

# Questel

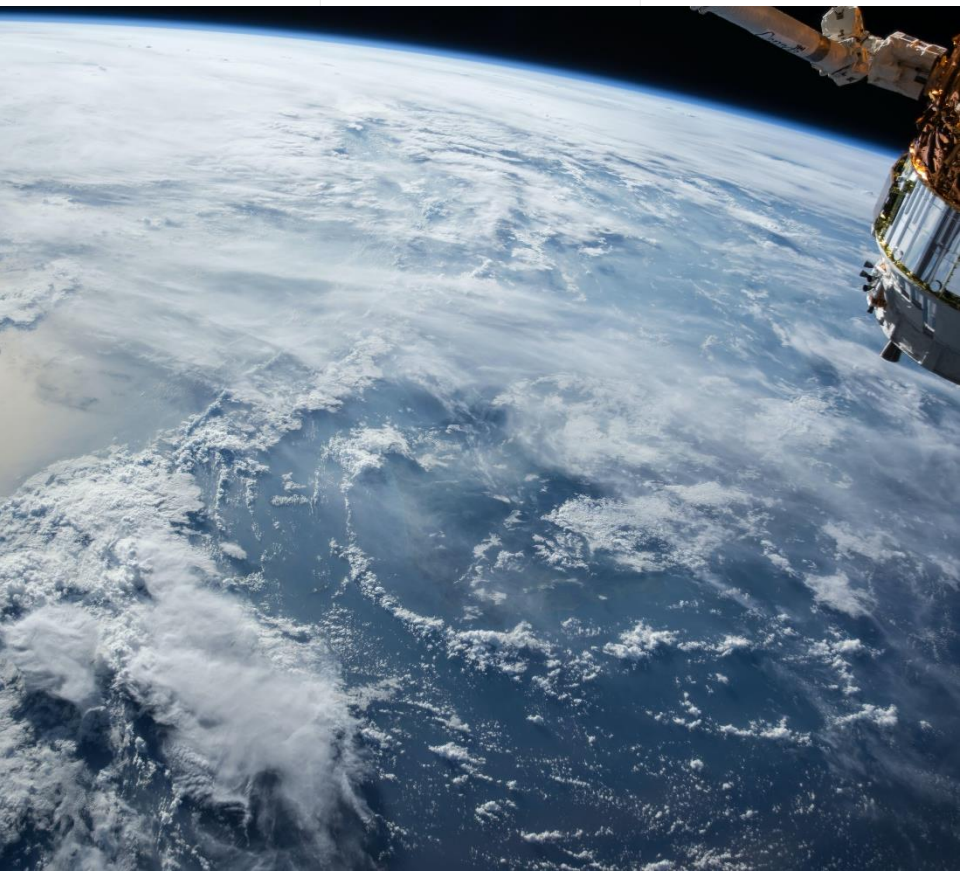
## AEROSPACE

### Patent Trends for Academics and Research Organizations

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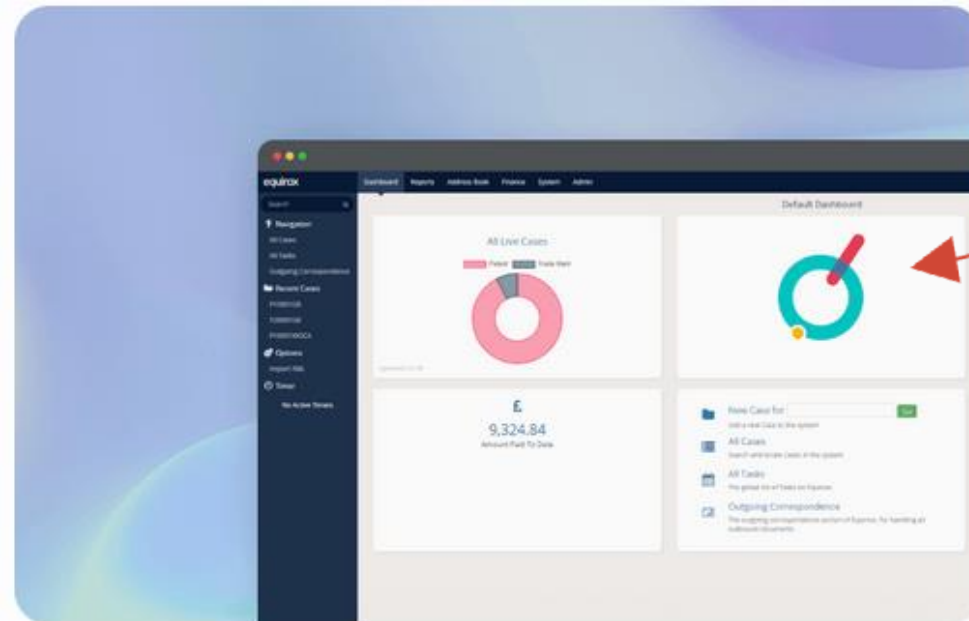
# Aerospace, Innovation Trends and Patents



- Questel updates & Introduction
- Global trends
- Technologies & applications
- Inventions strength and impact
- Technology focus trends
- Conclusion

# Integrating third-party solutions – Directly or API

Equinox can be **fully connected** to commonly used data configuration and management systems, either through direct connectors, which enable work performed in these platforms to be directly saved in Equinox, or through **advanced and flexible APIs**.



