

History of Rocketry and Astronautics

**Proceedings of the Thirtieth History Symposium of
the International Academy of Astronautics**

Beijing, China, 1996

**Hervé Moulin and Donald C. Elder
Volume Editors**

Donald C. Elder, Series Editor

AAS History Series, Volume 25

A Supplement to Advances in the Astronautical Sciences

IAA History Symposia, Volume 16

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AMERICAN ASTRONAUTICAL SOCIETY

AAS Publications Office
P.O. Box 28130
San Diego, California 92198

Affiliated with the American Association for the Advancement of Science
Member of the International Astronautical Federation

First Printing 2003

ISSN 0730-3564

ISBN 0-87703-498-2 (Hard Cover)
ISBN 0-87703-499-0 (Soft Cover)

Published for the American Astronautical Society
by Univelt, Incorporated, P.O. Box 28130, San Diego, California 92198
Web Site: <http://www.univelt.com>

Printed and Bound in the U.S.A.

Chapter 4

A Study of the History of Rocketry and Astronautics in the International Academy of Astronautics*

V. N. Sokolsky,[†] F. C. Durant III,[‡] F. I. Ordway III^{**}

The desirability of conducting research in the history of rocketry and astronautics first arose in 1961, shortly after the founding of the International Academy of Astronautics (IAA). It was during the first regular meeting of the Academy on 3 October of that year when the Chairman of the Founding Committee and first President, Theodore von Kármán, was “authorized to establish within the Academy a Committee on the History of the Development of Rockets and Astronautics whose task would be the stimulation of the preparation of scholarly studies of various aspects of these developments in different countries from earliest times.”¹

It was thus understood that research was to be undertaken in the history of rocketry and astronautics over a broad international spectrum and timeline. In planning the work of the new committee, advantage was to be taken of the experience of the International Union on History and Philosophy of Science and the International Academy for the History of Science.¹

The following questions were posed to the members of the newly constituted committee: how best to stimulate historical research in the fields of rock-

* Presented at the Thirtieth History Symposium of the International Academy of Astronautics, Beijing, China, 1996.

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etry and astronautics, how to coordinate such research, how to exchange information regarding the status of ongoing research in many parts of the world, and how effective might become the exchange of published books, articles, and professional papers.

C. Dollfus of France, a well-known specialist in the history of aeronautics and other branches of technology, was selected to chair the committee.

Other early members were: A Buseman, USA; E. M. Emme, USA; C. H. Gibbs-Smith, UK; A. G. Haley, USA; F. J. Malina, USA; J. Needham, UK; R. Pesek, Czechoslovakia; I. Sanger-Bredt, BRD; L. R. Shepherd, UK; V. N. Sokolsky, USSR; T. Tabanera, Argentina; and U. S. von Euler, Sweden.

The committee first met in September 1963 in Paris on the occasion of the XIVth International Astronautical Congress. Attendees discussed plans for the future and recommended that the committee initially seek contributions in the history of rocket technology, the nature of the space environment, the development of unmanned spacecraft, guidance and control, space communications, and bioastronautics.² Committee members also devoted considerable time in discussing how members could most effectively maintain currency in the emerging field of rocket and astronautics history.

The committee's second session met in September 1965 in Athens during the XVIth Congress.³ Members discussed progress in rocketry and astronautics in the United States and the Soviet Union and a proposal to hold regular history symposia at the annual congresses. All agreed that the proposal should be presented to the governing body of the IAA. This was subsequently carried out.

The IAA supported the view of the committee and soon appointed a small study group chaired by F. C. Durant III (USA) and assisted by C. Dollfus, (France), E. M. Emme (USA) and V. N. Sokolsky (USSR). The first mission was to investigate the feasibility of holding regular historical symposia.⁴ During the course of its deliberations, the study group presented its ideas to such distinguished Academy members as C. S. Draper, V. P. Glushko, F. J. Malina, and I. Sanger-Bredt. Their reaction was positive and unanimous: all supported the proposal to hold historical symposia at the annual congresses and each provided his own arguments in support of the plan.⁵⁻¹⁰

The first Symposium on the History of Rocketry and Astronautics, as it was then termed (later, rocketry was deleted from the title), took place in September 1967 in Belgrade during the XVIIIth Congress. There were two sessions, morning and afternoon. IAF Vice President R. Pesek introduced F. C. Durant III and V. N. Sokolsky as co-chairmen. Some 60 persons from 11 countries participated with 14 papers being presented (5 from the United States, 4 from the Soviet Union, 2 from West Germany, and a single contribution each from France, Italy and the United Kingdom). Subjects presented were about, or by, pioneers of astronautics, professional society organizations, and memoirs by participants in the development of rocket technology—some of whom had been active from the early 1930s.

