COMMERCIAL SPACE OPPORTUNITIES FROM THE SOVIET UNION

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The Space Commerce Corporation and GLAVKOSMOS began a joint venture on January 1, 1989. This agreement makes available to the entire world the vast array of goods and services in the Soviet space program. Businessmen, corporations, and civil space agencies now have access to the robust space capability and infrastructure of the U.S.S.R. This historic development in the commercialization of space activities is made even more dramatic by the commitment to make these services and products available under the terms and conditions specified by the buyer. We do it your way.

The primary capabilities available are: launch service; communications satellites; remote sensing information; and microgravity opportunities for materials processing.

INTRODUCTION

There is now the opportunity for private firms and entrepreneurs to take part in the commercial space arena. Up to now, the businessman has been stifled in his attempts to make the space market profitable due to government dominance of the field. The opportunity now presents itself for the entrepreneur to forge out into space limited only by the constraints of the Outer Space Treaty of 1967.

The Joint Venture provides that SCC shall market all Soviet space goods and services, including:

A. Marketing launch and associated services for commercial and scientific spacecraft including communications satellites;

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B. Marketing experimental and associated services in the space environment, including man tended services on Soviet space stations and the use of automatic systems;

C. Marketing Soviet space hardware and component parts of launch vehicles and spacecraft;

D. Production of technical literature describing Soviet space goods and services;

E. Production of advertising materials for marketing Soviet space goods and services;

F. Marketing Soviet space goods and services through trade shows, conferences and scientific meetings;

G. Obtaining the technical information and governmental approvals required to market Soviet space goods and services;

H. Marketing the services of Soviet communications, remote sensing and navigation satellites;

I. Marketing and conducting technical training and educational activities including visits to Soviet space facilities;

J. Providing engineering and technical services including the design and construction of space apparatus, spacecraft and facilities;

K. Conducting public relations activities.

This listing is meant to be illustrative and not exhaustive. We trust that innovative entrepreneurs will suggest new ways to turn a profit from the resources of the Soviet space program.

What makes this opportunity truly unique is that prior to now, every space program in the world has been instigated, managed and controlled by a government. The restrictions and labyrinth of procedures necessary to obtain space services have had a chilling effect on the businessman. Therefore, it is truly remarkable that it is through a socialist society that the free enterprise businessman will have the first legitimate opportunity to utilize space.
SOVIET SPACE CAPABILITIES

Few people in the world outside of military circles appreciate the full capability of the Soviet space programs. Soviet space activities in recent years leave no doubt of the vitality and commitment of the most prolific space program in the world. Less than four weeks after the celebration of the 30th anniversary of the space age, the launch of Sputnik I on October 4, 1957, the Soviet Union achieved its 2,000th space mission, compared with less than 1,000 for the rest of the world combined. In all, the Soviets reached Earth orbit 90 times in 1988 payloads while the United States and the rest of the world could only muster 26 space flights.

Although the second lowest annual launch rate for the Soviet Union in the 1980's, the year's total was only 5% below the decade's average and was caused primarily by temporary technical problems within two programs. Despite the recoveries and expansions underway in the space programs of the United States and the European Space Agency, the Soviet Union is likely to retain her crown of the most active space-faring nation - a title she has held for 22 years - into the foreseeable future. In all, the Soviet Union placed 108 new satellites into Earth orbit during the year.

As must be expected with a space program of such magnitude, setbacks are not uncommon, and in 1988 the Soviets experienced more major failures than usual. Within the first two months of the year five Kosmos satellites were lost: three navigation satellites to a launch failure of the SL-12 booster and two photographic reconnaissance satellites which had to be destroyed in separate incidents when they failed to respond to commands. The greatest shock was the loss of the irreplaceable Phobos 1 spacecraft due to a simple software error. Meanwhile, the ambitious program to explore Mars in the 1990's appeared to be in disarray most of the time and ended the year with another schedule delay and more modest near-term objectives.

Throughout the summer, an uncontrolled nuclear-powered spacecraft slowly fell to Earth, only to be saved in the eleventh hour by a fortuitous series of events. Equally alarming were malfunctions on two successive manned spacecraft which resulted in aborted reentries. The first large scientific module for Mir was again postponed, and three different geophysical and astrophysical spacecraft failed to make promised launches.

** The author is indebted to Dr. Nicholas L. Johnson of Teledyne Brown Engineering for his succinct summary of the Soviet space program.
The breakdown of mission types changed a little in 1988 but this was due more to changes in the smaller programs as the photographic reconnaissance, communications, and man-related missions remained at 1987 levels. The high annual launch rate of Soviet satellites continues to be a direct consequence of their relatively short (by Western standards) operational lifetimes. By the end of the year 49% of the missions begun in 1988 had already been terminated.

