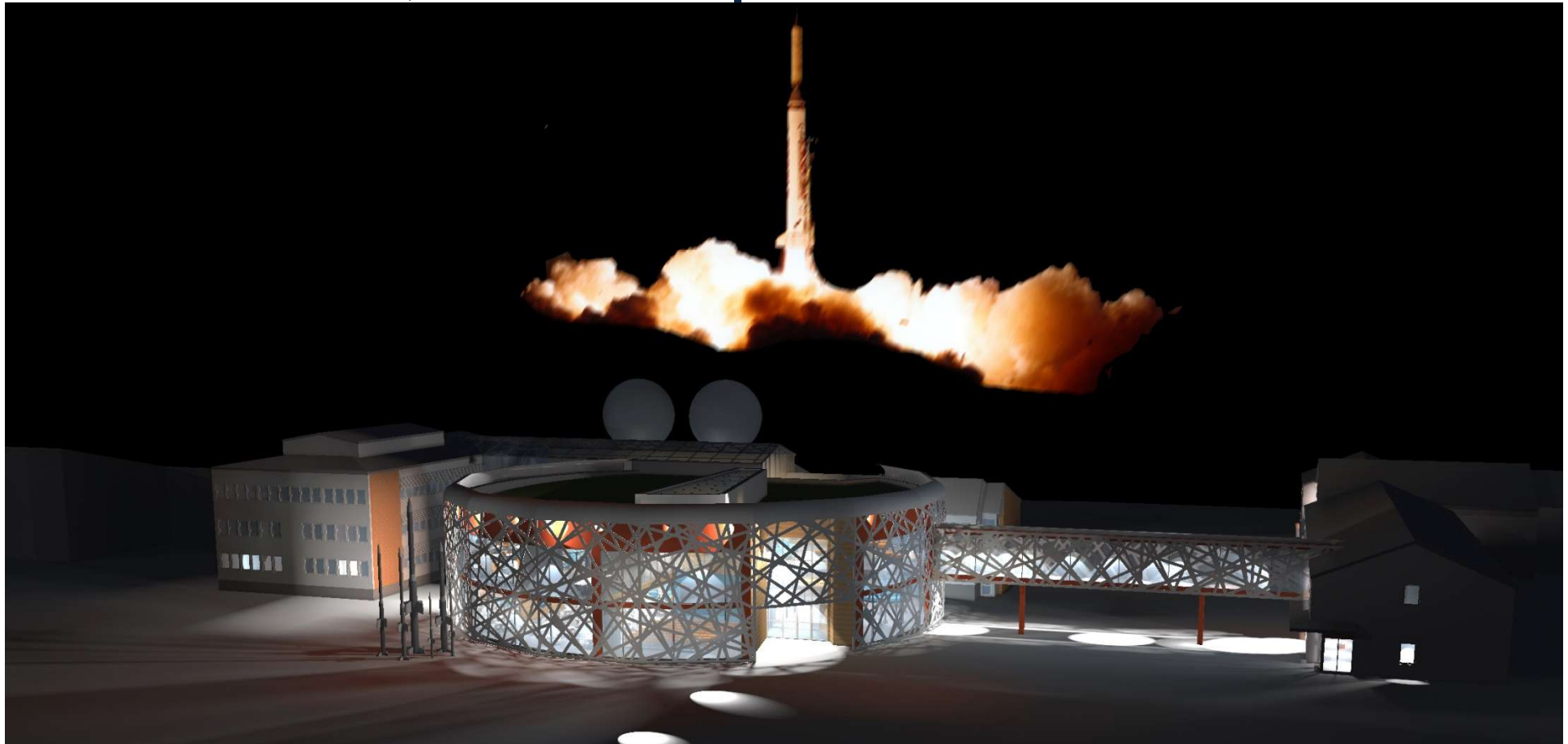


# Esrange Space Center – A Future Center of Excellence for Cubesats, SmallSat Express



Anna Rathsman, SSC (Swedish Space Corporation)

October 12, 2016

[www.sscspace.com](http://www.sscspace.com)