On that single day, many of the individuals and organizations involved in forming astronomical societies were present. It is stimulating to reflect on the simultaneous dream of spaceflight and the technological developments then known to be required for its achievement. The accomplishments of R. H. Goddard (USA), H. Oberth (Germany), M. K. Tikhonravov (USSR), F. J. Malina (USA), L. Damblanc (France), and others were presented and the origins of the American Interplanetary Society, the British Interplanetary Society, and related Soviet entities were described. This pattern was repeated at the XXIXth Congress the following year in New York City.

Since Belgrade, astronautics history symposia have been held yearly to the point that the Academy is now celebrating in Beijing the 30th anniversary of the series. Professional historians E. M. Emme and V. N. Sokolsky and amateur historians F. C. Durant III and F. I. Ordway III guided the evolution of these symposia in subsequent years. The process continues under the able leadership of J. Becklake (UK) and J. Villain (France). To date, more than 500 papers have been presented at Congress sites in many parts of the world. The very existence of Academy-sponsored symposia has helped encourage the pursuit of historical research and astronautics in many countries. Moreover, not only have many professional and amateur historians become involved but so too have scientists and engineers who might otherwise have lacked the incentive and forum to record their memories and accomplishments. Many of these individuals are world-famous in their rocket and space-related research and development specialties.

Over the years, papers have dealt with varied and broad subjects with particular attention being directed to rocket engine technology, flight control systems, ground support systems, life support systems, institutional developments, and personal memoirs. These latter included pioneers from the United States (C. S. Draper, F. J. Malina and others), the Soviet Union (O. G. Gazenko, V. P. Mishin, Ju. A. Pobedonostsev, B. V. Rauschenbach, M. K. Tikhonravov, and E. S. Shchetinkov), West Germany (I. Sanger-Bredt), and others. Of particular interest were contributions dealing with the history of scientific, research and design institutions in the Soviet Union, the United States, France, Italy, Great Britain and other nations.

The creative legacy of scientists and engineers active in the fields of rocketry and astronautics has drawn undiminished interest during the last three decades. Reflecting this, reports on the life and accomplishments of pioneers have invariably been well received. Among them are K. E. Tsiolkovsky, R. H. Goddard, H. Oberth, R. Esnault-Pelterie, F. Zander, W. Hohman, E. Sanger, S. P. Korolev, W. von Braun, T. von Karman and many others.

A respectable number of veterans engaged in rocket experimentation and in planning for and promoting interest in spaceflight prior to World War II have spoken at history of astronautics symposia during the last 30 years. At the same time, attendees have listened to reports in such diverse specialties as space

transportation systems, spacecraft development, space station design and operations, launch vehicles, astrodynamics, space biology and medicine, space research, national and international aeronautical organizations, and the societal aspects of space as reflected in literature, art and philosophy.

Soon after the committee structure was established and symposia began to be organized, the importance of arranging for the publication of symposia proceedings became apparent.

The initial collection of papers, taken from the first history symposium held in Belgrade in 1967, was published in Moscow in 1970.¹¹ This was followed by further collections in 1974, 1977 and 1979¹²⁻¹⁴ initiated by F. C. Durant III (USA), V. N. Sokolsky (USSR) and R. Cargill Hall (USA). Then, during the XXXVIth Congress in Stockholm, Durant and F. I. Ordway III (USA) concluded arrangements with Academy representative L. Napolitano (Italy) whereby the IAA would permit the Univelt, Inc. publishing arm of the American Astronautical Society to reprint earlier proceedings and publish later ones on behalf of the Academy. The proceedings would appear as volumes in the *AAS History Series*. Hall served as series editor from the inception through 1995 with each volume being edited by individuals selected by him in consultation with the IAA History of Astronautics Committee. Donald C. Elder III (USA) took over the series editorship beginning in 1996.

Table 1 gives the IAA History Series volume number followed by that of the AAS, the surname of the editor and the year of publication. Table 2 provides further details on each volume in the series, and Table 3 notes the symposia sequence, dates and sites where held. These English-language proceedings are complete through the decade of the 1980s.*

Unfortunately, the appearance of parallel Russian language volumes has been delayed because of the difficulties experienced in publishing scientific literature in Moscow after 1991.

The level of presentations at History of Astronautics Symposia has occasionally been uneven. Along with reports that offered interesting and hitherto unpublished material were those that repeated well-known facts, were inadequately organized or poorly delivered.

