

SPACE SHUTTLE DISCOVERY

A2 Final Project



Introduction

Why the space shuttle?

- Launched 39 missions (184 crewmen)
- Carried the Hubble Space Telescope
- Reusability (Cost per flight)

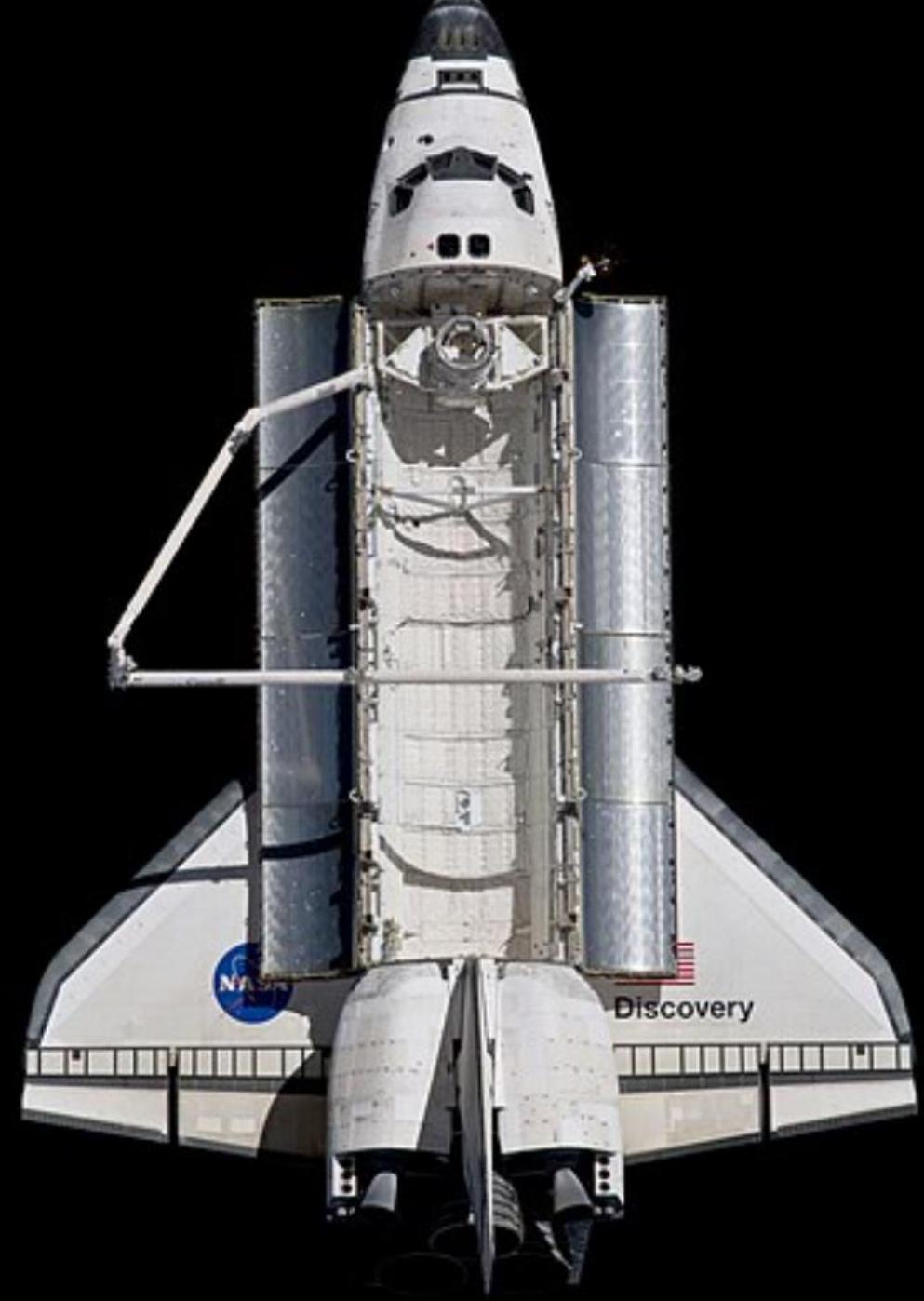
Roles:

- Becca: Fuselage
- Hope: Vertical Fin Stabilizer
- Daniel: Wings & Assembly
- Sal: Orbiter engines & External tank
- Jake: SRB

