팀명:Multiplanetary

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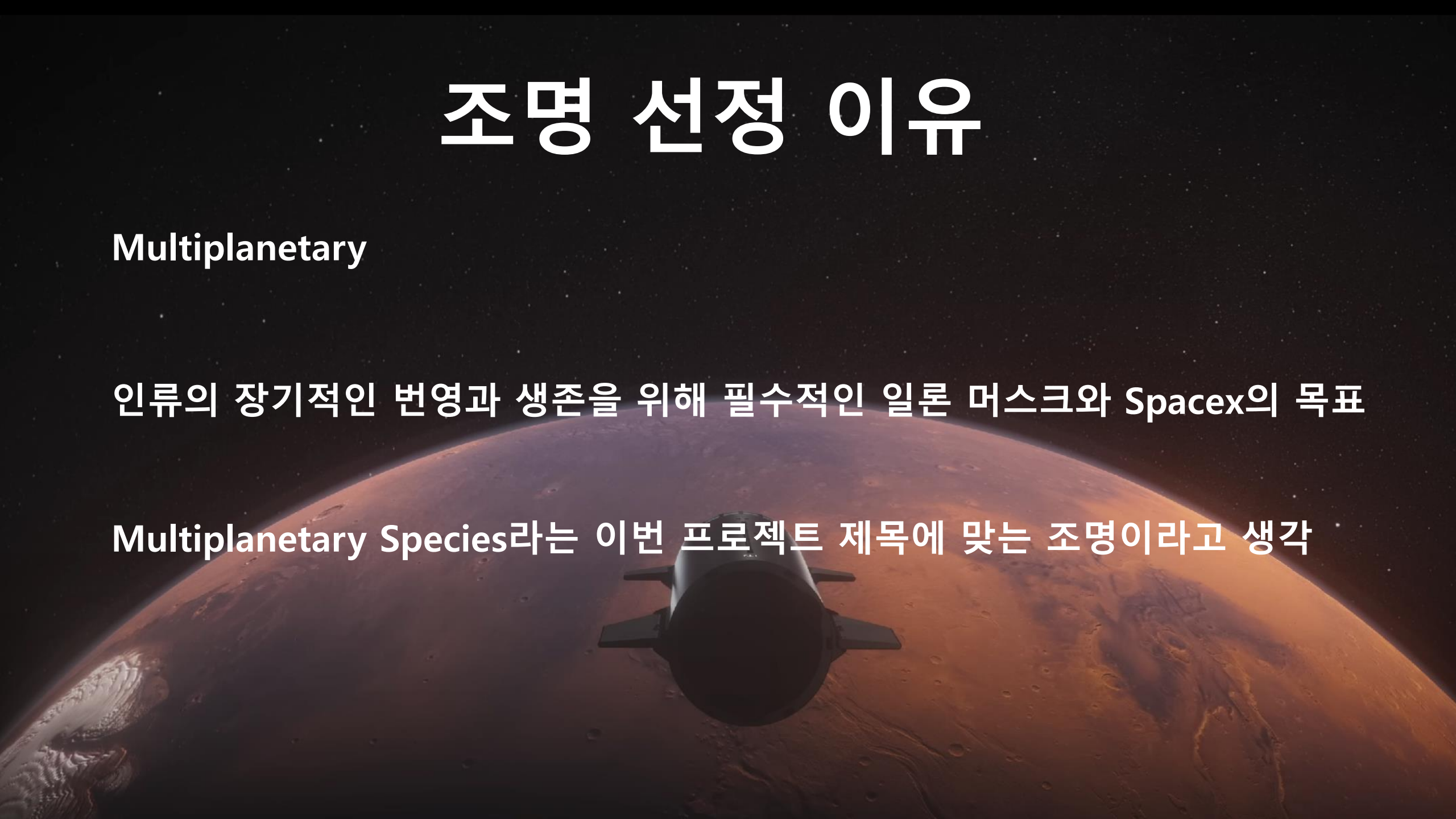
조명 선정 이유

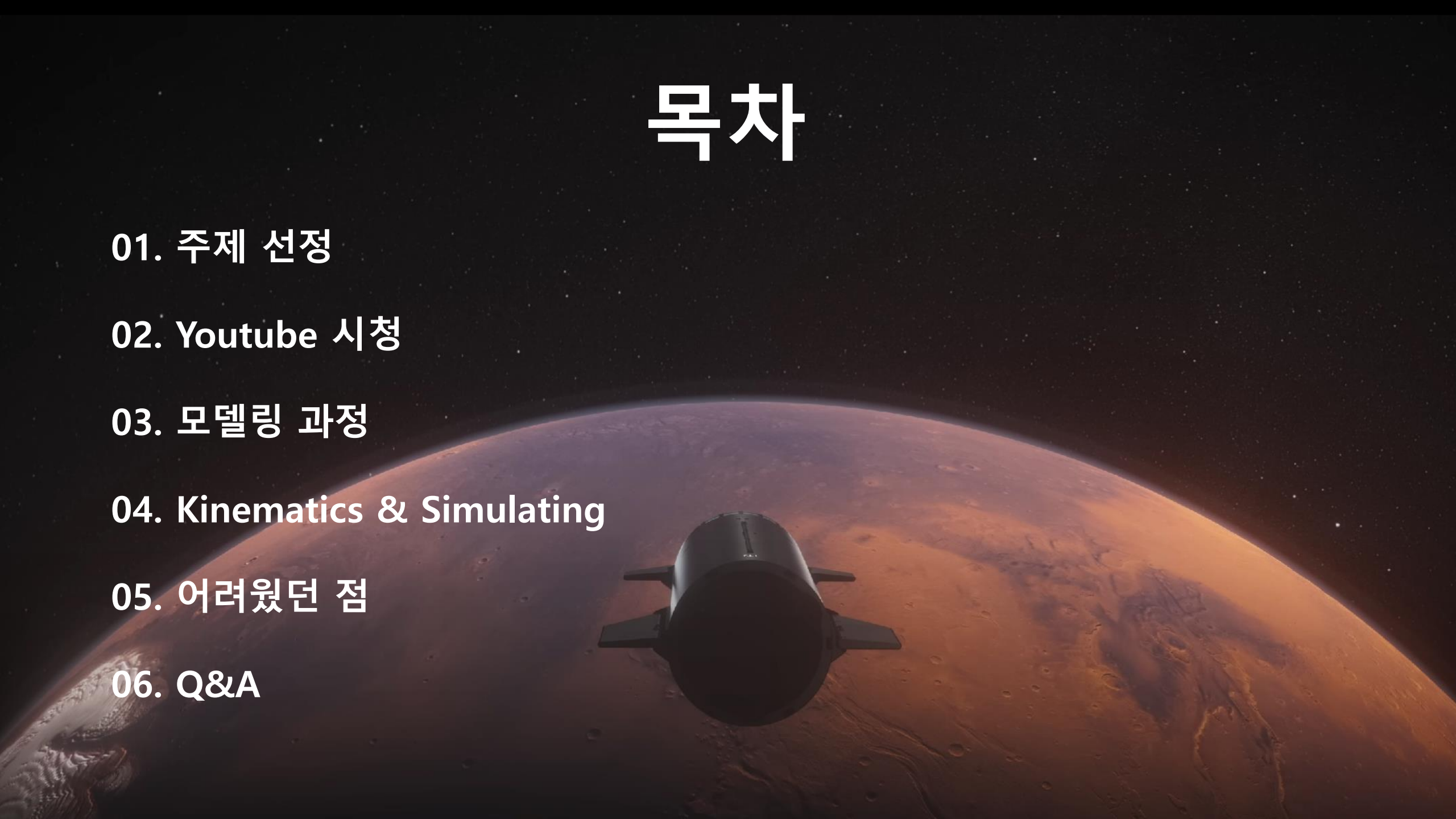
Multiplanetary

인류의 장기적인 번영과 생존을 위해 필수적인 일론 머스크와 Spacex의 목표

Multiplanetary Species라는 이번 프로젝트 제목에 맞는 조명이라고 생각



목차



01. 주제 선정

02. Youtube 시청

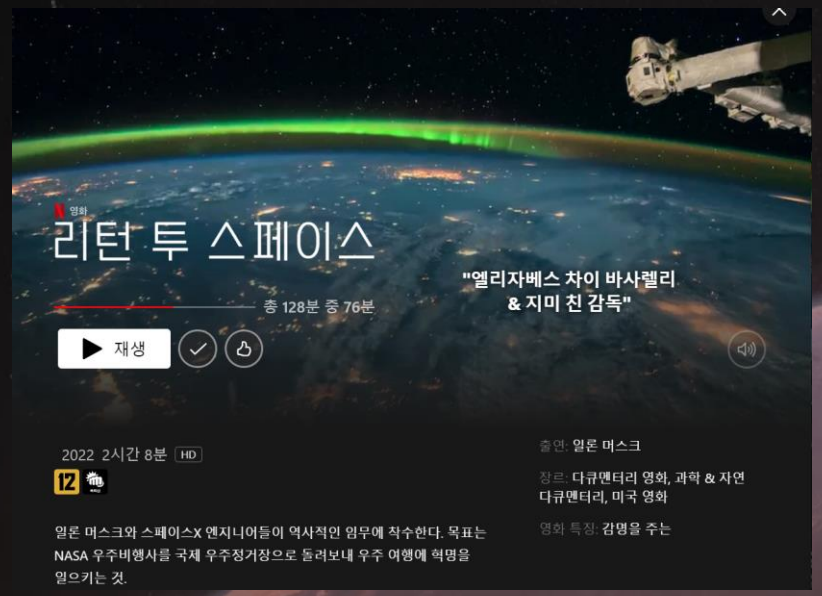
03. 모델링 과정

04. Kinematics & Simulating

05. 어려웠던 점

06. Q&A

01. 주제 선정



1. 최근 <리턴 투 스페이스>라는 다큐멘터리를 시청한 후 흥미를 갖게 됨
2. 마침 누리호 2차 발사 성공했고, 최근 화두에 있는 우주 탐사에 관련된 주제로 결정
3. 두개로 나눠진 우주선의 분리와 착륙이 CATIA로 구현하기 좋다고 판단
4. Space X에서 만들고 있는 우주선과 엔진을 바탕으로 모델링함

02. Youtube
영상 시청

https://youtu.be/0SKEcOPdqfU

STARSHIP OVERVIEW

SpaceX's Starship spacecraft and Super Heavy rocket – collectively referred to as Starship – represent a fully reusable transportation system designed to carry both crew and cargo to Earth orbit, the Moon, Mars and beyond. Starship will be the world's most powerful launch vehicle ever developed, capable of carrying up to 150 metric tonnes fully reusable and 250 metric tonnes expendable.

HEIGHT	**120 m** / 394 ft
DIAMETER	**9 m** / 29.5 ft
PAYLOAD CAPACITY	**100 – 150 t** (fully reusable)

STARSHIP

Starship is the fully reusable spacecraft and second stage of the Starship system. The vehicle offers an integrated payload section and is capable of carrying crew and cargo to Earth orbit, the Moon, Mars and beyond. Starship is also capable of point-to-point transport on Earth, enabling travel to anywhere in the world in one hour or less.

HEIGHT	**50 m** / 164 ft
DIAMETER	**9 m** / 29.5 ft
PROPELLANT CAPACITY	**1,200 t** / 2.6 Mlb
THRUST	**1,500 tf** / 3.3Mlbf
PAYLOAD CAPACITY	**100 - 150 t**

SUPER HEAVY

Super Heavy is the first stage, or booster, of the Starship launch system. Powered by 33 Raptor engines using sub-cooled liquid methane (CH_4) and liquid oxygen (LOX), Super Heavy is fully reusable and will re-enter Earth's atmosphere to land back at the launch site.

HEIGHT	**69 m** / 226 ft
DIAMETER	**9 m** / 29.5 ft
PROPELLANT CAPACITY	**3,400 t** / 7.5 Mlb
THRUST	**7,590 tf** / 16.7 Mlbf

RAPTOR ENGINES

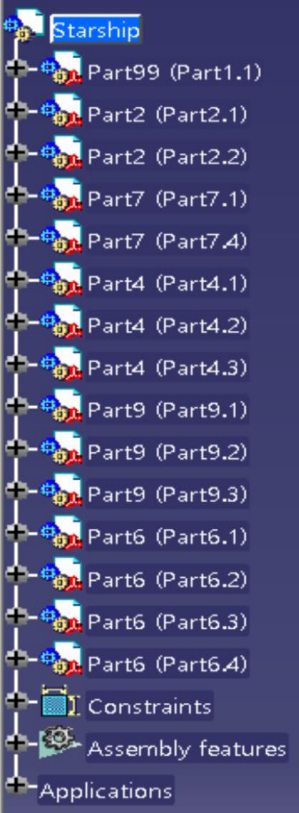
RAPTOR | RAPTOR VACUUM (RVAC)

The Raptor engine is a reusable methane-oxygen staged-combustion engine that powers the Starship system and has twice the thrust of the Falcon 9 Merlin engine. Starship will be powered by six engines, three Raptor engines, and three Raptor Vacuum (RVac) engines, which are designed for use in the vacuum of space. Super Heavy will be powered by 33 Raptor engines, with 13 in the center and the remaining 20 around the perimeter of the booster's aft end.

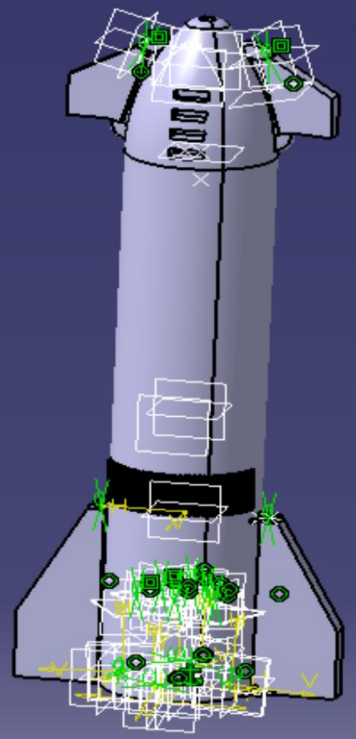
DIAMETER	**1.3 m** / 4.2 ft
HEIGHT	**3.1 m** / 10.2 ft
THRUST	**230 tf** / 507 klbf

