

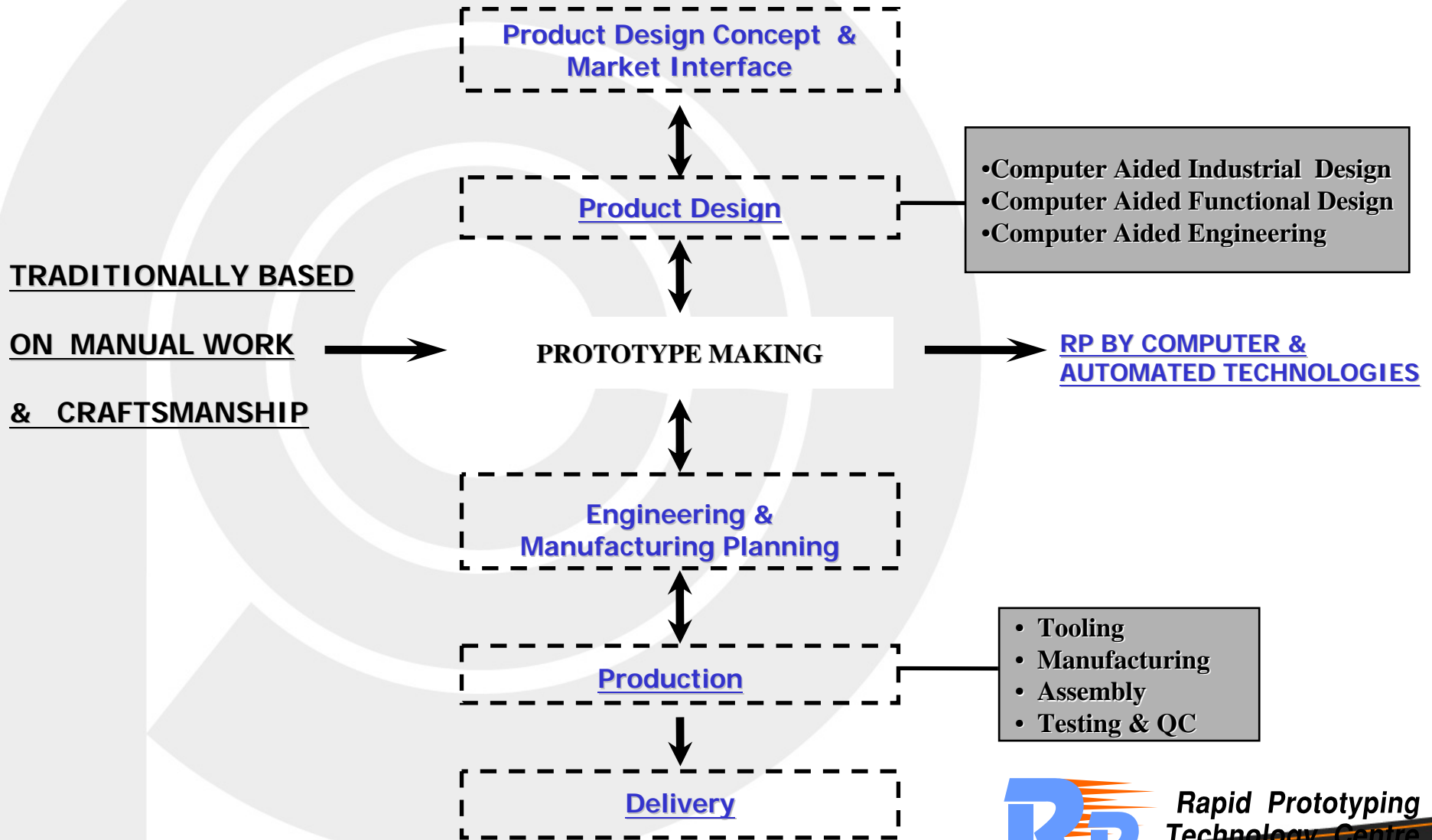
# Overview

## 內容

- 快速原型科技中心服務
- 激光抄數原理
- 快速原型技術
- 鈦金屬鑄造於其產品開發之應用
- 激光焊接技術
- 快速原型一站式個案研究
- 參觀快速原型科技中心



