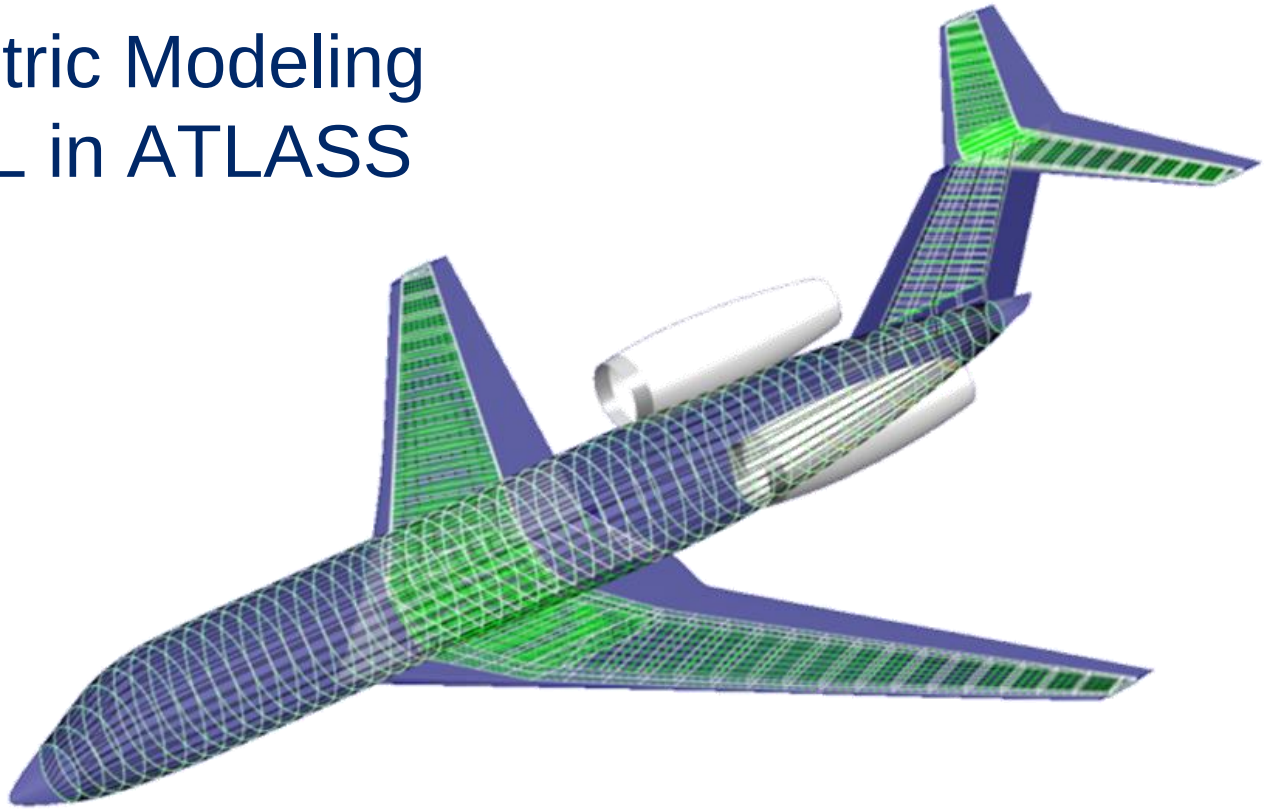
ASMI Rotation - Parametric Modeling and EKL in ATLASS



Vishank Battar

04/24/2019

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Overview

- Introduction
- Parametric Modeling
- Engineering Knowledge Language
- Questions

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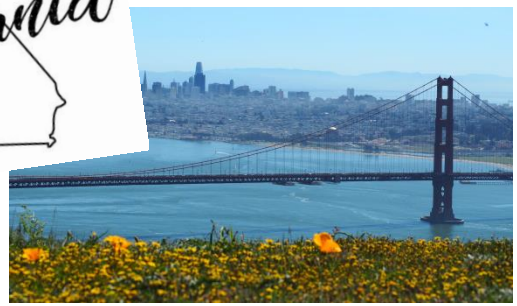
Introduction - About me

Where I'm from and what I love!



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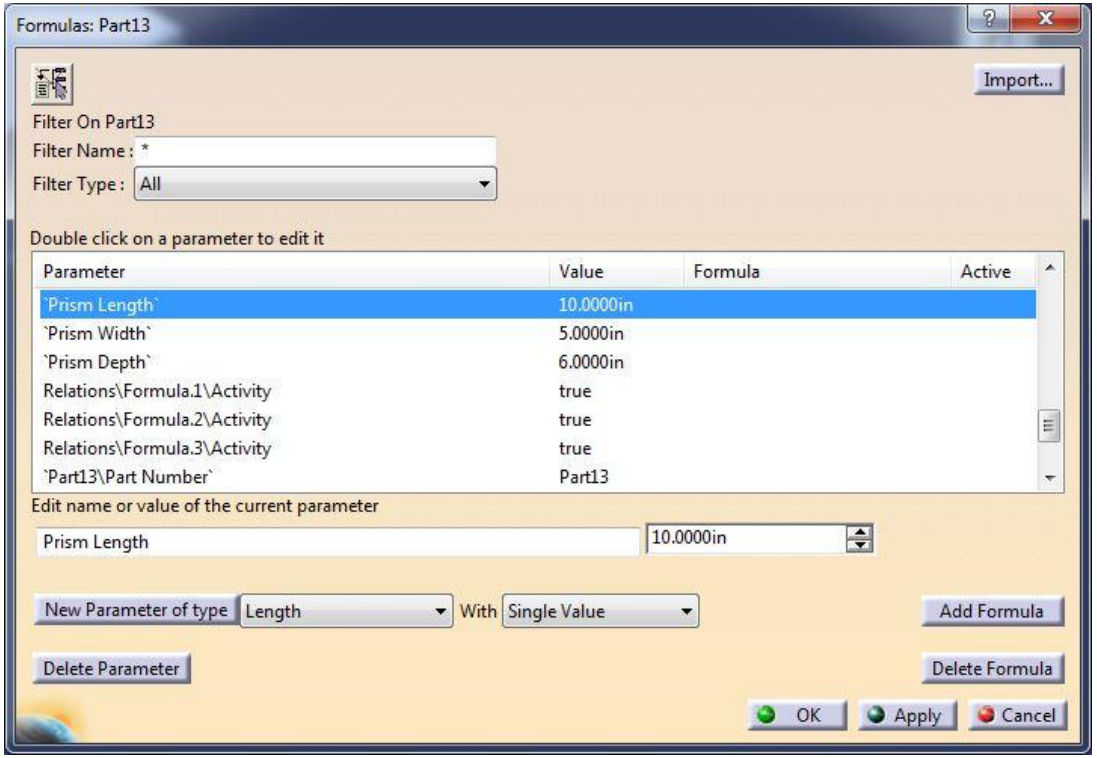
Parametric Modeling - What is Parametric Modeling?