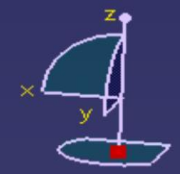
03 . Modeling

Starship



1. Starship Body
2. Upper Wing
3. Bottom Wing
4. Raptor Engine
5. Landing Leg

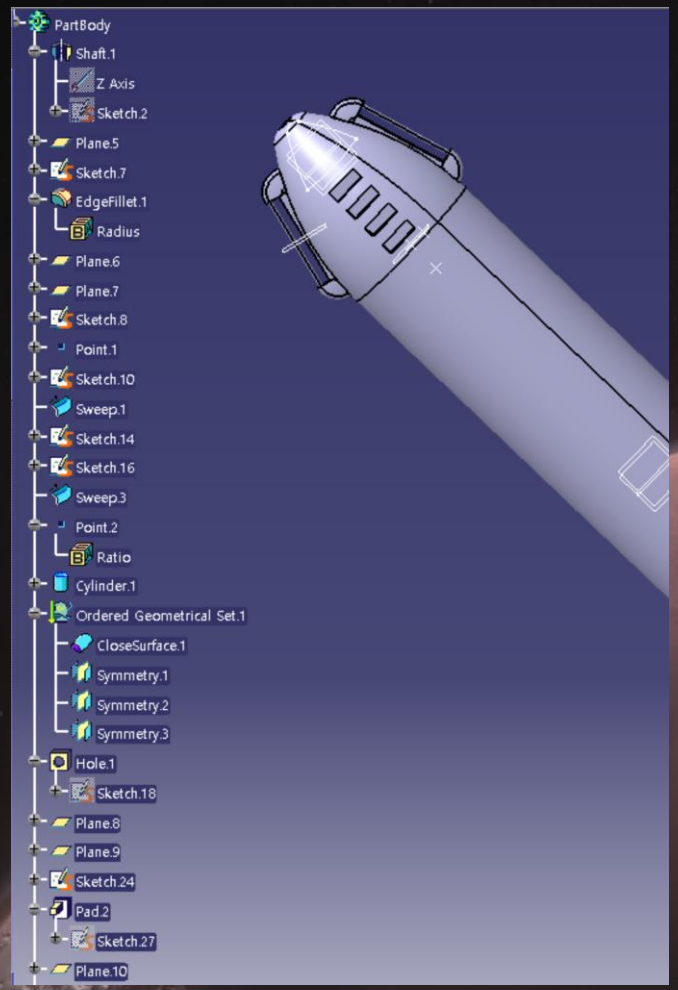


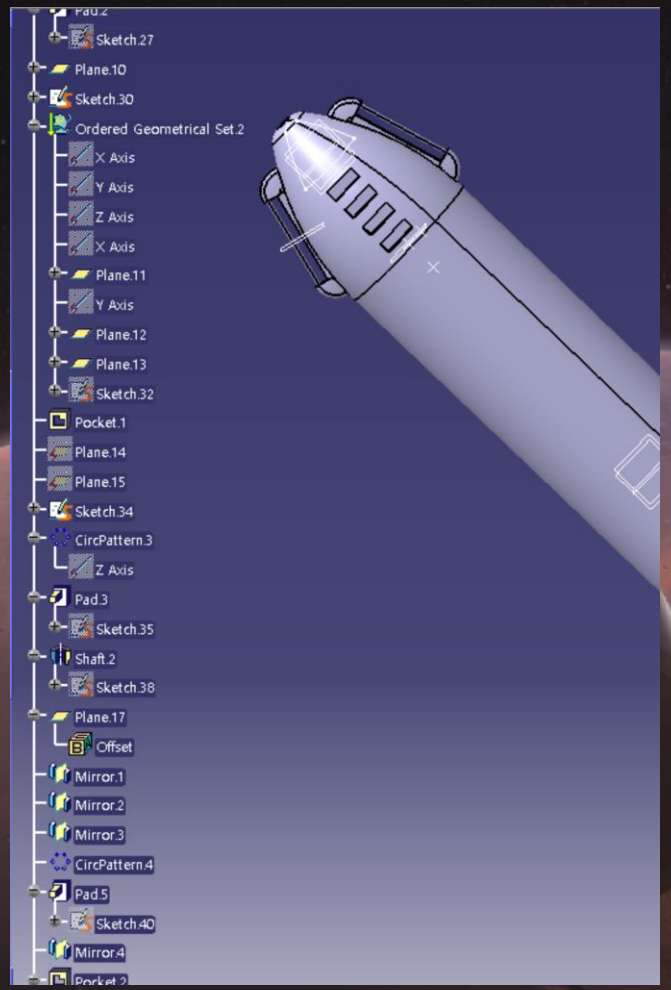


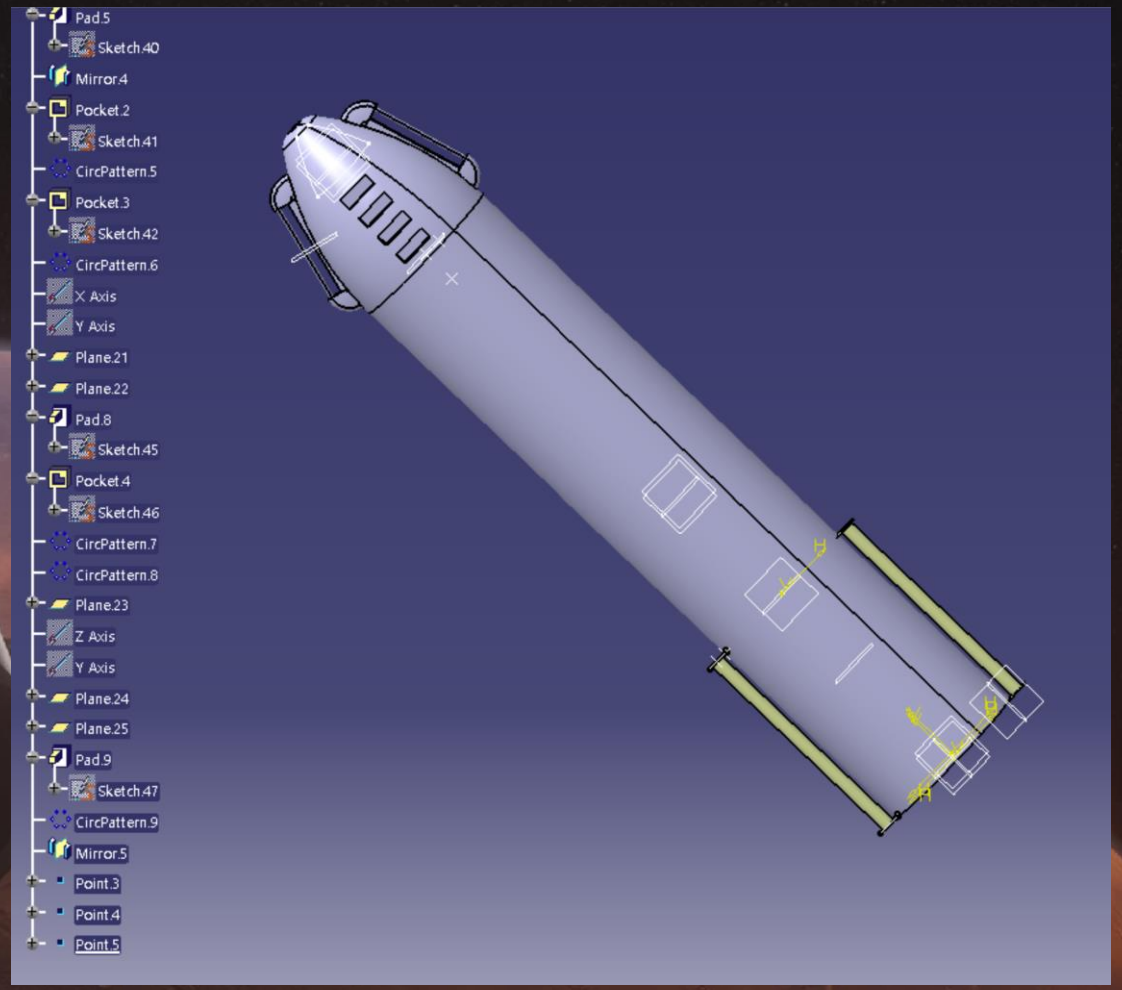
03 . Modeling

Starship

Starship Body



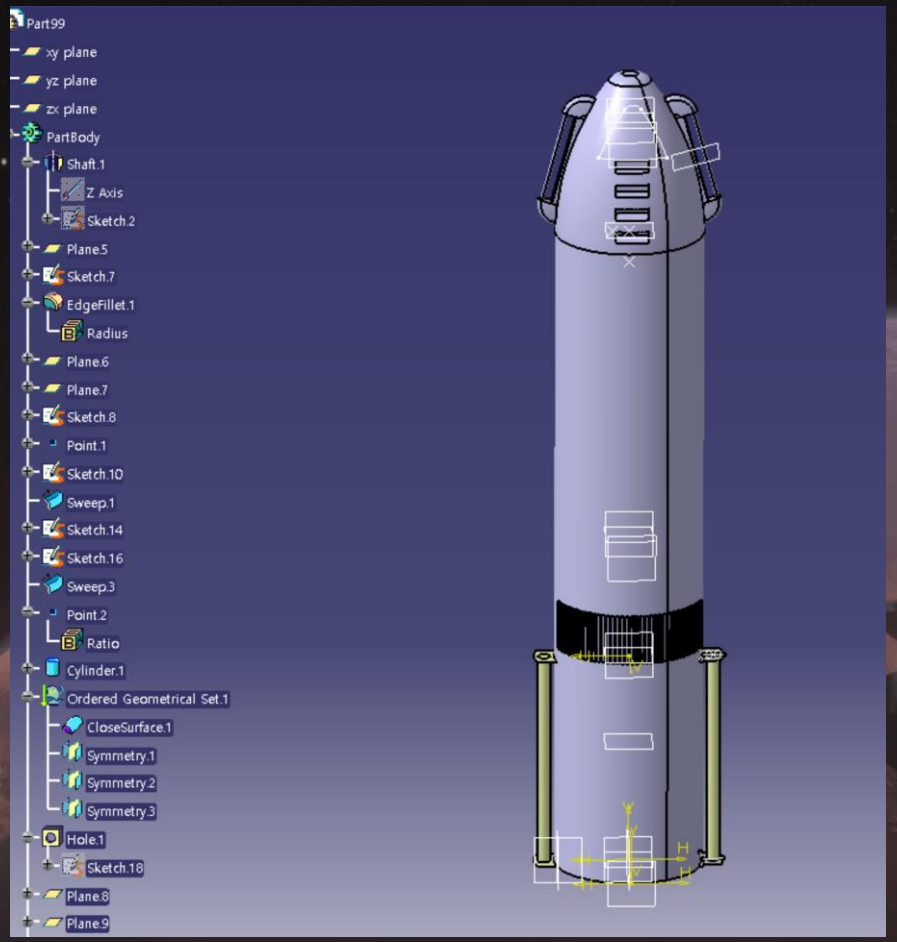




03 . Modeling

Starship

Starship Body

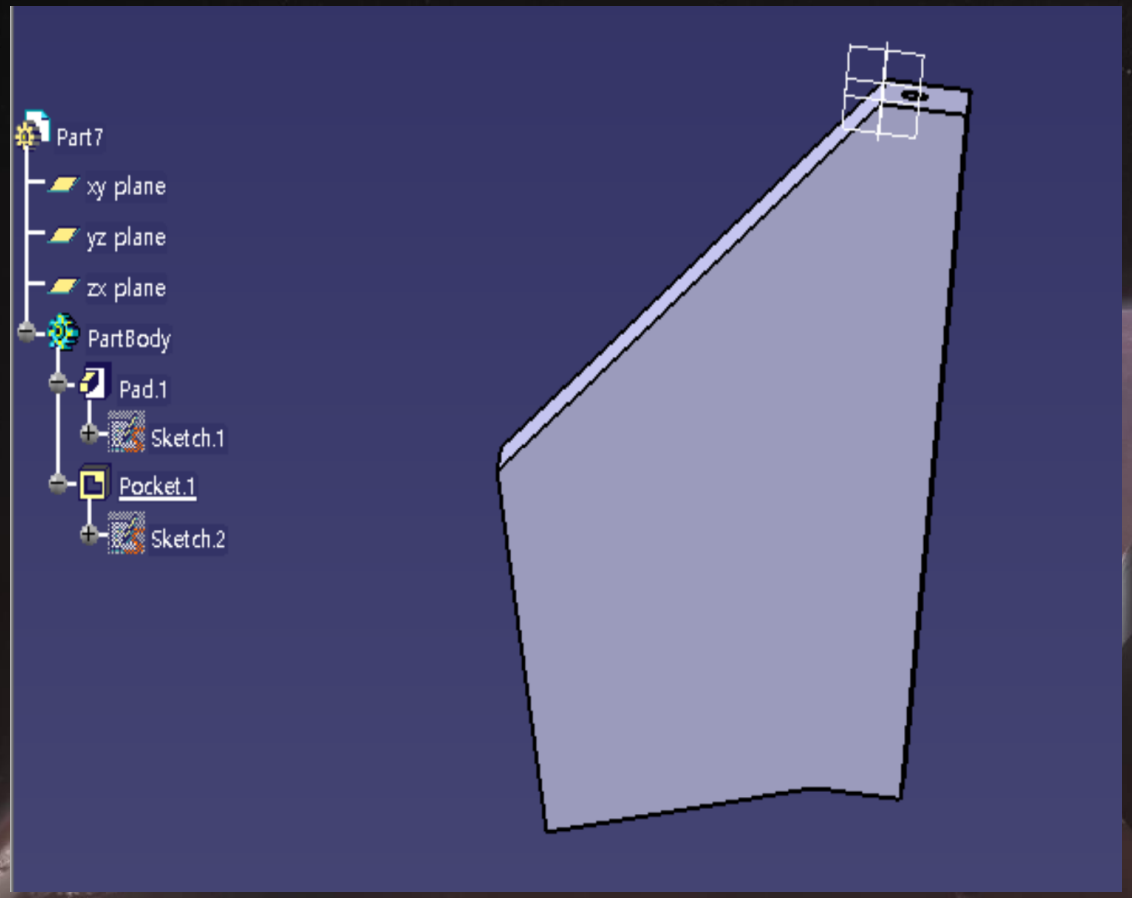


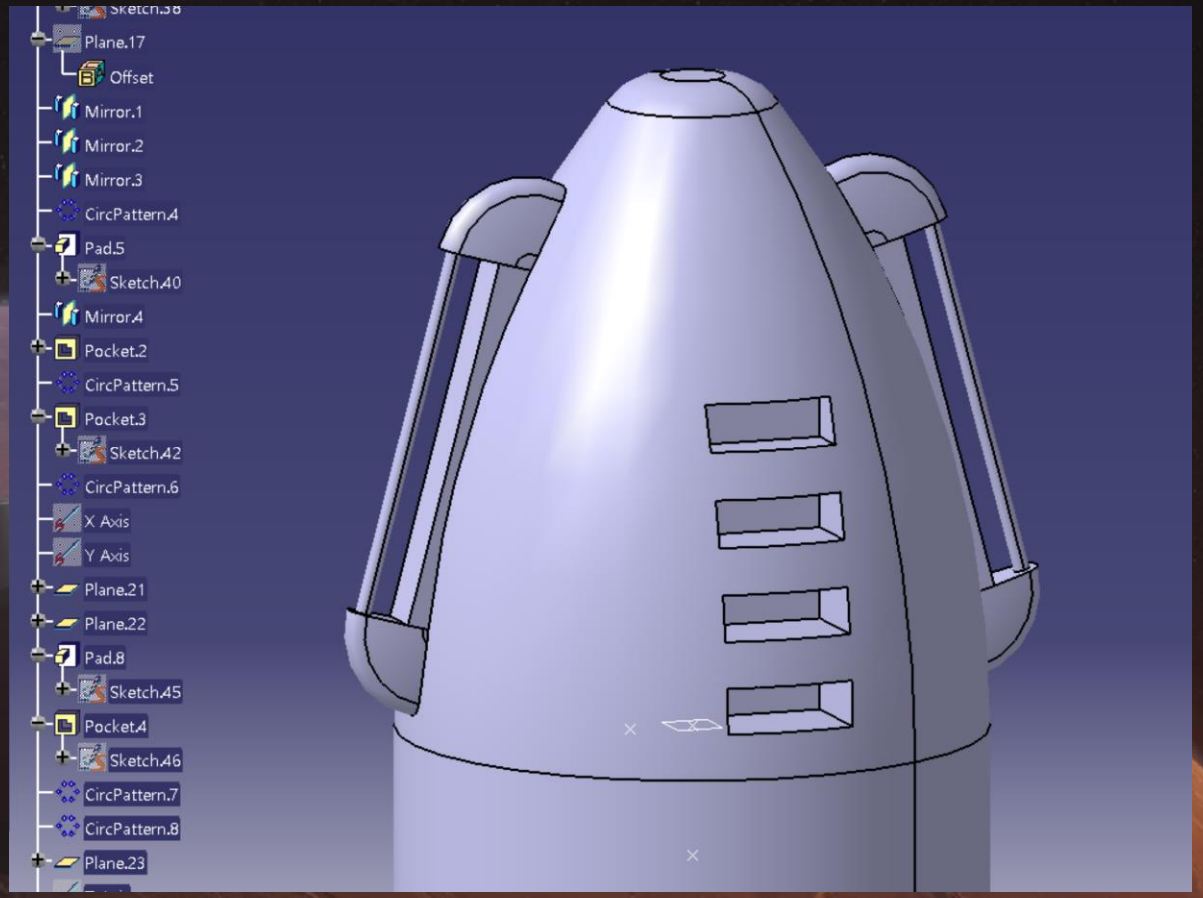
Pad, Pocket, Shaft 등 사용

03 . Modeling

Starship

Upper Wing

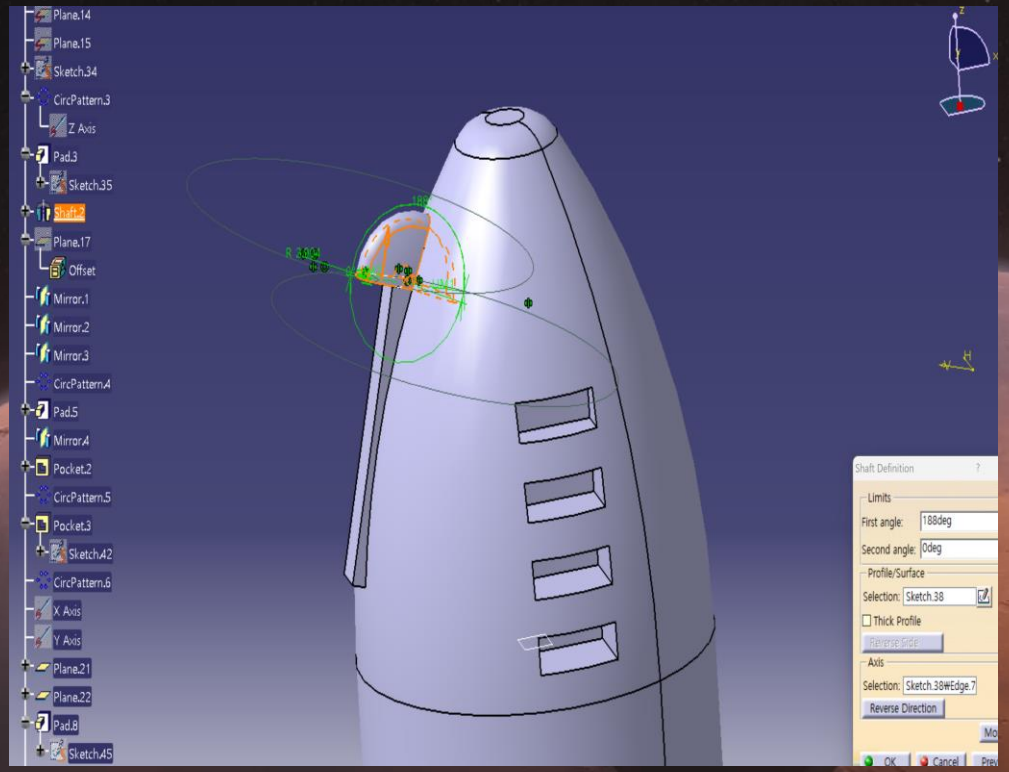