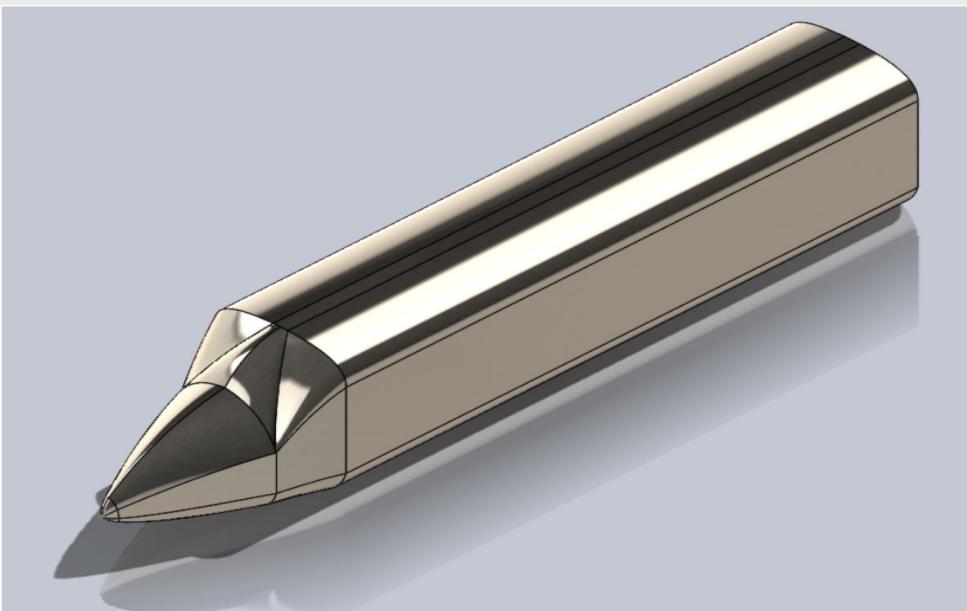
MODELING INDIVIDUAL PARTS



FUSELAGE



Fuselage Modeling Process



Sources:

- NASA

Part breakdown:

- Forward Fuselage: Nose & Crew Compartment
- Mid-fuselage & Aft fuselage

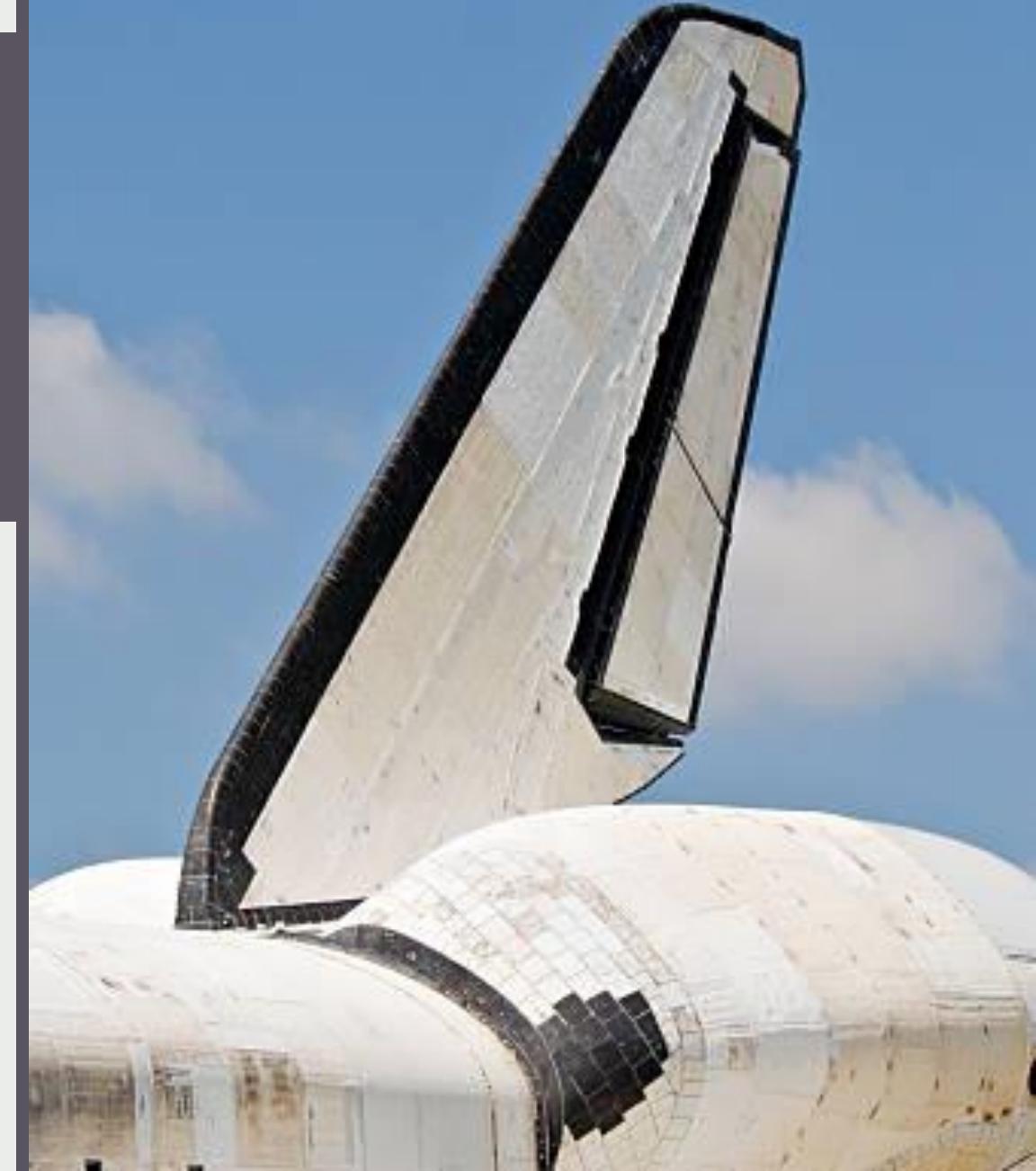
Modeling challenges:

