

Yearbook on Space Policy

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Peter Hulsroj  
Arne Lahcen *Editors*

# Yearbook on Space Policy 2014

The Governance of Space

 **ESPI**  
European Space Policy Institute

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# **Yearbook on Space Policy**

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# Yearbook on Space Policy

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# Preface ESPI Yearbook 2014

## “The Governance of Space”

The increasing number and diversity of players in space in recent years, and the onset of new technologies as well as the residue of past space activities, has brought the issue of space governance to the fore. While some aspects of space governance are specifically legal and technical, others raise broader questions about the entire current space regime. In order to clarify and shed additional light on these issues, ESPI has decided to focus on the topic of governance from a wide variety of angles in its Yearbook on Space Policy 2014.

Traditionally, the first part of the Yearbook sets out a comprehensive overview of the economic, political, technological and institutional trends that are affecting space activities. It is prepared in-house in ESPI, and while its perspective is European, it also provides a comparative analysis of space developments around the world.

The second part of the ESPI Yearbook approaches the overall theme from an analytical perspective. This year it includes nine external contributions that bring together the views of various eminent professionals in the space field. This part of the Yearbook opens with a contribution by Professor Stephan Krasner and ESPI Resident Fellow Marco Aliberti on the theoretical link between space and international relations theory. Thus, they analyse the two major paradigms of international relations theory, realism and liberalism, to describe and explain the different and often contending approaches followed by states in the governance of space activities. Thereafter, Professor Emeritus Jacques Blamont assesses the effects of globalisation on the governance of space activities in the USA and NASA in particular. The political and institutional aspects of governance are explored in a contribution by Xavier L.W. Liao from the Ghent Institute for International Studies, focusing on the impacts of regionalisation processes on space governance, and in a contribution by Hokkaido University Professor Kazuto Suzuki on how governance models affect geopolitics in Asia. Gérard Brachet, former President of CNES and former

Chairman of UNCOPUOS, contributes an article on the optimal role for governments in space, and Amy Kaminski, Senior Policy Advisor at the Office of the Chief Scientist of NASA, sets out some of the findings of her research on the roles of the public and NGOs in space governance and how this public engagement has been evolving over time. Rajeswari Rajagopalan, who is a Senior Fellow at the Observer Research Foundation, New Delhi, assesses the International Code of Conduct for Space Activities and describes its importance for the long-term sustainable use of the outer space environment. Finally, the hot topic of governance in the European setting is addressed. Professor Thomas Hoerber offers a historic perspective describing how the processes of European integration have shaped the creation and governance of ESA, while Professor Emmanuel Sigalas writes about the role of the European Parliament in the legitimisation of Europe's space policy.

The third part of the Yearbook continues the character of the Yearbook as an archive of space activities. Again prepared in-house by ESPI, a bibliography, chronology and data about institutions are provided where readers of the now eight volumes of the Yearbook can identify statistical developments and evolutions.

In closing, we would like to thank the contributors of the articles in Part Two for their engagement in this publication. Moreover, we are very grateful to Frances Brown, former editor-in-chief of Space Policy and current member of the ESPI Advisory Council, for her support and inspiration as we prepared the ESPI Autumn Conference 2014. The contributions in Part 2 of the Yearbook reflect the presentations made by the authors at the Autumn Conference.

Vienna, Austria

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# List of Acronyms: Acronym Explanation

## A

AARSE	African Association of Remote Sensing of the Environment
ABS	Asia Broadcast Satellite
ACE	Advanced Composition Explorer
ACS	Alcântara Cyclone Space
ADF	Aerospace Defence Forces
AEB	Agência Espacial Brasileira (Brazilian Space Agency)
AG	Aktiengesellschaft
AIA	Atmospheric Imaging Assembly
Airbus D&S	Airbus Defence and Space
ALASA	Airborne Launch Assist Space Access programme
ALOS	Advanced Land Observing Satellite
APSCO	Asia-Pacific Space Cooperation Organization
ARD	Atmospheric Re-entry Demonstrator
ARM	Asteroid Redirect Mission
ASAT	Anti-Satellite
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
ATV	Automated Transfer Vehicle

## B

BDC	Business Development Bank of Canada
BMD	Ballistic Missile Defence
BMO	Bank of Montreal