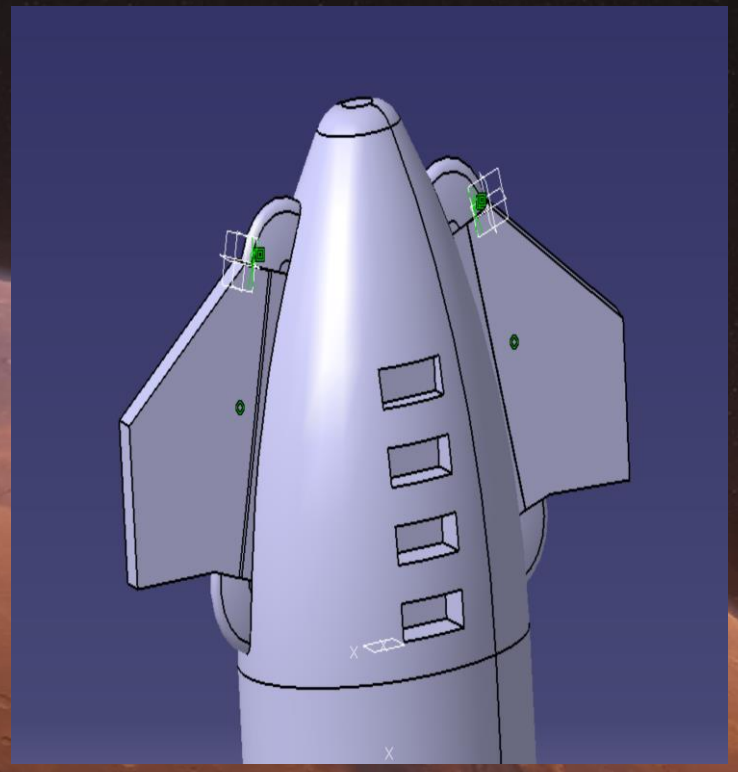


03 . Modeling

Starship

Upper Wing



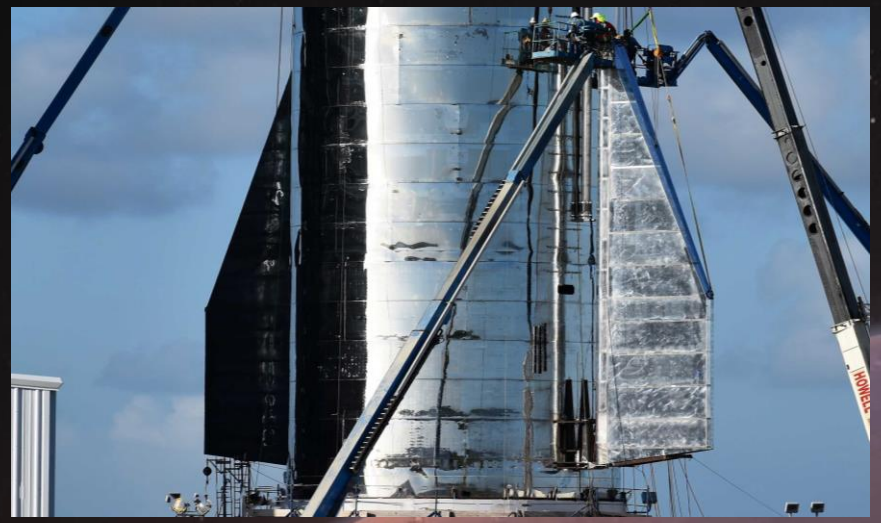


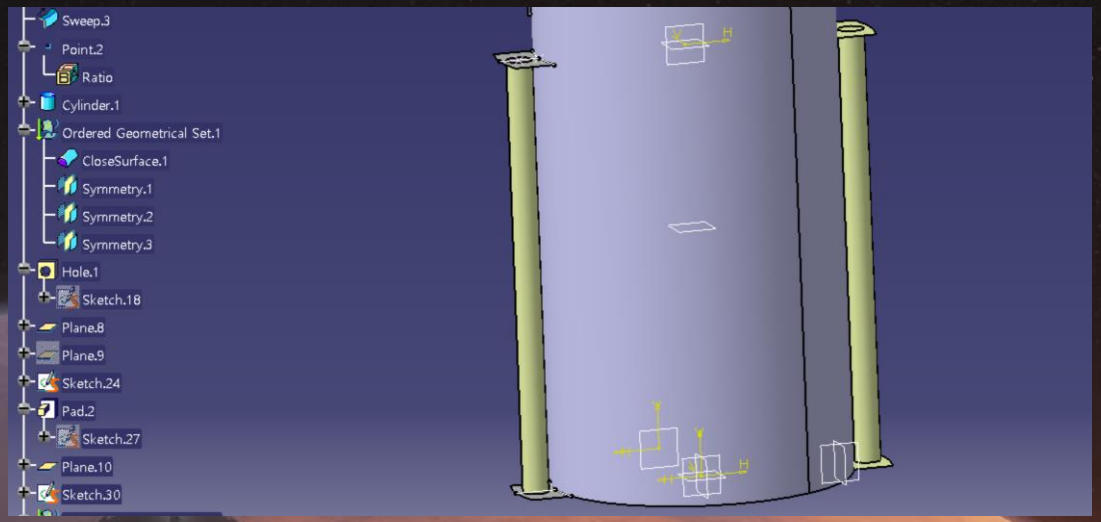
Pad, Pocket, Shaft, Assembly등 사용

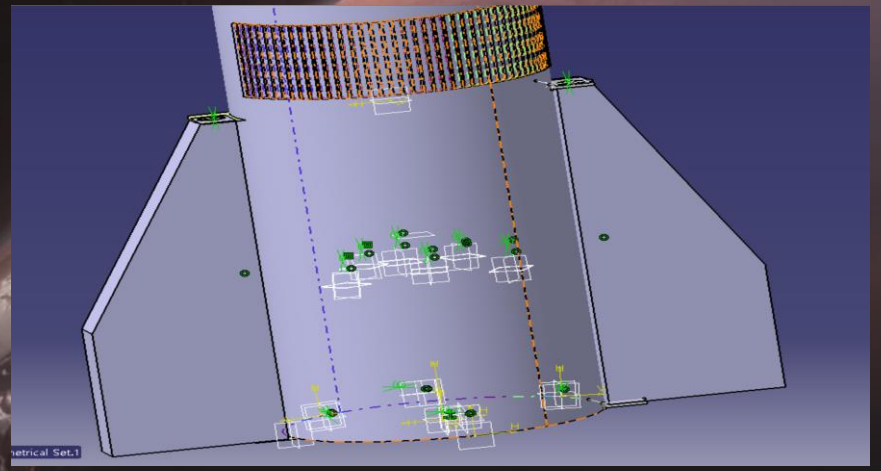
03 . Modeling

Starship

Bottom Wing





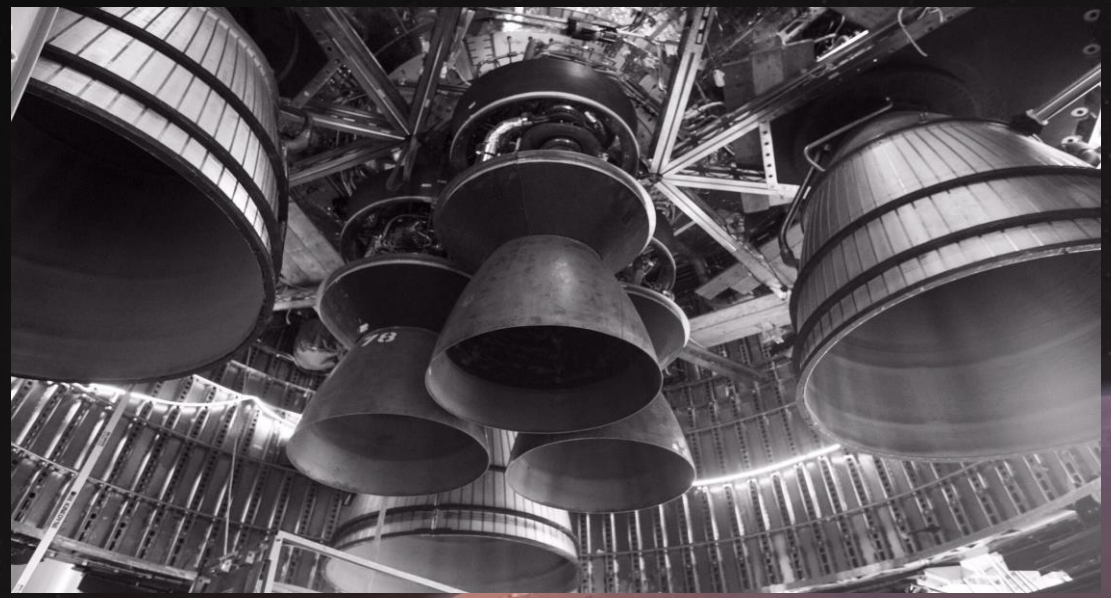


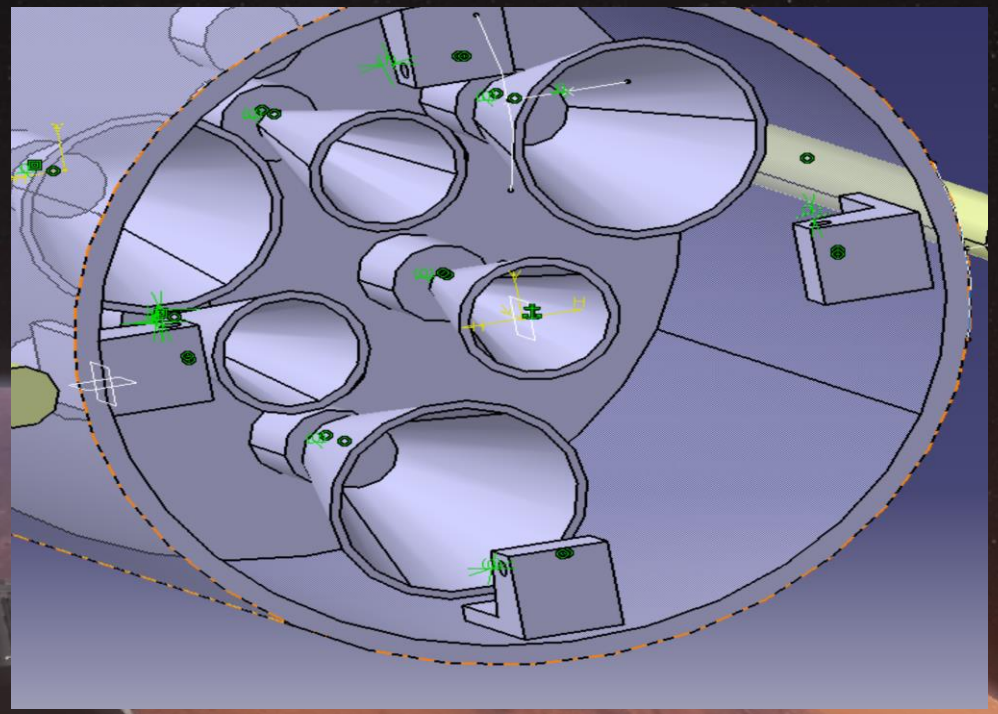
GSD(기둥), Assembly 주로 사용

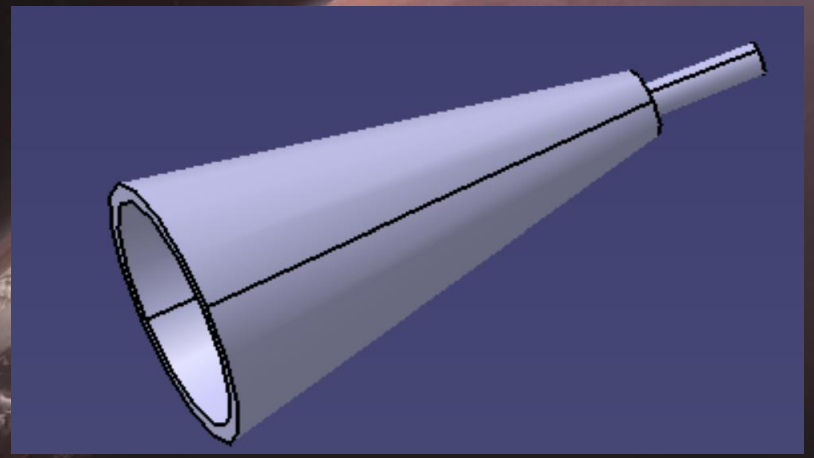
03 . Modeling

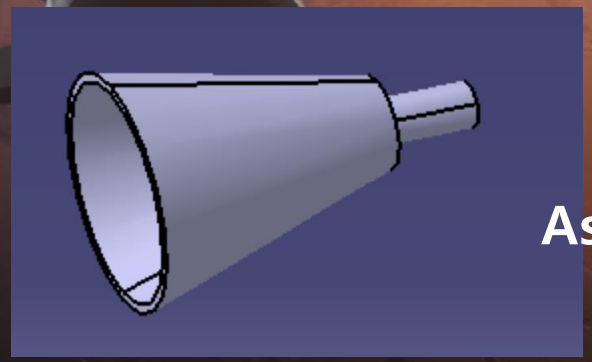
Starship

Raptor Engine
(3 vacuum engine & 3 sea level engine)