- Properties of Design are defined by changeable parameters

← Knowledge Workbench



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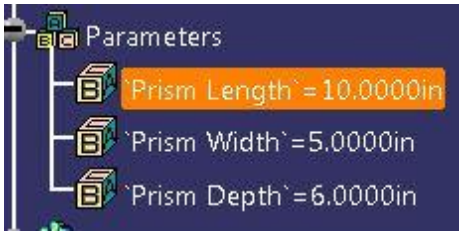
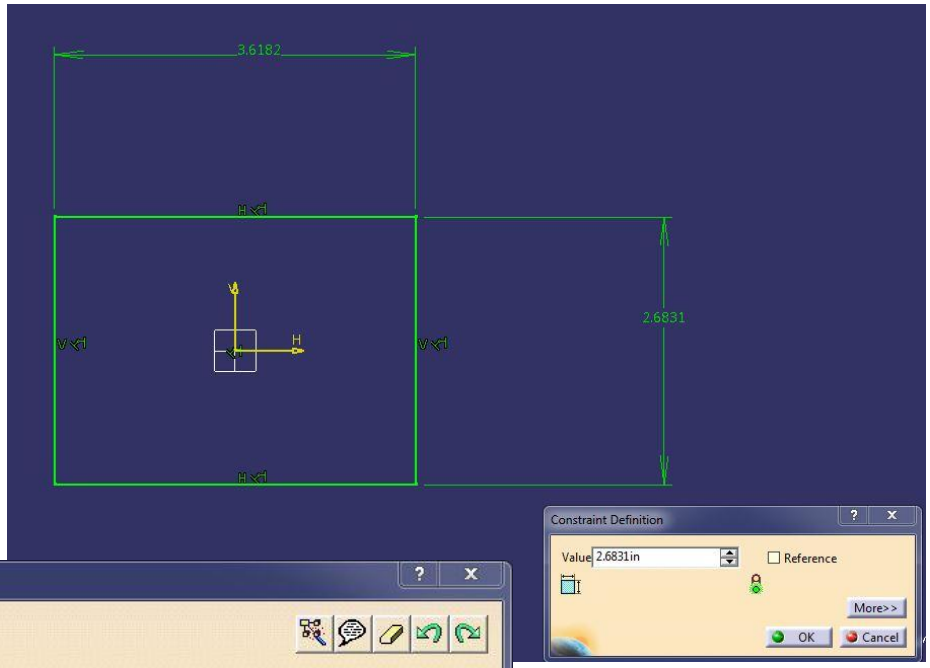
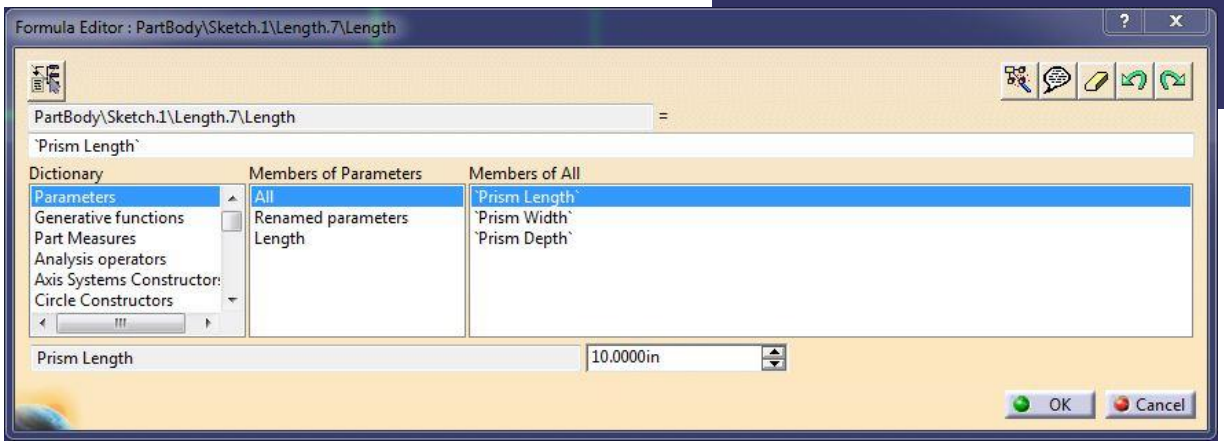
Parametric Modeling - Linking Design Constraints to Parameters

- Constraints can be defined by formulas set equal to parameter values







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Parametric Modeling - Linking Design Constraints to Parameters

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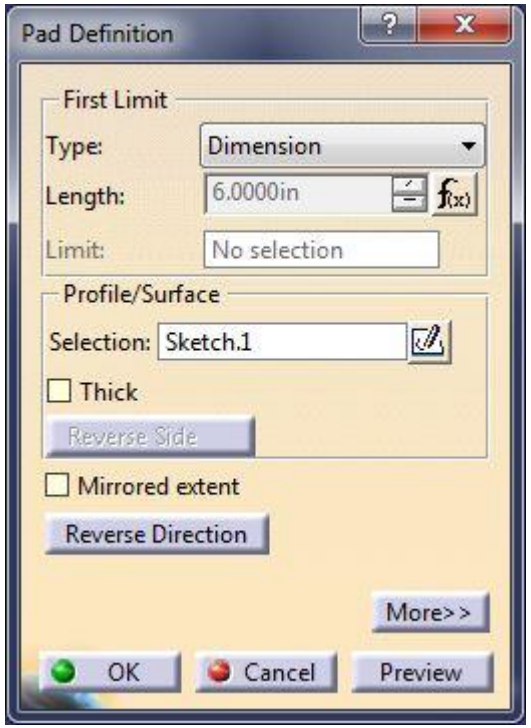