**C**

CAA	Civil Aviation Authority
CAGR	Compound Annual Growth Rate
CASBAA	Cable and Satellite Broadcasting Association of Asia
CASC	China Aerospace Science and Technology Co.
CASIC	China Aerospace Science and Industry Co.
CAST	China Aerospace Science and Technology Corp.
CBERS	China–Brazil Earth Resources Satellite
CCDev	Commercial Crew Development programme
CCP	Commercial Crew Programme
CCiCap	Commercial Crew integrated Capability initiative
CCtCap	Commercial Crew Transport Capability
CD	Conference on Disarmament
CEPT	European Conference of Postal and Telecommunications Administrations
CHF	Swiss franc
CHIRP	Commercially Hosted Infrared Payload
CLA	Alcântara Launch Center
CMB	Cosmic Microwave Background
CME	Coronal Mass Ejections
CNES	Centre National d'Études Spatiales (French Space Agency)
CNSA	China National Space Administration
COP	Conference of the Parties
COPUOS	Committee on the Peaceful Uses of Outer Space
COROT	COncvection, ROtation and planetary Transits space telescope
CPC	Certification Products Contract
CRS	Commercial Resupply Services
CSA	Canadian Space Agency
CST-100	Commercial Space Transportation-100
CSO	Czech Space Office

**D**

DARPA	Defense Advanced Research Projects Agency
DARS	Digital Audio Radio Service
DBS	Direct Broadcast Services
Dextre	Special Purpose Dexterous Manipulator
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
DND	Department of National Defence
DoD	Department of Defence
DoT	Department of Telecom
DRDO	Defence Research and Development Organisation

DSCOVr      Deep Space Climate ObserVatoRy  
 DTH          Direct To Home

## **E**

EADS          European Aeronautic Defence and Space  
 EAP          Environmental Action Programme  
 EBITDA      Earnings Before Interest, Taxes, Depreciation and Amortization  
 ECA          Evolution Cryotechnique type A  
 EDA          European Defence Agency  
 EDM          Entry, Descent and Landing Demonstrator Module  
 EDRS        European Data Relay Satellite System  
 EELV        Evolved Expendable Launch Vehicle  
 EFT          Exploration Flight Test  
 EKV          Exoatmospheric Kill Vehicle  
 EO          Earth Observation  
 EPIC        Earth Polychromatic Imaging Camera  
 EPS-SG      European Polar System Second Generation  
 ERA          European Research Area  
 ESA          European Space Agency  
 ESM        European Service Module  
 EU          European Union  
 EUMETSAT   The European Organisation for the Exploitation of  
                  Meteorological Satellites  
 EUTELSAT   European Telecommunications Satellite Organisation  
 EVE        EUV Variability Experiment

## **F**

FAA          Federal Aviation Administration  
 FCC        Federal Communications Commission  
 FSS        Fixed Satellite Services

## **G**

GCF          Green Climate Fund  
 GCSP        Global Collaborative Space Programme  
 GDP        Gross Domestic Product  
 GEO        Geostationary Earth Orbit  
 GEOSS      Group on Earth Observation System-of-Systems  
 GERD        Gross Domestic Expenditure on Research and Development  
 GLONASS    Globalnaya Navigatsionnaya Sputnikovaya Sistemya (Russian  
                  GNSS Constellation)

GM	General Motors
GmbH	Gesellschaft mit beschränkter Haftung
GMD	Ground-based Midcourse Defence
GMES	Global Collaborative Space Programme Monitoring for Environment and Security
GNSS	Global Navigation Satellite Systems
GPIM	Green Propellant Infusion Mission
GPS	Global Positioning System
GSA	European GNSS Agency
GSLV	Geosynchronous Satellite Launch Vehicle
GTO	Geosynchronous Transfer Orbits

## H

HCN	Hydrogen Cyanide
HDTV	High-Definition Television
HFI	High-Frequency Instrument
HiRISE	High-Resolution Imaging Science Experiment
HMI	Helioseismic and Magnetic Imager
HTV	H-2 Transfer Vehicle

