COMPLEXES OF ENGINEERING CONSTRUCTIONS AND LARGE SPACE AND MOBILE GROUND ANTENNAS TESTING

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Contemporary level of space engineering development advantages without exaggeration necessity of solution of creation large radiotechnical complexes as in the space orbits and on the earth as well. Successful decision of the given problem requires complex approach from the point of view of logics designing, producing technology, constructive materials, methods and plants for system testing. The Institute of Space Constructions carries out these questions.
At present, a number of large space antennas of various constructions of technical newness have been created at the Institute. Among them: space expansible antenna with surface controlled (fig.I) in the process of operation and pneumorigid system of antenna with increased accuracy (fig.2).

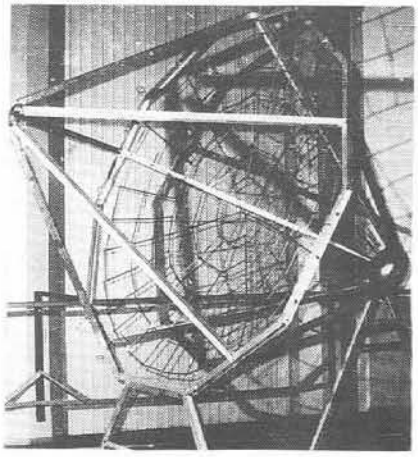


Fig.I Space antenna with controlled surface

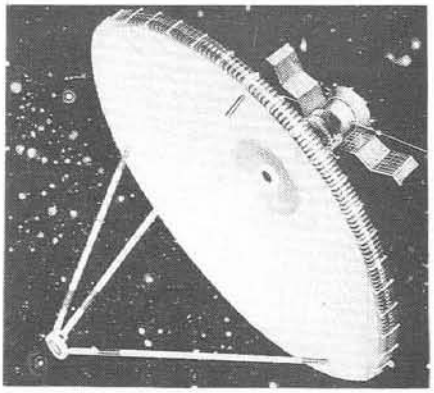


Fig.2 Pneumorigid construction of space antenna

The principal cycle of scientific-research, designing, technological and experimental works have been carried out in creation of space expansible parabolic radiotelescope of 30m diameter and ground mobile antenna with I2m of mirror diameter operating in the cm range of radiowaves. Constructive building of space antenna is based on a number of inventions in the field of screw-rod and combined ring system (fig.3). In this direction it has been carried out and produced three generation of 30m expansible space parabolic antennas not having analogues in the world practice. The antenna of the third generation is characterized by the highest operational characteristics: accuracy and rigidity. Sizes of transport block construction in setting view are: in height - 2,Im, diameter - 2,0m (fig.4). The time of expansion in space is

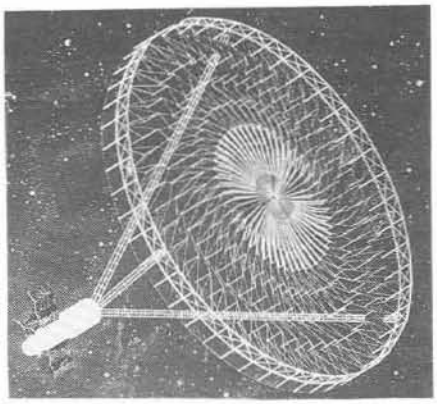


Fig.3 Screw-rod ring system of space expansible radiotelescope

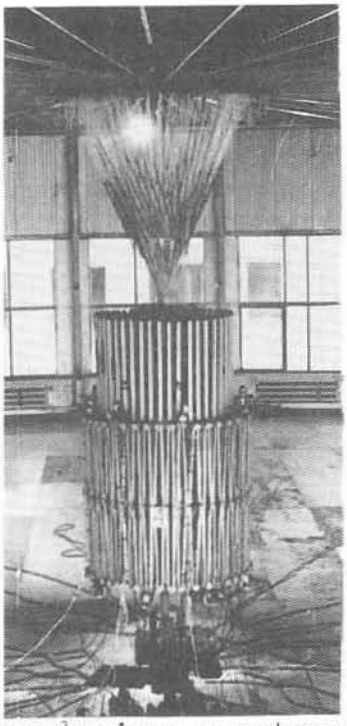


Fig.4 Transport block of construction of space expansible antenna in setting view

25sec. The weight-II00kg or 850kg when producing constructions correspondingly from metal or composition materials.With the purpose of theoretical investigations of the processes of expansioning and functioning of the constructions in the space orbits a mathematical model with appropriate software has been created.

