While the commercial satellite sector has been growing steadily over the past three decades, according to Euroconsult, government programmes are set to remain the main source of revenues for the world space industry for the foreseeable future. *Satellite Evolution Asia (SEA)*, was allowed to look at a report on public space programmes by the leading Paris-based consultancy.

# State of the industry

**The public market constituted by far the main** source of revenues for the world space industry in the 1980s. Despite a slowdown of government expenditures over the last decade and then a stagnating public space market, the space industry succeeded in maintaining its level of activity thanks to a booming commercial market.

However, as the commercial market is currently going through a cyclical downturn of (which is widely predicted to end in the second half of the decade) the public space market is reaffirming itself as the main source of revenues for the industry.

Over the next few years, government space programmes are predicted to be a secure market for the space industry. On a global scale, expenditures in this field should at least be stable, or even keep a slow growing trend, with a more significant increase in the second part of the decade.

Nevertheless, prospects for growth of public spending differ among national or regional markets. Depending on the level of backing for national public space programmes, some domestic industries may be more exposed to declining commercial activity.

## How big is big?

But how big is the public space sector? For the year 2001 world public budgets for space activities were estimated to be about US$38 billion, a slight growth of two per cent compared to 2000 ($37 billion). Civil applications represented the biggest part of public allocations with almost two-thirds of the world's space budget ($23 billion), while the remaining third was dedicated to military space programmes ($14.7 billion).

After a slight decrease between 1996 and 1998, the world civil space budget grew by ten per cent between 1998 and 2001 driven by the cumulated growth of the world's three largest budgets (US, Western Europe and Japan). The world's military space budgets experienced a significant decline in the first half of the last decade due to the fall of almost all national budgets and the collapse of the Russian military programme in dollar terms. The year 1996 marked a breakpoint, as military space budgets begun to increase again driven by the renewed growth of the US military budget.

## General trends

Governments have been, and remain, the major clients for the satellite industry, particularly so in years such as 2001 and 2002 that registered an unusually low commercial launch rate, reflecting a depressed market.

In 2001, for example, 54 public satellites (33 civil and 21 military) were launched. The spacecraft's value amounted to approximately $7.1 billion, while the estimated cost of launch was in the region of $1.25 billion. In the same year, only 15 satellites were launched for the commercial market. Their total estimated manufacturing value was $1.7 billion, while launch cost is estimated at $1.1 billion. Currently, two key trends can be observed in the world's public space programmes:

- A growing number of countries involved in space activities can be counted with no less than 30 space agencies listed in the world - to which 26 emerging space programmes should be added; and
- Space budgets are still dominated by the three main public space powers - the US, Europe and Japan. They account for 95 per cent of the world public funding for civil space activities, a constant

*The space industry succeeded in maintaining its level of activity thanks to a booming commercial market.*

rate since the last decade, making up a total of $21.8 billion.

The US civil space budget is by far the largest in the world, amounting to 61 per cent of the world's total budget. Europe and Japan make up for 23 per cent and ten per cent respectively of the world's total budget. Despite an important activity with 15 satellites launched in 2001, the Russian civilian space budget remains small in dollar terms ($180 million).

Military space budgets are also highly concentrated in the US, a nation that alone spends 95 per cent of the world public funding. France, the country with the second largest budget, allocates 37 times less money for space military applications than the US.

Apart from these two countries, only nine other states are reported to have a budget dedicated to military space - Belgium, Canada, China, Germany, Israel, Italy, Russia, Spain and the UK. Other countries, even though without an identified dedicated budget, may include military space applications in general programmes of military or civil Research and Development (R&D). The unshared leadership of the US has been growing over the last decade and is unlikely to be challenged in the near future as no country today seems capable of comparable scales.

However, the growth of public space budgets in financial terms does not reflect an increased effort from countries to dedicate relatively more national resources to space activities. In fact, over the last decade leading countries have been spending less of their Gross Domestic Product (GDP) on space programmes, either for civil or military applications.

## Asian national trends

An increasing level of activity in the public space sector can be witnessed in numerous Asian countries. Among them, the leading 'space powers' are Japan, India and China.

**Re-orienting the Japanese space programme**

Following two decades of steady high growth (expenses doubled between 1986 and 1995), the Japanese public space budget stalled in national currency in the mid 1990s and even lost $500 million between 1995-1998 due to the collapse of the Yen. Non-government users contributions compensate a decreasing public funding and have enabled Japan to maintain its budget level.

Of the $2.3 billion dedicated to national budget for civil space activities in 2001, 70 per cent was spent for NASDA. Following a development phase of its space capabilities to become a major space power, the country is now turning to a new space policy in order to raise its competitiveness. This may lead it to rationalise national programmes and merge its three national agencies NASDA, ISAS and NAL into one single entity, as recommended by the Japanese Space Activities Commission in March 2001.

**India: the highest space budget of developing countries**

Considering the acquisition of space technology for development and military purposes as a national priority, India has been constantly investing a high level of its national resources in civil space R&D (0.08 per cent of its GDP in 2001).

