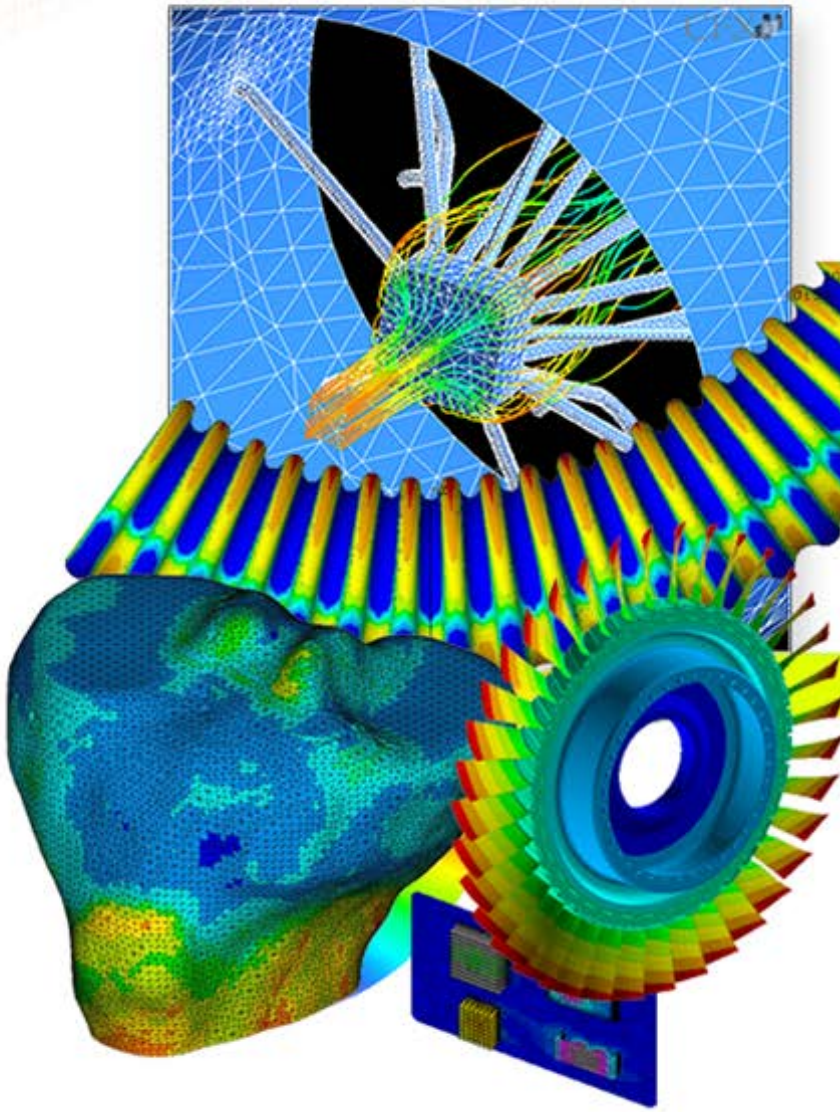
CAE ASSOCIATES

ENGINEERING ADVANTAGE

Building Flow Domains with ANSYS DesignModeler

February 7, 2013



MJK Notes

- Talk through simplification, break
- Discuss Internal Flow domains, Fill and Demo, break
- Discuss External Flow domains, Enclosure break
- Demo, summary
- TO DO:
  - Enclosure operation slide
  - Poll questions

