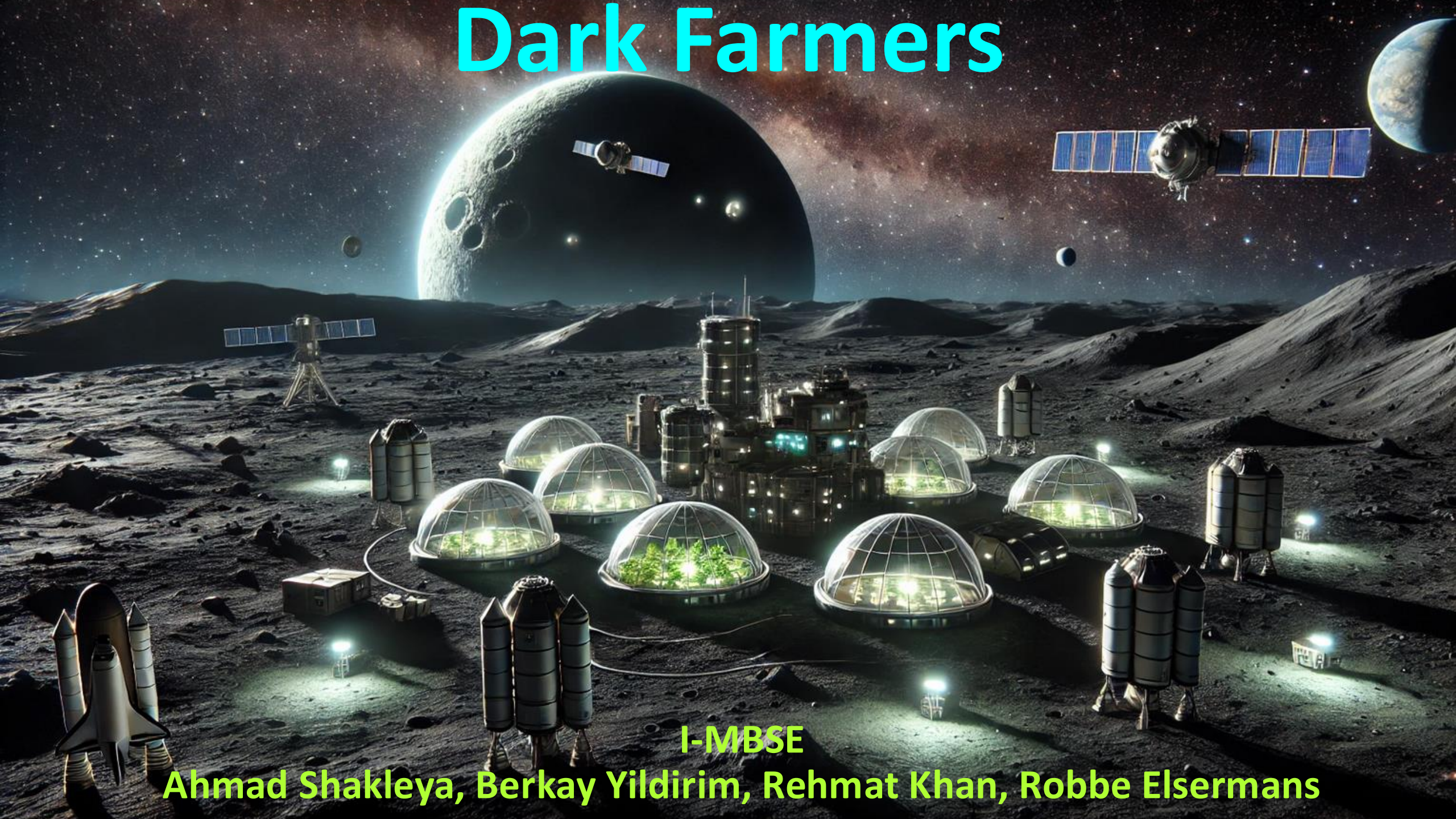
# Dark Farmers



I-MBSE

Ahmad Shakleya, Berkay Yildirim, Rehmat Khan, Robbe Elsermans

# Mission

- **Experimental farm module on the dark side of Mun**

# System requirements and constrains

- **Bring experimental farm module to Mun**
  - Weight: 4000 Kilograms
  - Energy: 0.29 EC/s
- **Provide constant communication between Kerbin and Mun**
  - An emergency communication interval of 10 minutes
  - A normal communication interval of 30 minutes
  - 3 Mit/s
- **No return vessel nor reusability of used components**
- **No kerbin onboard**
- **Delta-V of 5150 m/s -> 5922 m/s (+15%)**
- **Budget -> It is in the name of science!** **(we want to be faster than the Russians)**