Following a compound annual growth rate of its space budget of 13 per cent between 1997 and 2001 in national currency, India has become the fourth largest space power in financial terms, with a budget of $402 million, administered principally by ISRO.

While India had focused its programmes on government and military needs, country's orientations are shifting towards close cooperation with the private sector concerning service provision and project financing.

**Financial value does not reflect the strength of Chinese space programme**

Little information is available on the classified Chinese space budget. Exchange rates make the Chinese space budget, estimated at $150 million for civil programmes and $30 million for military programmes, undervalued in comparison with its effective capabilities. Following a decade of rapid expansion of the national space industry, the Tenth Five-year Plan should keep up with the growing pace of the Chinese budget so as to support new ambitious programmes, especially in human spaceflights.

## The applications

Public space programmes usually dedicate time and resources to science, communications, navigation, Earth observation, meteorology, human spaceflight, microgravity and development of satellite launchers.

## Public expenditure

Public budgets on space programmes include expenditures to run the internal operation of agencies or concerned administrations and other non-space expenses. Normally, of the space budget only 70 per cent is assumed to be accessible to the space industry - a ratio based on the average registered over the last decade.

The budget accessible to the space industry includes public spending on Research and Development (R&D) and procurement of space hardware (including orbital infrastructure), as well as launcher [Expendable Launch Vehicles (ELV) and Re-usable Launch Vehicles (RLV)] procurement and operation.

**Steady growth of space science budget**

Space science is traditionally less sensitive to budget variations than other applications. This is notably due to the long-term implementation of research programmes. Leading science budgets have been increasing slowly but constantly for two decades with a five per cent Compound Annual Growth Rate (CAGR).

NASA should experience the strongest growth for the decade in order to finance future Mars missions, while ESA science budget is stabilising at around $350 million for five years. Large-scale deep space missions initiated by the major space agencies, like the various Mars missions planned for the next decade, should absorb the largest part of science budgets with significant activities for domestic industries.

Besides these ambitious programmes, the 'better, faster, cheaper' doctrine, initially developed by NASA, has been adopted by other agencies to rationalise programme budgets.

Agencies are focusing towards low-cost small programmes, some of them being developed in cooperation to share costs.

**Space communications: fluctuating budgets for cyclical programmes**

Government space communications budgets are cyclical by nature because of recurring or replenishing programmes. Following a 51 per cent increase between 1985 and 1993, the world budget (for military and civil applications) dropped by 40 per cent in the second part of the decade and, in 2001, finally reached a level similar to 1987 in current US dollars ($2.15 billion).

**Navigation: growth of European and US budgets for new system development**

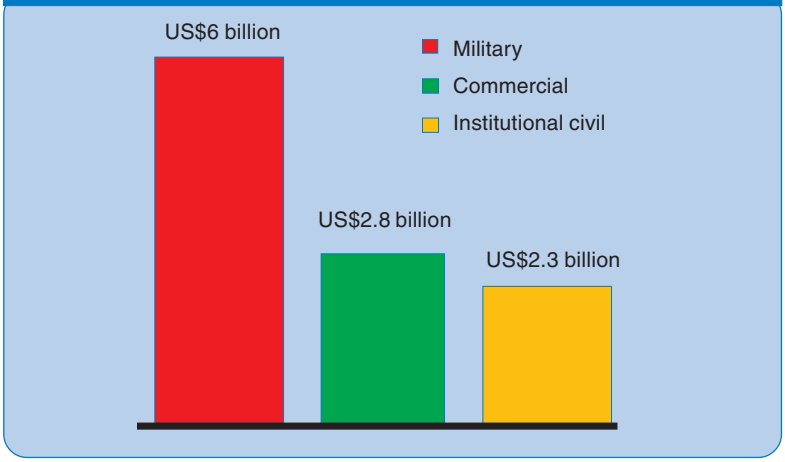
While several countries have R&D activities on navigation, only the US and Europe invest a significant part of their budget in operational navigation systems.

The market value of Russia's Glonass satellite system in dollars is insignificant and its maintenance is even under question - only half of the 18 satellites required to fully operate the system are still in operation. China seems to consider its Beidou system more as a technology demonstration system than fully operational.

On the other hand, the Japanese navigation programme is focused on MTSAT, the GPS regional augmentation system, which will consists of two satellites to be launched in 2003 and 2004.

*Table 1: World Satellite Market Value - breakdown for satellites launched in 2001 (satellite manufacturing and launch services value only)*

*Source: Euroconsult*




**Earth observation still attractive for emerging space powers**

Earth observation remains the most attractive space application for governments, especially developing countries because of the strategic and environmental issues involved, as well as low satellite costs. The US NRO with a $7.9 billion estimated budget dominates the sector and constitutes 75 per cent of the world budget. NASA's budget follows with $1.5 billion, along with ESA ($343 million) and Japan ($238 million).