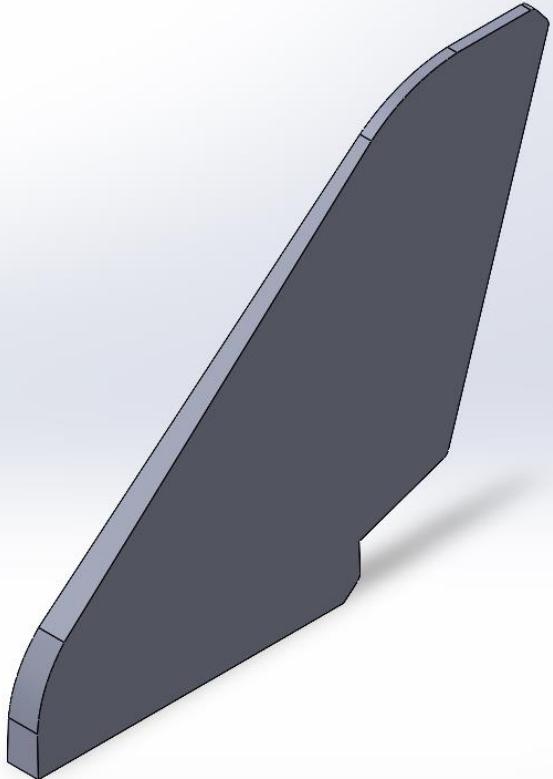
- Struggles with the lines in the lofts not working

Assumptions Made:

- Dimensions: Error on sketching over the blueprints

VERTICAL "FIN" STABILIZER





Vertical "Fin" Stabilizer

Sources:

- NASA

Assembly breakdown:

- Three main "sections"

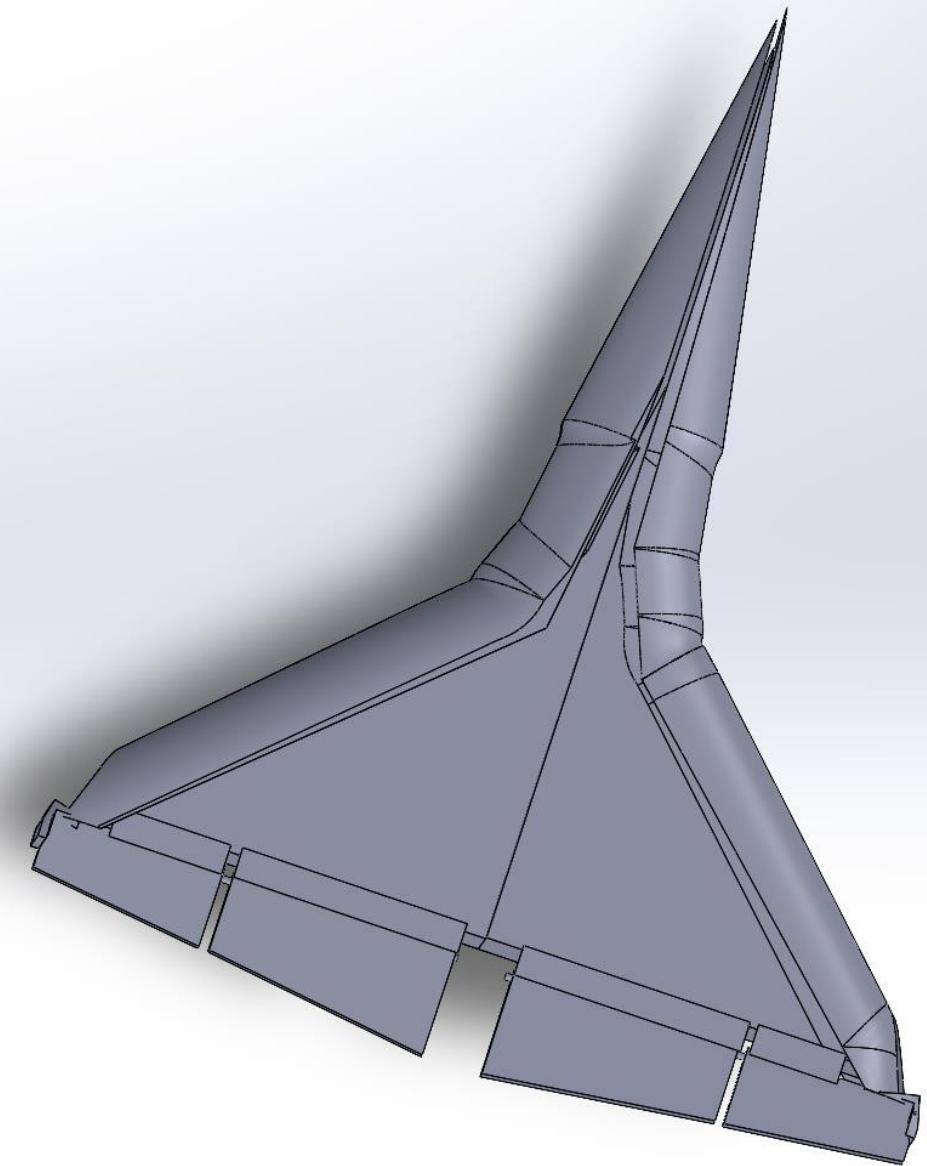
Modeling challenges:

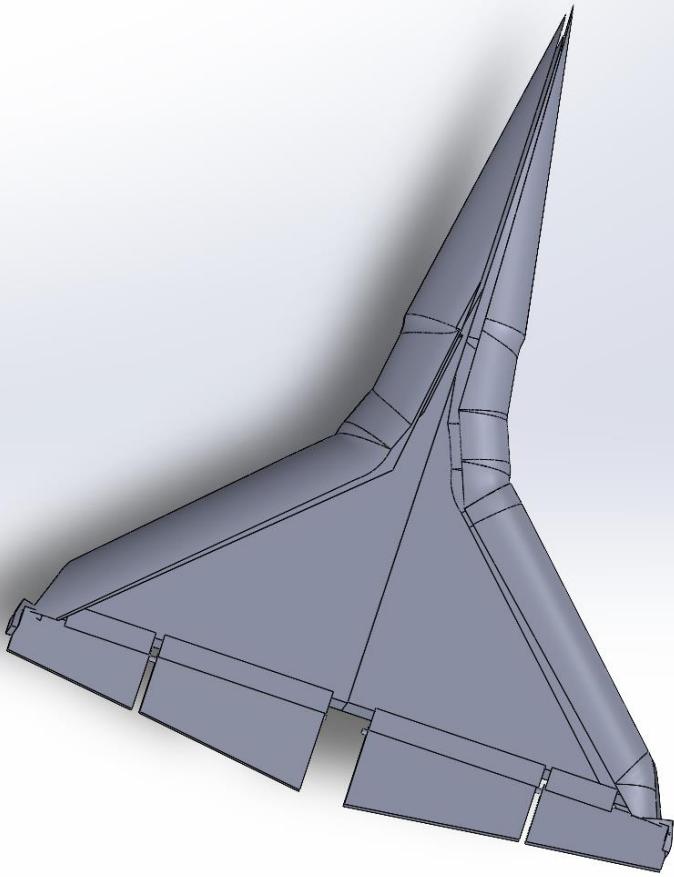
- Using the spline tool and extruding the part

Assumptions made:

- Dimensions

WING





Wing Modeling Process

Sources:

- NASA

Part breakdown:

- The double-delta wing shape
- The reinforced carbon-carbon (RCC) panels along the leading edge
- The elevons/flaps on the trailing edge
- Elevon connection cylinder (spar)
- Hinges