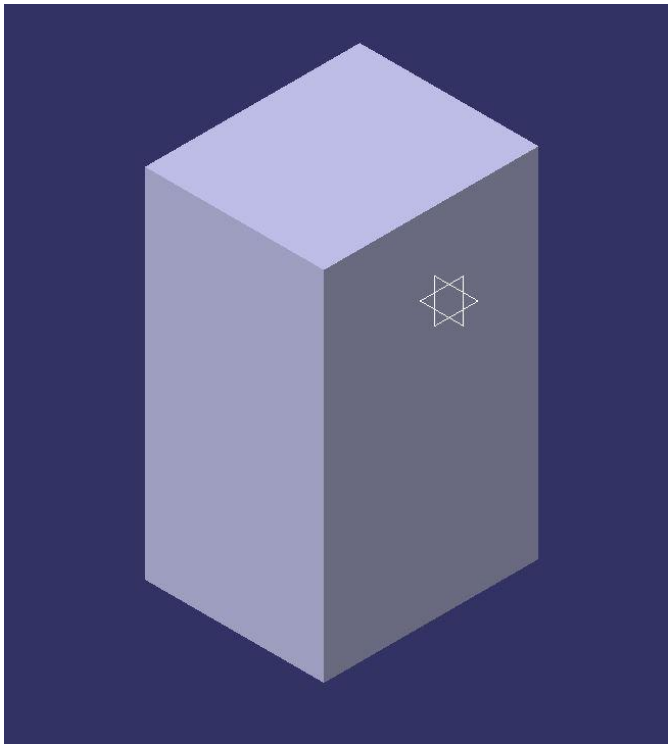
← An indicator that this constraint was defined with a formula

Parametric Modeling - Relations Folder

- All formulas are stored in the relations folder

Parametric Modeling - Final Product

- The final product is the same, but changing the design becomes much easier



User Defined Features (UDFs) and Knowledge Patterns

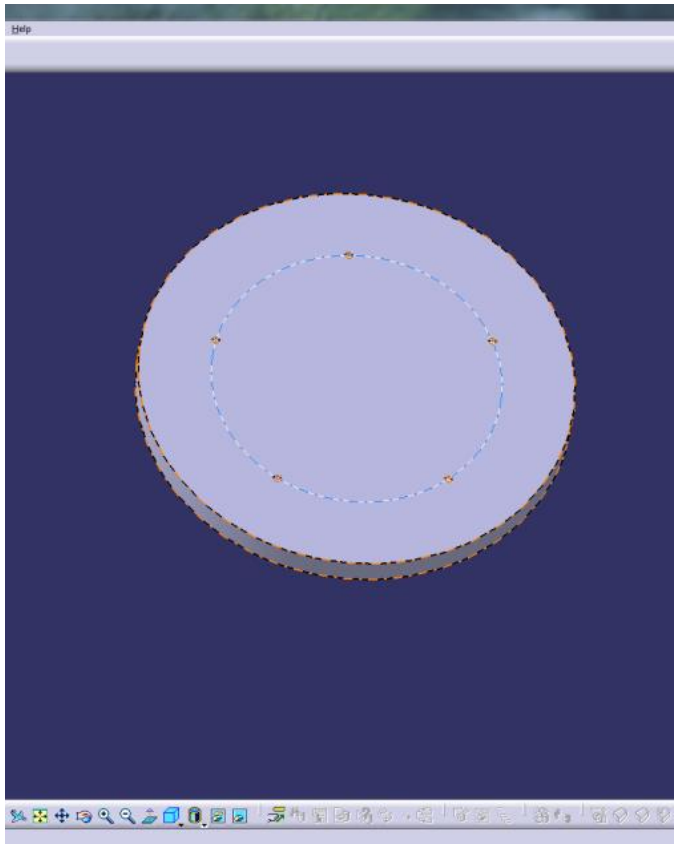
- User Defined Features are Packaged Sets of Geometry

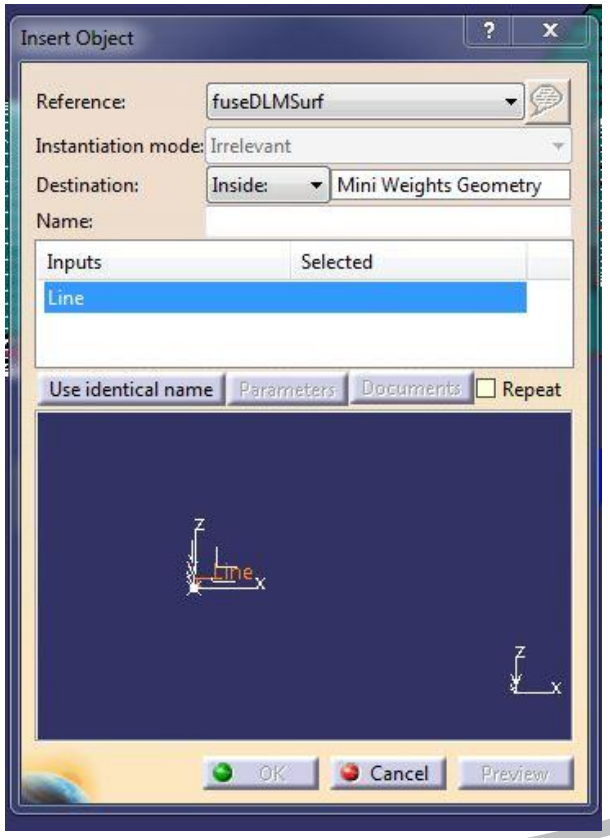
  E.g. a sphere, a rivet, a spar, etc.