# Real-time dashboards

Centralize all your new markets and opportunities in one place



## Web application

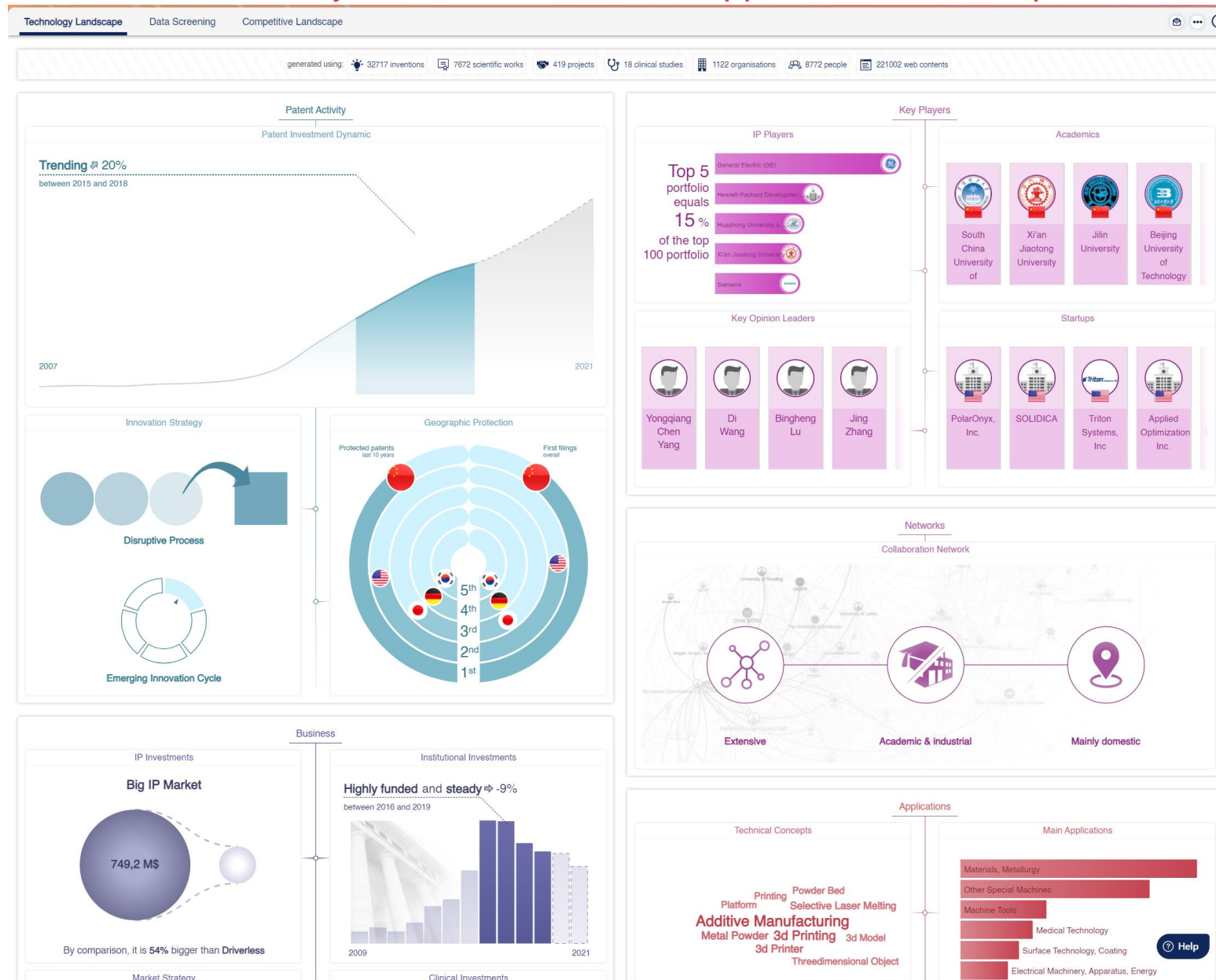
- Use case dashboards
- Sourcing
- Trends



## Exports

- PNG, Excel, PDF
- Do your own analysis

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## Newsletter

- Personalized newsfeed
- Competitive watch



## API

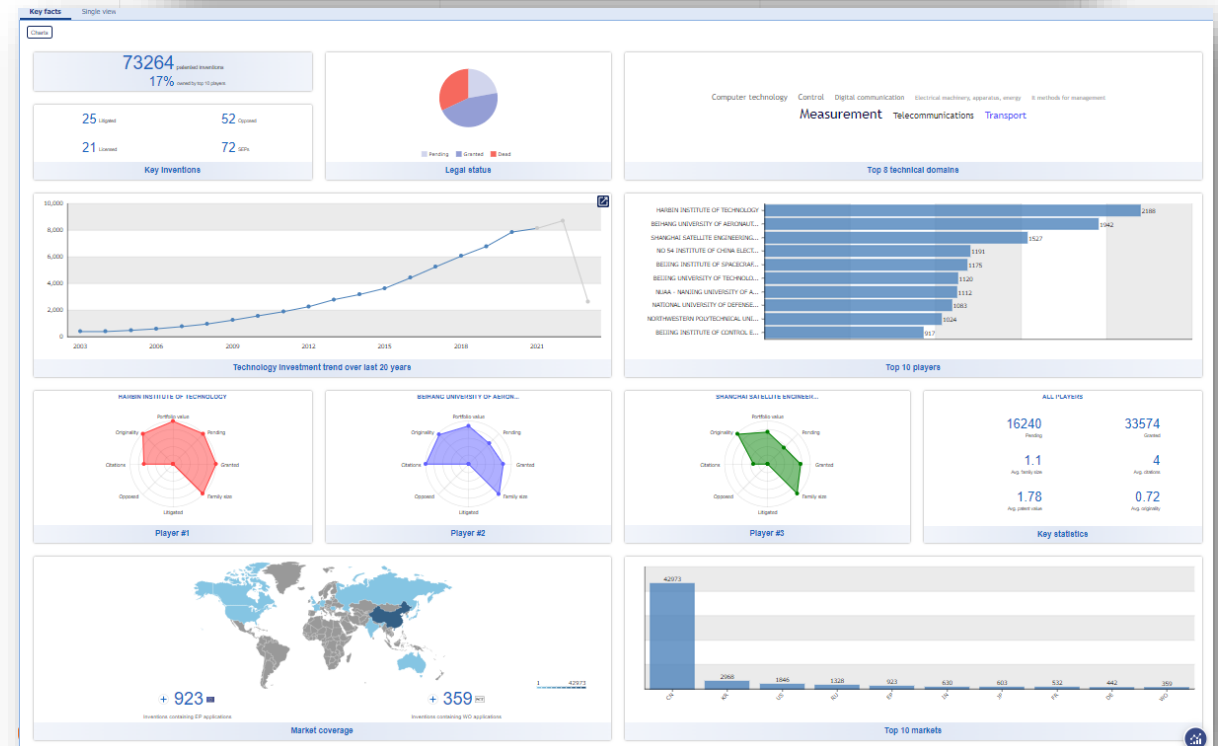
- KMS integration
- Questel's software (Partnering, Capture...)

# Introduction

**Aerospace** has been at the heart of a fierce competition as to gain **world supremacy** between many countries. The contribution of **academics and research organizations** have been playing a major role in the advancement and the development of the field.

What are patents' dynamics in the academic and research organizations environment revealing about R&D and the latest trends in innovation for this crucial technological field ?