In addition to historical symposia held in conjunction with the annual International Astronautics Congresses, a number of related symposia were organized in individual countries (USSR, USA, and East Germany). Beginning in 1971, ten symposia on the history of aeronautics and astronautics took place in the Soviet Union at which more than 250 scientists and cosmonauts from foreign countries attended (Austria, Belgium, Bulgaria, China, Cuba, France, Germany, East and West, Great Britain, Hungary, India, Italy, Japan, Mongolia, Poland, Romania and the United States). These efforts were guided by B. V. Rauschenbach and V. N. Sokolsky of the USSR Academy of Sciences.

* Note added in the proofs: English-language proceedings including the papers presented at congresses between 1990 and 1995 are also now available as noted in Table 3.

Also beginning in the early 1970s, steps were taken to prepare information bulletins designed to keep committee members current about on-going research in the history of rocketry and astronautics. Between 1973 and 1977, four such bulletins were prepared for publication in Moscow by V. N. Sokolsky. These were written in both English and Russian and were sent to committee members as well as organizations actively engaged in space history research (the NASA History Office and the National Air and Space Museum in Washington; the Deutsche Museum in Munich, the State Museum in Kaluga, the Memorial Cosmonautics Museum in Moscow, and other locations). Interest in, and support of, research in the history of astronautics has long been a major concern in Russia and other members of the post-Soviet Commonwealth of Independent States.

Lacking a regularly published bulletin, the History of Astronautics Committee members have relied on fairly comprehensive annual meeting minutes. Twenty or more persons typically attend committee sessions during which reports are presented on the status of the history proceedings; of publications, films and videos released during the previous year of importance to the history of rocketry and astronautics; of anniversaries and significant dates; of deaths; of plans for future congresses; and of a variety of other matters. NASA's "History, News and Notes" bulletin has been distributed to attendees during the past several years and the committee has been invited to contribute news items to it. The most recent minutes,¹⁵ for example, contained 44 pages including annexes. All committee minutes are available at IAA headquarters in Paris.

From time to time, the History of Astronautics Committee has been requested to take on special tasks. Noteworthy was its involvement (in 1985), at the request of IAA President George E. Mueller, in organizing oral presentations at the Royal Swedish Academy of Sciences in Stockholm on the occasion of the 25th anniversary of the Academy's founding in 1960. This led to the release in October 1967 of a special issue of the *Acta Astronautica* entitled "International Academy of Astronautics—25 Years (1960-1985)" and guest-edited by F. I. Ordway III.¹⁶ Introduced by the publisher I. R. Maxwell, it contained contributions by F. C. Durant III (USA), V. N. Sokolsky (USSR), G. E. Mueller (USA), L. R. Shepherd (UK), V. Kopal (Czechoslovakia), M. Claudin (France) and Ordway (USA).

Years later, the IAF requested the committee to plan for another special issue of the *Acta Astronautica*, this one to cover the 40-year history of the Federation. Released in mid-summer 1994, it was entitled "International Astronautical Federation: The First Four Decades" and again guest-edited by Ordway.¹⁷ Its contributors included Durant, Shepherd, Kopal, Claudin and Ordway who had been involved with the IAA anniversary issue as well as A. Azcarraga (Spain), W. H. Pickering (USA), A. L. Jaumotte (Belgium), J. Grey (USA), J. J. Harford (USA), L. Perek (Czech Republic), and R. Mory (France).

The committee responsible for these and many other activities has been active since 1961. From then to 1983 it was the Committee on the History of

the Development of Rockets and Astronautics; and, from 1983 to the present, the History of Astronautics Committee. First, under the guidance C. Dollfus (France, starting in 1961), it was successively chaired by E. Cambi (Italy), E. M. Emme (USA), V. N. Sokolsky (USSR), F. C. Durant III (USA), and F. I. Ordway III (USA). The committee is now co-chaired by J. Becklake (UK) and J. Villain (France).

Table 1
HISTORY OF ASTRONAUTICS SYMPOSIA PROCEEDINGS

IAA History Series No.	AAS History Series No.	Editor(s)	Title
1	6	Durant and James	First Steps Toward Space
2	7	Hall	History of Rocketry and Astronautics (two parts)
3	8	Lattu	History of Rocketry and Astronautics
4	9	Ordway	History of Rocketry and Astronautics
5	10	Skoog	History of Rocketry and Astronautics
6	11	Launius	History of Rocketry and Astronautics
7	12	Sloop	History of Rocketry and Astronautics
8	14	Crouch and Spencer	History of Rocketry and Astronautics
9	15	Cornett	History of Rocketry and Astronautics
10	17	Becklake	History of Rocketry and Astronautics
11	19	Hunley	History of Rocketry and Astronautics
12	20	Hunley	History of Rocketry and Astronautics
13	21	Jung	History of Rocketry and Astronautics
14	22	Jung	History of Rocketry and Astronautics
15	23	Elder and Rothmund	History of Rocketry and Astronautics

Note: Listing updated in the proofs: These volumes were published between 1986 and 2001, IAA Volumes 1 and 2 being reprints of out-of-print collections originally published, respectively, in 1974 by the Smithsonian Institution Press for the National Air and Space Museum and in 1977 by NASA. The 15 proceedings listed above covered symposia held between 1967 and 1995; see Table 3.