## I

IAC	International Astronautical Congress
IAG	International Association of Geodesy
ICG	International Committee on Global Navigation Satellite Systems
ICoC	International Space Code of Conduct for Outer Space Activities
ICS	Information and Communication Systems
ICT	Information and Communication Technology
IGS	International GNSS Service
IHMC	Institute for Human and Machine Cognition
ILN	International Lunar Network
ILS	International Launch Services
IMAAFS	Information for Meeting Africa's Agricultural Transformation and Food Security
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions
IOV	In-Orbit Validation
IR	Infrared
IRGC	Islamic Revolution Guards Corps
IRIS	Interface Region Imaging Spectrograph
IS	Islamic State or ISIS
ISEF	International Space Exploration Forum
ISPS	Innovative Space Propulsion Systems

ISRO	Indian Space Research Organisation
ISS	International Space Station
ITU	International Telecommunication Union
IXV	Intermediate Experimental Vehicle

**J**

JADE	Jovian Auroral Distributions Experiment
JAXA	Japan Aerospace Exploration Agency
JEDI	Jupiter Energetic Particle Detector Instrument
JIRAM	Jovian Infrared Auroral Mapper
JUICE	JUPiter ICy moon Explorer

**K**

K2	Kepler 2
KSLV	Korea Space Launch Vehicle

**L**

LADEE	Lunar Atmosphere and Dust Environment Explorer
LDEX	Lunar Dust Experiment
LEO	Low Earth Orbit
LFI	Low Frequency Instrument
LIRIS	Laser InfraRed Imaging Sensors
LMC	Large Magellanic Cloud
LRO	Lunar Reconnaissance Orbiter
LWS	Living With a Star programme

**M**

MAG	Magnetometer
MAVEN	Mars Atmosphere and Volatile Evolution
MDA	Missile Defense Agency
MDA Ltd.	MacDonald, Dettwiler and Associates Ltd.
MDIS	+Mercury Dual Imaging System
ME	Mid-life Evolution
Melco	Mitsubishi Electric Co.
MESSSENGER	MERCURY Surface, Space ENVIRONMENT, GEOchemistry and Ranging
Metop	Meteorological Operational Satellite
Metop-SG	Metop Second Generation
MEXT	Ministry of Education, Culture, Sports, Science and Technology

MFF	Multiannual Financial Framework
MFG	Meteosat First Generation
MIRO	Microwave Instrument for Rosetta Orbiter
MLA	Mercury Laser Altimeter
MMO	Mercury Magnetospheric Orbiter
MOIRE	Membrane Optical Imager for Real-Time Exploitation
MOM	Mars Orbiter Mission
MPCV	Multi-Purpose Crew Vehicle
MPO	Mercury Planetary Orbiter
MRO	Mars Reconnaissance Orbiter
MSG	Meteosat Second Generation
MSL	Mars Science Laboratory
MTG	Meteosat Third Generation
MTM	Mercury Transfer Module
MWR	Microwave Radiometer
<b>N</b>	
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organisation
NDAA	National Defense Authorization Act
NEC	Nippon Electric Company
NEO	Near-Earth Object
NEOWISE	Reboot of the Wide-field Infrared Survey Explorer mission to find NEOs
NGA	National Geospatial-Intelligence Agency
NISTAR	National Institute of Standards and Technology Advanced Radiometer
NOAA	National Oceanic and Atmospheric Administration
NRO	National Reconnaissance Office
NSOAS	National Satellite Ocean Application Service
<b>O</b>	
OECD	Organisation for Economic Co-operation and Development
OHB	Orbitale Hochtechnologie Bremen
ONSP	Office of National Space Policy)
OPEC	Organization of the Petroleum Exporting Countries
OPSAT	Optical SATellite
OSIRIS	Optical, Spectroscopic and Infrared Remote Imaging System

**P**

PCW	Polar Communications and Weather mission
PDV	Prithvi Defence Vehicle
PLA	People's Liberation Army
PND	Portable Navigation Devices
PNT	Positioning, Navigation and Timing
PPP	Public-Private Partnership
PPWT	Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects
PRIDE	Programme for Reusable In-orbit Demonstrator in Europe
PROBA	PRoject for OnBoard Autonomy
PRS	Public Regulated Service
PSLV	Polar Satellite Launch Vehicle

**Q**

QZSS	Quasi-Zenith Satellite System
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**R**

