



SIRIUS

SPACE, BUSINESS  
& LAW

# ACTIVITY REPORT 2017 - 2020





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« Taking the time, every 3 years,  
to reflect on how far we have come  
allows us to measure the efforts we  
made and the further efforts  
to be provided. »



## Lucien Rapp

Scientific director  
of the Sirius Chair

7 years marked by the confirmation of the relevance of the initial intuition of its five founders: the exo-atmospheric space, without ceasing to be a States'affair, will increasingly open up to the presence of private companies.

While remaining a place of exploration, it will also become a commercial issue and consequently, a stake of international financing, a business activity, a fast expanding market that should be supported with more appropriate rules or management techniques.

The following pages outline the main milestones of what has been, and will continue to be, the journey of the SIRIUS Chair. The renewal of the initial agreement for the years 2018-2023 being one notable milestone.

Taking the time, every 3 years, to reflect on how far we have come allows us to measure the efforts we made and the further efforts to be provided.

Among the achievements of the Chair, we can mention: the creation of a team, which is regularly enriched by the commitment of funded doctoral students, specifically addressing the themes of the Chair; the organization of seminars, conferences, and colloquiums that have become international events or the

participation to numerous scientific events in France and abroad.

We can also point out the setting up of a network of scientific expertise, based on strong European and non-European networks, in several fields, on many projects and many publications in leading international journals. The Chair has also been taking stances useful to the global industry on major issues related to the space sector and has created efficient and innovative tools, made available for the international space community

But, despite these first results, much remains to be done to continue ensuring the outreach of the SIRIUS Chair, to expand its network, to establish its perennity, and to start actions that could not be undertaken, particularly in the field of education and training. The following developments outline the work done. But, above all, this represents the work of the coming years towards which the SIRIUS Chair, being on the threshold of a new decade, is resolutely oriented.

7 like the 7 days of the week, the 7 colours of the rainbow, the 7 branches of a menorah, the 7 notes of the diatonic scale, the 7 Wonders of the World, the 7 chakras, the 7 circumambulations around the Kaaba in Mecca...

But above all, 7 as this 7th year in which the SIRIUS Chair steps at the dawn of 2021 - the age of reason, as we say for humans - but for an institution it is only a step in its history. A history whose duration will be, we hope so, equal to the density of the six previous years.

# Editorial



# Testimonials



« Space activity raises or renews a growing number of questions, particularly related to the management of debris, traffic regulation as well as the exploitation of extra-terrestrial natural resources or the militarization of space. These questions obviously concern the law, but also the business models that could contribute to find an economically viable solution to some of these issues. The SIRIUS Chair contributes to inform us in this context made complicated by a weak global governance and by the initiatives of some countries »



**Gilbert GRISERI**  
Head of Technical Strategy and R&D France  
Airbus Defence and Space

« In the space sector, cycles are long, regulatory and political issues are structuring and economic models are, quite often, not yet mature. The research activity carried out by the SIRIUS Chair is a necessary light to reflect on the dynamics and mutations in progress, to better understand and anticipate the developments of our sector or to assess the hindrances and opportunities brought about by the Newspace initiatives. The combination of Law and Management, through our two academic partners, TBS and UT1, is an asset that makes this Chair unique for our industry. »



**Cédric BALTY**  
Innovation Director Thales Alenia Space

« The work carried out by the SIRIUS CHAIR echoes the Law and Space Days (Journées Droit et Espace) launched in 2010 by the CNES to highlight the legal issues related to new space applications and to initiate new research topics. This modest dynamic, bringing to light fundamental questions about law and new economic models, has structured and amplified itself around the SIRIUS Chair and is now perfectly known and recognized internationally.




This has certainly been made possible thanks to the CNES (not only a Space Agency but also an ecosystem facilitator) but also to industrial partners, such as Airbus Defence and Space and Thales Alenia Space, who believed in this project and, especially, thanks to the excellence of the academic actors from Toulouse 1 Capitole University and the Toulouse Business School.

In that respect, SIRIUS is a real success and meets all our expectations. Moreover, it positions France as a real stakeholder in both regulatory discussions and concrete proposals, always supported by robust studies. »

**Hubert Diez**  
Head of relations with the  
Higher education sector,  
CNES Toulouse





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# 1. The Chair



# Key figures

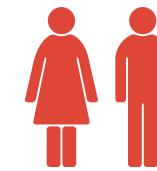
Since 2013

**1** Business Chair to support the European space sector



**5** partners including **2** industrial partners

**25** students and professionals involved annually

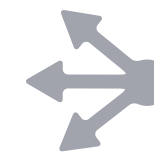
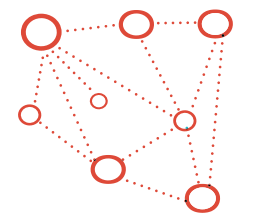


**19** researchers



**7** events organized

**95** scientific productions



**56** conferences across the globe



**8** SIRIUS Prizes awarded





# First international research Chair in Law and Management of the Space industry

**The SIRIUS Chair uses its annual allowance to promote international research works concerning the Law and Management of activities in the space sector.**

**O**riginally, the SIRIUS Chair was set up to create an interdisciplinary and international research team and to promote innovative research in the fields of law and management of space activities and now it also disseminates its knowledge all around the world (through conferences and seminars). It regularly shares its standpoint on major industrial issues (mini-satellites launches, competition, uses and applications, funding ...) and societal issues (climate, ageing, environment, migratory movements, artificial intelligence, mobility, urbanization, energy, protection of territories ...). The Chair's research works are part of an international dynamic and constitutes a pool of skills available for government agencies and the space industry. In less than six years, the Sirius Chair has created a new specialty, which is its actual subtitle «Space, Business and Law». This theme places the Chair at the very heart of the profound changes affecting the global space industry.



## 6 years of research

“

**A unique partnership between Toulouse 1 Capitole University and Toulouse Business School, two renowned public higher education institutions, and three partners of international standard: CNES, Airbus Defence and Space and Thales Alenia Space.**

”

# Innovative research geared towards the needs of the space industry

The SIRIUS Chair is now an incubator for new scientific research supporting the European space industry. Its work is articulated around four main themes: Space sector, Space companies (strategies, governance, joint ventures); Space and Society; Space Law and Policy.

## SPACE COMMERCIAL EXPLOITATION

- Space sector and industry
- Space market dynamics
- Strategy of space sector companies
- Economic impact of the space industry

## NEWSPACE

- Disruptive technologies
- Deeptech
- Space entrepreneurship
- Corporate finance and funding of space projects
- Space, debris and climate
- Space resources and commercial exploitation

## SPACE & SOCIETY

- Space exploration and expeditions
- Space resources and commercial exploitation

## SPACE LAW & POLICY

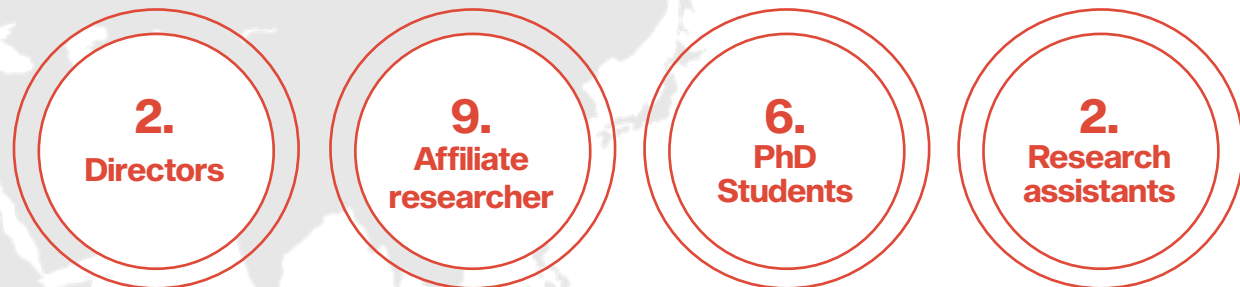
- Space insurance
- Space contracts
- International space treaties, multilateralism and the principle of reciprocity
- Space policy and international cooperation
- Space Law and Regulations





# An international and multi-skilled team

Around its scientific leaders and under their direction, the SIRIUS Chair brings together researchers (PhD students, post-doctoral fellows) or experts well-known internationally. It is opened to all other French and European research teams. The team encompasses all social science disciplines (law, economics, management, sociology, psychology, history, geography, linguistics) applied to the transformations which have been impacting the space sector since two decades.



