

The following is the text of the speech delivered by Peter Willmore at the COSPAR General Assembly in Montreal, Canada, on July 14, 2008, on the occasion of the 50th anniversary of COSPAR.

COSPAR's first 50 Years

When Sputnik 1 was launched in 1957, the Cold War was at its height. There were still 5 years to go before the Cuban Missile Crisis, where the world stood closer to nuclear war for a few days than at any time before or since. The space programmes of the US and the USSR were in part products of the military and political competition of the Cold War. However, the scientific potential of this new development was widely recognized well before the launch, and so it was immediately appreciated that, given the very poor state of scientific communication between East and West at the time, a new channel of communication needed to be opened up if this new science was to flourish. Moreover, the IGY in 1957 had shown a divided world how powerful international cooperation could be. Out of this recognition, COSPAR was born in 1958.

Before I describe how this happened, I hope you will allow me a couple of personal anecdotes by way of background and in order to give you something of the flavour of a very different world.

The first COSPAR Scientific Assembly was held in Nice in 1960. At that time, I was a young post-doc and this was my first international meeting. The first few assemblies were particularly memorable for a succession of exciting new results which you will appreciate better if first I remind you of the scientific context.

By the late 50's the temperature of the Solar Corona had been established to be of order a million K, mainly by a number of ground-based observations, together with observations of the EUV and X-ray spectrum of the Sun in rocket experiments carried out by Herb Friedman's group at NRL, the latest of which were described at Nice. The existence of a layer in the Solar atmosphere at such a temperature with the photosphere at 6000 K below, and the coldness of space above, was a serious thermodynamic puzzle which of course is still not fully resolved. The interplanetary medium was thought to be similar to that around any other star—sparse (consisting of about 1 H atom/cc), static and at a temperature of about 100K—except at times of solar outbursts.

The next year in Florence, Konstantin Gringauz described some measurements by Lunik II of the ambient electron density at a distance of 4 Earth radii, which showed it to be 10^3 /cc. Harrie Massey, Robert Boyd and I spent some time over dinner making sure we had really got his message. This was that the density was far higher than would be expected from the then-current picture of the F-region of the ionosphere, where the density decreased exponentially with a scale height of perhaps 100 km from a peak height of 250 km. In fact Gringauz had made the first direct observation of the magnetosphere. That term had been introduced a few years earlier by Tommy Gold, though in Gold's magnetosphere there was no magnetopause or bow shock, only a dipole magnetic field. In addition, Gringauz reported measuring positive ion currents in the interplanetary medium, which he attributed to a static solar corona.

At the subsequent assembly in Washington, this story unfolded still further. I have especially vivid memories of one session in particular, in which there were three seminal papers¹. In the first of these, Sydney Chapman described a static model of the solar corona, which stretched out to the Earth's orbit and beyond, thermal conduction maintaining a plasma temperature of 250,000K at the distance of the Earth. In the second, Eugene Parker described a dynamic model, differing from Chapman's mainly in that the plasma swept past the Earth at a supersonic speed. Neither of these models was new in 1962, but which of them was correct was still a matter of active debate. Finally, in the third paper, Bridge's group from MIT described in-situ measurements from Explorer 10 which confirmed the essentials of Parker's picture¹. The following year (Florence again) Marcia Neugebauer described results from Mariner 2 which completed the picture and so the cold, static interplanetary medium was finally replaced by the dynamism of what we now call the heliosphere. The latest results from the Voyager 2 crossing of the termination shock last year will be described at this assembly.

