# Survey - M-IND: Mid-Size Sat INDustrialisation & Competitiveness for LEO Constellations

## INTRODUCTION

The Mid size satellite INDustrialisation (M-IND) initiative main objective and the way the information of this Survey will be processed is further explain at [**https://atpi.eventsair.com/m-ind-workshop/survey**](https://atpi.eventsair.com/m-ind-workshop/survey)

The Survey is split in the following areas, and it should take **1 hour** to complete (depending on the length of free text answers):

1-2 – Introduction - General: Contact Point, Company and Business Unit/Site

3 – Categories and capabilities with LEO Mid-Size Satellites and LEO Constellations

4– Pain Points and Priorities, including Product Policy, Industrialisation aspects, etc.

5 – Supply Chain

6- Other

7 – Final Remarks

**(This Word document is ONLY to help you draft or help you collect answers by several experts in the Company).**

## GENERAL – CONTACT, COMPANY, BUSINESS UNIT

Please provide the following details about your company and Business Unit. This information will be used to gain an understanding of the stakeholders and will not be shared outside ESA.

**Contact point:**

Name: *type your answer here*

Responsibility / Role: *type your answer here*

Email: *type your answer here*

**Company information** :

Company Name: *type your answer here*

Company type: (Select one)

* LSI (definition [link](https://www.esa.int/About_Us/Business_with_ESA/Large_System_Integrators))
* MidCap (250 to 3000 employees – as per [link](https://www.eib.org/en/projects/topics/sme/) )
* SME (up to 249 employees – as per [link](https://www.eib.org/en/projects/topics/sme/))
* Other: FREE TEXT - Clarify

Size of company (in nb. employees): *type your answer here (free text)*

***Business Unit/Site information*** *(particularly relevant if part of a large group) :*

Name *of Business Unit / Site: type your answer here*

Country *of Business Unit / Site: Select from LIST (only European and Canada)*

*City* of *Business Unit / Site: type your answer here*

*Size of Business Unit (in nb. of employees): type your answer here*

URL : *of the Business Unit if available, otherwise of the company*

Specify type of activities and potential role of your Business Unit / Site in mid-size satellites for LEO constellations:

* *type your answer here (FREE TEXT)*

## CATEGORIES and CAPABILITIES in M-IND

The definition of Mid-Size satellite can be quite broad (from 100 kg and even smaller, to a few 100s of kg). This might result in different architectures and integration needs.

This section of the Survey intends to identify segments, both for a) individual satellites and b) for LEO constellations, and also addresses related industrial capabilities.

## Individual satellite

**Wet mass**: Which segment, in terms of LEO Mid-size satellite mass, do you find the most attractive to build LEO constellations? (*select as many as apply)*

|  |
| --- |
| * < 100 kg LEO sats, excl. CubeSats
 |
| * 100 to 250 kg LEO sats
 |
| * 250 to 400 kg LEO sats
 |
| * 400 to 800 kg LEO sats
 |
| * > 800 kg LEO sats
 |

**Payload(s) mass**: Which segment, in terms of LEO Mid-size payload mass, do you find the most attractive to build LEO constellations? (*select as many as apply)*

|  |
| --- |
| * < 10 kg LEO sats, excl. CubeSats
 |
| * 10 to 50 kg LEO sats
 |
| * 50 to 100 kg LEO sats
 |
| * 100 to 200 kg LEO sats
 |
| * 200 to 400 kg LEO sats
 |
| * > 400 kg LEO sats
 |

Please, clarify assumptions and why you made these choices for the mass segment:

* *type your answer here (free text)*

**Satellite Average Power**: Which segment, in terms of LEO Mid-size satellite power in nominal operations, do you find the most attractive to build LEO constellations/ ? - (*select as many as apply)*

|  |
| --- |
| * < 200 W LEO sats, excl. CubeSats
 |
| * 200 to 500 W LEO sats
 |
| * 500 to 1000 W LEO sats
 |
| * 1000 to 2000 W LEO sats
 |
| * > 2000 W
 |

Please, clarify assumptions and why you made these choices for the Power segment:

* *type your answer here (free text)*

**Spacecraft Design Life**: Which segment, in terms of lifetime does your Business Unit consider for your LEO Mid-size Sats? (*select as many as apply)*

|  |
| --- |
| * Below 1 year
 |
| * Between 1 and 3 years
 |
| * Between 3 and 5 years
 |
| * Between 5 and 7 years
 |
| * Between 7 and 10 years
 |
| * More than 10 years
 |

 Please, clarify assumptions and why you made these choices for the Design Life:

* *type your answer here (free text)*

How many LEO mid-size satellites, with significant involvement by your Business Unit, have you launched into space in the past 3 years? *Choose one*

* none
* 1
* 2-10
* 10-100
* > 100

How many different LEO mid-size platform products do you have ? *Choose one.*

* 1
* 2-3
* 4-7
* > 7

What is / are the name of your mid-size platform product(s)? Please also clarify assumptions for the two questions above, as needed.