## RESEARCH DIRECTORS



**LUCIEN RAPP**

- Scientific Director of SIRIUS Chair
- Director of IDETCOM
- Professor of Public Law at Toulouse 1 Capitole University
- Associate professor at HEC



**VICTOR DOS SANTOS PAULINO**

- Co-Director of SIRIUS Chair
- Associate professor of Strategy and Innovation Management at Toulouse Business School

**MARIA LUCAS-RHIMBASSEN**

- PhD student and research associate

**MARIA TOPKA**

- Research Assistant

## RESEARCH ASSISTANTS

## AFFILIATE RESEARCHERS

- Akram AL ARISS  
Professor of Human Resources Management, Toulouse Business School
- Sophie d'ARMAGNAC  
Associate Professor of Human Resources Management, Toulouse Business School
- Pascale BUENO-MERINO  
Professor of Strategic Management Toulouse Business School
- Denis LACOSTE  
Professor of Strategic Management, Toulouse Business School
- Wadid LAMINE  
Associate Professor at Telfer School of Management, University of Ottawa
- Amadou LO  
Professor of Strategy and Entrepreneurship, Toulouse Business School
- Lourdes PEREZ  
Associate Professor of Marketing, Toulouse Business School
- Magdalena TEISSANDIER  
Assistant Professor of Strategy, Toulouse Business School
- Christina THEODORAKI  
Assistant Professor of Strategy, Toulouse Business School

## PHD STUDENTS

- Nadège CARME, Doctoral school of Law and Political Science, Toulouse 1 Capitole University
- Alexandre CHAZELLE, Doctoral school of Law and Political Science, Toulouse 1 Capitole University
- Aveline CLOITRE, Toulouse Business School, Toulouse 1 Capitole University
- Rémy DURAND-CARRIER, Doctoral school of Law and Political Science, Toulouse 1 Capitole University
- Delphine MIRAMONT, Ecole Doctoral school of Law and Political Science, Toulouse 1 Capitole University
- Julien VILLAR, Doctoral school of Law and Political Science, Toulouse 1 Capitole University

# A global network of competences

**UNIQUE PARTNERSHIPS WITH MAJOR INTERNATIONAL ACADEMIC CENTRES IN EUROPE, IN ASIA (CHINA, JAPAN, AUSTRALIA) AND NORTH AMERICA.**

The SIRIUS Chair works in collaboration with numerous scientific, industrial and institutional partners. It has asserted itself on the international scene and is known for the originality and relevance of its project.



**As a partner of the Aerospace Valley, the SIRIUS Chair benefits from an international exposure.**





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# 2. Research



# Governance

The SIRIUS Chair is administered by a Steering Committee which includes its directors and managers as well as representatives of its three partners. The Steering Committee is held every 2 months and at least three times a year :

- Budget Committee (December/January)
- Scientific Committee (May/June)
- Strategic Committee (September/October)

## Lucien Rapp

Scientific Director of SIRIUS Chair  
Toulouse 1 Capitole University

## Victor Dos Santos Paulino

Co-Director of SIRIUS Chair,  
Toulouse Business School

## Gilbert Grisieri

Head of Technical Strategy and R&D  
France, Airbus Defence and Space

## Bernard Andrau

Head of Technical Strategy France,  
Airbus Defence and Space

## Hubert Diez

Head of relations with the Higher  
education sector, CNES Toulouse

## Cedric Balty

Innovation Director  
Thales Alenia Space



# Scientific production

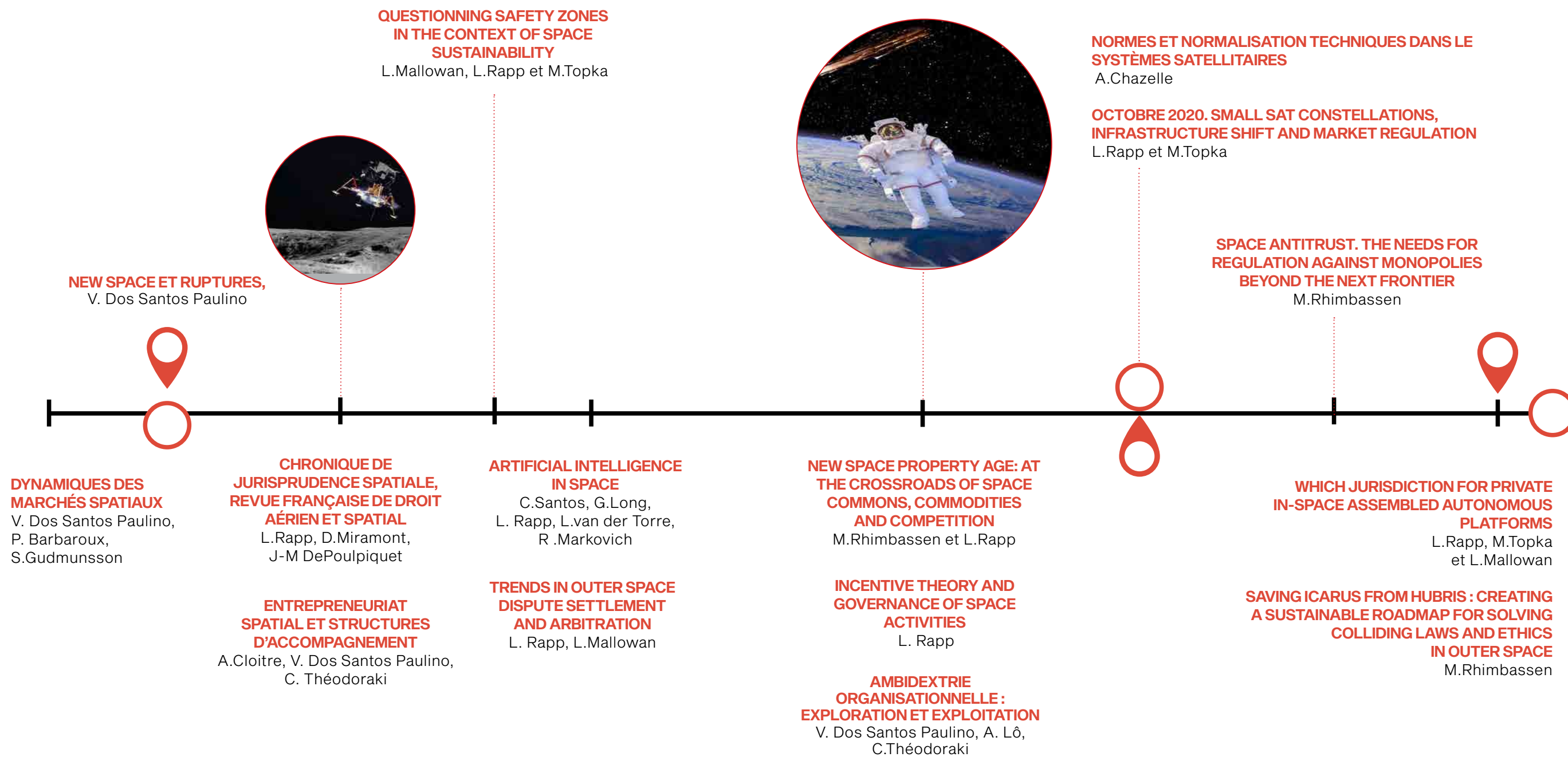




# 11 ongoing studies

The SIRIUS Chair is committed to lead concrete studies focused on the new challenges and mutations of the global space industry.

“ Led by lecturers, researchers and high-level experts, these are leading studies in their respective fields. ”



# 9 publications & articles

Our team often shares its findings and results by publishing them in major international scientific journals: *Air and Space Law* (The Netherlands), *Annals of Air and Space Law* (Canada), *Journal of Air Law and Commerce* (USA), *Journal of Space Law* (USA), *Space Policy* (UK), *ZLW - Zeitschrift für Luft und Weltraumrecht* (Germany).

6  
IN 2019

2  
IN 2018

1  
IN 2017

2017 - 2019

**DOS SANTOS PAULINO V., L'Espace d'innovations : de la NASA à Jeff Bezos**  
*Alternatives économiques*, 13/12/2019.

**GHOBADI H., TESTA P., SPOGLI L., CAFARO M. & AL, User-Oriented ICT Cloud Architecture for High-Accuracy GNSS-Based Services**  
*Sensors*, 19 (11), 2635.

