IDEAS START HERE®

ems

Engineering & Mfg Services, Inc.

Welcome to ems

IDEAS START HERE®

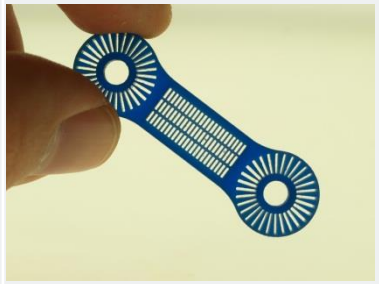
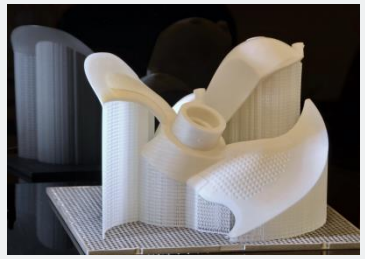
3D Printing Technologies

Who is EMS ?

- Focused on rapid product development products & services
  - 3D Scanning, 3D Printing, Product Development
- Founded in 2001
- Offices in Tampa, Detroit, Atlanta
- 25+ years of Design, Engineering & Mfg Experience
- Unmatched knowledge, service & support
- Engineers helping engineers
- Continuous growth every year
- 6,000 SQ Ft expansion in 2014
  - More equipment
  - More engineers

15 YEAR ANNIVERSARY
ems-usa.com
15,000 PROJECTS

3D Printing Technologies

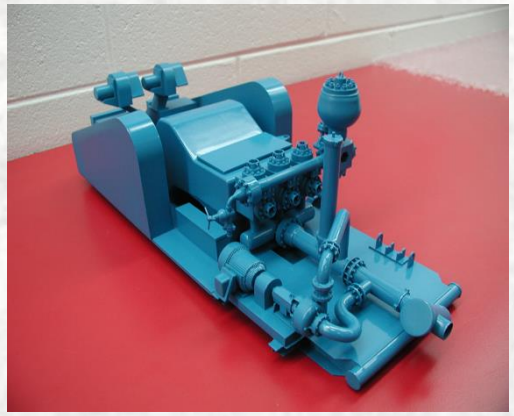
ColorJet	MJM	SLA	SLS	DMLS	FDM
					
					
A thin layer of plaster powder is spread and printhead jets a color binder to bond each layer	UV material is jetted through a printhead cured with UV lamp. Supports are wax and melt away	A laser cures a vat of photopolymers by tracing each layer of the part.	A layer of powder nylon is spread and then sintered by a laser tracing each layer of the part	A layer of powder metal is spread and then sintered by a laser tracing each layer of the part	A string of plastic is heated and extruded through nozzle that traces around the shape of the part layer by layer
Pros – very fast, color, low cost Cons – rigid material	Pro's highest resolution and accuracy. Digital materials Cons – slow on large parts	Pro's – largest build envelop, good strength, fast, excellent surface and detail Cons – not as strong as SLS	Pro's – strongest parts for end use Con's - Involved process & equipment. Surface finish	Pro's – fully dense metal parts with complex geometry Con's - expensive	Pro's – good part strength. Con's – slow, rough surface finish.

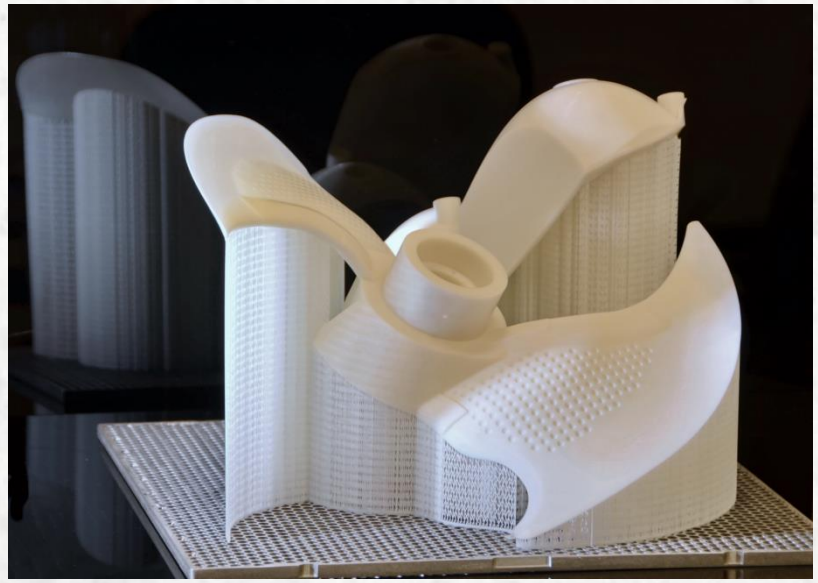
Stereolithography (SLA)

