

CHAPTER I  
INAUGURAL CEREMONY

**2 August 1988**

The Inaugural Ceremony was held at the Convention Center, Baltimore, in the presence of distinguished representatives from the Government of the United States, the State of Maryland, the City of Baltimore, the Johns Hopkins University, the National Aeronautics & Space Administration, the and the US National Committee for the IAU.

The chair was taken by Dr. A. Davidsen, co-Chairman of the Local Organizing Committee, from the Johns Hopkins University.

A rousing aubade, specially composed for the occasion by Elam Ray Sprenkle, was beautifully performed by the Annapolis Brass Quintet under the direction of David Cren.

An Aubade for Brass Quartet,  
composed by Elam Ray Sprenkle,  
Commissioned for the XXth General Assembly

An Aubade

for Brass Quartet

Commissioned For the Astro-Physics Convention

Baltimore, Md., Summer, 1988

E. Sprenkle

INAUGURAL CEREMONY

This image displays a handwritten musical score for an "INAUGURAL CEREMONY". The score is organized into two rows of four systems each. Each system contains three staves, likely representing different instruments or voices. The notation includes various musical symbols such as notes, rests, slurs, and dynamic markings like *mp* (mezzo-piano) and *sfz* (sforzando). There are also tempo markings such as *Tempo* and *all. rit.* (allegretto ritardando). The score is numbered with measures 21 through 34. The bottom right corner of the page features the logo for "ARCHIVES" with the text "Digitized by Google" below it.

This page contains a handwritten musical score for the piece "INAUGURAL CEREMONY". The score is arranged in two systems, each with four staves. The top system includes a string quartet (Violin I, Violin II, Viola, and Violoncello) and a woodwind section (Flute I, Flute II, and Clarinet). The bottom system includes a string quartet (Violin I, Violin II, Viola, and Violoncello) and a woodwind section (Flute I, Flute II, and Clarinet). The score is written in a cursive, handwritten style with various musical notations such as notes, rests, slurs, and dynamic markings. Key markings include "Tango" at the beginning of the first system, "Forte" at the beginning of the second system, and "Archives" at the end of both systems. The page number "5" is located in the top right corner, and the title "INAUGURAL CEREMONY" is centered at the top.

This image shows a page of a musical score for a string ensemble, labeled "ARCHIVES" in the bottom right corner. The score is written on four systems of staves, each system containing three staves. The measures are numbered 107, 108, 109, and 110. The notation includes various musical symbols such as notes, rests, slurs, and dynamic markings like "p" (piano) and "f" (forte). The key signature is one sharp (F#), and the time signature is 3/4. The score is oriented vertically on the page.

**Address by Dr. A. Davidsen, co-Chairman of the Local Organizing Committee**

"Dr Graham, Lt. Gov Steinberg, Mayor Schmoke, Members of the IAU, Distinguished Guests, Ladies and Gentlemen,

My name is Arthur Davidsen and I am co-Chairman of the Local Organizing Committee of the Twentieth General Assembly of the IAU. I have the honor of being the first to welcome you to Baltimore and to bring you greetings and good wishes from a veritable army of local astronomers and staff, who have labored extremely hard to arrange what we hope will be a very memorable meeting for each of you.

When we began planning this event in 1982, it was with the belief that Baltimore was on the verge of becoming one of the world capitals of astronomical research. This expectation was of course based on the establishment of the Space Telescope Science Institute on the Johns Hopkins Homewood Campus. In spite of the tragic event which has delayed the launch of the Hubble Space Telescope, I believe we have come a long way toward achieving our goal.

When this decade began there were only five astronomers in Baltimore; now there are over one hundred working here. From a narrow base of studies, primarily in ultraviolet astronomy, we have expanded to include a broad range of research in experimental, observational and theoretical astrophysics. In addition to the Hubble Space Telescope, Baltimore astronomers are involved in several other space missions, such as the Astro Observatory, also planned for launch aboard the space shuttle next year. Back on the ground, we are collaborating in the Magellan Project with the Carnegie Institution of Washington and the University of Arizona in the development of an eight meter telescope for Los Campanas, in Chile. If you take time to visit the Johns Hopkins campus this week or next, as I hope you will, you'll see that a major expansion of the Space Telescope Science Institute is nearing completion and that a magnificent new home for the Department of Physics and Astronomy and the Center for Astrophysical Sciences is being built directly across the street from the Institute. The successful sponsorship of this important meeting is yet another hallmark of the growth of astronomy here in Baltimore and will, we hope, set the stage for us to play an even more significant role in the decades to come.