R2	Robonaut 2
Radio LANS	Radio wireless broadband devices
RCM	Radarsat Constellation Mission
RCS	Reaction Control System
RHESSI	Ramaty High Energy Solar Spectroscopic Imager
RLV	Reusable Launch Vehicle
ROSINA	Rosetta's Orbiter Spectrometer for Ion and Neutral Analysis
RRM	Robotic Refuelling Mission
RROxiTT	Robotic Oxidizer Transfer Test

**S**

SABRE	Synergistic Air-Breathing Rocket Engine
SAM	Sample Analysis at Mars instrument
SAP	Space Applications Programme
SAR	Synthetic Aperture Radar
SDO	Solar Dynamics Observatory
SE	Societas Europae
SecTelSat	Secure Telecom by Satellite
SES	Société Européenne des Satellites
SHEFEX	Sharp Edge Flight Experiments

SIA	Satellite Industry Association
SIP	Swiss Innovation Park
SLATS	Super Low Altitude Test Satellite
SLS	Space Launch System
SLV	Satellite Launch Vehicle
SM	Standard Missile
SMEX	Small EXplorer
SNC	Sierra Nevada Corporation
SOHO	SOLar and Heliospheric Observatory
SpaceX	Space Exploration Technologies
SPC	Space Programme Committee
SS/L	Space Systems/Loral
SSA	Space Situational Awareness
SSCO	Satellite Servicing Capabilities
SSN	Space Surveillance Network
SST	SpaceShip Two
SSTO	Single-Stage-To-Orbit
STEREO	Solar TERrestrial RELations Observatory
STFC	Science and Technology Facilities Council
SUMER	SOHO's Solar Ultraviolet Measurements of Emitted Radiation instrument

## T

TAI	Turkish Aerospace Industries
TCBM	Transparency and Confidence Building Measures
TDM	Technology Demonstration Mission
TFEU	Treaty on the Functioning of the European Union
TGO	Trace Gas Orbiter
THEMIS	Thermal Emission Imaging System

## U

UAV	Unmanned Aerial Vehicle
UK	United Kingdom
UKSA	UK Space Agency
ULA	United Launch Alliance
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDSS	United Nations Department of Safety and Security
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNGIWG	United Nations Graphic Information Working Group

UNIDIR	United Nations Institute for Disarmament Research
UNREDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
UNOOSA	United Nations Office for Outer Space Affairs
UNSDI	United Nations Spatial Data Infrastructure
UNSPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
URSC	United Rocket and Space Corporation
US	United States of America
USAF	US Air Force
USAT	Ultra Small Aperture Terminals
UVS	Ultraviolet Imaging Spectrograph

## V

VIPIR	Visual Inspection Poseable Invertebrate Robot
VIRTIS	Visible, Infrared and Thermal Imaging Spectrometer
VLM	Brazil's Microsat Launch Vehicle
VLS-1	Brazil's Satellite Launch Vehicle
VSAT	Very Small Aperture Terminals

## W

WGP	World Gross Product
WISE	Wide-field Infrared Survey Explorer
WRC	World Radiocommunication Conference
WRS	World Radiocommunication Seminar
WSF	Weather System Follow-on

## X

X1	Robotic Exoskeleton
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**Part I**  
**The Year in Space 2014**

# Chapter 1

## European Space Activities in the Global Context

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### 1.1 Global Political and Economic Trends

#### 1.1.1 Global Economic Outlook

The United Nations Annual Report “World Economic Situation and Prospects” noted a slight improvement in global growth in 2014, which was expected to continue at only a moderate level across most regions and major economic groups.<sup>1</sup>

In 2014, the growth of World gross product (WGP) was estimated to be 2.6 %, thus marginally better than the growth of 2.5 % in 2013, but less than the 2.9 % that had been anticipated mid-year. This was due partially to a number of unexpected shocks such as the heightened geopolitical conflicts in different parts of the world, in addition to unfinished post-crisis adjustments in the recovery process from the global financial crisis.<sup>2</sup>

In the Euro zone, while monetary policy measures led to a significant improvement in the sovereign debt crisis, the economic situation remained fragile. Western Europe continued to struggle with GDP growth estimated to be only 1.2 % in 2014, as growth in the region had yet to reach pre-recession levels. However, Germany, Spain, Portugal, Ireland, and the UK returned to positive growth. Also, Eastern Europe gained further ground due partially to recovering domestic demand, the gradual abandonment of fiscal austerity, and a turnaround in the inventory cycle. And while labour markets continued to improve, progress was uneven across the member states.<sup>3</sup>

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<sup>1</sup> “World Economic Situation and Prospects 2015.” 10 Dec. 2015. United Nations 7 Mar. 2015. [http://www.un.org/en/development/desa/policy/wesp/wesp\\_archive/2015wesp\\_full\\_en.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_archive/2015wesp_full_en.pdf).