# System requirements and constrains

## Budget

ChatGPT-chat

Given budget by: Chief Financial Officer: Lye G. Batenkaitos

| Estimation costs | |
|---|---|
| **Category** | **Funds (F)** |
| Farm Module | 45 000 |
| Satellite Network | 12 000 |
| Launch Vehicle | 60 000 |
| Transfer Stage | 25 000 |
| Contingency (10%) | 16 000 |
| **Estimation costs** | 158 000 |

# System requirements and constrains

ChatGPT-chat antenna

ChatGPT-chat EC

## Farm Power - Decisions

Given energy consumption by: Chief Agricultural Scientist: Regulus G. Corneas

**Farm module energy EC/day** 39 765

| Module Energy Consumption | | | | |
|---|---|---|---|---|
| **Item** | **EC/Sec** | **Number** | **duration/s** | **Total (Energy) / day** |
| Communotron 16 | 18 | 1 | 231,64 | 4 169.52 |
| Farm Module | 0,28611207 | 1 | 138 984,00 | 39 765 |

**Total EC Consumption** **43 934.52 EC/day**

**Total EC Consumption** **0.31611207 EC/day**

# System requirements and constrains

## Farm Power - Decisions

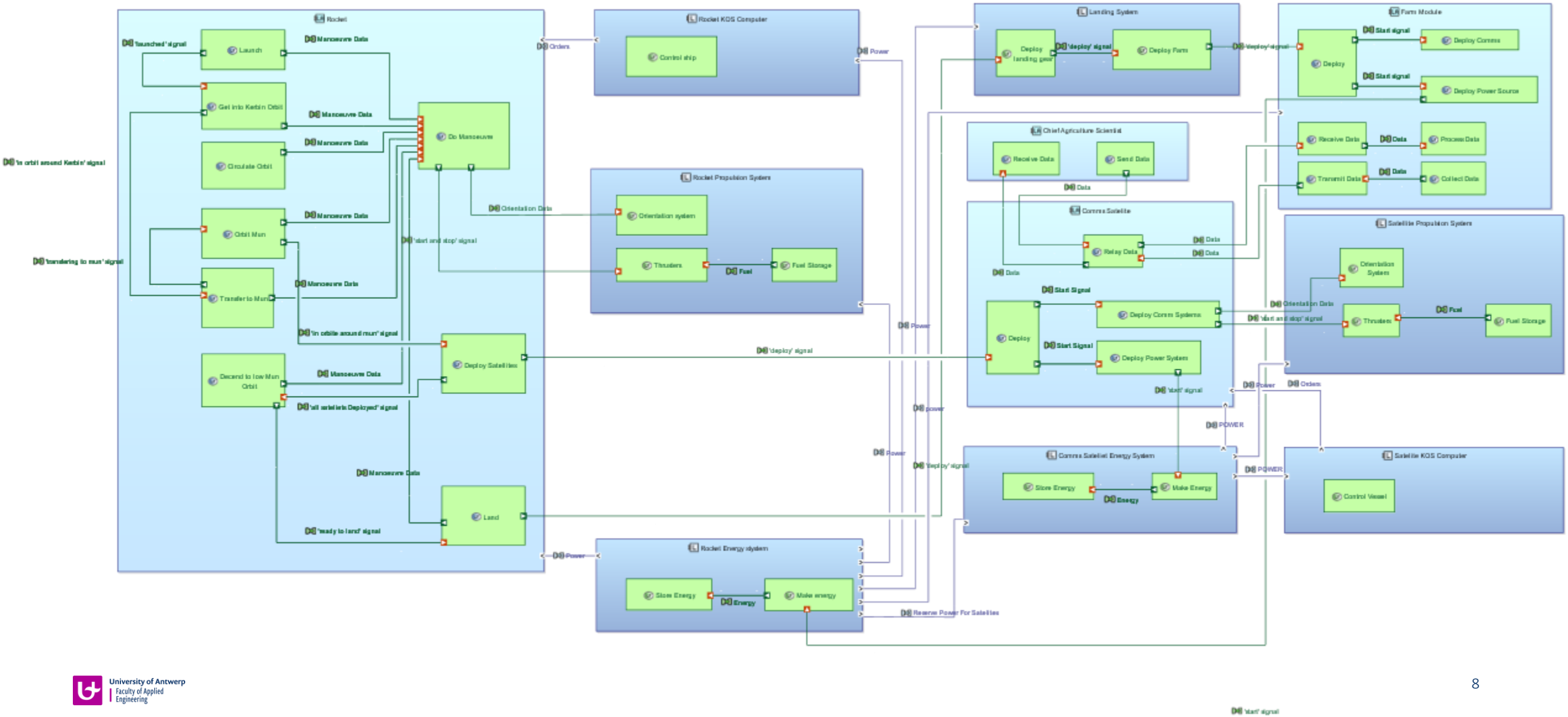
| Module Energy Storage | | | |
|---|---|---|---|
| **Item** | **Energy storage (EC)** | **Number** | **Total capacity (EC)** |
| Big round battery | 4 000 | 6 | 24 000 |