Table 2

PROCEEDINGS OF THE HISTORY OF ASTRONAUTICS SYMPOSIA

Published by Univelt, Inc. for the International Academy of Astronautics

1st - 2nd (1967-1968), *First Steps Toward Space*, Edited by Frederick C. Durant, III and George S. James, 1986, 318p., hard cover \$45 (IAF Society Member \$22.50) (ISBN 0-87703-243-2); soft cover \$35 (IAF Society Member \$17.50) (ISBN 0-87703-244-0). Volume 6, American Astronautical Society (AAS) *History Series*.

This is the first of a series of volumes covering the history symposia of the International Academy of Astronautics (IAA), 1967 to the present. These proceedings of the first two IAA history symposia present a wealth of historical material on early space pioneers, rocketry, propulsion and materials research, guidance and control, biomedical investigations, the history of astrodynamics and space law, and ramjet engine and instrumentation developments around the world. The papers in these symposia also address biographics and achievements of the rocket and space pioneers Robert Esnault-Pelterie, Robert H. Goddard, Giulio Costanzi, Vladimir Mandl (space law), Hermann Oberth, Ludvik Ocenasek, S.P. Korolyev, and Wilhelm Theodor Unge. Early theory and work on jet propulsion and rockets in Italy, France, the U.S.S.R., Germany, Austria, and the U.S. Other papers consider the foundations of astrodynamics (U.S.), biomedical space research (Switzerland), and ramjet experimentation (U.S.S.R.). The early history of the American Rocket Society, the British Interplanetary Society, and the pioneering organizations in the U.S.S.R. is included in these proceedings. Illustrated. Index.

3rd - 6th (1969-1972), *History of Rocketry and Astronautics*, Edited by R. Cargill Hall, 1986. Part I, 250p, Part II, 502p, sold as a set. hard cover \$100 (IAF Society Member \$50) (ISBN 0-87703-260-2); soft cover \$80 (IAF Society Member \$40) (ISBN 0-87703-261-0). Volume 7 Parts I & II, *AAS History Series*.

These two volumes contain international essays in rocketry and astronautics including Romanian, Swedish, Hungarian, Austrian, Spanish, Polish, German, Swiss, Soviet and U.S. contributions. Biographics and achievements of space pioneers include Guido von Pirquet, K.E. Tsiolkovsky, and Eugen Sänger. Among the many historical essays on space flight: the evolution of spacecraft altitude control, new sources of energy for rockets, the development of ramjet engines, Tsander's liquid propellant rocket engines, the German A-4 guidance and control system, aerospace guidance technology at MIT until 1951, Aerospace Corporation liquid-hydrogen rocket engine development until 1950, the Viking rocket, and Project Mercury. Illustrated. Index.

7th - 8th (1973-1974), *History of Rocketry and Astronautics*, Edited by Kristan R. Lattu, 1989, 368p., hard cover \$50 (IAF Society Member \$25) (ISBN 0-87703-307-2); soft cover \$35 (IAF Society Member \$17.50) (ISBN 0-87703-308-0). Volume 8, *AAS History Series*.

Among the historical contributions are essays on early spin-stabilized rockets (Hungary), the Rogallo wing, inertial navigation (U.S.S.R.), rocket dynamics (U.S.S.R.), inertial navigation (U.S.S.R.), rocket flight control (U.S.S.R.), camera rockets and space photography (U.S.), ramjet engines (U.S.S.R.), and the biographics and achievements of Robert H. Goddard and Mikhail K. Tikhonravov. Other papers treat the origins of the Sergeant missile powerplant (U.S.) that gave rise to large grain solid-propellant engines, the sounding rocket Veronique (France), meteorological rockets (Poland), development of Sputnik I (U.S.S.R.), early cosmic ray research (U.S.S.R.), liquid-propellant research (U.S.), and American rocket aircraft (U.S.). Illustrated. Index.

9th - 11th (1975-1977), *History of Rocketry and Astronautics*, Edited by Frederick I. Ordway, III, 1989, 330p., hard cover \$50 (IAF Society Member \$25) (ISBN 0-87703-309-9); soft cover \$35 (IAF Society Member \$17.50) (ISBN 0-87703-310-2). Volume 9, *AAS History Series*.