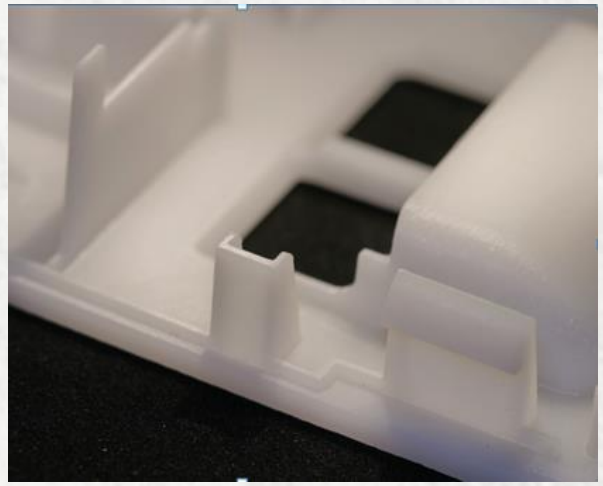
SLA rapid prototyping is one of the most widely utilized rapid prototyping processes in the RP industry. SLA uses a vat of liquid UV-curable photopolymer resin and a UV laser to build parts one layer at a time.

- **Pro's**
  - **Very high resolution**
  - **Good strength**
  - **Dozens of materials**
  - **Largest build volume**
- **Con's**
  - **Large complex machines**
  - **Upfront equipment Costs**
  - **Complexity**
- **Applications**
  - **Appearance**
  - **Functional**
  - **Master patterns**
  - **End use**
  - **Medical**

SLA Sample Parts







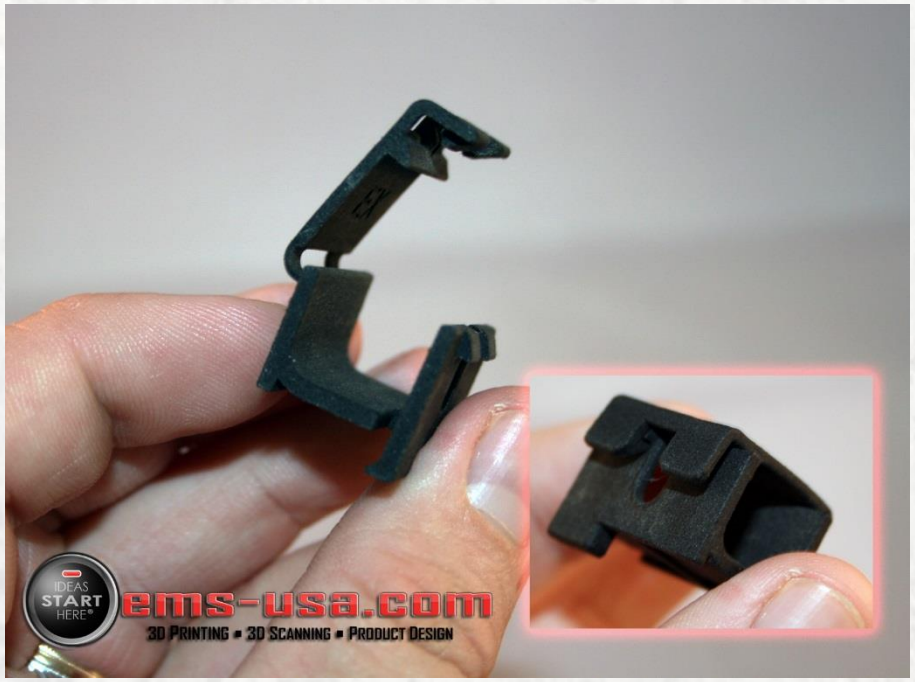
Selective Laser Sintering (SLS)

SLS is an additive manufacturing process in which builds parts layer by layer using a powerful laser to fuse small particles of powder together. SLS is most commonly known for it's nylon 12 material available with glass, aluminum, and carbon filled blends making it popular for functional testing and end use parts.