<sup>2</sup> Ibid. at 1.

<sup>3</sup> Ibid. at 8.

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The economy of the United States of America had some fluctuations in 2014 with GDP growth estimated at 2.3 %; however that growth was expected to increase to 2.8 % in 2015. While the fiscal drag on growth was diminishing, the possibility of volatility in financial markets in response to the normalization of monetary policy could lead to adverse effects on the real economy. And with an overall decline in employment rates in developed economies since the beginning of the financial crisis in the United States the labour force participation rate was near its lowest level in the past 10 years due to population ageing, an increase in skill requirements, and a higher number of discouraged workers.<sup>4</sup>

In Japan, the momentum generated by the fiscal stimulus package and monetary easing introduced in 2013 receded due to a rise in inflation expectations and the further increase of the consumption tax by the central bank in late-2014. Exports were expected to eventually benefit from the depreciation of the Japanese yen triggered by the monetary easing, while the planned cut in corporate taxes would support fixed investment. And while GDP grew by 0.4 % in 2014, it was expected to increase to 1.2 % for 2015.<sup>5</sup>

While the global economy has struggled to gain momentum grappling with the legacy of the global financial crisis, developed economies are expected to see growth in the oncoming years, thanks to gradually recovering labour markets, ebbing fiscal consolidation, and low financing costs. While GDP growth was estimated at 1.8 % in 2014, it was expected to grow to 2.2 % in 2015. In developing countries growth was projected to gradually accelerate, rising from 4.4 % in 2014 to 4.8 % in 2015.<sup>6</sup>

Overall, WGP was forecast to grow at a pace of 3.1 % and 3.3 % in 2015 and 2016, respectively. Unemployment figures remain elevated in several developed countries, particularly in the euro zone, and wage stagnation has, to some extent, eroded the benefits of salaried employment. However, in developing economies, unemployment rates have remained relatively stable since 2013, partly owing to lower labour force growth. Nevertheless, high unemployment levels continue to persist in South-Eastern Europe, Northern Africa, and Western Asia.<sup>7</sup>

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<sup>4</sup> Ibid. at 11.

<sup>5</sup> Ibid. at 8.

<sup>6</sup> “Global Economic Prospects | Having Fiscal Space and Using It.” 13 Jan. 2015. The World Bank 7 Mar. 2015: 21. [http://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015a/pdfs/GEP15a\\_web\\_full.pdf](http://www.worldbank.org/content/dam/Worldbank/GEP/GEP2015a/pdfs/GEP15a_web_full.pdf).

<sup>7</sup> “World Economic Situation and Prospects 2015.” 10 Dec. 2015. United Nations 7 Mar. 2015. [http://www.un.org/en/development/desa/policy/wesp/wesp\\_archive/2015wesp\\_full\\_en.pdf](http://www.un.org/en/development/desa/policy/wesp/wesp_archive/2015wesp_full_en.pdf).

## ***1.1.2 Political Developments***

### **1.1.2.1 Geopolitics**

The year 2014 saw its own share of significant world events, some of which remained unresolved by year's end. In the Middle East Abdel Fattah el-Sisi's success in the May 2014 Egyptian presidential elections ushered in increased military and political relations with Russia and deteriorating relations with the United States; in Syria and Iraq the emergence of the 'Islamic State' (IS or ISIS) brought renewed concern to the region. In contrast to the Arab Spring that arose through political demonstrations and unrest within the Arab world, ISIS had already existed as 'al-Qaeda in Iraq' and gained notoriety when it began to send forces to fight in Syria's civil war. Denounced even by al-Qaeda for its brutality toward its enemies, its scale as an international threat remains uncertain. While the U.S. has sent troops to Iraq to advise its local army on how to regain territory, and the U.S. and Iran have launched airstrikes on IS territory to slow the growth of the group, the IS continues to draw in foreign jihadists (including some Europeans and Americans), and pledges of allegiances from other jihadi groups.<sup>8</sup>