**RAPP L., LONG G., LUCAS-RHIMBASSEN M. & SANTOS C., Conceptual model for a profitable return on investment from space debris as abiotic space resource**  
*8th Conference for Aeronautics and Space Sciences, EUCASS, 2019* 13 p.

**RAPP L., SANTOS C., Satellite Imagery, Very High-Resolution and Processing-Intensive Image Analysis: Potential Risks Under the GDPR**  
*Air and Space Law*, 2019, vol. 44, Issue 3, p. 275–295.

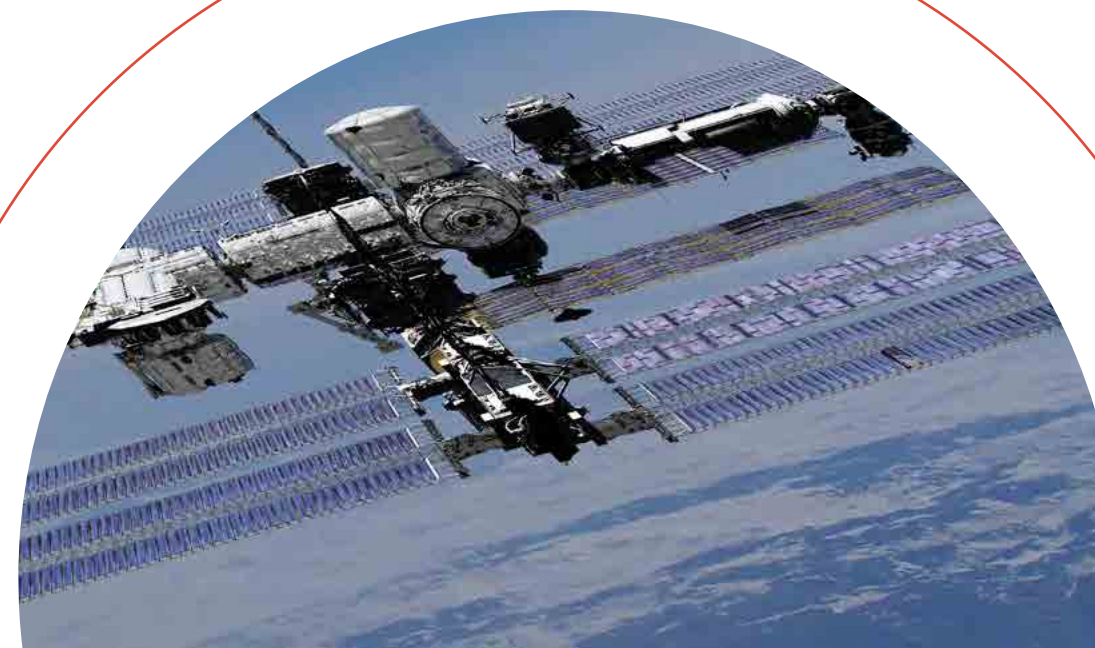
**D'ARMAGNAC S., GERAUDEL M. & SALVETAT D., Knowledge sharing in a coopetition project team: An institutional logics perspective**  
*Strategic Change*, 2019, 28(3), p. 217–227.

**RAPP L., MIRAMONT D. & SANTOS C., High Resolution Satellite Imagery and Potential Identification of Individuals.** P. Soille, S. Loekken, and S. Albani (Eds.) *Proc. of the 2019 conference on Big Data from Space (BiDS'2019), EUR 29660 EN Publications Office of the European Union, Luxembourg, 2019*, p.237-240.

**RAPP L., Space lawmaking.** *Space Review*, 2018

**CAMBRA-FIERRO J., DOS SANTOS PAULINO V. & PÉREZ L., Taking advantage of disruptive innovation through changes in value networks: insights from the space industry**  
*Supply Chain Management: An International Journal*, 2017, 22(2), 97–106. Sélectionné comme « highly commended paper » dans le 2018 Emerald Literati Awards.

**DOS SANTOS PAULINO V., Innovation de rupture et acteurs historiques: le cas de l'industrie des satellites** 2017





01

**PÉREZ L., DOS SANTOS PAULINO, V. & CAMBRA-FIERRO J. (2017)**

Taking advantage of disruptive innovation through changes in value networks: insights from the space industry. *Supply Chain Management: An International Journal*, 22(2), 97–106. <https://doi.org/10.1108/SCM-01-2017>

02

**D'ARMAGNAC S., GERAUDEL M. & SALVETAT D. (2019)**

Knowledge sharing in a coopetition project team: An institutional logics perspective. *Strategic Change*, 28(3), 217–227. <https://doi.org/10.1002/jsc.2263>

03

**GHOBADI H., TESTA P., SPOGLI L., CAFARO M., ALFONSI L., ROMANO V. & BRU R. (2019)**

User-Oriented ICT Cloud Architecture for High-Accuracy GNSS-Based Services. *Sensors*, 19(11), 2635. <https://doi.org/10.3390/s19112635>

04

**SANTOS C. ET RAPP L. (2019)**

"Satellite Imagery, Very High Resolution and Processing, Intensive Image Analysis : Potential Risks under GDPR". *Air and Space Law*, 2019, Vol44, Ussie 3, p.275-295

05

**RAPPL. TOPKA M., MALLOWAN L. (2021)**

Which Jurisdiction for Private In-Space Assembled Autonomous Platforms. *Space Policy* 56 (2021) n°101413

**5 peer-reviewed publications**



# 7 SIRIUS Notes since 2017

1

**“SATELLITE MINIATURIZATION. ARE NEW ENTRANTS ABOUT TO THREATEN EXISTING SPACE INDUSTRY ?”**,  
V.Dos Santos Paulino A. Martin

2

**“WHAT’S HAPS? OVERVIEW OF APPLICABLE BRANCHES OF LAW TO HIGH ALTITUDE PLATFORMS STATIONS”**,  
M.Rhimbassen, L.Rapp

3

**“SPACE INDUSTRIAL WARS”**,  
L.Rapp, N.Carme et R.Durand Carrier

4

**“BUILDING BRIDGES ON GLOBAL GOVERNANCE ISSUES”**, L.Rapp

5

**“REVISITING LIABILITY AND INSURANCE IN THE AGE OF MEGA-CONSTELLATIONS”**,  
C.Santos et M.Rhimbassen

6

**“RESILIENSIS SPATIALIS : CONTRACTING FOR CRITICAL SPACE INFRASTRUCTURES”**,  
M.Rhimbassen

7

**“SPACE LAW MAKING”**,  
L.Rapp et C.Santos

## 1 book

**Dos Santos Paulino, V. (2020). Trajectoires d'innovation dans l'industrie spatiale (Innovation Trends in the Space Industry). London : Wiley-ISTE.**

Available on [www.istegroup.com](http://www.istegroup.com)

Space activities have always been innovative, but their economic aspects have long remained a secondary issue. It was only with the end of the Cold War that the commercialization of space has gained prominence to now reach an unprecedented level.

“Innovation trends in the Space Industry” analyzes the evolution of this industry while studying the reasons for its technological and organizational conservatism. It also provides a framework to analyze the technological threats facing existing space firms.

Through an economic perspective, this book offers a detailed study of the space industry and contributes to broaden the Innovation management field. It takes a closer look to the role of customers in an emerging industry while reinterpreting technological and organizational inertia in high-tech activities and exploring the notion of disruptive innovation.





# 7 PhD thesis defended

Since its creation, the SIRIUS Chair has been accepting doctoral students enrolled in Toulouse University doctoral schools or in cotutelle with other universities and has been financing or co-financing their research work in Law and management of the space industry.

1

IN 2019

3

IN 2018

2

IN 2017

1

IN 2020

## PHD THESIS DEFENDED

**TEISSANDIER M.**, Awards a global and competitive strategy of the European space companies: the role of key players, 2020

**DE POULPIQUET JM.**, L' immatriculation des Satellites, 2019

**GIRMA-VIDAL B.**, Influence of supply chain dependence on corporate efficiency in a multiple actor context: the case of the aerospace industry, 2019

2017  
2020

## ONGOING PHD THESIS

**CARMEN.**, La protection juridique internationale du droit de propriété sur les objets spatiaux

**CLOITRE A.**, Entrepreneurial Dynamics in the Space Ecosystem

**MIRAMONT D.**, Essai sur la nature et le régime des données d'origine spatiale

**CHAZELLE A.**, Minitraité et Gouvernance spatiale

**DURAND-CARRIER R.**, Recherches sur le régime de responsabilité applicable aux dommages causés par les débris accumulés dans l'espace extra-atmosphérique

**RHIMBASSEN M.**, La régulation internationale du marché des activités spatiales

**TESTA P.**, Diffusion of Innovations and Strategic Marketing in the Context of the Space Economy

**VILLAR J.**, La paradiplomatie au service d'une stratégie régionale et sectorielle: Etude de cas du secteur spatial. Etude de cas de la région Occitanie et du secteur spatial



# 52 research papers

During their academic training or as part of their final exam, more and more graduate schools and university students are doing research studies and have to submit research papers to validate their degrees.