**NEW SPACE**

**NEW APPLICATIONS**

**CONSTELLATIONS**

**REGULAR  
LAUNCHES**

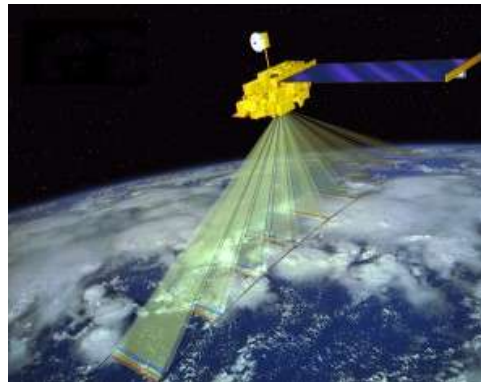
**STANDARDIZED  
ORBITS**



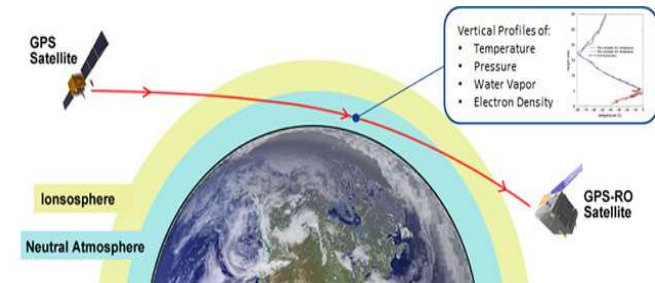


# New SATELLITE APPLICATIONS

## Satellite Communication Earth Observation



## Radio Occultation



## Internet to everyone



## Higher resolution and frequency of update

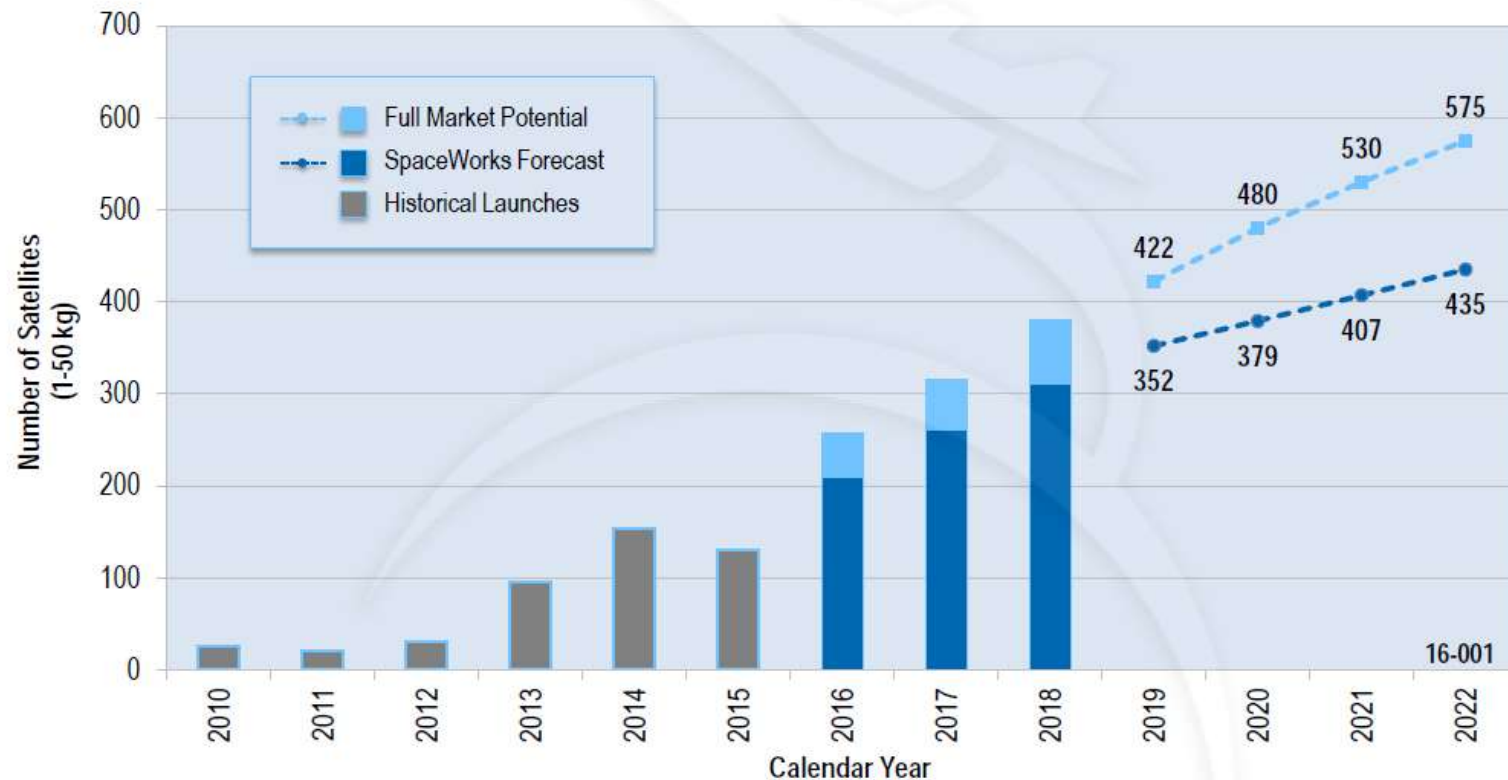


## Better weather predictions



## Nano/Microsatellite Launch History and Forecast (1 - 50 kg)

Projections based on announced and future plans of developers and programs indicate as many as 3,000 nano/microsatellites will require a launch from 2016 through 2022



The 2016 Full Market Potential dataset is a combination of publicly announced launch intentions, market research, and qualitative/quantitative assessments to account for future activities and programs.