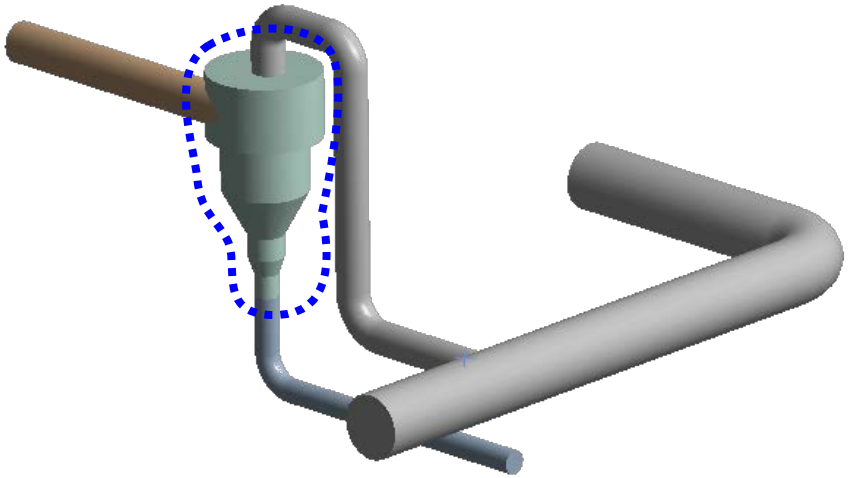
Agenda

- Flow Domain Basics
- Why use ANSYS DesignModeler?
- Extraction Techniques and Simplification Tools
- Live Demonstration

Flow Domains

- One of the first steps in any CFD analysis is to identify the extents of the flow domain in which the governing equations are to be solved

- Often this requires isolating a section of a larger physical system
  - i.e. a single valve in a piping network



- Deciding where the computational domain begins and ends has an impact on the accuracy of your model, so choose wisely
  - Do you have information about the physical system in a particular location?

Flow Domains

- Once you've identified the overall shape and extents of the flow domain, now you have to extract it!

- Flow Domains can be divided into two basic categories:
  - Internal Flow Domains
    - Flow through pipes, pumps, etc.
    - Flow is bounded on all sides by walls
  - External Flow Domains
    - Flow around objects like buildings, aircraft, etc.

Why ANSYS DesignModeler

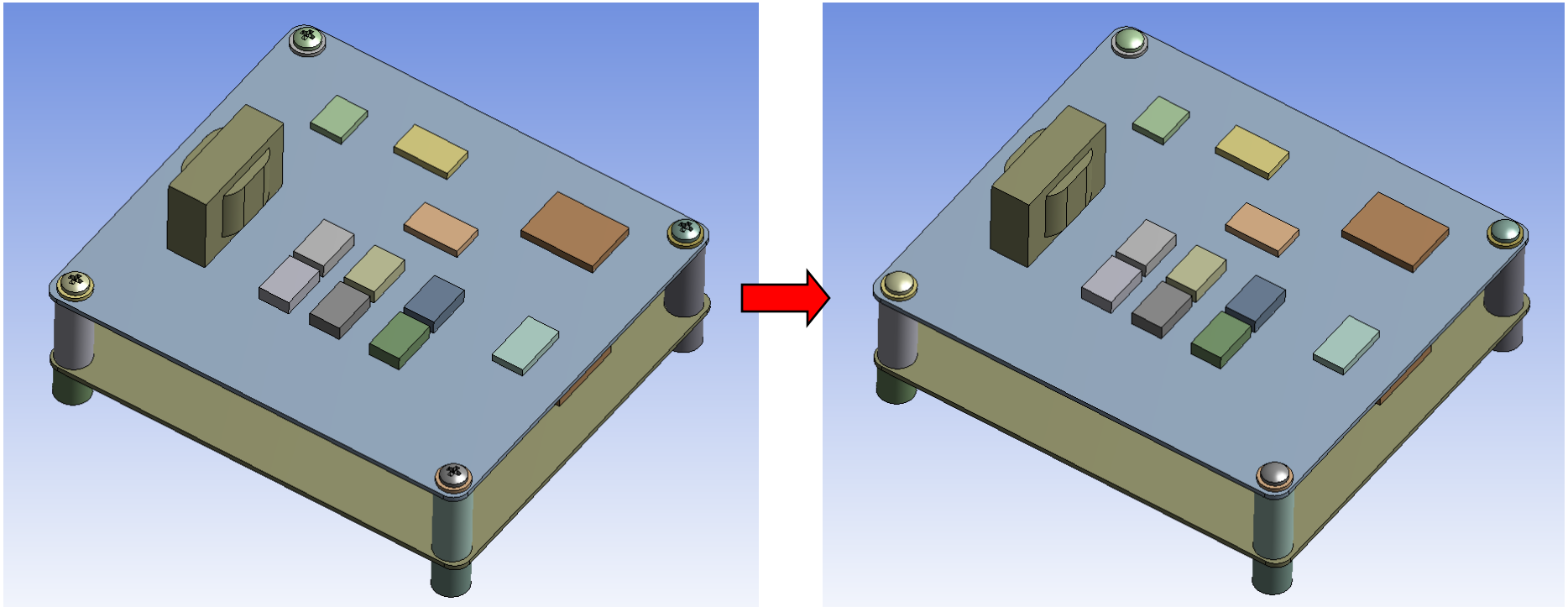
- Typically flow domain extraction starts with an existing CAD part and we build the flow domain around it

- If I already have a CAD tool, why would I want to use ANSYS DesignModeler to extract my flow domain?