Patent family searches (FamPat)				
Search Step	Result(s)	Query	Assistant	Source
3	73264	( 1 OR 2) AND (UNIVERSIT+ OR INSTITUT+ OR ACADEM+ OR AGENC+ OR ADMINISTRAT+ OR PROGRAM OR PROJECT OR COLLEGE OR FOUNDATION OR CENTER OR CENTRE OR ORGANIZATION OR COUNCIL OR ISTITUTO OR AGENZIA OR AMMINISTRAZIONE OR FONDAZIONE OR CENTRO OR ORGANIZZAZIONE OR CONSIGLIO)/PA/NPA/OPA	Search history	FAMPAT
2	152702	(B64G+ OR H04B-007/185+ OR H04W-084/06 OR G01S-019/+ )/IPC/CPC	Search history	FAMPAT
1	198598	((AERO_SPACE OR SPACE_SHIP? OR SPACE_CRAFT? OR SPACE_PLANE? OR SPACE_FLIGHT? OR AIR_SHIP? OR ((AIRCRAFT? OR SHIP? OR VEHICLE? SHUTTLE? OR STATION? OR TETHER? OR ELEVATOR? OR LAUNCH+ ) 3D SPACE) OR ASTRONAUT? OR (SATELLITE? P (GEO_STATIONARY OR LEO OR MEO OR GEO OR NETWORK? OR CONSTELLATION? OR ORBIT OR LAUNCH+ OR ALTITUDE? OR TELECOMMUNICATION? OR COMMUNICATION? OR RECEIVER OR SENDER OR SENDING OR TRANSCEIVER OR TRANSMITTER OR ANTENNA OR RADIO OR CHANNEL OR SIGNAL? OR BROADCAST+ OR NAVIGATION?)))//TI/AB/ICLM	Advanced search	FAMPAT





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## Global trends

Investment trend, geographical areas and top players

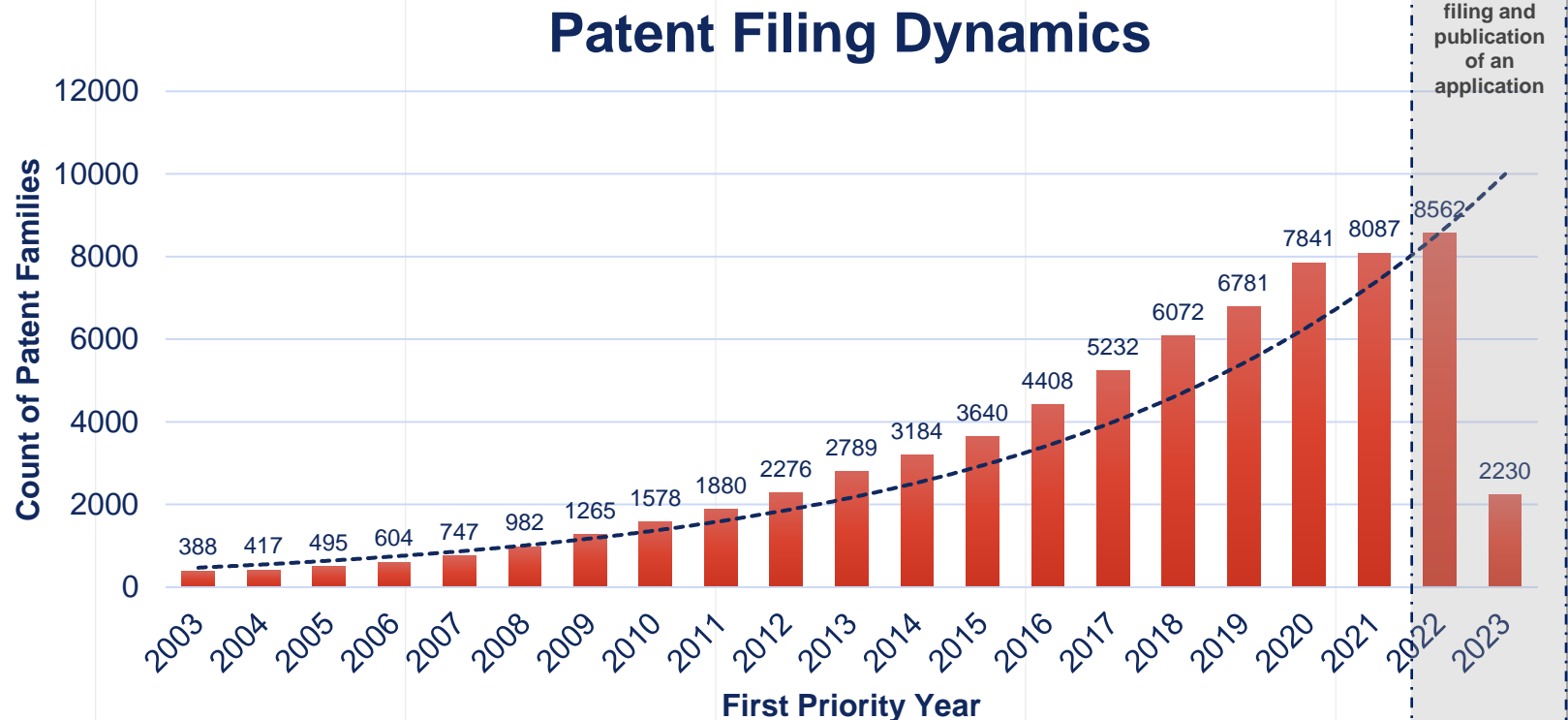


## Technology investment trend over last 20 years

The patent filing dynamic in aerospace for academics and research organizations is high and follows an Exponential Growth Curve.

Despite the 18-month delay between priority filing and publication of an application, 2022 number of patents is the highest and is therefore subject to increase once the above-mentioned delay expires, which reflects an increasing innovation's interest in this field.

A compound annual growth rate (CAGR) of ~13% was registered from 2016 to 2021, a growth forecasted to keep increasing.