The 2016 SpaceWorks Forecast dataset reflects SpaceWorks' expert value judgment on the likely market outcome.

Please see End Notes 1, 2, 3, 4, and 5.

# Commercial launchers





# ESRANGE SPACE CENTER



A hot spot above the arctic circle

[www.sscspace.com](http://www.sscspace.com)



# SSC GLOBAL PRESENCE



550 employees  
25 nationalities  
18 locations  
10 countries

## CUSTOMER PROXIMITY

[www.sscspace.com](http://www.sscspace.com)





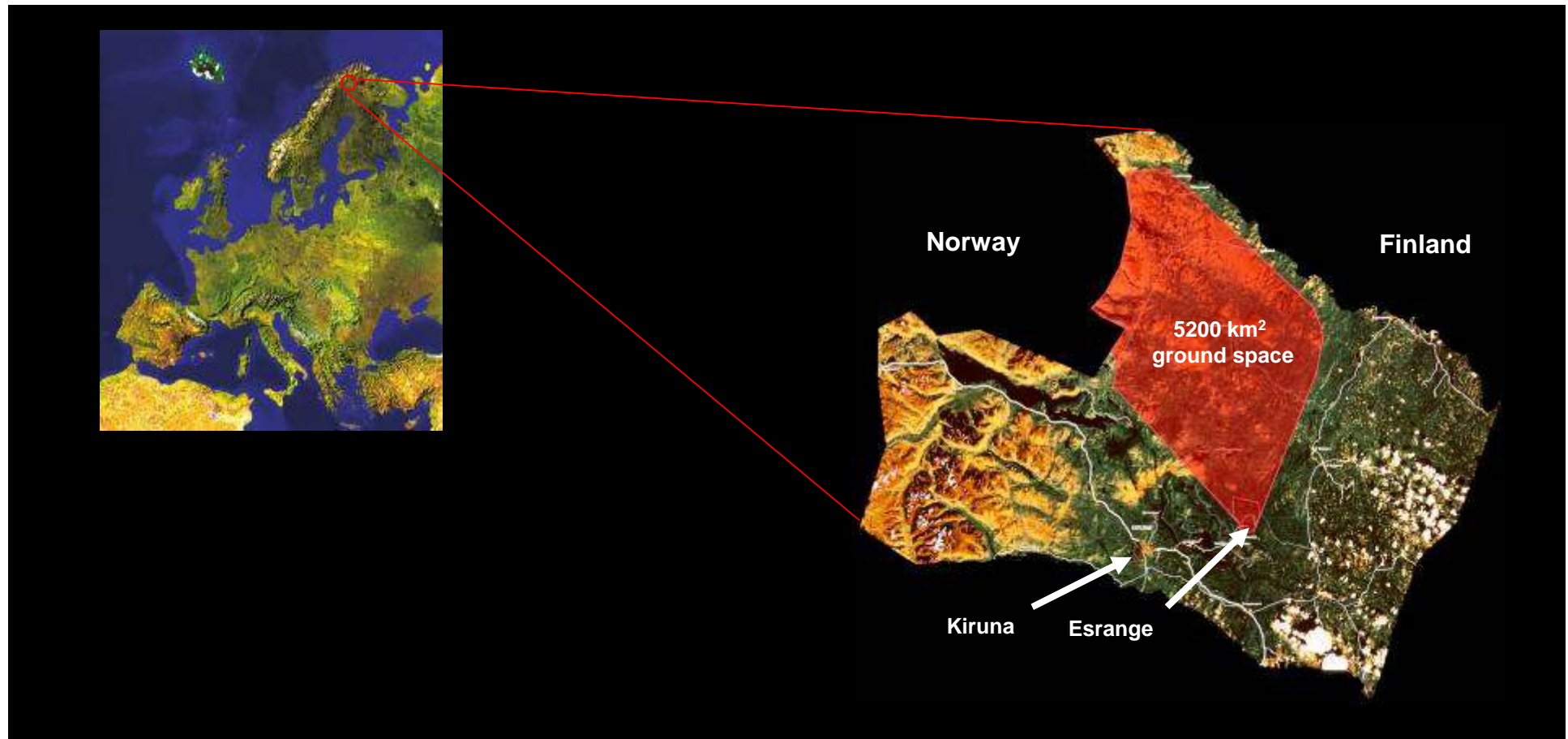
# ESRANGE SPACE CENTER - 68°N, 21°E

- Established in 1966 by ESRO (now ESA)
- Owned and operated by SSC since 1972
- Launch services
  - Sounding rockets
  - High altitude balloons
- Hosts one of the world's largest civilian satellite ground station (hub in SSC Universal Space Network)