* *type your answer here (free text)*

Does your organisation have the ground segment infrastructure and experience to operate your own missions? :

|  |
| --- |
| * Yes , we always operate our missions
 |
| * Yes, but we also let or would let others operate them (e.g. ESOC, Telecom Operator, others, etc.)
 |
| * No, others always operate them
 |

Please, explain why these choices, add assumptions if needed?

* *type your answer here (free text)*

## LEO Constellations

What market segments for LEO constellations do you think could offer the best **growth opportunities** for you organisation in the next 5 years?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GROWTH OPPORTUNITIES |  |  |  |  |  |
|  |  .1 - Low |  |  |  | 5- High |
| * National missions
 | O | O | O | O | O |
| * ESA
 | O | O | O | O | O |
| * Other institutional in Europe
 | O | O | O | O | O |
| * Fully commercial in Europe
 | O | O | O | O | O |
| * Export commercial programmes
 | O | O | O | O | O |
| * Export to institutional
 | O | O | O | O | O |

What market segments for LEO constellations do you find the most **challenging** for you organisation **to be competitive** in the next 5 years?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COMPETITITVENESS CHALLENGE |  |  |  |  |  |
|  |  .1- Low |  |  |  | 5- High |
| * National missions
 | O | O | O | O | O |
| * ESA
 | O | O | O | O | O |
| * Other institutional in Europe
 | O | O | O | O | O |
| * Fully commercial in Europe
 | O | O | O | O | O |
| * Export commercial programmes
 | O | O | O | O | O |
| * Export to institutional
 | O | O | O | O | O |

Please, clarify assumptions and why you made these market segment choices:

* *type your answer here (free text)*

**Current production capability**: What is your current manufacturing rate in terms of LEO mid-size sats platform per year ? (*select as many as apply)*

* 1 to 10 LEO sats / yr
* 10 to 25 LEO sats / yr
* 25 to 100 LEO sats / yr
* > 100 LEO sats / yr

**Projected production capability**: How many LEO mid-size sats platforms are you planning to be able to produce per year in 2028 ?

* 1 to 10 LEO sats / yr
* 10 to 25 LEO sats / yr
* 25 to 100 LEO sats / yr
* > 100 LEO sats / yr

Please, clarify assumptions for the questions above (e.g. current limitation), and what would you need (max. 5 bullets) to increase your yearly manufacturing rate accordingly?

* *type your answer here (free text)*

For what type of payload market do you focus your mid-size satellite platforms ?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | FOCUS |  |  |  |  |
|  | . 1 - Low | 2 | 3 | 4 | 5- High |
| * Telecom
 | O | O | O | O | O |
| * Navigation
 | O | O | O | O | O |
| * Earth Observation (EO)
 | O | O | O | O | O |
| * Space Safety Awareness (SSA)
 | O | O | O | O | O |
| * Science
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, clarify assumptions and why you made these payload segment choices:

* *type your answer here (free text)*

What payloads do you support today? For which type of payloads will your platform need an evolution to become competitive ?

(e.g. RF / Optical and active/passive for EO, fixed vs mobile, direct to device, Narrow Band messaging, Navigation, secondary payloads like ISL, Science, etc. )

* *type your answer here (free text)*

For this section, please summarise in max. 5 bullets the areas covered by your mid-size satellites suitable for LEO constellations, and relate it to the biggest challenges if appropriate.

* *type your answer here (free text)*

## PAIN POINTS and PRIORITIES

This section includes questions to address the challenges and pain points for your Company / Business Unit to grow into the market of LEO constellations with mid-size sats.

This first question is about your global view, which is then expanded in the following questions.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CHALLENGE |  |  |  |  |  |
|  | .1 - Easy |  |  |  | 5- Difficult |
| * Technology capability to meet customer needs
 | O | O | O | O | O |
| * Availability of full European supply chain
 | O | O | O | O | O |
| * Industrialisation and related process issues
 | O | O | O | O | O |
| * Acquiring customers / finding a market for LEO constellations
 | O | O | O | O | O |
| * Non-recurring cost to initiate the development of a LEO constellation
 | O | O | O | O | O |
| * Recurring cost to complete the LEO constellation.
 | O | O | O | O | O |
| * Access to funding
 | O | O | O | O | O |
| * Availability of suitable launcher services
 | O | O | O | O | O |
| * Availability of specific competences for LEO constellations
 | O | O | O | O | O |
| * Compliance to Rules and Regulations (Export, … )
 | O | O | O | O | O |
| * Compliance to Environmental Regulations (Zero Debris, LCA, REACH, … )
 | O | O | O | O | O |
| * Others
 | O | O | O | O | O |

