

Yearbook on Space Policy

Cenan Al-Ekabi
Blandina Baranes
Peter Hulsroj
Arne Lahcen *Editors*

Yearbook on Space Policy 2011/2012

Space in Times of Financial Crisis

 | **ESPI**
European Space Policy Institute

 Springer

Yearbook on Space Policy

For further volumes:
<http://www.springer.com/series/8166>

Yearbook on Space Policy

Edited by the
European Space Policy Institute

Director: Peter Hulsroj

Editorial Advisory Board:

Herbert Allgeier

Frank Asbeck

Alvaro Azcárraga

Frances Brown

Alain Gaubert

Leen Hordijk

Peter Jankowitsch

Alfredo Roma

Cenan Al-Ekabi • Blandina Baranes •
Peter Hulsroj • Arne Lahcen
Editors

Yearbook on Space Policy 2011/2012

Space in Times of Financial Crisis

 Springer

Editors

Cenan Al-Ekabi
Blandina Baranes
Peter Hulsroj
Arne Lahcen
European Space Policy Institute
Vienna, Austria

ISSN 1866-8305

ISBN 978-3-7091-1648-7

ISBN 978-3-7091-1649-4 (eBook)

DOI 10.1007/978-3-7091-1649-4

Springer Wien Heidelberg New York Dordrecht London

© Springer-Verlag Wien 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Cover illustration: Artist's impression of Herschel, ESA – C. Carreau.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface Yearbook 2011–2012

‘Space in Times of Financial Crisis’

The financial crisis and the subsequent economic crisis have yet again shown how interconnected our world has become. The space sector – in spite of its somewhat particular and uncommon structure – is not entirely immune to the merciless dynamics that are affecting the functioning of the overall economy. Fortunately, the space sector has been relatively protected from the most volatile caprices that typically characterise commercial markets however. This is due to the fact that, despite increasing trends of commercialisation and privatisation of space activities, the lion’s share of activities and funding is still in one way or another managed by governments, on the national level or on intergovernmental basis. Moreover, space is very much research and development driven and because of its development requirements operates on a mid- to long-term time horizon. As such, investment in space activities during times of economic turmoil is administrated as a way of countercyclical economic stimulation à la Keynes. These features have created a time lag that has long shielded the space sector.

Recently, it seems that the dynamics might be somewhat changing, however. Financial austerity is forcing some governments to revise and reconsider their approach vis-à-vis investment in space activities. This is especially true for the governments of the countries that feel the effects of the crisis the most. As opposed to some examples in the regular economy, the question for space is actually not so much one of life or death, given that many governments remain capable and willing to fund space activities. Rather, the question is how the financial crisis will affect a sector which has been, and still is, a showpiece of cutting-edge human ingenuity, fruitful international cooperation and scientific and technological progress. It is for these reasons that the thematic title of this Yearbook highlights the implications of the financial crisis on the space sector.

As in previous editions, this Yearbook is comprised of three parts. The first part seeks to set out a comprehensive overview of the economic, political, technological and institutional trends that affect space activities. It is prepared in-house in the

European Space Policy Institute (ESPI), and while its perspective is European, it also provides a comparative analysis of space efforts around the world.

The second part of the Yearbook includes seven external contributions that bring together the views of various professionals in the space field. Because of their divergent backgrounds, this part of the Yearbook reveals some interesting dynamics on, inter alia, the implications of the crisis for space industry, its effects on political decision-making, international cooperation and the position of young professionals in the sector. The overall picture shows that the implications of the financial crisis are ambiguous to say the least. While it clearly poses considerable challenges for some specific actors and branches in the space sector, others are very likely to encounter opportunities as the diverse space ecosystem moves towards a novel state of equilibrium.

An important milestone in the preparation of the Yearbook was again the ESPI Autumn Conference, where authors met for an exchange on the content of their contributions. Having taken place in Vienna in September 2012, it provided a forum for constructive exchange and coordination of the contributions.

The third part of the Yearbook carries forward 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 six volumes of the Yearbook can identify statistical development and evolutions.

In closing, we would like to thank the contributors of the articles in Part II for their engagement in this publication, as well as the ESPI staff that has been instrumental for its production.

Vienna, Austria

Cenan Al-Ekabi
Blandina Baranes
Peter Hulsroj
Arne Lahcen

Acronyms

ACE	Advanced Composition Explorer
AEB	Brazilian Space Agency
AHP	Analytic Hierarchy Process
AIA	Atmospheric Imaging Assembly
ALHAT	Autonomous Landing and Hazard Avoidance Technology
AMS	Alpha Magnetic Spectrometer
AO	Announcement of Opportunity
APL	Johns Hopkins University Applied Physics Laboratory
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCO	Asia-Pacific Space Cooperation Organization
Ariane 5 ME	Ariane 5 Midlife Evolution
ARTEMIS	Acceleration, Reconnection, Turbulence and Electrodynamics of Moon's Interaction with the Sun
ARTEMIS	Advanced Responsive Tactically Effective Military Imaging Spectrometer
ARTIST	Austrian Radionavigation Technology and Integrated Satnav Services and Products Testbed
ASAP	Austrian Space Applications Programme
ASAT	Anti-satellite Missile Test
ASI	Agenzia Spaziale Italiana (Italian Space Agency)
ATCS	Active Thermal Control System
ATV	Automated Transfer Vehicle
BMD	Ballistic Missile Defence
BSP	Basic Plan for Space
CAGR	Compound Annual Growth Rate
Casbaa	Cable and Satellite Broadcasting Association of Asia
CAST	China Academy of Space Technology
CCL	Commerce Control List
CD	Conference on Disarmament
CDI	Call for Declarations of Interest
CDTI	Centre for the Development of Industrial Technology