- Knowledge Patterns are pieces of code that help automate the design process

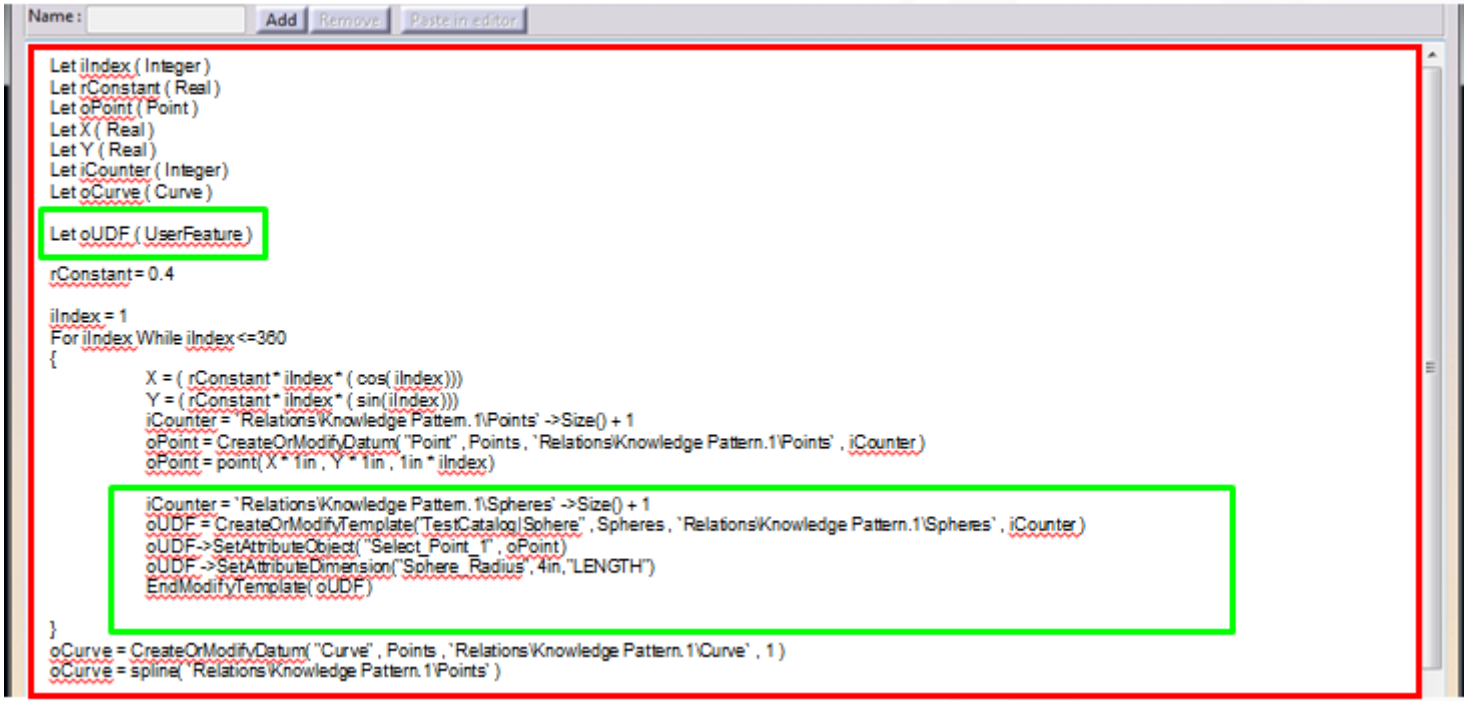
Training - User Defined Features (UDFs)

- UDFs can be instantiated manually



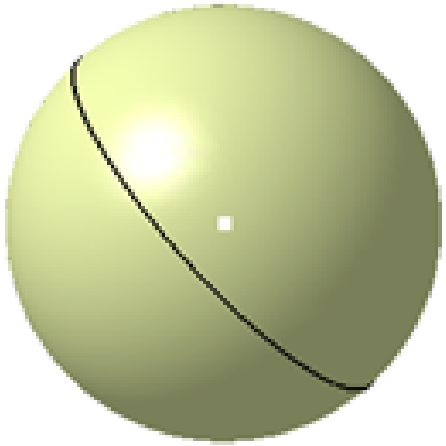


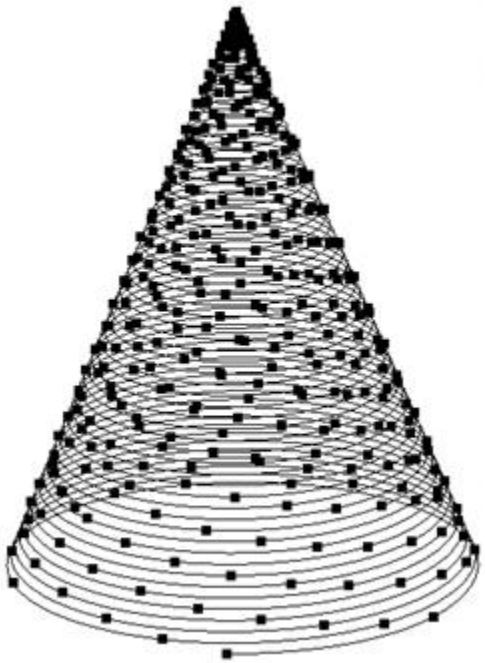
Training - User Defined Features (UDFs)