On behalf of all the astronomers and staff of the Local Organizing Committee, I offer you a very warm welcome to the Twentieth General Assembly of the IAU and I have arranged the weather specifically to emphasize that point. And now I would like to introduce the co-Chairman of the Local Organizing Committee, Dr. Ricardo Giacconi, who is of course the Director of the Space Telescope Science Institute."

**Address by Dr. R. Giacconi, co-Chairman of the Local Organizing Committee**

"Ladies and Gentlemen, Distinguished Guests,

It was entirely appropriate that Arthur Davidsen should speak first, because although we are co-Chairmen, he did all the work, and I wanted to take this opportunity to make that clear.

We at Space Telescope Science Institute have been involved in helping to prepare this meeting, and we had the hope and fond expectation that the intellectual highlight of this meeting would be the fact that we would paper the walls with data from the now-unlaunched Hubble Space Telescope. As you know, the tragic accident that befell Challenger and the long period of recovery which is being required to put the NASA fleet back in operation has prevented us from doing that. Notwithstanding which, I hope you will take this opportunity to visit the Institute, to acquaint yourself with the instrumentation and with the details of how you may wish to operate and use the Space Telescope, those of you who do intend to use it. We have arranged, in a practical manner, buses to bring you up there with two visits a day, and to do that you just sign up at the Space Telescope desk.

The Association of Universities for Research in Astronomy (AURA) has asked me to transmit to you their warmest wishes, and the welcome that I am extending to you is not only from AURA, not only from the European and American staff of the Space Telescope Science Institute, but also from the literally thousands of people in the NASA/ESA family of institutions, its centers, its contractors, the academic and research institutions which have been involved now for so many years in the preparation of this very sophisticated, fantastic instrument. Their work is what is going to make it happen and they are extremely happy to share it with you. So once again, welcome to Baltimore."

**Address by Dr. F. Drake, Chairman of the National Organizing Committee.**

"I am here to welcome all of you on behalf of the American astronomical community.

Twenty-seven years have passed since the General Assembly last met in the United States. Twenty-seven eventful years in the history of astronomy, and I am sure there are many people here who remember those exciting days long ago in Berkeley and even perhaps the wonderful trip to the Napa Valley, when it was even hotter than it is in Baltimore. But so much has happened in that time.

When last we met in the United States, the words quasar and pulsar had never, not once, been uttered by a human voice in the entire history of the planet. The words "microwave background" would have meant nothing to any astronomer, and aperture synthesis was a hazy but fascinating concept understood by only a few. In those twenty-seven years, the words "Viking", "Venera", "Voyager", have taken on entirely new meanings, and indeed it is amazing to realize that in such a short time, we have explored almost all of the planets of the solar system.

It has been said that there have been two golden ages of astronomy; the first started at the time of Galileo and lasted for the next hundred years as the basic structure of the solar system and its laws were discovered. The second started but a few decades ago and is still rich with progress.

We astronomers have been privileged to live in it. The greatest discoveries continue: the events surrounding Supernova 1987A; the gravitational lenses; the eclipsing pulsar, destroying its companion before our very eyes. The potential for future discoveries is actually growing as we await the launch of the Hubble Space Telescope, follow with excitement the flight of two spacecraft to Phobos and watch the construction of a new generation of giant optical and radio telescopes on the Earth.

Astronomy continues as a prime cutting edge in the development of science. We have seen the way to understand the earliest moments of the history of the Universe. Astronomy may even serve as a source for major developments in physics, revealing in an indirect but profound way the nature of elementary particles. It may even tell us, someday, of the variety of biologies which exist in the Universe.

American astronomers have been fortunate and proud to be an important part of the recent golden age of astronomy. Our science is highly respected in our country and we enjoy generous support, not only from federal and state governments, but from private citizens and corporations. We have had a long tradition of excellence, at least long by American standards. This year, for example, we are celebrating the one-hundredth anniversary of the Lick Observatory, the first experiment in placing large telescopes on mountain tops and in fact a successful experiment, which has pointed the way to other new observatories ever since. We also celebrate, here in America, the one-hundredth anniversary of the founding of the Astronomical Society of the Pacific. Americans, both scientists and the general public, have long been admirers of astronomy. It is an important part of our culture, and serves as an intellectual, philosophic, and aesthetic magnet to attract our citizens to interests in science.

Now for more than three years, as Arthur Davidsen just mentioned, indeed from before the General Assembly in New Delhi, the National Organizing Committee and the very much harder working Local Organizing Committee have been preparing for this General Assembly. It has been a privilege to create the setting for a General Assembly which so fosters international cooperation and progress in astronomy. We welcome this opportunity to acquaint you more extensively with America and its astronomy and so, on behalf of the National Organizing Committee and indeed on behalf of all of the American astronomers, I welcome you to the General Assembly of the International Astronomical Union. We stand ready to do all that is possible to make your stay here a pleasant and productive one."