- ANSYS DesignModeler has unique tools suited to this process:
  - CAD import tools allow us to combine parts from different CAD programs
  - Geometry Simplification tools allow us to alter the CAD geometry without affecting the production part
  - Streamlined and simple flow domain creation tools.

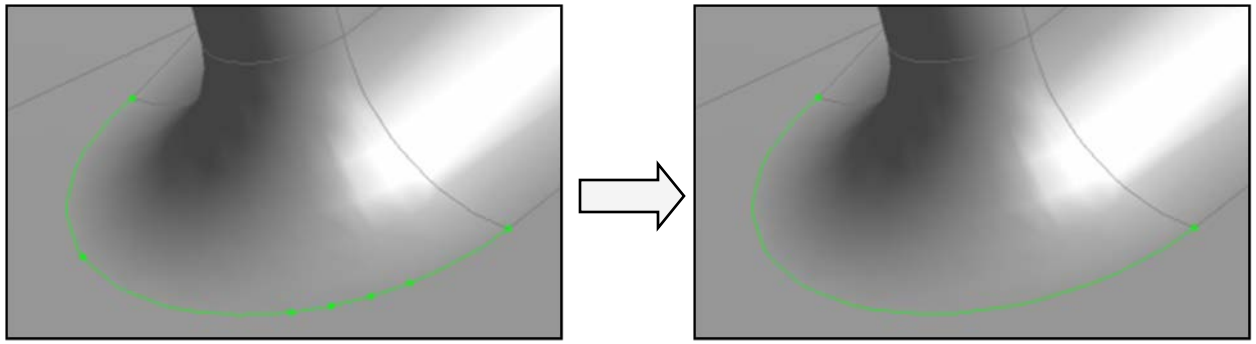
Geometry Simplification

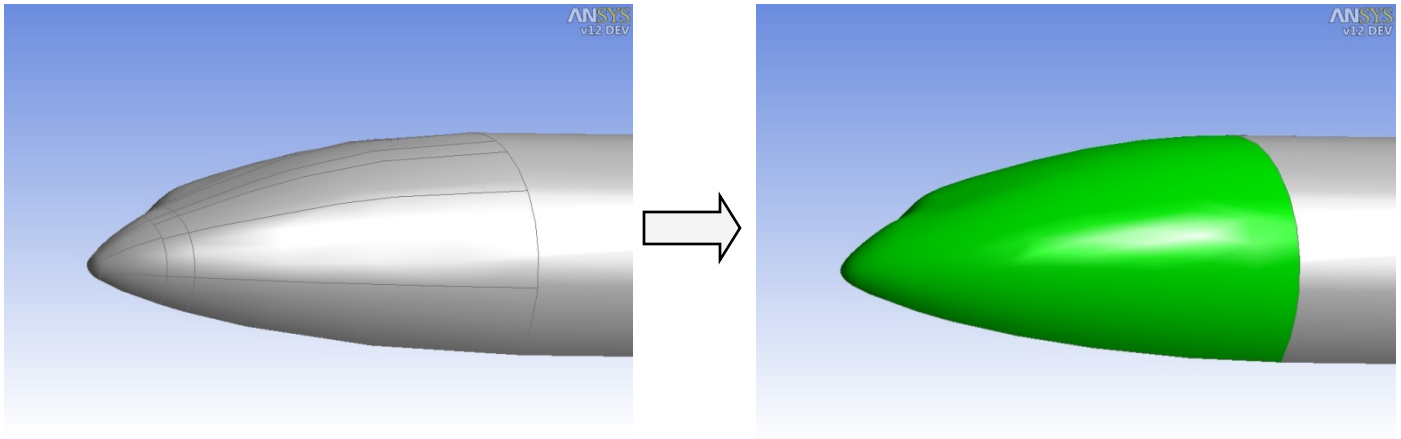
- Face Delete
  - Parts can be simplified by removing unnecessary features.
  - Intersections of the surrounding topology are calculated around the deleted feature.
  - Face delete is not subject to parent/child feature relationships that result from the CAD modeling process.



