Reader's Guide

This reader's guide introduces the contents and structure of The Space Economy at a Glance publication, some general definitions, the sources used and some methodological notes.

What's new in this report?

Published every three years to provide reviews of major trends in the space sector and its contributions to economic activity, *The Space Economy at a Glance* is part of the broader "at a glance" OECD collection of reports. These reports provide indicators on a variety of topics of interest to decision-makers and citizens.

The Space Economy at a Glance 2014 brings several new features:

- As compared to the 2011 version, more countries are included in the graphs, building on new time-series on institutional budget, thanks to co-operation with many countries developing space programmes.
- The country profiles, featuring members of the OECD Space Forum as well as invited economies, have also been enriched with new indicators.
- Original work on global value chains, using the space sector as a case study, has also been feeding many sections, and provides thought-provoking findings featured in the publication. This activity on value chains built on several OECD Space Forum workshops that were held in 2013 and 2014, in Paris and Washington D.C., to discuss definitions, methods, indicators, and industry survey methodologies with stakeholders from public administrations, as well as the private sector.
- New indicators have also been developed and included, thanks to co-operation with different OECD divisions and the space community. They include indicators on patents, with data available now at the regional level, as well as new bibliometric data on scientific publications per country. Improved trade data on space and aerospace are also available with the inclusion of intermediate and final products in some cases.

Structure of the report

The Space Economy at a Glance is structured in several parts:

- The introductory chapter provides an overview of key trends in the space sector in 2014.
- Part I provides a review of "readiness" indicators, i.e. capabilities that are necessary to be able to engage in significant space activities (e.g. budget, infrastructure, human capital).

- Part II reviews a diversity of "intensity" indicators, which illustrate the multiplicity of space programmes and stakeholders (e.g. sectors, industry revenues).
- Part III provides selected illustrations of the impacts of space investments.
- Part IV offers a global overview of the aerospace sector.
- Part V presents selected country profiles, using a common framework to present key information on the space activities of selected OECD economies that are members of the OECD Space Forum, as well as invited emerging economies.

From Part I, each indicator presented in the report is preceded by a short text that explains in general terms what is measured and why, followed by a brief description of the main trends that can be observed. A paragraph on methodologies highlights those areas where some caution may be needed when comparing indicators across countries or over time.

Basics about space technologies

Launching a satellite into space to orbit the earth, or a probe to visit another celestial body, remains a formidable challenge. Major progress has been achieved over the past few decades, including notably the successful development of several families of rockets (e.g. Soyuz, Ariane, Atlas, Delta), but access to space remains costly and risky. Satellites are essentially platforms that can carry instruments used for diverse applications. They are often very sophisticated R&D objects with a lengthy development time (several years), although the greater recurring use of standard satellite platforms is reducing that time (six months or less for some small satellites). These satellites are launched in different orbit, depending on their missions.

Basics about satellites' orbits

Orbit	Description
Low earth orbit (LEO)	Satellites in LEO orbit the earth at altitudes of between 200 km and 1 600 km. Compared with higher orbits, LEO satellites can capture images and data with better detail (better resolution), have speedier communications with earth (less latency), and require less power to transmit their data and signals to earth. However, due to friction with the atmosphere, a LEO satellite will lose speed and altitude more rapidly than in higher orbits.
Polar orbit	A majority of satellites never "see" the poles, as more often than not they are positioned in equatorial orbits to cover large populated areas. Satellites that use the polar orbit – particularly meteorological satellites – go over both the North and the South Pole at a 90-degree angle to the equator. Most polar orbits are in LEO, but any altitude can be used.
Geosynchronous/Geostationary orbit (GSO/GEO)	The satellites in geosynchronous orbit (also known as geostationary when it has an inclination of zero degrees) are at a higher altitude, around 36 000 kilometres, forming a ring around the equator. Their orbits keep them synchronised with the earth's rotation, hence they appear to remain stationary over a fixed position on earth, and provide an almost hemispheric view. Their advantage is the frequency with which they can monitor events (three GEO satellites placed equidistantly can together view the entire earth surface, but with less precision than LEO satellites). They are ideal for some types of communication and global meteorological coverage.
Sun Synchronous Orbit (SSO)	When in sun-synchronous orbit, the satellite orbital plane's rotation matches the rotation of the earth around the sun and passes over a point on earth at the same local solar time each day.

