

中国空间应用的回顾与展望

1989年空间应用座谈会文集

CHINA SPACE APPLICATIONS —
REVIEW AND PROSPECT

(The symposium on Space Applications
in 1989)

王大珩 主编



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内 容 提 要

本书集录了我国空间应用论文41篇，分为概述、遥感、卫星通信、微重力科学与空间实验等几个方面，比较全面地介绍了我国空间应用科学的现状、历史，以及今后的发展方向。

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主 编 的 话

1965年着手考虑我国卫星系列规划时,就把可回收的国土普查卫星、通信卫星、气象卫星等应用卫星系列确定为我国卫星发展规划的重点。1970年我国第一颗人造地球卫星的发射成功,促进了我国空间应用事业的全面起步。

随着我国航天技术的发展,空间应用从人材培养到组织研究,从基础研究到工程设计,建立了一定基础。特别是实行改革开放政策10年来,空间应用的发展注入了新的活力。在空间遥感方面,除了我国可回收的国土卫星外,还引进了地面站,接收国外气象和资源卫星数据,应用于国民经济各个部门;在卫星通信方面,发射了对地定点卫星,针对解决边远地区的电视、通信和教育,初见成效;微重力科学与应用研究,在我国则是最近几年才刚刚起步。今后,在我国航天技术从试验阶段向实用阶段过渡的同时,有必要更加重视和强调应用,以使空间应用在我国国计民生的各个方面,发挥更大的效益。

我国空间应用是在“自力更生为主,争取外援为辅”的指导思想下发展起来的。结合我国国情,以较少的投资,在较广泛的领域开展了工作,培养了科技队伍;在预研、设计、制造、试验、应用以及组织管理等方面取得了不少成绩和经验。但是,在调整建立合适的体制,统一规划、协调发展、合理投入和综合利用等方面,还存在着不少急待解决的问题。为了回顾和交流我国在卫星通信、遥感和微重力科学三个领域中,主要是“七五”期间所取得的成果和效益,认真地分析、总结经验教训,继往开来,我们编辑出版了该文集,并望读者批评指正。

王大珩

1989. 12.

PREFACE

Ever since planning our space project in 1965, much emphasis were put forth towards establishing an application satellite series, including such as the retrievable remote sensing satellite, the communication satellite, the meteorological satellite, etc. The successful launching of the first Chinese satellite marked the milestone for comprehensive development on space applications in China.

While the development of our space technology was in progress, the technical foundations on space applications were laid by the same time. Scientific and technical personnels were trained research and development works were organised, right through basic research to technical design and manufacturing of all sorts of equipment and facilities. Especially in recent years, our government policy of Reformation and Openning to the Outside World renders a new vigour to the development of space applications.

In the realm of remote sensing, it is well known that retrievable satellites have been laaunched many times for investigating land cover and environmental studies. Satallite ground stations were established through foreign aids for meteorological and Landsat data receptions. They have been used to advantage in various aspects beneficial to our national economy.

As regards to satellite communications, our home-made satellites have been put into operation at geostationary orbits. They have served our requirements for communication with remote outlying districts as well as for television and TV educational services.

Recently, application of satellite for microgravity experiments have been carried out for investigating semiconductor monocrystalisation and biological effects. Works are just at the start.

Up to now, we are gradually trnsforming our activities through experimental stage towards operational practices, the results of which would certainly play more important role to our national economy and to the bettering of people's livelihood.

In the course of our development, we adhered to the principle of self-reliance with external assistance as the subsidiary. By so doing, we have gained invaluable experiences on wide spread fields of relevant sciences and technology. Solid foundations have thus been built up in both respects of technical facilities and personnel. Besides, what is equally important to us, is the saving of a colossal amount of our financial investment.

With the view of rapid development of space applications nowadays in the world, it is deemed timely to review our past experiences for achievements as well as for our drawbacks. For the latter in particular, lots are to be improved on our organisation and efficient management. Our main purpose is however to learn from the past in order to open new ways for the future. The publication of the present proceedings may be useful for such a sake. Any criticisms and suggestions will be very valuable and welcome.

Prof. Wang Daheng
Academical Member
Chinese Academy of Sciences

前 言

航天科学技术的巨大成就，为人类社会、经济的发展提供了新手段：人们可以利用空间对地球进行居高临下的观察和监测，以获取前所未有的地球信息；通过定点卫星进行稳定的大容量、远距离信息传输；可以利用空间特殊环境进行空间实验（如微重力实验），甚至进行空间生产，从空间信息利用发展到物质利用。当今不仅已形成了世界性的空间产业和市场（投资效益比在1:10以上），而且空间活动加速商业化的趋势十分明显，这是一种挑战。

我国空间事业经30年努力，不仅具备了坚实的技术基础，而且已步入实用阶段。相对而言，我们的空间应用还必须进一步开拓。虽然我们在遥感、通信、教育、微重力等诸多方面有了基础，甚至在个别方面有了较好的基础，取得了经济和社会效益，但由于空间应用涉及门类多、覆盖领域广，必须大力宣传、积极推动、广泛合作才能更充分的利用空间和我们的空间技术能力。