In Iran, President Hassan Rouhani was unable to rally the country to scale back its nuclear ambitions in exchange for the rollback of Western sanctions. In January 2014 a 6-month joint plan of action between Iran and the U.S., UK, France, Germany, Russia, and China, was launched in an attempt to conclude the negotiations process, yet an agreement was not reached by July—nor was one reached in November, following a 4 month extension in talks. A new deadline was set for 1 July 2015.<sup>9</sup>

Russia's annexation of Crimea significantly impacted EU-Russia relations, especially following the downing of Malaysia Airlines passenger Flight 17 over rebel-held territory in Ukraine. Tensions began at the end of 2013, when the pro-Russia former Ukrainian President Viktor Yanukovich decided not to sign a much anticipated trade deal with the EU. Protests continued into February 2014, when Yanukovich resigned from office and fled the country, and pro-Russian militants seized the Crimean capital in return. Following a questionable referendum, wherein 95 % of Crimeans voted in favour of rejoining Russia, by May pro-Russian separatists in other regions of eastern Ukraine declared independence, and held their own elections; while the rest of the country elected Petro Poroshenko as the pro-Western Ukrainian president. Following the downing of the Malaysia Airlines flight on 17 July 2014, the EU and United States responded by increasing sanctions against Russia, which did not do much to abate tensions by the end of the year.<sup>10</sup>

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<sup>8</sup> Lindsay, James M. "Top Ten Most Significant World Events in 2014." 15 Dec. 2014. Council on Foreign Relations 10 Mar. 2015. <http://blogs.cfr.org/lindsay/2014/12/15/top-ten-most-significant-world-events-in-2014/>.

<sup>9</sup> Ibid.

<sup>10</sup> Ibid.

In West Africa, Ebola outbreaks in Liberia, Guinea, and Sierra Leone resulted in a death toll of over 6000 people by the end of 2014. While several outbreaks had occurred since the virus' discovery in 1976, those deaths ranged between several dozen to hundreds, having emerged in less densely populated areas. The opposite was the case this time; and with the inadequate, slow and uneven international response, some isolated cases reached the U.S. and Europe. With economic growth rapidly decreasing, and food shortages becoming common, there was concern that the economic costs of the Ebola outbreak in West Africa would persist into the future.<sup>11</sup>

In Europe, austerity measures accompanying the financial crisis drove a wedge between Euro zone members in the north and south. And while there was some sign of growth, its impact on the high unemployment rates in the countries of the 'periphery' was minimal—youth unemployment rates in particular remained very high, more than 50 % in Greece and Spain.<sup>12</sup>

### 1.1.2.2 Environment

Space applications have an important role in the monitoring and protection of the environment. Space assets are uniquely positioned to offer a global perspective on climate change. They help to better manage disaster situations around the world, and are often a common multinational platform for collecting relevant meteorological and environmental data. These characteristics make them ideal promoters of international understanding and cooperation in this field. Satellite based systems are being used to gather information on climate change indicators e.g. the melting of the ice-caps, changes in the global sea level, and gathering data on the regions most affected by global warming. Remote sensing technologies can also be used to monitor deforestation and land use, and are important for better utilization of fresh water sources. There is no doubt that space technologies will play an important role in human and environmental security in the future, hence technical development of their capabilities is necessary.

Climate change remains one of the commonly recognized agenda topics within the global political debate. In the days leading up to the 20th UN Framework Convention on Climate Change Conference of Parties (UN FCCC/COP) which took place in Lima, Peru, from 1 to 12 December 2014, the EU had pushed for the legally binding mitigation target of a 40 % reduction in emissions by 2030; whereas the U.S. preferred a more buffet-like approach that included some binding elements, but allowed countries to determine the scale and pace of their emissions reductions even if this could mean that the aim of keeping global temperature rises

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<sup>11</sup> Ibid.