- **Pro's**
  - **Very high strength**
  - **Most end uses**
  - **Dozens of materials**
- **Con's**
  - **Large complex machines**
  - **Very expensive**
  - **Complexity post process**

- **Applications**
  - **Functional end use parts**
  - **Surgical guides**
  - **Complex parts that are difficult to manufacture**

SLS Sample Parts

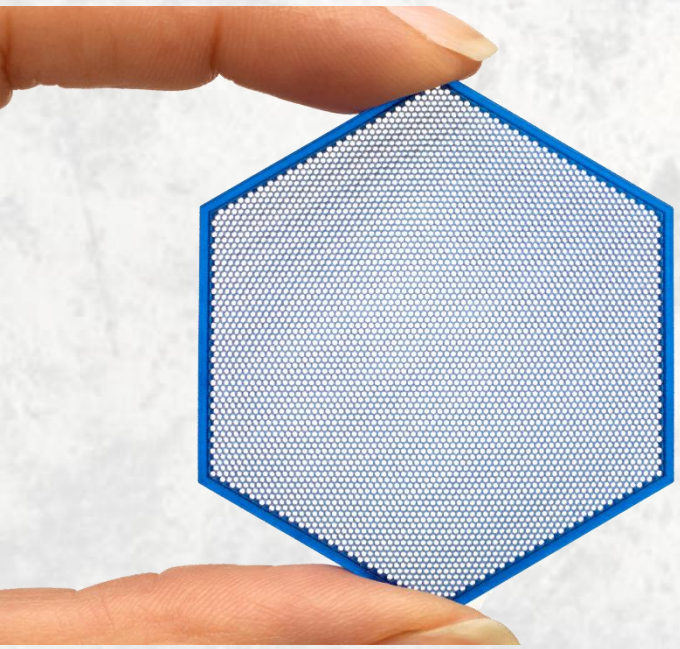


Multi-Jet Printing (MJP)

MJP is a rapid prototyping process where photopolymer materials are extruded through a printhead then cured by UV light. MJP can 3D Print to incredibly thin 16µ layers. More notable, its ability to print multiple materials at once to create different durometers as well as simulate overmolding.

- **Pro's**
  - **High resolution**
  - **Office Friendly**
  - **Digital materials**
  - **Many models**
- **Con's**
  - **Slow build speed**
  - **Expensive**
  - **Complexity**
- **Applications**
  - **Appearance**
  - **Master patterns**
  - **Concept**
  - **Dental**
  - **Wax patterns**
  - **Small parts**