The heliosphere—now and then

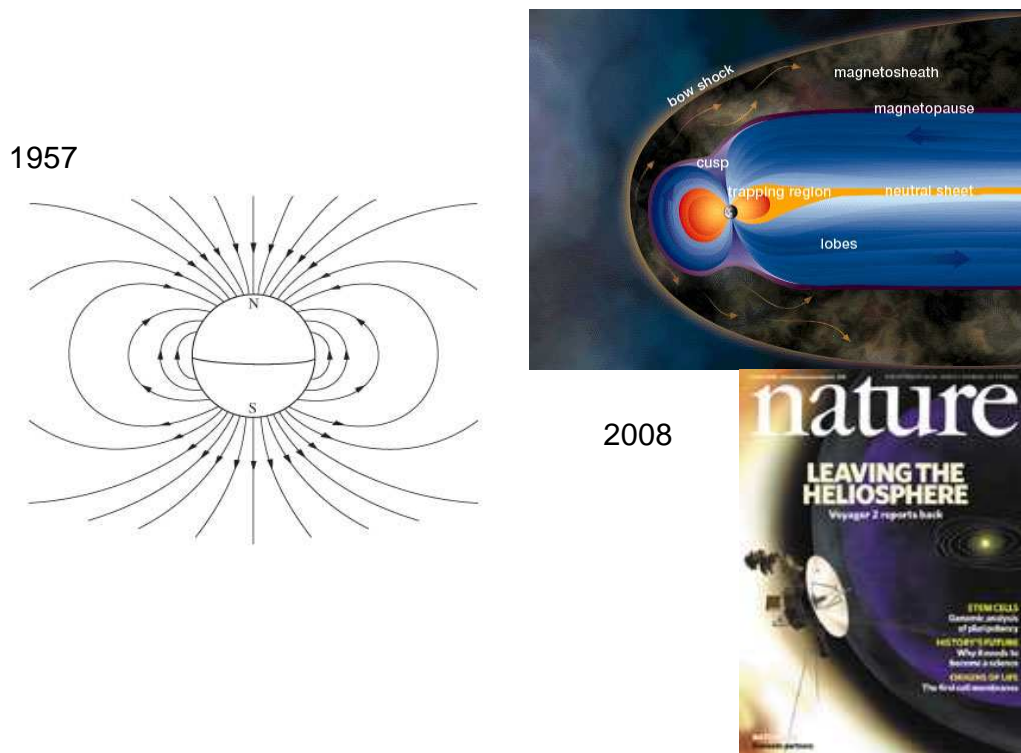


Figure 1. The heliosphere before and after. On the left is a sketch of Gold's magnetosphere and, on the right, of the modern view of the magnetosphere together with the front cover of the issue of Nature in which the results of observations of the Voyager 2 crossings of the termination shock of the heliosphere were recently (July 5th 2008) described. The cover shows in the background the shock structure of the heliosphere. The Voyager 2 results were also described at the 2008 COSPAR assembly.

I think these anecdotes capture the spirit of those COSPAR assemblies, where dramatic first results were presented both by US and by USSR participants in "Latest

Results” sessions, and very soon by Canadians, Europeans and others as well. There was always great excitement on the day before the start of the assembly, as we waited to find out if the Soviets had obtained their visas. They always did, though sometimes late or in the nick of time, and in Tokyo in 1968 the group which arrived was not that whose papers had been accepted in the programme!

One further anecdote. In 1962, I made some of the earliest observations of the interaction of a spacecraft with its environment using Ariel 1. The only theoretical investigation had been made by a young Russian, Alexander Gurevich, whom I met at the COSPAR assembly in Washington, and this was our first and only opportunity to compare notes. I suggested to him that he might return to the USSR via England, but he said that was utterly impossible for him, not the less because he was Jewish and so automatically politically suspect and were he to put a foot wrong, the consequences could have been serious.

This gives an idea of the strength of the impediments to ordinary scientific discourse at the time, which created many unusual difficulties especially for Soviet scientists. To understand it, you must remember the point I have already made about the scientific space programme coming out of the growing military programmes.

The creation of NASA in 1958 meant that in the US some space was created between the construction of military and civil spacecraft. This proved of vital importance for the future growth of space science, but it never happened in the Soviet Union, leading always to a fear that sensitive information would leak to the West through contacts with scientists.