**Battery Load (%)** 91.53025

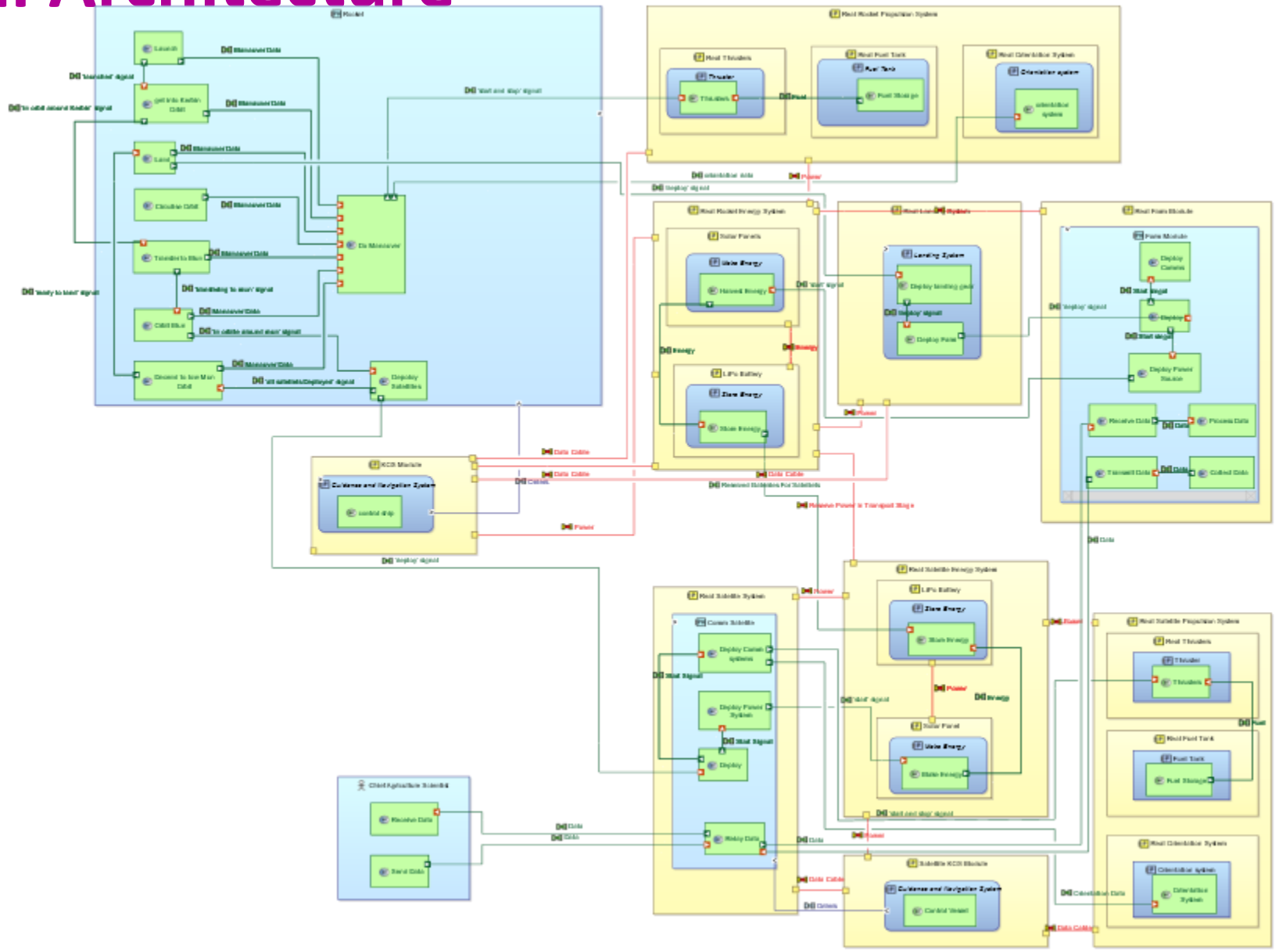
**Total charge needed in daytime:** 43 934.52

| Module Energy Harvesting | | | | | |
|---|---|---|---|---|---|
| **Item** | **EC/sec** | **Number** | **Duration/day (s)** | **Total harvested energy (EC)** | **Charge of battery (%)** |
| Gigantor XL Solar Array | 24,4 | 1 | 69 492 | 1 695 604,8 | 3 819,118965 |
| OX-STAT-XL Photovoltaic Panels | 2,8 | 1 | 69 492 | 194 577,6 | 438,2595534 |
| OX-STAT Photovoltaic Panels | 0,35 | 3 | 69 492 | 729 66,6 | 166,0803396 |
| SP-L 1x6 Photovoltaic Panels | 1,64 | 1 | 69 492 | 113 966,88 | 256,6948813 |