<sup>12</sup> "Youth Unemployment Could Prolong Eurozone Crisis, Christine Lagarde Says." 10 Dec. 2013. The Guardian 19 May 2014. <http://www.theguardian.com/business/2013/dec/10/youth-unemployment-eurozone-crisis-christine-lagarde-imf>.

below 2 °C would not be met.<sup>13</sup> However, rather than establishing a new global agreement on climate change, the Lima meeting provided a set of procedural steps, which consisted of loose arrangements for parties bringing forward their intended nationally determined contributions (INDCs); these INDCs and the remaining issues and options put forward by the parties will be included in the elements for a draft negotiating text that will be produced mid-2015. Containing the raw material for the next meeting, the elements paper covers such issues as mitigation, adaptation, finance, technology transfer, transparency, the legal nature of parties' commitments, the use of market mechanisms, and procedures to periodically update commitments. However, amid the compromises being made by industrialized and emerging nations, unresolved major issues remained by the end of the conference, such as whether INDC's are to focus only on mitigation, or also adaptation and finance, and whether quantifiable information was expected on a voluntary or mandatory basis. Moreover, the method for assessing the aggregate effect of the INDCs, and whether the responsibilities of and financing from industrialized and emerging nations should remain differentiated, remained points of discussion.<sup>14</sup>

The Lima conference featured the first "multilateral assessment" of mitigation efforts by 17 industrialized countries, as part of the transparency procedures established under the Cancun Agreements of 2010; showing their progress toward achieving the 2020 emission pledges as agreed in the "Copenhagen Accord" of 2009. Moreover, by the end of the Lima conference, the Green Climate Fund (GCF) established under the Cancun Agreements of 2010 surpassed an informal initial goal of \$10 billion in pledges; at the Cancun conference, industrialized nations committed to mobilizing \$100 billion per year in public and private finance by 2020, to assist developing countries in handling the effects of global warming and climate change. And in terms of aid to developing countries for "loss and damage" resulting from climate change, the meeting decided on the composition of the executive committee for the Warsaw International Mechanism for Loss and Damage, established in the Warsaw conference of 2013, and adopted an initial 2-year work plan to mitigate climate impact and risks.

Aside from increased transparency through the development of an online Information Hub on the UN FCCC website, not much progress was made regarding the UN Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN REDD), where governments had previously agreed on a set of measures to reduce emissions from deforestation and forest degradation.

The new global agreement on climate change is expected to be concluded at the 21st UN FCCC/COP in Paris, France, running from 30 November to 11 December 2015.<sup>15</sup>

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<sup>13</sup> Nelsen, Arthur. "UN climate change deal must have legally binding targets, says EU." 27 Nov. 2014. *The Guardian* 31 Mar. 2015. <http://www.theguardian.com/environment/2014/nov/27/un-climate-change-deal-must-have-legally-binding-targets-says-eu>.

<sup>14</sup> "Outcomes of the U.N. Climate Change Conference in Lima." Dec. 2014. C2ES.org 31 Mar. 2015. <http://www.c2es.org/docUploads/cop-20-summary.pdf>.

<sup>15</sup> *Ibid.*

On 20 November 2013 the European Parliament and European Council adopted a decision to establish the EU's 7th Environmental Action Programme (EAP) (running until 2020) "living well, within the limits of our planet", which entered into force in January 2014. It identifies three key objectives: e.g. protection, conservation and enhancement of the EU's natural capital; turning the EU into a resource-efficient, green, and competitive low-carbon economy; and safeguarding the Union's citizens from environment-related pressures and risks to health and wellbeing. It also lists four 'enablers' that will facilitate these goals: better implementation of legislation; better information by improving the knowledge base; increased and wiser investment for environment and climate policy; and full integration of environmental requirements and considerations into other policies. Its two overarching horizontal priority objectives are to make the Union's cities more sustainable, and to help the Union address international environmental and climate challenges more effectively.<sup>16</sup>

### 1.1.2.3 Energy

Instability in parts of the Middle East, the major source of low-cost oil, and tension between Russia and Ukraine, sparked concerns over natural gas security, demonstrating that the energy system may be in danger of falling short of meeting global energy needs in the coming decades. While global energy demand should grow by 37 % by 2040, the change in the distribution of that demand will be more dramatic, with consumption increasing substantially in China and the rest of Asia (60 % of the global total), along with other emerging regions in Africa, the Middle East, and South America. On the other hand, energy demand will remain flat at current rates in Europe, Japan, South Korea, and North America.<sup>17</sup>