In the 70's, my group was involved with the construction of instruments for Spacelab and the Mir space station at the same time. One day I had a visit from someone from the British Secret Service, who said he was worried about the potential for classified US information to leak through our lab to the Soviet Union. I was able to show him this couldn't happen simply because I didn't have any classified information. Other people with projects in the USSR and the US had similar experiences, but, oddly enough, they did not seem to arise from the Franco-USSR collaboration.

So how did COSPAR come into being? The programme of the IGY was guided by a Special Committee of the International Council of Scientific Unions (ICSU), now the International Council for Science, called the CSAGI (Comité Spécial de l'Année Géophysique Internationale) which rather amazingly had a section devoted to Rockets and Satellites, and it was through this route that both the US and then the USSR announced their intention to launch earth satellites during the IGY. The IGY was not only a great success scientifically, it also captured the public imagination worldwide as perhaps no other scientific venture has ever done. After the war, science was seen almost unreservedly as a power for human good, and the IGY showed how that power could be multiplied by global collaboration. The motivation for bringing the new science of space into this framework was thus very strong, and the need to overcome the difficulties caused by the cold war was recognized.

Not only the experience of the IGY, but also what was then happening within the UN which I shall come to in a moment, suggested it would be better for the science if this could be brought about through ICSU. Accordingly, in October 1958, the Bureau of

ICSU approved the creation of a Special Committee on Space Research (COSPAR), and appointed Lloyd Berkner convener of a group to draft its charter, and decide on its constitution. This group did its work at a series of meetings over the next year in London, The Hague and finally Amsterdam.

