

Rapid Prototyping

*Integration of rapid prototyping
into design and manufacturing.*

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Useful Conditions for RP

- Single unique item or small number of copies needed
- Shape of object is in computer form
- Shape is too complex to be generated in any other way

Benefits to RP Technologies

- Visualization, verification, iteration, and design optimization
- Communication tool for simultaneous engineering
- Form-fit-function tests
- Marketing studies of consumer preferences
- Metal prototypes fabricated from polymer parts
- Tooling fabricated from polymer parts

Form, Fit, Function



Seen here attached to the US Navy's M4A1 machine gun, an ABS prototype stock was tested on the firing range with live ammunition. Prototype built on FDM system from Stratasys.

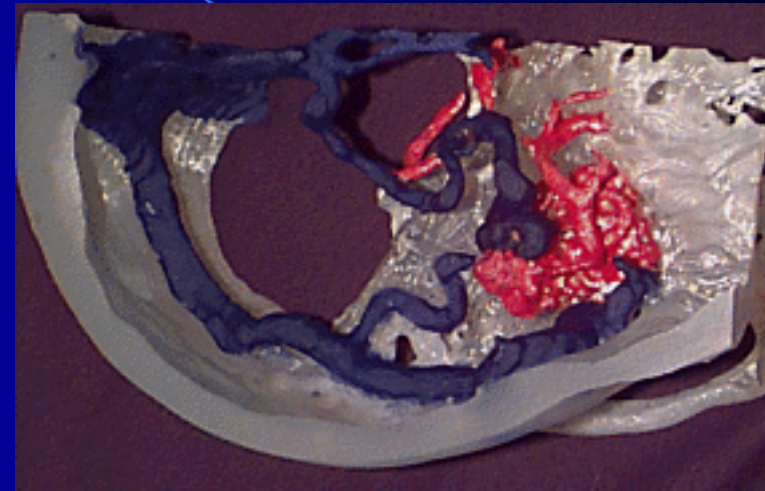
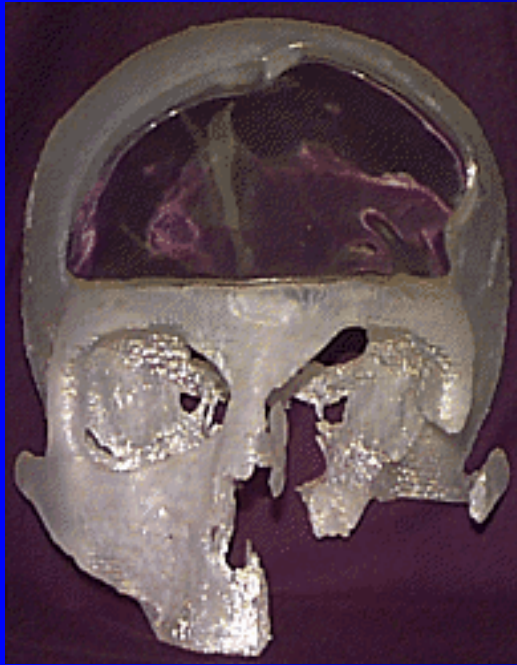
Manufacturing

Example: Investment Casting



- Wax pattern build from Stratasys multi-jet droplet technique
- Pattern used in investment casting to fabricate metal ring
- Allows for design modifications and quick turnaround of metal band

Medical Uses



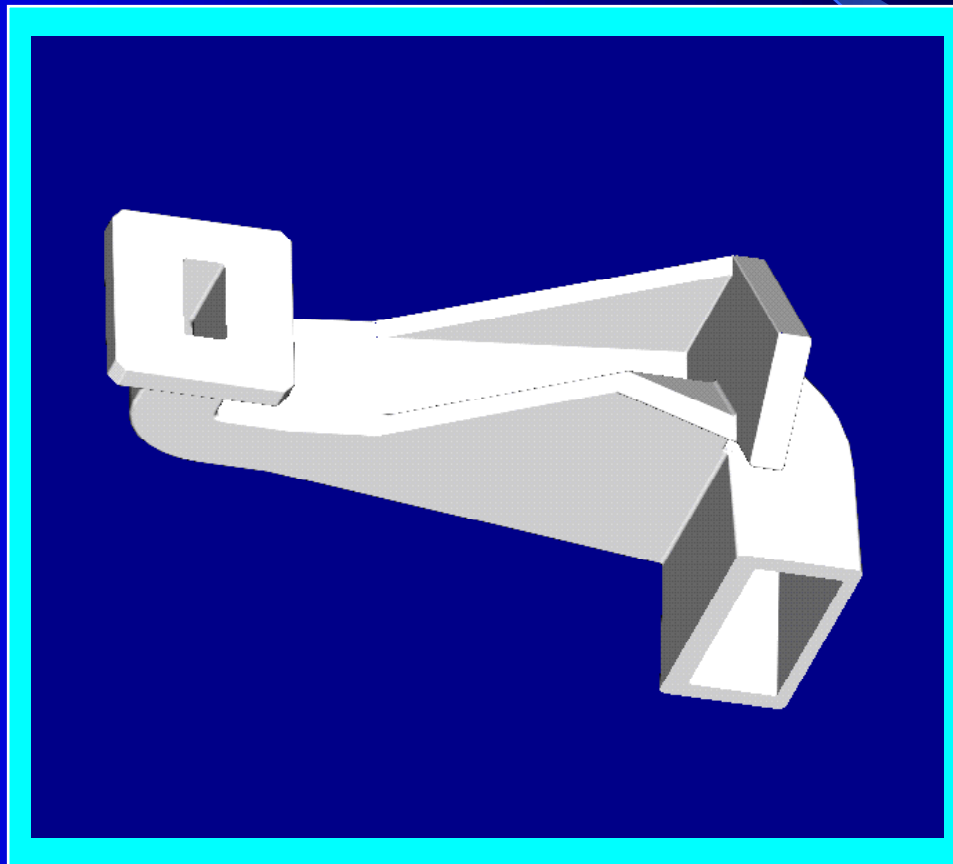
Models of Cerebral Arterio-venous Malformation and surrounding skull, with data from a CT Angiogram. Built by stereolithography RP process. Allows advanced neurosurgical planning.