我国在空间应用方面可以做的事很多，但要根据国力的可能和技术基础有计划有步骤地进行开发。

为使我国空间应用更好、更快地协调发展，由国家计委、国家科委、中国科学院有关部门共同发起，经近一年的准备，于1989年8月29日至31日在北京圆满召开了“空间应用座谈会”。参加会议的有28个部委、省、市的78个单位110名代表。共有各个空间应用领域的128篇专题报告，回顾了我国在遥感、教育、卫星通信和微重力科学领域的发展和成效，交流了经验，提出了问题，展望了今后的发展，提出了建议。这里选编出部分专题报告，以《中国空间应用的回顾与展望》为书名汇集出版，以兹交流并推动空间应用的发展。

马俊如

1989年12月

Foreword

The tremendous achievements made in the astronautic science and technology have provided with a new way for the development of human society and economy, it is possible to survey and monitor the earth from the space for acquiring the information about the earth, which were never achieved before; a stable data communication of large capacity and over a long distance can be realized through the stationary satellites; some experiments, even the productions can be carried out in special environment of the space, for instance, microgravity experiments. Application of space information has now developed into the application of materials. Recently, the worldwide space industry and market have been formed (investment and benefit ratio over 1/10), moreover, the commercialization tendency of the space activities is quite obvious which has become a serious challenge we are facing with.

After 30 years of development, the space activities in China have not only laid a firm foundation, but also entered into the application stage. However, relatively speaking, great efforts would have to be made further in promoting space applications, although, we have already done some work in the areas of remote sensing, education, satellite communication and microgravity experiments. Even better foundations have been laid in a few areas, which have resulted in economical and social benefits. As the space applications involve many subjects and cover wide areas, the energetical propaganda, vigorous promotion and extensive collaboration are essential in order to fully utilize the space and our space technologies.

Many things could be done in the areas of space application in China, but a well planned and stepwise development should be further carried out based on the possibilities of the country and the technical infrastructures.

Aimed at a better, faster and coordinated development of space application, a "Symposium on Space Applications" jointly sponsored and organized by the divisions of the State Planning Commission, State Science and Technology Commission and Chinese Academy of sciences was held on August 29-31, 1989, in Beijing. 110 delegates from 78 agencies representing 28 ministries, provinces and municipalities attended the symposium. In total, 128 special papers have presented, which reviewed the development and the achievements in the areas of remote sensing, education, satellite communication and microgravity. At the meetings the delegates also have exchanged viewpoints, put forth the questions, looked forward to the future development and made suggestions.

Some of the papers have been selected in this volume, which is being published under the title "China Space Applications—Review and prospect" as a means of exchange and to promote the development of space applications.

Ma Junru

Director, Department of Fundamental Research
and High-technology, SSTC

December, 1989

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Abstracts

1. 团结起来,开拓空间应用

马俊如

(国家科学技术委员会基础研究和高技术司)

一、我国空间应用的进展情况

需要说明的是,我们讨论的空间应用是指以卫星、飞机、探空火箭、高空气球等为载体,利用多学科的先进成就所从事的空间探索和有目的、具有社会效益的应用实验与开发,例如对地观测、通讯、微重力实验等。这是一个覆盖面相当广阔的领域,是学术内容极其丰富技术要求非常高、与国计民生密切相关、具有很强的社会效益的领域。各国政府都在空间活动方面投入了大量的人力物力,其主要目的是开拓空间应用。

我国党和政府高度重视和关怀空间科学技术的发展,一贯坚持走独立自主发展空间科学技术的道路,经过30多年的艰苦努力,我国空间事业已打下了很好的基础,具有了一定的规模,空间应用正在逐步开展。十一届三中全会以来,在改革开放政策的指引下,我国空间应用通过扩大国际合作注入了新的活力,日趋活跃、形势喜人。这里列举几点:

(一) 遥感方面

“六五”、“七五”期间,通过国家投资、部门支持及国际合作等多种渠道,经过国内设备研制和国外技术引进,我国遥感技术系统的主要环节和设备已有了一定的基础。从气象卫星接收、陆地卫星地面站到机载遥感系统,已经初步形成了多层次遥感信息获取的业务系统能力。一些遥感传感器的研制,如红外多光谱扫描仪、合成孔径侧视雷达等均进入国际先进行列。遥感图象处理和地理信息系统的软件研究开发也取得了很大的进展。

遥感技术已经在我国得到了广泛的应用,利用航天遥感在大区域范围的资源、环境综合调查方面取得了明显的社会效益,在重大自然灾害的动态监测、工程建设评价等方面都显示了很大的应用潜力。

我国在航空遥感方面所开展的工作卓有成效,在资源勘探、城市规划等方面的应用成绩显著,特别值得提出的是各部门大力协同、多学科联合作战在防洪遥感试验方面所进行的出色工作,使指挥机关在北京的办公室中能够了解洪水现场的情况。这一成就解决了灾情监测和损失评估中的难题,受到了田纪云副总理和中央防汛总指挥部的赞扬和鼓励。我们的遥感队伍在科学实践、在解决国家急需的重大问题中经受了考验,得到了锻炼和提高。正如陈述彭教授等所说的:我们的遥感技术与国际水平的差距并不象其他领域那么大,工作有自己的特色,在亚洲处于领先水平,这是我们应当引为自豪的,它凝聚了我们很多科学家、科技人员和管理专家的心血,凝聚着他们为民族、为国家的献身精神。

但我们也应当清醒地看到,目前我国遥感技术应用的发展中存在着一个明显的问题,