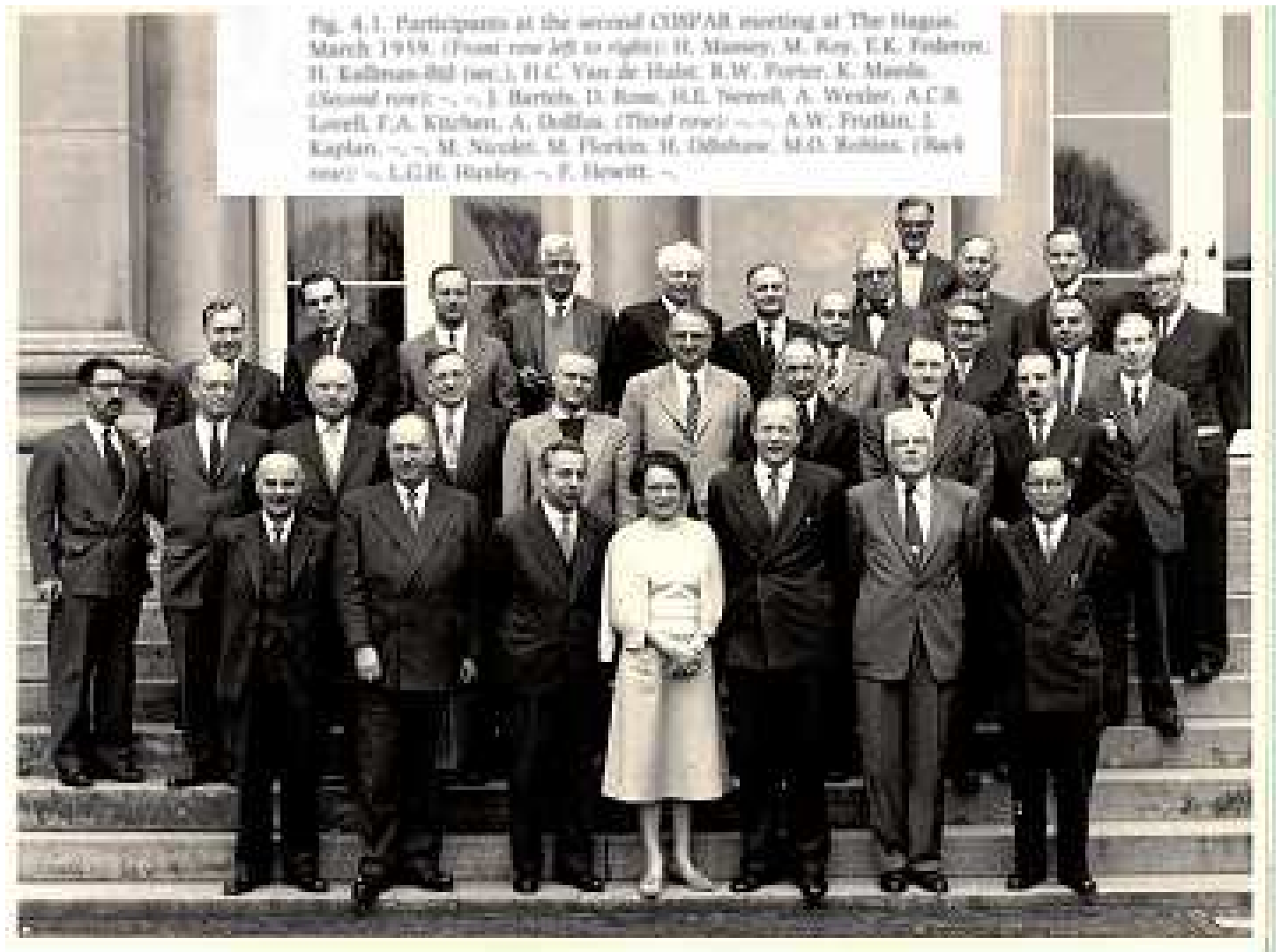


Figure 2. Photograph of the founding group of COSPAR at the meeting in London in 1958.

That this involved real political difficulties is indicated by the extraordinary arrangements which were agreed for appointing the Bureau. In the final, approved version there were to be two Vice-Presidents nominated by the Academies of the USSR and the US, and these two would each nominate two Bureau members for the available four places. The President was to be nominated jointly by the same two academies. On the other hand, the Council followed the norm for scientific unions, being composed of national members (open to the academies of all countries willing to pay the subscription) and representatives of scientific unions. The Council however

had little influence over the composition of the Bureau. At the Nice meeting of the new Bureau in 1960, Henk van de Hulst was appointed the first President.

Milestones

- 1957 Launch of Sputnik 1
- 1958 ICSU establishes COSPAR
- 1960 First scientific assembly held in Nice
- 1982 Assemblies become biennial
- 1984-1992 New COSPAR Charter
- 1998 ASR becomes a refereed journal
- 2004 Bonnet initiates “Reflections”

Figure 3. Some COSPAR Milestones.

It is amazing that such an undemocratic structure was internationally acceptable. Once again the general political situation is the key. The US and the USSR were locked in a battle in the UN over questions of space law, such as the legality of surveillance satellites. International law gave countries control over the airspace above them and of over-flying rights in that airspace. These and similar issues were resolved by the Treaty on the Peaceful Uses of Outer Space in 1967³ but in the meantime, it was in nobody's interest to have COSPAR drawn into such questions.

It is a tribute to the wisdom of those who led space science, in the US, the USSR and Europe, for the main part, that in these remarkably unpropitious circumstances, COSPAR was born and flourished, as space science itself flourished across the world.

COSPAR's first function, the holding of annual scientific assemblies, was both the normal task of a member of the ICSU family as well as natural in the conditions I have described and to it was also naturally added the production of a journal, *Space Research*, which has evolved over the years into today's *Advances in Space Research (ASR)*. There have been however many other ways in which COSPAR has served the space community.