The papers presented at these symposia address early solid-propellants (Sweden), aero-medical weightlessness research (U.S.), computer-oriented dynamic modeling of spacecraft (U.S.), genesis of liquid-hydrogen propulsion (U.S.), development of the first space liquid-propellant rocket engines (U.S.S.R.), upper atmosphere research (U.S., U.S.S.R., France), early research on solar, short wave radiation (U.S.S.R.), the Skylark rocket (England), and development of the first automatic stations for lunar flight (U.S.S.R.). This work also contains biographic profiles and contributions of the rocket pioneers Harry Bull, S.P. Korolyev, and Albert Fono. Illustrated. Index.

12th - 14th (1978-1980), *History of Rocketry and Astronautics*, Edited by Å. Ingemar Skoog, 1990, 318p., hard cover \$50 (IAF Society Member \$25) (ISBN 0-87703-329-3); soft cover \$40 (IAF Society Member \$20) (ISBN 0-87703-330-7). Volume 10, *AAS History Series*.

Papers presented at these symposia address early rocketry in China, India, and Sweden, celestial mechanics to space flight mechanics (Germany), early theoretical and experimental investigations of rocketry (U.S.S.R.), evolution of methods of cooling liquid-propellant engines (U.S.S.R.), origins of Reaction Motors (U.S.), early Hungarian lunar radar experiments, technological steps to liquid-hydrogen propulsion (U.S.), rocket tests and research at NACA/NASA Wallops Island Flight Test Range (U.S.), and the antecedents of the Space Shuttle (U.S.). This volume also contains memoirs of the founding of the Pacific Rocket Society and of the International Astronautical Federation, and biographics of rocket and space pioneers Walter Hohmann and Maurice Zucrow. Illustrated. Index.

15th - 16th (1981-1982), *History of Rocketry and Astronautics*, Edited by Roger D. Launius, 1994, 236p., hard cover \$60 (IAF Society Member \$30) (ISBN 0-87703-282-X); soft cover \$40 (IAF Society Member \$20) (ISBN 0-87703-283-8). Volume 11, *AAS History Series*.

These papers, divided into five parts, follow the format of earlier volumes. The articles, representing five different countries, discuss a variety of subjects from plans for 19th century spacecraft, to the development of space science, human training and operations in space, an aerospace corporation's history, through several interesting biographical studies. Specifically the topics covered are: on the design of N. I. Kibal'chich's flying machine; the origins of inertial navigation in space; evolution of space fiction in film; rocketry personnel training in the U.S.S.R. (1924-1936); the supersonic wind tunnel installations at Peenemünde and Kochel and their contributions to aerodynamics of rocket-powered vehicles; origins of magnetospheric physics by James A. Van Allen; history of institutional developments, and research and development at Reaction Motors, Inc. (1941-1958); early experiments with erosive burning in solid rockets; fundamental scientific questions in the early period of rocket propulsion development; scientific foundations for implementation of manned space flight; the history of extravehicular activity (EVA) in U.S. human space flight; and space research in Poland after 1958. Also appearing in the volume are papers on space and rocketry pioneers Tsiolkovsky, Rynin, Esnault-Pelterie, Carafoli and Szternfeld. Illustrated. Index.

17th (1983), *History of Rocketry and Astronautics*, Edited by John L. Sloop, 1991, 252p., hard cover \$60 (IAF Society Member \$30) (ISBN 0-87703-332-3); soft cover \$40 (IAF Society Member \$20) (ISBN 0-87703-333-1). Volume 12, *AAS History Series*.

A variety of subjects and activities in seven countries are covered, including war rockets as early as 1377 (Korea), rocket society/institute activities in three countries (U.S.S.R., Great Britain, Hungary), theoretical and practical contributions to rocket propulsion technology including Leonhard Euler's importance for aerospace sciences, Alexandru Churcu's contribution to the development of theoretical and practical reactive motion in the 19th century (Romania), some vignettes from Bernard Smith's diary (U.S.), liquid propellant rocket development by the U.S. Navy, the early evolution of communication satellites (U.S.), initial nuclear rocket experiments (U.S.), a comparative study of evolution of manned and unmanned space flight operations (U.S.), the history of a rocket firm (Thiokol's Reaction Motors Division, U.S.), and even a brief, albeit facile description of a contemporary space camp at the Alabama Space and Rocket Center. A summary of Dr. Olgierd Wolczek's contributions to astronautics is included in the pioneers of rocketry and astronautics section (Poland). Illustrated. Index.

18th - 19th (1984-1985), *History of Rocketry and Astronautics*, Edited by Tom D. Crouch and Alex M. Spencer, 1993, 222p., hard cover \$50 (IAF Society Member \$25) (ISBN 0-87703-374-9); soft cover \$35 (IAF Society Member \$17.50) (ISBN 0-87703-375-7). Volume 14, *AAS History Series*.