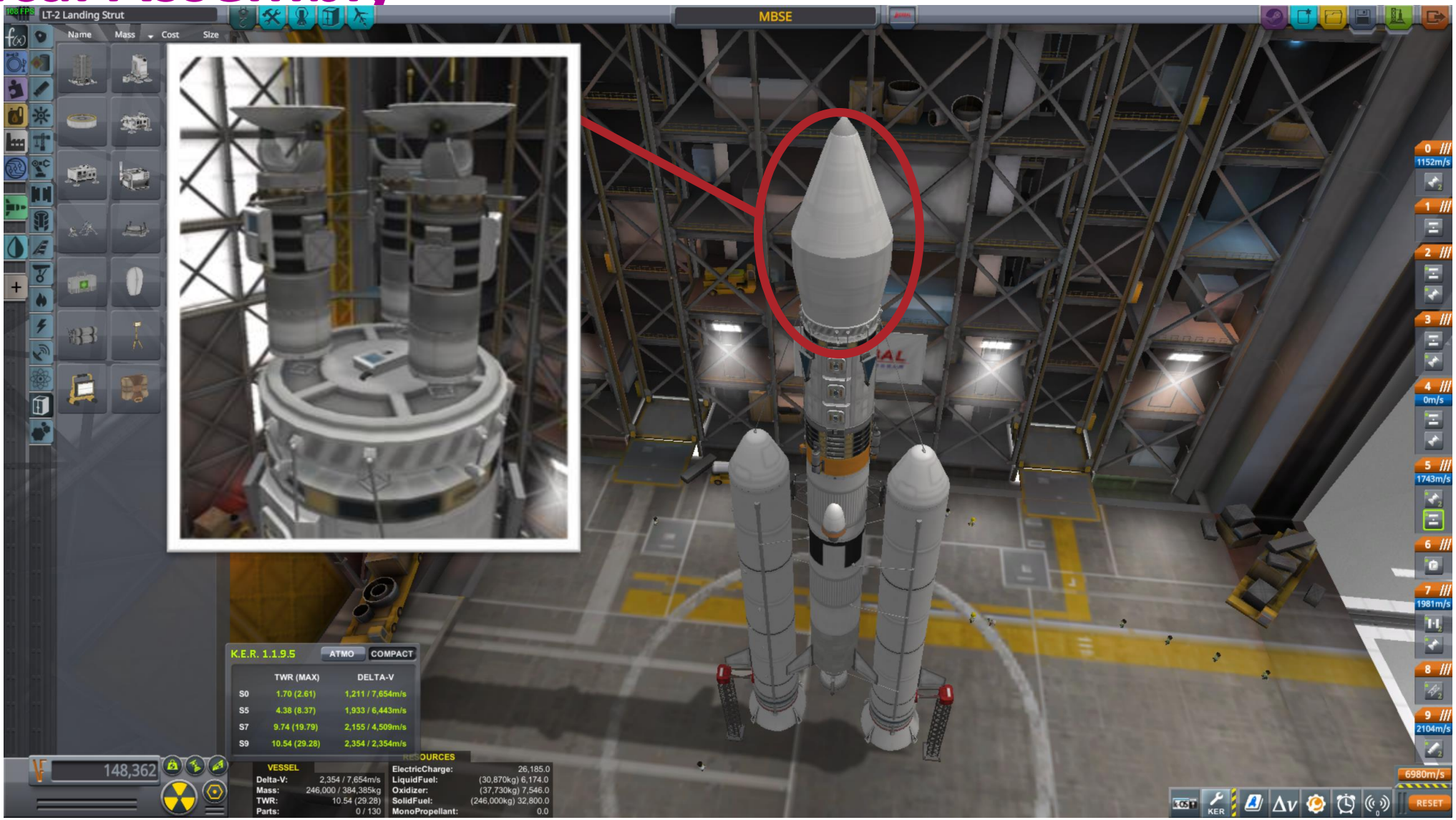
# Logical Architecture



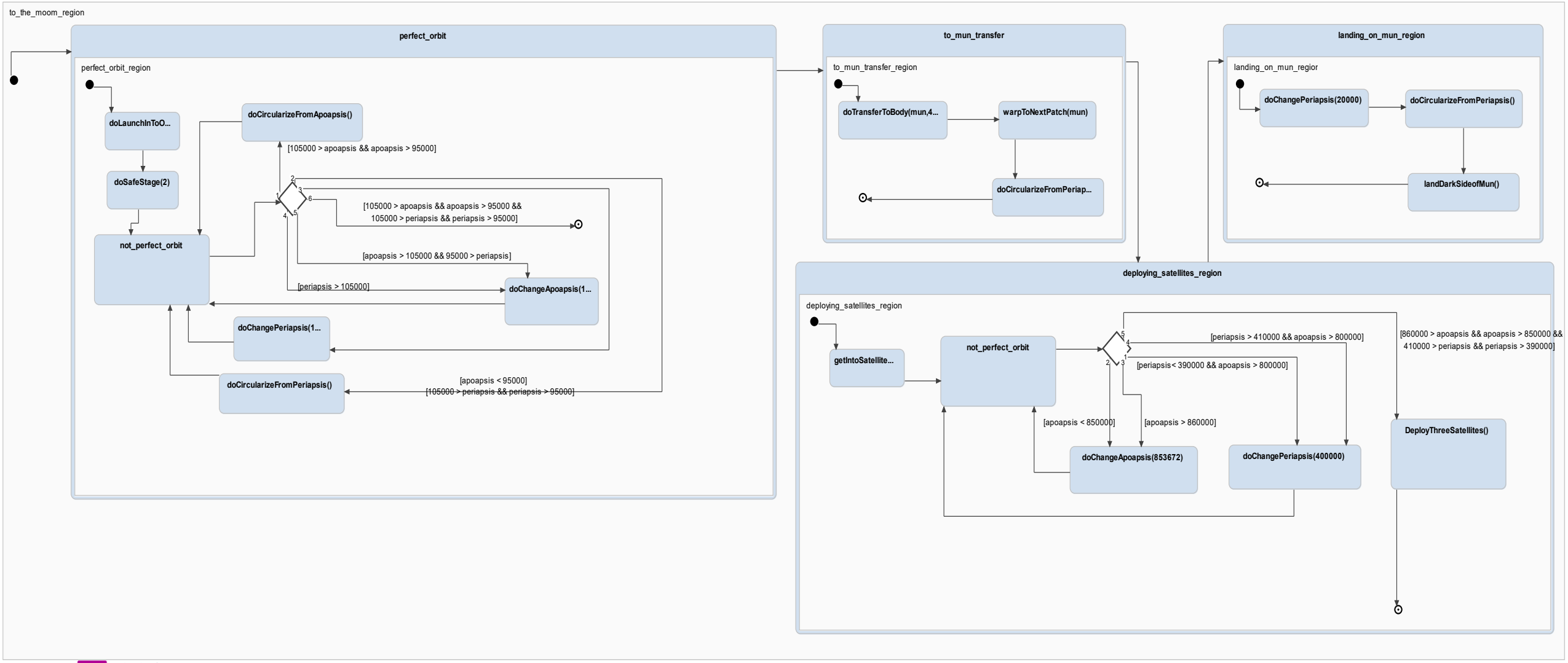
# Physical Architecture



# Physical Assembly



# Controller Architecture



# Demo

# Budget - Outcome

| Category | Funds (F) | difference with estimation |
|---|---|---|
| Farm Module | 43618,8 | 1381,2 |
| Satellite Network | 28916,92 | -16916,92 |
| Launch Vehicle | 43532,8 | 16467,2 |
| Transfer Stage | 6170 | 18830 |
| total dry parts cost | 122238,52 | |

| Resources | Weight(kg) | price per kg (F/kg) | price (F) |
|---|---|---|---|
| MonoPropolent | 0 | 0,3 | 0 |
| LiquidFuel | 30870 | 0,16 | 4939,2 |
| Oxidizer | 37730 | 0,04 | 1509,2 |
| SolidFuel | 246000 | 0,08 | 19680 |
| | | | **26128,4** |