CEO	Chief Executive Officer
CFAS	Federal Commission for Space Affairs
CHF	Swiss franc
CHIRP	Commercially Hosted Infrared Payload
CM12	European Space Agency Council at Ministerial Level 2012
CMB	Cosmic Microwave Background
CMEs	Coronal Mass Ejections
CNES	Centre National d'Etudes Spatiales (French Space Agency)
CODA	Central Office for Delay Analysis
CONCORD	European Conference on Corporate Research and Development
CONEA	National Space Activities Commission of Argentina
COP 10	10th Conference of the Parties
COROT	Convention, Rotation and Planetary Transits
COTS	Commercial Orbital Transportation Services
CSA	Canadian Space Agency
CSO	Czech Space Office
CST-100	Commercial Space Transportation-100
CVA	Communauté des Villes Ariane
DARPA	Defense Advanced Research Project Agency
DARS	Digital Audio Radio Service
DBS	Direct Broadcast Services
Dextre	Special Purpose Dexterous Manipulator
DLR	German Aerospace Center
DoD	Department of Defense
DRDO	Defence Research and Development Organisation
DSCOVER	Deep Space Climate Observatory
DTH	Direct to Home
DTU	Technical University of Denmark
DWD	Deutsche Wetterdienst (German Meteorological Service)
DWSS	Defense Weather Satellite System
EAC	European Astronaut Centre
EADS	European Aeronautic Defence and Space Company
EAP	Environmental Action Programme
EARSC	European Association of Remote Sensing Companies
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EC	European Commission
ECMWF	European Center for Medium Range Weather Forecasts
EDA	European Defence Agency
EDRS	European Data Relay System
EFQM	European Foundation for Quality Management
EJSM	Europa Jupiter System Mission
ELC	Express Logistics Carrier
ELISA	Electronic Intelligence Satellite
EO	Earth Observation

EPOXI	Extrasolar Planet Observations and Characterisation/Deep Impact Extended Investigation
EPS	Eumetsat Polar System
ERA	European Research Area
ESA	European Space Agency
ESF	European Science Foundation
ESM	European Support Module
ESOC	European Space Operations Center
ESPI	European Space Policy Institute
ESTEC	European Space Research and Technology Center
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EUTELSAT	European Telecommunications Satellite Organization
EVE	EUV Variability Experiment
FAA	Federal Aviation Administration
FCC	U.S. Federal Communications Commission
FCT	Portuguese Foundation for Science and Technology
FFG	Forschungsförderungsgesellschaft (Austrian Research Promotion Agency)
FP7	Seventh Framework Programme
FSO	Forecast-Sensitivity-to-Observation
FSS	Fixed Satellite Services
GDP	Gross Domestic Product
GENIE	Guidance Embedded Navigator Integration Environment
GEO	Geostationary Orbit
GEO	Group on Earth Observations
GEOSS	Group of Earth Observation System-of-Systems Cooperation Platform
GER	Global Exploration Roadmap
GERD	Gross Domestic Expenditure on Research and Development
GES	Global Exploration Strategy
GFCS	Global Framework for Climate Services
GME	Global Forecast Model
GMES	Global Monitoring for Environment and Security
GMT	Greenwich Mean Time
GNI	Gross National Income
GNSS	Global Navigation Satellite System
GOCE	Gravity Field and Steady-State Ocean Circulation Explorer
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GRAIL	Gravity Recovery and Interior Laboratory
GSLV	Geosynchronous Satellite Launch Vehicle
GSRT	General Secretariat for Research and Technology

GTO	Geosynchronous Transfer Orbits
HFI	High Frequency Instrument
HMI	Helioseismic and Magnetic Imager
HST	Hubble Space Telescope
HTV	H-II Transfer Vehicle
IASI	Interféromètre Atmosphérique de Sondage dans l’Infrarouge
ICBM	Inter-continental Ballistic Missile
ICG	International Committee on Global Navigation Satellite Systems
IEA	International Energy Agency
IGS	Information Gathering Satellite
IKAR	Interdepartmental Coordination Committee for Space
ILN	International Lunar Network
IMF	International Monetary Fund
IMO	International Maritime Organisation
IMPEL	Implementation and Enforcement of Environmental Law
INPE	National Institute for Space Research
Intelsat	International Telecommunications Satellite Consortium
IOV	In-Orbit Validation
IPCC	Intergovernmental Panel on Climate Change
IRGC	Islamic Revolution Guards Corps
ISECG	International Space Exploration Coordination Group
ISPS	Innovative Space Propulsion Systems
ISRO	Indian Space Research Organisation
ISS	International Space Station
ISU	International Space University
ITAR	International Traffic in Arms Regulations
ITU	International Telecommunication Union
JADE	Jovian Auroral Distributions Experiment
JAXA	Japan Aerospace Exploration Agency
JEDI	Jupiter Energetic Particle Detector Instrument
JFK	John Fitzgerald Kennedy
JIRAM	Jovian Infrared Auroral Mapper
JWST	James Webb Space Telescope
KAI	Korea Aerospace Industries
KARI	Korea Aerospace Research Institute
KSLV	Korea Space Launch Vehicle
LADEE	Lunar Atmosphere and Dust Environment Explorer
LEO	Low Earth Orbit
LFI	Low Frequency Instrument
LRO	Lunar Reconnaissance Orbiter
LTRO	Long-Term Refinancing Operation
LWS	Living with a Star
MAG	Magnetometer
MAVEN	Mars Atmosphere and Volatile Evolution