**Address by Dr. S. Muller, President of Johns Hopkins University**

"Ladies and Gentlemen, good afternoon,

It is a pleasure to add my welcome to Baltimore and to the Twentieth General Assembly of the International Astronomical Union on behalf of all of the Johns Hopkins University.

It strikes me as fitting that this University is serving again as host for this major international gathering. You may know that Johns Hopkins has had an international character since its founding in 1876. The Johns Hopkins University, in fact, owes its very existence to the German statesman and educator, Wilhelm von Humboldt who was the founding spirit of the modern German university; because Johns Hopkins, modeled explicitly on von Humboldt's precepts, became America's first true, modern research university, granting the doctorate, committed to freedom of teaching and research, dedicated to the unity of research and teaching.

As you already know, the Department of the University that is most deeply involved with IAU is, of course, the Department of Physics and Astronomy. We had great good luck in that in the initial, original faculty of the Johns Hopkins University, the first Professor of physics was Henry A. Rowland, perhaps now best known for the Rowland grating. Since Dr. Rowland founded the department in 1876, the university's faculty in physics and astronomy have attained great distinction at the university and of course in the past few years the department has been enhanced by the establishment of the Center for Astrophysical Sciences and very much so by the presence of Space Telescope Science Institute at Homewood, now in immediate geographic adjacency to the new building of the department.

The Johns Hopkins University is not resting on its laurels in astronomy with the Hopkins Ultraviolet Telescope and with the Space Telescope Science Institute. Recently, we've reached an agreement with the Carnegie Institution of Washington and the University of Arizona to collaborate in the design, construction and operation of an eight meter optical telescope at Los Campanas in Chile. The Magellan Telescope Project will give astrophysicists another major tool for the study of the Universe, one which will significantly complement the Hopkins Ultraviolet Telescope and the Hubble telescope. Formally, so far, we are committed only to the design phase of this project, but we have every hope that the Magellan Telescope will prove to be feasible and that it will serve to reinforce our commitment to the astrophysical sciences, which is already so substantial.

It is an honor for the Johns Hopkins University to serve as host institution for this General Assembly in cooperation with the National Academy of Sciences. We are deeply grateful to the National Aeronautics and Space Administration and the National Science Foundation for their magnificent support of this conference, and we are especially indebted to the corporate sponsors, whose generosity has made possible the special events that we hope will make this Assembly truly a memorable one for you.

I wish you productive and rewarding meetings, and as I close, it is my special privilege and pleasure to introduce to you the Mayor of the City of Baltimore, the Honorable Kurt L. Schmoke."

**Address by K.L. Schmoke, Mayor of the City of Baltimore**

"Thank you very much, President Muller. Good afternoon,

Every so often, cities, like people, are treated to something special. It's usually not hard to tell when it happens. If you've ever seen a child's face light up during a show at the planetarium, you know exactly what I mean. Well, for Baltimore, hosting the International Astronomical Union's Twentieth General Assembly is indeed something special. So on behalf of all of our citizens I want to warmly welcome you to Baltimore and to welcome Dr. William Graham, Science Advisor to President Reagan and Director, Office of Science and Technology Policy, and all of the Members and Friends of the IAU.

Baltimore, as many of you know, has a strong interest in astronomical discovery. We are very proud of the one hundred and six year old Baltimore Astronomical Society, and of the fact that Johns Hopkins University is the home of the Space Telescope Science Institute and the Center for Astrophysical Sciences. We are equally proud to have been chosen as the meeting place for this Assembly. I say that in particular because those things that will most concentrate the collective mind of the IAU over the next ten days: quasars, the Hubble Space Telescope, the Space Station, joint ventures to Mars, to name just a few, are, for all their complexity, the stuff of dreams and youthful fascination.

So I think that there is a message for the children of our city and children everywhere in the work of this Assembly: make your future one of hope, human adventure, and exploration. I should add that those themes also characterize the kind of city that Baltimore has become and I want to thank the IAU for helping to identify our city with the ideals that you represent.

Now I know that many of you are from out of town and from out of this country and I invite you to see Baltimore and to meet our citizens, especially our young people. You'll discover that they, like you, are curious, adventurous and open to new ideas. So again I want to welcome all of you here today, and I wish you much success with both this assembly and your ongoing scientific endeavors. Thank you all very much."

