00185 Roma, Italy

A. Agneni[1),3)], St. Baccaro[1),4)], A. Bartoloni[1)] , B. Borgia[1),2)], C. Bosio[1)], C. Gargiulo[1)], S. Gentile[1),2)], M. Montecchi[1),4)], A. Paolozzi[1),3)], P. Rapagnani[1),2)], E. Valente[1)]
1) INFN-Sezione di Roma 1
2) Dip. Di Fisica, Università La Sapienza, Roma
3) Dip. Ingegneria Aerospaziale, Università La Sapienza, Roma
4) ENEA, Roma

Department of Physics, Ewha Womens University, Seoul, 120-750, South Korea
J. Yang, K. Kim

Shanghai Jiaotong University, SJTU, Shanghai, 200030, China
W.J. Ding, A.Z. Gu, Z.J. Jin, W.S. Lin, Q.J. Pang, W.X. Qiao, J.H. Shi, Y.M.Shi, R.S. Wang, S.W. Xie, Q.H. Ye

Università di Siena, I- 53100 Siena, Italy
M.G. Bagliesi[1),2)], G. Bigongiari[1),2)], E. Falchini[1),2)], P.Maestro[1),2)], P.S. Marrocchesi[1),2)]
1) INFN-Sezione di Pisa
2) Università di Siena

Dept. of Aeronautics and Astronautics, National Cheng Kung University, NCKU, Tainan, 701, Taiwan
Y.-C. Chao, C.E. Lin,

Institute of Physics, Academia Sinica, Nankang, Taipei, 11529, Taiwan
S.C. Lee, Y. Lei, Z. Ren, C. Wan, Y. Zhou

AstroParticle and Cosmic Radiation Detector Research and Development Laboratory, Florida A&M University, Tallahassee, FL 32307, USA
R.H. O'Neal, Jr.

Instituto de Astrofisica de Canarias, E-38205 La Laguna, Tenerife, Spain
R. J. García López, C. Delgado, M. Panniello

Center for Advanced Research in Space Optics, CARSO, I-34012 Trieste, Italy
P. Trampus

Space Research Laboratory, Department of Physics, University of Turku, FIN-20014 Turku, Finland
T. Eronen, E. Riihonen, J. Torsti

Labor für Hochenergiephysik, ETH-Hönggerberg, CH-8093 Zürich, Switzerland
H. Anderhub, A. Biland, H. Hofer, F. Pauss, J. Ulbricht, G. Viertel

Annex 4. List of the AMS detector subsystems

I. Sub–system structure of the AMS detector

- ***SUPERCONDUCTING MAGNET including CRYOGENIC GROUND SUPPORT EQUIPMENT***
- ***TRANSITION RADIATION DETECTOR***
- ***TRACKER SYSTEM AND TRACKER COOLING SYSTEM***
- ***RICH DETECTOR***
- ***ECAL DETECTOR***
- ***TIME OF FLIGHT COUNTERS***
- ***ANTICOINCIDENCE COUNTERS***
- ***ELECTRONICS***
- ***ACOP***
- ***THERMAL SYSTEM***
- ***STAR TRACKER***
- ***GPS***
- ***COMPUTING FOR DATA ANALYSIS (POCC, SOC and GSC@MFSC)***
- ***ANALYSIS***

II. Integration and Operations

- ***INFRASTRUCTURE & INTEGRATION AT CERN***
- ***BEAM TESTS AT CERN***
- ***OPERATIONS AT ESTEC (ESA)***
- ***OPERATIONS AT KSC (NASA)***

Annex 5. Overview of the Participation in Detector Construction and Assembly by Sub-system

Sub-System	CHINA	DENMARK	FINLAND	FRANCE	GERMANY	ITALY	KOREA	MEXICO	NETHERLANDS	PORTUGAL	ROMANIA	RUSSIA	SPAIN	SWITZERLAND	TAIWAN	USA
Superconducting Magnet including Cryogenic Ground Support Equipment	X		X									X	X	X	X	X
Transition Radiation Detector					X	X										X
Tracker and Tracker Cooling System	X		X	X	X	X			X		X	X		X		
RICH Detector				X		X		X		X			X			X
ECAL Detector	X			X		X										
Time of Flight Counters						X									X	X
Anticoincidence Counters					X	X										
Electronics	O				O	O							O	Y	Y	Y
ACOP						X									X	X
Ground Support System			X													X
Thermal System	X								X					X	X	X
Star Tracker						X										
GPS				X												
Computing for Data Analysis (POCC,SOC, GSC@MSFC)	X			X	X	X	X	X				X	X	X	X	X
Analysis	X			X	X	X				X		X	X	X	X	X