# Technology Integrated Product Development Cycle



# Changes is inevitable

## OLD Tradition

**Good**

**Fast**

**Cheap**

*Pick Any Two!*



## New Trend

**↑Customer Satisfaction**

**while**

**↓Total Cycle Time and Cost**

Customer Expectation...



# Rapid Prototyping Technology Center (RPTC)

Background and Role



## Rapid Prototyping Technology Center (RPTC) Background

- Funded by Industry & Technology Development Council
- Found in 1994
- Introduced RP technology & support new product development
- Provide one stop product design and development services to local designers and industries



Rapid Prototyping Technology Center (RPTC)

## Role of RPTC(1)

- Product Innovation and market analysis
  - Intellectual property application
  - Technology search
  - Market research
- Support product design & development
  - Industrial design
  - Engineering and functional design
  - Product compliance with international standards
  - Rapid prototyping and concept modeling
- Production support & planning
  - Mass production planning and control
  - Tooling development
  - Quality assurance





Rapid Prototyping Technology Center (RPTC)

## Role of RPTC(2)

- Product promotion & business planning
  - Marketing and promotion
  - Branding
  - Business matching
- Authorized training center for CAD/CAID & Animation
- Promote concepts of product visualization and e-marketing



# Rapid Prototyping Technology Center (RPTC)

3D Geometric Data Capture





## Rapid Prototyping Technology Center (RPTC) 3D Geometric Data Capture

Type of 3D Geometric data Capture

- **Contact type**
  - Mechanical touching probe
  - Suitable for engineering component digitizing
- **Non-contact type**
  - **Laser scanner\***
  - Optical scanner
  - Suitable for fine detailed product digitizing

\* RPTC introduced technology



# Contact type digitizer

- Adv.
  - high accuracy
  - low cost
  - selective digitizing (e.g. guide rail)
  - less data to handle
- Disadv.
  - medium digitizing speed
  - probe compensation required
  - part may move during contact
  - no soft parts
  - accuracy depends on operating environment
  - Plaster support may be needed



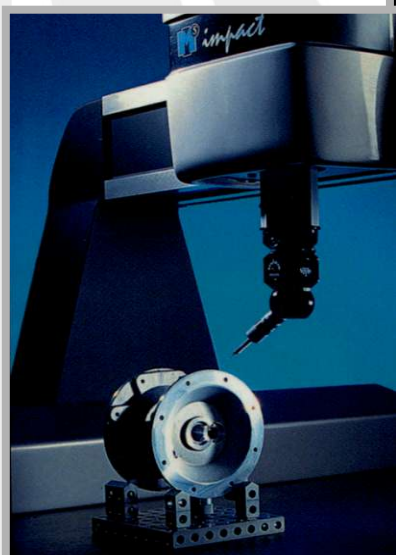
# Non-contact type laser scanning

- Adv.
  - high speed
  - high resolution
  - automatic scanning
  - high detail
  - soft & fragile models allowed
  - less environment dependent
- Disadv.
  - dark or shining surface
  - sharp edge
  - deep cavities



## Rapid Prototyping Technology Center (RPTC) 3D Geometric Data Capture

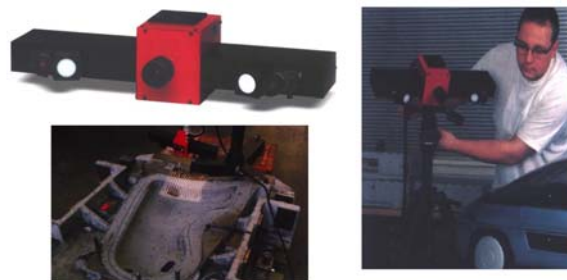
- Contact type
  - Touching Probe System