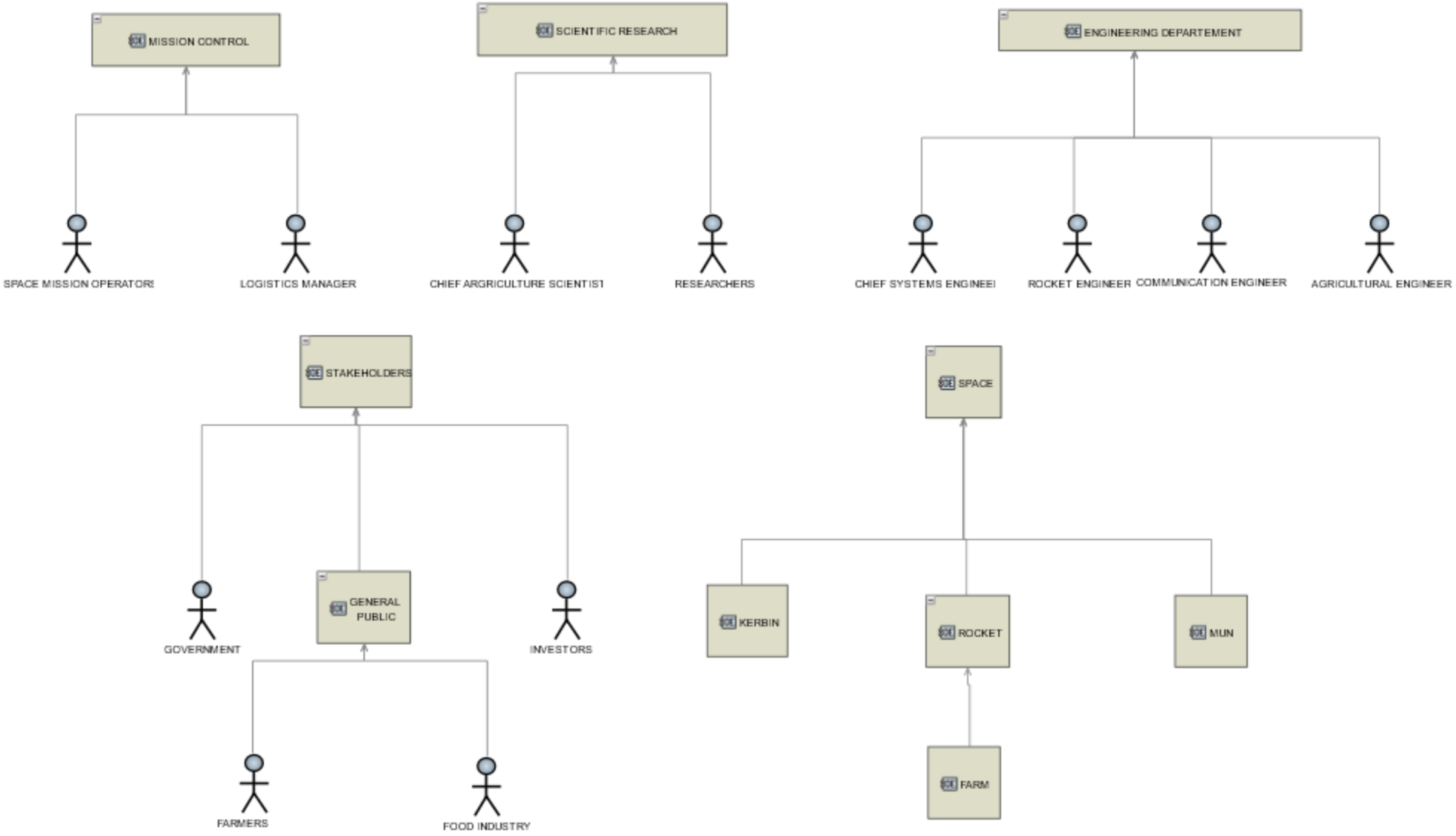
Total: 148 366,92 F

budget leftover 9633,08 F

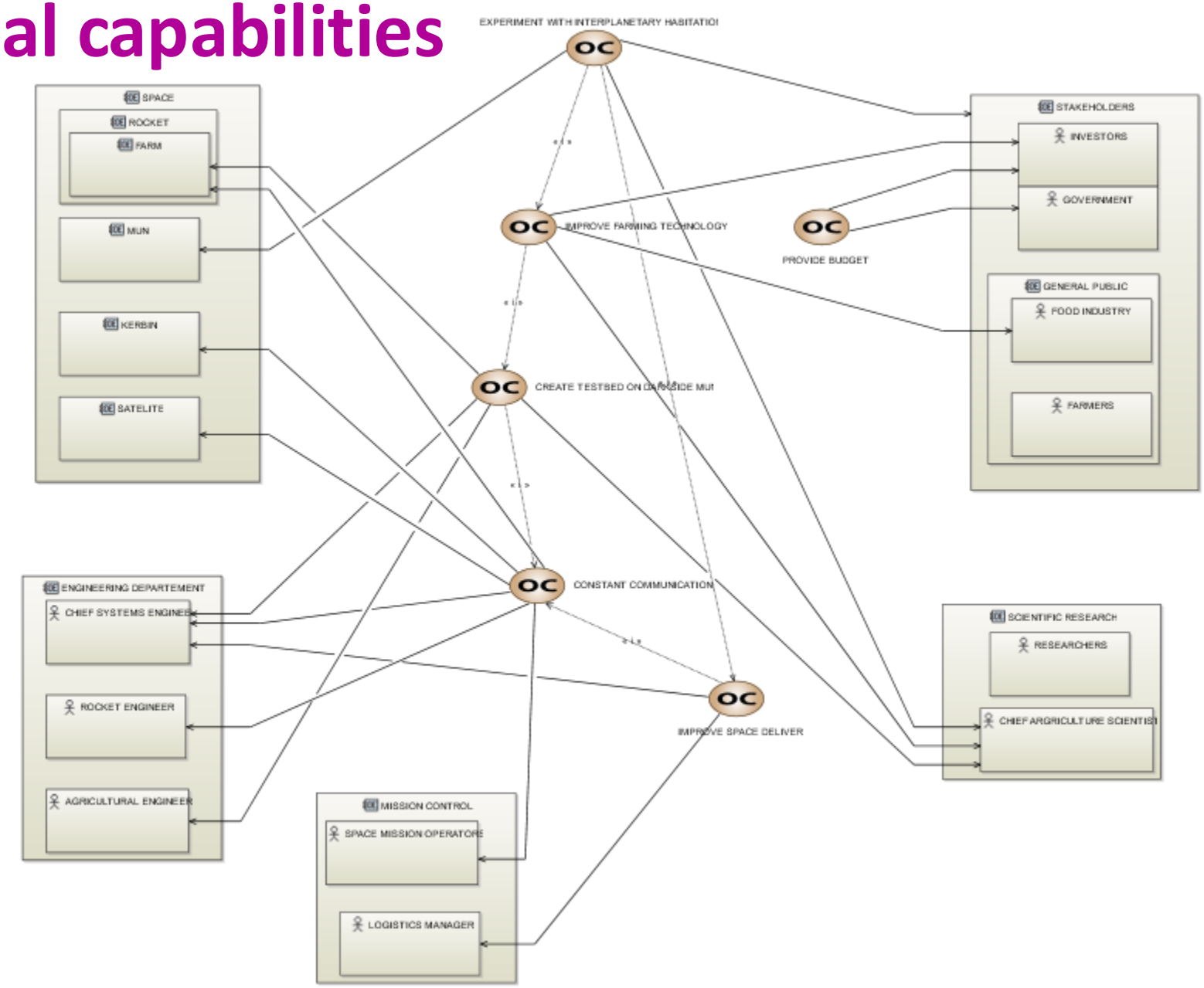
Excel workdocument

| Cost per used part (dry) | | | | |
|---|---|---|---|---|
| Part | Am | Cost | Category | Sub-tota |
| 24-77 "Twitch" Liquid Fuel Engine | 2 | 230 | Farm Module | 460 |
| Communotron 16 | 1 | 300 | Farm Module | 300 |
| LT-2 Landing Strut | 3 | 340 | Farm Module | 1020 |
| Mk2 Lander Can | 3 | 3202 | Farm Module | 9606 |
| OX-10C Photovoltaic Panels | 4 | 1200 | Farm Module | 4800 |
| Rockomax X200-8 Fuel Tank | 1 | 432,8 | Farm Module | 432,8 |
| Z-4K Rechargeable Battery Bank | 6 | 4500 | Farm Module | 27000 |
| Delta-Deluxe Winglet | 5 | 600 | Launch Vehicle | 3000 |
| EAS-4 Strut Connector | 39 | 42 | Launch Vehicle | 1638 |
| Protective Rocket Nose Cone Mk7 | 2 | 450 | Launch Vehicle | 900 |
| RE-M3 "Mainsail" Liquid Fuel Engine | 1 | 13000 | Launch Vehicle | 13000 |
| Rockomax Jumbo-64 Fuel Tank | 1 | 2812,4 | Launch Vehicle | 2812,4 |
| Rockomax X200-32 Fuel Tank | 2 | 1531,2 | Launch Vehicle | 3062,4 |
| S2-33 "Clydesdale" Solid Fuel Booster | 2 | 8660 | Launch Vehicle | 17320 |
| TT18-A Launch Stability Enhancer | 2 | 200 | Launch Vehicle | 400 |