A second factor behind the prolific Soviet space launches is the dependence of the Soviet Union on the proliferation of modest, cheaper satellites in lieu of a smaller number of more capable, expensive spacecraft. Standardization and manufacturing ease also drive this philosophy of simpler is better. As a result, Soviet space networks degrade gracefully through attrition, an attractive characteristic to both military and civilian users. Furthermore, failures can be overcome in short order. Six weeks after the SL-12 failure in February the launch vehicle was returned to service. Likewise, less than a month elapsed between the loss of a military photographic satellite and the launch of another in its class.

Sometimes hidden behind the raw statistics and the belief that Soviet space systems are "old" and "unsophisticated" is the tremendous modernization which has taken place in the 1980's. Major new space systems have appeared in the Soviet program at a rate of four per year during the decade. Additionally, improvements of reliability and capability have occurred in other Soviet satellites.

The sheer magnitude and complexity of the Soviet space program demands a tremendous support organization for the planning, manufacture, launch, and operation of satellites from dozens of individual projects. For the past 20 years a new Soviet space mission has been started every four days on the average. During this same period that number of operational satellites being maintained has grown from about 50 spacecraft to 150. According to the U.S. Department of Defense, the Soviet Union now has at least 20 useable launch pads and could reconstitute almost all of its satellite constellations in 2-3 months if the spacecraft were available.

The original Soviet space launch complex, responsible for the launching of Sputnik 1, is located just east of the Aral Sea in Kazakhstan, north of Afghanistan, and is usually referred to as the Baikonur Cosmodrome or Tyuratam (the latter is an historical reference to a nearby rail stop). In 1988 Baikonur conducted 43 space launches.

Baikonur is roughly analogous to the U.S. launch facilities at Cape Canaveral. All manned space flights originate from there as do all geosynchronous, lunar, and planetary craft. It is the
only facility capable of launching the Proton family of launch vehicles (SL-12 and SL-13), the SL-16 medium-lift booster and the new Energia (SL-17) heavy-lift/shuttle booster. All other Soviet launch vehicles can be launched from there with the exception of the small SL-8.

Two of the most impressive features of the Soviet space program are its ability to conduct routine launches regardless of weather conditions and to carry out launches in rapid succession. The former was dramatically emphasized in March, 1988, when the SL-3 carrying an Indian satellite lifted off a pad at Baikonur on schedule in the midst of a driving snowstorm. Likewise, when the Buran (Russian for snowstorm) space shuttle made its first voyage in November the cloud ceiling was down to a mere 410 m and the winds were gusting to more than 70 km/hr. The high winds which buffeted Buran were attributed to an approaching cyclone.

On 18 occasions in 1988 two launchings were conducted within 24 hours, including two instances in which less than two hours elapsed between flights. In just over a 20-hour period during 10-11 March the Soviet Union placed 10 satellites into orbit with three launch vehicles (SL-4, SL-6, SL-8) using two launch complexes (Plesetsk and Baikonur).

With the successful launch of the Buran space shuttle, the U.S.S.R. can now claim a launch vehicle arsenal of ten different boosters with payload capacities ranging from 1700 kg to more than 100,000 kg. For the 12 years prior to 1988, these launch vehicles placed an average 360 metric tons of payload (excluding rocket bodies) into Earth orbit annually. As the Energia becomes fully operational these figures may increase dramatically although a maximum of 4-5 such flights - with and without Buran - per year is likely through the mid-1990's.

Since 1979 the Soviets have concentrated on developing a capable geostationary network, placing an average of six satellites in this unique orbit 36,000 km above the equator each year.

Another half dozen geosynchronous communications satellites were launched in 1988 while four resident satellites were abandoned or placed in storage locations to become inactive standbys. Two new slots in the geostationary ring were opened up, bringing the Soviet total to 17, and individual systems were expanded. By the end of the year 26 satellites were being maintained at operational locations, and four more were in apparent inactive standby status.

Soviet geostationary communications satellites are currently divided among four distinct programs: Raduga, Gorizont, Ekran, and Kosmos. Raduga and Gorizont satellites, which account for the majority of Soviet operational geostationary spacecraft, are
general purpose communications satellites handling telephone, television, and telegraph traffic for civilian, military, and government subscriber. Ekran satellites represent a unique direct broadcast system for television programming, particularly to the sparsely populated interior regions of the U.S.S.R. Kosmos satellites are usually acknowledged as testbeds for new communications equipment. During 1988 the Gorizont and Ekran systems received two new satellites each while only one Raduga and one Kosmos spacecraft were launched.