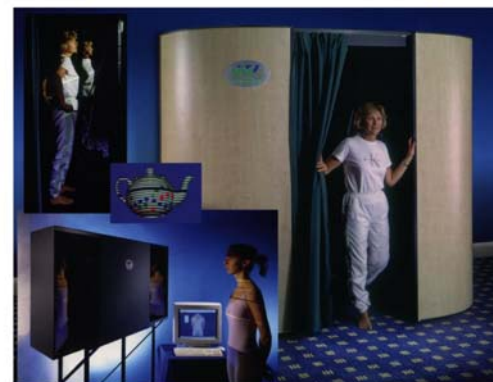
# Rapid Prototyping Technology Center (RPTC) 3D Geometric Data Capture

- Non-contact type

Optical Scanning



Optical Human Scanning





## Rapid Prototyping Technology Center (RPTC) 3D Geometric Data Capture

- Non-contact type



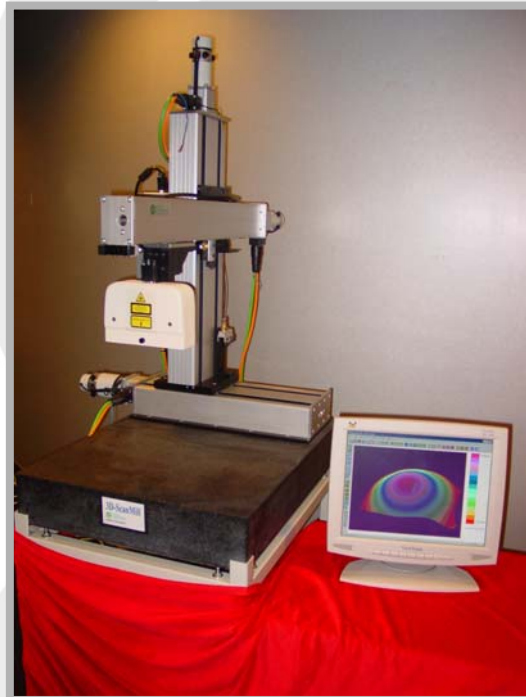
ATOS (high-end 3D Digitizer)