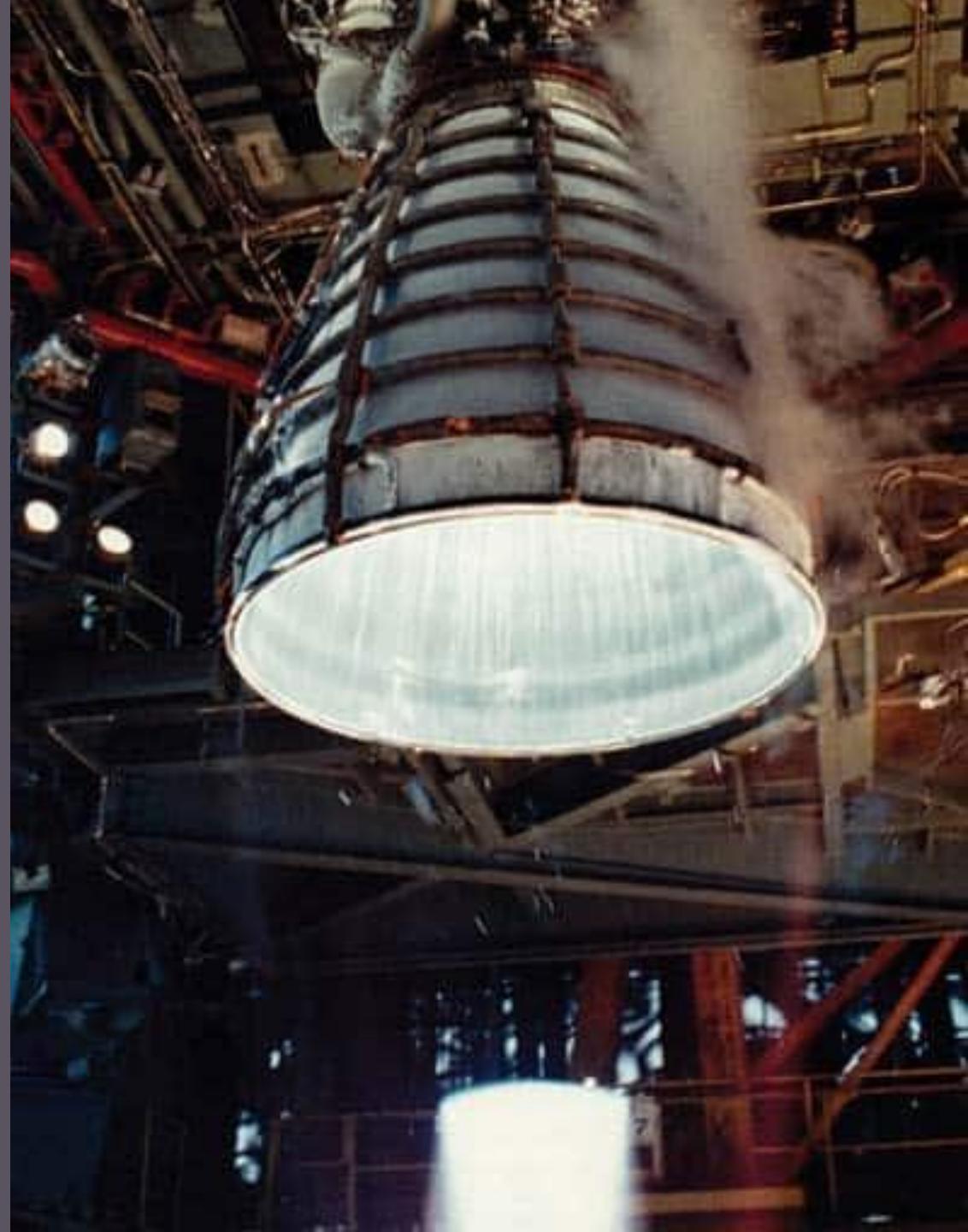
Modeling challenges:

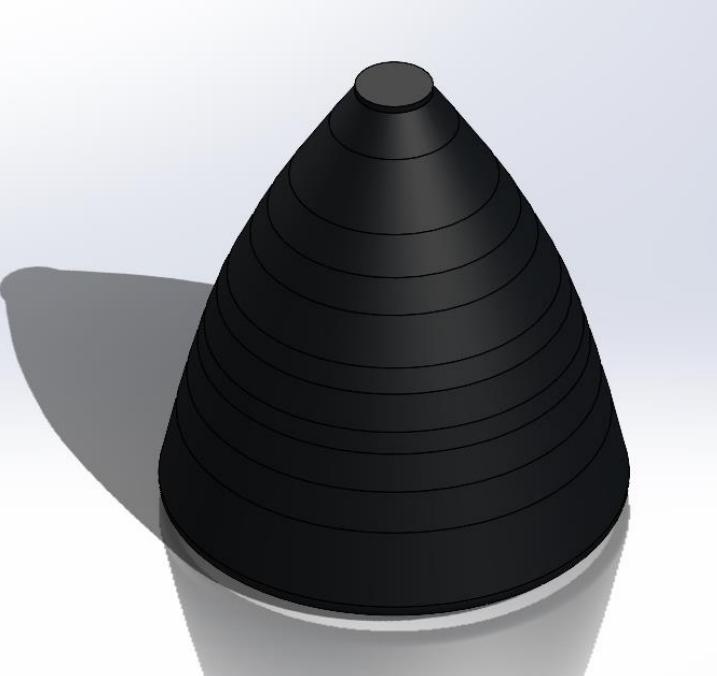
- The delta wing shape does not employ conventional airfoils.

Assumptions made:

- The base profile was sketched on the wing planform
- The elevons were arbitrarily chosen to be 11 inches thick, slightly less than 1/5th the wing maximum thickness

ORBITER ENGINES





Orbiter Engines Modeling Process

Sources:

- NASA

Part breakdown:

- Modeling via external shape 'function' and application of calculus II solid rotation.

Modeling challenges:

- Random fixed points kept the solid from being fully defined.

