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Business strategist at SSC



**We help
Earth benefit
from space**

SmallSat Express

Space Innovation Forum 2021

Philip Pahlsson

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Esrange space center

THE MOST VERSATILE SPACE CENTER IN THE WORLD



Twice the size
of Luxembourg
or Rhode Island

5200 km²
ground space

6600 km²
airspace



Esrange

The most versatile space center in the world



Stratospheric balloons

658 LAUNCHED SINCE 1974



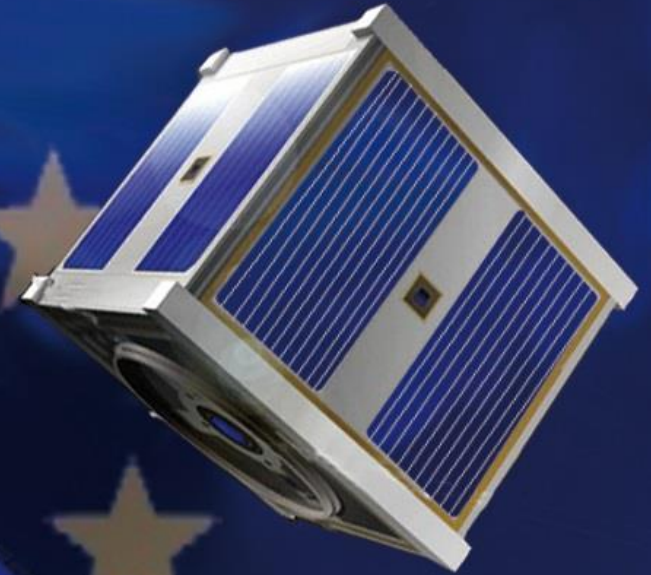
Sounding rockets

600+ LAUNCHED SINCE 1966



Technology demonstrations





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Smallsat Progress

Project evolution

- A: Study with 5 WP:s
- B: Part 1: Study with 4 WP:s
Part 2: Pre-study with 10 WP:s
- C1: Study with 12 WP:s
- C2: Project with 80 WP:s
- D: Project with 80+ WP:s
Preparation of operational organization
- E: Operational work

Projected growth to meet 2022 launch

- 5 FTE:s Q3 2019.
- 9 FTE:s Q1 2020.
- 19 FTE:s Q4 2021
- 28 FTE:s Q2 2022
- 40+ FTE Q2 2023



Proposed European spaceports



- Operational
- Planned vertical launch
- Planned air launch
- Planned off-shore

Comparative study 2018

US VS EU MODEL



What is the secret sauce?

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Step-by-step realization



Capability Level		Year
5	Estrange 2.0	2023+
4	Spaceport – Launch Service Provider	2023
3	Spaceport – Flight Ticket Provider	2022
2	Testbed – Reusability and fly-back	2021
1	Testbed – Rocket motor and stage	2020
0	Modernization and upgrade (>100 MSEK)	

Estrange Space Center – A Strategic National Asset

Smallsat express & testbed esrange



Step-by-step realization

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Estrange Space Center – A Strategic National Asset		

50 M€ invested so far



Evolution of Esrange fully in line with Swedish National Space Strategy

2018 Swedish National Space Strategy

*..Activities at Esrange will continue to be modernized to serve as a strategic resource for national and international research, development, demonstration, test activities and other space-related activities. The facility also has the potential to develop into a **rocket launch test facility**.*

*..An upgrade and modernization of Esrange is currently ongoing. The modernization provides Esrange the possibility to be used as an **international test-bed** for technology development within a broad spectrum of applications that support technology development. Examples of such applications can be **planetary landers** and **reusable rockets**.*

*..The government assigned to the Swedish national space board to, in consultation with SSC, examine the feasibility of **launching small satellites into orbit** ... the issue is currently in preparation at the Government Offices.*