Please, explain why, and add, if you wish :

* *type your answer here (free text)*

Regarding **Technology capability**, please rank the main challenges :

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CHALLENGE** |  |  |  |  |  |
|  | .1 - Easy |  |  |  | 5- Difficult |
| * Availability of suitable European P/F equipment with high TRL =7 or higher
 | O | O | O | O | O |
| * Finding competitive payloads compatible with your mid-size platform
 | O | O | O | O | O |
| * Effort to adapt Interfaces to avoid customisation for each customer
 | O | O | O | O | O |
| * Effort to update the platform to meet functional / performance requirements for new customers
 | O | O | O | O | O |
| * Effort for higher integration and digital transformation to reduce platform SWaP to be competitive
 | O | O | O | O | O |
| * Effort to adapt your platform to higher commonality envisaging interchangeability of equipment and payloads
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why these choices:

* *type your answer here (free text)*

Regarding **Industrialisation and related process** issues, please rank the main challenges

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CHALLENGE** |  |  |  |  |  |
|  | .1 - Easy |  |  |  | 5- Difficult |
| * Availability of Supply chains capable of producing units in sufficient numbers to meet LEO constellations.
 | O | O | O | O | O |
| * Implementation of lean **manufacturing processes** to deliver a competitive recurring mid-size platforms adaptable to host diverse payloads
 | O | O | O | O | O |
| * Product Manufacturing Readiness Level ([MRL](https://www.dodmrl.com/MRL_Deskbook_V2.pdf)) to reduce risks, increase production rates and improve lead-time to integrate a recurring mid-size platform with diverse payloads
 | O | O | O | O | O |
| * Scalability and flexibility in your manufacturing chain – agile manufacturing, modular expansion of production lines
 | O | O | O | O | O |
| * Finding funding sources for covering ramping up the production (industrialisation)
 | O | O | O | O | O |
| * Investment on automation and smart manufacturing
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why these choices:

* *type your answer here (free text)*

Regarding **the establishment of a Qualified Equipment Product Policy** for LEO constellations, please rank the importance of these areas :

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| IMPORTANT |  |  |  |  |  |
|  | .1 - Not | 2 | 3 | 4 | 5- Very |
| * reduce manufacturing risk and increase manufacturing rate
 | O | O | O | O | O |
| * reduce procurement and engineering processes
 | O | O | O | O | O |
| * availability of standardised electrical (mechanical, thermal) interfaces
 | O | O | O | O | O |
| * ensuring interchangeability / interoperability
 | O | O | O | O | O |
| * Availability of a catalogue of recurring units off-the-shelf
 | O | O | O | O | O |
| * Credibility of price and delivery time
 | O | O | O | O | O |
| * Established procurement processes for Institutional Constellations
 | O | O | O | O | O |
| * Certification process through an independent entity to maximise value for both, the supply chain and the integrators
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why these choices:

* *type your answer here (free text)*

Regarding certification, please specify what areas, if any, should be prioritised to make the supply chain and the mid-size satellite integrators more competitive:

* *type your answer here (free text)*

What **system limitations** are the most challenging to allow you satisfy user needs and develop new markets:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CHALLENGING SYSTEM LIMITATIONS |  |  |  |  |  |
|  | 1. Not
 |  |  |  | 5- Most |
| * Power available to meet customer needs
 | O | O | O | O | O |
| * Size and Weight to integrate primary auxiliary payloads
 | O | O | O | O | O |
| * SWaP to integrate auxiliary payloads (e.g. Inter Sat. Link terminal)
 | O | O | O | O | O |
| * Pointing accuracy and/or agility
 | O | O | O | O | O |
| * Mission Data throughput capacity
 | O | O | O | O | O |
| * Timeliness (coverage, revisit, resilience) for user with limited number of affordable satellites
 | O | O | O | O | O |
| * New resilience / security needs
 | O | O | O | O | O |
| * Lifetime of LEO mid-size sats affecting sustainability
 | O | O | O | O | O |
| * Functionality to integrate auxiliary payloads (e.g. limited Interfaces )
 | O | O | O | O | O |
| * Fitting into available and competitive launchers
 | O | O | O | O | O |
| * Complying to new End of Life / Disposal policies
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why, add another any category if you wish, or additional possible recommendations :

* *type your answer here (free text)*

Regarding challenges for reducing **Recurring (RC) and Non-Recurring** **costs** (**NRC**) **to build a LEO constellations**, please rank the items below where priority could be put for ESA support to the mid-size satellite integrator:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PRIORITY for ESA SUPPORT** |  |  |  |  |  |
|  | 1 - Low |  |  |  | 5- High |
| * NRC: to reduce cost for the development of the 1st satellite (including integration and system activities)
 | O | O | O | O | O |
| * NRC: to reduce cost for the development of individual platform Equipment
 | O | O | O | O | O |
| * NRC: to prepare the production line for high volume industrialization
 | O | O | O | O | O |
| * RC: to reduce the whole cost for developing recurring satellites
 | O | O | O | O | O |
| * RC: to reduce cost for procuring recurring equipment (in the platform)
 | O | O | O | O | O |
| * RC: to reduce cost for integrating payloads into recurring satellites
 | O | O | O | O | O |
| * RC: to reduce cost related to the deployment of the constellation (launch and operations)
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why your choices:

