

Cart3D Engine Modeling in OpenVSP

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OpenVSP Workshop 2020

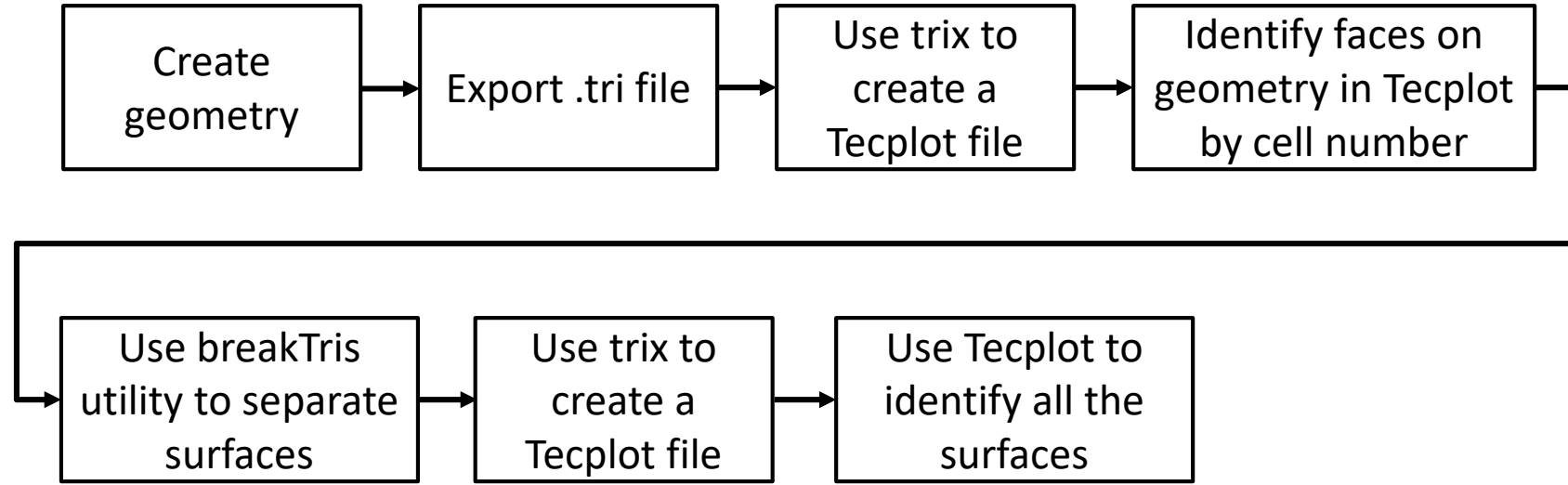
- Motivations
- Current Process
- Desired Solution
- VSP UW Coords
- Engine Geometry

- PhD Dissertation centered on understanding propulsion-airframe integration aspects of over-wing nacelles
- Needed a powered engine model for the analysis
- Started with SU2, but moved to Cart3D when I joined NASA
- Plan was always to use OpenVSP for the geometry engine

Described Cart3D Surface Splitting Process



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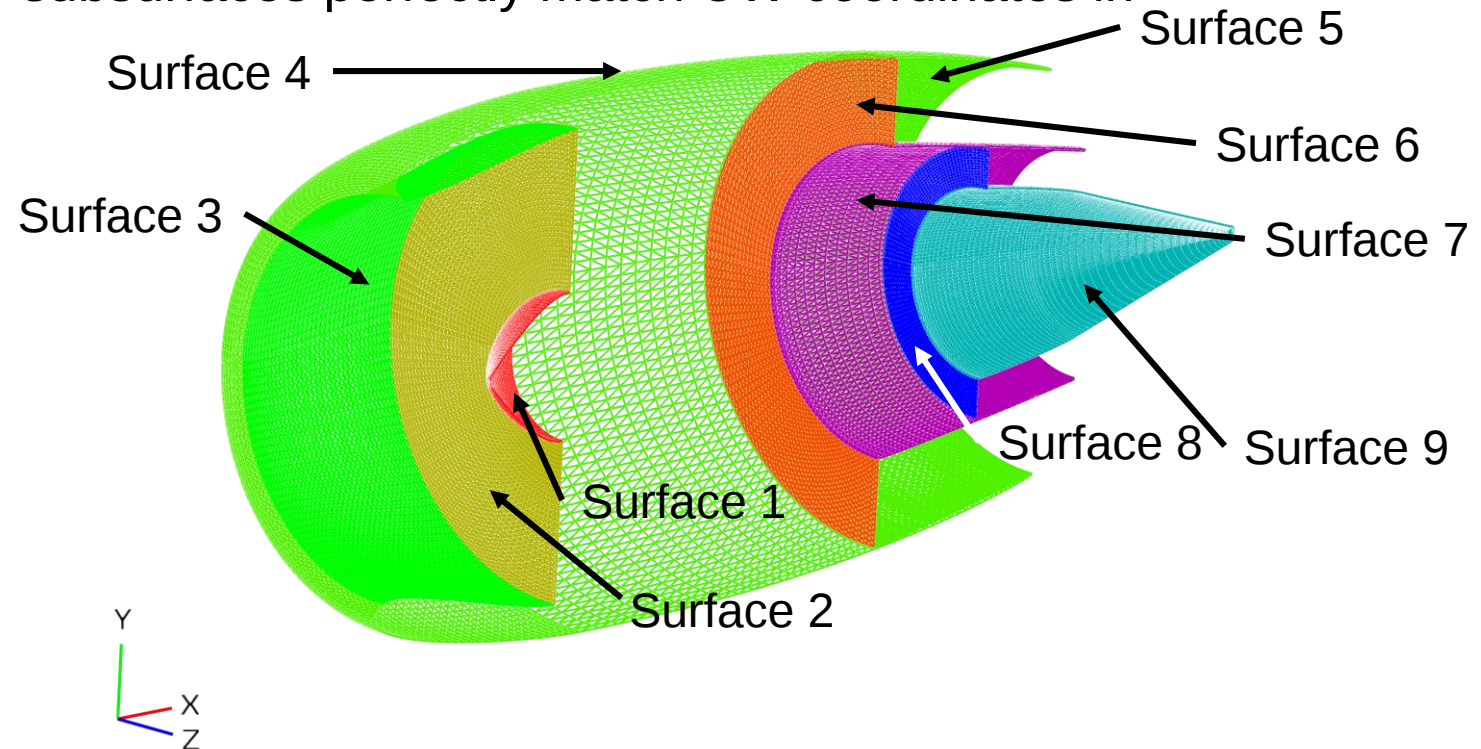