MJP Sample Parts

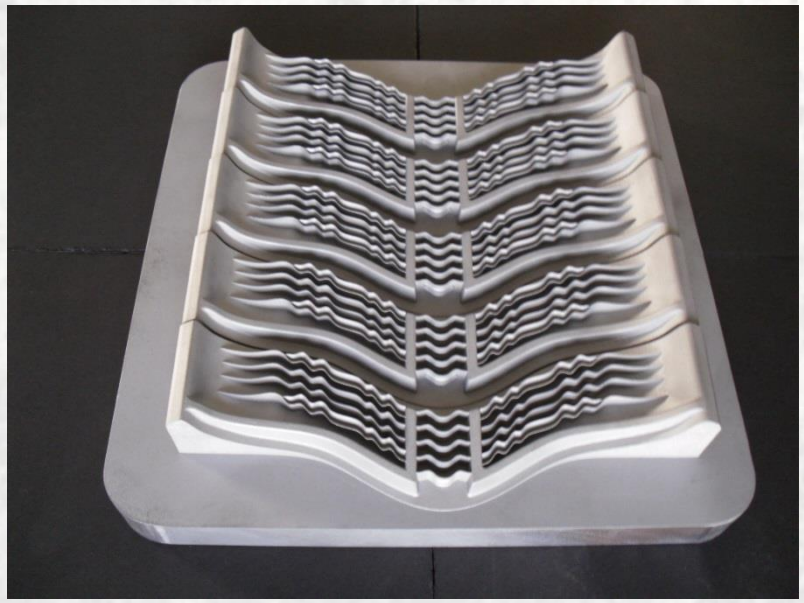


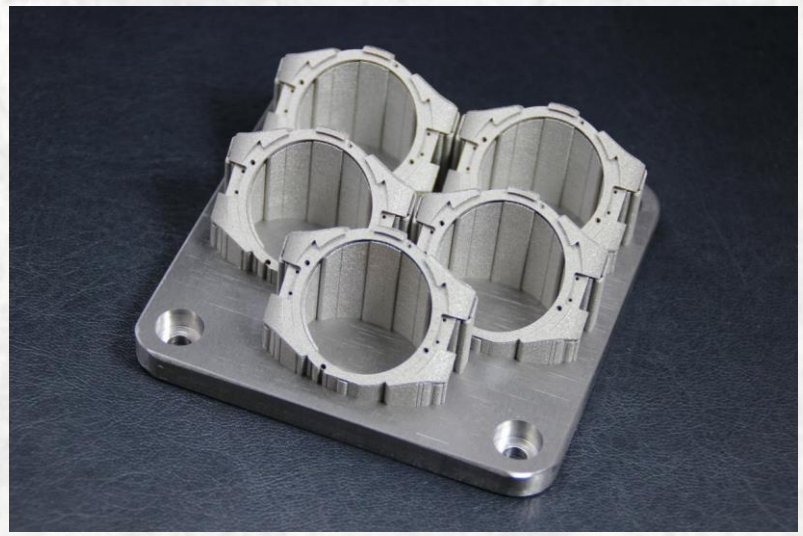
Direct Metal Printing - DMP

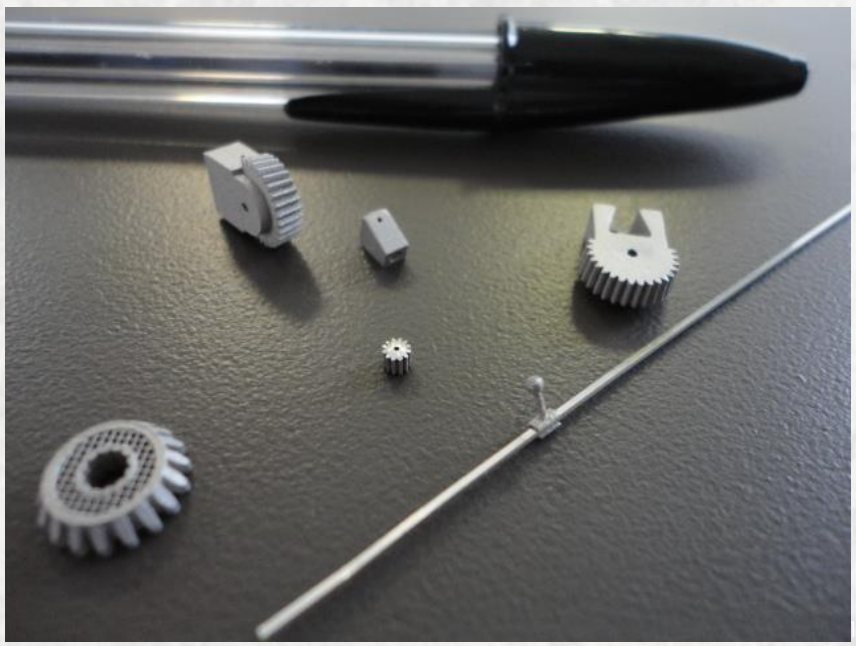
DMP or DMLS is an additive manufacturing process where a metallic powder is laser sintered one thin layer at a time. These powders are available in titanium, stainless steel, cobalt chrome, and aluminum and more making them popular in the aerospace, insert tooling and medical fields.