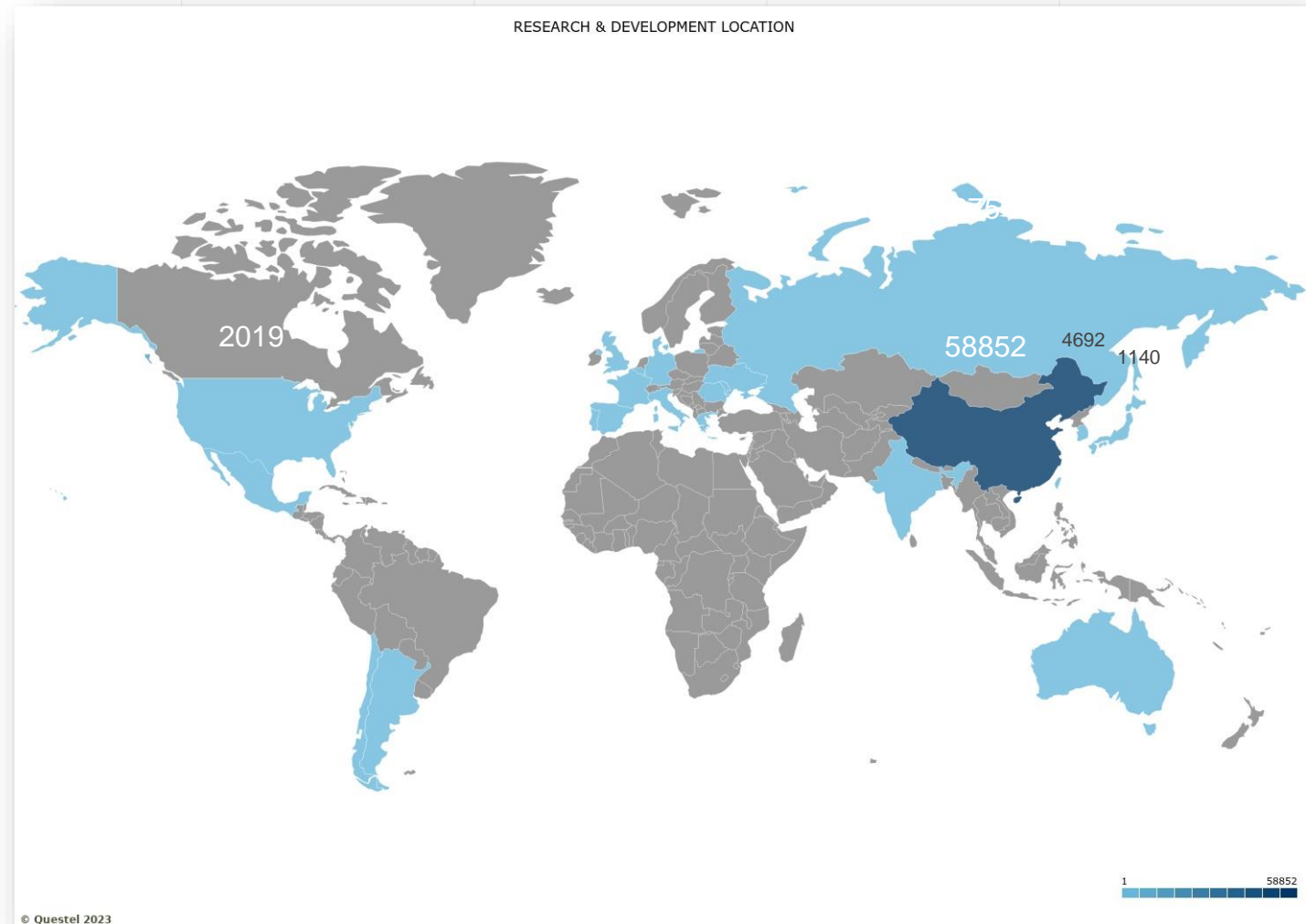
## R&D geographical areas

The Chinese domination of R&D market is remarkable with 81% of the total number of inventions. This trend is different than most of other technical domains where Chinese presence usually count for around 50%. The same high involvement was seen in Deep Learning where 77% of DL related patent applications worldwide (2011-2021) originated from China.

The South Korean holds the second place in terms of patent applications with a share of 6% of the total number of patents.

Russian presence among the top innovation countries with the third place and a 4% share is also uncommon, however not strange due to this country high involvement and investment in the aerospace field.

The American holds the 4<sup>th</sup> place followed by Japan with 3% and 2% respectively.





## Extension and market protection strategies

It is not surprising to see that main patents' publication geographical areas are limited to the same R&D country in this strategic technical domain.

Indeed, most of the Chinese patent applications are only published in China, with some minor PCT applications (WIPO) and small number of extensions to the USA.

Countries displaying the highest extension strategies as to others are the USA and France



Publication country	CN	KR	RU	US	JP	FR	IN	TW	UA	SU
CN	58821	87	14	109	38	63	6	23		
KR	29	4540	8	65	21	24	4	1		1
US	406	729	18	1933	176	371	25	81	2	2
RU	22	1	2751	18	12	50	5		2	45
WO	581	303	35	525	124	251	32		3	5
JP	68	95	7	172	1135	180	6	8		5
EP	104	105	19	240	95	374	13	8	1	6
FR	3	11		53	10	666				1
IN	18	7	4	41	11	26	544			
CA	14	6	10	191	25	150	2			
DE	12	13	7	95	34	143		1	1	4
AU	38	15	5	164	19	26	5	2	1	1
TW	8	1		17	13	4		314		
UA	1		1		1				301	
ES		1	4	18	4	129	1			1
SU						2				242
GB	24	5		65	7	9	1			
AT		4	2	30	2	72				2
BR	5	2	5	43	6	25				
IT				13	1					1
	CN	KR	RU	US	JP	FR	IN	TW	UA	SU

1st priority country

# Investment dynamics of top players over the last 10 years

Among the top 20 players, only three are not Chinese (2 South Korean and 1 American) 2022 numbers may not be final due to the 18-month delay, however there are some exceptions to the 18-month rule and patents may be published earlier. This fact may explain the difference in number of patents between China and the other 2 countries as players may be adopting early publication strategies.

Investment trend for key players

Assignees	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
HARBIN INSTITUTE OF TECHNOLOGY	80	152	172	105	109	208	177	160	214	312	100
BEIHANG UNIVERSITY OF AERONAUTICS & ASTRONAUTICS	65	85	89	117	127	166	143	156	193	186	72
SHANGHAI SATELLITE ENGINEERING INSTITUTE	77	84	104	155	161	164	185	171	149	151	11
NO 54 INSTITUTE OF CHINA ELECTRONICS SCIENCE & TEC...	22	43	51	60	67	84	90	105	242	212	89
BEIJING INSTITUTE OF SPACECRAFT SYSTEM ENGINEERING	76	45	70	91	115	82	102	181	161	147	7
BEIJING UNIVERSITY OF TECHNOLOGY	33	39	58	53	63	86	132	117	162	177	68
NUAA - NANJING UNIVERSITY OF AERONAUTICS & ASTRONA...	44	52	38	75	99	102	132	115	122	170	44
NATIONAL UNIVERSITY OF DEFENSE TECHNOLOGY	35	40	79	84	73	77	81	136	164	173	51
NORTHWESTERN POLYTECHNICAL UNIVERSITY	43	43	42	84	103	107	96	111	112	161	47
BEIJING INSTITUTE OF CONTROL ENGINEERING	62	68	46	45	38	75	86	110	122	90	50
CHINA ACADEMY OF SPACE TECHNOLOGY	37	51	50	64	44	90	93	91	119	191	13
KARI-KOREA AEROSPACE RESEARCH INSTITUTE	69	38	61	45	55	53	58	42	48	1	
NASA - NATIONAL AERONAUTICS & SPACE ADMINISTRATION	10	9	18	21	23	20	11	8	7	2	
XIDIAN UNIVERSITY	22	31	42	53	82	74	84	91	92	105	40
TSINGHUA UNIVERSITY	29	37	37	56	87	74	65	81	70	67	15
SOUTHEAST UNIVERSITY	30	33	34	40	38	81	78	71	86	104	27
WUHAN UNIVERSITY	36	33	44	65	59	50	79	79	68	79	25
KOREA ELECTRONICS & TELECOMMUNICATIONS RESEARCH IN...	18	8	14	31	26	10	24	19	24	11	
SHANGHAI AEROSPACE SYSTEM ENGINEERING INSTITUTE	21	33	55	54	57	46	58	64	48	93	43
SHANGHAI ENGINEERING CENTER FOR MICROSATELLITES	5	25	13	50	32	66	66	138	105	62	38

1st application year

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## Technologies & applications