15  
IN 2019

13  
IN 2018

8  
IN 2020

16  
IN 2017

2017

Dufour, M., & Galzi, X. (2017). Répartition des connaissances entre donneur d'ordres et sous-traitant dans le secteur spatial. Toulouse Business School - Master 2 - OP Management de l'innovation high-tech - SIRIUS Award, Toulouse

Gargav, A., Kemsaram, N., Jaffri, R. E., Ahmed, S., & Keviv, V. (2017). Influence of Institutional actors on the strategy and performance of Indian Space Companies. Toulouse Business School & Indian Institute of Management Bangalore - Aerospace MBA

Gao, L. (2017). Study on the Convergence Between the Space Industry and the Internet Industry. Toulouse Business School - Aerospace MBA

Sebastian, E., Vittal, G., Chevuru, M. R., Shaik, M. G., & Kurian, T. J. (2017). Nano satellites, what's next? Toulouse Business School - Aerospace MBA

Maley, K. K., Subramanian, P., Mohanty, S., R, T., & Mukherjee, U. (2017). The entry of Google, Apple, Facebook, Amazon, Microsoft (GAFAM) in the Space Sector. Toulouse Business School & Indian Institute of Management Bangalore - Aerospace MBA

Surti, A., Chikkanna, H., Kulkarni, S., Kapoor, S., & Panda, S. (2017). Innovation Strategy for Thales Alenia Space. Toulouse Business School & Indian Institute of Management Bangalore - Aerospace MBA

Keviv, V. (2017). Exploration and exploitation. Toulouse Business School & Indian Institute of Management Bangalore - Aerospace MBA

YANG, L. (2017). Cost consideration and main actors analysis in regard to space debris issue. Toulouse Business School - Master 2: Aerospace Management

Cassin, M., Jean-baptiste, S., & Thine, A. (2017). The environmental regulations : brake or accelerator of innovation in the space sector ? Toulouse Business School - Master 2 – OP Procurement and Supply Chain Management

Blain, C., Van Binst, E. T., Gao, L., Xu, L., & Patil, V. (2017). Is space market ready for LEO deorbiting commercial services? Toulouse Business School - Aerospace MBA

Araujo, G., Dupuy, F., Sachdeva, S., & Tan, J. (2017). Convergence between Internet and space. Toulouse Business School - Aerospace MBA





2019

**Girma-Vidal, B. (2019). Dépendance et pouvoir perçus dans la chaîne de valeur : quels impacts sur la relation et la performance client-fournisseur ? Une étude de cas appliquée aux industries aéronautique, spatiale et de défense.** *SIRIUS Workshop 2019: Research Advances in Management Science and Law Applied to the Space Sector*, 15. Toulouse, France

**Haibo, H. (2019). Airbus space business diagnosis & recommendations.** *Toulouse Business School - Aerospace MBA - Space Business and Applications Track*, 5. Toulouse, France

**Tantatoui El Araki, K. (2019). Should we send Cars to Space ? Should Car Equipment Manufacturer consider new Space Applications ?** *Toulouse Business School - Aerospace MBA - Space Business and Applications Track*, 7. Toulouse, France

**Nugraha, A. B., &Reksoprodjo, A. R. (2019). Study in space sector collaboration.** *Toulouse Business School. Master 2 : Aerospace Management*

**Birouti, E. (2019). Baggage tracer: tracing baggage through GPS and space application support.** *Toulouse Business School - Aerospace MBA - Space Business and Applications Track*, 6. Toulouse, France

**Liu, X. (2019). A Self Reflection for My Company: China Academy of Space Technology (CAST).** *Toulouse Business School - Aerospace MBA - Space Business and Applications Track*, 4. Toulouse, France

**Rueda-Medina, M., & Weber, L. (2019). La motivation des nouveaux entrants : Le cas des GAFAM dans le secteur spatial.** *Toulouse Business School. Master 2 : Management de l'Innovation High-Tech*

**Girma-Vidal, B. (2019). Dépendance et pouvoir perçus dans la chaîne de valeur : quels impacts sur la relation et la performance client-fournisseur ? Une étude de cas appliquée aux industries aéronautique, spatiale et de défense.** *TBS Business School - Toulouse 1 Capitole University*

**Iris, M. (2019). OHB System & New Space.** *Toulouse Business School - Aerospace MBA - Space Business and Applications Track*, 3. Toulouse, France

**JIANG, D., BABU, P., & JADHAV, H. (2020). Kinéis – Market Survey For India.** *Toulouse Business School - Aerospace MBA*



2020

**Teissandier, M. S. (2020). Internationalization of small firms: influence of institutional logics and firms' responses to institutional complexity. Case of subcontracting SMEs in the space industry in France.** *Toulouse Business School & Toulouse 1 Capitole University*

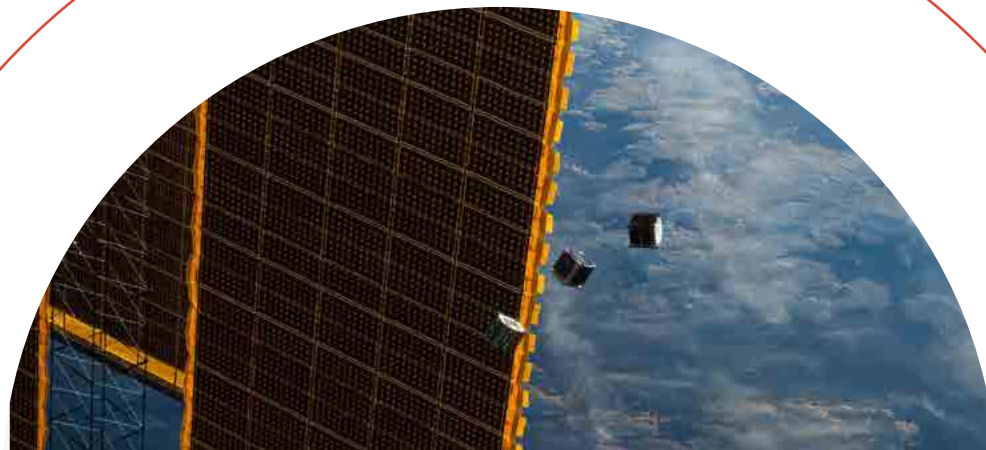
**Amroun, E., & Baret, P. (2020). L'intégration de la Blockchain dans l'industrie spatiale : une perspective managériale.** *Toulouse Business School, Master 2 : Management de l'Innovation High-Tech*

**Conquet, F., & Lor, C. (2020). How space companies can explore the advantages and disadvantages of being first mover or fast follower in their respective markets ?** *Toulouse Business School, Master 2 : Aerospace Management*