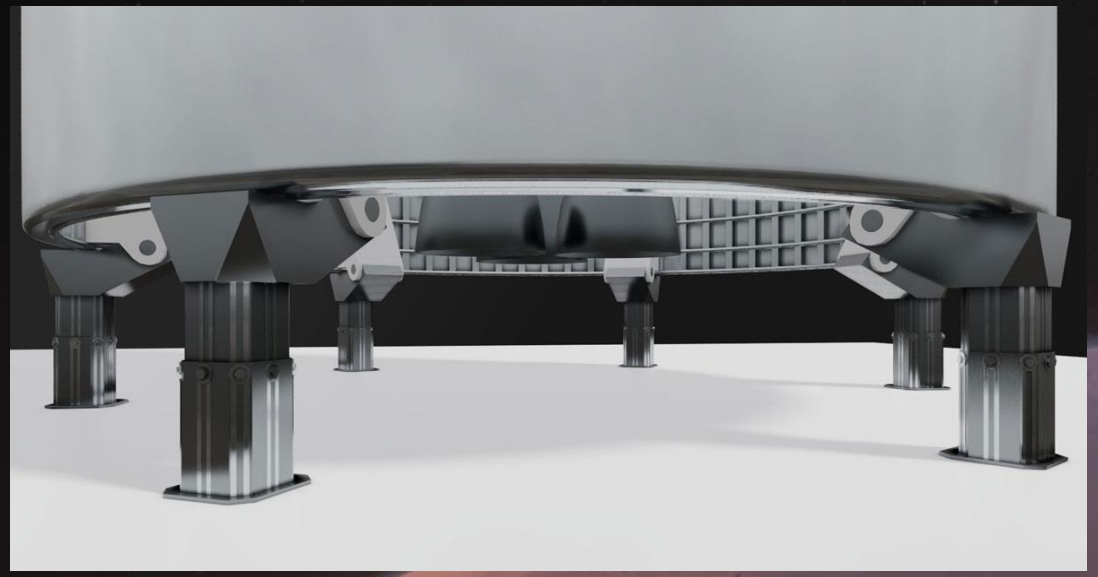


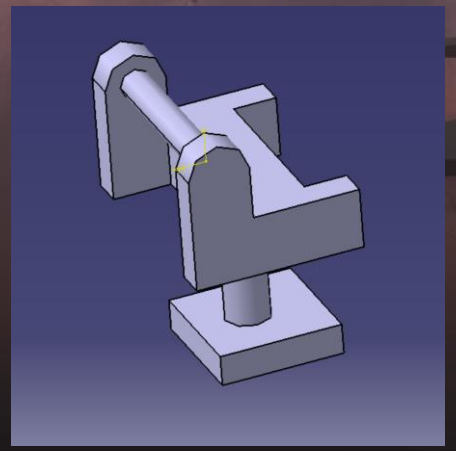
Assembly, Revolute joint 등 사용

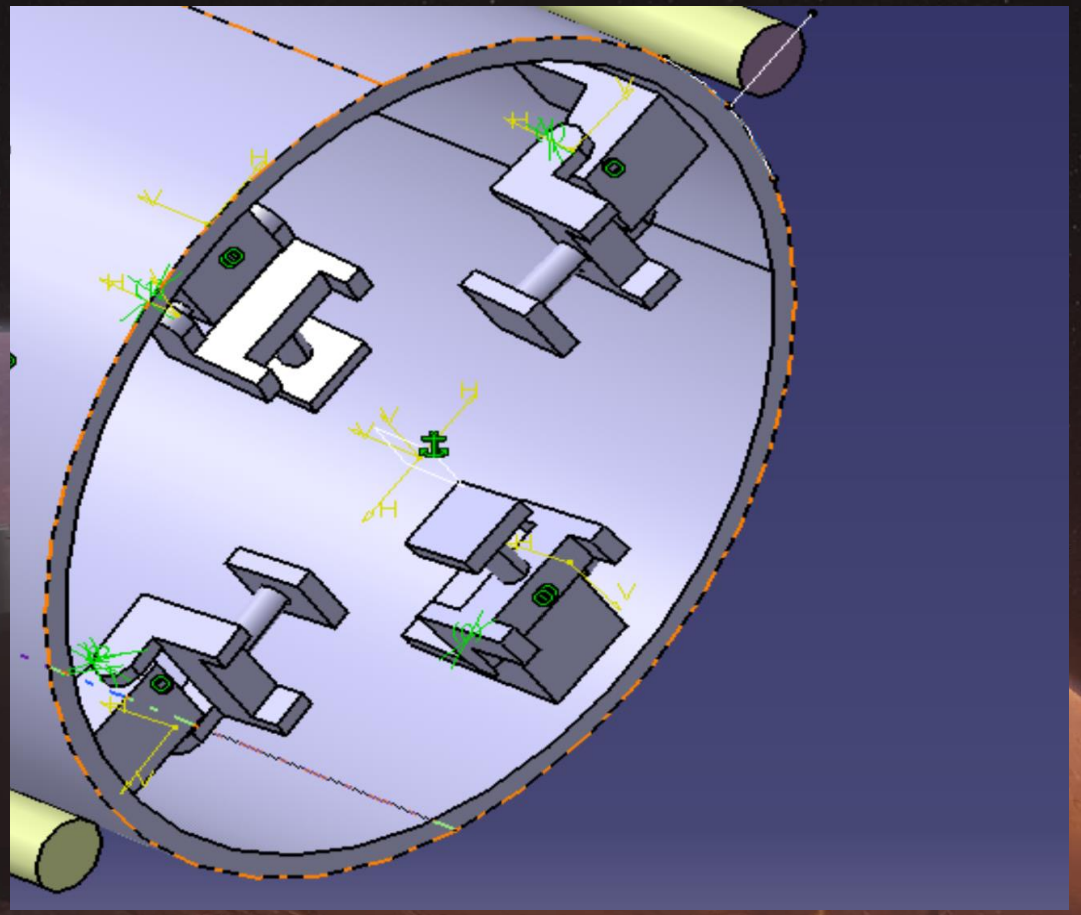
03 . Modeling

Starship

Landing Leg







Assembly, Revolute joint 등 사용

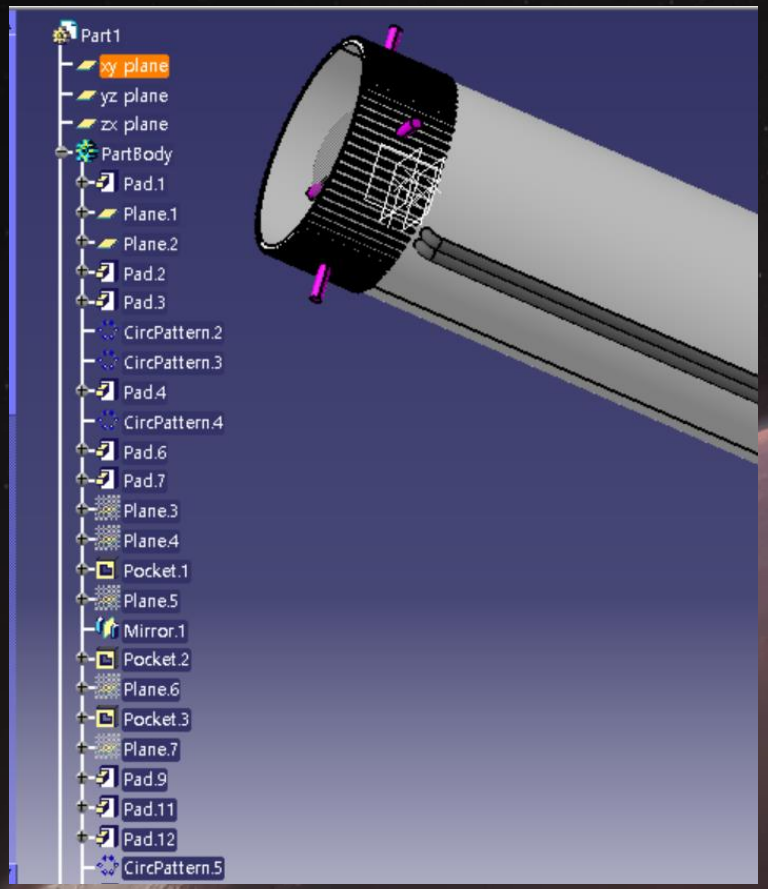
03 . Modeling

Stage 1

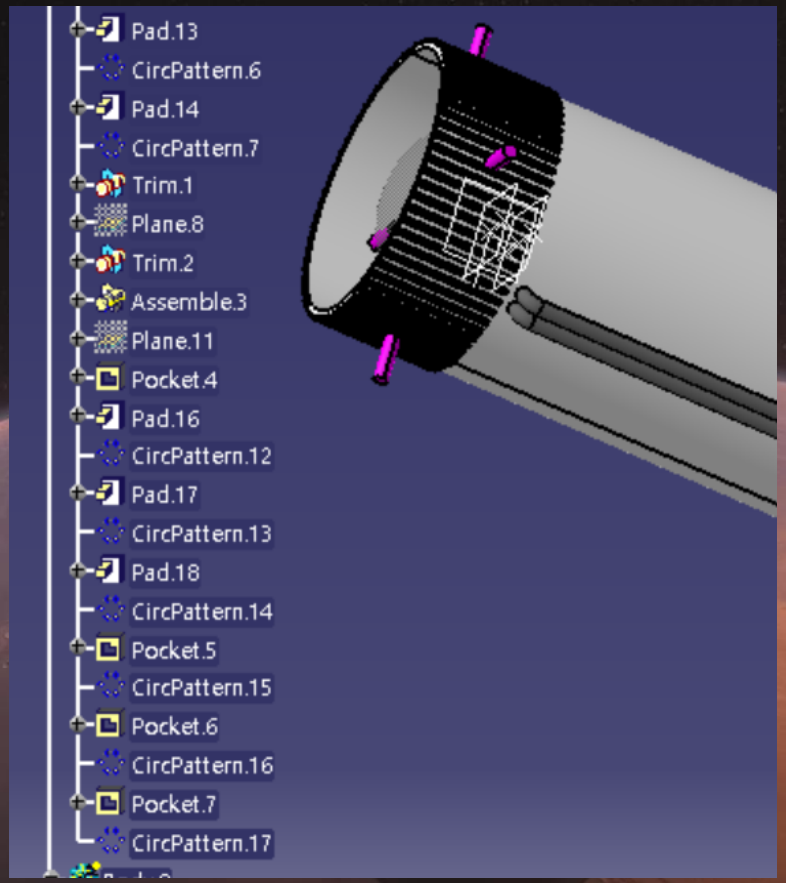
1. Stage1 Body
2. Grid Fin
3. Connecting Rod
4. Raptor Engine