O Subdetector Electronics
Y Global Electronics

Annex 6. AMS Detector Assembly and Testing Schedule

Annex 7. Memorandum of Understanding for the AMS precursor flight

Annex 8. Implementing Agreement between NASA and DOE with respect to the AMS experiment

Annex 9. Memorandum of Understanding between CERN and the AMS Collaboration

Annex 10. Integration, Testing and Operation Common Fund

Integration, testing and operation of the AMS detector may be broken down into seven different categories, which are, as a general rule, jointly financed by the Institutions in the form of fund contributions to the Common Fund:

1. **Consumables (non-computer related) & Operations at CERN**
   It includes electric power, gases, chemicals, liquid helium, tools and associated equipment.

2. **Office Space**
   Under this paragraph we include the cost of refurbishing the office space in the Prevessin area (the so-called Pavillion).

3. **Computing for Data Analysis**
   Expenses related to GSC, the SOC and POCC equipment and manpower including maintenance.

4. **Infrastructure and Integration at CERN**
   The cost related with the refurbishing of the space on the CERN site (the space allocated for the SOC and POCC, the detector assembly space).

5. **Operations at ESTEC**
   Costs related to the transportation of the detector to ESTEC (ESA, Noordwijk) and the costs associated with the thermal vacuum test at ESTEC.

6. **Operations at KSC**
   Cost related to the transportation and the final integration and activities at KSC.

Breakdown by Sub-System (kCHF)

Sub-System	2005	2006	2007	2008 –12 (per year)
Operations at CERN & Consumables	**30**	**55**	**55**	
Office Space	**205**			
Computing for Data Analysis/ Hardware Manpower [ManYears]	**325 [4.5]**	**335 [4.5]**	**710 [6.5]**	**100 [9]**
Infrastructure and Integration at CERN	**800**	**550**		
Operations at ESTEC & Transport		**200**		
Operations at KSC & Transport			**200**	
TOTAL (kCHF)	1360	1140	965	100

Profile of expenditures in the Common Fund (kCHF)

Year	Total (kCHF)
2005	**1360**
2006	**1140**
2007	**965**
2008-2012 (per year)	**100**

The Common Fund will be managed and operated by the Resources Manager, in agreement with the IB, and will be reviewed regularly in the Finance Review Committee (FRC). The profile of expenditures shall be supported by means of appropriate justifications, in order to facilitate requests to the corresponding Funding Agencies.

In the event of a new Institute joining the Collaboration, the scheme of contributions to the Common Fund will be discussed and decided by the IB and then presented to the FRC.

The fractional contributions to the Common Fund are broken down by country. They are calculated on the basis of the number of scientists that will appear in the forthcoming AMS02 physics publications. Engineers and students are not counted.

Number & Percentage of Ph.D Scientists

COUNTRY	Number of Ph.D Scientists	Percentage of Ph.D Scientists
China	64	**26.67%**
Denmark	1	**0.42%**
Finland	5	**2.08%**
France	15	**6.25%**
Germany	10	**4.17%**
Italy	56	**23.33%**
Korea	3	**1.25%**
Mexico	1	**0.42%**
Netherlands	2	**0.83%**
Portugal	4	**1.67%**
Romania	4	**1.67%**
Russia	14	**5.83%**
Spain	14	**5.83%**
Switzerland	12	**5.00%**
Taiwan	11	**4.58%**
USA	24	**10.00%**
TOTAL	240	100%

Profile of Expenditures in the Common Fund by Country (CHF)

COUNTRY	2005	2006	2007	2008-2012 (per year)
China	**362.712**	**304.038**	**257.366**	**26.670**
Denmark	**5.712**	**4.788**	**4.053**	**420**
Finland	**28.288**	**23.712**	**20.072**	**2.080**
France	**85.000**	**71.250**	**60.312**	**6.250**
Germany	**56.712**	**47.538**	**40,241**	**4.170**
Italy	**317.289**	**265.962**	**225.135**	**23.330**
Korea	**17.000**	**14.250**	**12.062**	**1.250**
Mexico	**5.712**	**4.788**	**4.053**	**420**
Netherlands	**11.287**	**9.462**	**8.009**	**830**
Portugal	**22.713**	**19.038**	**16.115**	**1.670**
Romania	**22.713**	**19.038**	**16.115**	**1.670**
Russia	**79.287**	**66.462**	**56.260**	**5.830**
Spain	**79.287**	**66.462**	**56.260**	**5.830**
Switzerland	**68.000**	**57.000**	**48.250**	**5.000**
Taiwan	**62.288**	**52.212**	**44.197**	**4.580**
USA	**136.000**	**114.000**	**96.500**	**10.000**
TOTAL	1.360.000	1.140.000	965.000	100.000