A variety of subjects and activities in seven countries are covered, including early rocket weapons in China; 19th century rocketry in France; features of lifesaving rocket development in the 19th and early 20th centuries; rocket development of Isaac Lubbock and Geoffrey Collin; contributions of Russian/Soviet scientists and design engineers to rocket launch technology; involvement of the smaller British societies in astronautics and interplanetary flight; the evolution of the space station at NASA; reaching for the planet Mars; Sotir Cherkezov: the inventor of a device for rescuing spacemen, some historical aspects of Romanian aerospace techniques; British rocketry during World War II; a brief history of the first U.S. JATO flight tests of August 1941; comparative analysis of developments in the active and reactive methods of reaction; engines and propulsion units for space vehicles constructed by Alexey M. Isaev; a survey of world meteorological and environmental satellites, 1960-1985; history of heat shields for manned space flight; and thirty years of the Polish Astronautical Society. A paper on Soviet pioneer Anatole Arkadievich Blagonravov is also included. Illustrated. Index.

20th - 21st (1986-1987), *History of Rocketry and Astronautics*, Edited by Lloyd H. Cornett, Jr., 1993, 452p., hard cover \$60 (IAF Society Member \$30) (ISBN 0-87703-376-5); soft cover \$40 (IAF Society Member \$20) (ISBN 0-87703-377-3). Volume 15, *AAS History Series*.

Topics covered include: The 'Boun Bang Fai' rockets of Thailand and Laos: possible key to determining the spread of rocketry in the orient; the legacy of Schiaparelli and Lowell; analysis of K. E. Tsiolkovsky's ideas on space industrial development and exploitation; speculative spacecraft, 1610-1957; development of the theory of correction maneuvers for the first transfer trajectories to Mars and Venus by Soviet scientists; camera rockets and space photography concepts before World War II; propellant chemists' contribution to modern rocket flight: a memoir by Karl Klager; the beginning of the U.S. space program: a memoir by William H. Pickering; the Apollo generation: a profile of NASA's first engineers; Project Manhigh balloon-borne predecessor to project Mercury; from HF radio to unified S-band: an historical review of the development of communication in the space age; V-2 operations at White Sands Missile Range (1946-1952); the French SE 1900 and SE 1910 rocket sleds; Georgy Nikolaevich Babakin's contribution to the development of

automatic space stations; and personal recollections of Theodore von Kármán by Boris Kit. Illustrated. Index.

22nd - 23rd (1988-1989), *History of Rocketry and Astronautics*, Edited by John Becklake, 1995, 480p., hard cover \$60 (IAF Society Member \$30) (ISBN 0-87703-395-1); soft cover \$40 (IAF Society Member \$20) (ISBN 0-87703-396-X). Volume 17, *AAS History Series*.

Topics covered include: Indo-Aryan traditions and the history of astronautics; William Congreve and the city of Toulouse; collaboration of Wernher von Braun and Fred Freeman; preserving chapters in aerospace history; preserving historic sites; evolution of liquid rocket propulsion in France; the SE 4100/4400/4401 family of French rockets; British rocket experiments in the 1950s/early 1960s; British Black Knight rocket; Ariel I satellite; the first control system for space vehicles (Soviet Luna-3); development trends of Soviet orbital space stations; an American Rocket Society memoir (1953-1963) by James J. Harford; a brief history of the German Rocket Society; the 6000C-4 Black Betsy rocket engine (1945-1989); the X-20 space plane; Atlas and Centaur steel balloon tanks; Mercury primates; first American man-rated space launch vehicle (Mercury-Redstone); aeromedical field laboratory of space medicine; Apollo scientific exploration of the Moon; American manned planetary mission studies (1962-1968). Also included are papers on the roles of space and rocketry pioneers Mikhail Klavdiyevich Tikhonravov in creating staged rockets (1947-1953) and of Vladimir Petrovich Vetchinkin. Illustrated. Index.

24th (1990), *History of Rocketry and Astronautics*, Edited by J. D. Hunley, 1997, 318p, Hard Cover \$60 (IAF Society Member \$30) (ISBN 0-87703-422-2); Soft Cover \$40 (IAF Society Member \$20.00) (ISBN 0-87703-423-0). Volume 19, *AAS History Series*.