- UDFs can also be instantiated with the use of a knowledge pattern

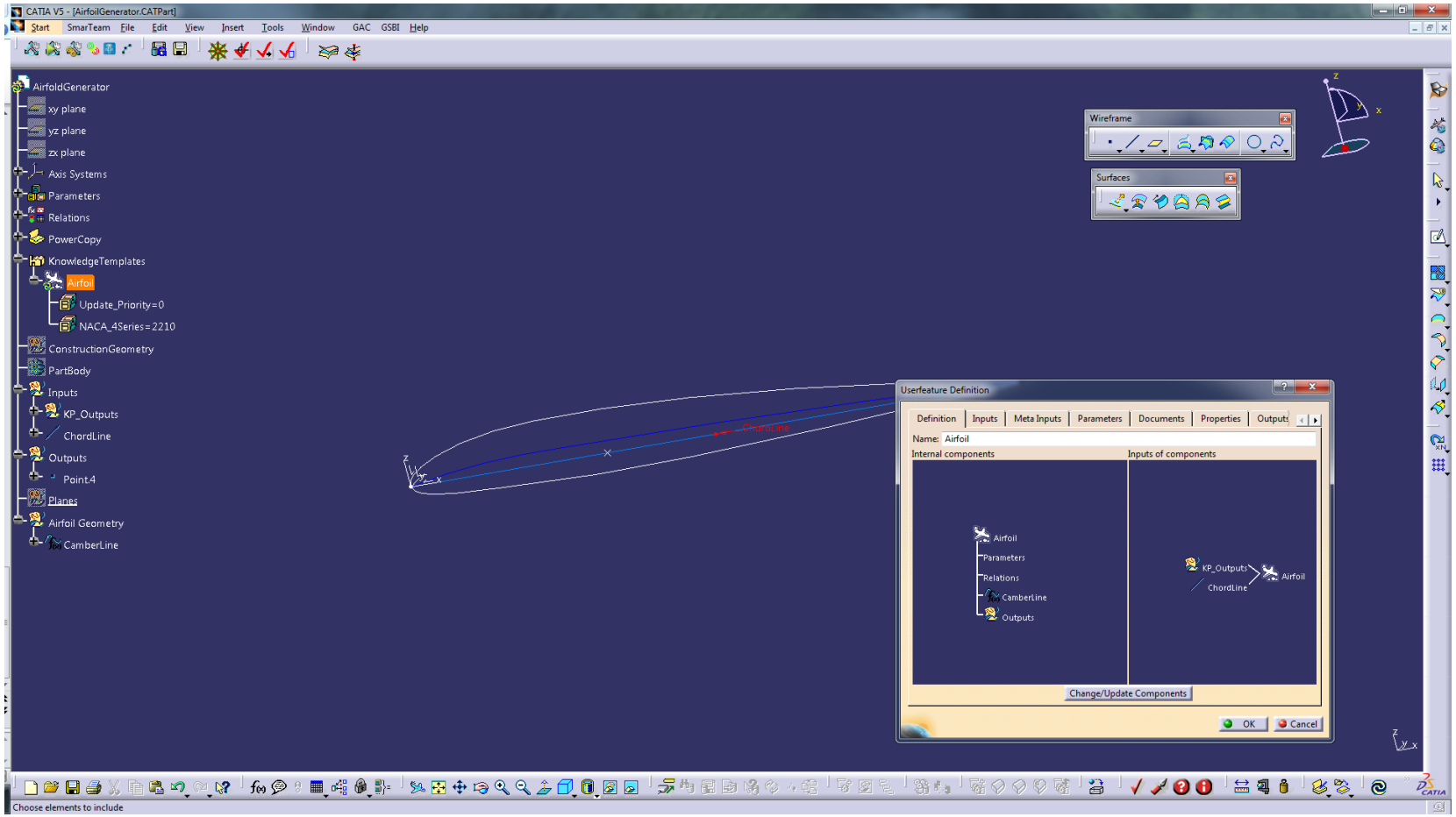
Training - User Defined Features (UDFs)





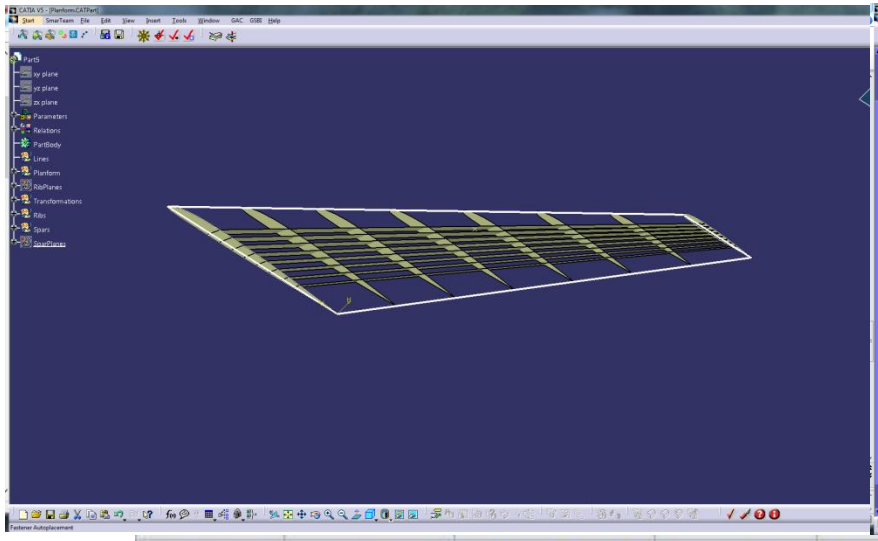
- UDFs can also be instantiated with the use of a knowledge pattern

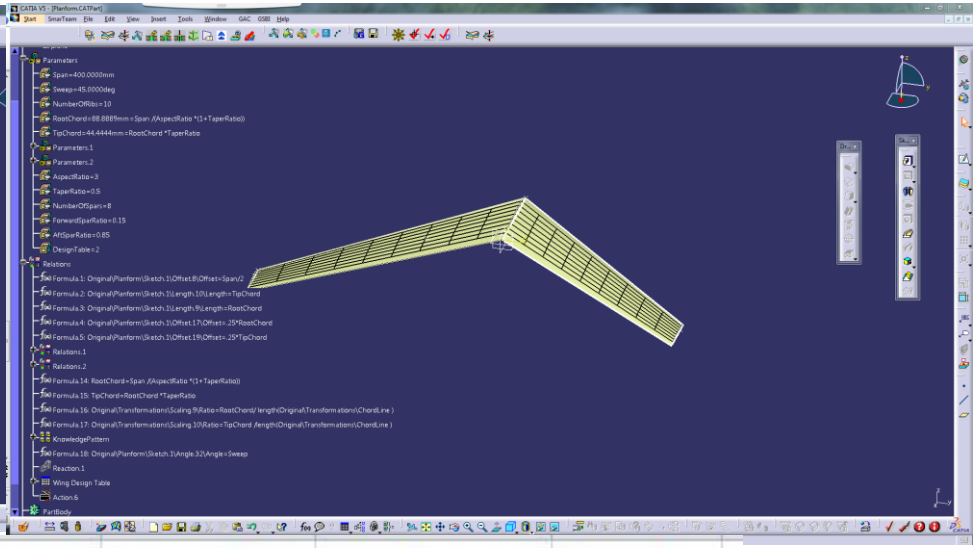
Training - Putting a Knowledge Pattern Inside of a UDF