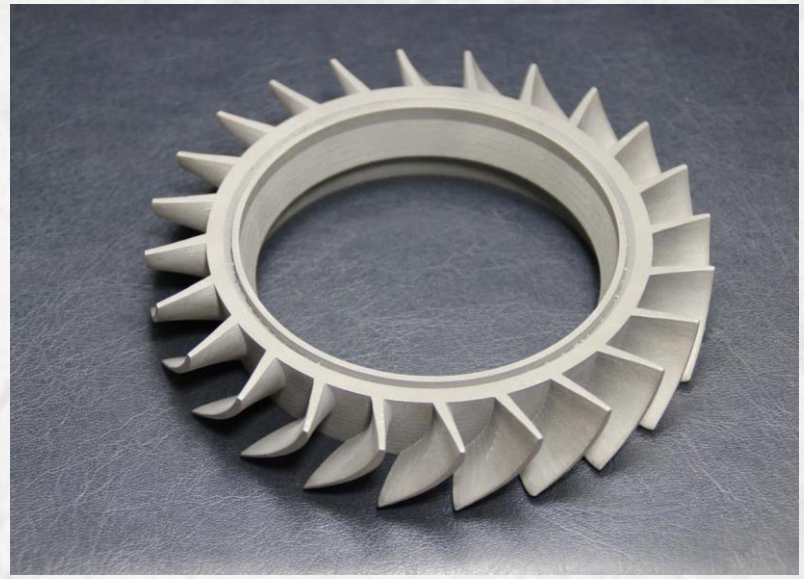
- **Pro's**
  - **Very high strength**
  - **Most end uses**
  - **Dozens of materials**
- **Con's**
  - **Large complex machines**
  - **Very expensive**
  - **Complexity**
- **Applications**
  - **Functional end use parts**
  - **Medical / implants**
  - **Tooling/inserts**
  - **Prosthetics**
  - **Dental**
  - **Aerospace**

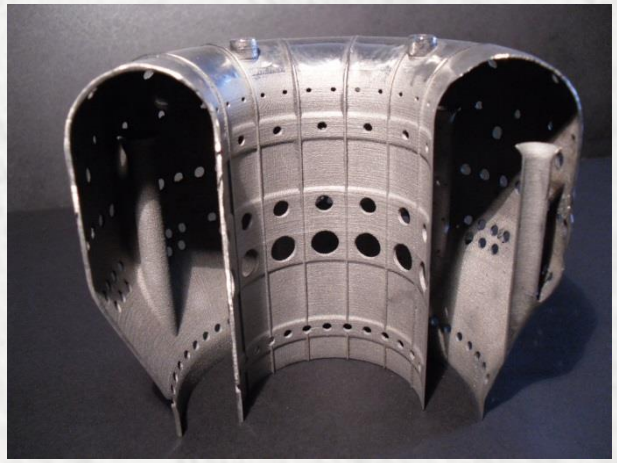
DMP Sample Parts











Fused Deposition Modeling

FDM is an a rapid prototyping process that extrudes plastic through a heated nozzle head one layer at a time. Most utilized materials included ABS, polycarbonate (PC), and Ultem 9085 – a heat resistant material.

- Pro's
  - High strength
  - Office friendly
  - Numerous plastics
  - Many models
- Con's
  - Slow
  - Surface finish
  - Support removal
- Applications
  - Functional
  - End use
  - Concept