Annex 11. Regulations regarding Safety of Personnel and Insurance against Damage

Responsibilities and Insurance

Damage suffered by personnel:
The CERN rules and regualtions, applicable to registered CERN Users, will be applied.

Damage to goods:
Each Party assumes sole responsibility, except in cases of intentionally inflicted damage, for the repair of damage suffered by its own goods until the moment that its goods, as part of the detector, have been integrated into the AMS detector. From that moment on, the Common Fund will finance the repair of damage of the goods provided.

Personnel working on the premises of another Party

During the execution of the AMS experiment, a party may host on its premises personnel of another party of AMS.

Personnel of parties participating in an activity that is part of the AMS experiment are obliged to follow the rules and procedures concerning insurance coverage, discipline, hygiene and safety applicable on the premises of the host. Such rules and procedures are made available by the host to personnel upon their first entry on the premises of the host.

Annex 12. Regulations of the AMS Collaboration

SCOPE

The AMS Collaboration aims to construct a particle physics state-of-the-art detector to perform a systematic study of the primary cosmic radiation, charged and neutral, for particle astrophysics investigations. The experimental project is defined in the AMS proposal.

ORGANISATION

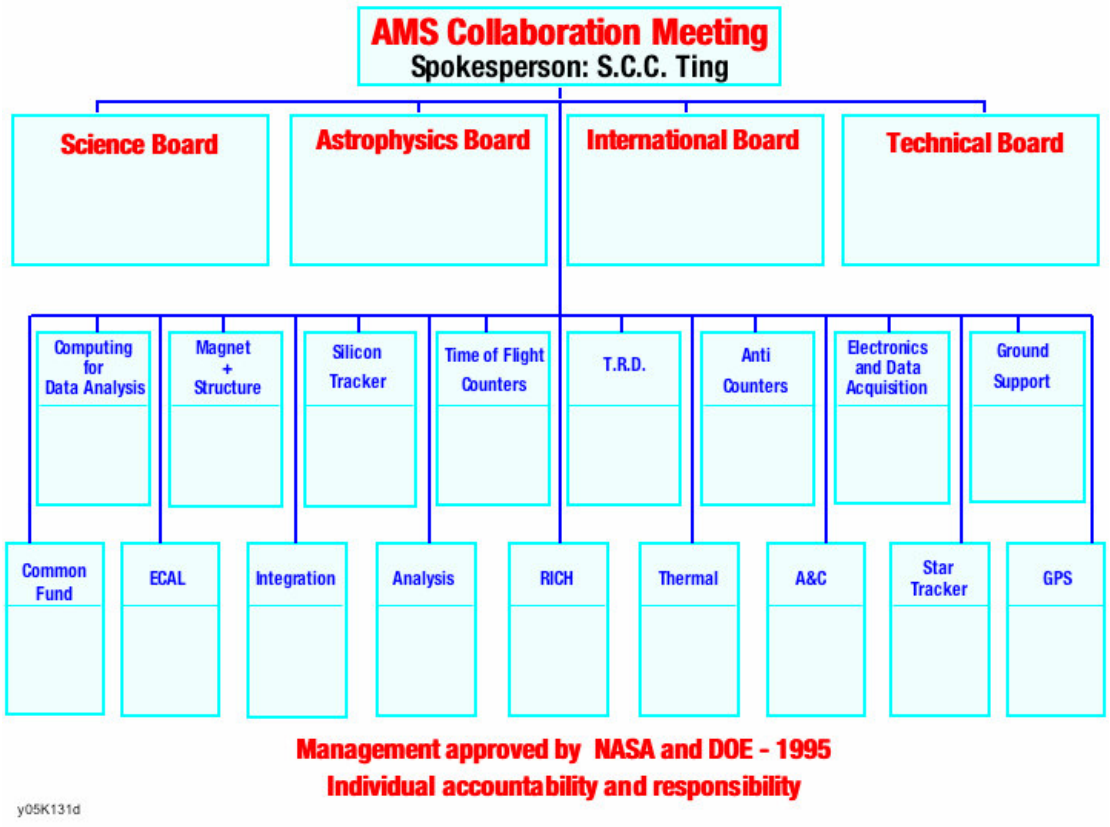
The purpose of this Annex is to describe the motivation and evolution of the organizational framework that permits the orderly monitoring, by all parties of the AMS Collaboration, of the design, fabrication, assembly and integration of the AMS experiment leading to its final installation on the International Space Station (ISS) and subsequent data taking and analysis. The initial framework in which this was established was through an agreement entitled “Implementing Arrangement Between the Department of Energy and the National Aeronautics and Space Administration Regarding the Alpha Magnetic Spectrometer in Space Program” (See Annex 8). It was this arrangement between NASA and DOE, which led to NASA’s agreement to install AMS on the ISS. This document recognized that the MIT Principal Investigator (P.I.) for the AMS International Collaboration would be its Spokesperson. It noted that DOE or, as appropriate, through its contractual agreement with MIT, the AMS P.I. would be responsible for: “the definition, design and development of the AMS hardware and related GSE; delivery to and return from a location to be specified at the KSC for integration or de-integration in the NASA processing system; and establishment of the science mission requirements“.