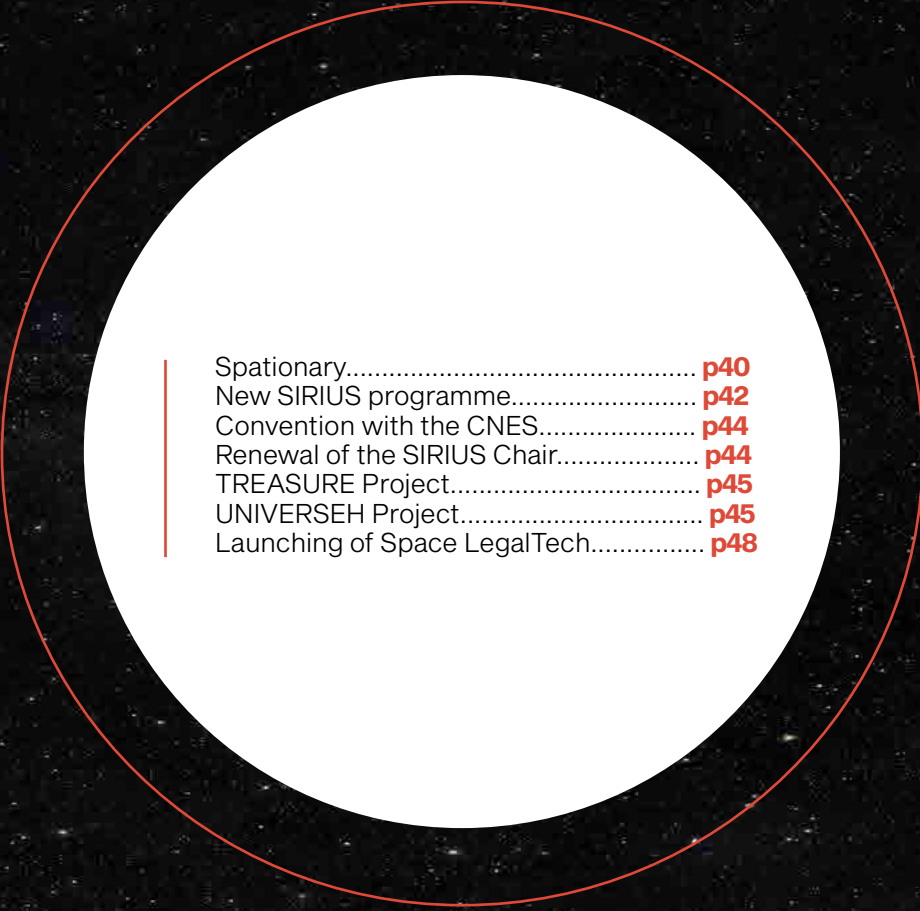
**Hundekar, R., Mehrotra, V., Singh, B., & Singh, P. (2020). Kineis4India Survey – Go To Market Strategy Team.** *Toulouse Business School, Aerospace MBA*

**Quéno, A., &Houdry, R. (2020). Return to the Moon: how to define the lunar business ecosystem?** *Toulouse Business School, Master 2 : Aerospace Management*

**Jusuf, M. S. (2020). Analyzing the Impacts of Blockchain Technology for Supply Chain Management in Space Industry: A Comprehensive Explanation of Case Studies From Major Companies in Space Industry.** *Toulouse Business School, Master 2 : Aerospace Management*







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# 3. Highlights





# Spationary

Due for  
publication  
at the end  
of 2021

**A unique interactive and educational resource containing a list of reference terms and their definitions.**

**D**esigned as a unique, convenient and reliable resource, the Spationary will be made available to international organizations and national governments, to companies in the space sector, practitioners in international firms or legal and financial departments and researchers. This resource will help them in the drafting of international texts, treaties or contracts and guide them to deal with scalable and often difficult-to-access concepts. It provides a complete and up-to-date source of information on the actual terminology and constitutes the basis of a universal vocabulary which integrates both the key commercial developments and the major trends.

## Spationary's aims

- 1** Provide a summary of the legal vocabulary used in various texts governing space activities (treaties, law, regulations, resolutions, customs, contracts, agreements) and in global scientific productions on space activities, which are bound to become very abundant and multidisciplinary;
- 2** Offer an overview and report the emergence of new concepts relating to law and spatial techniques and to find a common ground which goes beyond cultural differences or approaches;
- 3** Allow the development of new commercialization and privatization dynamics in the space sector, by providing a shared language and some universal references;
- 4** Encourage the emergence of new actors with diversified approaches of spatial activities by overcoming the challenges of having various vocabularies and contrasted conceptual reference;
- 5** Provide a pool of words to describe the contemporary dynamism of space activities and find links between the terminology used or the space sector and the one used for terrestrial activities.

“

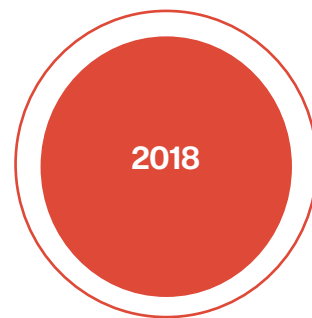
**Undoubtedly, Spationary will quickly be a leading resource for texts or contracts drafting, for international fundings, to define space policies and to facilitate dialogue between experts from different backgrounds.**

**Lucien Rapp,  
Scientific Director  
SIRIUS Chair**





# New SIRIUS Programme in the Aerospace MBA



Space activities are undergoing many changes. New producers and customers are showing up, new technologies are being introduced and an increasing number of countries are considering space as a strategic estate. All these changes form part of what we now call the “New Space” which is offering new opportunities both for new actors and for existing space companies. This specialized course focuses on providing knowledge, tools and techniques to enable participants to take advantage of the developments in Space Affairs and to participate in Space activities.



## Syllabus content

- Fundamentals of Space activities and their applications
- Space history across the World
- Strategic and economic review of Space markets
- New Space activity
- Innovation strategy in the Space sector: the case of Space X and CubeSats
- Emergence of a Space market and analysis of the threat for traditional operators
- Space applications and downstream services
- Principal space activities
- Space partnership: challenges and opportunities
- Defence and acquisition: application to the Space sector
- Overview of international turnkey contracts for telecommunication satellites or Business plan and funding
- Space funding

## Expected learning outcomes

This specialized training course promises challenging opportunities to improve each participant's management skills in the space sector. It delivers an MBA-level specialization enabling experienced executives to shoulder commercial responsibilities in the Main Space and New Space business.

After this training, the participants are expected to have acquired the following skills and competences:

- Understand the Space sector and its complex value chain
- Develop Innovation strategies
- Produce a Dynamic Market Analysis
- Engage in Space partnerships
- Participate in international turnkey contracts







# Conventions & fundings



## Agreement with the CNES



During the 53rd edition of the Paris Air Show, on the 21st of June 2019, Professor Lucien Rapp, Scientific Director of the SIRIUS Chair, signed an agreement with Mr. Jean-Yves Le Gall, President of the National Center for Space Studies (CNES). They defined the principle and the framework of a cooperation, pertaining to research and training, between the SIRIUS Chair and the CNES, in the field of ethics and compliance in space activities.

## Renewal of the SIRIUS Chair

In 2018, on June 27, during the Toulouse Space Show, the SIRIUS Chair renewed its agreement with the main stakeholders of the space sector namely Airbus, CNES and Thales Alenia Space. As we reach halfway through our agreement period, this activity report is very timely to showcase the work accomplished.



## TREASURE Project

The aim of the TREASURE project (Training, REsearch and Applications network to Support the Ultimate Real time high accuracy EGNSS solution) is to provide a specialized training course to 13 PhD students in European GNSS (Global Navigation Satellite System). The project focuses on developing a multidisciplinary research to maximize the promotion and exploitation of the GNSS technology. This innovative multidisciplinary training promotes the global positioning of Galileo, the European GNSS (EGNSS). The researchers of the SIRIUS Chair are supervising a doctoral student in the field of strategy and marketing in collaboration with the Toulouse-based SME NOVELTIS. Funded by the European Commission's Horizon 2020 programme, the TREASURE Project will run from September 2017 to December 2020.

## UNIVERSEH Project

The European Space University of Earth and Humanity project (UNIVERSEH) seeks to provide the European Union with a leading university in the Space sector by combining the expertise of several renowned stakeholders of aerospace training. The purpose is to align higher education and research competencies with future labour market needs in order to boost employment, the industry and build a sustainable space sector.



## 1. Gathering experts from Space training and education

To create this unique European university, the UNIVERSEH project brings together the Toulouse Federal University (France), the University of Luxembourg (Luxembourg), the Heinrich-Heine-Universität Düsseldorf (Germany), the Luleå Tekniska Universitet (Sweden) and the Akademia Górniczo-Hutnicza im. Stanisława Staszica Krakowie (Poland).



The project is coordinated by the Federal University of Toulouse with the cooperation of 5 local partners, recognized for their specific know-how and their academic excellence in the Space sector namely the University of Toulouse Jean Jaures, the Paul Sabatier Toulouse III University, Toulouse -INP, ISAE-Supaero and TBS/SIRIUS Chair. These partners are training flagships of the European Aerospace Capital.

## 2. Addressing all aspects of Space careers

The UNIVERSEH project's purpose is to train future employees, collaborators and entrepreneurs of the European Space sector through the combination of science, engineering, economics, social sciences and humanities, patents and innovation, entrepreneurship, science & medicine, art & culture...in order to cover all facets of this rapidly evolving sector.