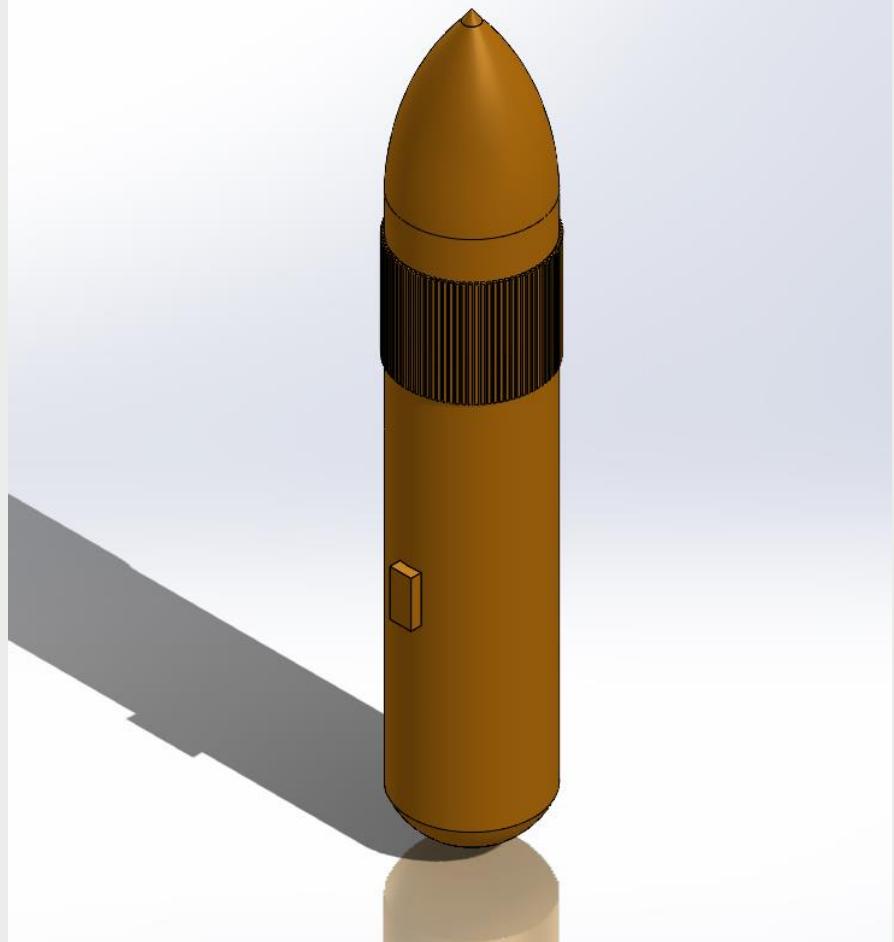
Assumptions made:

- Diameter of the main engine rings.

EXTERNAL TANK



External Tank (ET) Modeling Process



Sources:

- NASA

Part breakdown:

- Mid-tank section.
- Parabolic Nose cone.
- Elliptical Aft dome.
- Inter-tank "ring" section.
- Orbiter-ET attachment point.

Modeling challenges:

- Aligning the nose and aft dome curves so that the solid remained fully defined.

Assumptions made:

- Orbiter-ET attachment point; inter-tank "ring" section.

SOLID ROCKET BOOSTER (SRB)





SRB Modeling Process

Sources:

- United space alliance (USA) illustrated design schematics
- NASA

Part breakdown:

- Motor Stack (mid, forward)
- Nose cone
- Engine Stack and Nozzle

Modeling challenges

- Lost work

Assumptions made:

- Access runway, nozzle, rear engine segment, Support rings

ASSEMBLY PROCESS



THE ORBITER

Sources:

- NASA

Part breakdown:

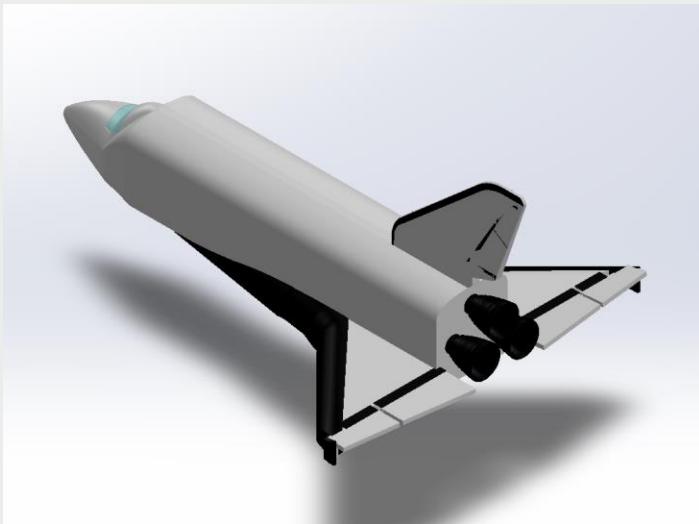
- The Orbiter
- Wings
- Fuselage
- Main Engines
- Vertical Stabilizer/ tail fin