- Knowledge pattern outputs can also be put into UDFs

Training - Final Outcome

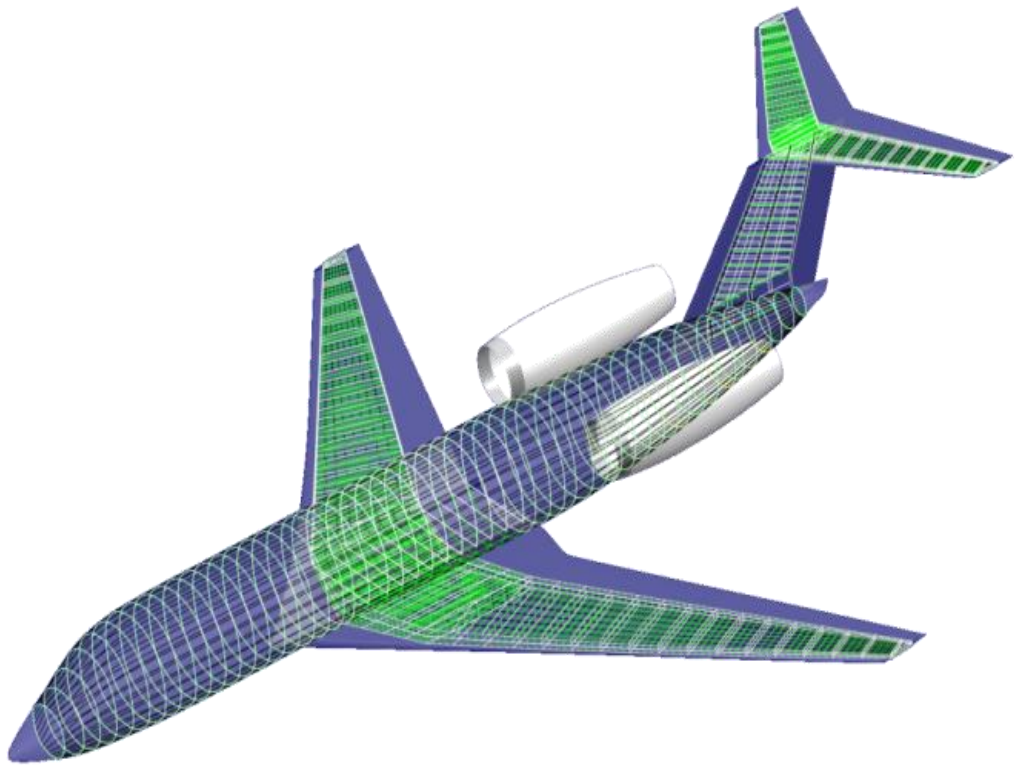




Span (mm)	Sweep (deg)	NumberOfRibs	AspectRatio	TaperRatio	NumberOfSpars	ForwardSparRatio	AftSparRatio
400	25	10	3	0.5	8	0.15	0.85
400	45	10	3	0.5	8	0.15	0.85
400	25	6	3	0.5	8	0.15	0.85
400	25	10	5	0.5	8	0.15	0.85
400	25	10	3	0.3	8	0.15	0.85
400	25	10	3	0.5	12	0.15	0.85
400	25	10	3	0.5	8	0.25	0.85
400	25	10	3	0.5	8	0.15	0.75

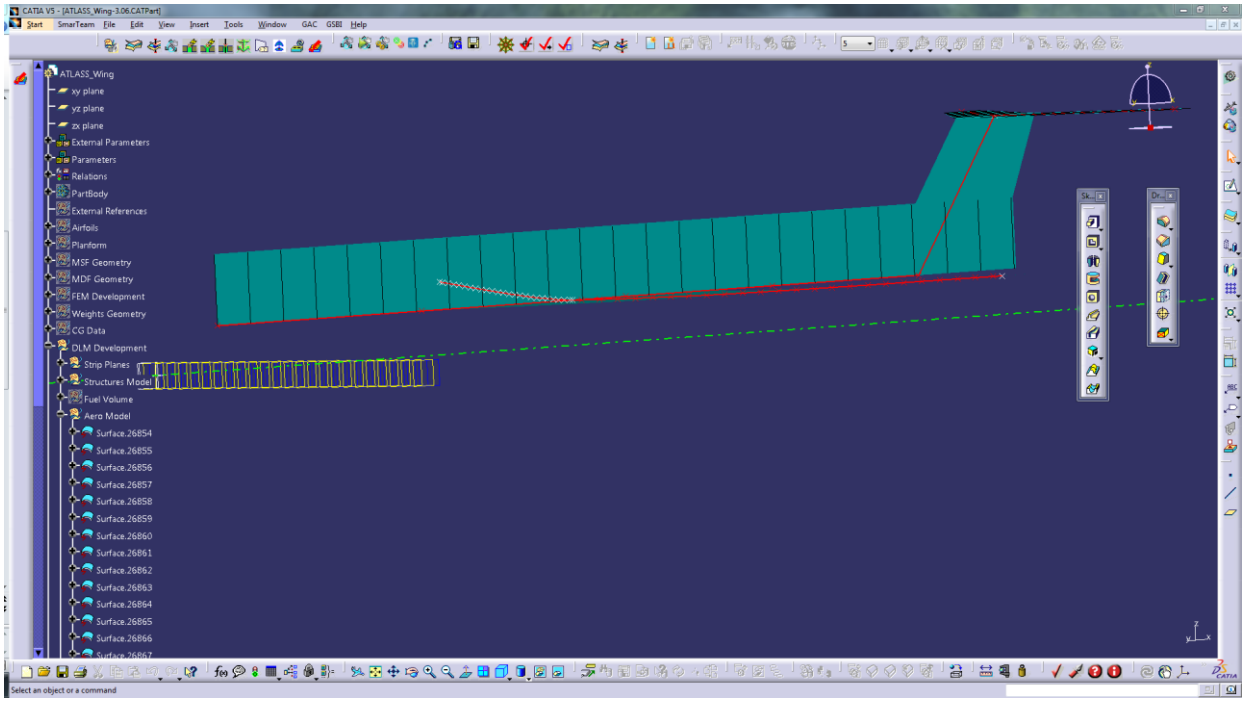
- Used knowledge patterns and UDFs to create parameter-based wing design