**Address by M.A. Steinberg,  
Lieutenant Governor of the State of Maryland**

"Thank you very much and good afternoon, everyone,

It is a privilege for me to represent the Governor today to issue a proclamation. But I would like to just take a short moment or two to express some personal comments. I have tremendous respect for the scientific community because as an elected official, and I've had the privilege of serving in elected office for twenty-two years, I've always respected the ability of the scientific community to remove the geographic barriers of countries and jurisdictions, to look at the Planet as a single entity and to utilize the collective minds of everyone on this Planet so that this quality of life may be enriched for all of us.

I'm very proud to be here today, for a number of reasons. Astronomy is one of the oldest sciences. But it's an old science, and man always was cognizant of the fact of the importance of the sun: that it gave the heat, that it provided the light; farmers always utilized the skies to see the change of the seasons; and how the science of astronomy has advanced in a relatively short time is just amazing to a lay individual.

As the Lieutenant Governor of this State, I am extremely proud that you chose the State of Maryland and the city of Baltimore, which is a jewel in the State of Maryland, to hold this conference. Why is it special? I mean, in your sixty-seventh year, this is only the third time that the United States has served as a host community. We are very proud of the Johns Hopkins University. We have an outstanding higher educational system in the State of Maryland, but I have always been very sensitive to the fact that higher education was important both in the private sector as well as in the public schools, because it's a higher education system to our citizens.

You know, before I read the proclamation, one of the earlier speakers indicated two things about which I want to make some personal observations. First, I think Dr. Davidsen alluded to the fact that he arranged a bright, sunny day today. It shows you it's a relative statement to make. As most of you know, we've been experiencing a terrible drought. Several weeks ago when the rains finally broke through, in July, I had the occasion to come before a group that was hosting its convention in this facility and as I came to the podium there was a downpour outside and I was very jubilant; and I said, "Ladies and gentlemen, I am extremely pleased to be here. I think your organization broke the drought, and we're very pleased to have a nice rainy day." So it's a relative situation that you're talking about.

The second point, I forget which speaker alluded to it, is that astronomy has experienced two basic golden ages: the time of Galileo and then the last two decades. I would hope and I sincerely pray that, perhaps twenty years from today, someone will be standing in a podium before one of your conferences and will say that the last two decades were diamond ages in the field of astronomy. Because as an elected official, I see the future with tremendous problems and concerns: the source of energy, the ability to have enough food to feed the people on this planet, our resources that are diminishing; and I believe your science, your discipline, holds the key to unlock some of the mysteries that we need to know for these answers. So before reading the proclamation, I say to you: I wish you well in the next ten days of your conference; I certainly hope that your intellectual discussions will lead to more progress and I wish you the greatest success. I look forward that in the next two decades, if I'm fortunate enough to be here, you will be able to continue the progress that you've made in the last two decades.

And finally, where Mayor Schmoke invited you to see Baltimore, for those of you from out of State and out of the country, Maryland is a microcosm of the United States, and so you can save a lot of money by just visiting the various sections of the State of Maryland and you will walk away from the State of Maryland seeing the United States. My home base, Annapolis, is a beautiful place as are the west of Maryland and the Eastern Shore. I also hope that you will avail yourself of the opportunity of looking at many of our historic sites and very beautiful facilities. At this time I would like to read the proclamation issued by Governor Schaefer. It reads as follows:

**Whereas** it has been said that the future of mankind as we know it depends directly upon how far our dreams will take us; and over the years astronomers and other dedicated members of our international scientific community have properly utilized their skills and visions to further this truth; and **whereas**, since its founding in 1919, the IAU has proudly remained at the forefront in providing forums through which astronomers cooperate internationally while exchanging scientific information and boasts a membership of over 6000 active members hailing from more than 50 countries; and **whereas**, Maryland, home to The Johns Hopkins University and the renowned Space Telescope Science Institute, is extremely proud of the various scientific and educational institutions located throughout our great State, facilities which are consistently on the cutting edge of scientific exploration and technological breakthroughs; and **whereas**, Maryland is pleased to join in welcoming distinguished members of the International Astronomical Union to our State as they attend their organization's prestigious Twentieth General Assembly, as they nobly share in discussion, camaraderie, and friendship for the ultimate betterment of all mankind; **now I, William Donald Schaeffer, Governor of the Great State of Maryland, do hereby proclaim August 2-11, 1988, as International Astronomical Union Days in Maryland and do commend this observance to all of our citizens.**

And it's signed under today's date by Governor William Donald Schaefer. Thank you very much."