Topics covered include: EMPIRE—background and initial dual-planet studies; the origin of gravity-propelled interplanetary space travel; modern Romanian aerospace achievements; from Vahrenwald via the Moon to Dresden; the legacy of Hermes, participation of German specialists in the development of rocketry in the USSR in the first years after World War II; the French SE 4300 guided rocket program; the R-3 rocket project development in the USSR in 1947-1959 as a basis for the first Soviet space launchers; the evolution of the Titan rocket (Titan I to Titan II); engineering development of the Apollo Lunar Module; “Black Betsy”: the 6000C-4 rocket engine, 1945-1989. Also included are papers on the roles of space and rocketry pioneers Alfred Maul (camera rocket pioneer); and French pioneer Jean Jacques Barré. Illustrated. Numerical and author index

25th (1991), *History of Rocketry and Astronautics*, Edited by J. D. Hunley, 1997, 344p, Hard Cover \$60 (IAF Society Member \$30) (ISBN 0-87703-424-9); Soft Cover \$40 (IAF Society Member \$20) (ISBN 0-87703-425-7). Volume 20, *AAS History Series*.

Topics covered include: French rocketry (1739-1872); gravity propulsion research at UCLA and JPL (1962-1964); contribution to jet propulsion theory and practice by Romanian inventor Paul Popovatz; the Navaho cruise missile; development of the Jupiter propulsion system; Project Farside; development history of the Vostok spacecraft; segmented rocket demonstration—historical development prior to their use as space boosters; Coralie—the forgotten rocket; Vela—a space system success story; construction and testing of the first Soviet automatic interplanetary stations; the role of S.P. Korolev in development of space rockets for lunar exploration; Black Arrow—the first British satellite launcher; activities of former Peenemünders who remained in Germany. Also included is a detailed paper on the role of and experience of space and rocketry pioneer Hermann Oberth. Illustrated. Numerical and author index.

26th (1992), *History of Rocketry and Astronautics*, Edited by Philippe Jung, 1997, 368p, Hard Cover \$60 (IAF Society Member \$30) (ISBN 0-87703-439-7); Soft Cover \$40 (IAF Society Member \$20) (ISBN 0-87703-440-0). Volume 21, *AAS History Series*.

Topics covered include: Theodore von Kármán's students; Heyland's rocket cars and the V-2; the Origins of U.S. space policy: Eisenhower, Open Skies, and freedom of space; Australia's space history and heritage; France and the Peenemünde legacy; historical aspects of spacecraft technology and its diffusion in society in Japan; NASA and the politics of the Space Shuttle decision, 1967-1972; the "Burya" intercontinental cruise missile; LH2 technology pioneered on Centaur 30 years ago; development of the booster-launchers in the U.S.S.R.; Agate and its forebears: early French "Precious Stones" rockets; early days of LOX/LH2 engines at SEP and MBB; origins of the MOUSE proposal; early Lunar base concepts: the Lockheed experience; and project Dyna-Soar: the roots of Shuttle. Illustrated. Numerical and author index.

27th (1993), *History of Rocketry and Astronautics*, Edited by Philippe Jung, 1998, 418p, Hard Cover \$60 (IAF Society Member \$30) (ISBN 0-87703-444-3); Soft Cover \$40 (IAF Society Member \$20) (ISBN 0-87703-445-1). Volume 22, *AAS History Series*.

Topics covered include: The history of the UFA rocket; Rocket Center Peenemünde (personal memories by Konrad Dannenberg and Ernst Stuhlinger); Klaus Riedel at Peenemünde; 50 years at Aerojet (1942-1992); results and perspectives of the development of rocket and space engineering in the U.S.S.R.; the SE4200: first ramjet missile?; German engineers contribution to British rocket technology after World War II; Alpha, Beta, and RTV-1 (development of early British liquid propellant rocket engines); a survey of rocketry for space science in Japan; historical origins, development and deployment of the lunar roving vehicle; history of space navigation development; CNES: the French Space Agency (1962-1992); the history of the Viking engine; the development of Space Station objectives and; 50 years of the Rocket Research Institute (1943-1993). Illustrated. Numerical and author index.

28th - 29th (1994-1995), *History of Rocketry and Astronautics*, Edited by Donald C. Elder and Christophe Rothmund, 2001, 566p., hard cover \$85 (IAF Society Member \$42.50) (ISBN 0-87703-477-X); soft cover \$60 (IAF Society Member \$30) (ISBN 0-87703-478-8). Volume 23, *AAS History Series*.

A variety of subjects and activities in several countries are covered in 35 papers. The volume is divided into three sections. Section I covers pioneering work in rocketry and astronautics, including evolution and accomplishments of the supervision of youth research experiments; the origins of the Ariane rocket; A-1 (the first French satellite); Etude 4212 (the first French large liquid rocket project); the Delta Project early LOX/Kerosene engines in the UK; a memoir on Albert Püllenber and the GEFRA; the Japanese "Pencil" rocket and Hideo Itokawa; the trip to the moon and other early spaceflight simulation shows (ca. 1901-1915); Krafft Ehrlicke's extraterrestrial imperative; the SE 1500 French missile tests; the personality of rocket pioneer Hermann Oberth; the excluded: Hermann Oberth and Rudolf Nebel in the Third Reich; a biographical memoir of Dr. Homer Joseph Stewart; the history of rocket-space techniques in the Ukraine. The second section covers applications in rocketry and astronautics, including current studies on the History of astronautics and rocketry; the Grand Central Rocket Company; a retrospective of Apollo at 25; the Dniepropetrovsk space rocket complex in the 1970s and 1980s; the San Marco Project; Japanese festival rockets; the first manned lunar landing spacecraft; the French SEPR/SEP from 1944 to 1994; and the development of putting payloads into low Earth orbit (Soviet/Russian). Section III covers Cold War projects, including evolution of the Soviet space industry, history of the foundation of the Soviet Cosmodrome Baikonour, what the