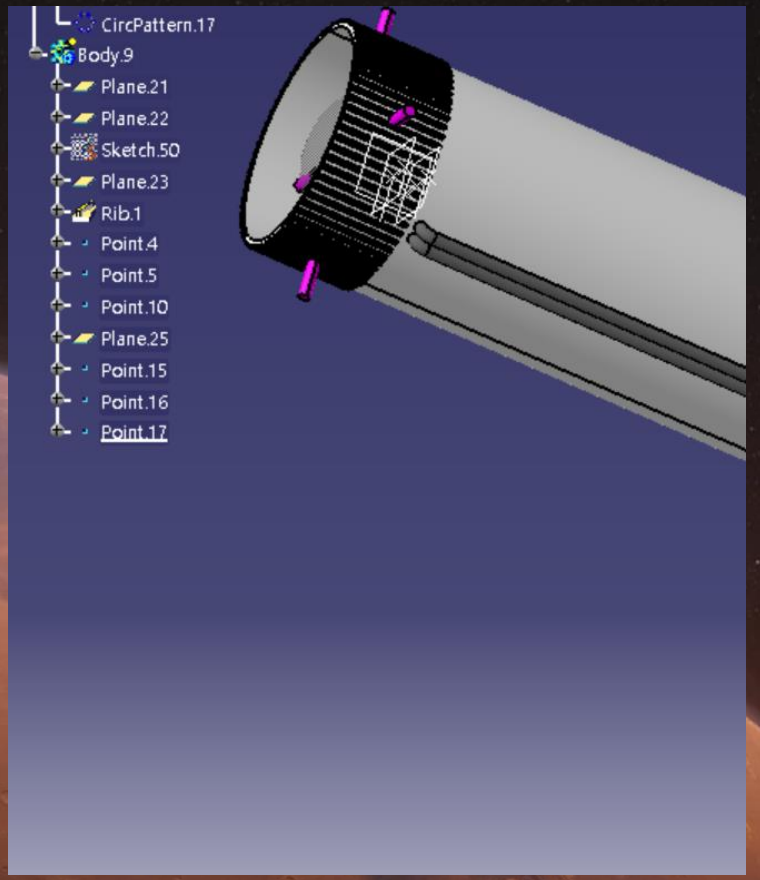
03 . Modeling

Stage1



Stage1 Body

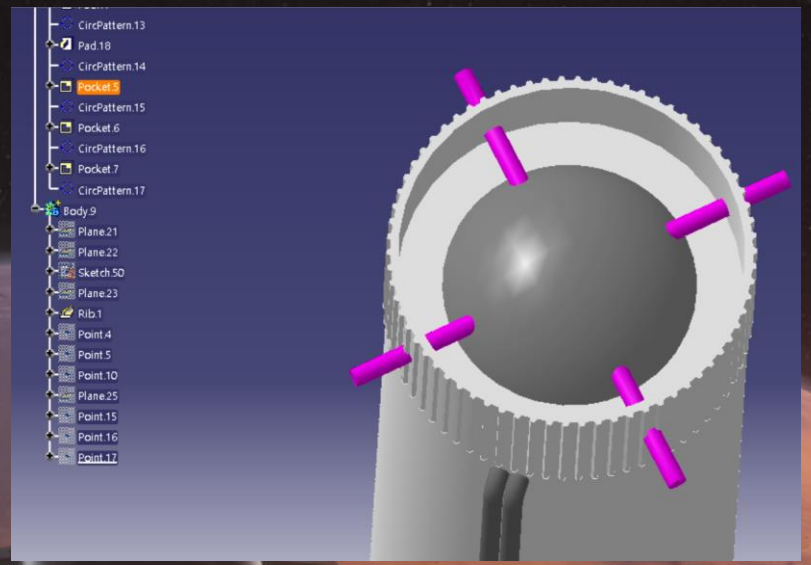




03 . Modeling

Stage1

Stage1 Body

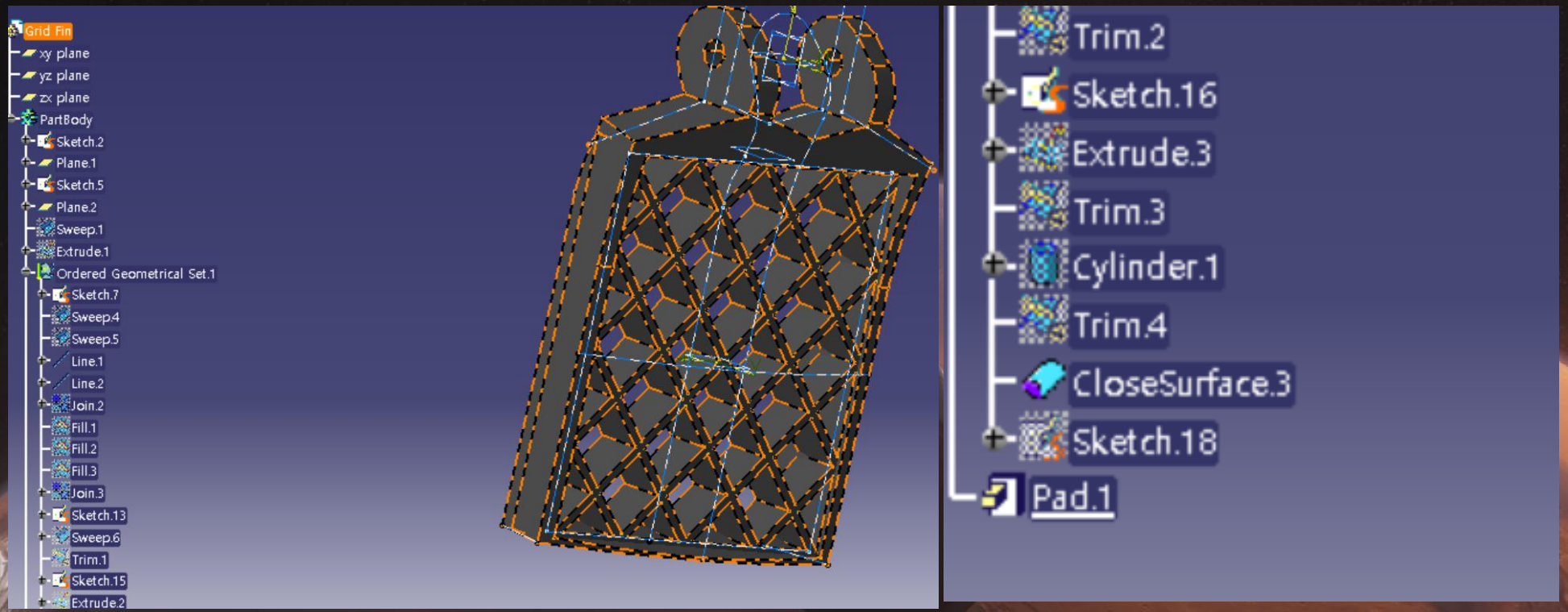


Pad, Pocket, Shaft, Boolean Operator 등 사용

03 . Modeling

Stage1

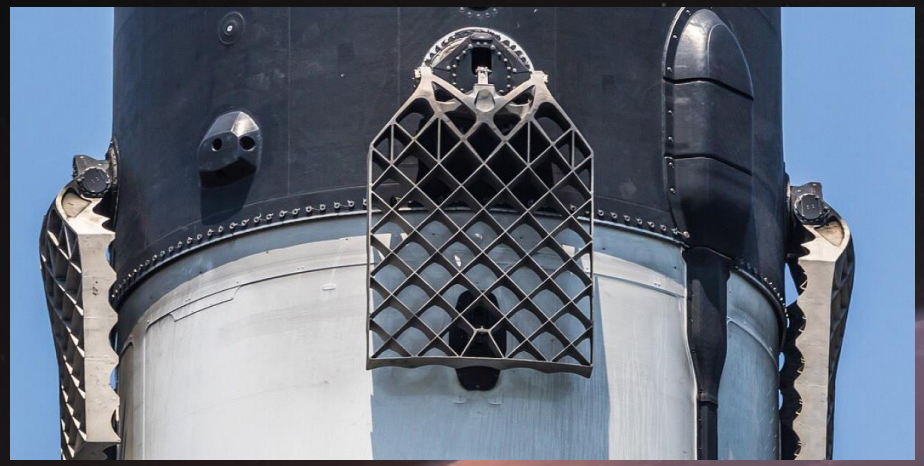
Grid Fin

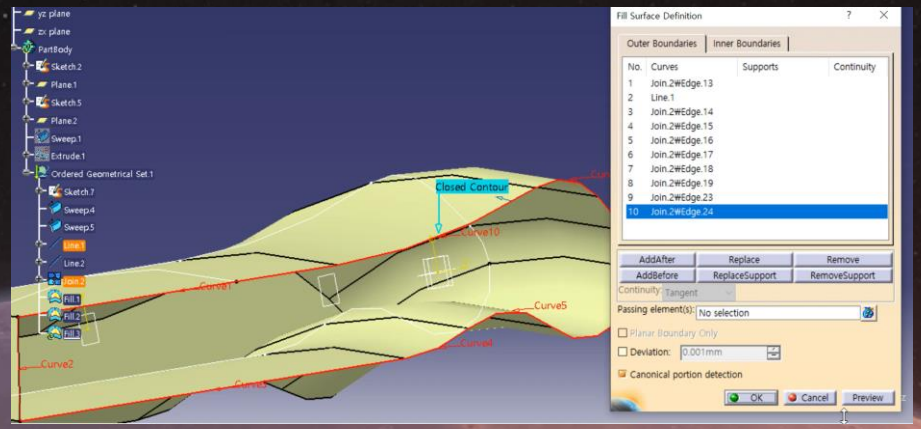


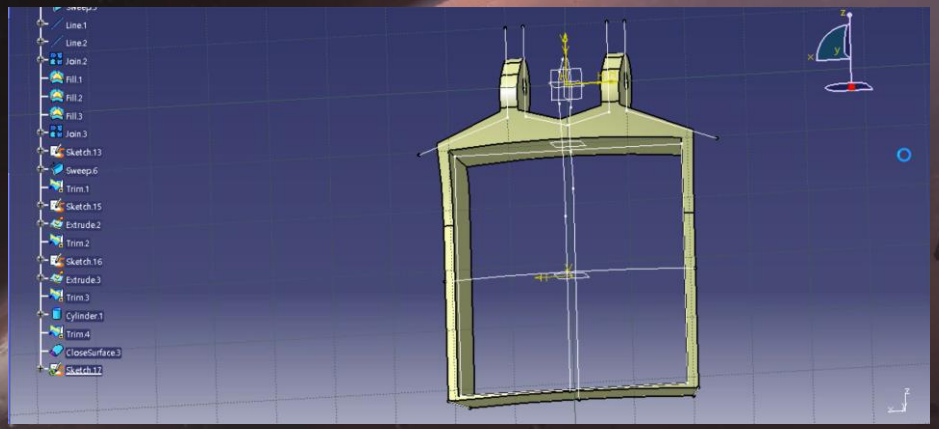
03 . Modeling

Stage1

Grid Fin





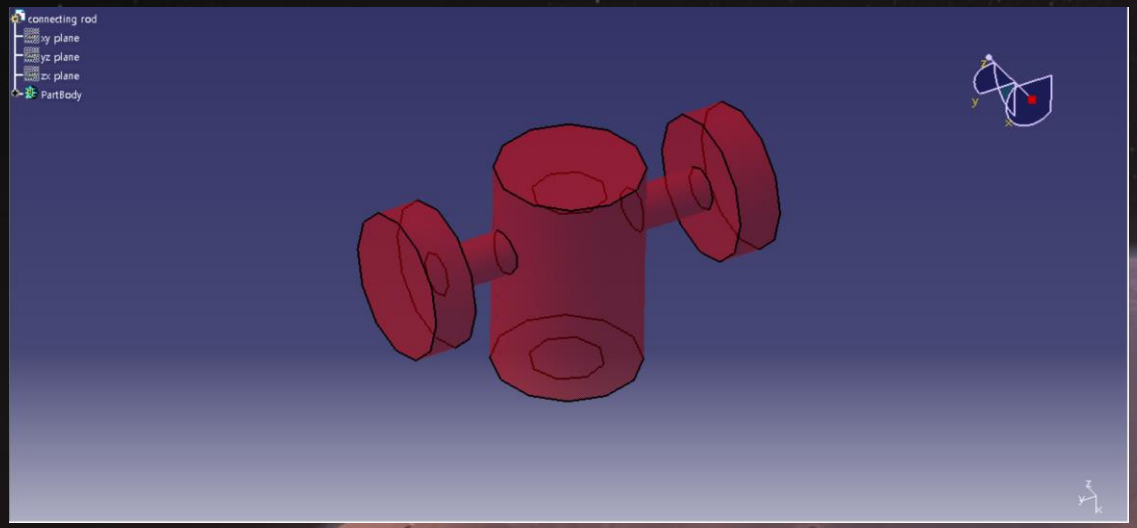


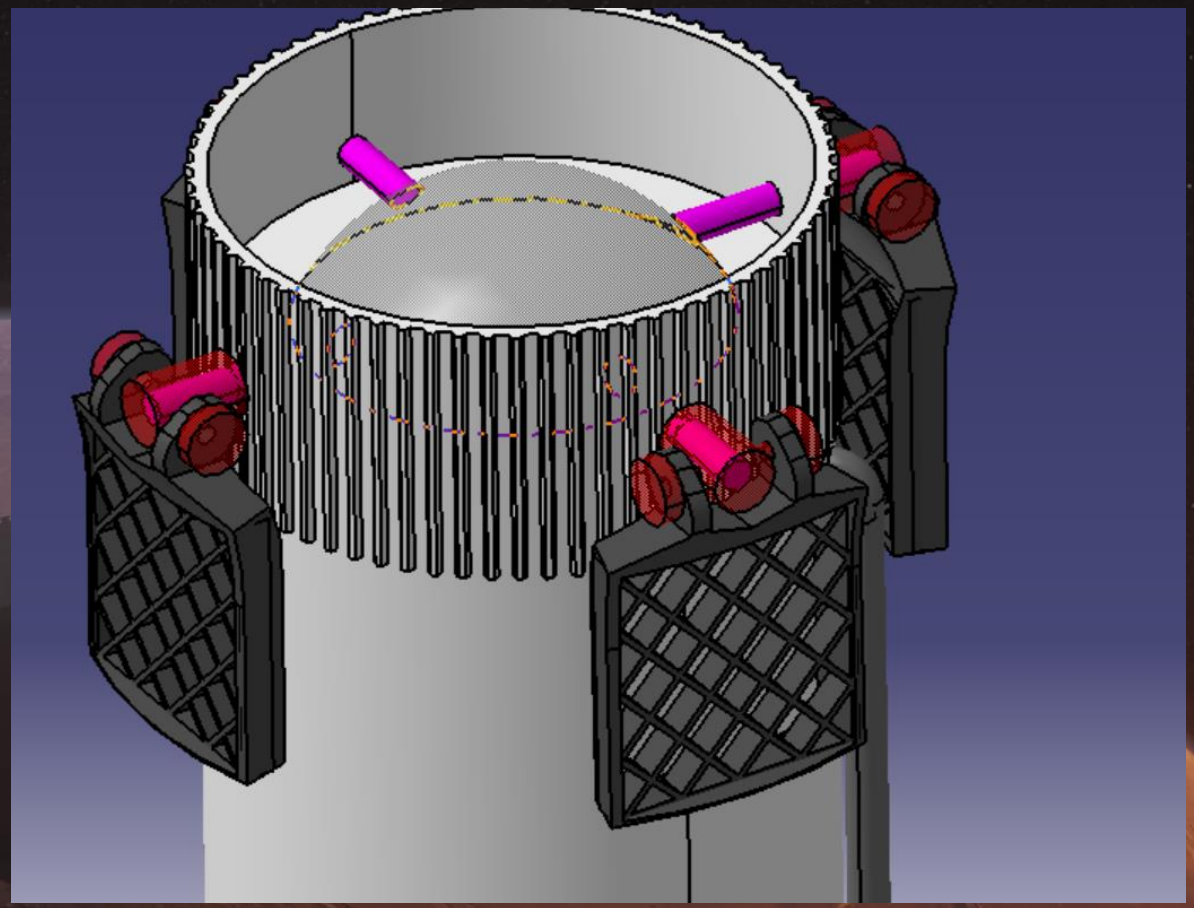
GSD의 Sweep, Extrude, Fill Surface 주로 활용

03 . Modeling

Stage1

Connecting Rod