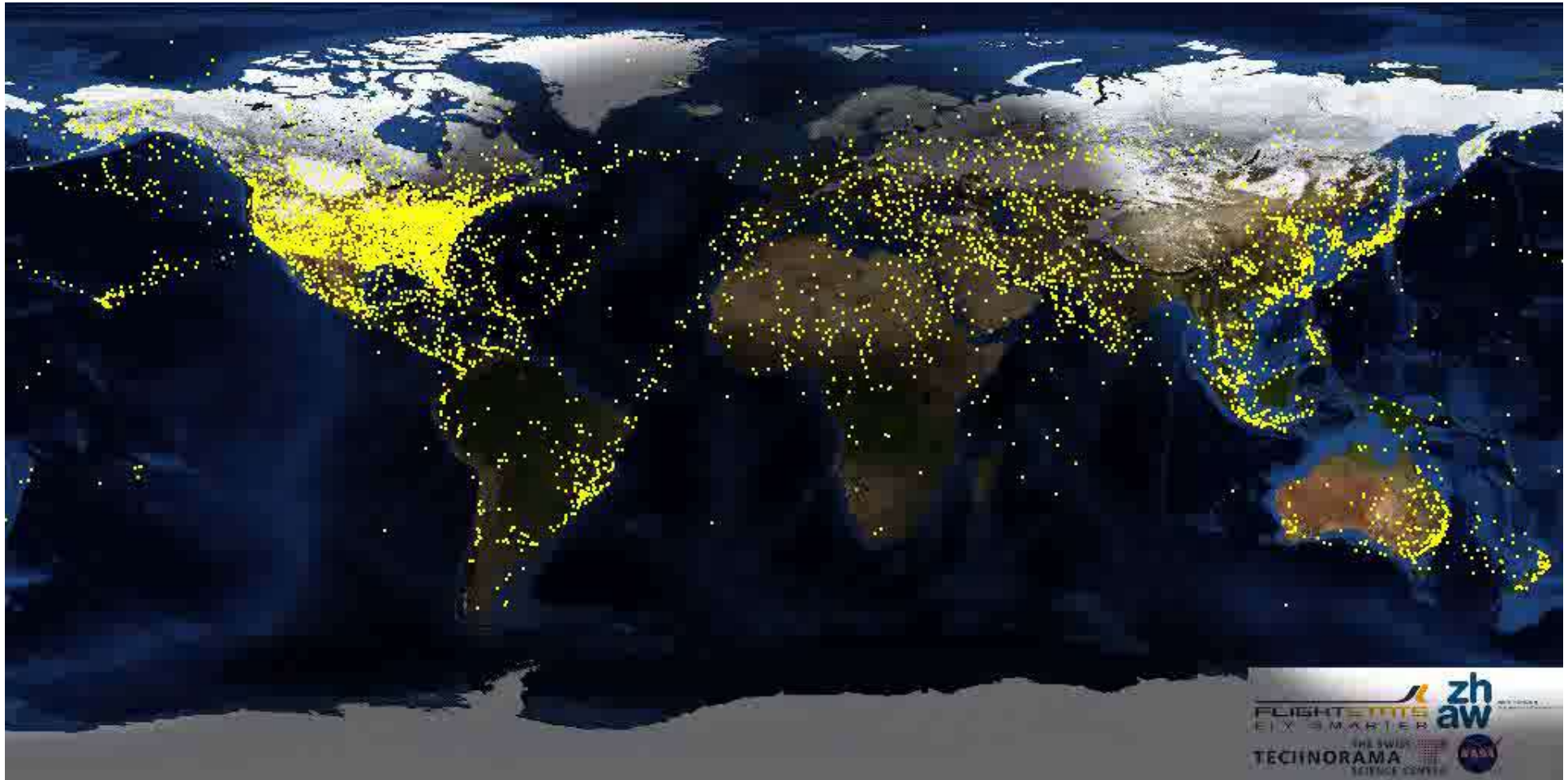




# ESRANGE SPACE CENTER - 67.9°N - 21.1°E

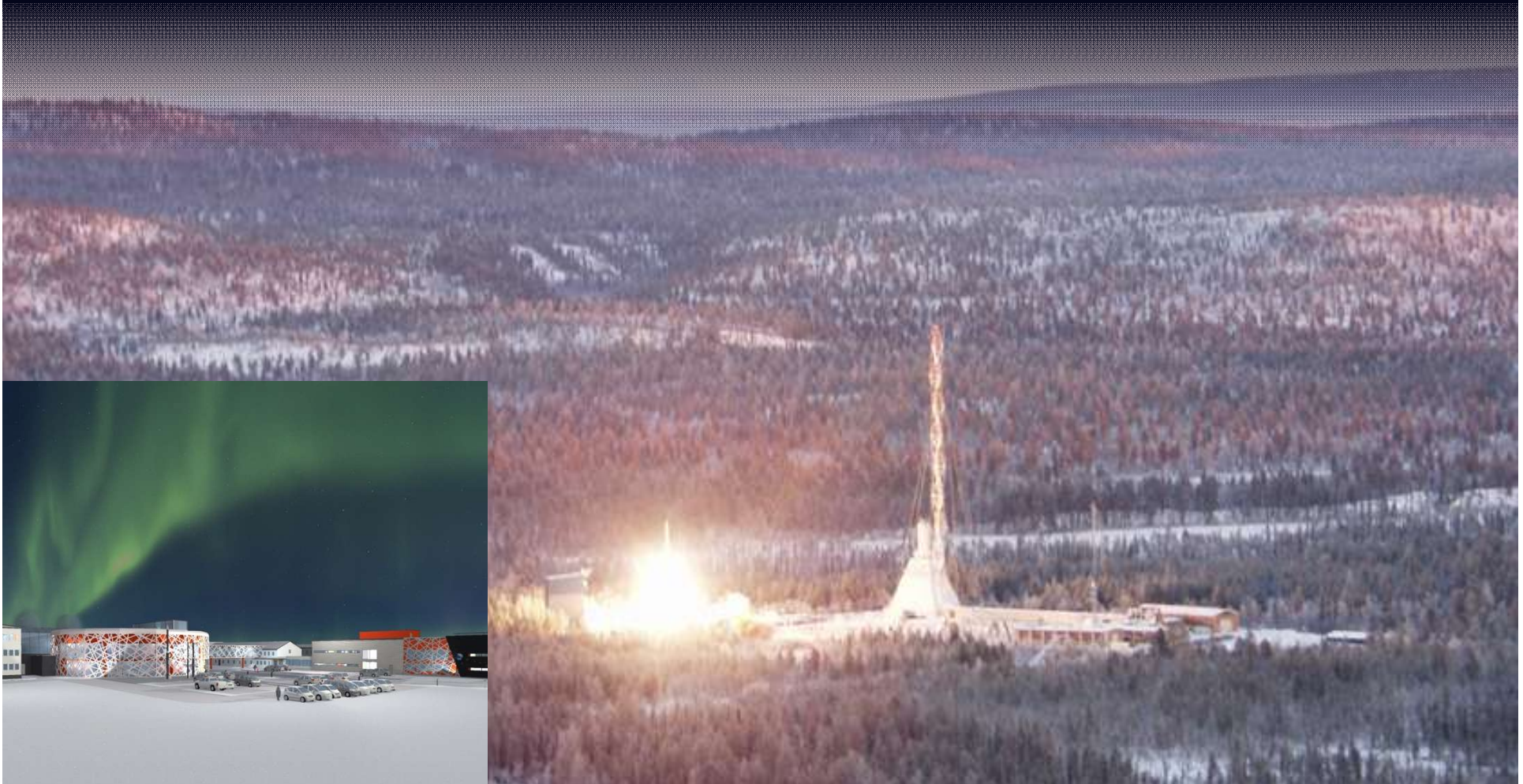


# GLOBAL AIR TRAFFIC





# New Esrange



# SMALLSAT EXPRESS



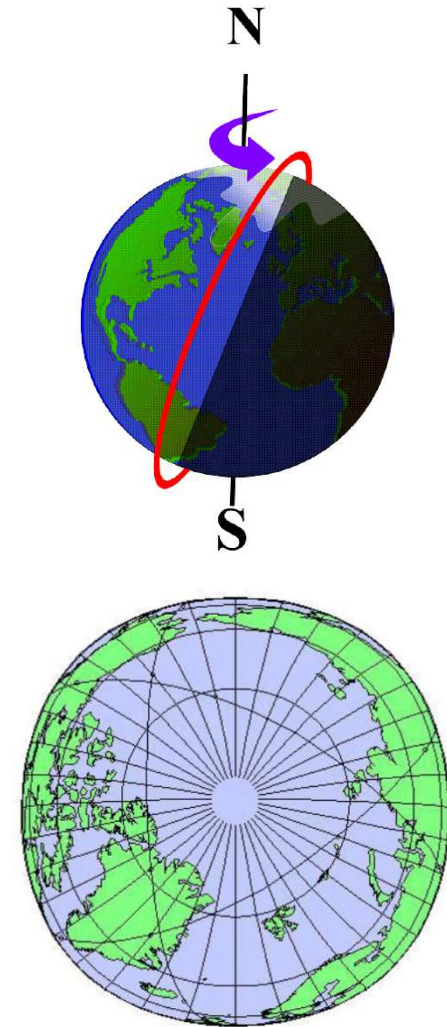
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# SMALLSAT EXPRESS CONCEPT:

- 1 -  $\approx 200$  kg satellites. 1-50 kg are main target payloads
- Standardized sun synchronous orbit:
  - $h=500$  km,  $i=97,4^\circ$
  - Ascending node at 2200, 0600, and 1400 local solar time
- Fixed launch periods
- Deploy a constellation in three consecutive launches covering every local time
- “Green” launch site, no hydrazine



# SMALLSAT EXPRESS PROJECT STATUS





# SMALLSAT EXPRESS PROJECT STATUS

- Phase A study completed