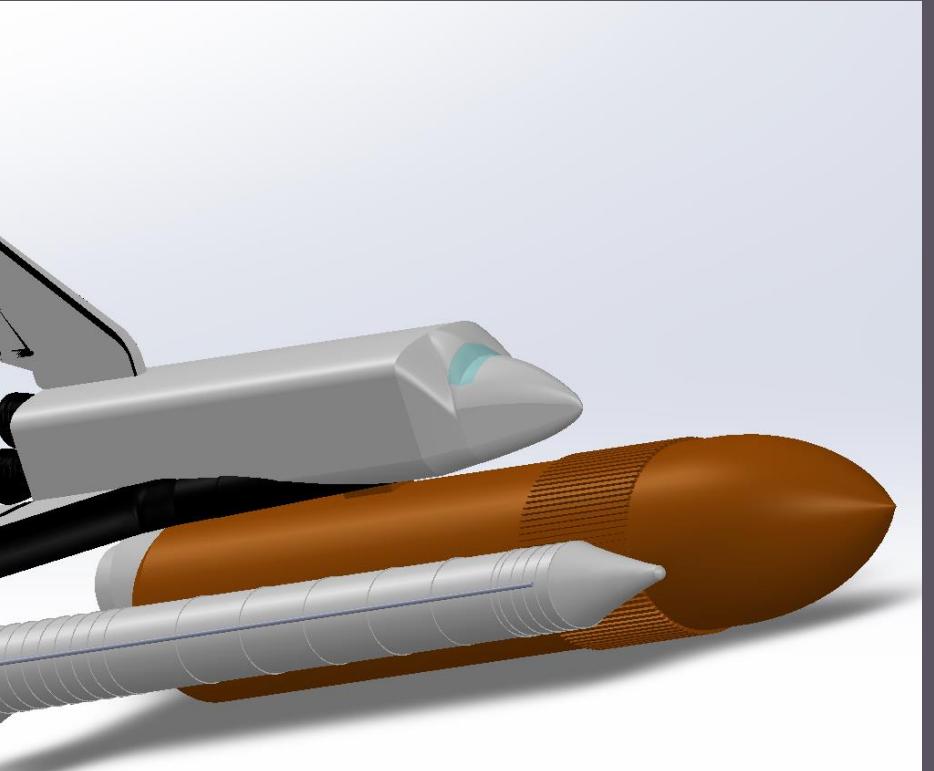
Modeling challenges:

- N/A

Assumptions made:

- The positioning of the main engines was not done according to specific units. They were arranged in a triangle





ORBITER, EXTERNAL TANKS & SOLID ROCKET BOOSTERS

Sources:

NASA

Part breakdown:

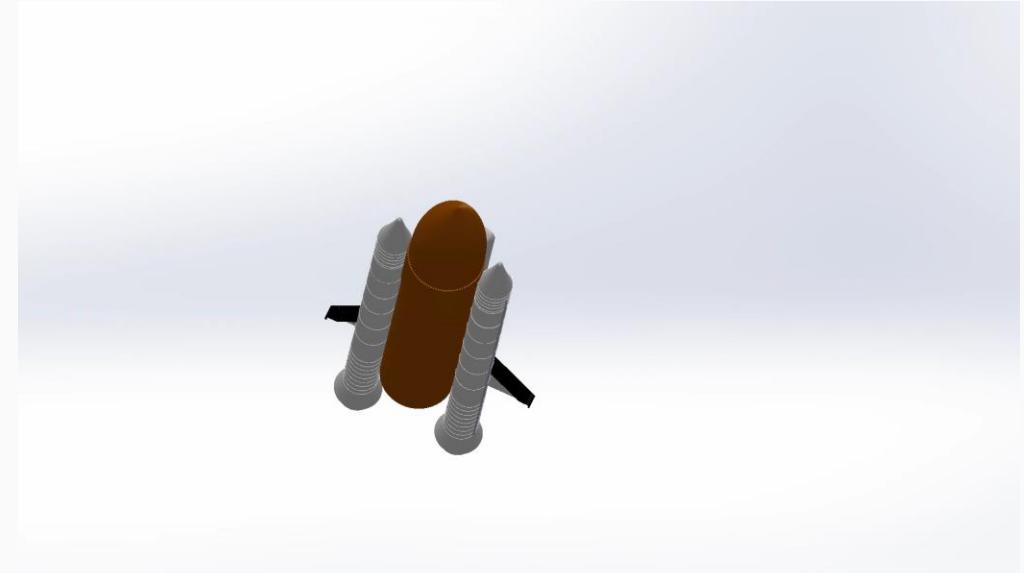
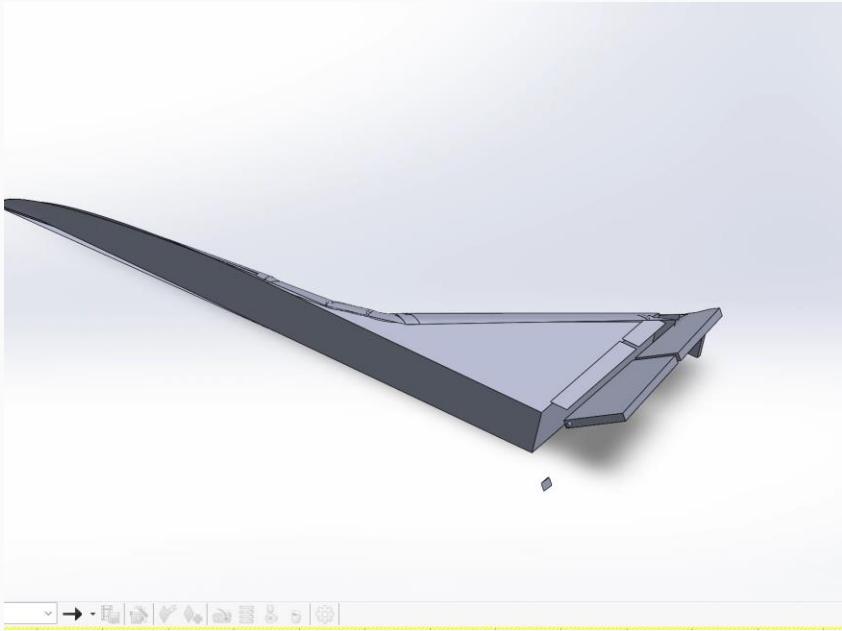
- The Orbiter – Wings, Fuselage, Main Engines, Vertical Stabilizer/ tail fin
- The external tank
- The Solid Rocket boosters