| TT-70 Radial Decoupler | 2 | 700 | Launch Vehicle | 1400 |
| 48-7S "Spark" Liquid Fuel Engine | 3 | 240 | Satellite Network | 720 |
| AE-FF2 Airstream Protective Shell (2,5m) | 1 | 600 | Satellite Network | 600 |
| Communotron 16-S | 3 | 300 | Satellite Network | 900 |
| CompoMax Radial Tubeless (kOS) | 4 | 2200 | Satellite Network | 8800 |
| Cubic Octagonal Strut | 7 | 16 | Satellite Network | 112 |
| Octagonal Strut | 1 | 20 | Satellite Network | 20 |
| Oscar-B Fuel Tank | 3 | 51,64 | Satellite Network | 154,92 |
| OX-4W 3x2 Photovoltaic Panels | 6 | 380 | Satellite Network | 2280 |
| Probodobodyne OKTO2 | 3 | 1480 | Satellite Network | 4440 |
| RA-2 Relay Antenna | 3 | 1800 | Satellite Network | 5400 |
| Small Inline Reaction Wheel | 3 | 600 | Satellite Network | 1800 |
| TD-06 Decoupler | 3 | 150 | Satellite Network | 450 |
| Z-200 Rechargeable Battery Bank | 9 | 360 | Satellite Network | 3240 |
| Fairing Construction Estemate | 1 | 530 | Transfer Stage | 530 |
| Mk-55 "Thud" Liquid Fuel Engine | 2 | 820 | Transfer Stage | 1640 |
| RC-L01 Remote Guidance Unit | 1 | 3400 | Transfer Stage | 3400 |
| TD-25 Decoupler | 2 | 300 | Transfer Stage | 600 |
| | | | dry part total | 122238,5 |