Result: it is technically feasible to implement a satellite launch service at Esrange

- Phase B1 study completed

Aimed for political endorsement, mainly in Sweden and obtaining data for different launch vehicle options

Result: National coordinator appointed

Brazilian/German VLM launcher base case but not final decision, other launcher alternatives will be considered...



# NEXT STEP

- Phase B2 study
  - Project manager for New Esrange recruited
  - Further investigation and selection of launcher(s)
  - Flight safety risk assessment based on selected launcher(s)
  - Infrastructure design at Esrange
  - Orbit raiser design (concept and main engine). ECAPS' High Performance Green Propulsion, the preferable choice for an orbit raiser

**Goal: Launch small satellites from Esrange by 2020-2021**





# LAUNCH VEHICLE REQUIREMENTS

- Payload 100 -  $\approx$ 200 kg to 500 – 600 km SSO
- No toxic propellants (Hydrazine etc.)
- Launches all around the year (low temperatures  $\approx$  -20°C)
- Ascent restrictions
  - First stage impact
  - Second stage ignition and impact
  - "Dog leg" capability
- Ground launch
- Track record of three successful launches
- First launch from Esrange around 2020



# Localization of downrange stations



# VEHICLE PROPERTIES

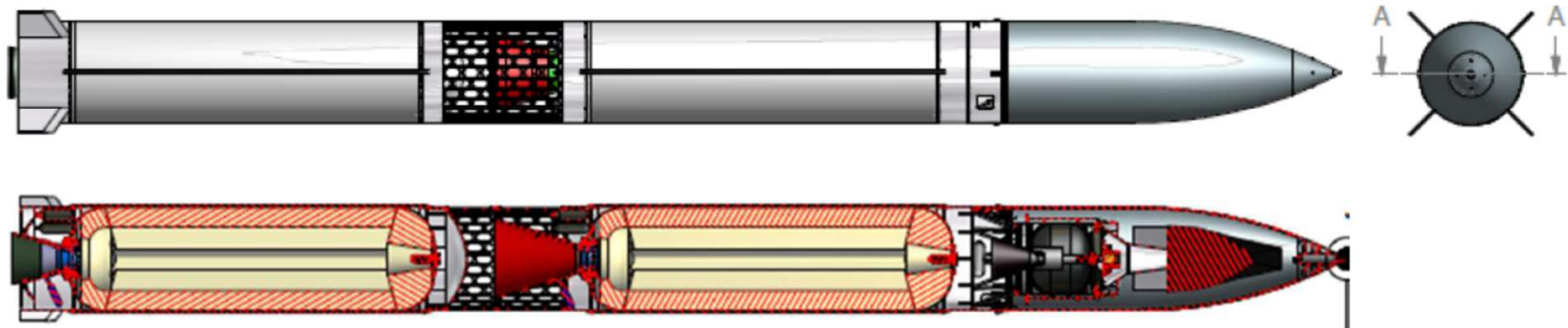


## Structural Hardware Specifications/Targets

- \* VLM-1 Lift-Off Configuration consists of three stages each of which encompasses specific stage elements.
- \* Overall Length 18,910 mm
- \* Diameter 1,460 mm
- \* Lift-Off Mass *(preliminary estimate)* 28,500 kg
- \* Payload
  - ✦ Suborbital (500 kg)
  - ✦ Orbital (< 200 kg)