MCTES	Ministry of Science, Technology and Higher Education
MDA	Missile Defense Agency
MDA	McDonald Dettwiler and Associates
MEP	Member of the European Parliament
MER	Mars Exploration Rover
MESSENGER	Mercury Surface, Space Environment, Geochemistry and Ranging
METoP	Polar Orbiting Meteorological Satellites
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MFF	Multiannual Financial Framework
MHS	Microwave Humidity Sounder
MIRI	Mid-infrared Instrument
MMO	Mercury Magnetospheric Orbiter
MPCV	Multi-purpose Crew Vehicle
MPLM	Multi-purpose Logistic Module
MPO	Mercury Planetary Orbiter
MRO	Mars Reconnaissance Orbiter
MSL	Mars Science Laboratory
MSS	Mobile Servicing System
MWR	Microwave Radiometer
NASA	National Aeronautics and Space Administration
NASRDA	National Space Research and Development Agency of Nigeria
NATO	North Atlantic Treaty Organization
NGA	National Geospatial-Intelligence Agency
NOAA	National Oceanic and Atmospheric Administration
NOFBX	High Performance Nitrous Oxide Blended Monopropellant
NRC	National Research Council
NRO	National Reconnaissance Office
NSC	Norwegian Space Centre
NSI	National Space Institute of Denmark
NSO	The Netherlands Space Office
NTIA	National Telecommunications and Information Administration
NTU	Nanyang Technological University
NWP	Numerical Weather Prediction
OECD	Organisation for Economic Co-operation and Development
OSE	Observing System Experiments
OSP	Orbital/Suborbital Program
PARP	Polish Agency for Enterprise Development
PHAs	Potentially Hazardous Asteroids
PLA	People's Liberation Army
PM	Pump Module
PMM	Permanent Multipurpose Module
PPP	Purchasing Power Parity
PPP	Public Private Partnership

PROBA	Project for Onboard Autonomy
PSLV	Polar Satellite Launch Vehicle
PTSS	Precision Tracking Space System
PWR	Pratt & Whitney Rocketdyne
QZSS	Quasi Zenith Satellite System
RCM	Radar Constellation Mission
RHESSI	Reuven Ramaty High Energy Solar Spectroscopic Imager
ROEM	Renseignement d'Origine Electromagnétique
ROSA	Romanian Space Agency
RRM	Robotic Refuelling Mission
RXTE	Rossi X-ray Timing Explorer
SGAC	Space Generation Advisory Council
SAR	Synthetic Aperture Radar
SDO	Solar Dynamics Observatory
SESAR	Single European Sky Air Traffic Management Research
SIA	Satellite Industry Association
SIS	Space Infrastructure Service
SLS	Space Launch System
SM	Standard Missile
SMEX	NASA Small Explorer
SNSB	Swedish National Space Board
SOHO	Solar and Heliospheric Observatory
SpaceX	Space Exploration Technologies Corporation
SPOT	Satellite pour l'Observation de la Terre
SRON	Dutch Space Research Organization
SSC	Swedish Space Corporation
SST	SpaceShipTwo
SSTA	Singapore Space & Technology Association
SSTL	Surrey Satellite Technology Limited
STEREO	Solar Terrestrial Relations Observatory
STFC	Science and Technology Facilities Council
TCBM	Transparency and Confidence Building Measures
TEKES	Finnish Funding Agency for Technology and Innovation
THEMIS	Time History of Events and Macroscale Interactions During Substorms
TRL	Technology Readiness Level
TÜBİTAK/ UZAY	Scientific and Technological Research Council of Turkey
UAS	Unmanned Aerial Systems
UK	United Kingdom
UN	United Nations
UN COPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UN FCCC/ COP	United Nations Framework Convention on Climate Change/ Conference of Parties

UN OOSA	United Nations Office of Outer Space Affairs
UN REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
UN SAP	United Nations Programme on Space Applications
UN SPIDER	United Nations Platform for Space-Based Information for Disaster Management and Emergency Response
UNCTAD	United Nations Conference on Trade and Development
UNGA	United Nations General Assembly
UNGIWG	United Nations Geographic Information Working Group
UNIDIR	United Nations Institute for Disarmament Research
UNISPACE	United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UNSDI	United Nations Spatial Data Infrastructure
USAF	United States Air Force
USAT	Ultra Small Aperture Terminals
USML	U.S. Munitions List
VSAT	Very Small Aperture Terminals
WISE	Wide-Field Infrared Survey Explorer
WMO	World Meteorological Organisation
WRC	World Radiocommunication Conference

Contents

Part I The Year in Space 2011/2012

- 1 European Space Activities in the Global Context 3**
Cenan Al-Ekabi
- 2 Developments in Space Policies, Programmes and Technologies
Throughout the World and in Europe 103**
Cenan Al-Ekabi

Part II Views and Insights

- 3 The Effect of the Financial Crisis on Political Decision-Making . . . 149**
Per Tegnér
- 4 The Psychology and Reality of the Financial Crisis in Terms
of Space Cooperation 159**
Peter Hulsroj
- 5 Space Industry and the Financial Crisis 169**
Jean-Jacques Tortora
- 6 Space: the Last Frontier for Socio-economic
Impacts Evaluation? 183**
Jean Bruston
- 7 The Case for the Eumetsat Polar System (EPS)/Metop
Second-Generation Programme: Cost Benefit Analysis 193**
Stéphane Hallegatte, John Eyre, Tony McNally, Roland Potthast,
and Robert Husband

8 The Benefits of Human Space Flight; the Discourse at a Time of Financial Crisis 215
Cenan Al-Ekabi

9 Space, Youth Unemployment and Professional Status in the Financial Crisis 227
Andrea Jaime Albalat

Part III Facts and Figures

10 Chronology: June 2011–May 2012 243
Cenan Al-Ekabi and Blandina Baranes

11 Bibliography of Space Policy Publications July 2011–June 2012 275
Blandina Baranes

About the Authors and Editors 287

Index 291

Part I
The Year in Space 2011/2012

Chapter 1

European Space Activities in the Global Context

Cenan Al-Ekabi

1.1 Global Political and Economic Trends

1.1.1 Global Economic Outlook

In the reporting period covering the second half of 2011 and the first half of 2012, the world economy seemed to be on a successful path out of the financial and economic crisis. The booming economies of China, India, Brazil, Russia in particular, and some other emerging and developing countries were providing impetus to global economic recovery. Due to strong export orientation, industrialised countries, such as Germany, had benefitted from demand from these countries. Thus Germany had record growth rates and declining unemployment.