## 3. Innovative teaching approaches

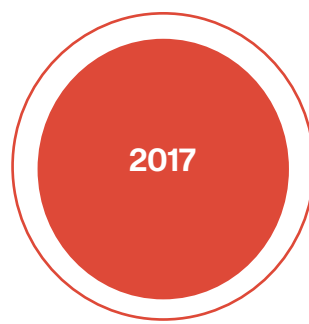
The UNIVERSEH project will also be about developing innovative teaching approaches and a common European culture through the sharing of skills and best practices and the promotion of multilingualism.

## 4. Erasmus exchange programmes

With the support of Erasmus+, the UNIVERSEH project also has a substantial European and international dimension, allowing the wide movement of students between different universities in France, Luxembourg, Germany, Sweden and Poland.



# Launching of Space Legaltech



Created by the SIRIUS Chair and launched in 2017, **SPACE LEGALTECH** is the first global legal database dedicated to Space law. It provides access to all Spac law and regulations around the world through an interactive map containing law, decrees, ordinances, permits, launches, registrations, control of space objects and security, etc.



## Over 100 countries and 250 legal texts

With nearly 100 countries represented, 250 legal texts referenced and 7 major space agencies studied, **SPACE LEGALTECH** is a practical tool for the legal community interested in a close follow up of developments and trends in space activity on a global level.

## An enriched database

The Space Legaltech is actually being reshaped in collaboration with PwC. The database will most probably be broadened with additional texts to facilitate queries.

**Space LegalTech is undergoing deep changes and an expansion of its scope is planned to add many other useful texts. The addition of more algorithms will allow more precise queries and its whole ergonomics will be upgraded for more efficiency. All this will be done in collaboration with the Space department of PwC, one of the world's leading audit and consulting firms.**

**Lucien Rapp,  
Scientific Director  
SIRIUS Chair**



# 4. Dissemination

4 Sirius Talks.....	<b>p52</b>
14 conferences in Toulouse.....	<b>p53</b>
15 conferences in Europe & USA.....	<b>p56</b>
6 major international meetings .....	<b>p59</b>
1 Morning dedicated to research.....	<b>p62</b>
4 SIRIUS prizes awarded.....	<b>p63</b>
Press review.....	<b>p64</b>





## 4 SIRIUS Talks

The SIRIUS Talks were launched in 2009, under the aegis of the Midi-Pyrénées Region, the Toulouse Capitole University and the National Centre for Space Studies (CNES). They are an annual opportunity to bring together national and international representatives from the industrial and academic communities to discuss the actual concerns of the space sector. These talks include presentations from a dozen scientific experts or renowned practitioners. They provide, during a whole day, a place for debates, dialogues, information sharing or meetings, between experts from the scientific and industrial communities.



- **3 DECEMBER 2020 :**  
« PACKMAN SPACE GAMES : IF THE WAY OF US SPACE DEATH FLOW TO CROSS OVER THE OCEAN ? »
- **15 OCTOBER 2019 :**  
« MOVING FAST ? IMPLICATION OF SPACE BUSINESS ACCELERATION »
- **23 OCTOBER 2018 :**  
« SPACE ECONOMY : URGENT NEED FOR NEW GLOBAL REGULATION ? »
- **12 OCTOBER 2017 :**  
« RISQUES ÉMERGENTS ET OPPORTUNITÉS NAISSANTES DANS LE SECTEUR SPATIAL »

## 14 conferences in Toulouse

Located in Toulouse, in the heart of the European Space Capital, the SIRIUS Chair regularly shares its latest work and studies with various professionals and experts from the Occitanie region.

**4**  
IN 2019

**1**  
IN 2018

**9**  
IN 2017



2019

**GIRMA-VIDAL B., DÉPENDANCE ET POUVOIR PERÇUS DANS LA CHAÎNE DE VALEUR : QUELS SUR LA RELATION ET LA PERFORMANCE CLIENT-FOURNISSEUR ?**

Une étude de cas appliquée aux industries aéronautique, spatiale et de défense. SIRIUS Workshop 2019: Research Advances in Management Science and Law Applied to the Space Sector, Toulouse, France, 15 october 2019.

**DOS SANTOS PAULINO V., EMERGENCE OF HIGH TECHNOLOGY MARKETS: THE CASE OF SPACE BUSINESS.** 2d Treasure Workshop 21-22 May 2019,

**DOS SANTOS PAULINO V. & JANSOU E., BRAINSTORMING SESSION ON BUSINESS MODELS FOR GNSS.** 2nd TREASURE Workshop: Scientific Board Meeting, Toulouse, France, 22 May 2019.

**TESTA P., MARKET INTRODUCTION OF THE TREASURE CONCEPTUAL PROTOTYPE.** 2nd TREASURE Workshop: A Response to User Needs in PPP and RTK, Toulouse, France, 22 May 2019.



2017-2018

**DOS SANTOS PAULINO, V., BARBAROUX, P., THE INFLUENCE OF CUSTOMERS ON THE CONSTRUCTION OF THE SPACE INDUSTRY.** SIRIUS Talks, Toulouse, France, October 2018.

**DOS SANTOS PAULINO V. & RAPP L., L'INDUSTRIE SPATIALE ENTRE DEUX ÉPOQUES ?.** In Les Matinales de la Recherche – Toulouse Business School & SIRIUS Chair (p. 25). Toulouse, France, 2017

**DOS SANTOS PAULINO V., GENTILUCCI E. & LACOSTE, D., HOW TO “DISRUPT” THE “DISRUPTORS”? STRATEGIC INTENTS OF INCUMBENTS AFTER THE INTRODUCTION OF RADICAL INNOVATIONS: THE CASE OF “LOW COST” SATELLITES AND LAUNCHERS.** In SIRIUS Workshop, Toulouse, France, 2017, 13 p.

**GIRMA-VIDAL B., DONNEURS D'ORDRE ET SOUS-TRAITANTS SONT-ILS RÉELLEMENT SOLIDAIRES ?.** In Ateliers SIRIUS 8. Toulouse, France, 2017.

**DOS SANTOS PAULINO V., LES PETITS SATELLITES : UN NOUVEAU DÉFI POUR L'INDUSTRIE SPATIALE ? APPROCHE : MANAGEMENT STRATÉGIQUE.** Parole d'Expert – Thales Alenia Space, Toulouse, France, 2017.