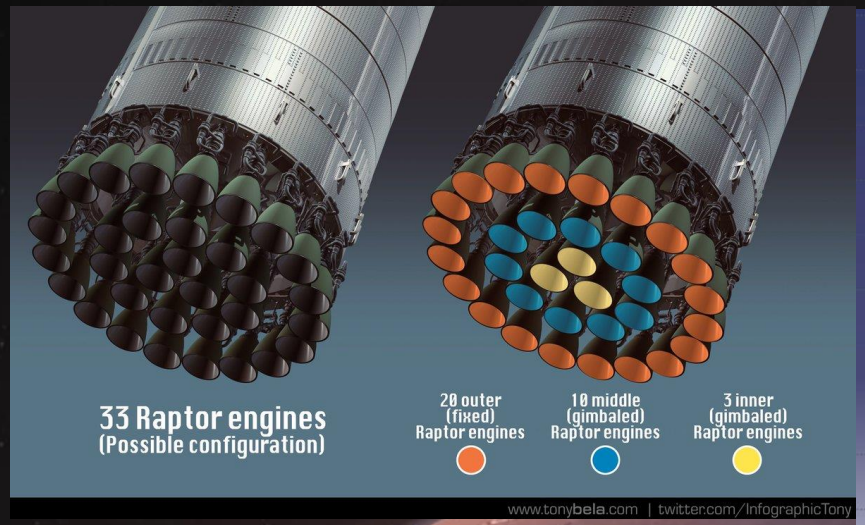


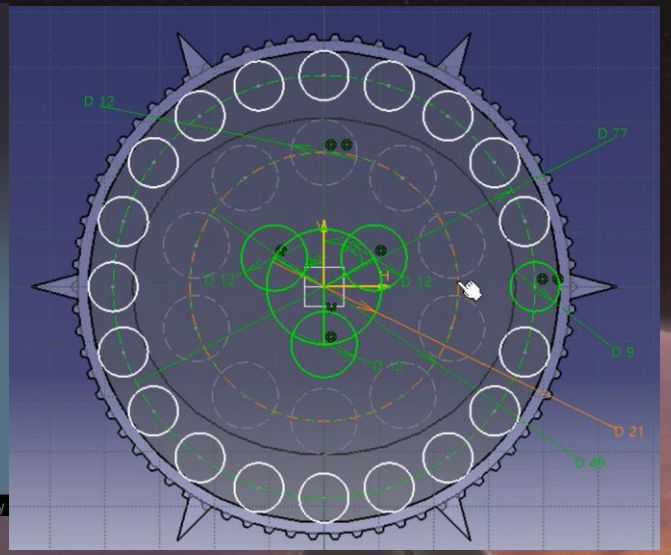
Pad, Pocket 간단히 활용

03 . Modeling

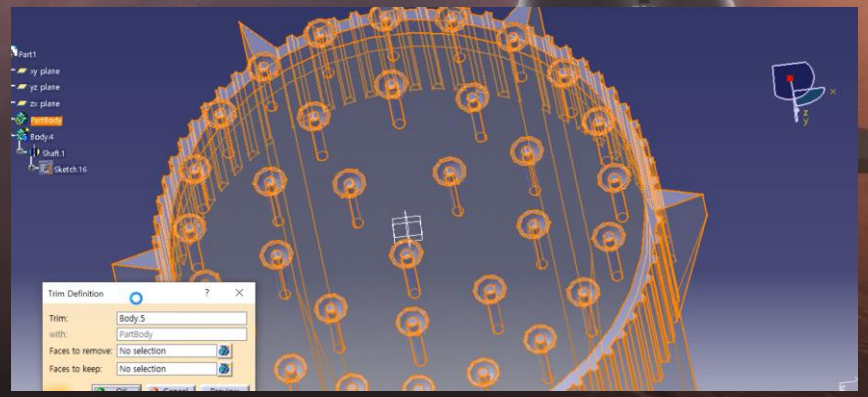
Stage1

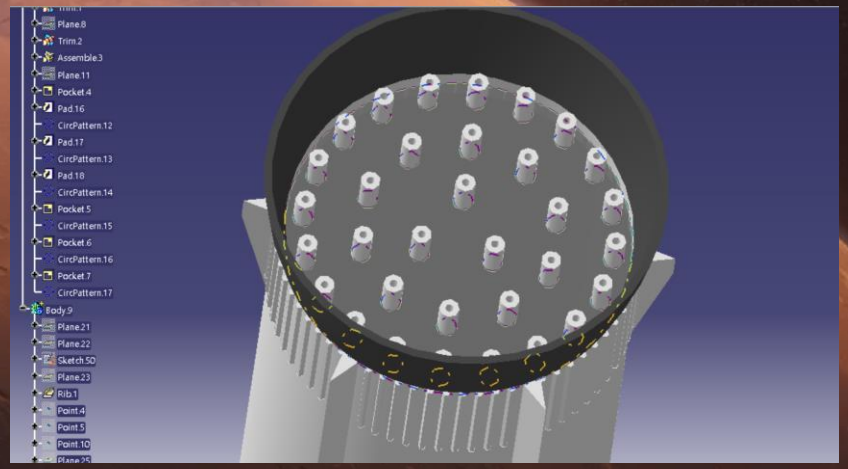
33 * Raptor Engine





Kinematic Joint(Spherical Joint)
활용의 어려움->수정

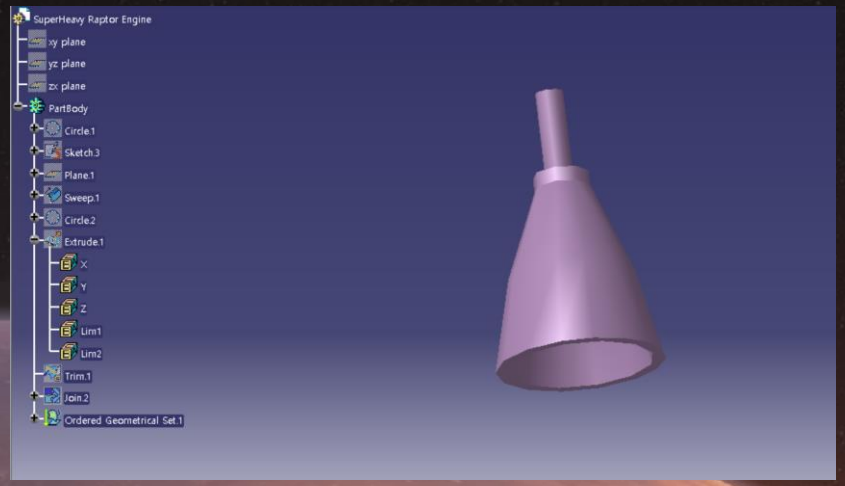


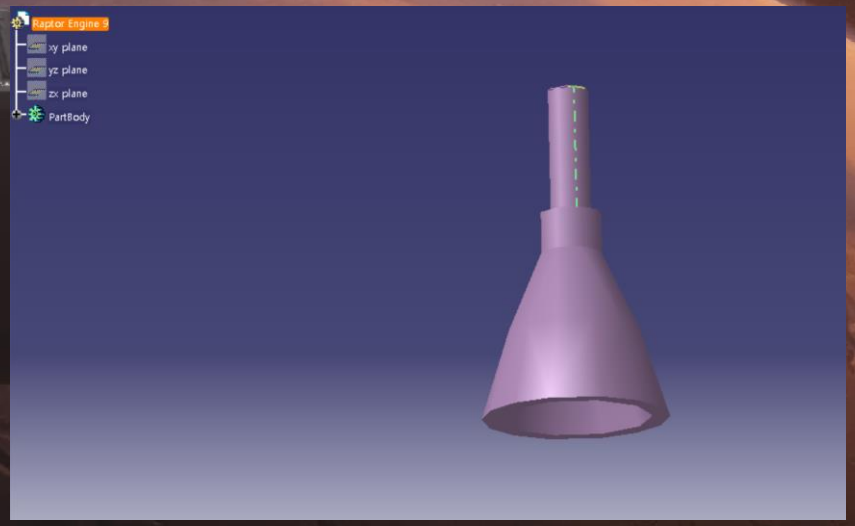


03 . Modeling

Stage1

33 * Raptor Engine

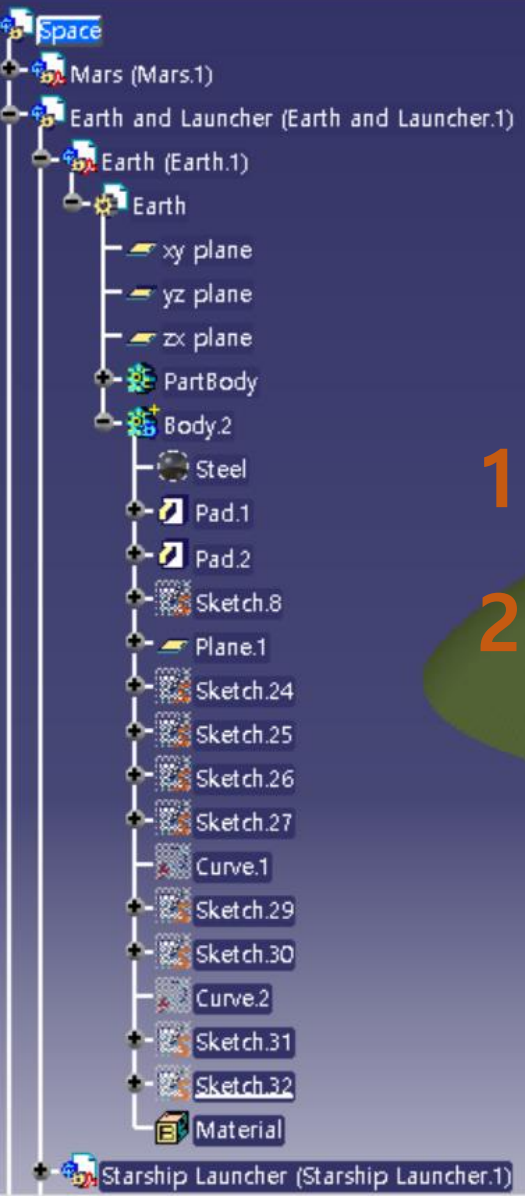




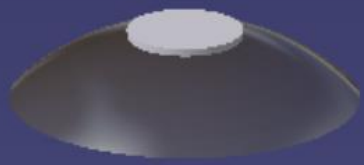
GSD 사용

03 . Modeling

Background



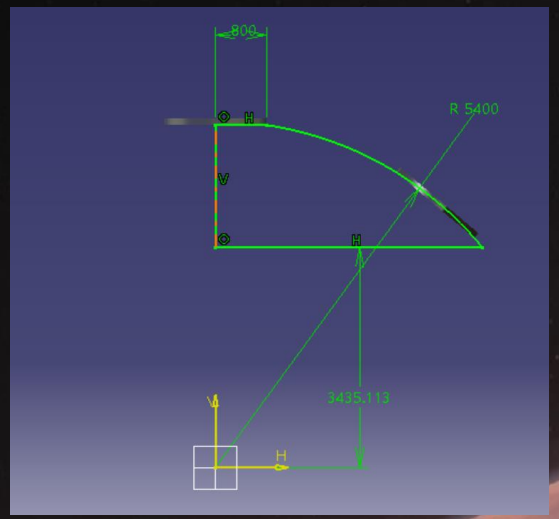
1. Earth & Mars
2. Orbital Launching Pad