Russians learned from German V-2 technology; the French SE 4500 nuclear missile; history of space launch vehicle development (Soviet/Russian); the race to the Moon: a look back from Baikonour; the unknown biography of M. K. Yangel; U.S./Soviet space systems as driven by the Cold War; the history of the National Reconnaissance Office; roles and impacts of RAND in pre-Apollo U.S. space programs; the Soviet Moon surface research program (1966-1976). Illustrated. Index.

Table 3
PUBLISHED SYMPOSIA PROCEEDINGS — SITES AND DATES

IAA History Series No.	Symposia Sequence	Dates	Symposia Sites
1	1 st and 2 nd	1967–1968	Belgrade, Yugoslavia and New York City, USA
2	3 rd , 4 th , 5 th , and 6 th	1969–1972	Mar del Plata, Argentina; Constance, West Germany; Brussels, Belgium; and Vienna, Austria
3	7 th and 8 th	1973–1974	Baku, USSR and Amsterdam, The Netherlands
4	9 th , 10 th , and 11 th	1975–1977	Lisbon, Portugal; Anaheim, California, USA; and Prague, Czechoslovakia
5	12 th , 13 th , and 14 th	1978–1980	Dubrovnik, Yugoslavia; Munich, West Germany; and Tokyo, Japan
6	15 th and 16 th	1981–1982	Rome, Italy and Paris, France
7	17 th	1983	Budapest, Hungary
8	18 th and 19 th	1984–1985	Lausanne, Switzerland and Stockholm, Sweden
9	20 th and 21 st	1986–1987	Innsbruck, Austria and Brighton, UK
10	22 nd and 23 rd	1988–1989	Bangalore, India; and Málaga-Torremolinos, Spain
11	24 th	1990	Dresden, Germany
12	25 th	1991	Montreal, Canada
13	26 th	1992	Washington, D.C., USA
14	27 th	1993	Graz, Austria
15	28 th and 29 th	1994–1995	Jerusalem, Israel and Oslo, Norway

Note: Listing updated in the proofs.

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- ²Report of the First Meeting of the Committee on the History and the Development of Rockets and Astronautics, Paris, France, 27 September 1983; IAA History Ctee/2, p.1-2 IAA N 1669 A. 7.6.
- ³Report of the Second Meeting of the Committee on the History of the Development of Rockets and Astronautics, Athens, Greece, 14 September 1965; IAA History Ctee/4, pp. 1-2. IAA N 3641 A.7.6.
- ⁴Letter from C. S. Draper to F. C. Durant III, 30 April 1966.
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- ⁶Letter from T. Tabanera to F. C. Durant III, 22 June 1966.
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- ⁹Letter from I. Sanger-Bredt to F. C. Durant III, 30 August 1966.
- ¹⁰Letter from E. M. Emme to F. C. Durant III, 28 September 1966.
- ¹¹Iz Istorii Astronavtiki i Raketnoy (in Russian), from the History of Aeronautics and Astronautics, papers of the XVIIIth International Astronautical Congress, M. Nauka, 1970.
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- ¹³Essays on the History of Rocketry and Astronautics: Proceedings of the Third through the Sixth History Symposia of the International Academy of Astronautics, Washington, D.C., 1977: NASA Conference Publication 2014.
- ¹⁴Iz Istorii Astronavtiki i Raketnoy Tekhniki, Volumes 2-3 (in Russian), from the History of Aeronautics and Astronautics, papers of the II and III International Astronautical History Symposium, Moscow, 1979.
- ¹⁵Minutes of the 31st History of Astronautics Committee Meeting, Secretariat, International Academy of Astronautics, Paris, 1995.
- ¹⁶International Academy of Astronautics: 25 Years (1960-1985), guest edited by F. I. Ordway III, *Acta Astronautica*, Vol. 15 No. 10, October 1987.
- ¹⁷International Astronautical Federation: The First Four Decades, guest-edited by F. I. Ordway III, *Acta Astronautica*, Vol. 32 Nos. 7/8, July/August 1994.