FDM Sample Parts

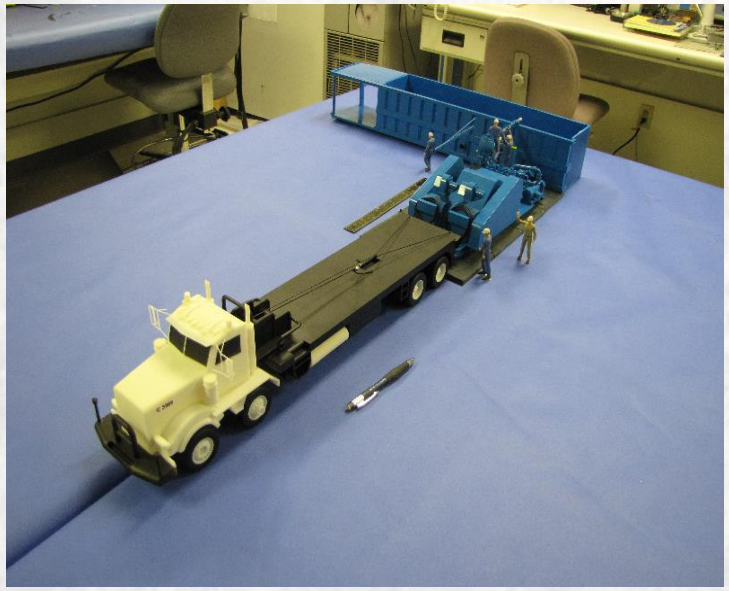
ColorJet Printing - CJP

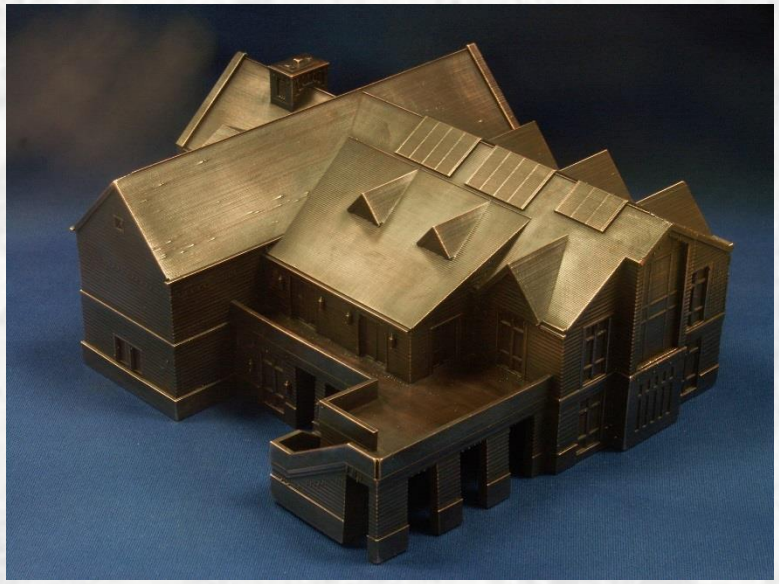
CJP is the fastest and most economical 3D Printing process on the market today. CJP 3D Printers deposit color binders at 600 x 540 DPI onto a bed of composite powder. This process is repeated over and over until the parts is completed. When finished the excess powder is reused over and over as there are no support structures.

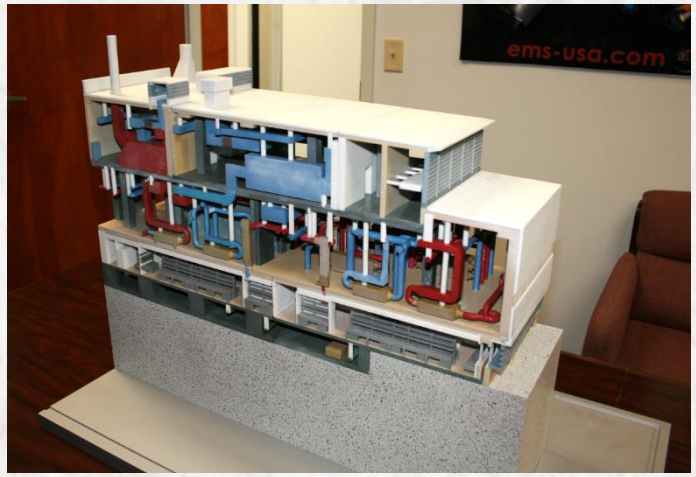
- **Pro's**
  - **Very fast**
  - **Lowest cost**
  - **3D Color**
  - **Recyclability**
- **Con's**
  - **Part strength**
  - **Post process**
- **Applications**
  - **Concept**
  - **Analysis**
  - **AEC**
  - **GIS**
  - **Sales / promotion**
  - **Figures**

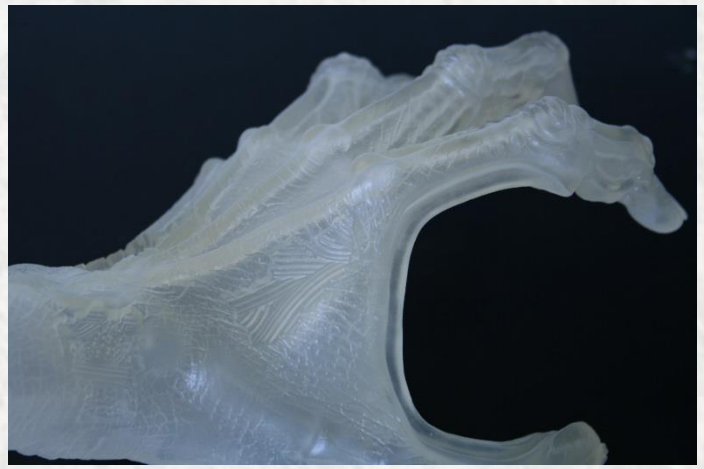
CJP Sample Parts

EMS - Sample Projects









EMS– Sample Projects