Automated Top Level Aircraft Structural Sizing Tool (ATLASS) - Overview



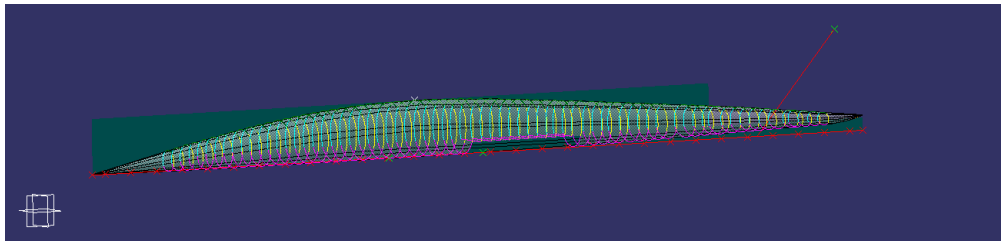
- ATLASS is a weight optimization tool that bridges the gap between preliminary design and detailed design

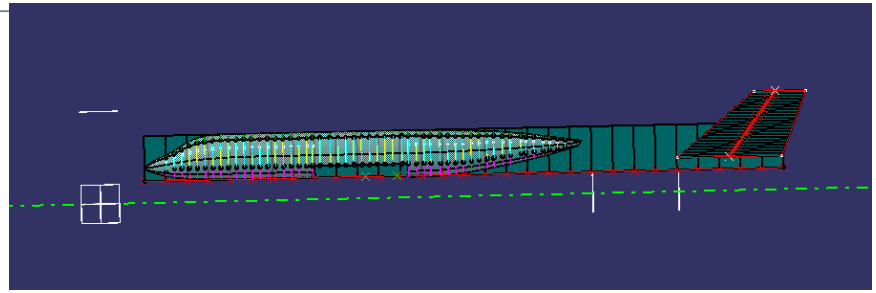
Fuselage Doublet Lattice Model (DLM)

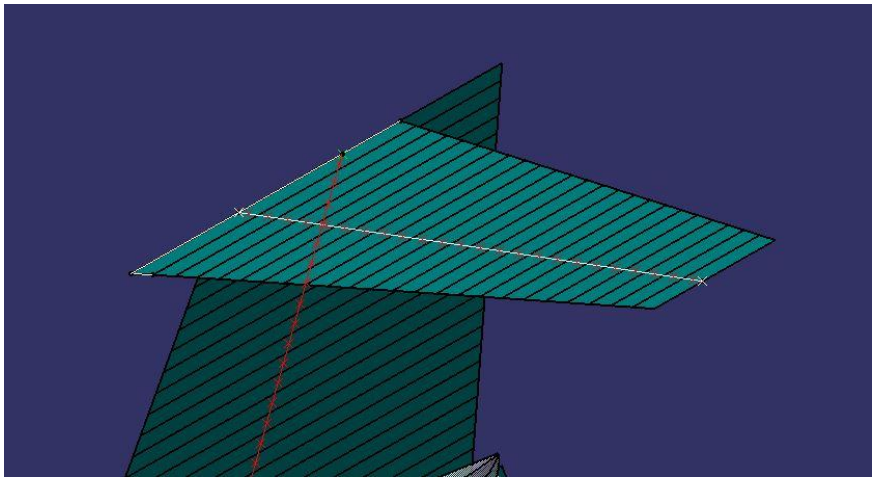


- Creates Panelized weights to be used in determining aerodynamic loads
- Initially used UDFs, switched to creating geometry entirely from code for consistency with other parts of plane

Fuselage DLM (continued)