Desired Solution



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- Goal was to make and identify surfaces coming out of Cart3D so that I would not have to re-identify cells to separate via breakTris
- OpenVSP subsurfaces will be broken out as separate components
- Challenge: Small gaps in the geometry and subsurface definition caused meshing and CFD run errors
- Solution: Make the subsurfaces perfectly match UW coordinates in OpenVSP





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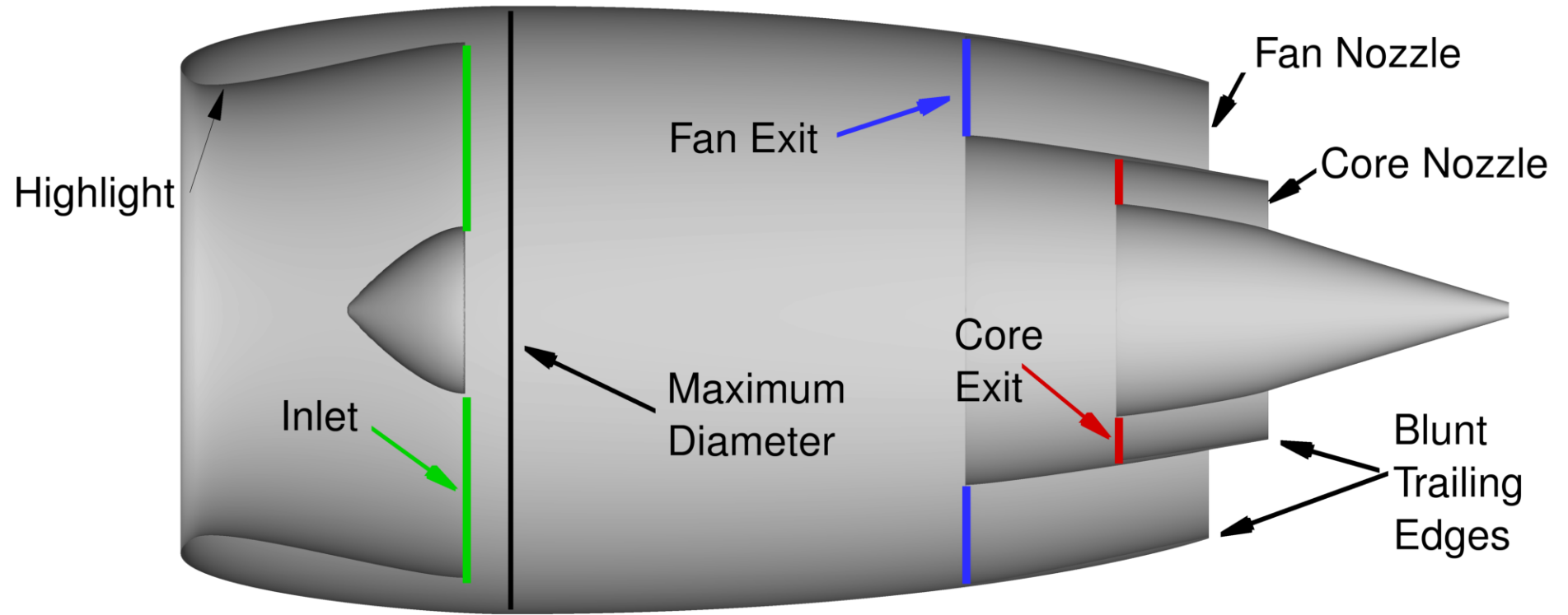
- In UW-space, 0 is the first cross section, 1 is the last, regardless of component size
- Intermediate cross sections have the U (or W) coordinate $U = i/n$ where n is the last listed cross section and i is the current cross section
- If $1/n$ is irrational, sub-surfaces cannot be placed exactly on the cross-section U/W coordinates
 - Therefore acceptable number of surfaces are 2, 4, 5, 8, 10, 16, 20, 25, ...
- What if your geometry does not have the proper number of cross sections? Pad the geometry.

My Engine Geometry



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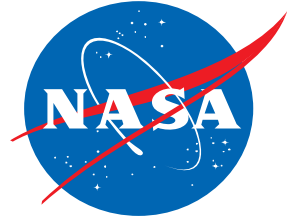
- Stack geometry with 20 cross sections (numbered 0 – 20)
- Controls key areas and dimensions
- Has blunt surfaces on spinner nose, trailing edges
- Non-axis-symmetric nacelle is possible through skinning



Acknowledgements



- This work was completed independently, prior to working at NASA. The presentation was compiled and presented with the support of the Advanced Air Transport Technology program.



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- Engines can be exported directly from OpenVSP to Cart3D with high quality, structured meshes
 - Placing a cross section at the highlight eases meshing in external programs and OpenVSP
 - Place subsurfaces elsewhere allows for exporting straight from OpenVSP