Geometry Simplification

- Merge
  - Faces or edges can be merged if the angle between them is equal to or greater than the minimum angle specified in the details menu
  - Automated search tool for face/edge cluster generation



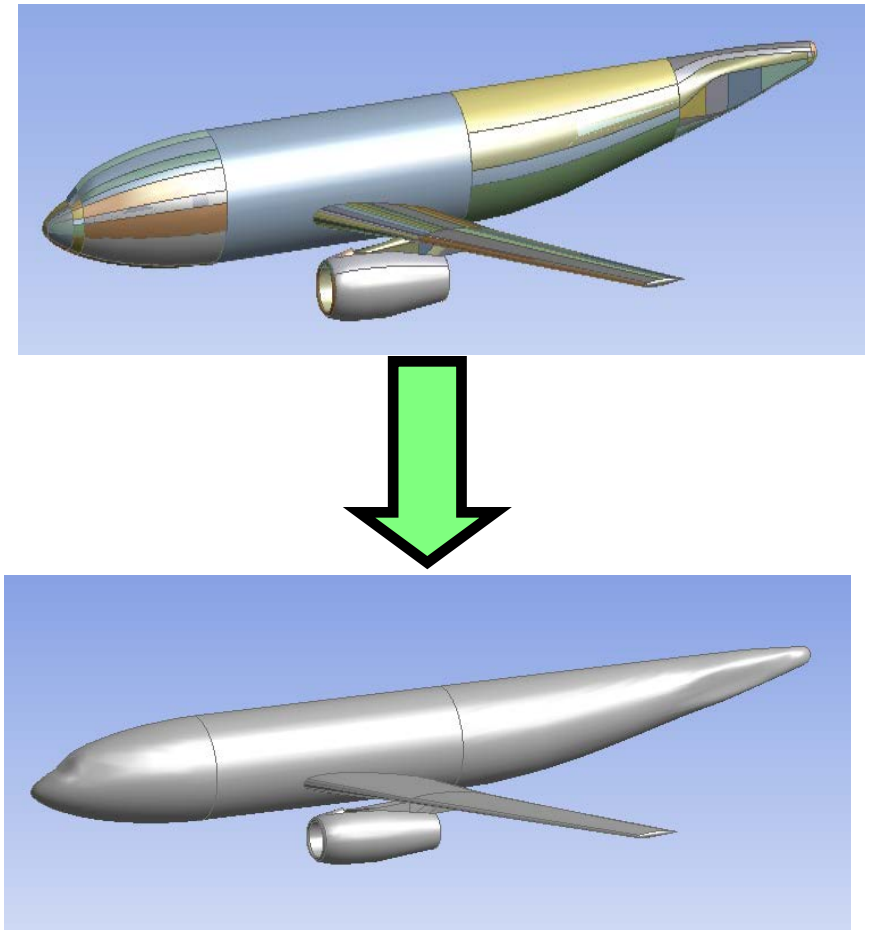


Cleanup and Repair of CAD Imports

- Repair Tools – Help alleviate many meshing headaches!
  - Small edges
  - Small faces
  - Holes
  - Slivers
  - Spikes
  - Seams
  - Sharp angles