RP Sequence

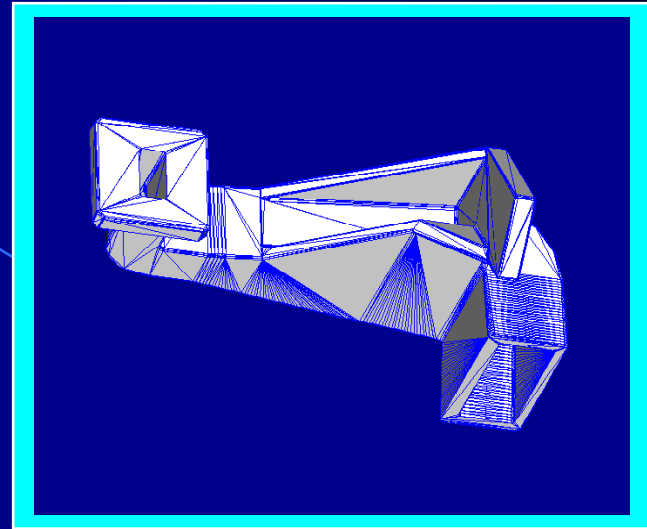
- CAD solid model
- '.STL' file
- Slicing the file
- Final build file
- Fabrication of part
- Post processing

CAD Solid Model

- Solid model or closed surface model required



‘.STL’ File



- Software generates a tessellated object description
- File consists of the X, Y, Z coordinates of the three vertices of each surface triangle, with an index to describe the orientation of the surface normal
- Support generation to hold overhung surfaces during build

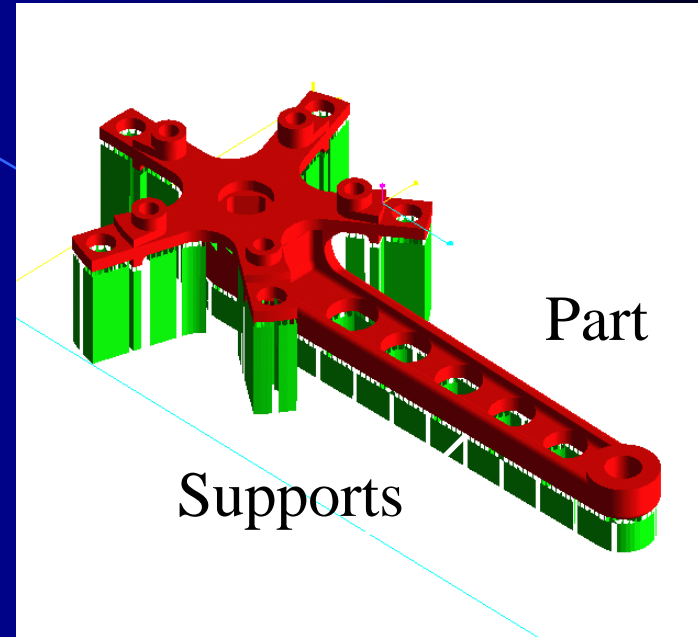
Slicing the File

- Series of closely spaced horizontal planes are mathematically passed through the .stl file
- Generate a '.sli' file : a series of closely spaced 2D cross-sections of the 3D object
- Typical Z thickness 0.006" (0.150 mm)
- Other Parameters chosen
=fn(RP technology)

like a stack of pancakes!!

Final Build File

- Part sliced
- Supports sliced
- RP technology parameters set
 - layer thickness, scan speed,...
- Send file to RP machine



Fabrication of Part



**Models built on stereolithography apparatus.
Part and supports shown attached to platform.**

Post-processing

- Removal of part from platform
- Removal of supports from part
- Cleaning of part (wiping, rinsing, ...)
- Finishing part (sanding, polishing, ...)