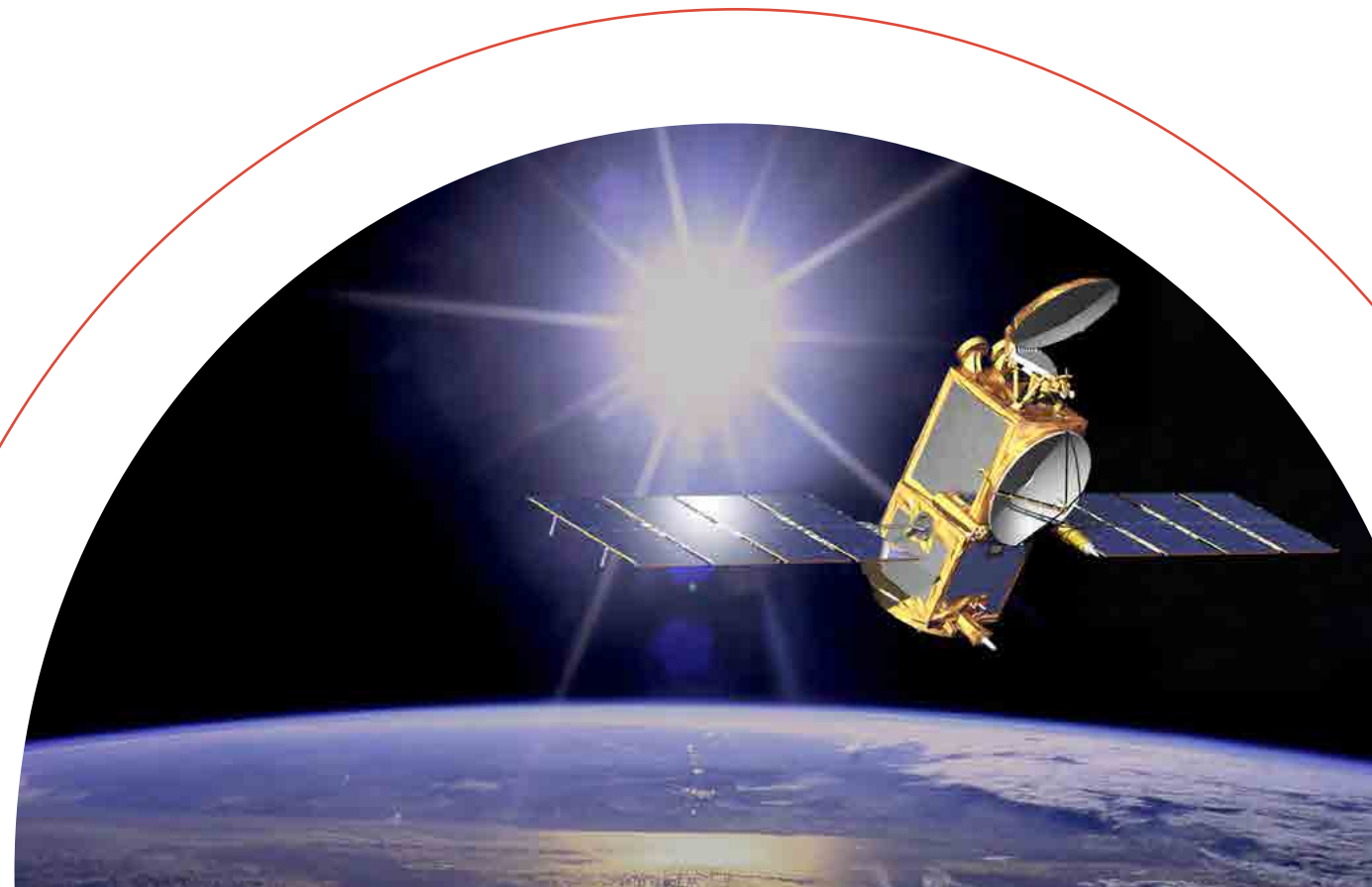
**DUFOUR M. & GALZI X., RÉPARTITION DES CONNAISSANCES ENTRE DONNEUR D'ORDRES ET SOUS-TRAITANT DANS LE SECTEUR SPATIAL. TOULOUSE BUSINESS SCHOOL – MASTER 2 – OP MANAGEMENT EN ENVIRONNEMENT HIGH-TECH – SIRIUS Prize, Toulouse, France, 2017.**

**AL ARISS A., N'CHO J. & D'ARMAGNAC S., POINT D'AVANCEMENT: MANAGEMENT DES TALENTS & INDUSTRIES CYCLIQUES.** SIRIUS Chair Internal Seminar, Toulouse, France, 2017.

**GENTILUCCI E., DOS SANTOS PAULINO V., & LACOSTE V., INTENTIONS STRATÉGIQUES DES FIRMES EN PLACE SUITE À L'INTRODUCTION D'INNOVATIONS RADICALES : LE CAS DU SECTEUR SPATIAL.** SIRIUS Chair Internal Seminar, Toulouse, France, 2017.

**ROZANOVA O., SOME THOUGHTS ON THE NEED OF SPACE DEBRIS REMOVAL.** SIRIUS Chair Internal Seminar, Toulouse, France, 2017.

**GIRMA-VIDAL B., LA DÉPENDANCE AUPRÈS DES FOURNISSEURS : QUEL IMPACT SUR LA PERFORMANCE ?** Étude de cas dans l'aéronautique, le spatial et la défense. In SIRIUS Chair Internal Seminar, Toulouse, France: SIRIUS Chair, 2017, 21 p.





# 15 conferences in USA & Europe

The SIRIUS Chair ensures knowledge sharing by giving global access to its research and knowledge. Besides its scientific productions and editorial activities, the Chair has an active role in the international public and scientific discussion through conferences and contributions to public debates.

9

IN 2019

5

IN 2018

1

IN 2017

2019

**RAPP L., LUCAS-RHIMBASSEN M., SANTOS C., MEGA CONSTELLATIONS – LIABILITY AND INSURANCE ISSUES.** 70th IAC Conference, Washington, D.C., USA, 21-25 October 2019

**RAPP L., LUCAS-RHIMBASSEN M., SANTOS C., BREAKING THE GOLDEN CHAIN OF TRANSPARENCY: CROSSLINKS BETWEEN CYBER THREAT AND BLOCKCHAIN WITHIN SPACE AND GOLD INDUSTRIES.** 70th IAC Conference, Washington, D.C., USA, 21-25 October 2019

**RAPP L., LUCAS-RHIMBASSEN M. & SANTOS C., BLOCKCHAIN GOLDEN RUSH.** 70th IAC Conference, Washington, D.C., USA, 21-25 October 2019

**RAPP L., LONG G. & SANTOS C., SPECIAL SESSION ON SPACE AND ARTIFICIAL INTELLIGENCE.** 70th IAC Conference, Washington, D.C., USA, 21-25 October 2019

**ALARY D. & RAPP L., WHAT IF ....** 70th IAC Conference, Washington, D.C., USA, 21-25 October 2019

**ALARY D., SPACE TRAFFIC MANAGEMENT: TOP-DOWN OR BOTTOM-UP?.** Summit for Space Sustainability, Washington, D.C., USA, 25 June 2019

**RAPP L. & SANTOS C., NUDGING SPACE – POSSIBLE GOVERNANCE FOR SPACE SAFETY.** IAASS Conference “Making Safety Happen”, Los Angeles, USA, 15-17 June 2019





**GHOBADI, H. ET AL., AN ADAPTATIVE ICT SOLUTION TO SUPPORT GNSS MARKET APPLICATIONS.** *American Geophysical Union Fall Meeting, San Francisco, USA*

**RAPP L., BEYOND THE CRADDLE'19. MIT,** *Harvard and Sloan Business School, Boston, USA, 13-15 March 2019*

## 2018-2017

**ALARY D., CLERC P., MORANTA S. & RAPP L., TOWARD AN INTERNATIONAL ORGANIZATION TO HANDLE A SUSTAINABLE SPACE TRAFFIC MANAGEMENT**

*A functional approach of ICSO. IAC-18-E3.4.10, Bremen, October. 2018*

**DOS SANTOS PAULINO V., INNOVATORS HINDER THE TECHNOLOGY ADOPTION BY EARLY ADOPTERS: THE CASE OF SPACE INDUSTRY.**

*In Forum Innovation 8, Nîmes, 2018, 30 p.*

**BOUTARY M. & TEISSANDIER M., INTERNATIONALIZATION OF SUBCONTRACTING SMES: HOW DO THEY LEARN? THE CASE OF SPACE INDUSTRY IN FRANCE.**

*In The 22nd Mc Gill Conference on International Entrepreneurship, Halmstad, 2018, 14 p. /documents/f7f550-teissandier-boutary-2018-internationalization-of-subcontracting-smes-how-do-they-learn-the-case-of-space-industry-in-france-presentation.pdf*

**DOS SANTOS PAULINO V., INNOVATORS HINDER THE TECHNOLOGY ADOPTION BY EARLY ADOPTERS: THE CASE OF SPACE INDUSTRY.**

*Presented at the 3rd Abbé Grégoire Innovation Days, Paris, France, 2018*

**TESTA P, HOW A PERMANENT LINK BETWEEN INDUSTRY AND SCIENTIFIC COMMUNITY CAN ENHANCE INNOVATION: THE CASE OF GNSS DOWNSTREAM MARKETS.**