Nevertheless, there were developments in the global economy that gave cause for concern. For many countries the financial and economic crisis of the previous 3 years had begun to acquire a more permanent character:

- Capital movements are rather detached from investments in the real economy;
- National and international financial markets are above all secondary markets;
- Financial markets are still highly speculative;
- Financial markets are volatile due to overreaction and underreaction in financial and foreign exchange markets, as well as abrupt and voluminous international and domestic capital movements;
- High reliance on liquidity interventions; however, with IMF, central banks and governments having limited room for backup at this time.¹

¹ Kampeter, Werner. "International Financial Crises in Comparison - Lessons for Managing the Current Crisis." May 2011. Friedrich-Ebert-Stiftung – International Policy Analysis. 11 May 2012 <http://library.fes.de/pdf-files/id/ipa/08081.pdf>.

C. Al-Ekabi (✉)
ESPI (European Space Policy Institute), Vienna, Austria
e-mail: Cenan.Al-Ekabi@espi.or.at

The combined effects amassed over time on a global scale have created new concerns and negative consequences. Not only has global economic activity weakened, but the economic pace has also become more uneven, exacerbating inequalities on a global, regional and societal scale. These growing imbalances in the global distribution of wealth and trade could potentially increase geopolitical tensions and encourage politically radical and economically protectionist reflexes. However, financial confidence in the United States began increasing, and the glacial European response to the Euro crisis had possibly finally reached a turning point, despite recent events in Greece. Still, the world faces a multitude of unresolved structural economic and financial deficiencies. Unforeseen geopolitical events, like the Arab spring, and natural disasters (such as the great earthquake of Japan) have multiplied the shocks to an already unsettled global financial and economic community.

In the past 3 years mainly public funds have been used to secure the European financial system and buffer the Euro crisis, in turn triggering austerity measures in almost all countries but the United States. The newly elected President of France, François Hollande, planned to reopen talks on the European Union's hard-won fiscal austerity pact in order to refocus the EU's economic policy on growth. The realism of reopening the austerity pact might be questionable, but there was growing recognition also within the European Commission that austerity alone will not solve the situation, and that active investment in growth must operate in parallel. In this sense, Europe will likely start to move in the direction of the approach of the United States, where growth has always been the priority.

Considering the aforementioned conditions, one must be cautious regarding the global economy's short term prospects. In developed economies the pace of economic recovery continues to be sluggish at best, with real economic growth reaching only 1.5 % in 2011 and not expected to increase beyond 2 % in 2012. On the other side, emerging economies have demonstrated a much more robust expansion of approximately 6 %, which was expected to continue in 2012 as well. As fiscal problems in developed economies persist, however, the prospects for emerging economies begin to look more uncertain too.² This is particularly true for countries that are more heavily dependent on foreign demand for their products and services. The current global outlook is based on a series of assumptions, such as the containment of the Euro crisis; continued and successful fiscal consolidation in the U.S. without obstruction of economic recovery, especially on the demand side; the ability of markets in advanced economies to absorb the shock of the gradual withdrawal of quantitative easing measures previously applied; the absence of further major geopolitical shocks; and that global market volatility and risk aversion will not become more pronounced.

Concerns about banking sector losses and fiscal sustainability have lowered credit confidence and widened the sovereign spreads for a large number of Euro area countries, which towards the end of 2011 reached highs not seen since the

² International Monetary Fund. World Economic Outlook 2011. Washington DC: IMF, 2011.

launch of the Economic and Monetary Union. As a result of this deterioration, bank funding came to a near stop across the entire eurozone towards the end of 2011, prompting the European Central Bank to initiate debt re-monetarisation measures through its Long-Term Refinancing Operation (LTRO). In general, bank lending conditions deteriorated across most advanced economies. More importantly, currency market volatility increased significantly, witnessing a sharp appreciation of the Japanese Yen and an equally violent depreciation of the currencies of several emerging countries.

The uneven nature and geographical distribution of post-crisis economic expansion is a major reason behind the significant risks to global economic activity. In fact, two simultaneous balancing acts should take place. On the one hand, private demand should take over again from public demand. Worryingly enough, advanced economies seem to be lagging behind on this front. On the other hand, an effort should be made to rebalance global trade volumes and international payments to pre-crisis levels. This would imply that economies with large external surpluses should increase their domestic orientation, while countries with trade deficits should do the opposite or radically increase their productivity. At present, this transition is still underway, and much of its eventual success depends on the ability of policy makers in crisis-hit economies to resist the temptation of choosing accommodating monetary policies to mend balance sheets.

In many advanced economies, notably those with external deficits, the drop in house prices is expected to continue in the longer term. Furthermore, structural reforms are still needed to boost production, including measures to reform the labour and production markets and strengthen their resistance to the adverse effects of population ageing.