Ekran, debuted in 1976 as the world's first direct television broadcast satellite. Ekran is unique among all other geostationary satellites in many ways. First, since its transmissions are directed primarily at 40 percent of Soviet territory in the sparsely populated regions of the extreme northern and eastern portions of the U.S.S.R., the spacecraft can transmit directly in the television band (0.7 GHz) without fear of interference with other national television systems. A powerful 200-watt transmitter allows the construction of relatively simple communal or even individual receivers. Each day 18 to 20 hours of color TV and radio programming are broadcast.

A more capable, general purpose communications satellite called Gorizont debuted in late 1978. This versatile Soviet communications satellite program is the geosynchronous counterpart to the Molniya 3 system. A typical Gorizont now carries eight transponders: six for 6/4 GHz, one for 14/11 GHz, and one for 1.6/1.5 GHz Gorizont satellites have taken over the majority of Intersputnik (a Soviet-led international communications network) traffic from the Molniya 3 satellites.

A total of 16 Gorizonts have now been placed in geosynchronous orbits and in general have demonstrated unusual longevity by Soviet standards. Gorizont 3, launched at the end of 1979, was still being controlled at the end of 1988.

The civilian navigation satellite system is comprised of only four satellites, whose orbital planes are separated by 45 degrees of right ascension.

The maturation during the past decade of remote sensing technology to evaluate the status of the Earth's natural resources represents perhaps the greatest impact of space exploration on the world's economy. To profit from these new technologies the Soviet Union has assembled the world's most comprehensive network of diverse platforms and apparata to provide remote sensing data. These data are collected by visible and multi-spectral photography and infra-red, microwave, and radar soundings.
Resource-Ol, roughly analogous to the U.S. Landsat system, relies on multi-spectral data digitally transmitted from sun-synchronous satellites.

**LAUNCH SERVICES**

Launch services include the Proton, Soyuz, Cyclone, Energia, and in the future the START. From a cost and timeliness standpoint, launch of the first three rockets from Baikonur, U.S.S.R. is preferred. However, studies have been done which indicate that these vehicles can be launched from numerous locations around the world. If an equatorial launch site is chosen, the weight capability is increased by one-third. For example, the Proton which can place a 2,200kg payload into geosynchronous orbital position would be able to loft a 2,900kg payload from an equatorial location. The START launcher is fully transportable and the concept is to bring the launch capability to the satellite owner rather than having the satellite owner go to the launcher. This will enable the operator to select the most convenient launch location, taking into consideration weight and orbital parameters, personnel costs, time constraints and mission perspectives.

The Proton is an ideal vehicle to launch commercial communications satellites because it can place even the heaviest of them directly into final orbital position. The trend in that industry is toward very heavy 8,000 to 11,000 pound satellites. Western launch vehicles can only deliver these satellites to an intermediate orbit. The satellite must use its own fuel or an attached rocket engine to move to its final orbit. This fact is important because, if a satellite retains all its fuel, it can operate for several years longer and earn $40 to $50 million more in revenue.

In September, 1988, the U.S. granted export licenses for the launch of three Hughes communications satellites from the Peoples Republic of China. Congress, however, blocked these exports after the Tian'anmen Square tragedy. Nonetheless, SCC has signed a Memorandum of Understanding with a corporation to launch a Hughes communications satellite on the Proton. The corporation has already obtained the U.S. government license it required to build and operate this satellite. It has agreed to be SCC's test case for a change in U.S. policy prohibiting export of communications satellites to the Soviet Union. SCC plans to apply for the required export permits on behalf of the corporation in 1989.

On July 29, 1989, a Memorandum of Understanding was signed by the Space Commerce Corporation and Technoprebor to explore the feasibility of building a derivative of the SS-20 called "START". The three-stage, solid fuel launcher will be capable of carrying a 300-lb. payload into an orbit of up to 500 km. (310 mi.).
According to preliminary specifications, START will weigh 40-45 metric tons (88,400-99,450 lb.) and will have an overall length of 20 meters (65.6 ft.), making it slightly larger than the two-stage, 16.49 meter (54.1 ft.) SS-20. As with the SS-20, the START booster will be mounted on a transporter/launcher vehicle, enabling it to be launched from a variety of sites without special launching pads.

**COMMUNICATIONS**

This market consists of communications transponders, communications satellites, ground stations and specialized turnkey communications and navigation systems.