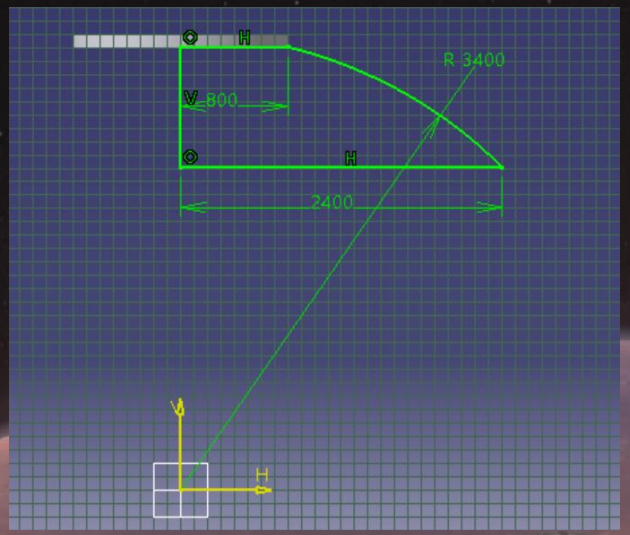


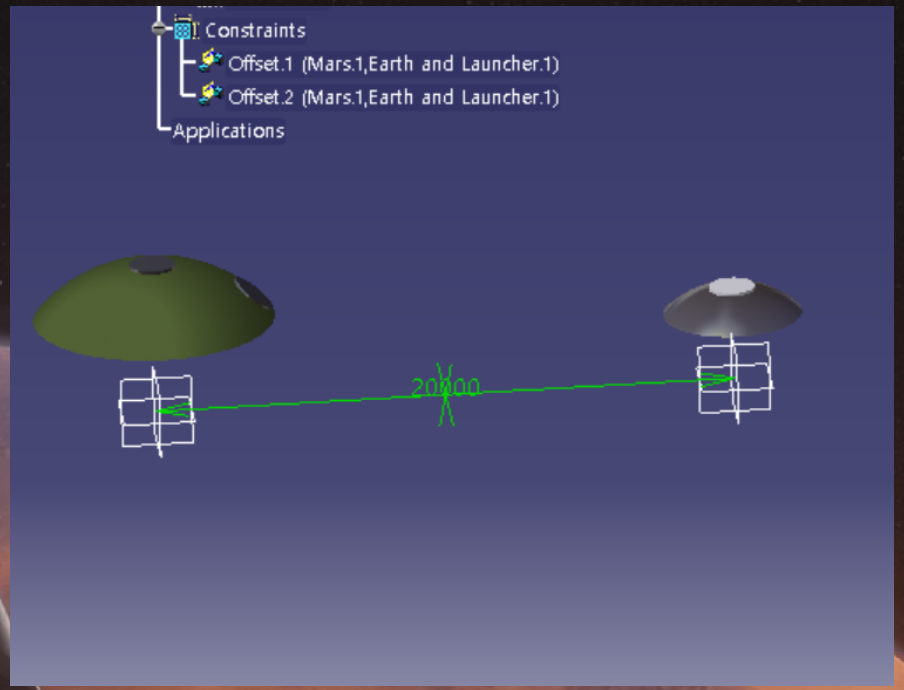
03 . Modeling

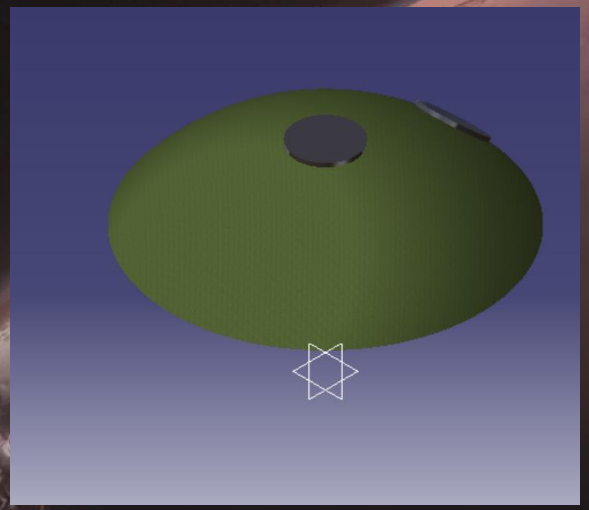
Background

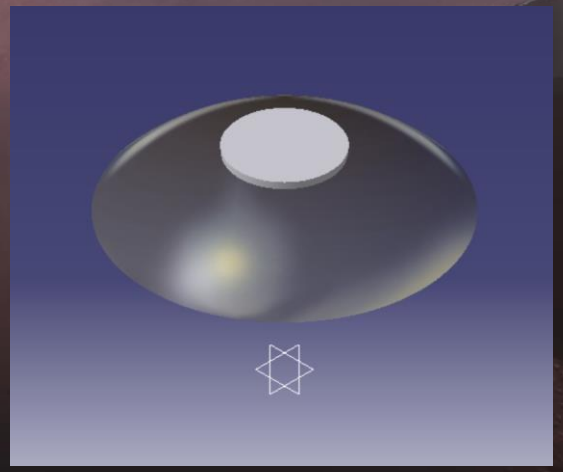
Earth & Mars









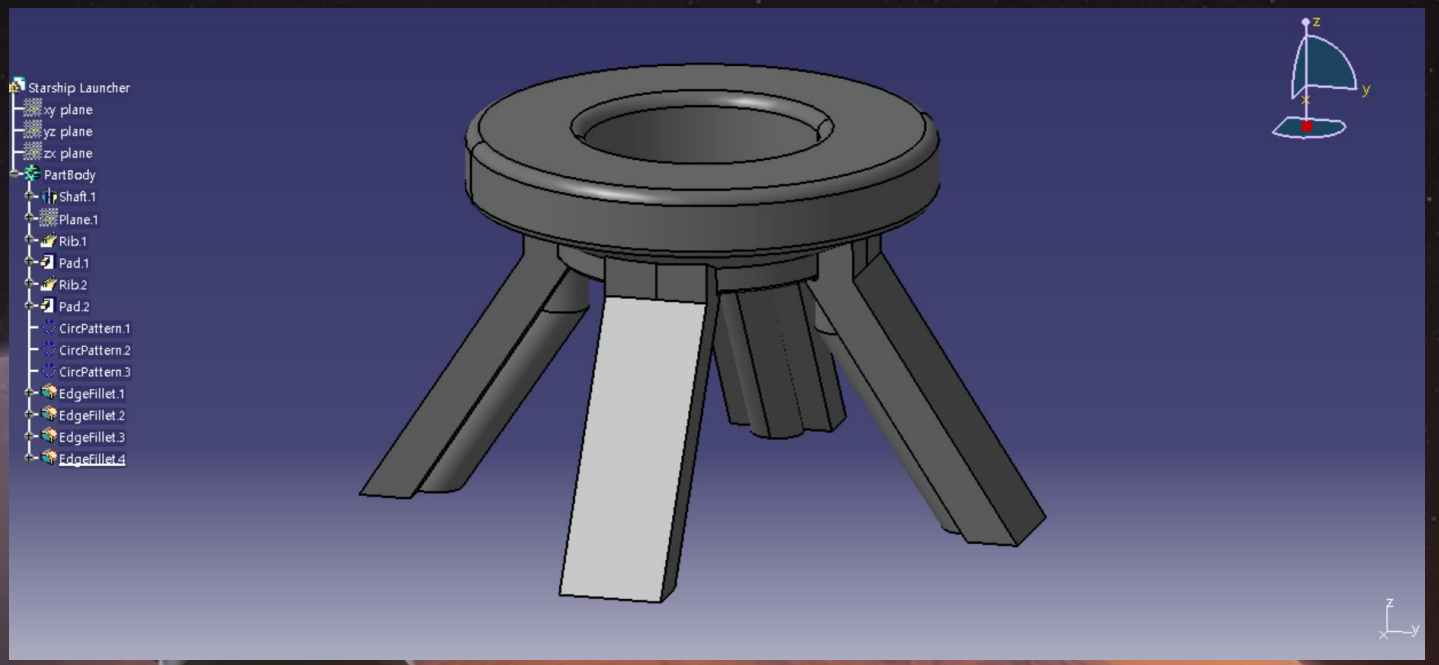


Shaft로 행성 일부 생성
(구로 만들면 렉이 걸리는 문제가 있었음)
Pad로 착륙지점
각 행성의 반지름을 최대한 맞추려 했음

03 . Modeling

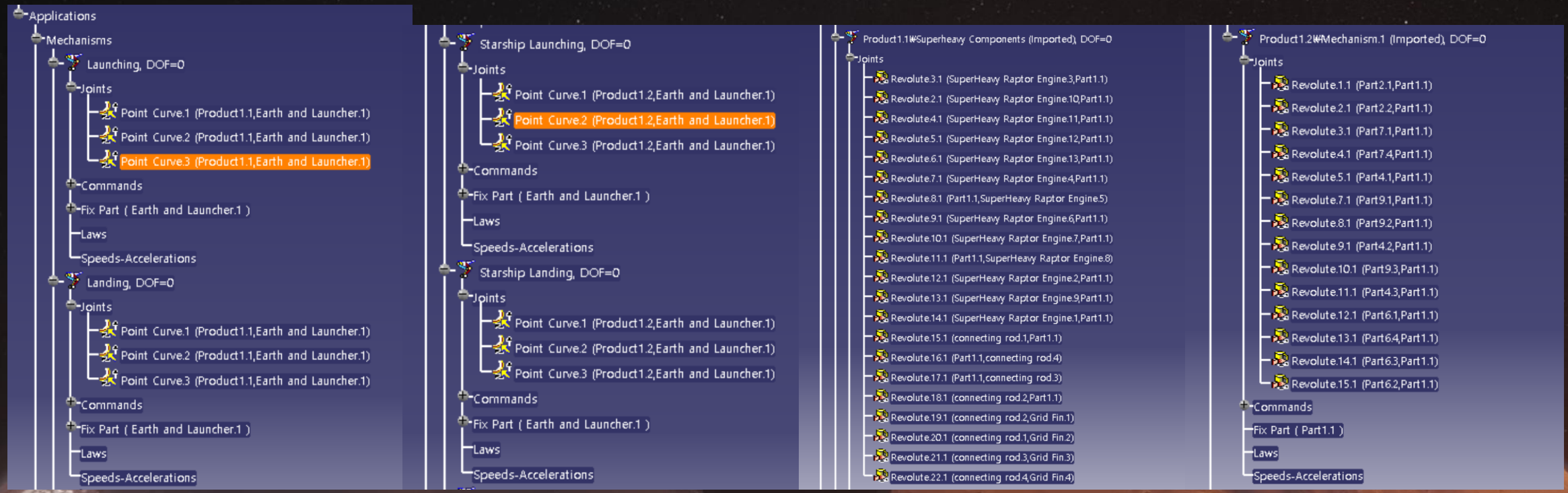
Background

Orbital Launch Pad



Pad, Pocket, Shaft, Boolean Operator 사용
실제 Starship의 발사대를 보고 제작

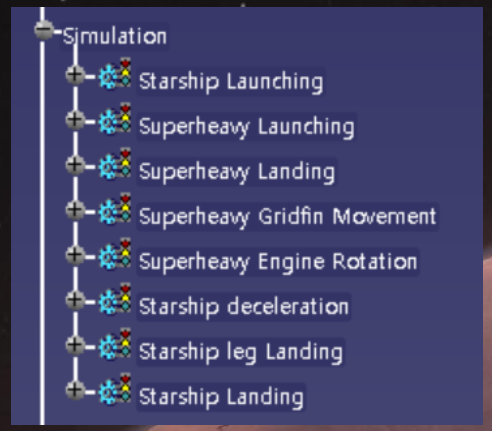
04 . Kinematics



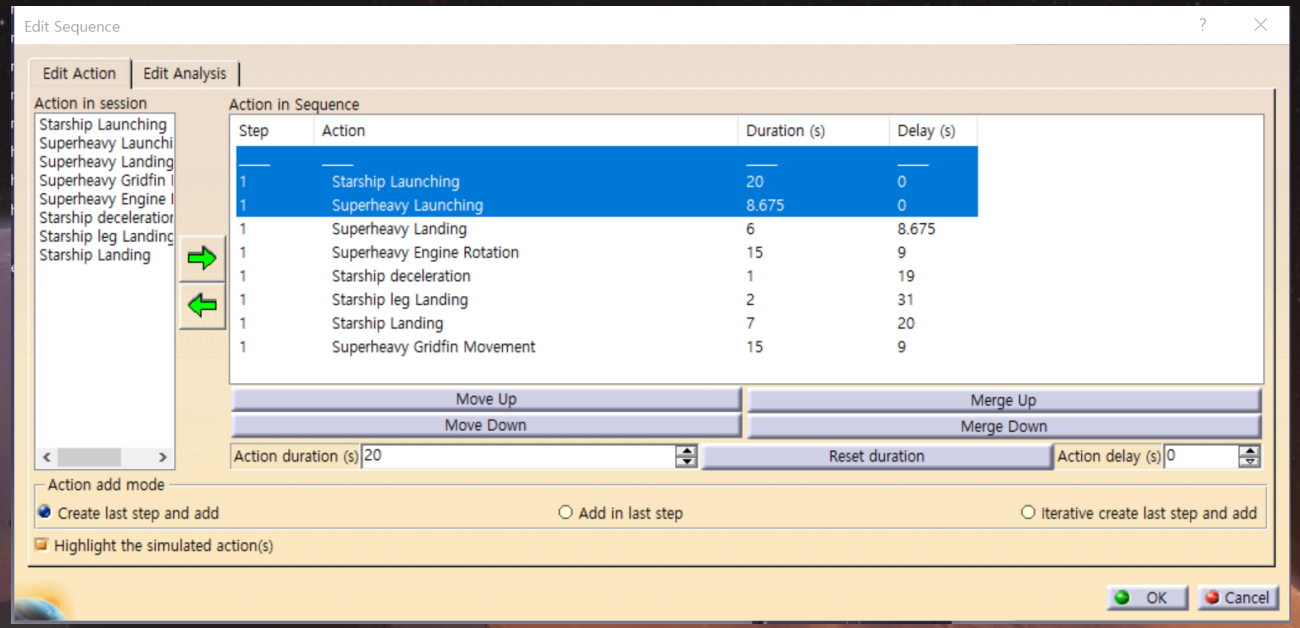
Joint 작업트리

04 . Kinematics

Stage1

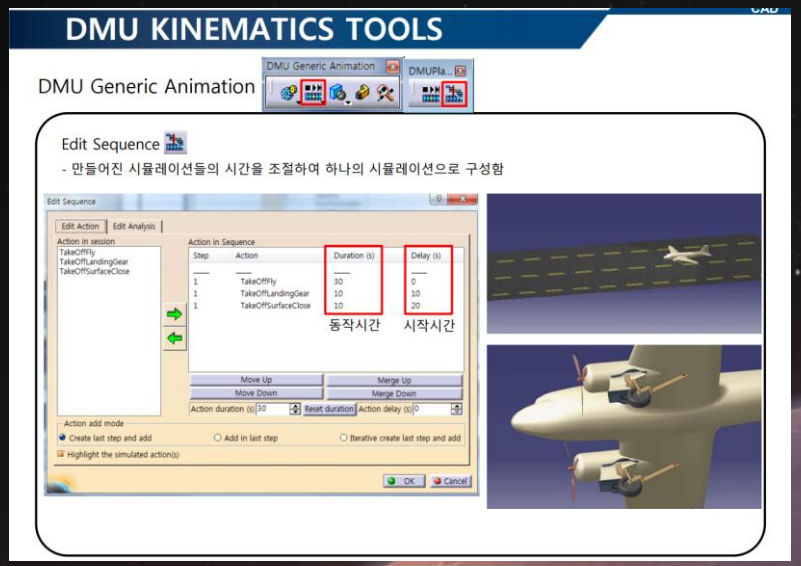


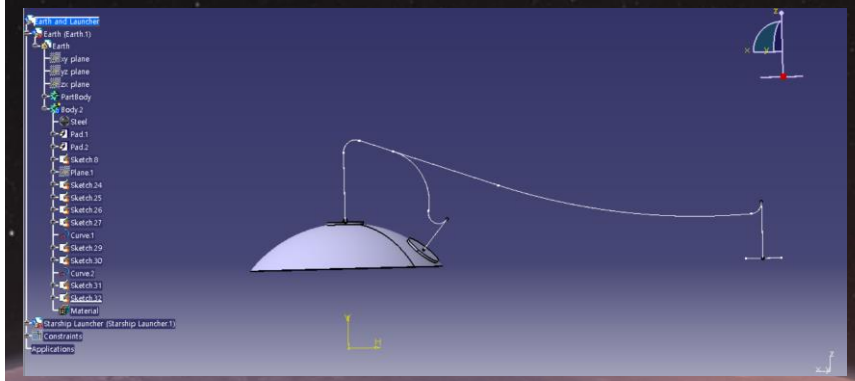
Simulations

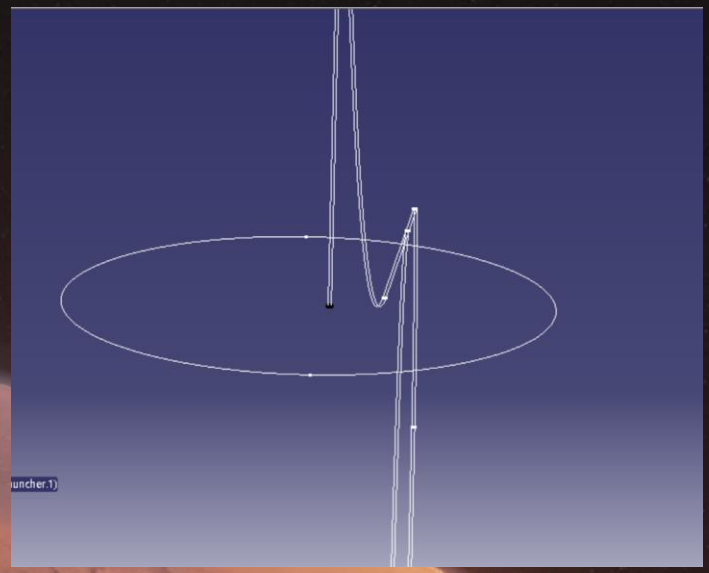


Sequence

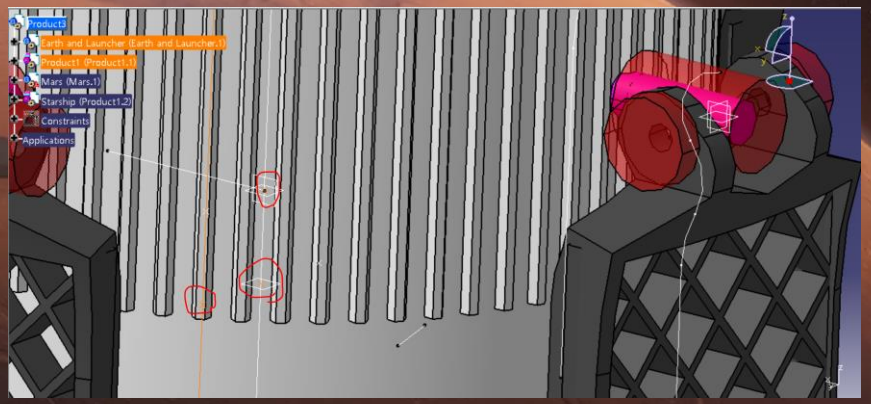
04 . Kinematics



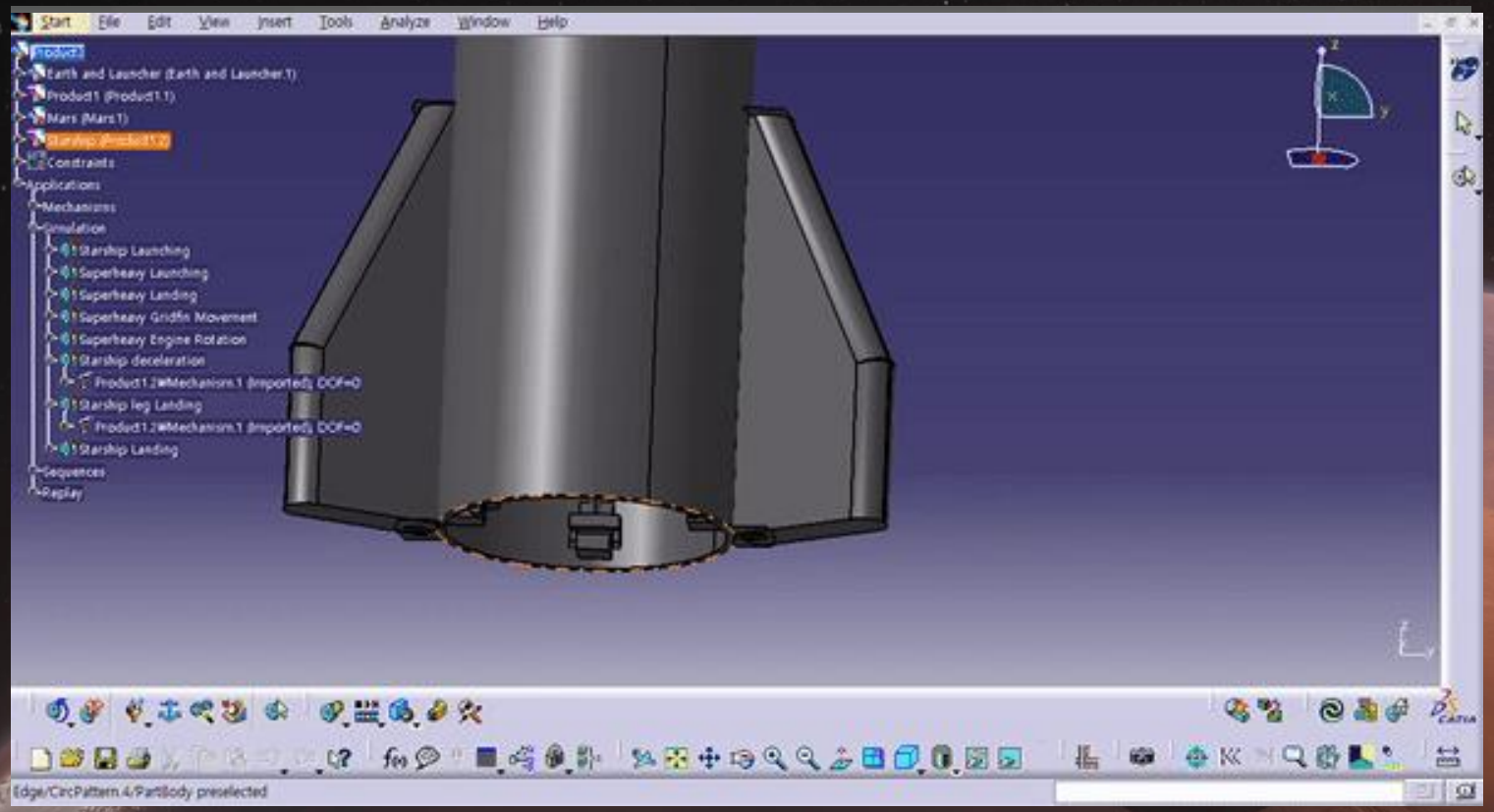




수업시간에 Sequence 부분에서 봤던 Dakota 비행기의
움직임을 참고하여 설계했음

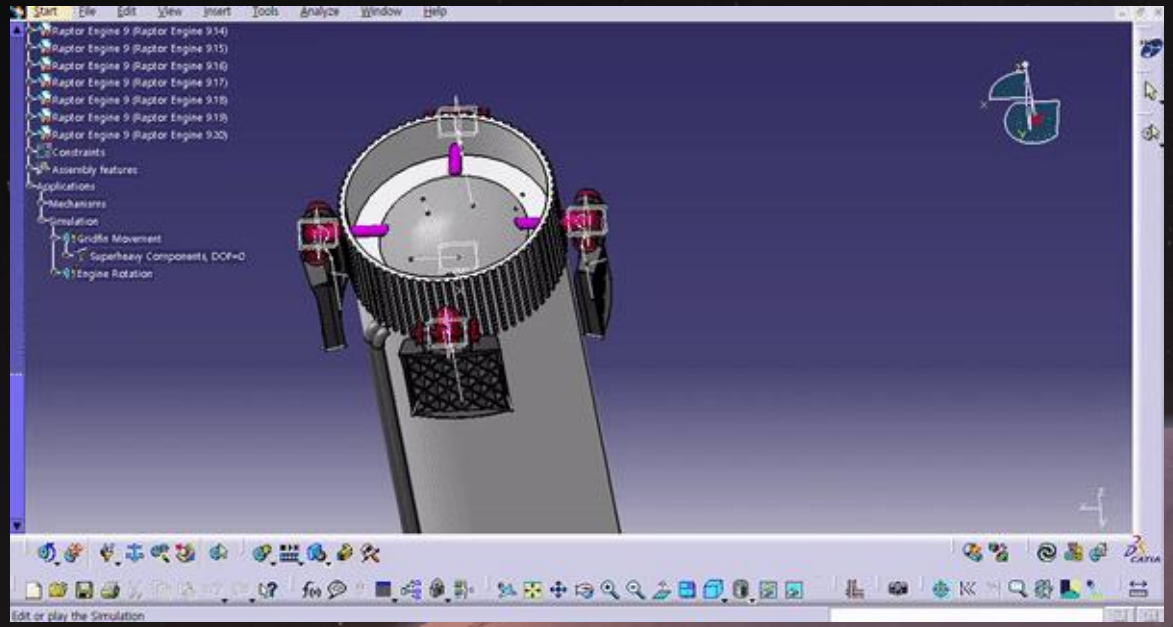


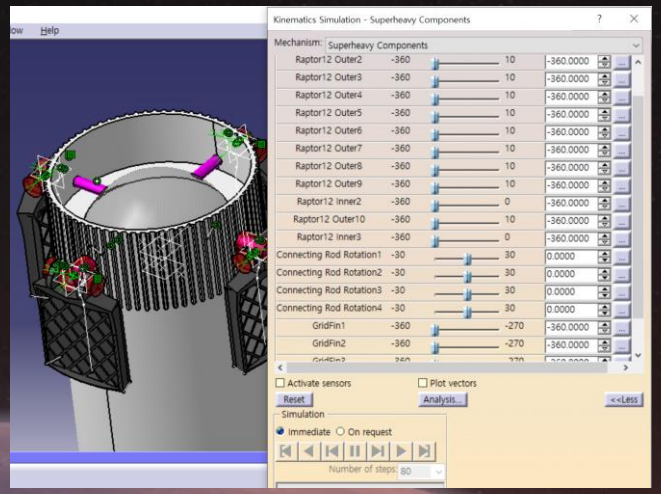
04 . Kinematics



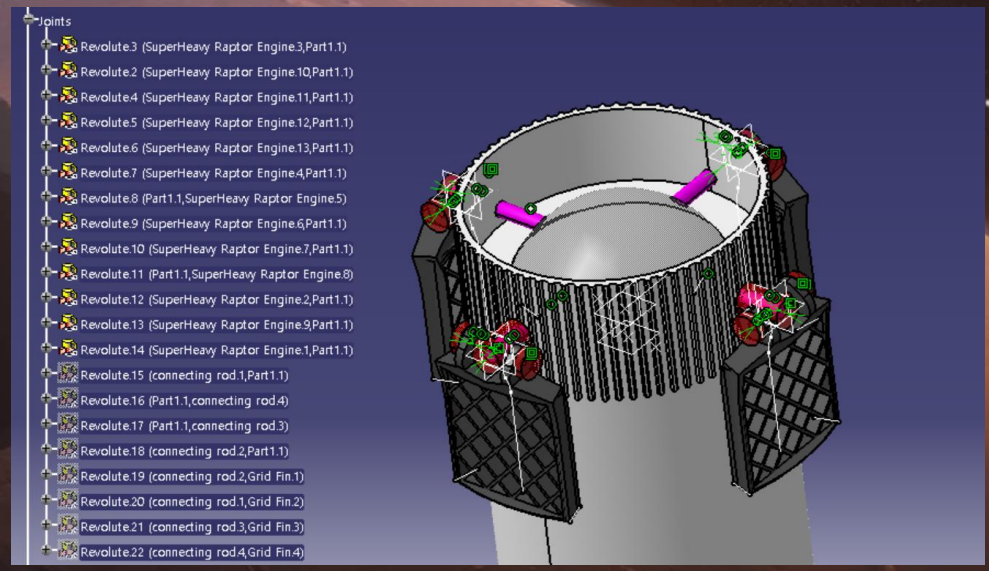
착륙 시 Starship의 날개 움직임과,
착륙다리

04 . Kinematics

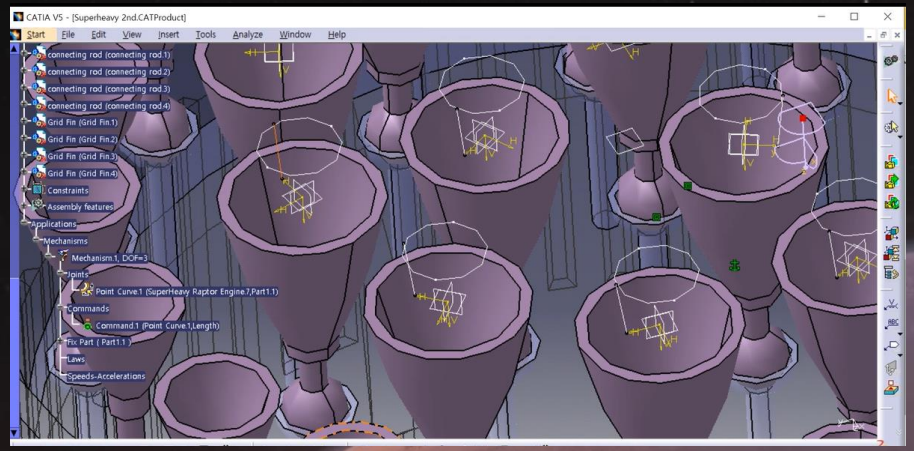


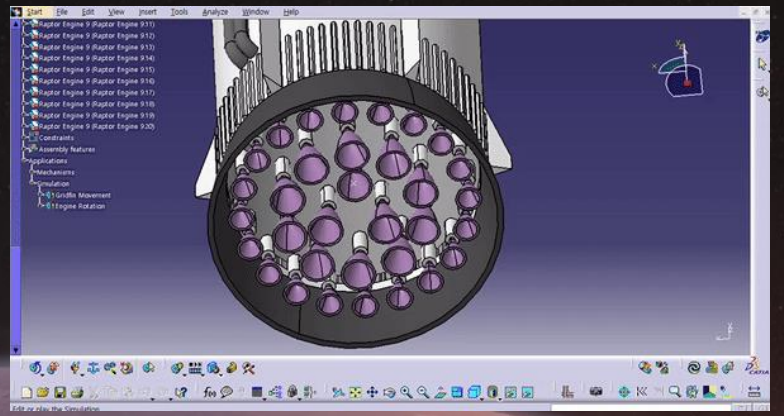


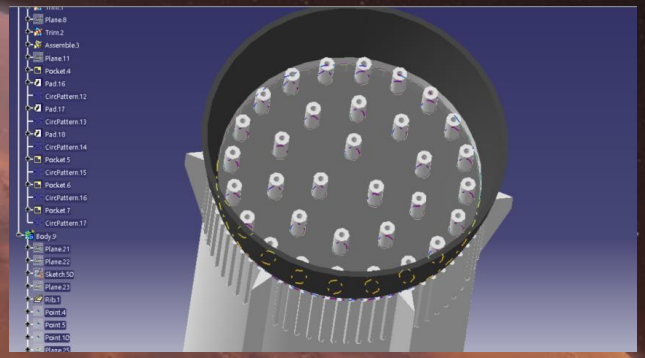
Grid Fin

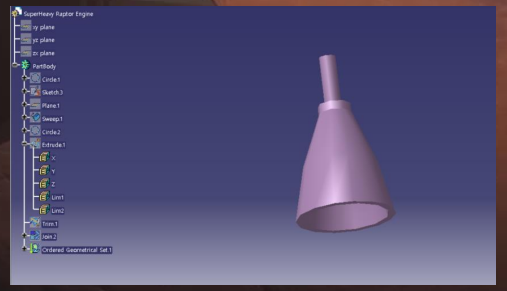