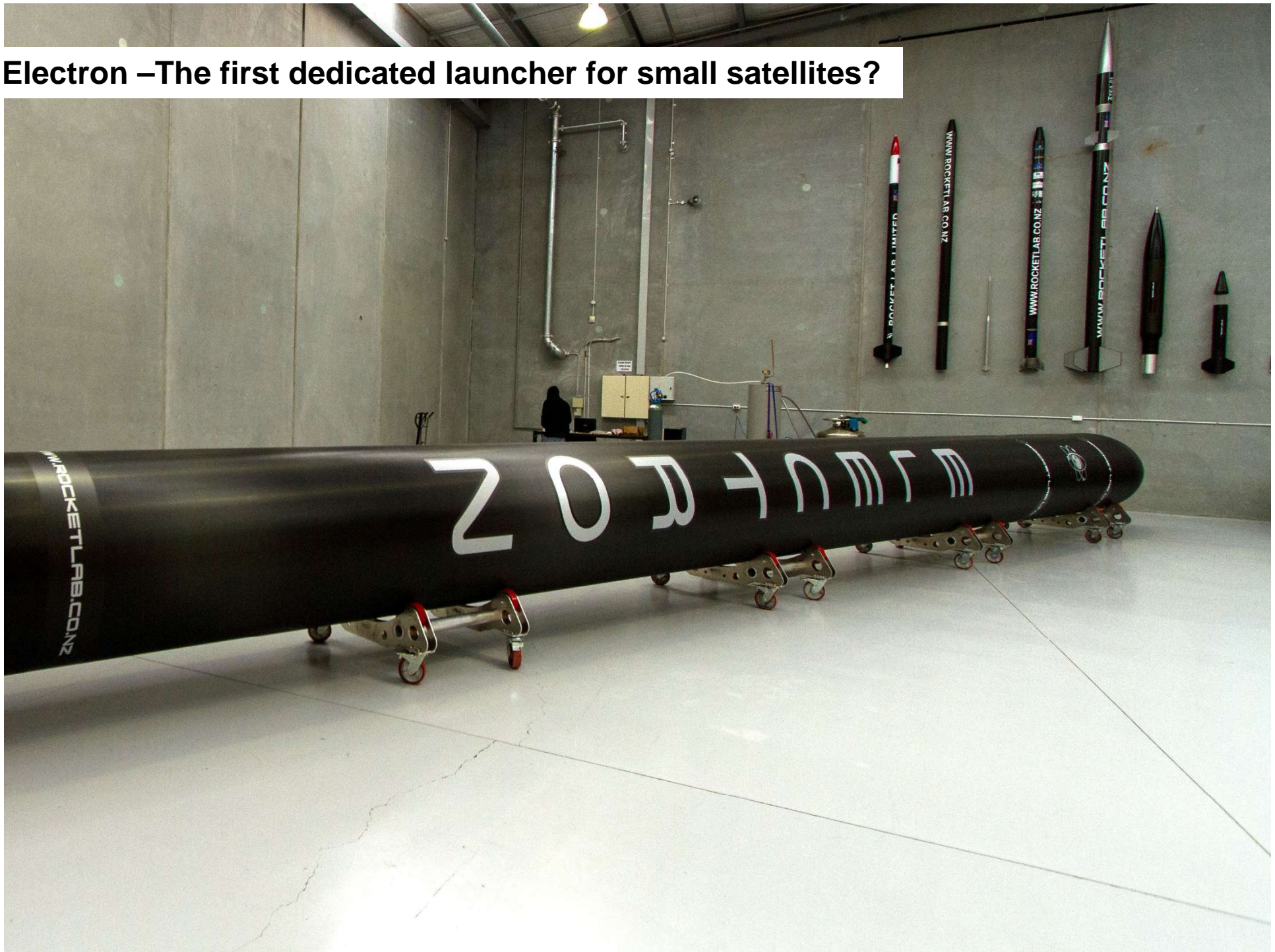


## Current VLM-1 Layout





## Electron – The first dedicated launcher for small satellites?

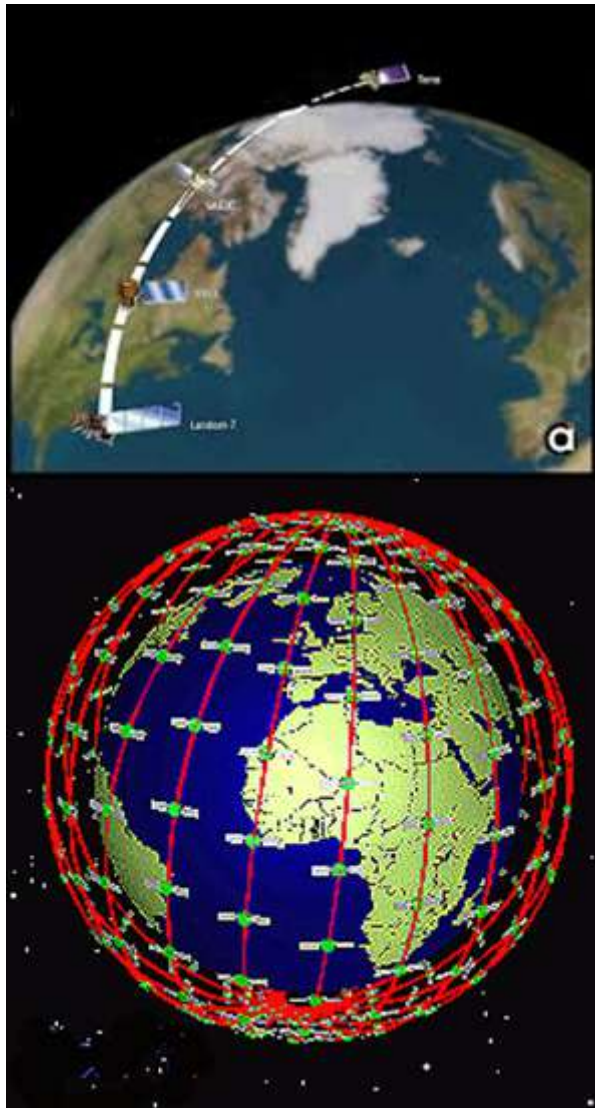


# CRITICAL PREREQUISITES AND CHALLENGES

- Support from the Swedish Government
- Overflight over Norway
- Help with financing SmallSat Express project and of the additional infrastructure needed for SmallSat Express
- A Sustainable Business concept







*In response to a complex and growing need, SSC is has announced a service dedicated to cubesat, smallsat, and constellation applications.*