**Meteorology: many systems to be replaced**

Because meteorology is of considerable concern for public interest, governments around the world have prioritised the building of domestic capabilities, or at least the access to data from foreign systems. Several meteorological satellite systems are to be replaced or complemented during this decade, requiring a high level of government financing:

- Japan, which started its GMS programme in 1977, is expected to launch the new MTSAT system (two satellites);
- Indian meteorological system, initiated in the mid 1980s with the INSAT satellites, should be completed via dedicated Metsat satellites;
- China plans to complete and replenish its Feng Yung programme with three geostationary satellites (FY2) and four satellites in polar orbit (FY3);
- Eumetsat, the European Meteorological Satellite Organization, is to replace its Meteosat system (three Metop satellites in polar orbit, three MSG satellites in geostationary orbit); and
- NOAA of the US intends to complete its NOAA and GOES series and to launch the NPOESS system for dual use starting at the end of the decade (seven satellites until 2010).

**Human spaceflight still represents the biggest share of expenditures**

Human spaceflight represents the largest civil space programme worldwide in financial terms, with 28 per cent of the budget of the first 14 space powers. Two programmes dominate this sector: the International Space Station (ISS) and the Space Shuttle. However, following the Columbia disaster the US human spaceflight is currently under strategic review. China and India also have programmes for human spaceflight, with China being extremely close to the goal.

**Flat budget trends confirmed for microgravity research**

Microgravity research, which deals with the study of physical and biological processes in orbit, received increasing financing supports from governments in the 1980s when it was believed that it would allow for great strides forward in science, and particularly medicine. However, due to poor results compared to the level of investments, budgets have been considerably reduced in the last ten years. The five leading countries are investing today as much as they did in 1990 ($512 million).

**Satellite launchers**

ESA raised its launcher budget significantly from the mid 1980s to the mid 1990s within the framework of Ariane 5 programme. Since then, the ESA launcher budget has decreased steadily. ESA expects its launcher budget to remain stable at around $730 million per year for the coming decade in order to finance the Ariane 5 plus programme and the Vega small launcher.

Though NASA no longer participates in ELV launchers development, it remains one of the major clients for launch service providers to whom the agencies brought financing and launch installations.

The Department of Defence (DoD) is also changing its policy from dedicated launchers development (like Titan) to buy launchers jointly developed with the industry - which has already an ensured market, with 181 launches expected. Identified R&D budget decline should be compensated by bulk procurement orders, which include amortization of R&D costs.

Russia is seeking to modernize its launch fleet (GTO and LEO) through bilateral agreements and commercial ventures to complement limited domestic financing capability.

Japan, India and China concentrate the remaining 20 per cent of the world launch budget and develop their own GTO capability. These countries are currently more concerned with satisfying their domestic needs rather than providing commercial services. Other limited numbers of countries dedicate budget effort to R&D for small launchers including Brazil, Israel and South Korea. ■

| Agency name (alphabetic order) | Country | 2001 budget (US$ millions) |
|---|---|---|
| AEB (Agenda Espacial Brasileira) | Brazil | 111 |
| Algerian Space Agency | Algeria | n.s. (created end 2001) |
| ASA (Austrian Space Agency) | Austria | 40 |
| ASI (Agenzia Spaziale Italiana) | Italy | 939 f |
| BNSC (British National Space Centre) | UK | 251 |
| Chilean Space Agency | Chili | n.s. (created end 2001) |
| CNES (Centre National d'Etudes Spatiales) | France | 1,157 |
| CNSA (China National Space Agency) | China | 150 e |
| CONAE (Comision Nacional de Actividades Espaciales) | Argentina | 30 |
| CONIDA (National Commission for Aerospace research & Development) | Peru | 5 |
| CSA (Canadian Space Agency) | Canada | 229 |
| DLR (Deutsches Zentrum fur Luft-und Raumfahrt) | Germany | 616 |
| DoS (Department of Space) | India | 427 |
| ESA (European Space Agency) | 15 European countries | 3,627 |
| Hungarian Space Office | Hungary | n.a. |
| ISA (Israel Space Agency) | Israel | 0.7 |
| NASA (National Aeronautics and Space Administration) | US | 13,100 |
| NASDA (National Space Development Agency of Japan) | Japan | 1,632 |
| National Aerospace Agency of Kazakhstan | Kazakhstan | n.a. |
| National Space Council | Nigeria | 26 |
| NIVR (Netherlands Agency for Aerospace programmes) | Netherlands | 89 |
| NKAU (National Space Agency of the Ukraine) | The Ukraine | 60 e |
| ROSA (Romanian Space Agency) | Romania | n.a. |
| Rosaviakosmos | Russia | 180 |
| SNSB (Swedish National Space Board) | Sweden | 66 |
| NSC (Norwegian Space Centre) | Norway | 26 |
| NSPO (National Space Program Office) | Taiwan | 80 |
| SSO (Swiss Space Office) | Switzerland | 57 |
| SUPARCO (Space & Upper Atmosphere Research Commission) | Pakistan | n.a. |
| Uzbekosmos (Uzbekistan Space Agency) | Uzbekistan | n.a. |

n.a.: not available
f: forecast (as of June 2001)
n.s.: not significant
e: estimates