A single transponder lease now costs $500,000 to $1,000,000 per year. Demand is expected to grow through the mid 1990's. By 1996, the number of transponders serving the U.S. is expected to grow from 524 to 710. Average transponder sale price during 1987 was about $5.3 million. In recent FCC filings, AT&T estimated it would pay $489 million for two satellites. Hughes has priced two satellites at $422 million including launch.

Due to the age of current satellites, virtually every C and Ku band transponder now in use will be out of service by 1996. The largest transponder increase is expected to come in private networks, which will grow from 94 today to 315 by the middle of the next decade.

The major segment of this market for SCC is the developing nations who do not need, and cannot afford, expensive Western systems. These countries also need assistance, which SCC will provide, in working with international regulatory authorities.

Soviet communications satellites have historically been highly elliptical Molniya satellites or geosynchronous Gorizonts with eight transponders. These have served the unique communication requirements of the U.S.S.R. In order to serve the world market with geosynchronous satellites, the Soviets are developing a new satellite called "GLAVSTAR" with 21 transponders. One half will be C band and the other half Ku band. The footprint of the Gorizont transponders has been quite broad because of the vast territory covered. The new satellites will have a narrow beam to meet the needs of the developed and developing nations.

In the long term, the company plans to build and launch communications satellite systems and to provide turnkey communications systems to end users, primarily in developing nations.
REMOTE SENSING

There are currently 17 non-U.S. Landsat and/or French Spot Image remote sensing satellite systems. Three additional stations are under construction. These stations have a combined sunk cost of over $500 million. Each station currently pays $600,000 per year for its license to receive Landsat data. This fee, we understand, will increase to $800,000 per year in 1991. Spot Image is even more expensive than Landsat.

The Landsat system may not be a dependable source of this data. It is expected that all of these stations and their customers may soon have to rely exclusively on foreign sources for current data for several years.

The company will seek to provide data to these stations at a cost less than their current Landsat license. For support of those sales, the Soviet government will guarantee a continuous supply of data until the year 2000.

Remote sensing Soyuzkarta photographic images with 5m resolution has in the past been provided by the Space Commerce Corporation. This had limited commercial value because of the restricted number of sensed areas available. SCC no longer handles these images but now markets remote sensing information from Resource-O1. This satellite provides near real time digital data with 45m resolution. Early in 1990 the resolution will be reduced to 22.5m. In the 1991-2 time frame 5m resolution will be available. This remote sensing satellite is now available for a cost of $100M, on orbit. This not only includes the satellite and launch costs, but the purchaser has the opportunity to tailor the instrumentation of the satellite to serve his particular needs.

The U.S.S.R. has guaranteed the availability of this remote sensing data stream through the year 2000 and has given assurances with regard to access and coverage that the United Nations Principles on Remote Sensing will be followed. In addition to digital data, tapes will be available in a standard format. The Soviet Union has an extensive capability for value added work. Orders are being taken for studies tailored to a particular requirement.

Additionally, the company has the ability to sell remote sensing products, including unique data from the COSMOS 1870 type radar observation satellite systems, which have no Western equivalent.

MATERIALS PROCESSING AND SCIENTIFIC RESEARCH IN SPACE

Microgravity experiments and materials processing opportunities exist both man-tended aboard the MIR space station
and on the Photon satellite. This can be done in a routine regimen under current Soviet procedures or specialized equipment can be created and flown for unique requirements.

Several private companies in the U.S. and Europe have contracted to fly unmanned experiments on the Soviet MIR space station. NASA currently lists a backlog on its waiting list of over 600 such experiments. The company expects to sell these services primarily in Europe, Japan, Korea, and Taiwan.

**SOVIET SPACE TOURS**

GLAVKOSMOS controls access to all space launch and flight control facilities in the Soviet Union. Except for distinguished visitors, no tours have been conducted in spite of considerable demand.

SCC tours are planned for 100 people each. The groups will travel from New York/Washington, D.C. to Moscow. The first will be this Fall. These are handled by a subsidiary of the Space Commerce Corporation: Aerospace Marketing Group, a Texas Corporation, 4131 Spicewood Springs Road, Suite G-4, Austin, Texas 78759, telephone (512) 338-4800.

Members of the tour will visit space vehicle processing facilities, white rooms, cosmonaut training facilities, space rockets and launch pads, in addition to Star City, Intercosmos Headquarters, Space Research Institute, Soviet Mission Control, and Russia's National Space Museum, plus space memorials and monuments in greater Moscow and Leningrad.