Youth unemployment, with extremes in Greece and Spain, but high in almost all industrialised countries, is both a short and a long-term challenge with a possible fundamental societal impact on the wealth and stability paradigm of these countries.

1.1.2 Political Developments

1.1.2.1 Geopolitics

The year 2011 ushered in a wave of political demonstrations and unrest within the Arab world. Dubbed the Arab Spring, the consequences of this mass social-political upheaval continued to show throughout the year with profound influence on the geo-political climate. Following the initial uprisings in Tunisia, inciting similar action in neighbouring states, the Arab Spring spread with varying results across all of North Africa, and to most of the Middle East countries. Syria had been experiencing its own long-lasting turmoil, and the crisis there had other regions promoting conflicting interests. While Western Europe and the United States backed the uprising, Russia sided with traditional government interests, and

China adopted a policy of non-interference, politically motivated by Tibet and Taiwan. As a natural consequence, the UN Security Council was stuck between two stools, despite very active and constructive diplomacy by some members, such as France and the United Kingdom. A sort of 'Great Game' was being replayed in the Middle East as a result of the Arab spring, with neighbouring states taking traditional positions based on historical and religious affiliations, along with internal influences. Iran is a prime example, expounding its religious and geopolitical interests, and seizing the opportunity to deflect attention from its own nuclear affairs.

The Arab Spring situation illustrates the vulnerability of old regimes faced with modern attitudes and the supra-regional interconnectedness among neighbouring states stretching from Morocco to Asia. Whereas the Arab Spring sparked other regions to assess their current situation, Palestine and Israel have struggled with their own autonomy issues since World War II, yet have still been profoundly affected by the uprisings. The problems with Iran both directly and indirectly influenced the situation in Iraq, with a chain reaction affecting the situation in Afghanistan, and complicating the already highly critical matters in Pakistan, which thereafter touched India, and introduced their local nuclear weapons issues into the equation, along with the problems with North Korea. From there both China (as a neighbour of Pakistan and North Korea), and Japan were affected – with an eventual trickledown effect that reached the United States and Western Europe.

Pakistan struggled with overcoming the results of the disastrous flooding that affected it, while also showing signs of being marginalized, which is highly alarming for the nuclear state, and for the already uneasy relations with its neighbour India.

And North Korea was in the throes of dealing with the death of Kim Jong-Il, and the installation of his inexperienced son as successor. The succession is likely to give rise to internal power struggles creating difficulties not only for China, but for all regional powers in addition to all countries concerned about proliferation of nuclear arms. However, should current power structures crumble, the result while unappealing in the short term might also provide an opportunity for normalisation.

The overall context was heavily influenced by the start of the election process in the United States. These elections meant that political compromise across party lines was nearly impossible, as illustrated by the debt ceiling debacle. Real progress on the 2013 budget would have to wait for the November 2012 elections.

The overall context was also heavily influenced by the continued assertiveness of China on the global stage. China is undergoing a very different kind of leadership election and eventual transition. Notwithstanding the Bo Xilai situation, tensions in China were barely noticeable with the likely future president, Xi Jinping, visiting the United States in a symbolic gesture of comity. Still, China continued its aggressive investment policies in Africa, and continued to leverage its strength in space geopolitically, as well as domestically. The rendezvous and docking of two Chinese spacecraft was a triumph, setting the scene for a full-blown space station. Less noticeable was Russian assistance behind the scenes; quickly absorbed and internalised by China.

Russia, having finished its presidential elections, continued with Vladimir Putin at the helm. Interestingly, Putin's absolute grip on power – typical of the last 12 years – was increasingly questioned in the run-up to the election and even thereafter; with the lingering effects of the Arab Spring noticeable even in Russia.

The proactive civic spirit injected into the political process thanks to the Arab Spring and social media was an underlying theme during the reporting period, the Occupy Wall Street movement with its many off-springs is but a further example.

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. Moreover they are helping to better manage disaster situations around the world. They often represent 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, for example, have recently been used to gather information about the situation of the melting of the ice-caps; to scan the rising global sea level and to map regions mostly 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.

Despite the financial crisis, climate change remains one of the commonly recognized agenda topics within the global political debate. Following the complicated acceptance and application of the 1997 Kyoto Protocol, which was set to expire in 2012, and the “Copenhagen Accord” of 2009 establishing voluntary emissions cuts,³ the new round of negotiations over the follow-up international agreement continued in 2011. From 28 November to 11 December 2011, the 17th Conference of Parties to the UN Framework Convention on Climate Change (UN FCCC/COP) took place in Durban, South Africa. After days of difficult negotiations between delegates, an agreement on the preparation of a new legally binding treaty to address global warming and its solutions was reached in the final period. The treaty is supposed to be prepared by 2015 and enter into force by 2020.⁴ With this effort, the international community showed willingness to move away from the long lasting deadlock and towards real political solutions. Traditional differences between the positions of developed and developing countries were

³“United Nations Climate Change Conference kicks off in Copenhagen.” 7 Dec. 2009. United Nations Development Programme 20 Feb. 2012 <http://content.undp.org/go/newsroom/2009/december/historic-united-nations-climate-change-conference-kicks-off-in-copenhagen.en>.

⁴“Durban Climate Change Conference – November/December 2011.” United Nations Framework Convention on Climate Change 20 Feb. 2012 http://unfccc.int/meetings/durban_nov_2011/meeting/6245.php.

significant and were stressed again during the conference. Nonetheless, emerging economies such as India and China and the representatives of major current CO₂ emitters (except the U.S.), took leading roles during the final negotiations.