**Address by Dr. F. Drake, on behalf of  
Dr. B. Shakhashiri, Assistant Director for Science and Engineering Education  
National Science Foundation**

"The National Science Foundation was to have been represented by Dr. Bassam Shakhashiri, Assistant Director for Science and Engineering Education. Dr. Shakhashiri has unfortunately been detained in a remote airport, and does send his regrets, and I think it will not surprise any of the astronomers here to recognize that these things happen and that the event which happened this morning is not usual. Dr. Shakhashiri found himself marooned in a remote airport in a city known as Indianapolis. Our apologies to those of you from Indiana. He has given me the essence of the remarks he wished to make to you and he is truly disappointed he could not be here because he felt this was an extremely important occasion and he was looking forward to being able to participate in it. In any case, his wishes and his remarks were as follows:

He does wish that this General Assembly be extremely successful, and on behalf of the National Science Foundation he sends greetings and welcome to all the participants in the General Assembly.

As one of the two lead agencies supporting astronomy in the United States, he is proud of the role the National Science Foundation has taken in supporting university and other astronomical research and in particular in developing the national astronomy centers, which are so prominent in American astronomy and in supporting their operations now over several decades. These have become one of the jewels in the crown, not only of American astronomy, but of worldwide astronomy. Many of you have used them, whether you be Americans or people from other countries. He is also pleased that the National Science Foundation was able to join NASA in providing the funding which has made this General Assembly possible. Or, I might add parenthetically, made it possible for your registration fees to be less than astronomical on this occasion.

He notes that the appeal of astronomy to people of all ages, and especially to youth, is extremely great. To those in education, astronomy is particularly important because it can serve as an excellent vehicle to stimulate excitement in science and to cultivate the senses to recognize and pursue intellectual activities. He notes that in our present world of growing population, of new aspirations to higher qualities of life, better standards of living, we need a much broader knowledge of science and appreciation of it and its limitations. He recognizes that scientists know this and calls upon us to be diligent in remembering that in our work.

He notes that because of the increasing impact, both positive and negative, on the welfare of the world: its climate; again, standards of living; economic viability and welfare and wealth; that there is a great importance to communicate science, not only to other scientists, as will be done in an excellent fashion at this General Assembly, but also to non scientists. We need educated citizens in all countries that can think and behave in a rational way. We need educated citizens who can distinguish between astronomy and astrology. We, as scientists, have a responsibility to promote rational behavior on the part of other members of our society, who not only depend on us for leadership, but also for their own welfare and who of course provide the support for our activities. The intellectual excitement in making discoveries is something which must be shared outside the scientific community.

Indeed, scientists and engineers must excel in research in their subspecialties, but they should beware that that is not enough. A dangerous situation will develop if a gap widens between the specialists and the general population. He knows that the General Assemblies play a role in reducing that danger and allowing that communication to occur and thus he congratulates us on this, our General Assembly in the United States, and wishes great success in our undertaking."

**Address by Dr. N.W. Hinners,  
Associate Deputy Administrator, NASA Headquarters**

"Honored Guests, Members of the IAU, Ladies and Gentlemen,

It is indeed a pleasure on behalf of NASA to be here today to welcome you to the State of Maryland and to Baltimore, home of the Space Telescope Science Institute. I'd like to take my brief time here today to talk about the basic state of the US space science programme, its relationship to the overall civil space programme, and the special place of astronomy, with note on the particular role of international cooperation, so well represented today by the IAU.

First, I think we're all aware that the top priority of NASA is indeed to return to safe flight with the shuttle. Despite annoying, but not unusual recent delays in this test or that, the launch of the shuttle is now measured in terms of weeks, not months or years. While we recognize the need for due caution, we're also cognizant of the large number of payloads awaiting launch, some of which have unique launch windows, such as Magellan and Galileo. Others, such as the Tracking and Data Relay Satellite, must precede the satellites they are to service. Add to this a priority for certain Department of Defense satellites, and one finds that the first available opportunity to launch the Hubble Space Telescope is the summer of 1989. Let me assure you that NASA is doing all it can to maintain that launch opportunity, recognizing the cost of delay both in dollars and to a waiting astronomy community and the public. While the delay is regrettable, the time has, in part, been well spent in tuning the very complex ground system of the Space Telescope.

NASA, in addition to the Department of Defense, realizes the extreme penalty we have paid for becoming reliant upon the shuttle for all our launches. It is one that we do not want to repeat, and we are committed to the concept of a mixed launch fleet. Missions that do not uniquely require the shuttle, either for launch or servicing, will be flown on expendable rockets. Conversion of the Cosmic Background Explorer to a Delta launch and conversion of the Extreme Ultraviolet Explorer and ROSAT to Deltas are the first steps in the implementation phase of that policy. The Gamma Ray Observatory, essentially complete, is tailored to the shuttle and will remain as a shuttle launch.