Note: Orbital mechanics (also called flight mechanics) deal with the motion of artificial satellites and space vehicles moving under the influence of forces such as gravity, atmospheric drag, thrust, etc. There are many types of orbits other than the ones described above [e.g. medium earth orbit for some navigational and communications satellites, Molniya orbits, etc.].

The economic and strategic significance of these complex systems come primarily from their capacity to function as enabling technologies in communication, earth observation, navigation and positioning. They contribute to:

- Communicate anywhere in the world and disseminate information and data over wide areas, whatever the state of the ground-based network.

- Observe any place on earth accurately and in a broad spectrum of frequencies, in a non-intrusive way.
- Locate with increasing levels of precision a fixed or moving object anywhere on the surface of the globe.

Space technologies therefore boast unique capabilities. However, there are a number of technical constraints that may lessen the usefulness of satellite signals or data for specific applications. For example in terms of earth observation for land-use or climate monitoring, one key aspect is the geographic area that a sensor can cover in one satellite pass and the level of detail that can be seen (it is a function of the satellite swath width, orbit and sensor's resolution – as with a telescope, the more one zooms, the less global coverage one gets). Another aspect is the satellite's revisit time over one specific area (from many times a day to only once a month depending on the orbit chosen for the satellite). And finally, the adequacy of the on-board sensors for a particular element that needs to be observed (this depends on the choice of sensors carried on the satellite, optical or radar, and on the bands that figure in the electromagnetic spectrum).

Methodological notes

The indicators in this report build on data provided regularly by member countries' authorities and on data available from other OECD and international sources. The data primarily come from official sources (such as OECD databases, statistical offices, national space agencies), as well as industry sources in some cases. Figures have been chosen based on the reliability and the timeliness of available data.

A number of currency conversions have been conducted for purposes of comparison, and the methods are always cited. The GDP figures used are expressed in USD. Purchasing power parities (PPPs) are also used. PPPs are the rates of currency conversion that equalise the purchasing power of different countries by eliminating differences in price levels between countries. For some calculations, this report also makes use of the Consumer Price Index (CPI) – all items as a deflator, from the OECD Main Economic Indicators (MEI) database. The CPI measures the average changes in the prices of consumer goods and services purchased by households. It is compiled in accordance with international statistical guidelines and recommendations, as there is no space industry-specific consumer price index. This allows interesting comparisons between countries. The report also uses OECD's Monthly Monetary and Financial Database for the calculation of exchange rates. Exchange rates are monthly averages, calculated by the OECD as averages of daily interbank rates on national markets. Data are averages of daily closing rates.

The tables below provide information on the country acronyms and grouping used throughout the publication.

Selected ISO codes

AUS	Australia	ISR	Israel
AUT	Austria	JPN	Japan
BEL	Belgium	KOR	Korea
CAN	Canada	LUX	Luxembourg
CHE	Switzerland	MEX	Mexico
CHL	Chile	NLD	Netherlands
CZE	Czech Republic	NZL	New Zealand
DEU	Germany	NOR	Norway
DNK	Denmark	POL	Poland
ESP	Spain	PRT	Portugal
EST	Estonia	SVK	Slovak Republic
FIN	Finland	SVN	Slovenia
FRA	France	SWE	Sweden
GBR	United Kingdom	TUR	Turkey
GRC	Greece	USA	United States
HUN	Hungary		
ISL	Iceland		
IRL	Ireland	EU	European Union
ITA	Italy		

BRA	Brazil	IDN	Indonesia
CHN	China	RUS	Russian Federation
COL	Colombia	TWN	Chinese Taipei
IND	India	ZAF	South Africa

Country aggregates

OECD Europe	All European member countries of the OECD, i.e. Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.
OECD	All member countries of the OECD, i.e. countries of OECD Europe plus Australia, Canada, Chile, Israel, Japan, Korea, Mexico, New Zealand, United States.
EU15	European Union countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.
G20	Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, the Russian Federation, Saudi Arabia, South Africa, Turkey, United Kingdom, United States and European Union (which is not included in the G20 average).
BRIC	Brazil, Russian Federation, India, China.
BRIICS	Brazil, Russian Federation, India, Indonesia, China, South Africa.

Sources

OECD (2014), *Main Economic Indicators (MEI)* (database), *www.oecd.org/std/mei*.

OECD (2014), *International Trade by Commodity (ITCS)* (database), *www.oecd.org/std/its/itcsinternationaltradebycommoditystatistics.htm*.

OECD (2014), *STAN Bilateral Trade Database by Industry and End-use (BTDIxE)*, *www.oecd.org/sti/btd*.