One is as a vehicle for international cooperation. At the preliminary meeting in 1958 at The Hague, Dick Porter, on behalf of the US National Academy of Science, offered NASA's facilities to launch without cost either experiments or satellites for scientists of other nations, saying that COSPAR would “serve as an avenue through which the capabilities of satellite launching nations and the scientific potential of other nations might be brought together”. I believe this was one of the seminal steps in the

development of international space science because it led to broad scientific access to the US programme through much of the 60's and 70's on extremely generous terms. This resulted in a rapid extension of space science capability in many countries, which certainly would not have occurred had they had to develop their own launchers. It also engendered a habit of international cooperation which has played an important part in establishing the character of modern space science.

Although COSPAR is inevitably influenced by the big agencies and certainly must work closely with them, its independence from them gives it another important role as a forum for the international scientific community. Possibly the most dramatic example was the early discussions which led to formal European cooperation in space. In 1959, Edoardo Amaldi, who had been much concerned with the establishment of CERN, the European centre for high energy physics, proposed in a letter to European colleagues, a similar initiative in space research. At the Nice assembly, Jacques Blamont got a few of us together to talk with Pierre Auger, who would be a key figure in the proposal. Later in the assembly, Amaldi, Massey and Auger agreed to pursue the question through a wider and more formal European meeting in Paris the next month⁴. This seems to me to be the point at which the proposal took off: it resulted in the creation of ESRO, which later metamorphosed into ESA, in 1962.

The COSPAR functions I have talked about so far are in a sense services to the space science community, but COSPAR has other roles. One of these is to act as the international body which identifies the necessary conditions for the preservation of near-Earth space and the moon and planets so that basic and applied science can be carried out and manned spaceflight can be conducted, at the same time allowing for appropriate commercial exploitation of these regions. The first requirement here was recognized in 1960 to establish standards for lunar missions to avoid chemical or biological contamination of the Moon, and a panel (now the Panel on Planetary Protection, PPP) on this and related topics has existed in one form or another ever since, producing its first standards in 1962. This is a difficult area because COSPAR has no role in implementing the standards it sets up, and can apply no sanctions if they are not observed other than to expose breaches to public opinion. Moreover, in setting standards, COSPAR must work closely with space agencies whilst maintaining some distance from them. This work, always important, has never been more needed than now, when we are seeing a renewed interest in visits to the Moon and to Mars, and when possible commercial exploitation of the Moon is being advocated.

Planetary contamination is of course not the only problem. Light pollution such as the UNESCO Star of Tolerance proposal or the Iridium satellites is another, and military uses of space such as the notorious Starfish experiments also, but many of these are covered by the Outer Space Treaty where the responsibility rests with the UN's COPUOS which has a better chance of triggering action than does COSPAR.

Planetary protection provides an interesting example of the need to manage relations with space agencies, who must implement protection policies. Space science is more, I think, than any other area of science dominated by the programmes of the space agencies, each of which has a national (or, in the case of ESA, a quasi-national) function, which is certainly not solely scientific, to fulfill. This provides a tension and

I think COSPAR Assemblies have provided a useful forum for scientific discussion which is not under an agency umbrella and indeed where inter-agency discussion can be encouraged. There have been a number of examples of the latter, but the prime example was the desirability of international cooperation in plans for the Comet Halley perihelion in 1986. COSPAR set up an ad-hoc committee under Jacques Blamont and out of this came the Inter-Agency Consultative Group which for a time provided a useful mechanism for inter-agency discussion which could usefully be revived in some form.

Another important practical role has been to provide a framework within which the creation of the various reference atmospheres could take place.

However, by the end of the 80's the political climate had changed radically, culminating in the collapse of the Soviet Union in the early 90's. Dissatisfaction with the undemocratic and by then out-dated constitution and also with the assemblies, which were thought to be of a poor standard scientifically, led to a complete and thorough review and reform of COSPAR, leading to the structure of the Bureau, the Assemblies and the Scientific Commissions we have today, effectively converting COSPAR into a scientific union, though formally it still does not have that status.