The Durban conference saw progress in the creation of the Green Climate Fund by adoption of its management framework. In the future, this fund will gather and distribute approx. €75.5 billion to help developing countries handle the side-effects of global warming and climate change.⁵ The other important outcome was the progress on the UN Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN REDD). Deforestation and soil degradation are well known, not only as the negative effect of global climate change, but also as a significant contributor to it.

In sum, recent progress on global climate issues shows that the gap between leading industrialised countries and countries in the development process is slowly changing. It seems that developing and emerging countries are beginning to accept greater involvement in climate change avoidance. Despite this progress, one event immediately following the Durban conference might in the future undermine the role of industrialised countries in climate change negotiations. The reaction of Canada, which a day after the conference in Durban decided to formally withdraw from the Kyoto protocol to save an estimated \$14 billion in penalties, illustrated that real progress in the international community can be counteracted by unilateral action.⁶

Environmental and sustainable development issues are still important for both internal and external EU policies. At the EU level, several important initiatives regarding environmental issues were undertaken during the Polish Presidency in the second half of 2011.⁷ Thus the EU Council stressed the urgency of establishing an ambitious international regime to solve global climate changes and called for agreement on a global and comprehensive legally-binding framework to keep the future increase of global temperature below 2 °C.

Furthermore, the European Council adopted a decision establishing the position of the EU for the tenth Conference of the Parties (COP 10) to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal. In parallel, the European Commission stressed the urgent need to effectively prevent, combat and significantly reduce illegal waste shipments. According to EU officials, this should be achieved through improved use and coordination of existing tools, such as the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL), and inter-agency cooperation.⁸

⁵ Black, Richard. "Climate Talks End With Late Deal." 11 Dec. 2011. British Broadcasting Corporation 20 Feb. 2012 <http://www.bbc.co.uk/news/science-environment-16124670>.

⁶ "Canada Pulls Out of Kyoto Protocol." 12 Dec. 2011. CBC News 21 Feb. 2012 <http://www.cbc.ca/news/politics/story/2011/12/12/pol-kent-kyoto-pullout.html>.

⁷ Council of the European Union. The 318th Council Meeting: Environment. Press Release 15321/11 final of 10 Oct. 2011. Brussels: European Union.

⁸ Council of the European Union. Preparation of the Tenth Meeting of the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous

During the Polish presidency, the EU Council also adopted conclusions on the assessment of the EU's sixth Environmental Action Programme (EAP) 2002–2012. The conclusions proposed by the European Commission are seen as comprehensive and forward-looking, and take into account existing initiatives such as the Europe 2020 Strategy; the EU positions on the UN Conference on Sustainable Development (Rio +20); the post-2010 Biodiversity Strategy; and more. The sixth EAP should allow for the consolidation and completion of legislation in almost all areas of EU environmental policy.

Regarding the 2012 Rio +20 UN Conference the Polish Presidency significantly assisted in establishing the EU's general positions, mostly stressing the use of green energy in the context of sustainable development and poverty eradication, and the establishment of an institutional framework for sustainable development.⁹

1.1.2.3 Energy

Despite the fact that economic recovery in 2011 and 2012 remained sluggish and uneven, and with future economic prospects still uncertain, global primary energy demand marked a remarkable 5 % increase on the preceding year of 2010, thus pushing CO₂ emissions to a new high. One of the key planks during the period in review was an increased effort in many countries to improve their energy efficiency. In spite of this, global energy use increased for the second consecutive year. Furthermore, events such as the Fukushima Daiichi nuclear power plant disaster, the resultant nuclear energy scepticism, and continued turmoil in parts of the Middle East and North Africa have cast doubts on the reliability of energy supply. But also the persisting global economic crisis has considerably lowered market confidence in sovereign financial performance, further weakening government resolve to implement comprehensive energy policies and achieve global climate change objectives.

Another recurring trend during the review period was the increasingly strong role of emerging countries in determining energy market behaviour. Emerging countries are projected to account for 90 % of global population growth, 70 % of global GDP increase and 90 % of energy demand growth over the period 2010–2035.¹⁰ China in particular expected to further strengthen its position as the world's largest energy consumer: by 2035, it is expected to consume almost 70 % more energy than the United States. Even in this case, however, Chinese per capita consumption would remain far lower than that of the United States. At the same time, energy consumption growth rates in other emerging countries, such as India, Indonesia, and Brazil are expected to grow even faster than in China. An important

Wastes and Their Disposal, Cartagena de Indias, Colombia, 17–21 Oct. 2011. Council Conclusion 15393/11 final of 11 October 2011. Brussels: European Union.

⁹Council of the European Union. Rio + 20: Towards Achieving Sustainable Development by Greening the Economy and Improving Governance. Council Conclusion 15388/11.

¹⁰International Energy Agency. World Energy Outlook 2011. IAE: Paris, 2011.

side effect of this trend is that significant investments in energy production and distribution will have to be made to keep pace with growing demand. By some estimates, as much as \$32 trillion will have to be invested in related infrastructure by 2035, of which \$20 trillion would be for fossil fuel exploitation.¹¹ On the supply side, market volatility and geopolitical events in oil-rich regions in 2011 and 2012 demonstrated the fragility of fossil fuel reliance. In the short term, the economic slow-down provoked by the crisis contributed to lowering pressure on oil prices. Long-term consumption trends remain unchanged, however, prices are expected to rise significantly once global economic growth returns. All of the projected net increase in oil demand is expected to come from the transport sector of emerging countries.