* *type your answer here (free text)*

Please, summarise your priorities to alleviate pain points in max. 5 bullets :

* *type your answer here (free text)*

## SUPPLY CHAIN

This section contains questions related to the Supply Chain in LEO mid-size platforms.

Regarding the Make-Buy procurement approach for the different sub-systems, please rank as follows:

* 1 – Fully Internal integration - procurement done at the lowest level (e.g. components, small building blocks)
* 2- Mostly Internal (larger elements procured externally, but integration done in-house) ;
* 3 – Balanced Internal and External;
* 4 – Mostly external, but some elements also developed internally ;
* 5- Fully External (Modular with plug-and-play of full sub-system)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Integration approach |  |  |  |  |  |
|  | 1 – Fully Internal |  |  |  | 5 – Fully External |
| * On-Board-Computer / Data Handling / Software
 | O | O | O | O | O |
| * AOCS Sensors and Actuators
 | O | O | O | O | O |
| * Electrical Power Sys – Conditioning and Distribution
 | O | O | O | O | O |
| * Electrical Power Sys – Generation, Storage
 | O | O | O | O | O |
| * Propulsion
 | O | O | O | O | O |
| * Structure, Thermal, Mechanisms, Harness
 | O | O | O | O | O |
| * Telemetry – TeleCommand
 | O | O | O | O | O |
| * High Speed Science data Downlink (in EO, SCI, SSA)
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why these choices, and clarify assumptions?

* *type your answer here (free text)*

Please, rank the potential **impact to competitiveness** when increasing **commonalities** and interchangeability in the supply chain (e.g. by having common interfaces, interoperable equipment) in LEO mid-size satellites, per sub-system :

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Impact** to competitiveness with higher **commonality** |  |  |  |  |  |
|  | 1 – Negative |  |  |  | 5 – very Positive |
| * On-Board-Computer / Data Handling / Software
 | O | O | O | O | O |
| * AOCS Sensors and Actuators
 | O | O | O | O | O |
| * Electrical Power Sys – Conditioning and Distribution
 | O | O | O | O | O |
| * Electrical Power Sys – Generation, Storage
 | O | O | O | O | O |
| * Propulsion
 | O | O | O | O | O |
| * Structure, Thermal and Mechanisms, Harness
 | O | O | O | O | O |
| * Telemetry - TeleCommand (TM & TC)
 | O | O | O | O | O |
| * High Speed Science data Downlink (in EO, SCI, SSA)
 | O | O | O | O | O |
| * Other
 | O | O | O | O | O |

Please, explain why these choices and assumptions

* *type your answer here (free text)*

**Supply Chain Evolution**: Please explain what should evolve in the Supply Chain for LEO mid-size satellite constellations to gain competitiveness? If relevant, please recommend priorities (e.g. common interfaces) or other needs.

* *type your answer here (free text)*

**Make or Buy**: What specific parts of these sub-system would benefit you the most if there were more commonalities, and why?

* *type your answer here (free text)*

**Non-dependency**: If not developed in-house, what sub-system elements are imported from outside Europe, and which ones are available / preferred for procurement in Europe?

* *type your answer here (free text)*

**Scaling-up**: Which of these sub-systems have limited production capabilities, i.e. long lead time which would not be compatible with LEO constellation development?

* *type your answer here (free text)*

Please, summarise your priorities to alleviate pain point in max. 5 bullets :

* *type your answer here (free text)*

## OTHER: DEPLOYMENT, OPERATIONS, END OF LIFE

What areas in the **deployment** of LEO constellations into orbit, both for your mid-size satellites as well as for launch services, do you recommend improving with the objective to gain competitiveness.

* *type your answer here (free text)*

What areas of **operations** (e.g. common space-ground protocols, autonomy, etc.), do you recommend developing in order to gain competitiveness for LEO constellations?

* *type your answer here (free text)*

What areas of LEO mid-size satellite **end of life** and their **disposal** do you recommend improving, with the objective to comply with regulations and gain competitiveness.

* *type your answer here (free text)*

## FINAL REMARKS

This section allows you to recap and provide the final remarks.

Any other additional recommendation, if not yet covered in earlier questions

* *type your answer here (free text)*

Please summarise (max. 5 bullets) the most important topics that should be addressed in the Workshop to be held on 20th March.

* *type your answer here (free text)*