This was then followed by a series of responsibilities to be undertaken by DOE and / or the MIT P.I. relative to AMS. Following this, an organization for the AMS program was developed (See Annex 7 and the chart below). This organization chart has been presented to DOE and NASA through reviews and proposals on numerous occasions and has received their approval. It is a dynamical structure that has evolved with time in accordance with the evolution of the overall project.

The most recent version specifies four “Boards” (Science, Astrophysics, International, Technical) reporting directly to the Spokesperson and seventeen “Sub-projects”. Nine of them representing the primary sub-detectors (cryomagnet, silicon tracker, TOF, TRD, RICH, ECAL, anti counters, star tracker and GPS); two technical groups (electronics/DAQ and thermal); one group responsible for ground support; one group responsible for integration; two groups related to computing and analysis; and one group, the A & C group, which provides logistic support to AMS where needed (export licenses, visas, coordination between NASA and DOE, etc).

The activities of these “Sub-projects” and particularly the responsibilities of the “Boards” have changed as AMS has evolved from AMS-0l to AMS-02. Now that AMS is approaching its integration phase, one additional group has been added to the organization chart, the Financial Group responsible for the AMS-02 “Common Fund” taking care of the management of the Maintenance and Operation expenses. Among other things, this group will establish the criteria for the apportionment of the Common Fund among collaborating members; will work out an annual budget with “backup” details; will work closely with the CERN Financial Office on the establishment and running of this fund; will work closely with all collaborating institutions to be sure each institutions financial obligations relative to this fund are met, etc.

The AMS organization is based on a set of senior physicists and engineers who manage the sub-groups (sub-project coordinators); who advise the spokesperson either directly or through Collaboration meetings; who report on activities and progress of their respective groups at the AMS Technical Interchange Meetings (TIM); and who coordinate the work of the participating Institutions. It must be emphasized that these people are the key elements of the AMS organization.



Boards

The responsibilities of the four "Boards" reporting directly to the Spokesperson and working closely with him continue to evolve, with functions / responsibilities which include but are not limited to the following:

Science Board: Establishes the AMS science plan; major detector performance issues; definition of data requirements; publication of data; application of AMS to related objectives, as for example, AMS and the cryomagnet to NASA's space exploration missions, etc.

Astrophysics Board: Sets forth the details regarding explicit scientific objectives of AMS-02, particularly as they relate to the studies of high energy phenomena and the physics of interstellar space (high energy cosmic rays, dark matter, anti-matter, etc.); extending invitations to experts on specific scientific subjects of particular interest to the AMS Collaboration; encouraging the development of new ideas (stranglets, etc.); development of details relative to data acquisition, etc.

International Board: Works closely with the Spokesperson on matters relating to the Collaborations Institutes and Universities; responsible for the preparation of the MOU; interfacing with CERN regarding logistic requirements of AMS; serving as a repository of information for new Collaboration members, etc.

Technical Board: Deals with a variety of technical issues as they relate to AMS-02 and these in particular are continually evolving (safety, limits on power and weight); establishment of an integration schedule and plans thereto; coordination of a variety of tests, etc. The Technical Board is coordinated by the Technical Director who is responsible for the day-to-day management of all the technical issues.