Technological concepts, key players technical domain focus

# Major concept fields

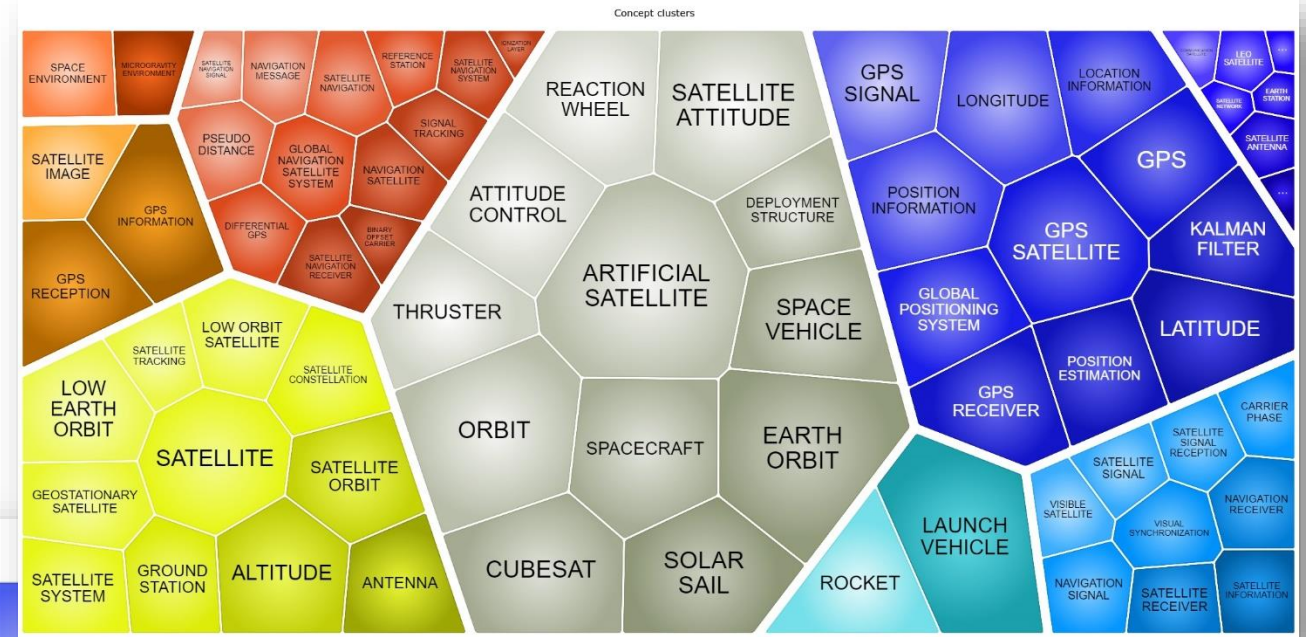
Concepts mainly influenced by Chinese activities

Patent families by Concept clusters



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## Non-Chinese activities



Global concepts are mainly influenced by Chinese activities as 81% of the total number of detected patent families in the field originate from China.

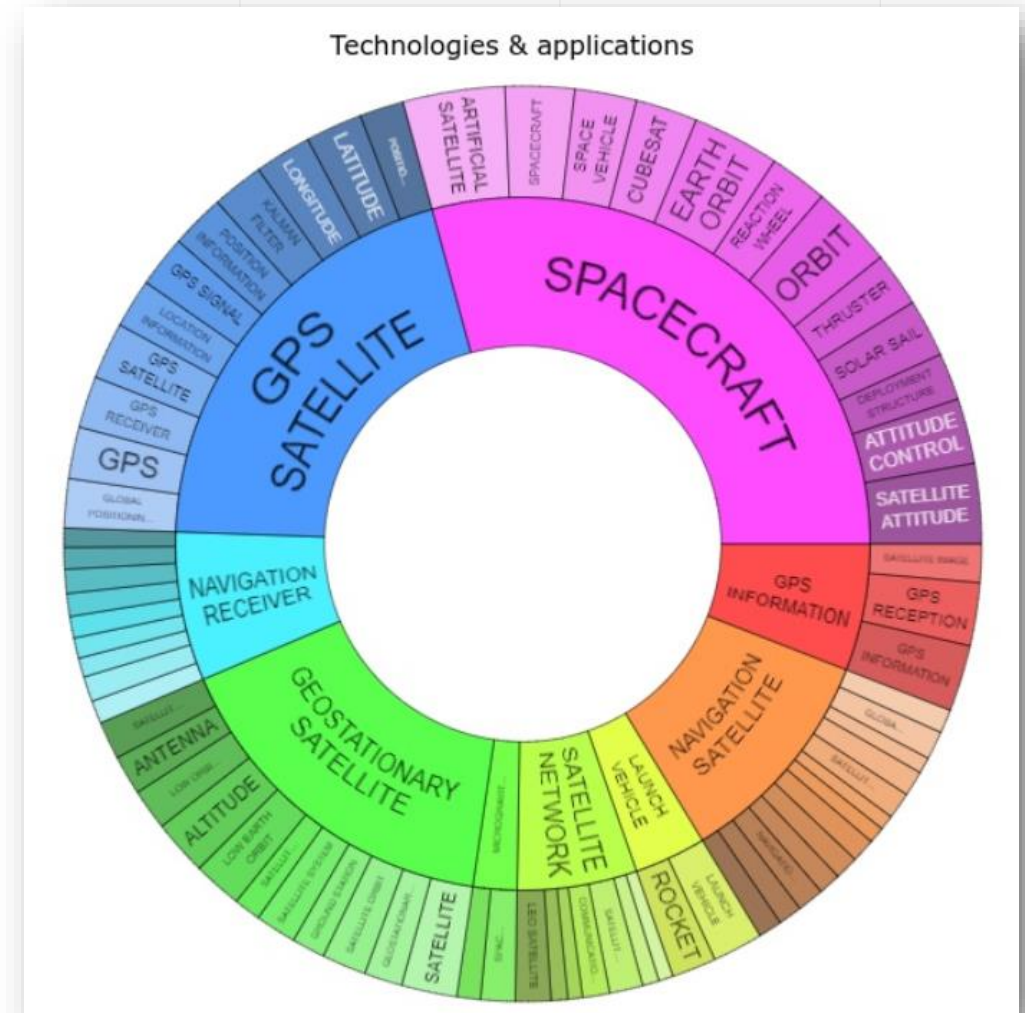
Other detailed information can be extracted when focus is on R&D outside China, however major concept clusters remain relatively the same.