Esrange Space center



UAS



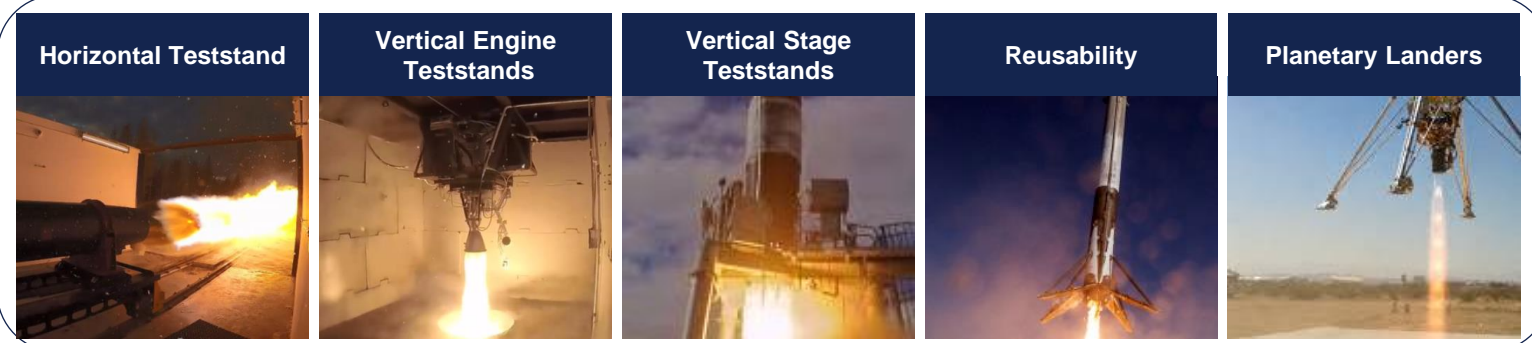
Sounding Rockets



Stratospheric Balloons



Testbed Esrange



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Esrange Space center



UAS



Sounding Rockets

Aurora and Atmospheric Science



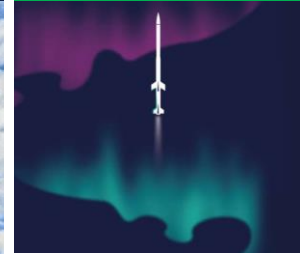
Microgravity and Atmospheric Reentry



Student Missions



Rideshare Missions Suborbital Express



Stratospheric Balloons

Cirumpolar Balloon Flights



Mobile Ballooning



Student Missions



Drop Tests



Testbed Esrange

Horizontal Teststand



Vertical Engine Teststands



Vertical Stage Teststands



Reusability



Planetary Landers



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Spaceport Services



Satellite Launch Service Provider



Estrange evolution



Suborbital Launch Era

Testbed and Reusability Era

Orbital Launch Era



Legacy Operations
Suborbital, Balloon

Engine and Stage
Teststands

Suborbital Test Launch

Reusable Launch (Themis)

Spaceport Services (light)

Launch Service Provider

Spaceport Services (heavy)