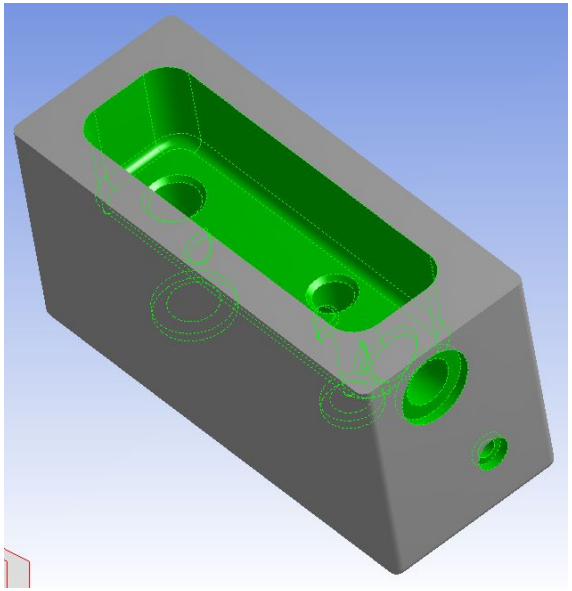
Details View

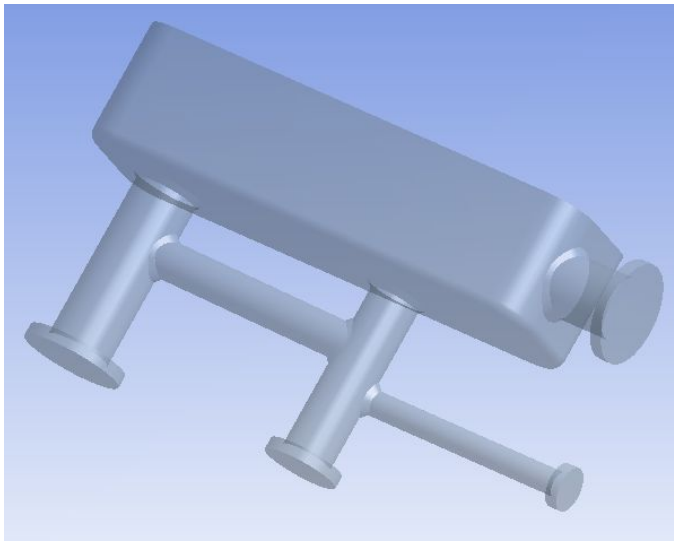
Details of Import1	
Import	Import1
Source	C:\users\cunningham\Applications Engine...\test_block.x_t
Base Plane	XYPlane
Operation	Add Material
Process Solid Bodies	Yes
Process Surface Bodies	Yes
Process Line Bodies	No
Simplify Geometry?	Yes
Simplify Topology?	Yes
Clean Bodies?	Yes
Refresh	No



Fill Operation

- The fill operation is uniquely suited for extracting internal flow domains
  - Creates a frozen body from the interior voids in our CAD part
  - Two ways of defining the void:
    - By Cavity – Requires picking the faces in the void (see below)
    - By Caps – Requires surface bodies “capping” the openings