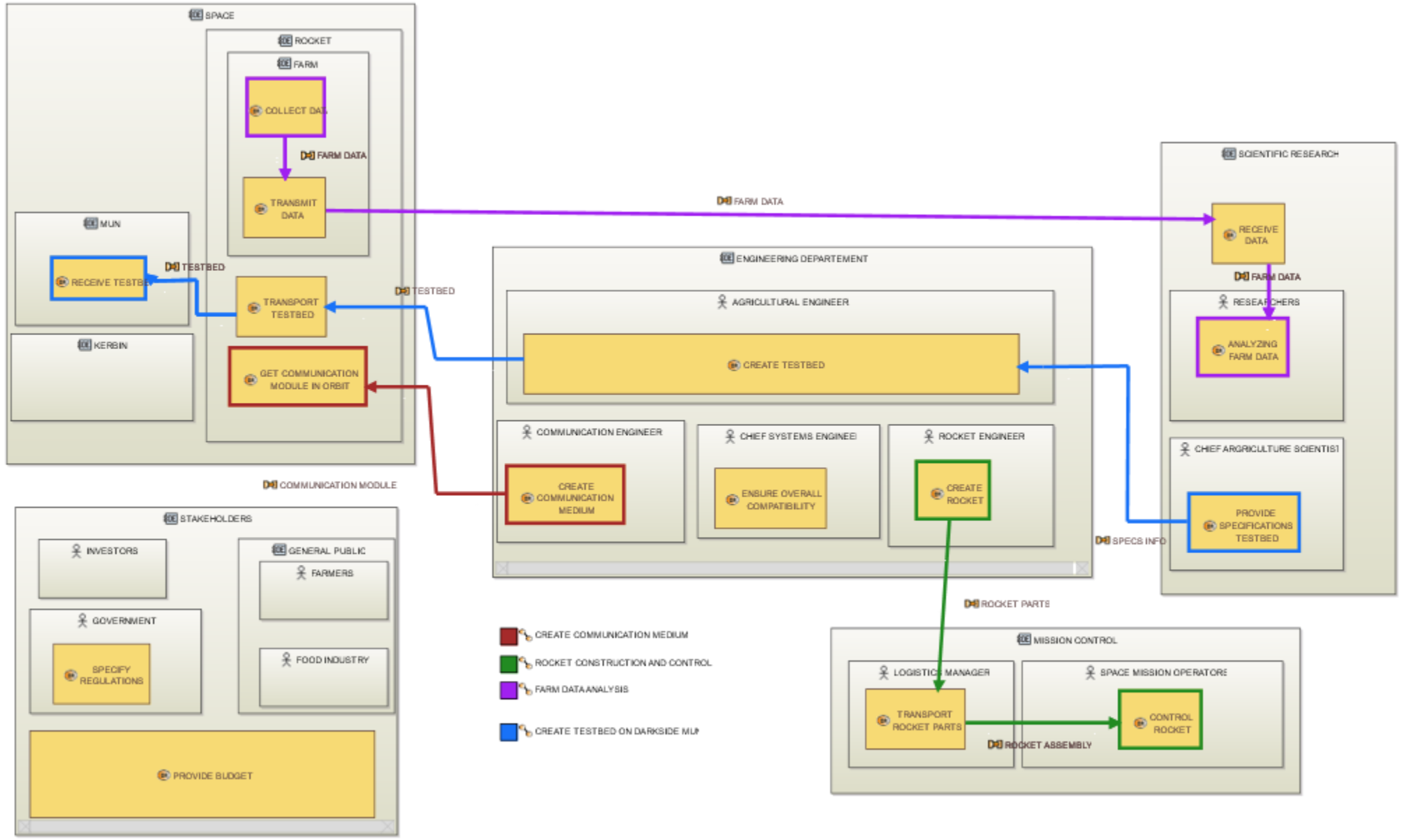
# Operational entities



# Operational capabilities



# Operational architecture




LT-2 Landing Strut
Name
Mass
Cost
Size
MBSE
K.E.R. 1.1.9.5
ATMO
COMPACT
TWR (MAX)
DELTA-V
S0 1.70 (2.61) 1,211 / 7,047m/s
S4 3.25 (5.03) 1,303 / 5,836m/s
S7 9.80 (20.02) 2,172 / 4,532m/s
S9 10.55 (29.39) 2,360 / 2,360m/s
147,836
VESSEL
Delta-V: 2,360 / 7,047m/s
Mass: 246,000 / 383,859kg
TWR: 10.55 (29.39)
Parts: 0 / 130
RESOURCES
ElectricCharge: 26,185.0
LiquidFuel: (30,870kg) 6,174.0
Oxidizer: (37,730kg) 7,546.0
SolidFuel: (246,000kg) 32,800.0
MonoPropellant: 0.0
0 1152m/s
1
2
3 0m/s
4 1175m/s
5
6
7 1997m/s
8
9 2109m/s
6434m/s
KER
RESET