Ground expansible mobile antenna differs by its nontraditional solution. In its united construction are combined the functions of autotrain trailer, package for packing up of setting reflector and support-turning part on which an expansible reflector of the full-turning antenna of I2m diameter is fixed (fig.5).

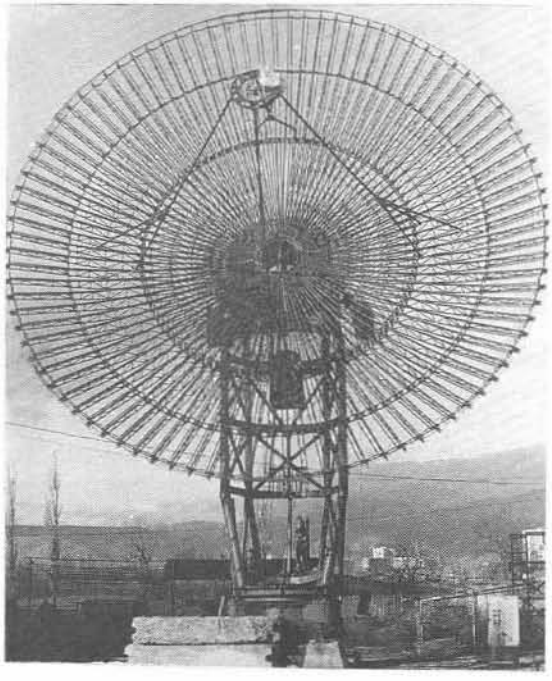


Fig.5 Construction of ground mobile antenna of I2m diameter in setting and functional view

The created antenna provides the transport package bringing into the state of functioning for 45minutes, own weight I8t in steel, if combined material-I3t.
Producing of active samples such antennas became possible due to the creation of the unique experimental complex for their thorough ground testing (fig.6). One of the main parts of the technological process of the construction of large space antennas creation is their special ground testing including expansion and radiotechnical checking up in the conditions of weightlessness imitation during the whole process of testing. However, as showed investigations it is extremely complicated to realize all these operations at the united stand, therefore the complex includes a number of stand constructions: complex for precision assemble and selection of antenna, hydrobasin for approvement of technological processes of antennas service in open space and a number of stand constructions enabling to lead detailed ground testing of constructions of expansible space antennas of about 30m diameter. The complex provides the elaboration of antennas testing into the expansion in the conditions of mechanical unweighing and hydroimitation and also checking up of radiotechnical parameters by different ways (e.g.radio astronomic) in the regime of ground radiotelescope without account of influence on the construction of ground gravitational loading. Common view of the stand construction is shown at fig.7.