## Rapid Prototyping Technology Center (RPTC) 3D Geometric Data Capture

- Non-contact type laser scanning



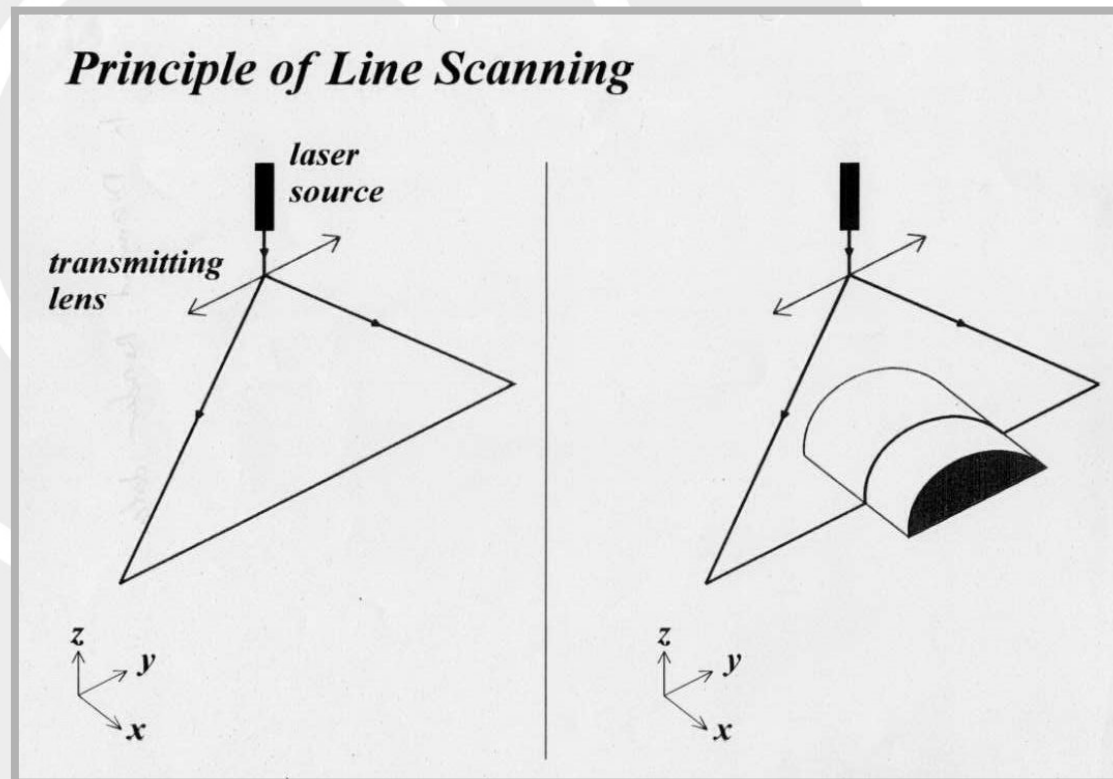
Laser scanner system developed by HKPC



Rapid Prototyping Technology Center (RPTC)