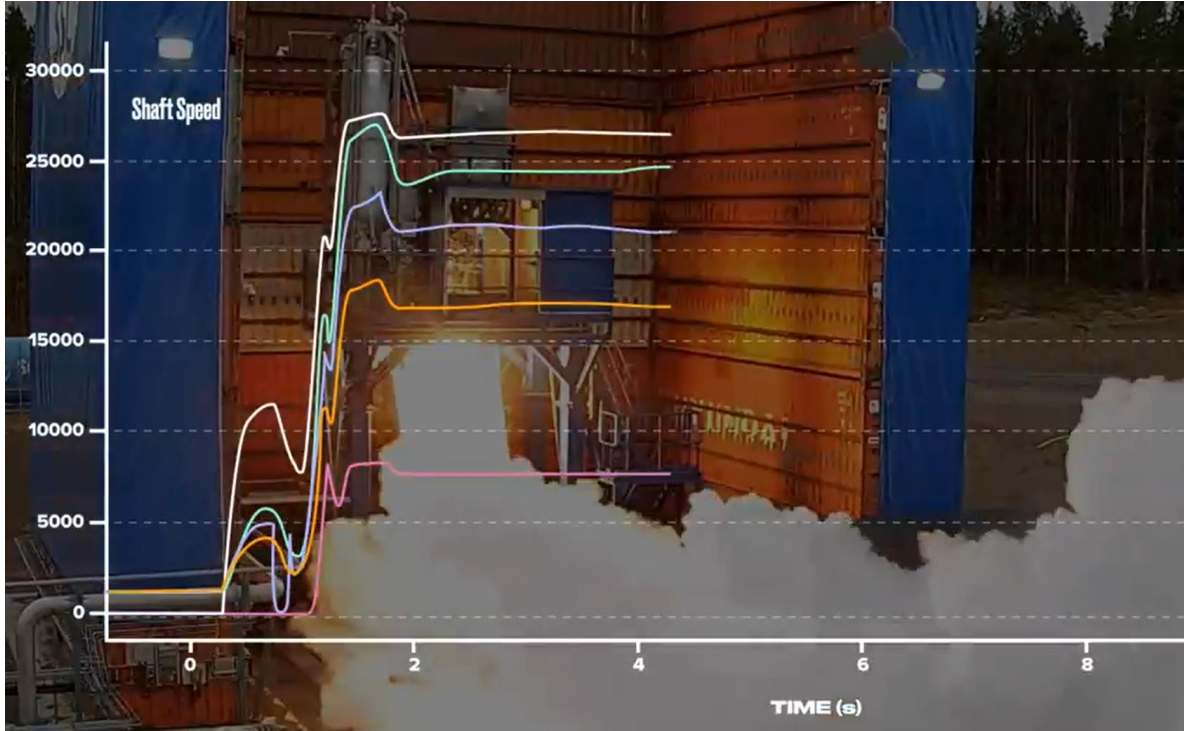






Teststands in operation

Constructed in 2020



RFA Test Site



ISAR Test Site

Simple and flexible sites and organisation to provide maximum customer freedom!



Announcements

- Swedish Space Strategy updated in 2018 calling out Esrange as national strategic asset to be developed towards:
 - Test site for new launch vehicles
 - International test bed for planetary landers and reusability
 - Spaceport for orbital launch
- Official Business Case performed in 2018
- Geopolitical assessments performed by Swedish authorities 2019
- Spaceport Funding Secured
- Minister of higher education announced Sweden will become launching state
- Launch license submitted



Launch site

First adaptation of LC-3 for Flyback booster and orbital launch

- Construction of LC-3A pad for small vehicles
- Construction of LC-3B for Themis
- Liquids and gases basic infrastructure
- LV and Payload integration building
- Adaptation of existing LCC at Esrange



- Will allow orbital launch up to 300 kg
- Will allow reusability tests of ESA Themis
- 600 m2 of ISO 7/8 cleanrooms



- Operational in 2022



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Launch services

- **Commercial launch in 2022**
- **~1000 kg to 550 km SSO
Inclinations: 83°- 104°**
- **LSP Services**
- **LSO Services**
- **Going live soon!**



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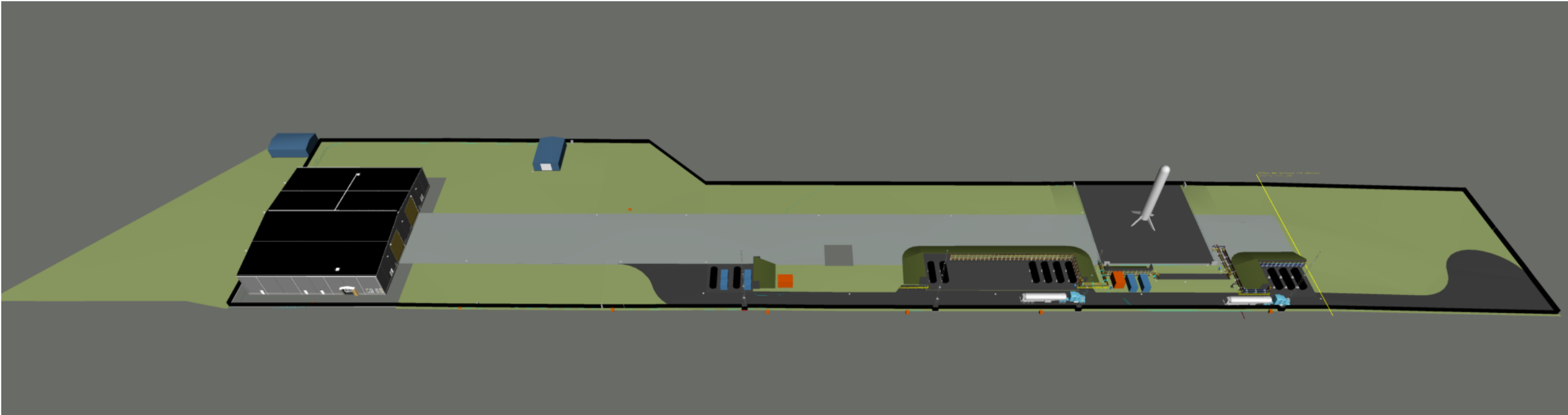
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Launch services