Thus the age of fossil fuels is not over, in spite of a slight anticipated relative decline in their demand, i.e. despite the increase in energy consumption, the share of fossil fuels in the global primary energy consumption mix is projected to fall only slightly from 81 % in 2010 to approximately 75 % in 2035. Only natural gas is expected to increase its relative share within the fossil fuel mix. At the same time, the problem of decreasing the environmental footprint of fossil fuel energy consumption remains unsolved. As a matter of fact, 4/5 of the total energy-related CO₂ emissions permissible by 2035 are already produced today by current capital stock (power plants, buildings, factories, etc.). If no corrective measures are taken, energy-related infrastructure is projected to generate all of the 2035 allowed CO₂ emissions nearly two decades too early, i.e. by 2017.¹²

1.1.2.4 Resources

Space applications and Earth monitoring technologies play an important role in the area of resource management. They provide better control and support of the utilisation of scarce natural resources. Likewise, satellite based technologies can perform indispensable tasks for accommodating international trade, e.g. by streamlining global business transactions and payments. Global navigation satellite systems are already 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. For many developing countries the rationale for investment in space is improvement of the management of their agricultural and natural resources.

In 2011 and 2012, commodity prices and consumer price inflation receded, yet risks remained. The observed tendency was attributed to weaker global demand as a result of the economic crisis. Still, in this period, adverse weather in many regions affected several agriculture markets, as well as coal and metals production. The political situation, mainly in North Africa and the Middle East with the Arab

¹¹ Id.

¹² Id.

Spring, which resulted in political and economical destabilisation, and the international sanctions against Iran, resulted in a loss of oil supply. Furthermore, currency fluctuations affected domestic prices of commodities, sometimes increasing demand. The long period of dollar weakness, in particular, contributed to upward pressure on commodity prices.¹³

In 2011, the growth of international trade was expected to return to a single-digit figure, in the range of 7–8 %. However, the revival of trade has been uneven among countries and geographic regions. For instance, in industrialised countries trade has yet to bounce back to a level above its pre-crisis levels. These countries recovered part of their previous trade losses between mid-2009 and mid-2010, but there has been no further growth since. Another example is the situation in the economies in transition. Their trade failed to reach its pre-crisis level by the end of 2010. In sharp contrast, the volume of both imports and exports in most groups of developing and emerging countries already exceeded their 2008 peak in the course of 2010. In this case, the countries in the East Asia region took the leading position. In countries that produce durable and capital goods, such as China and Japan, exports increased in volume by almost 30 %. In developing countries that export mainly primary commodities, the volume of exports was relatively stable.

It was significant during the period that oil and mineral exporters experienced significant gains. Oil prices maintained their price level, primarily because of supply insecurity related to geopolitical events. In general, geopolitical risks were expected to remain high, causing oil prices to ease only marginally during the second half of 2012. This development occurred in a period of further economic stagnation and crisis in the global economy, thus multiplying cyclical pressures. To compare the situation with previous years, according to the figures of the United Nations Conference on Trade and Development (UNCTAD) crude oil market prices fluctuated within a \$70–80 band during the first three quarters of, 2010. They then surged in the last quarter of the year, to reach a monthly average of \$116.3 during the fourth month of 2011.¹⁴ On average, global oil demand rose by 3.2 % in 2010. While the demand in non-OECD countries grew by 5.5 %, OECD countries witnessed an increase of only 1.1 %. The highest demand for crude oil came from China, with demand growing by 12.3 % in 2010. At the same time, oil supply increased by only 2.1 % in 2010, further increasing the gap between supply and demand.¹⁵

On the other hand, non-oil commodity prices continued their decline, thanks to improved supply conditions and a steep decline in global demand. In fact, non-oil commodity prices were projected to have fallen by 14 % by the end of 2012. In the near term, prices are expected to drop even further. During the previous years, uncertainty and instability have been the major distinguishing feature of commodity

¹³ The International Bank for Reconstruction and Development. *Global Economic Prospects 2011*. Washington DC: World Bank, 2011. 51–65.

¹⁴ *Id.* at 14.

¹⁵ *Id.* at 14.

markets. This is also reflected in the greater volatility of commodity prices. According to an UNCTAD report, between the two periods 2002–2005 and 2006–2011, the simple measure of volatility increased by a factor of 3.8 for food commodities and vegetable oil seeds and oils; by 2.7 for agricultural raw materials; and by 1.6 for minerals and metals and crude petroleum. In the markets for metals and minerals prices rose steeply in the second half of 2010, and peaked during the first months of 2011. Gold and silver in particular, benefited from uncertainties about the global economy. During the second half of 2011 the prices for gold reached a historical maximum and floated between \$1,690 per ounce and \$1,714 per ounce. The reason for these high prices was clearly the safe haven status of gold and silver.¹⁶

The overall trend of stabilising or lower commodity prices would explain the relative decline of consumer price inflation during the period. In advanced economies, inflation was expected to be low, especially when compared to the effect of last year's higher commodity prices. Inflation in these economies was projected to fall to about 1.5 % in the course of 2012, down from about 2.75 % in 2011. In emerging and developing economies, pressures were also expected to drop, as both growth and food price inflation slow. Overall, consumer prices in these economies were projected to decelerate, with inflation of around 6.25 % during 2012, down from over 7.25 % in 2011.¹⁷

1.1.2.5 Knowledge

There is no doubt that sustained education and knowledge improvement is one of the necessary conditions for successful space activities, as well as for the full exploitation of their societal benefits. In general, space technology and development, drawing on multiple scientific disciplines, is one of the most difficult and challenging fields in scientific and technical research. Therefore, coherent and sustainable strategies aimed at improving higher education and supporting technical and scientific activities are particularly relevant and necessary for space sector activities.