# 3D Geometric Data Capture

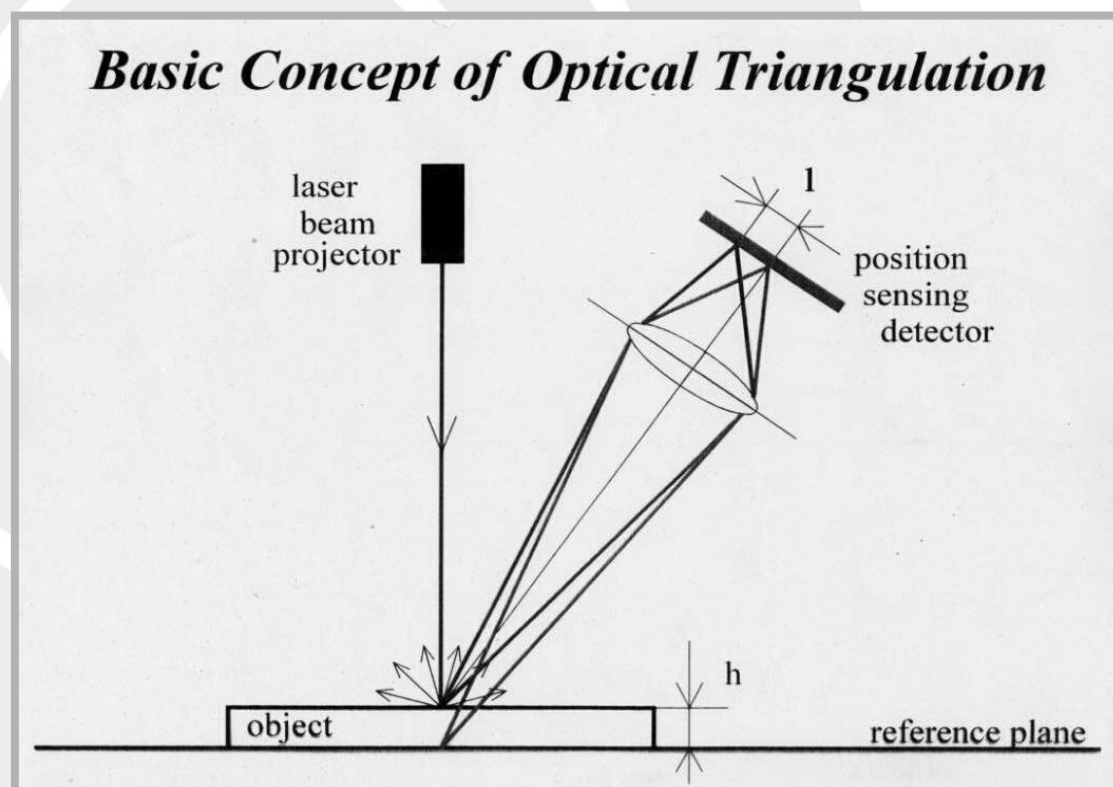
- Non-contact type laser scanning



# Rapid Prototyping Technology Center (RPTC)

## 3D Geometric Data Capture

- Non-contact type laser scanning

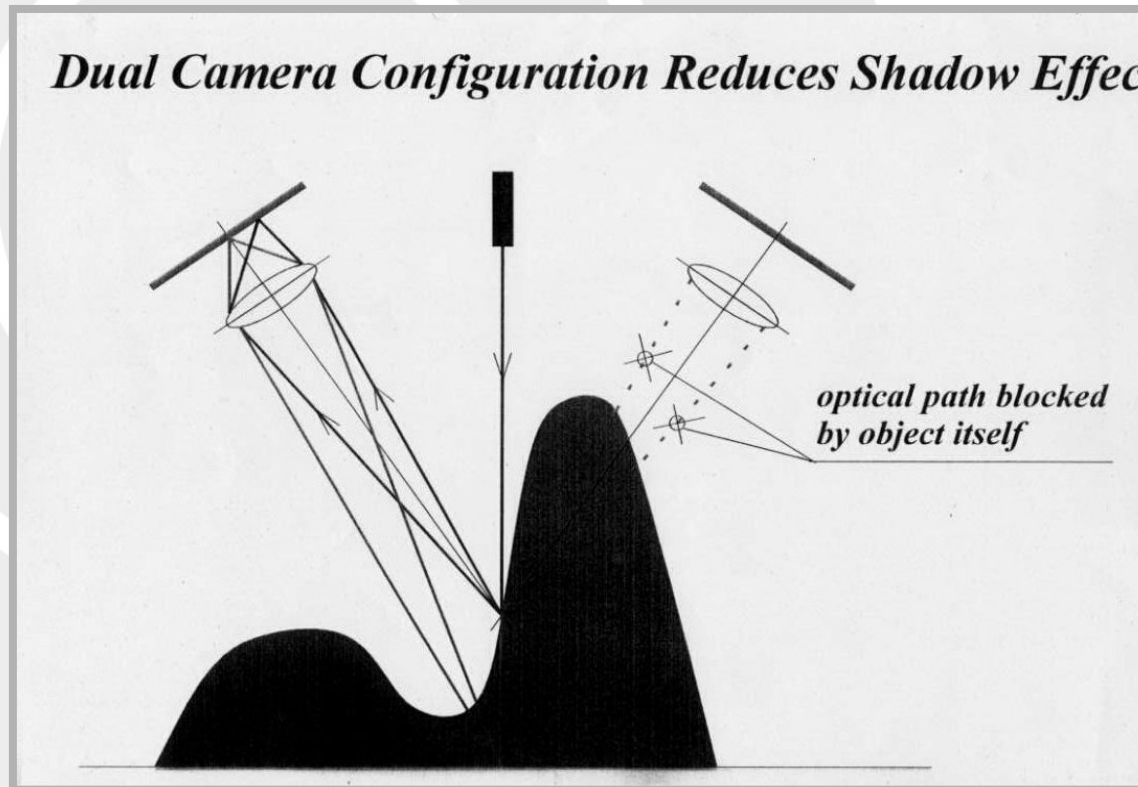


Rapid Prototyping Technology Center (RPTC)