Change started in 1982 under the Presidency of Kees de Jager, though it wasn't initially a very rapid process. After him, three successive Presidents of COSPAR have recognized the need for change. These were Ian Axford, Gerhard Haerendel and the current President, Roger Bonnet, each of whom has contributed something important to the process of revival. The Assemblies were made biennial, were shortened and given a stronger scientific focus and as a result have gone from strength to strength, producing the lively meetings we see today. This process reached a culmination in 2004 when Roger Bonnet led a thorough review ("Reflections") of what COSPAR's activities and function should be in modern circumstances.

How do we assess COSPAR's position today?

In 1996 the fact that the remit of space science continues to grow was recognised by setting-up a new Scientific Commission H, for Fundamental Physics.

In 2000, a new programme, that for Capacity-Building, was established, which holds workshops in developing countries for young developing country scientists, to encourage the use of space data in world-class research in those countries.



Figure 4. Evidence of hard work at a COSPAR Capacity-Building Workshop! Photograph of the participants at the Workshop on Chandra, XMM-Newton and Swift held in January 2008 at the Library of Alexandria.

The Workshops so far

2001 X-ray astronomy	Chandra, XMM-Newton	INPE, Brazil
2003 X-ray astronomy	Chandra, XMM-Newton, Astrosat	Udaipur, India
2004 Magnetospheric physics	Cluster, Double-Star	Beijing, China
2004 X-ray astronomy	Chandra, XMM-Newton, SALT	Durban, South Africa
2005 Space Oceanography		CRTS, Rabat, Morocco
2007 Solar-Terrestrial Physics	Cluster, PECS programme	Sinaia, Romania
Planetary Physics	Planetary Data System, Planetary Science Archive	Montevideo, Uruguay
2008 X-ray Astronomy	Chandra, XMM-Newton, Swift	Alexandria, Egypt
2008 Optical and UV astronomy	Hubble, Fuze	Kuala Lumpur, Malaysia

Figure 5. A list of the workshops held in the Capacity-Building programme up to 2008. An attempt is made to relate each workshop to some host country project or government initiative; these are listed in the second column.

Since then nine workshops have been held and the “graduates” from them, who number more than 250, are now appearing in small but increasing numbers at these assemblies, where they are presenting papers. The workshops have involved very active collaboration with other organizations and members of the ICSU “family”, especially the IAU. This programme is now a significant budget line for COSPAR and it has certainly contributed to a wider international appreciation of its activities,

though it is also not the only reason for this, as COSPAR has at the same time become increasingly pro-active within the ICSU family and the UN.

Funding collaborators

Unions and Agencies, etc

IAU

ICSU

UN/OOSA

UNESCO/IOC

URSI

Abdus Salam ICTP

US National Academy of Science

ESA

ESAC, ESA

NASA

IFREMER

IRD Medias France

ISPRS

Univ of Plymouth, UK

UK Met Office

Univ of Leicester, UK

MERCATOR OCEAN

Univ of Groningen, Netherlands

Univ of Leiden, Netherlands

MERSEA Project

Host country organisations

FAPESP, Brazil

Indian Space Research Organisation

Physical Research Lab, Ahmedabad

CSSTEAP, India

CCSAR, China

National Research Foundation, RSA

CRTS, Morocco

Ministerio del Educacion, Uruguay

Univers. de la Republica, Montvideo

Ministry of Science, Egypt

University of Cairo and CIAS, Egypt,

Library of Alexandria, Egypt

ANGKASA, Malaysia

University of Malaysia

Figure 6. The programme has depended on a large number of organizations who have helped to fund it which are listed here.

In the 2004 Reflections, the capacity-building programme was consolidated into a wider educational programme and was allied to giving a stronger encouragement to space scientists generally who are at an early stage in their careers.