## Non-Chinese technologies and applications clusters

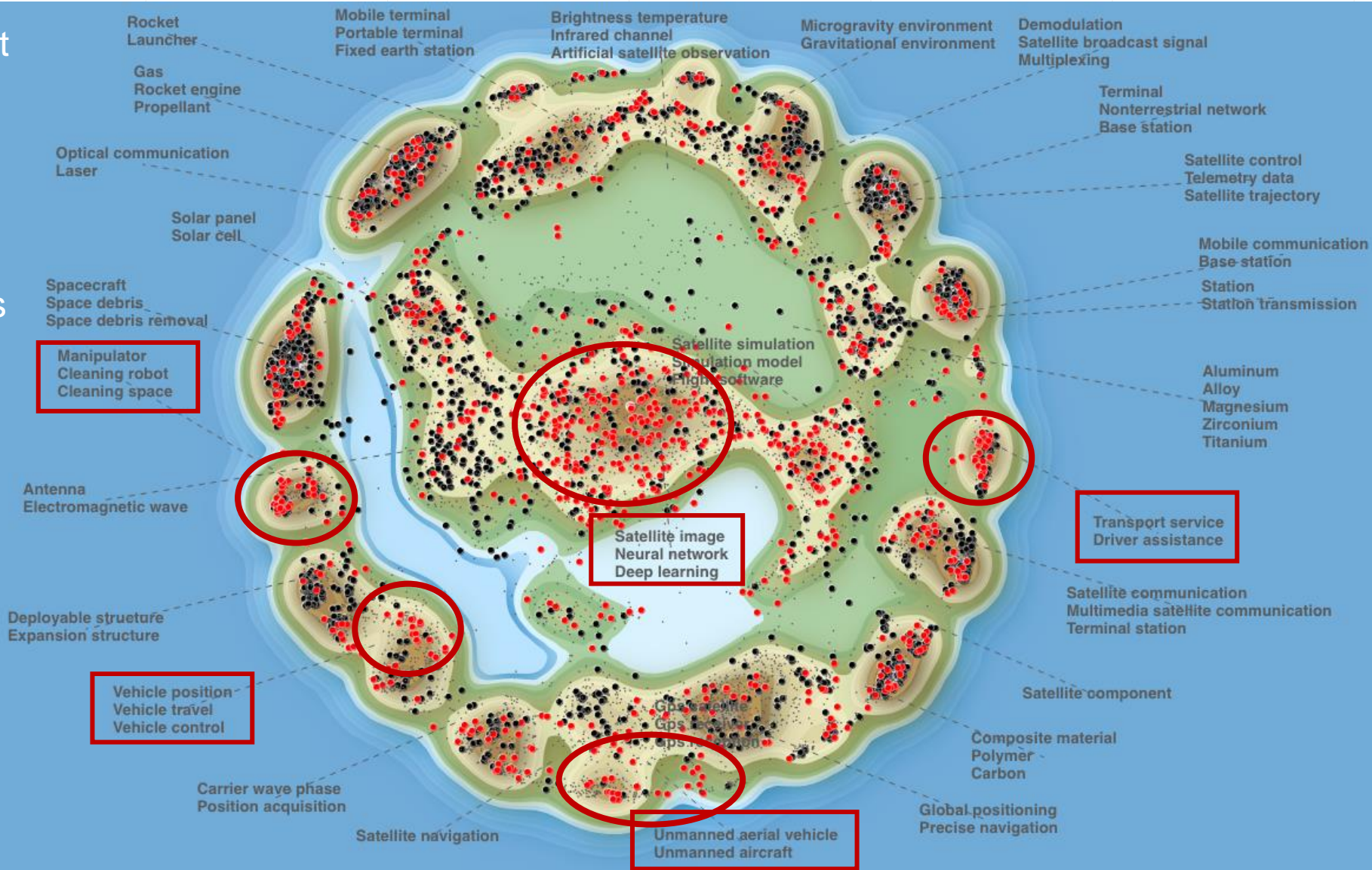
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- Pie chart type : It allows to have a global overview of the volume of the main technical domain (or concepts) and the sub-domains (or sub-concepts)
- Map chat: It allow to get a global overview and it is a way to highlight the current trends



Positioning of patent families filed after 2020 (red) VS old (black)

Identify emerging technological trends





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## Technology focus trends

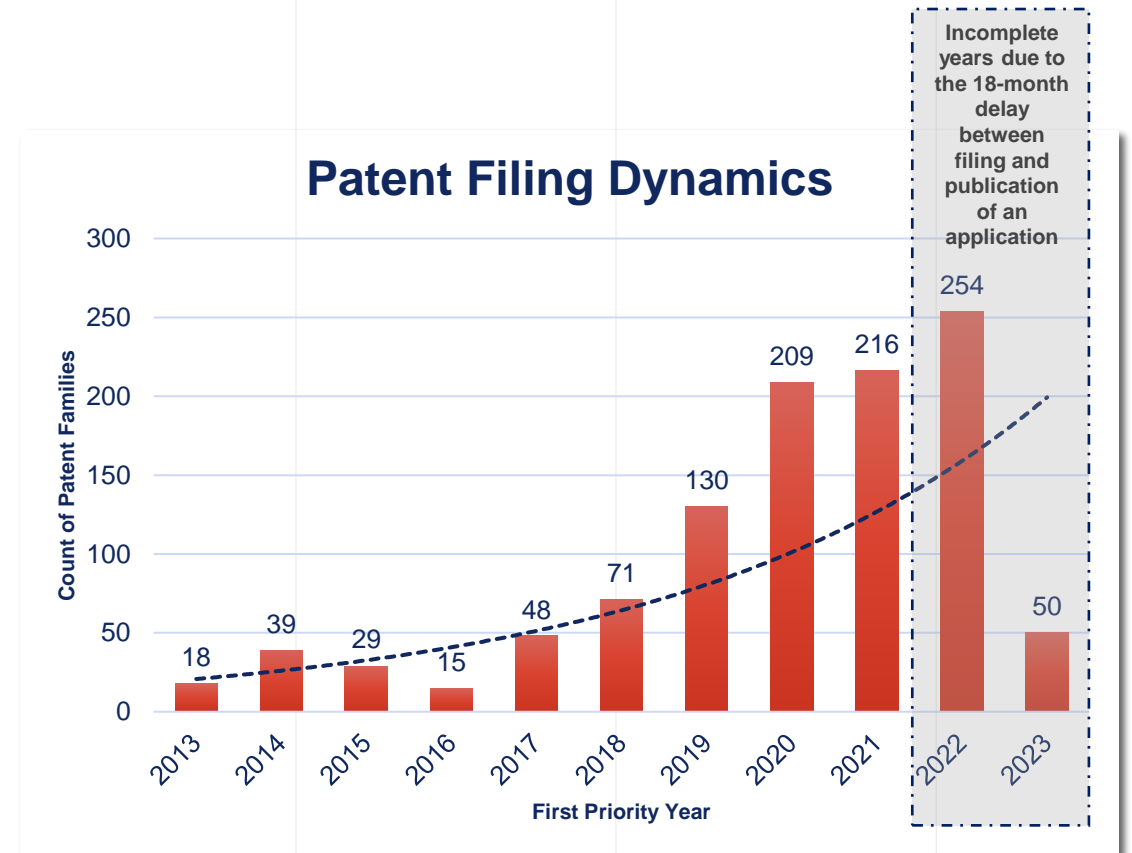
Artificial Intelligence / Deep Learning

# Technology investment trend over last 10 years

## 5G/6G Focus

Telecommunications 5G networks and beyond (6G) are starting to find their place in the Aerospace field with 1170 patent families.