# 3D Geometric Data Capture

- Non-contact type laser scanning

*Dual Camera Configuration Reduces Shadow Effect*



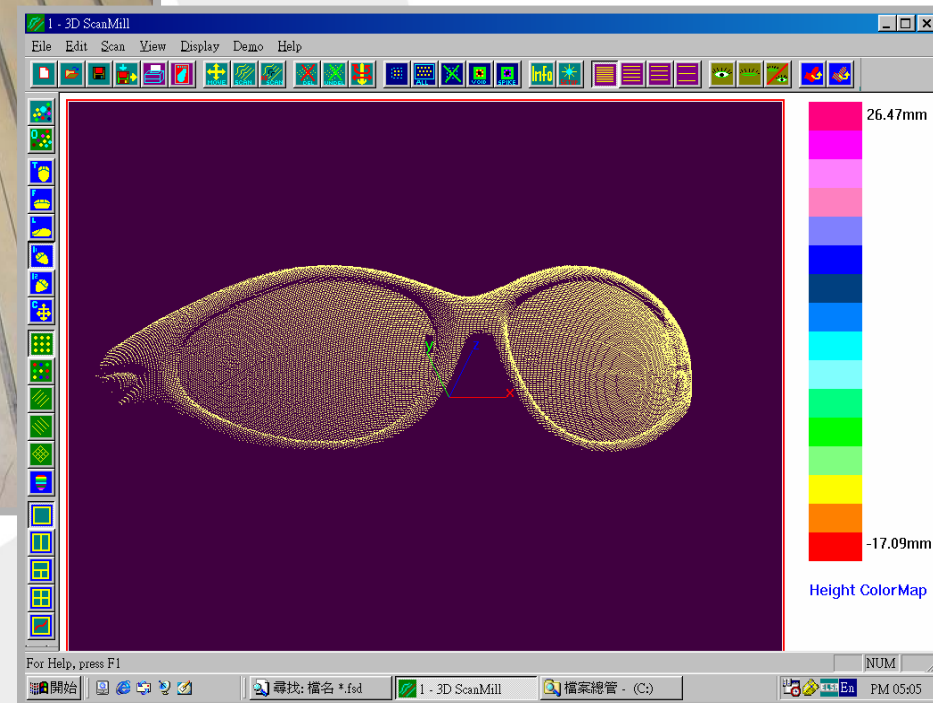
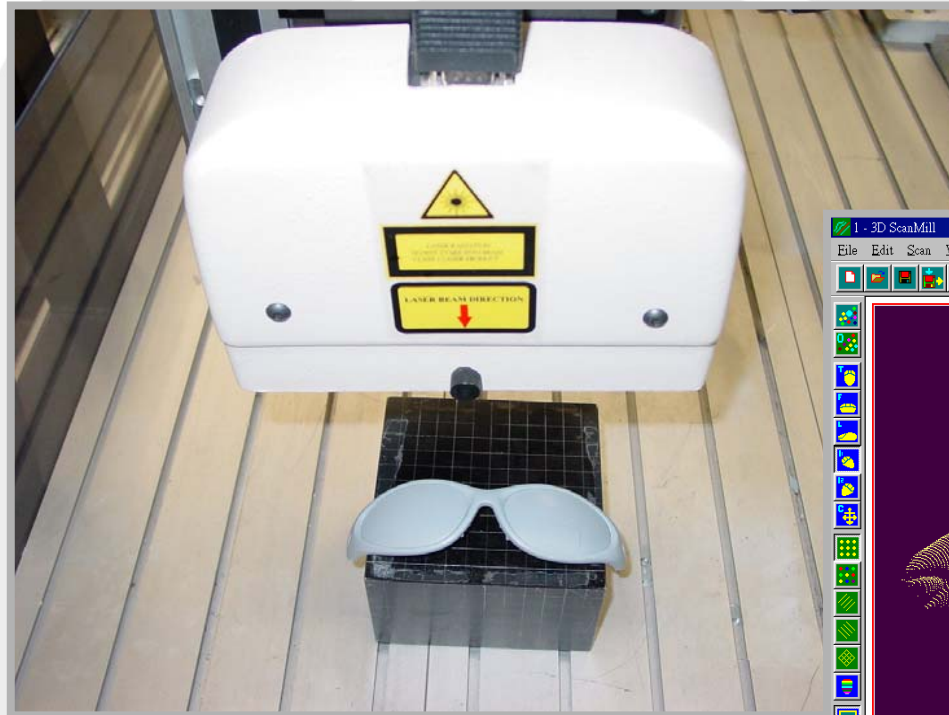