Another major issue which has been addressed over this period is that the climate for journals such as ASR is changing rapidly, and great efforts have been devoted (and here one should note the part played by Wim Hermsen and Peggy Shea amongst others) to developing, modernizing and improving it. It has been strictly refereed since 1998 to improve quality; a new editorial structure has been introduced in order to reduce publication delays, and the most recent change has been to convert it from a proceedings to an open journal. All these efforts are bearing fruit and are certainly important for COSPAR's future. Perhaps the best indicator of this is the remarkable level of on-line accesses.

Downloads of ASR

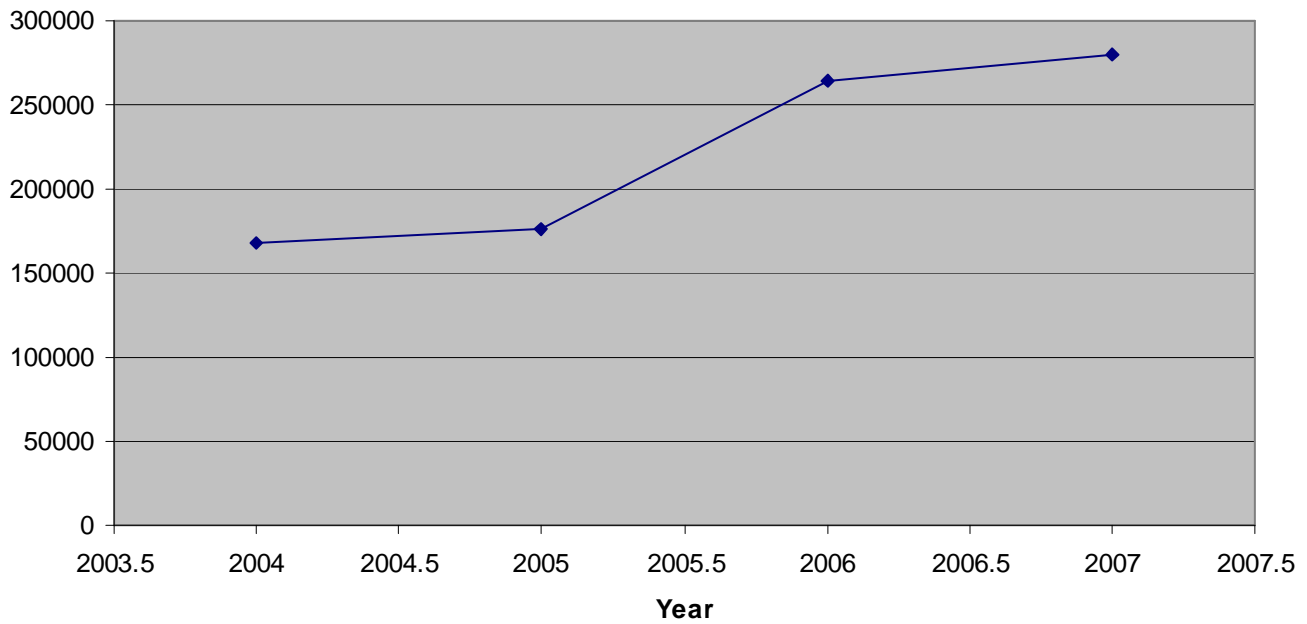


Figure 7. On-line accesses to ASR are at a high level and are rising faster than for any other Elsevier journal.

Finally, a measure of COSPAR's value to its community is the number of participants at each assembly and the number of papers presented, which are both increasing generally. My own perception is in addition that the scientific quality of the assemblies has been very high.