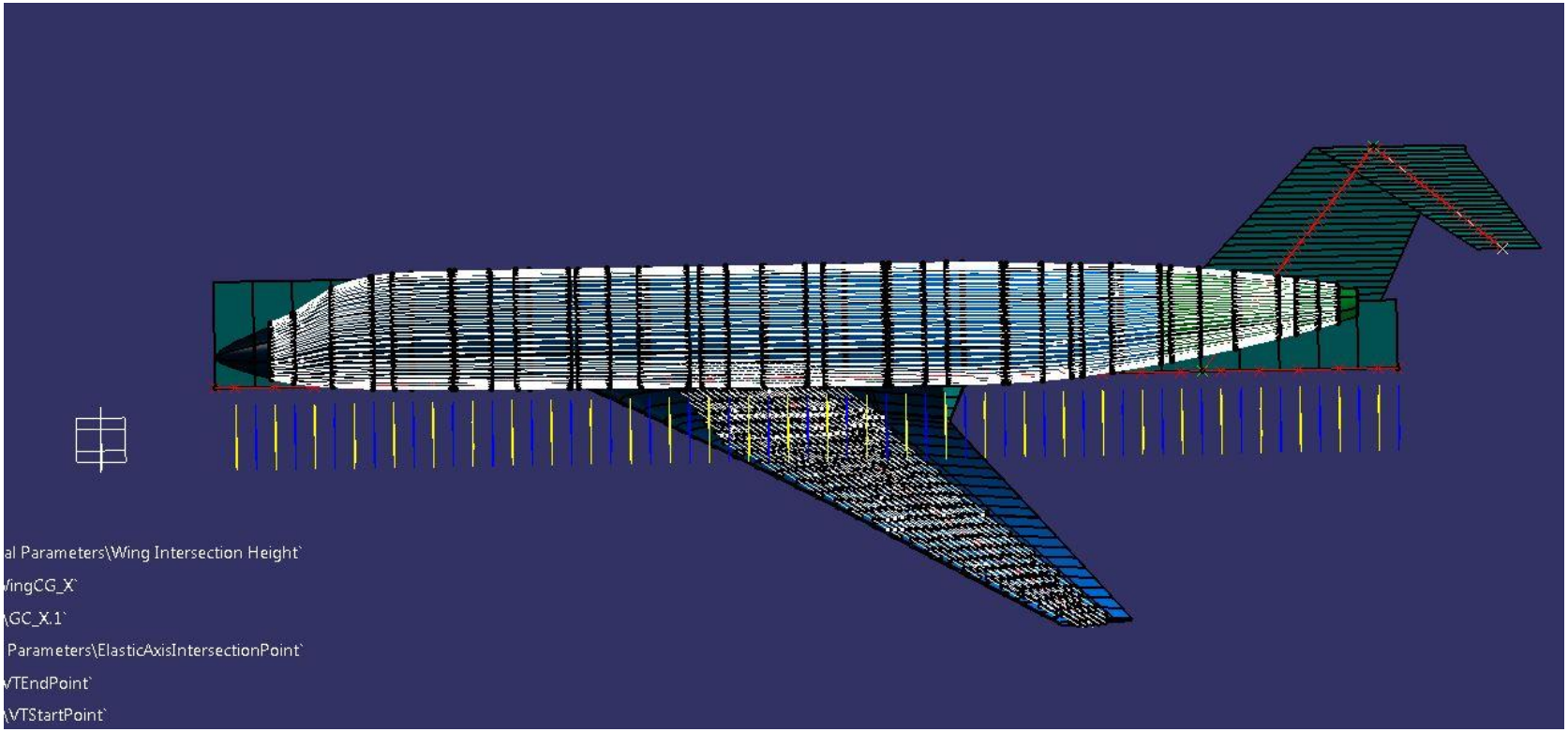






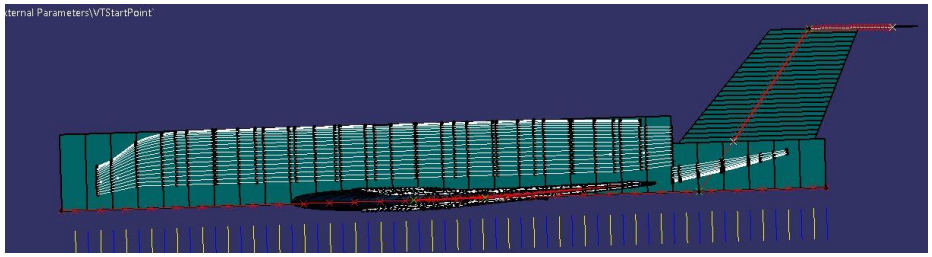
- Had trouble making it work with different design table configurations and different parts of aircraft

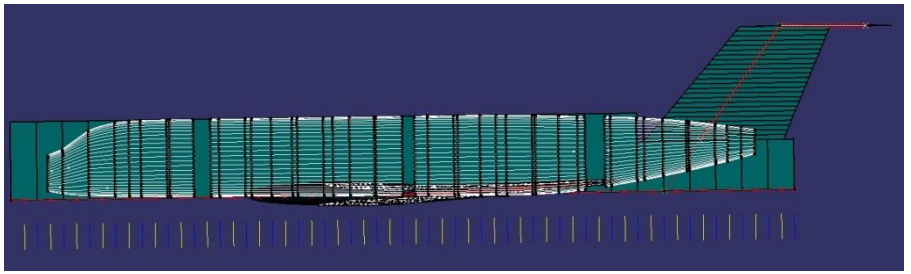
Mass Properties - Creation

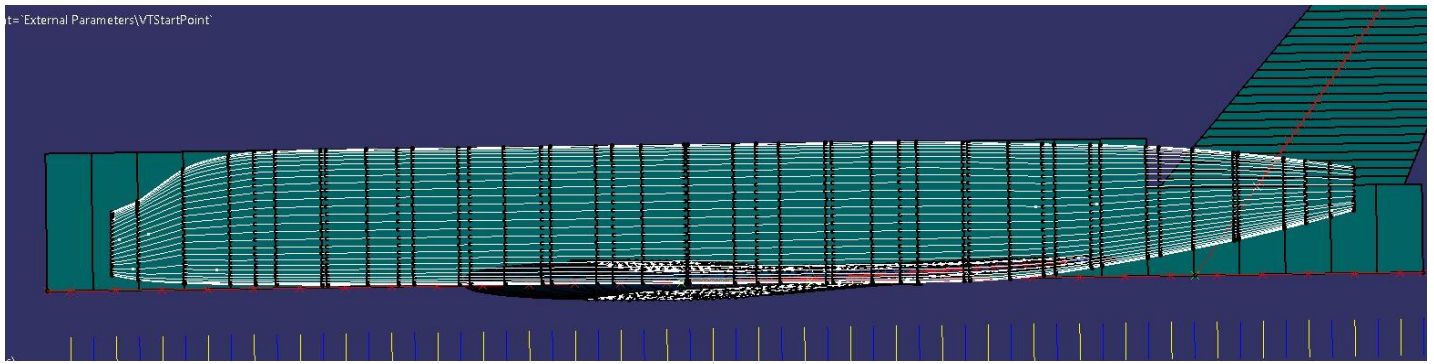


- Switched from panel UDFs to panels created from code to make panelizing weights easier
- Divides structural weight contributions from fuselage surfaces and stringers into panels

Mass Properties - Optimizing Code







- Code initially took 1-2 hours to run, so attempts were made to decrease required iterations
- Stringers were split into multiple lists so that code would not have to iterate through 1000 stringers each run through loop
  - Stringers were organized based on fraction of list, but this was unsuccessful
  - Stringers were organized based on fraction of fuselage length, this is in progress, but will likely be successful

Final Project Idea

- ATLASS for cars
  - Combine personal interest with knowledge acquired from this semester

Choices For Next Rotation

1. Service Engineering
2. Systems Test Design Engineering - Mechanical
3. Flight Test Engineering
4. Propulsion and Thermodynamics

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Plans at Purdue

I have a few major goals for my time at Purdue:

1. Get a co-op at a reputable company - Check
2. Do research - NASA Extraterrestrial Habitat
3. Study abroad - France, Fall 2020
4. Work at the Innovation and Design Center - Summer 2019

Thank You!

Questions?

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