04 . Kinematics





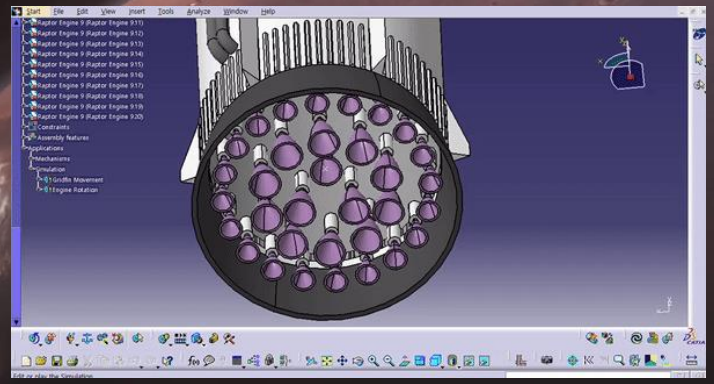


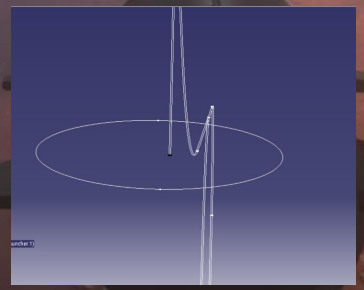


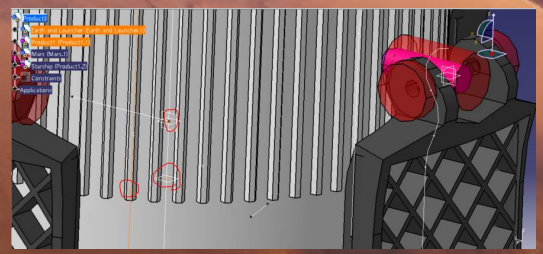
기존에 시도했던 Spherical Joint 와 Point Curve Joint

05 . 어려웠던 점

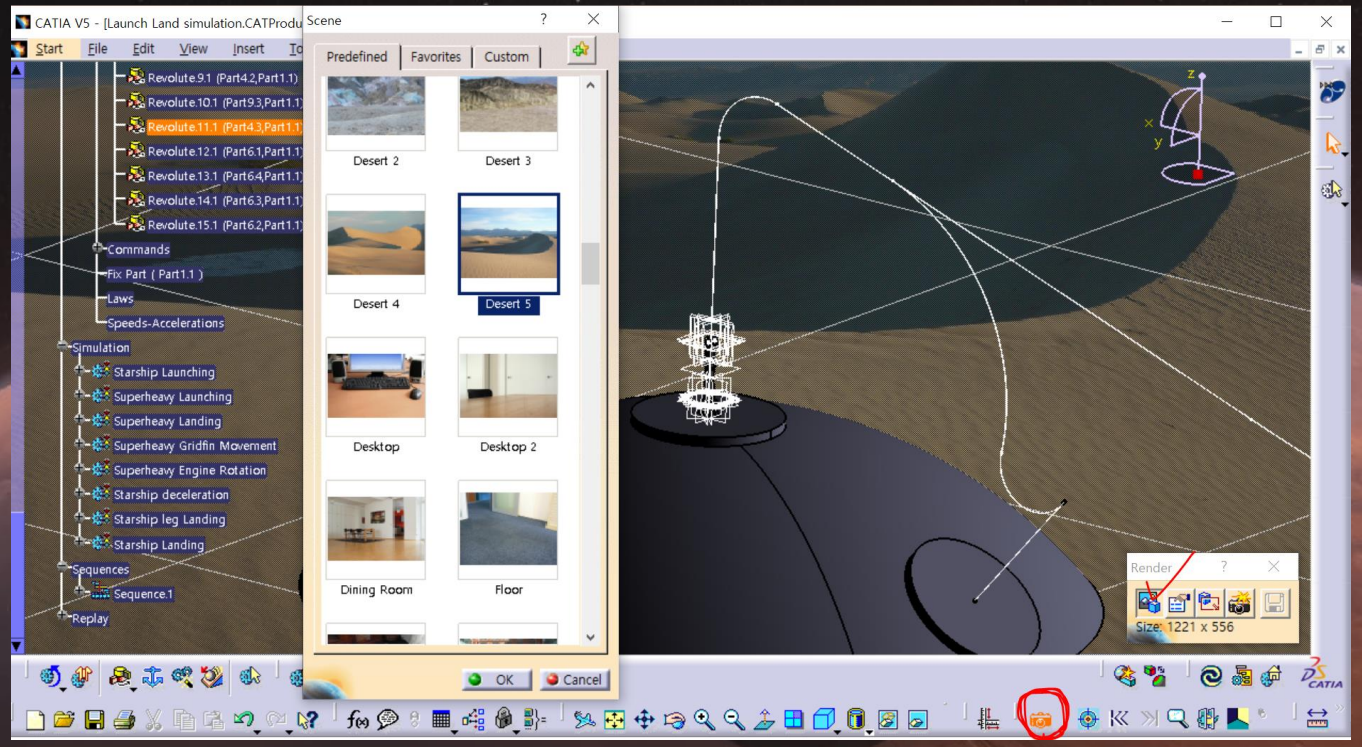
- Boolean Operator 사용시 취소가 불가능해서 새로 다시 만드는 경우도 있었음
- 엔진의 움직임을 구현할 때, Spherical Joint와 Point Curve Joint를 활용하려 했으나 배우 까다로웠음
- 로켓의 이동경로를 두 번씩 그리고, 경로에 맞게 점을 찍어놓아야 Simulated 됐음(DOF 맞추기)
- 팀 작업시, 파일을 주고받다가 파일명때문에 문제가 되는 경우가 있었음
- Assembly Design 작업에서 Constraint할 것이 너무 많고 대칭적이었음 (각 Constraint, Joint, Command 마다 이름을 붙여놓음)







06 . Q&A


CATIA V5 - [Launch Land simulation.CATProdu
Start
File
Edit
View
Insert
Revolute.9.1 (Part4.2,Part1.1)
Revolute.10.1 (Part9.3,Part1.1)
Revolute.11.1 (Part4.3,Part1.1)
Revolute.12.1 (Part6.1,Part1.1)
Revolute.13.1 (Part6.4,Part1.1)
Revolute.14.1 (Part6.3,Part1.1)
Revolute.15.1 (Part6.2,Part1.1)
Commands
Fix Part (Part1.1)
Laws
Speeds-Accelerations
Simulation
Starship Launching
Superheavy Launching
Superheavy Landing
Superheavy Gridfin Movement
Superheavy Engine Rotation
Starship deceleration
Starship leg Landing
Starship Landing
Sequences
Sequence.1
Replay
Scene
Predefined
Favorites
Custom
Desert 2
Desert 3
Desert 4
Desert 5
Desktop
Desktop 2
Dining Room
Floor
OK
Cancel
Render
Size: 1221 x 556