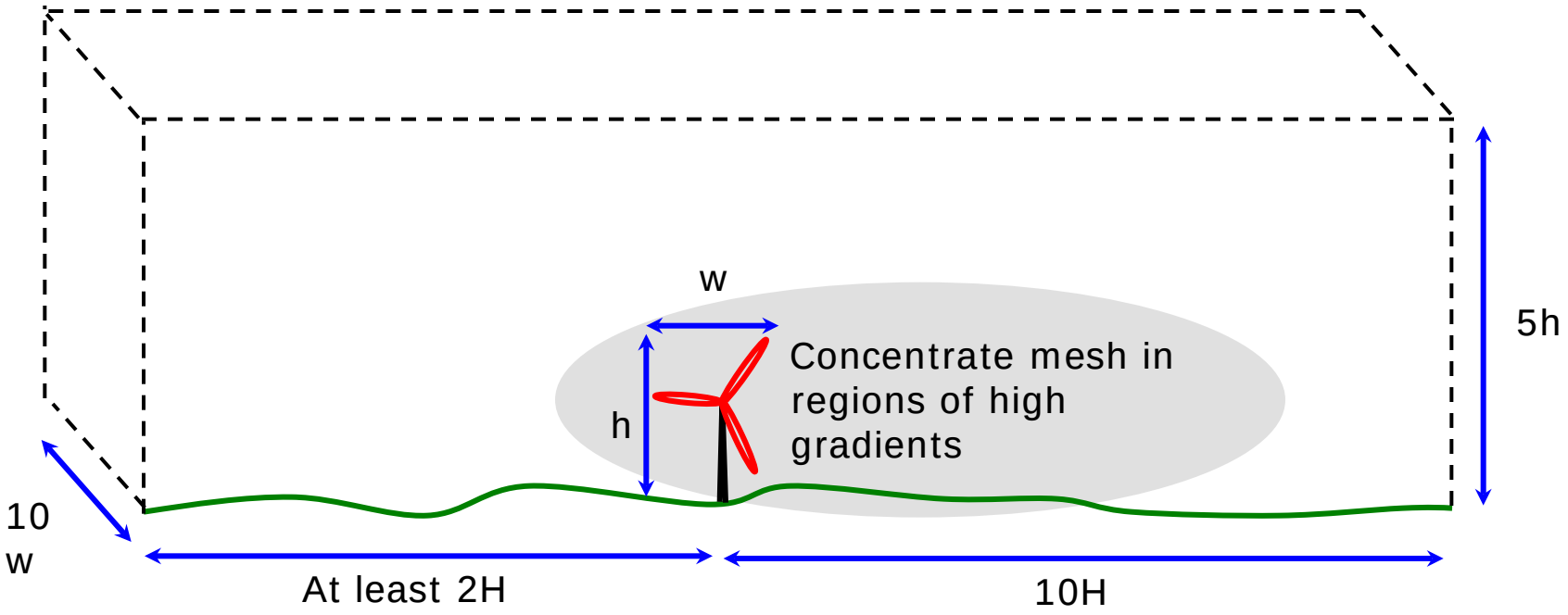




External Flow Domains

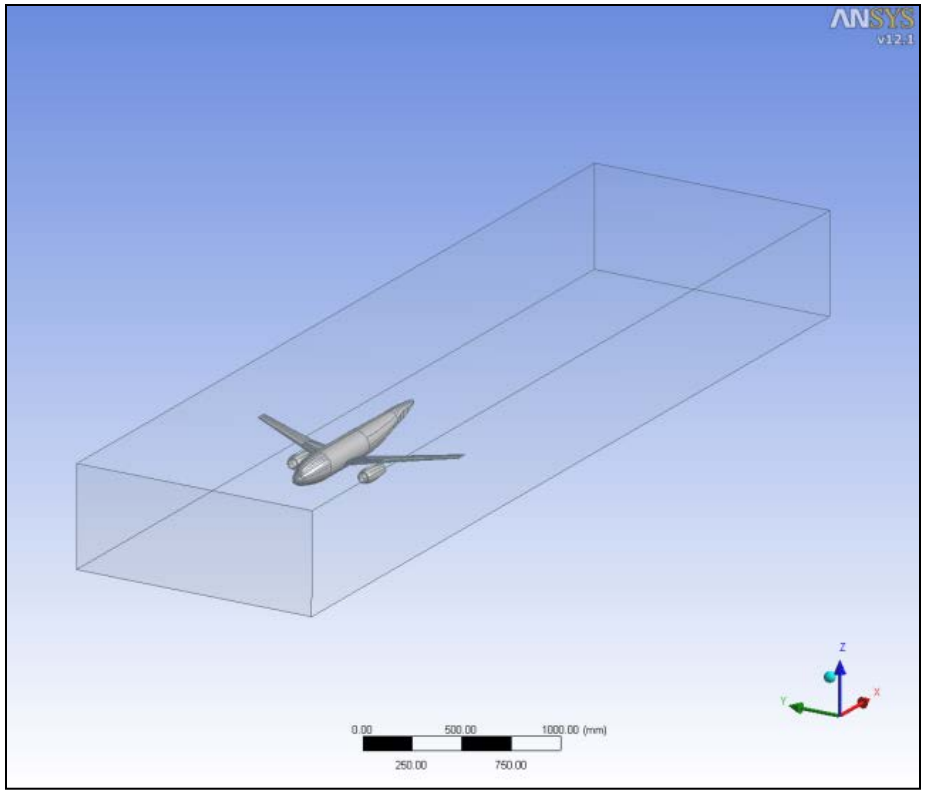
- For external flow domains, we want to ensure the domain is large enough so that there aren't large gradients normal to the boundaries

- A useful rule of thumb for the size of your flow domain is shown below:



Enclosure Operation

- The enclosure operation is intended for external flow domains, but can be useful for complicated internal flow domains as well
  - Creates a frozen body surrounding your CAD part and automatically performs a boolean subtract to define the flow domain
  - Several options for the shape and size of the enclosure



Summary

- Flow Domain extraction is streamlined using ANSYS DesignModeler
- ANSYS DM allows geometry simplification without altering the original CAD file
- Fill operation for internal flow domains
- Enclosure operation for external flow domains