A booming growth rate was registered in the last 5 years with a compound annual growth rate (CAGR) of ~70% from 2016 to 2021.



## R&D geographical areas

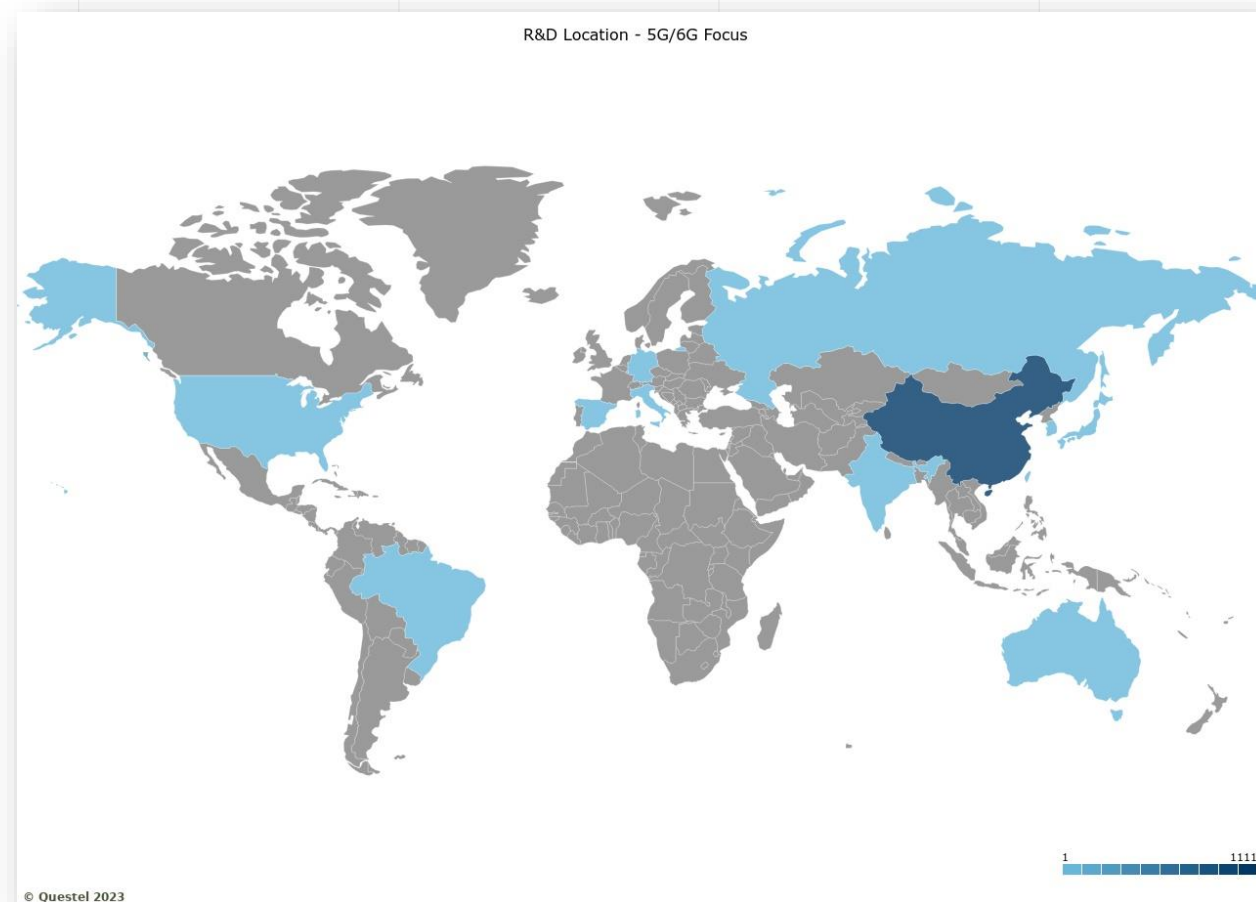
### 5G/6G Focus

Most of patent families with 5G/6G focus are Chinese with 1111 inventions followed by the USA with just 19 patent families.

88 patent families (71 Chinese) related to Drones or UAVs were detected, as Drones are supposed to play an important role in the millimetre waves deployment.

#### Patent families/First priority year

2015 (3) | 2017 (1) | 2018 (6) | 2019 (12) | 2020 (18) | 2021 (21) | 2022 (26) | 2023 (1) |

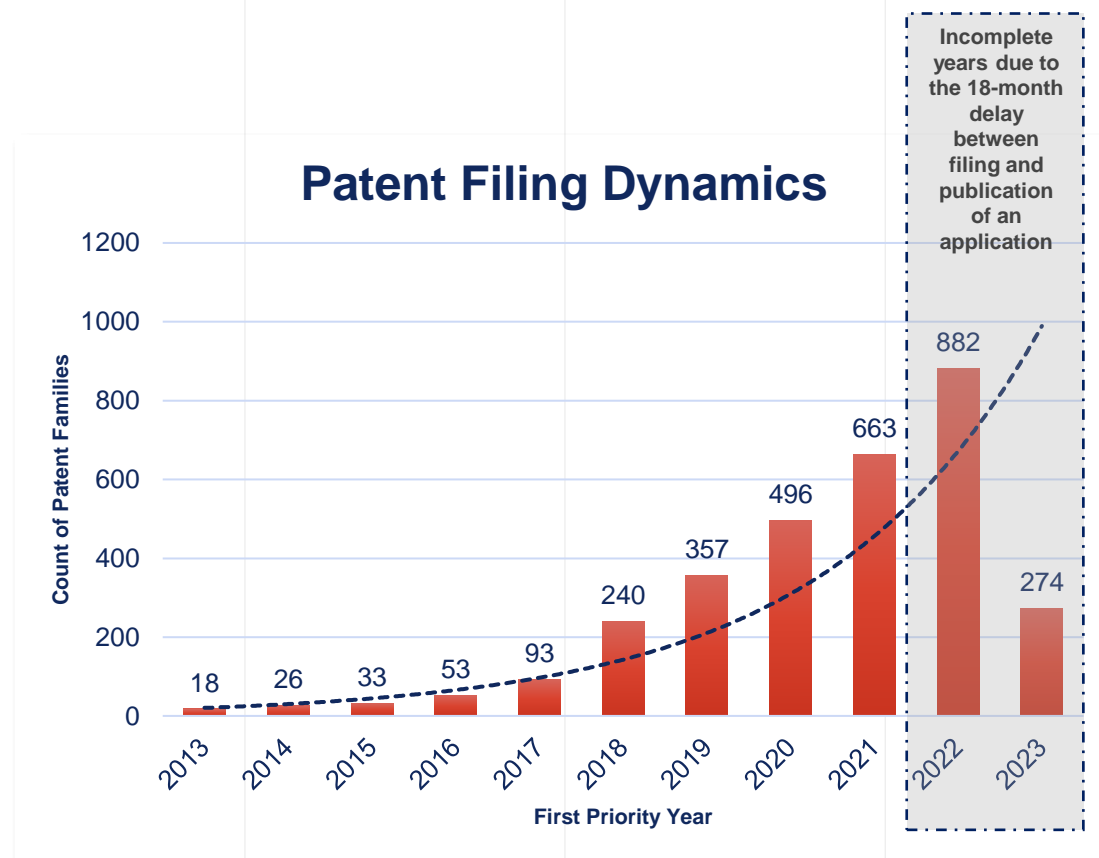
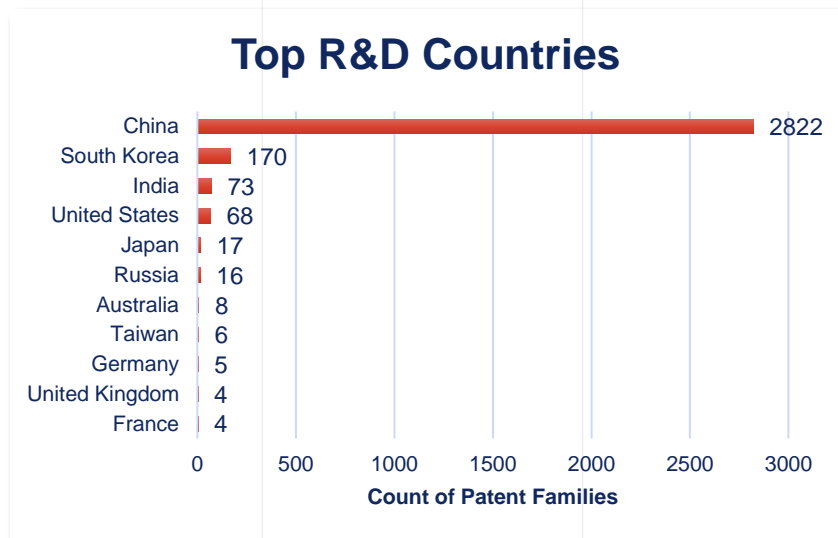