China is expected to become the largest oil-consuming country by the 2030s, surpassing the United States whose own oil production and consumption will start to fall back in the 2020s. As oil demand will increase in emerging countries, the turmoil in the Middle East is a major concern given the increasing reliance on this region for oil production growth. Additionally, the long-term supply of natural gas is another concern, with the key uncertainty being whether it can be produced at an attractive price to consumers across Asia and Europe, while still providing an incentive to invest in gas exploration and exploitation. An investment of around \$900 billion per year in upstream oil and gas production is needed by the 2030s to meet the projected demand.<sup>18</sup>

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<sup>16</sup> European Union. Decision of the European Parliament and of the Council on a General Union Environment Action Programmes to 2020 "Living Well, Within The Limits Of Our Planet". 20 Nov. 2013, European Parliament and Council Decision PE-CONS 64/1/13 REV 1 of 20 November 2013. Strasbourg: European Union. [http://ec.europa.eu/environment/newprg/pdf/PE00064\\_en.pdf](http://ec.europa.eu/environment/newprg/pdf/PE00064_en.pdf).

<sup>17</sup> International Energy Agency. World Energy Outlook 2014—Executive Summary. IAE: Paris, 2014.

<sup>18</sup> Ibid.

On the other hand, coal production will remain abundant, constrained mainly by measures to tackle pollution and reduce CO<sub>2</sub> emissions. India is expected to surpass the United States as the world's second biggest coal importer before 2020, and will overtake China shortly thereafter. Relieving pressure on energy supplies and mitigating the impact of price disparities between regions will require a focus on energy efficiency. In 2013, fossil-fuel subsidies totalled \$550 billion, whereas subsidies for renewable energy were nearly a quarter of that amount, i.e. \$120 billion. According to the United Nations Environment Programme report 'Global Trends in Renewable Energy Investment 2015', investment in developing countries rose by 36 % to \$131.3 billion in 2014, with China investing \$83.3 billion (up 39 % from 2013), while Brazil (\$7.6 billion), India (\$7.4 billion), and South Africa (\$5.5 billion) were also among the top 10 of investing countries. Additionally, more than \$1 billion was invested in Indonesia, Chile, Mexico, Kenya and Turkey. On the other hand, in industrialized countries, the U.S. invested \$38.3 billion (up 7 % from 2013), while Europe overall rose by less than 1 % to \$57.5 billion, and Japan rose by 10 % to \$35.7 billion.<sup>19</sup> By 2040, the world energy supply mix is expected to be split almost evenly between oil, gas, coal, and renewable/low-carbon sources.<sup>20</sup>

#### 1.1.2.4 Resources

Space applications and Earth monitoring technologies play an important role in the area of resource management, as they can provide better control of and support for the utilisation of scarce natural resources. Likewise, satellite based technologies perform indispensable tasks for international trade, e.g. by streamlining global business transactions and payments. Global navigation satellite systems (GNSS) are already relied on as an integral part of transportation and utilisation of natural, agricultural and industrial resources. And the use of meteorological and imaging satellites is making agricultural output bigger and more reliable, along with greater precision. For many developing countries the rationale for investment in space is improvement of the management of their agricultural and natural resources.

The growth of international trade continued at a rate of 2.2 % in 2013, remaining subdued from the 13.8 % growth experienced in 2010, and was expected to remain between 2.5 % and 3 % during 2014.<sup>21</sup> Moreover, the volume of trade in nearly all regions appeared to have decelerated, excluding some developing countries in Asia, and Sub-Saharan Africa, with varying impact on developed, developing and transitioning economies. Developed economies experienced the greatest slowdown, with 0.4 % reduction of imports in 2013, primarily the result of weak intra-EU

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<sup>19</sup> "Global Trends in Renewable Energy Investment 2015." 31 Mar. 2015. FS-UNEP 26 Aug. 2015. <http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2015>.

<sup>20</sup> International Energy Agency. World Energy Outlook 2014—Executive Summary. IAE: Paris, 2014.

<sup>21</sup> According to the latest data available from UNCTAD.