*Presented at the 3rd Abbé Grégoire Innovation Days, Paris, France, 2018*

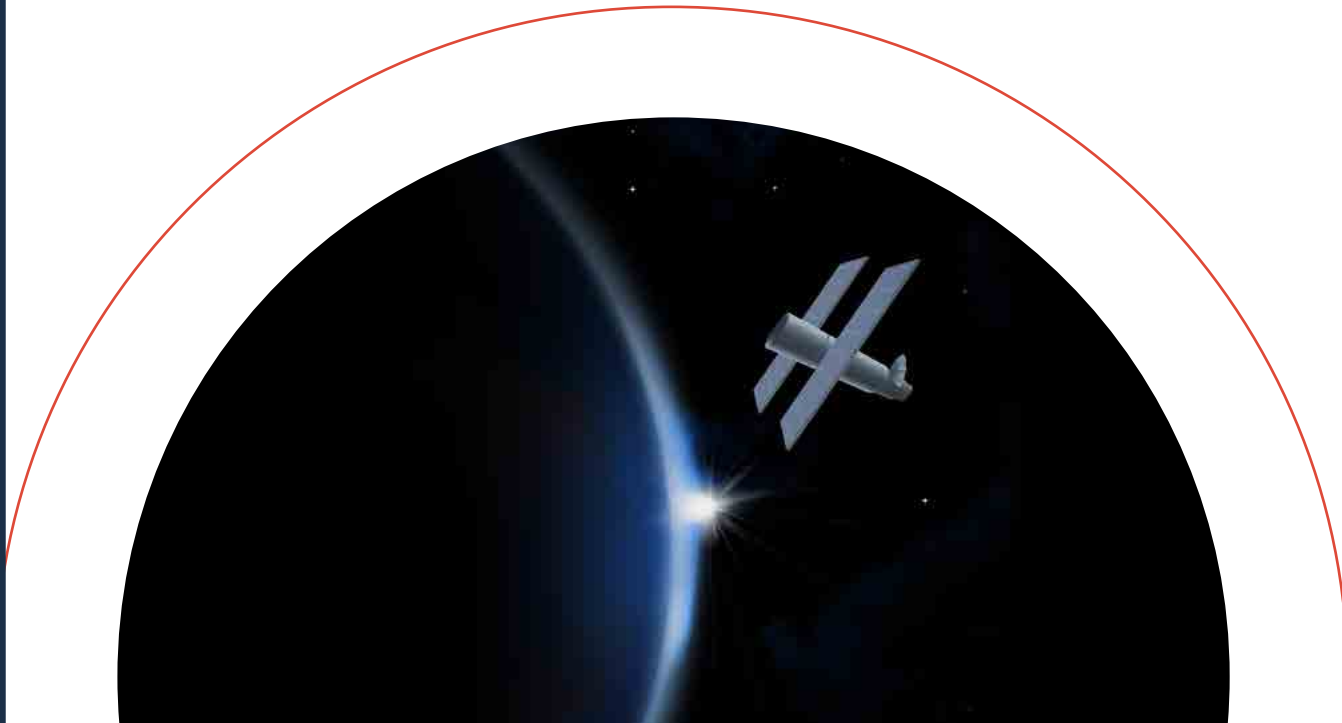
**MULLER C., ROZANOVA O., & URDANOZ M., ECONOMIC VALUATION OF DEBRIS REMOVAL.**

*In IAC – 68th International Astronautical Congress (IAC). Adelaide, Australia, 2017*



## 6 major international meetings

The outreach of the SIRIUS Chair's research activities is achieved through its participation in major international events (colloquia, conferences, public events). This represent a real opportunity for our researchers and PhD students to present their work and compare their research findings with other researchers or international experts. From 2017 to 2020, the SIRIUS Chair has participated in several major international events namely: International Astronautical Congress IAC, Toulouse Space Show, Le Bourget Paris Air Show, IAAC/IISL, IBA/Space Committee, International Forum on Innovative Trends in Space, and Manfred Lachs International conferences in Montréal which the SIRIUS Chair coorganizes since 2015 along with the Institute of Air and Space Law of McGill University.





# Knowledge across the globe

# 41

PAPERS &  
CONFERENCES  
WORLDWIDE

## EUROPE

10 in 2019  
6 in 2018  
16 in 2017

## USA

9 in 2019

## OCEANIA

1 in 2017

ADELAIDE

- SAN FRANCISCO
- LOS ANGELES
- WASHINGTON DC.
- BOSTON
- BELFAST
- LUXEMBOURG
- PARIS
- TOULOUSE
- LISBONNE
- MADRID
- NIMES
- HALMSTAD
- BREMEN



10 November  
2017

"A new boost for the  
space industry?"

## 1 morning session dedicated to research

The Toulouse Business School has been organizing Morning sessions dedicated to research with the aim of sharing the latest findings in economics and management with the public and economic stakeholders. The 4th edition was held on September 21, 2017.

During this event, the SIRIUS Chair compared the evolution of the space sector "between two eras", and explored the flourishing prospects awaiting operators as well as the possible threats to this sector. During this morning session, Victor Dos Santos Paulino and Lucien Rapp made an overview of the outlooks offered by the Space sector and this was followed by a discussion with 3 experts and partners namely: Murielle Lafaye, Space foresight and socio-economic impacts assessment expert from the CNES; Cédric Balty, Director of innovation at Thales Alenia Space and Thierry Duhamel, R&D and Foresight Manager at

Airbus. It was pointed out that the global battle for these markets is already well underway: the USA already have a clear position on the entire range of space-related activities. With a competitive and reactive offer, China is also a serious contender for these markets. All the experts have highlighted that the new stakeholders of the space sector, particularly those coming from the digital economy, are striving to have leading positions but they inevitably turn to experienced stakeholders for a competitive and large-scale production of satellites.

## 4 SIRIUS Prizes awarded

Each year, the SIRIUS Chair awards the SIRIUS Prizes in recognition for outstanding research work. The purpose of these awards is to raise awareness among Master students about the importance of research in social sciences, particularly in law, economics and management applied to the Space industry. Prizes worth 1000€ are awarded each year.



2020

**1st Prize: Conquet, F., & Lor, C.**

"How space companies can explore the advantages and disadvantages of being first mover or fast follower in their respective markets?"

**1st Prize ex-equ: Quéno, A., & Houdry, R.**

"Return to the Moon: how to define the lunar business ecosystem?"



2018

**1st Prize : Remisko, R., & Zielonka, A.**

"Développement durable et théorie des parties prenantes : le cas des partenariats public-privé comme solution à l'élimination des débris spatiaux"

**2nd Prize : Quintana, S., & Serinet, L.**

"Pourquoi l'application de la réflexion sur le cycle de vie et des principes généraux de durabilité est essentielle pour l'industrie spatiale"



2019

**1st Prize: Rueda-Medina, M., & Weber, L.**

«La motivation des nouveaux entrants : Le cas des GAFAM dans le secteur spatial.»

**2nd Prize: Le Huy, N-H. & Chng, W.**

«Ambidextérité organisationnelle : comment les entreprises spatiales peuvent équilibrer l'exploitation et l'exploration pour être compétitives dans le domaine du lancement.»



2017

**1st Prize : Ruffiot, M., & Baudet, L.** « Active debris removal: From the main barriers to the definition of a business model".

**2nd Prize : Dufour, M. & Galzi, X.**

«Répartition des connaissances entre donneur d'ordres et sous-traitant dans le secteur spatial.»



# Press review

«Space industry's outlooks after Covid-19 ?»

Lucien Rapp,  
The Conversation, 26 août 2020



« Innovation in the Space sector: from NASA to Jeff Bezos. »

Victor Dos Santos Paulino,  
Alternatives économiques,  
13/12/2019

« 50 years of man on the Moon : Can we really afford the Moon? »

Lucien Rapp,  
20 minutes, 21/07/2019



« Toulouse, next New Space Capital ? »

Lucien Rapp,  
La Tribune Toulouse,  
20/06/2018

«Space: «We have already been in the exploitation phase since a few years »

Lucien Rapp,  
TV5 Monde, 22/08/2020

«Economy and war, 3rd episode: Defence for Innovation»,

Victor Dos Santos Paulino,  
France Culture, 13/12/2017

« The Space Economy: Episode 2: Toward Industry and Beyond,

Victor Dos Santos Paulino,  
France Culture, 24/04/2018





# Outlooks for 2024

## 04

### Develop our scientific dissemination policy

- SIRIUS workshops/Space Talks (IOS)
- Conferences in cooperation with La Cité de l'Espace and Aerospace Valley.
- Books (Annual themed books, e-books)

## 03

### Enrich our training programme

- Creation of a MOOC in Space Business and Law
- Creation of a Summer School

## 01

### Enhance our international visibility

- International scientific community (papers, publications)
- International institutions (COPUOS, SpaceLegalTech)
- International expertise centers (ex. IAASS)
- Companies from this sector

## 02

### Broaden our network of competencies

- Continue the international development of the SIRIUS Chair through research and training partnerships.
- Strengthen the relationships with other Space and non-space organisations. (ESA, ESPI, ARNT)
- In Europe : Barcelona/Madrid, Cologne,- Munich, Rome, Leiden, Liege, Lauzanne
- In North America: Canada, USA
- In Asia-Pacific : Australia, Japan, China, Vietnam, Singapore







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Printing services : Graphic Pyrénées  
Pictures : Adobe Stock, Airbus, CNES