Modeling challenges:

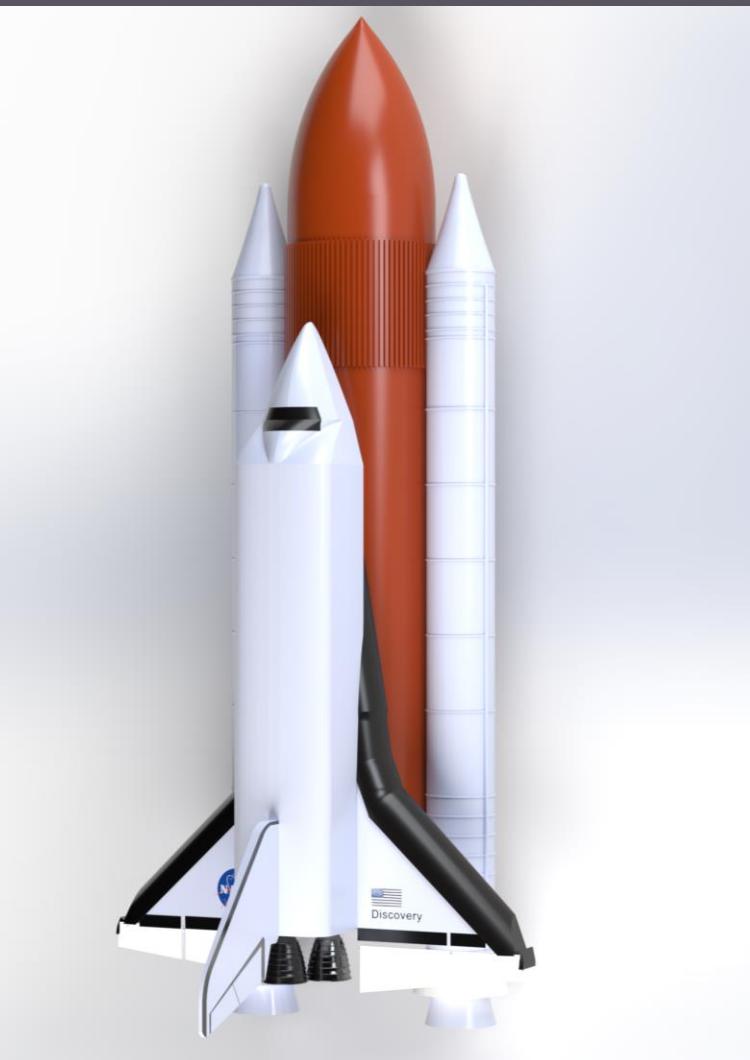
- N/A

Assumptions made:

- The connection systems for the SRB-External tank and Orbiter-External tank are adaptations of the real thing



MOTION STUDIES



SIDE BY SIDE
COMPARISON

Questions

Picture Sources

- <https://spaceref.com/science-and-exploration/stacked-shuttle-solid-rocket-boosters-on-the-move-2/>
<https://www.launchphotography.com/STS-133.html>
- <https://www.istockphoto.com/photo/space-shuttle-vertical-stabilizer-gm176979187-20037915>
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