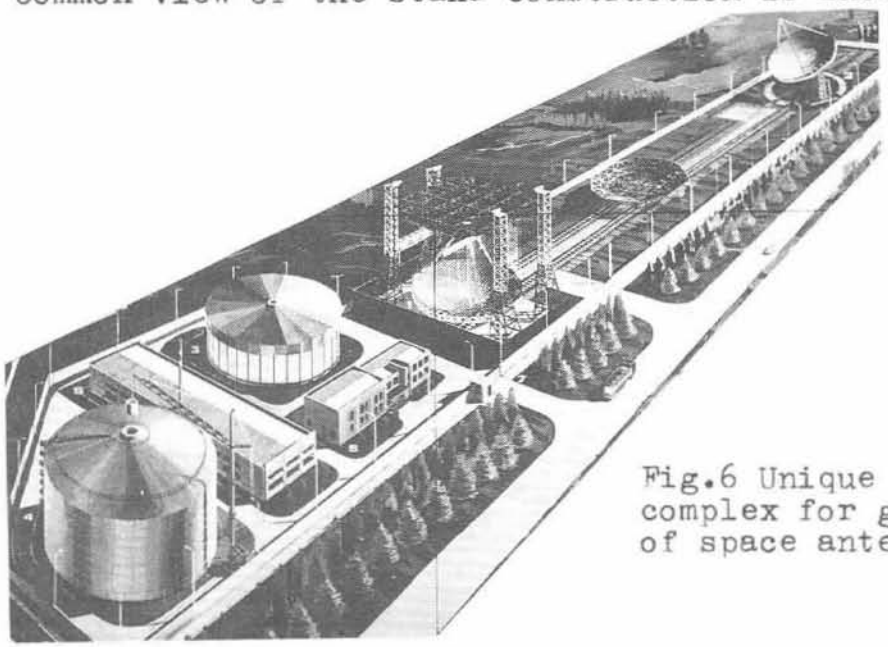
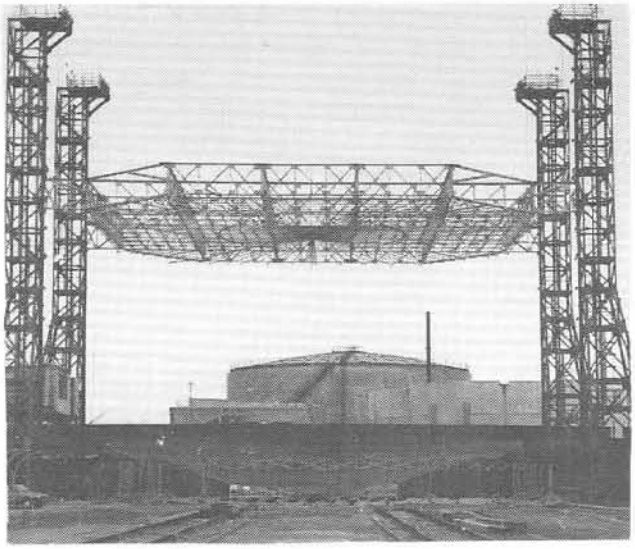


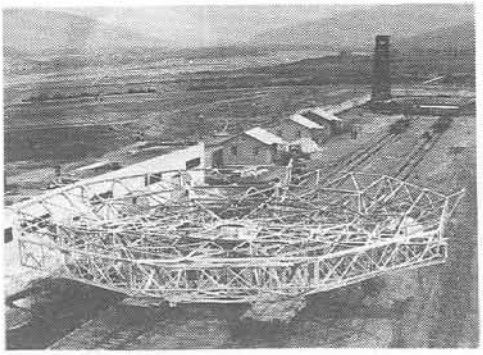
Fig.6 Unique experimental complex for ground testing of space antennas

Technological scheme of test processing as follows:
I. Multiplexing expansion of antenna at the stand (fig.7a) in the conditions of weightlessness imitation.
2. Put antijig (fig.7b) under unweighing antenna.
3. Assemble and fixing of antenna form into the antijig.
4. Separation of the antenna from the stand (fig.7a) for zone pure radiovisibility providing.
5. Transformation of antijig to the full-turning stand of radiotechnical checking up (fig.7c) and its fixing on the stand.
6. Elaboration of radiotechnical testing of antennas fixed in the antijig.

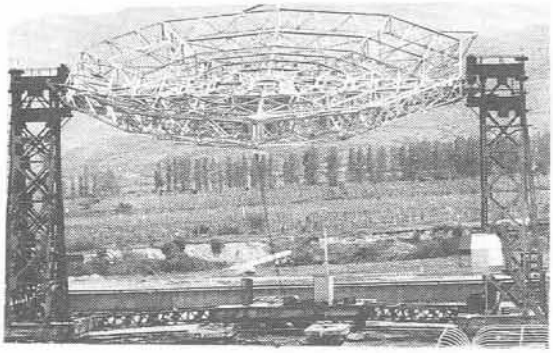
7.Antennas reverse to the stand of expansion (fig.7a).
8.Restoration of the system of unweighing and separation of the antenna from antijig (fig.7b).
9.Antenna setting into the transport package (fig.4).



a.



b.



c.

Fig.7(a,b,c) Stand constructions for thorough ground testing of large space antennas in the conditions of weighlessness imitation

The control of the geometrical form of the antenna showed that local deformations appeared in the zone of the working surface of the antenna during testing satisfy the requirements and is good to the mathematical account.
On the whole, theoretical and experimental bases of the Institute having productive capacity, experience of placing on the orbit of the engineering constructions (on the orbital station "Mir" in 1991,on the transport space ship "Progress -40" in 1989) and original in logics of designing of large radiotelescopes gave the possibility of realization of some practical problems in the extreme conditions of building of complex precision radiotechnical complexes of large dimensions as in space and on the earth as well.