- Range services** ● **Hotel accomodation, restaurant, logistics**
- Admin services** ● **Customs handling, regulatory and licensing**
- Payload services** ● **Payload preparation, payload to LV integration, encapsulation and mating to LV**
- Launch ops service** ● **Safety services, infra services incl. various vehicles, launch team support, flight director / ops team, mission management, TM, FTS and IT**
- On orbit services** ● **LEOP services, launcher tracking, Satellite TT&C and data reception**

LC3 Site Layout

FIRST PHASE BUILDOUT







LVIB Foundation

Pouring concrete





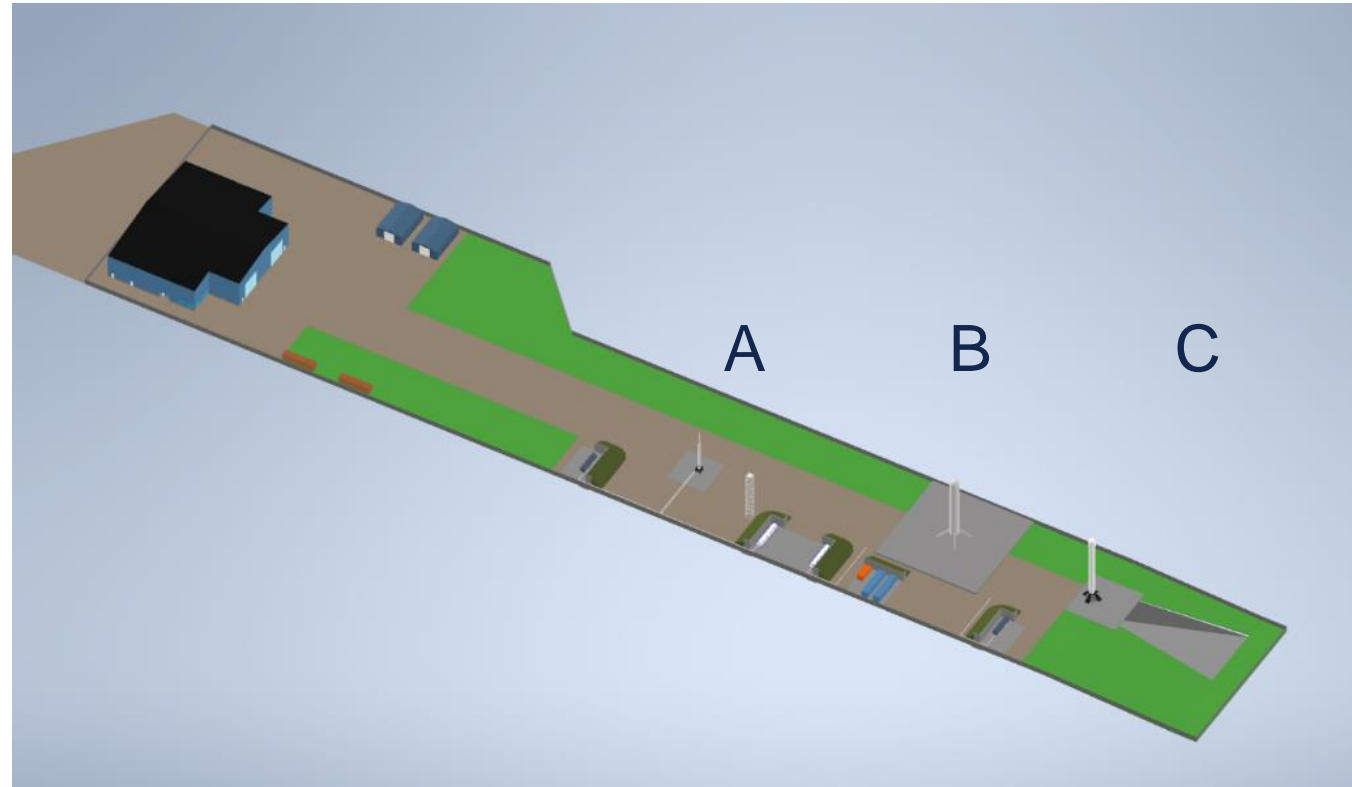
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STEP-BY-STEP REALIZATION – LEVEL 3