Growth of COSPAR assemblies

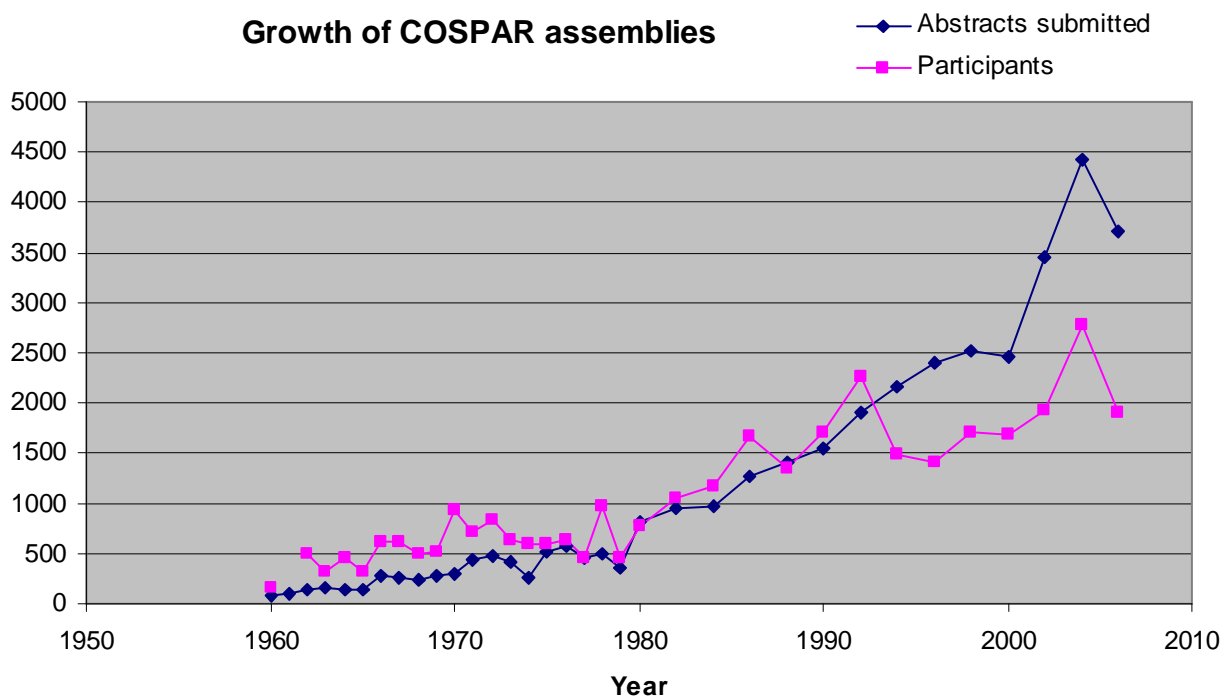


Figure 8. Besides the access to ASR, another indicator of COSPAR's continuing value to the space community is the number of papers submitted to each assembly,

and the number of people who attend them. Both of these are rising generally. The assemblies started to be held biennially in 1982, and it can be seen that the rate of growth increased from that point.

We can see that in the 21st millennium COSPAR has evolved to reflect its changing circumstances, with a new constitution, a new pattern for the assemblies, a re-modelled *ASR*, an expanded range of science, new educational activities and generally more pro-active policies. I believe that this process has demonstrably been successful in producing an organization which is in good shape to face the next several decades, which is just as well since they will no doubt present as many challenges as the last few. So I feel we can all confidently offer COSPAR our best wishes for its next 50 years.

Note: I would like to thank Roger Bonnet, Aaron Janofsky, Jean-Louis Fellous, Jacques Blamont and Oleg Vaisberg for helpful comments on the draft of this talk.

¹ Actually there is a discrepancy between the programme of the meeting, which lists only Bridges' paper, and my recollection, which however is quite vivid.

² from their abstract: "The signals obtained when the probe was more than 21.5 Earth radii from the Earth indicate that the vehicle traversed a boundary region a number of times; inside the boundary there were either no signals or very small signals recorded by the plasma probe, whilst outside the boundary fluxes of energetic, collimated particles were observed coming from the general direction of the Sun."

³ based on principles agreed in the General Assembly in 1963.

⁴ this is Massey's account; according to the ESA history, Amaldi was not actually present.