# Artificial Intelligence in Aerospace (Deep learning / Neural network)

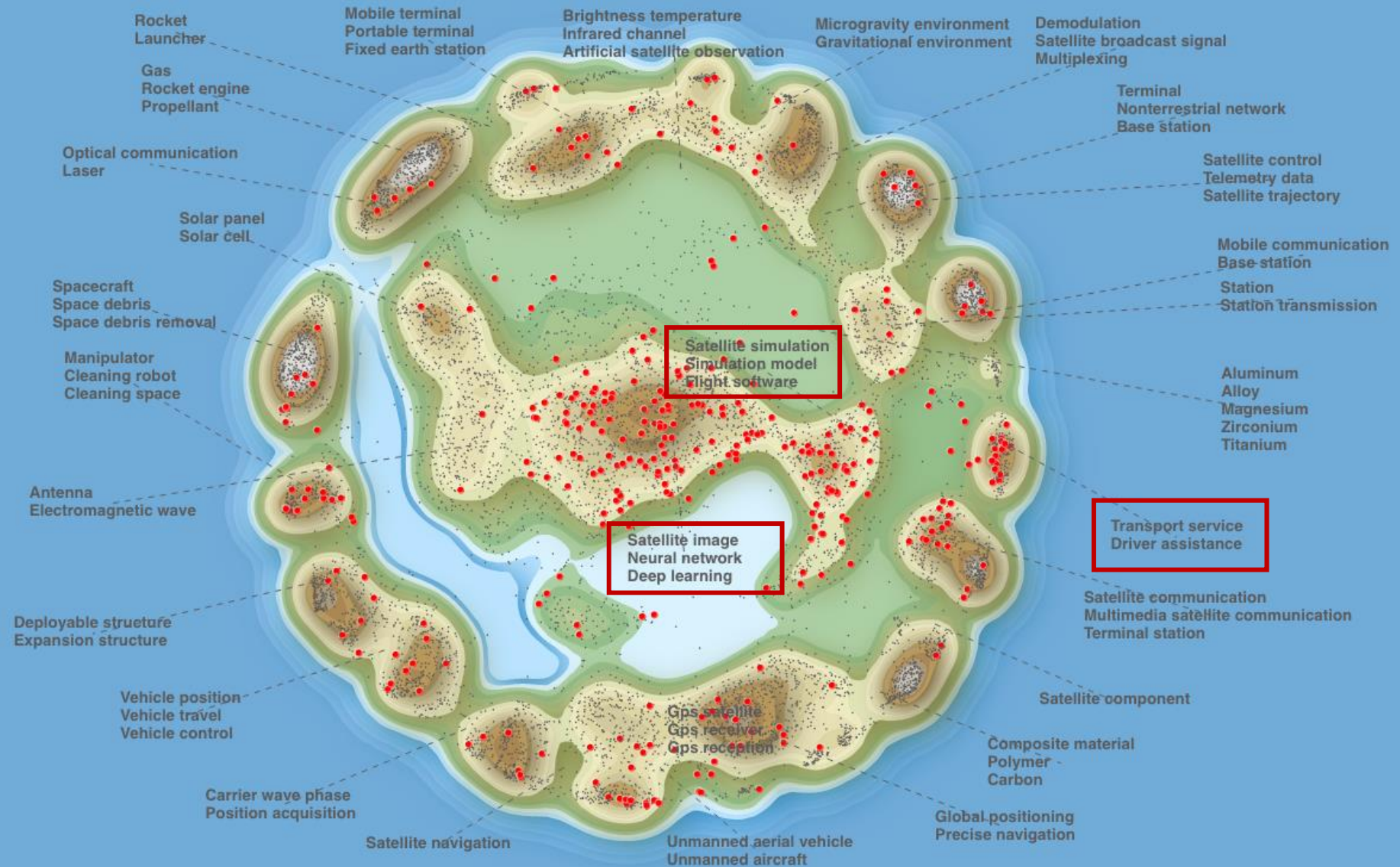
## Technology investment trend over last 10 years

Artificial Intelligence introduction to the aerospace field is speeding where 4% of aerospace patent families are AI related.

The compound annual growth rate (CAGR) over the last five years registered a remarkable value of ~66% reflecting a domain that is imposing itself in most technical fields with aerospace being no exception.



## Positioning of AI patent families (in red)



## Conclusion

Research and development investments in aerospace for academics and research organizations is increasing at a very high pace as displayed by patent filing dynamics.

China domination of the R&D market is perceived, however, major technological domains invested in align between non-Chinese and Chinese players.

Artificial Intelligence aspects' introduction to the aerospace world is making its entry with booming growth rates.





Thank you

Questions?  
Q&A Session



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