Adaptation of LC-3 for 1000 kg+ payload

- LC-3C launch pad
- LC-3C Flame duct
- Process water storage
- Process water pump
- Process water piping
- Concrete pads (fuel/oxidizers)
- Permanent fuel farms
- Ground works
- Power, communication, lights and lightning protection
- Sewage system
- Potable water system

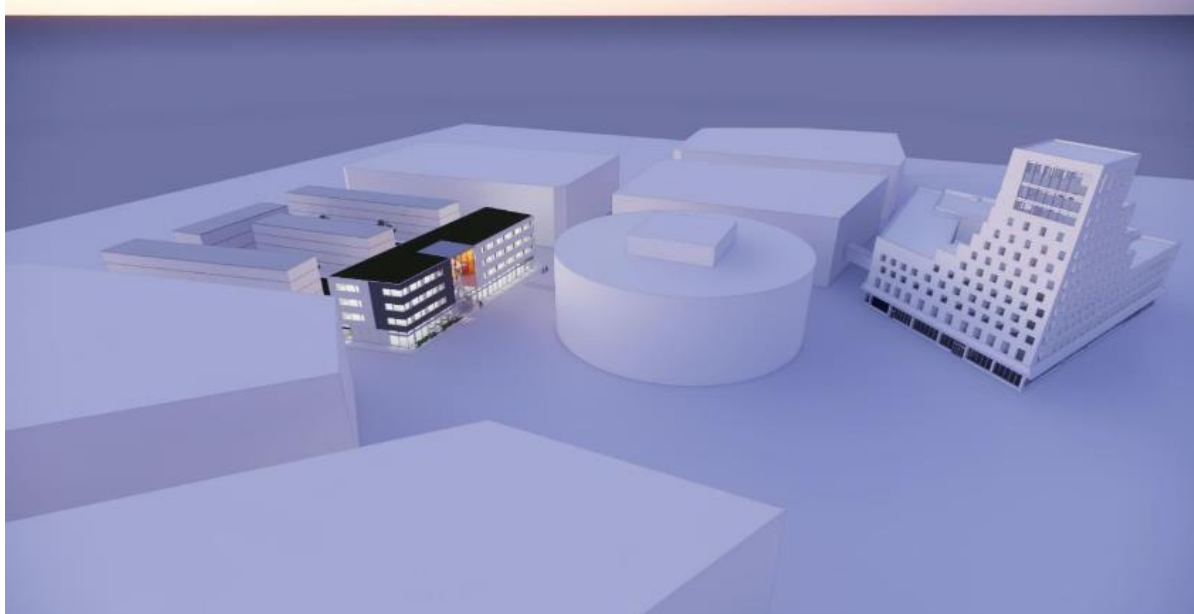


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STEP-BY-STEP REALIZATION – LEVEL 4

Expansion of Esrange to support launch service provider role

- New launch operation centre
- Radar upgrade
- Down-range permanent establishment



Internal



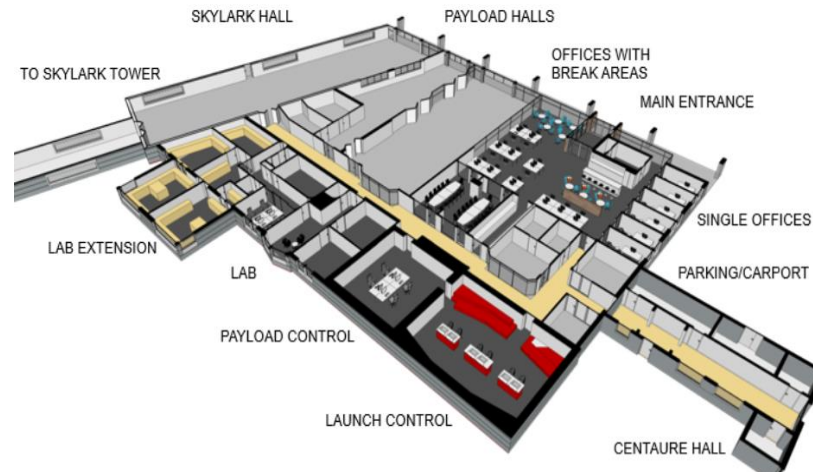
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STEP-BY-STEP REALIZATION – LEVEL 5

Estrange 2.0

Expansion of Estrange support infrastructure

- Expansion of hotel
- Expansion of offices
- GNC Testbed
- Orbit building
- Upgrade of Sounding rocket launch area
- Service integration with IRF and LTU





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