NASA's second priority has been to initiate the development of the Space Station, a key ingredient to the eventual fulfilment of the US goal to expand human presence and activity beyond earth orbit into the solar system. International in scope, the Space Station is going to enable certain science which requires either construction in orbit or frequent servicing or both. In the world of astronomy, such candidate missions as the Large Deployable Reflector, Astromag, and the Long Baseline Optical Space Interferometer immediately come to mind. The choice, however, of which missions to do in conjunction with the Space Station must be based primarily on the scientific requirements and only secondarily on using the Space Station because it is there. Initiation of Space Station has obvious major budget implications, especially in light of the serious US federal budget deficit. Indeed, it was recognition of the essential need to have a strong, healthy space science, technology and aeronautics programme that led NASA to propose, and the President to accept, a major increase in the NASA funding. The fate of the entire NASA budget is now in the hands of Congress, but I'm confident that out of it we'll survive a vigorous space science programme, highlighted by the beginnings of the Advanced X-Ray Astrophysics Facility. It's with only a little bit of chagrin that I recall telling Dr. Giacconi in 1978, that the AXAF new start would be delayed until 1982. I was only seven years off, Riccardo!

The Space Science Programme will, in addition to continuing the great observatory line, reemphasize Explorers and Scout class missions, enable faster response times and meet unique requirements. Similarly, sounding rockets and balloons, so important to Supernova 1987A observations, will be enhanced. No longer, I hope, will you hear of the potential phase-out of sounding rockets and balloons.

Now to the role of international cooperation. Clearly, history has a lesson for us. I am, as are many here, impressed with the extremely fruitful collaborations in the International Ultraviolet Explorer, the IUE, now in its tenth year of observatory operations; and in the Infrared Astronomy Satellite, IRAS, which has made so many fundamental discoveries. A host of additional collaborations exists, with ESA on the Hubble Space Telescope, Germany on ROSAT, the Gamma Ray Observatory. Many potentials exist for the future; the follow-on to IUE, called Lyman; the Space Station related missions; other free-flyers. There's no doubt that in our minds the international cooperation in astronomy is a healthy endeavor. There's simply so much to be done that it is beyond the financial ability of any one nation to go it alone. Repeated calls in our Congress for international participation make that abundantly clear. Science, by its nature, thrives on collaboration, and the talent is spread across national boundaries. Thus NASA remains committed to the concept and the reality of international cooperation.

We view international cooperation as something which must be approached systematically in the context of our overall national policy and goals. Clearly, the US and other nations aspire to pre-eminence in some scientific or technical arena, where they will want to go alone or have minor participation of others. Other arenas, by dint of where the talent is, or for reasons of priority or finance, will be amenable to major sharing. This applies not only to space hardware development, but more and more to the long term operations and data systems, including global data networking.

The key to successful international cooperation in the past has been the bottom up approach, whereby mutual interest generated at the scientist to scientist level has grown into country to country commitments. This is as it should be. Cooperation mandated from above is usually fraught with difficulty and simply suffers from well intentioned but frustrating bureaucratic impedimenta. The IAU is a major facilitator in generating scientific, technical and programmatic exchanges. Out of your activities in the next ten days can grow the right kind of international ventures.

Clearly, astronomy is the forefront space science, one which is on the cutting edge of technology, discovery and comprehension of that most marvelous invention of nature, the Universe.

Thank you."

**Address by Dr. William R. Graham, Science Advisor to the President  
and Director of the Office of Science and Technology Policy**

"On behalf of President Ronald Reagan, I would like to welcome you to the Twentieth General Assembly of the International Astronomical Union and for those of you from other countries, I'd like to welcome you to the United States of America as well. This meeting is a milestone in astronomy and also a milestone, I think, in international cooperation in astronomy, a field of scientific endeavor that has, over the centuries, led the way for international cooperation in research and discovery about the fundamental properties of the Universe.

President Reagan and the people of the United States strongly support scientific research in a wide range of areas and that certainly carries into the astronomical sciences as well. In fact, that support has been growing over the last decade and we have every expectation that it will continue to grow in the future. As a part of this, the United States strongly encourages international cooperation in scientific research. Many of the astronomical programmes that we're going to discuss here this week and next and many of the instruments have become so unique that they in all likelihood won't be duplicated, at least not exactly, but will be joined and used by scientists from many nations, and that is certainly as it should be. But even more basically, it is our experience that scientific research benefits all people. In terms of game theory, if you like that vernacular, it's truly a positive sum enterprise.

We recognize that scientific research draws heavily on the world's most valuable resources and those that are its scarcest: the human minds and the human skills of this Planet. But it also enriches and expands those human resources through the training of new generations of scientists, through the strengthening of our institutions and through enriching our cultures. And in recognition of the growing importance of international cooperation and the value of human ingenuity, last year, at the Organization of Economic Cooperation and Development, which is a group of twenty-four industrialized nations, the United States proposed a general framework of principles for international cooperation in science and technology. That proposal was carefully designed to make several explicit, fundamental principles known in the international area of science and technology cooperation.