The coordinators of the four Boards are appointed by the Spokesperson.

Sub-project Coordinators

The full scope of the programme is divided into sub-projects. Each has a coordinator taking responsibility for all significant decisions in their area. They are responsible for following the schedule, tracking milestones and controlling budgets of the various sub-project tasks. The Sub-project Coordinators report

at regular intervals to the Spokesperson and the different instances of the Collaboration as required. They are appointed by the Spokesperson.

The management as outlined above is completed by the following bodies.

Institution Board (IB)

It is the governing body of the Collaboration, and consisting of one representative from each Institute. It meets as often as needed, at least 4 times a year during each Collaboration Meeting (see below). The IB is chaired by the Spokesperson.

All the Collaboration decisions are made by the Institution Board, generally by consensus. In the case consensus cannot be reached, the Chair may call a vote or in case of close splitting he has the deciding vote. In practice, the majority of technical decisions for the detector assembly are made by the management structure described above and ratified by the IB.

The IB:

- approves all appointments in the organisational structure.
- decides on the application from Institutes wishing to join the Collaboration.
- approves the finance plan which will be presented to the FRC.

Finance Review Committee (FRC)

The Finance Review Committee is composed of one representative per Institution/Funding Agency. The FRC Chair is appointed by CERN. CERN's Chief Financial Officer has agreed to chair the FRC and will open an AMS02 CERN account for Common Fund use. This body acts as the garant of the financial commitments and corresponding contributions expressed in the Collaboration's Memorandum of Understanding.

It meets at least once per year to review expenditure of the present and the previous year and to discuss and decide the provisional budget for the coming year.

Other Members of the Collaboration may attend to FRC meetings upon invitation.

Resource Manager (RM)

The RM is the coordinator of the Common Fund sub-project and represents the AMS Collaboration in the FRC. The RM is appointed by the Spokesperson.

Publication Committee (PC)

It is composed of members of the Collaboration appointed by the Spokesperson. It organises the writing of papers for refereed journals and presentations to Conferences as per the Collaboration's Publication Rules.

The PC appoints AMS speakers for international conferences and presentations in outside laboratories, seeking equitable participation of all the collaboration members. The Publication Committee maintains a database of drawings, plots and numerical results for free use by all collaboration members.

TECHNICAL INFORMATION / COMMUNICATION FLOW

Collaboration Meetings

All physics and technical issues, as well as the strategy of the execution of the project are extensively discussed during the Collaboration Meetings, at least four times per year.

Technical Decisions

In general, technical issues will be presented to and discussed by the full collaboration during the regular Collaboration Meetings. Major technical aspects will be discussed by the Institution Board (IB). Most technical decisions about sub-systems will be made by the sub-project coordinators and members of their teams.

Annex 13. Publication Rules of the AMS Collaboration

Publication of papers by the AMS Collaboration (Publications) should conform with what is presented in the DOE/NASA Implementation Plan, and it is overseen by the Publication Committee (PC) appointed by the AMS Spokesperson. All scientists participating in the AMS Collaboration (hereinafter referred to as Members) are eligible to be part of this body.

Under exceptional circumstances, the Spokesperson may bypass the above procedure, with the only requirement to inform the Publication Committee as appropiate.

Membership and Authorship

The Parties provide via their representatives the names and affiliation of their Members. Based on this information, the AMS Secretariat maintains an official Members List (Annex 3.) that includes their incorporation date (and withdrawal where applicable).

Authorship for AMS publications is connected *by default* to membership provided that a visible contribution has been made for at least one year in activities connected to the achievement of the AMS Collaboration objectives, among which:

- design, assembly, testing and/or runtime operation of the detector,
- technical preparation of the experiment,
- hardware/software maintenance of detector components,
- execution and/or supervision of software simulation and analysis tasks.

General Author List and procedures

Publications are ranked according to a set of categories defined by the Spokesperson and the PC. This ranking distinguishes those of general scope from others, and different rules may apply to each.

By default, a Member is entitled to be author of *general* papers from one year after incorporation, until the end of the calendar year following membership withdrawal.

The general Author List is built from the Members List by extracting those fulfilling the above criteria. It is reviewed and approved by the IB at the end of each calendar year, with validity January 1st. The IB can decide to deviate from this default rule to add/delete author names for specified periods and/or publications.