For Europe, as a leading actor in the field of scientific and technological R&D related to space, maintaining and expanding its large pool of highly skilled and specialised scientists and professionals should be a constant priority. Recent evidence suggests that Europe's leading position and excellence in this field could be disputed in the medium term, both by developed and emerging economies. In order for Europe to continue to be among the leaders in the global race for knowledge and excellence in space R&D, current levels of financial spending and political commitment in this area will have to be increased, and not only simply maintained. For

¹⁶ United Nations Conference on Trade and Development. Trade and Development Report, 2011. Geneva: UNCTD, 2011. 15.

¹⁷ International Energy Agency. World Energy Outlook 2011. Paris: IAE, 2011.

example, today only a mere 26 % of the European working age population holds a higher educational degree compared to 41 % in the U.S., 44 % in Japan and 50 % in Canada.¹⁸ Furthermore, this relative lack of skilled workers is most likely to be accentuated as demand for their services is expected to increase.

According to a 2010 report of the European Centre for the Development of Vocational Training, the European skills forecast indicates that by 2020 around 35 % of jobs in the EU will require higher education qualifications.¹⁹ Based on this finding, for Europe to maintain its competitiveness and current position on the global scientific stage a 30 % increase in higher education graduates will have to be achieved by 2020. Encouragingly, the population of university and higher education students in Europe has been constantly increasing over recent years. Today, there are approximately 4,000 universities and other kinds of higher education institutions in Europe, with more than 19 million students. Nevertheless, this quantitative increase has not been accompanied by qualitative improvements in governance structures and proposed academic curricula, or by increases in funding. Although increasing in size, Europe's higher education system has not yet achieved an academic curricula distribution that will train scientists and professionals with the right kind of skills to support economic growth and scientific excellence in new technologies. This is especially true for the space sector, which has a relatively limited human resources supply and demand chain.²⁰

According to a European Commission report, the potential of European higher education institutions to fulfil their role in society and contribute to Europe's prosperity is not fully exploited. EU officials pointed out that greater capacity for research and development could fuel innovation across all sectors of the economy, improving competitiveness and fostering job creation. The same report highlights the potential technological spin offs of innovation and their capacity to revitalise more traditional economic sectors and rural areas, multiplying their broader societal impact.²¹ In this context, the role of space applications should be highlighted, as for example in the case of using communications satellites to improve broadband Internet connectivity in remote areas. Finally, the new strategy proposed by the European Commission identifies priority areas where EU countries need to do more to achieve shared education objectives and describes how the EU can support the modernisation of their national higher education policies. According to the EC proposal, EU-level initiatives will include a multi-dimensional university ranking which will better inform students about university courses and support competition between universities.

¹⁸ European Commission-Eurostat. *Europe in Figures*. Eurostat yearbook 2011. Luxembourg: Publications Office of the European Union, 2011. 212–218.

¹⁹ European Centre for the Development of Vocational Training. *Skills Supply and Demand in Europe: Medium-Term Forecast up to 2020*. CEDEFOP, 2010.

²⁰ *Id.*

²¹ European Commission. *Communication from the Commission. Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*. COM (2010) 2020 final of 3 Mar. 2010. Brussels: European Union.

Sustained and efficient investments in higher education are important prerequisites for quality improvement. For example, in 2008 the average level of direct spending on higher education in the EU, both public and private, was approximately 1.3 % of the European GDP. The majority of expenditure on higher education usually comes from the public sector and it has been constantly increasing. Private expenditure on education is less pronounced in the EU, thus showcasing the traditional role of the public purse in public endeavours. By comparison, U.S. total private and public investment for the same period amounted to 2.7 % of GDP.

The EU budget dedicated to funding programmes in education and training is about €8 billion for the period 2007–2013. In addition to this, the EU will spend an additional €4.7 billion on training, mobility and career development for researchers. For the 2014–2020 budget period the European Commission emphasises the priority of “smart growth” through knowledge creation, consequently allocating substantial funds to skills and knowledge creation. According to the budget proposal, a single funding programme for education, training and youth will receive €15.2 billion, which means an increase of 73 % compared to the 2007–2013 period. The Commission has also proposed a 46 % rise in research funding under the planned Horizon 2020 strategy that will bring it up to €80 billion.²²

Considering the aforementioned shortcomings, it was not a surprise that initiatives in the scientific research and education fields were among the top priorities of the 2011 Polish EU Council Presidency. For example, increasing continuous learning, as well as educational and professional mobility, and modernising higher education infrastructure and curricula have been some of the key initiatives in this respect. The implementation of these priorities followed the broad lines of the Europe 2020 Strategy and its flagship initiative “Youth on the Move”, for the creation of new skills and new jobs. In this context, the Polish presidency launched a comprehensive debate on learning and mobility issues in the framework of EU educational programmes, taking into account its international dimension and also including EU neighbours. These actions were further supported by the European Commission, which set the goal of doubling the number of EU grant recipients for studying and training abroad at 800,000 students by 2020. In addition to this, around €72.5 billion is to be spent on education and training across Europe’s regions until 2013, and this pace is expected to be maintained in the future.²³ Finally, the EC plans to emphasise quality support in teaching and scientific research, as well as improving governance practices and transparency in higher education establishments.²⁴

²² “An EU Strategy for Modernising Higher Education – Questions and Answers.” 20 Sept. 2011. European Commission – Press Release. 1 Mar 2012 <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/11/615&format=HTML&aged=0&language=EN&guiLanguage=fr>.

²³ “Extra Funds for Education, Youth and Creativity Will Boost Jobs, says Commission.” 11 June 2011. European Commission – Press Release. 29 Feb 2012 <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/857&format=HTML&aged=0&language=EN&guiLanguage=fr>.

²⁴ Programme of the Polish Presidency of the Council of the European Union. 1 July – 31 December 2011. Warsaw: Poland Ministry of Foreign Affairs, 2010. 32.