Among the OECD recommendations, the following were key: equitable contributions from all industrialized nations in support of basic research and maintaining up-to-date research facilities; equitable contributions from all industrialized nations to the education and advanced training of the next generation of scientist and engineers; open access for researchers, scientists and engineers to basic research facilities and activities supported by member governments; dissemination of basic research information and results through publication in the generally available scientific literature and other customary practices -certainly this General Assembly is a highpoint of those customary practices- and, of course, acknowledgement and respect for the intellectual accomplishments of scientists worldwide.

These principles strongly apply to astronomy and have been growing in strength for many years. Examples of US support for international cooperation in astronomy abound and you've already heard of many this afternoon. I would add to the list Mauna Kea, possibly a unique and certainly a prime site for ground based astronomical observation, and one where the US has been privileged to provide site and assistance to France, Canada and the UK, as well as to the US astronomical facilities and a welcome reception to astronomers from around the world. Similarly, we are received at the Cerro Tololo Inter-American Observatory in Chile and at many other sites around the world. The names that you have heard: IRAS, the IRAS programme, its great data bank still being digested; the Very Long Baseline Radio Astronomy programmes; the Hubble Telescope and the Gamma Ray Observatory, about to be launched; the Microwave Observation Programme, moving now into the immediate future, with its million channel data acquisition capability, and its challenge is not only to radio astronomy, but to providing the artificial intelligence and the expert systems we'll need to reduce the data that that's able to collect; and then to the AXAF and to many more space based experiments.

Even more interesting, perhaps, and something hardly even imagined at the last General Assembly in the United States: we're moving beyond the photon to other forms of energy detection, including the deep underground detectors for neutrinos, detectors which recently identified the neutrino flux from Supernova 1987A; and on beyond that to gravity wave measurements, to more advanced planetary measurements and perhaps to forms of energy that we haven't yet detected or decided could be of astronomical use.

So the United States is proud to host this meeting and happy to welcome every qualified astronomer, of whatever origin, to our country. I hope, when the history of this meeting is recorded, that it will be recognized as a testament to the realization that combining our resources, human and physical, we can further accelerate the pace of our long adventure in scientific discovery, the most challenging and exciting course of discovery that this world has ever known. Thank you."

**Address by Prof. J. Sahade,  
President of the International Astronomical Union**

"Ladies and Gentlemen, Distinguished Guests,

After such a remarkable performance of the Annapolis Brass Quintet and our listening to the inspired composition especially prepared for the occasion, I feel in the awkward situation of having to say a few words on behalf of the IAU when I would think that everyone of us would prefer to be left with the magic of the melodious piece we were just presented with ringing in our ears.

The International Astronomical Union is very happy to hold a General Assembly in the United States for a third time and very grateful to the US National Academy of Sciences for the warm invitation that was extended to us.

At this opening ceremony, where I enthusiastically welcome all of you, I would also like to express our gratefulness to the Johns Hopkins University for serving as the gracious host of it, the twentieth of our triennial gatherings.

I would like to thank President Muller for his words of welcome and I would also like to praise him very highly for the great support he gives to the development of Astronomy at Johns Hopkins and for the enthusiasm and the generosity of the contributions he has made as our host, towards the success of the General Assembly. We feel most honoured for your being with us at this ceremony, President Muller!

In a way, the Johns Hopkins University is living up to a long tradition. Those of us who are engaged in spectroscopic work do remember the father of the concave diffraction grating, Henry A. Rowland, the first Professor of Physics at Johns Hopkins University and the first President of the American Physical Society. I do not need to stress the importance of Rowland's discovery, or invention if you prefer, which he announced in 1882. For me, who started using in Cordoba, Argentina, a grating spectrograph, the name of Johns Hopkins was always present in my mind: the grating was a replica made by Professor Robert W. Wood at Johns Hopkins University.

We are most pleased indeed that the setting for our meetings is provided by the Monument City, by the two hundred and forty-nine year old City of Baltimore, and we are pleased indeed that the City's Mayor could be with us today. In Baltimore we find the past, the present and the future blended together in a wonderful, constructive, inspiring way. Baltimore is one of the particularly important places in the early history of the United States, during the American Revolution; it is now a busy and booming industrial center world-wide famous for the academic and research levels of our host, the Johns Hopkins University, for its glorious Baltimore Symphony Orchestra that will delight us next Thursday and for the many expressions of art and culture that characterize the City. And projecting itself in a future which is already here, Baltimore houses, on the Johns Hopkins University premises, the American Space Telescope Science Institute that is connected to the forthcoming activities of the Hubble Space Telescope, that we astronomers the world over are so eagerly and impatiently awaiting -and in particular to receiving its invaluable information that has long been overdue.