*SSC Infinity opens the door to low-cost access to a worldwide network of antennas that are equipped to meet the needs of the most demanding smallsat projects and satellite constellations.*









# ESRANGE ÅR 2021

# EN ÖGONBLICKSBILD

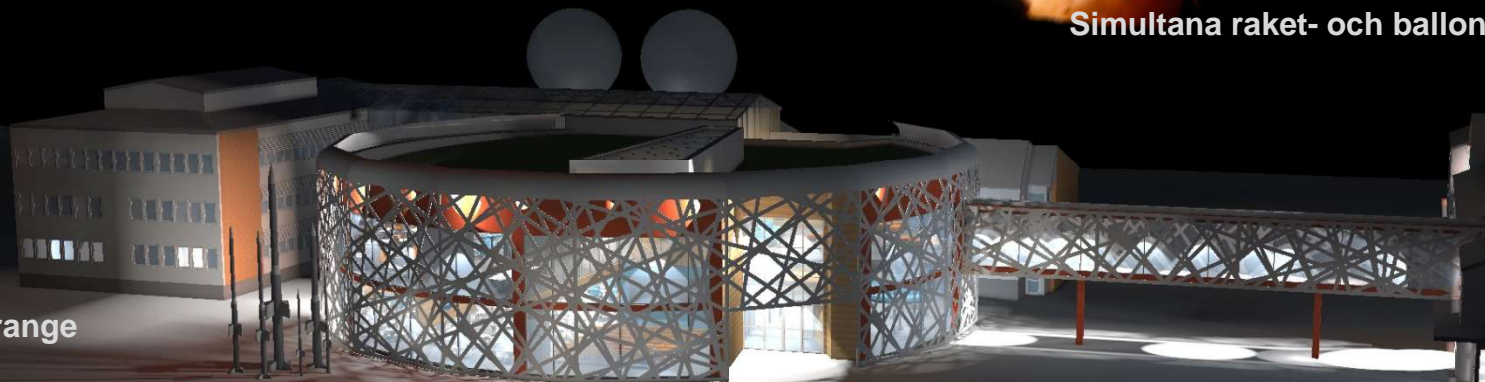
... 3, 2, 1, Lift-off!

"Grön" uppskjutningsplats



Simultana raket- och ballong kampanjer.

På Esrange



Markbaserade forskningsinstrument

På plats för långvariga projekt

Via internet

Satellitjänster



# WE HELP EARTH BENEFIT FROM SPACE



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