Perspectives, past and future

In this final chapter, we review, first, future missions that are proposed and then make an historical overview of Soviet and Russian space science so as to analyze key organizations, institutions, systems, and patterns of development. We look at its key features, personalities, decisions, and the dissemination of outcomes in an international context.

DECLINE OF SCIENCE DURING THE TRANSITION

Russian space science suffered badly during the period of post-Communist transition. The space program as a whole suffered three waves of contraction (pre 1991, 1991–1996, 1997), lost three-quarters of its staff, and, in the late 1990s, there were predictions that it might cease to exist [1]. It was only saved because resourceful space managers attracted in Western investment and collaboration and turned the space program around from being the most state-dependent to the most commercial in the world in less than ten years.

Within the retrenchment, some parts fared worse than others, especially the weather satellite and science programs. Russian space science fell into a “deplorable condition” in the view of the director of IKI, Lev Zelenyi [2]. Missions were repeatedly delayed, reorganized, and re-scoped and few survived at all, Interball and Koronas being the lucky exceptions. The institutes on which the science program was based suffered badly. The Ioffe Physical Technical Institute in St Petersburg, called “the cradle of Soviet physics”, saw its budget fall from 66 million rubles to 3.4 million rubles. Directors of institutes made a priority of holding on to their human resources – their scientific staff – but they did so at the cost of all other spending – laboratories, equipment, even journals – letting their buildings decay. The Institute for Space Research lost 25% of its staff and numbers fell below 1,000. Key scientists went to work abroad in a new “brain drain”. Roald Sagdeev went to the United States, where he began to tell the story of the space program. Oleg Vaisberg went on two assignments to the United States, including the South West Institute, which was well known for its space instrumentation, although he then returned to Moscow.
Many others, though, went for much longer periods or did not return. It was difficult to attract new, young graduates into space institutes when no fresh research was undertaken, although some did come and reworked old data with success [3].

Not until the early years of the new century was there a real (as distinct from inflationary) increase in the real space science budget, 2005 marking the first increase in value since the 1980s. With the Federal Space Plan, 2006–2015, came an attempt to put future missions on a more organized basis with, thanks to improvements in the Russian economy, the prospect that they would actually take place. The new missions attempted to avoid over-ambition and instead use common platforms and instruments so as to save costs, launch on smaller rockets (Soyuz rather than Proton), and focus on distinct areas of science, notably astrophysics [4]. First, we look at the missions that continued to be planned during the post-Soviet period and then the promise of new missions outlined in the plan. These were the Spektr observatory and missions to return to the Moon and Mars (Luna Resurs and Phobos Sample Return).

**SPEKTR OBSERVATORIES**

Spektr (not to be confused with the Mir module of the same name) was originally intended as a series of observatories to follow Astron, Grant, and Kvant. Had the Spektr program gone ahead in the 1980s, Russian space science would have stolen a lead over the NASA observatories of the 1990s. The concept of Spektr was approved at a conference in October 1987 attended by astrophysicists from Britain, Denmark, Finland, the GDR, and Italy. The idea was for at least three observatories for radio, ultraviolet, and X-ray/gamma-ray observations, starting with a high-apogee observatory, using X-ray oblique optics in the place of the earlier coded apertures [5].

The collapse of funding meant that Spektr made almost no progress in ten years. In 1997, it was announced that 200 million rubles would be injected into the project in the hope of generating some momentum. European Space Agency participation was sought, but when this was not forthcoming, the Russians turned to India.