I said that we feel very happy to meet once again in the United States. And this is something natural because this country is one of the first ever National Members that adhered to the IAU, upon its creation almost 70 years ago. Moreover, about 27 percent of our individual Members are US astronomers, and the category to which the country subscribes is the highest category that is listed in our By-Laws.

But there are even more profound reasons for our feelings, as you all know. The United States are noteworthy for the outstanding contributions to our astronomical knowledge that have always been made. The important optical astronomical centers started on the East Coast, Harvard, spread to the middle-west, Yerkes, and then to the West Coast, to California, also to Texas, and to Arizona, and even furthest west, to Hawaii, in search for the best skies available to place the large reflectors that were to be built.

The many contributions that have come from Lick, from Mount Wilson, from Mount Palomar, from McDonald, from Kitt Peak, from Mauna Kea are landmarks in our quest for learning more and more about the Universe and also a tribute to the people and institutions who provided the funding and to the hard work of the astronomers of this country, who, in many cases, carried out their research with the cooperation of astronomers from other lands.

The New Astronomies that started popping up practically immediately after the Second World War, and particularly since the advent of the space age, the new technologies that are being placed at our disposal, have so drastically changed our classical set up for observing and for analyzing the information that is obtained, that old-timers like myself are having an exciting time trying to adapt themselves to the new situation. And in all these changes the United States -its astronomers, its physicists, its engineers- have played and are playing an outstanding role.

As time goes by, Astronomy is becoming more and more exciting and to add to the excitement we are sometimes offered the possibility of attempting new approaches like in the case of Halley's Comet or of learning through the observations, about the characteristics of the actual progenitor of a supernova like the naked-eye one that appeared last year in the Large Magellanic Cloud, an object that is the subject of one of our Joint Discussions this week.

In the present day level of the astronomical activities in the United States there are two organizations that play a major role, the National Science Foundation and the National Aeronautics and Space Administration. We greatly appreciate that the two agencies are represented in this opening ceremony and I would like to take the opportunity to thank NSF and NASA for the very significant contributions that they have made to the Local Organizing Committee.

We feel also very honoured with the proclamation of the Governor of the State of Maryland, Terra Mariae, as it was called on the Latin Charter in 1632. Maryland is the home of several institutions where Astronomy is an important activity. I should particularly mention the University of Maryland and NASA's Goddard Space Flight Center, the seat of many outstanding astronomical space activities.

Unfortunately for our science, not everything is bright and rosy. There are, or there appear to be, some dark clouds coming up in our horizon that threaten to degrade drastically and increasingly the Earth's environment, thus adversely affecting "astronomical observations from the ground and from space".

The contamination of space could reach levels that are both ridiculous and frightening. We are very much concerned about it and equally concerned also with the people of this region in regard to the pollution of the Chesapeake Bay area which affects the quality of life both human and wild.

One of these frightening projects that will dramatically spoil our prospects of continuing contributing to our knowledge and understanding of the Universe originates in this country. I am referring to the so-called Celestis-Space Services payload launch proposal that aims at launching "cremated human remains into Earth orbit, using highly reflective containers". It seems incredible that business interests could attempt degrade in such a radical way the interests of mankind, of the human beings who aim at increasing knowledge and at living in a purer environment!

The international astronomical community is so concerned with Celestis-type projects that at our last General Assembly in Delhi, a resolution was unanimously passed that had the character of a general appeal to countries and space agencies. The reaction to such an appeal has not been as positive as we would have expected and, as a consequence, the relevant Commission of the Union is going to hold a press conference during this General Assembly and on August 13 to 16 will be holding, in Washington DC, a colloquium on "Light Pollution, Radio Interference and Space Debris". Let us hope that what will be said at the present General Assembly and the activities of our Commission 50 on "Protection of Existing and Potential Observatory Sites" will succeed in creating an awareness in decision-makers and in the general public on the important problem of the environmental pollution that goes beyond the immediate surroundings.

Let me finish my words of welcome by expressing our thanks to the Science Adviser to President Reagan for being with us and for speaking to us this afternoon, and the appreciation and congratulations of the Union to the wonderful work of the National and the Local Organizing Committees that has led to the perfect and detailed organization of this Assembly.

I am sure we will all enjoy, during the next few days, not only a good, carefully prepared scientific meeting but also the warm hospitality of Baltimore and a taste of your famous blue crabs.

And now, I declare the XXth General Assembly open!"