Rapid Prototyping Technology Center (RPTC)

# 3D Geometric Data Capture

		Probe Type Digitizer	Laser Scanner
1	<b>Type of scanning</b>	Contact type with rigid support needed	Non-contact type laser scanner
2	<b>Principle</b>	Mechanical contact sensor and electronic meter to record point position	Laser and optical triangulation to measure point position
3	<b>Speed</b>	Relatively slow	Relatively fast
4	<b>Scanning Process</b>	Point by point digitizing, need human monitoring	Fully automatic area scan, no need human monitoring
5	<b>Resolution</b>	Low to high (depends on type and price range)	Good (in general)
6	<b>Offset compensation</b>	Need probe radius compensation	No compensation required
7	<b>Feature details</b>	Constraint by probe diameter	Can capture fine feature details
8	<b>Deep slot and pit</b>	OK with long probe arm	Need focusing level adjustment
9	<b>Plaster support</b>	Plaster support needed which is time consuming	No need plaster support
10	<b>Direct CNC machining</b>	Supported. Tool diameter and machining step over must match with probe size and scanning step over respectively	Supported. Machining options ranging from Rough, Semi- finish to Finish can be selected via CAD/CAM system

# Laser Scanning Case Study - Spectacle

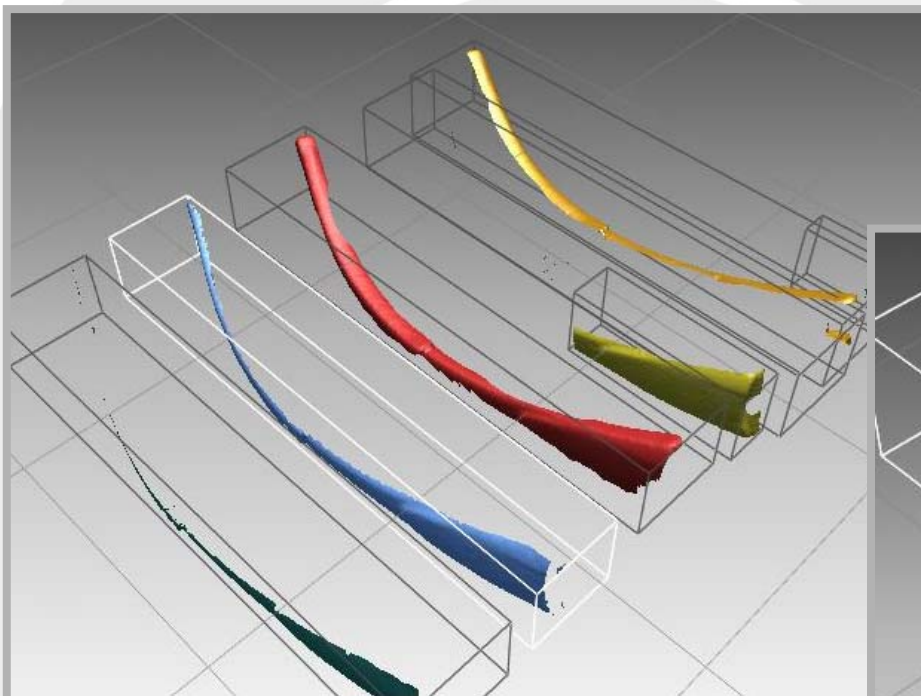


**Scan the spectacle sample by laser scanner**

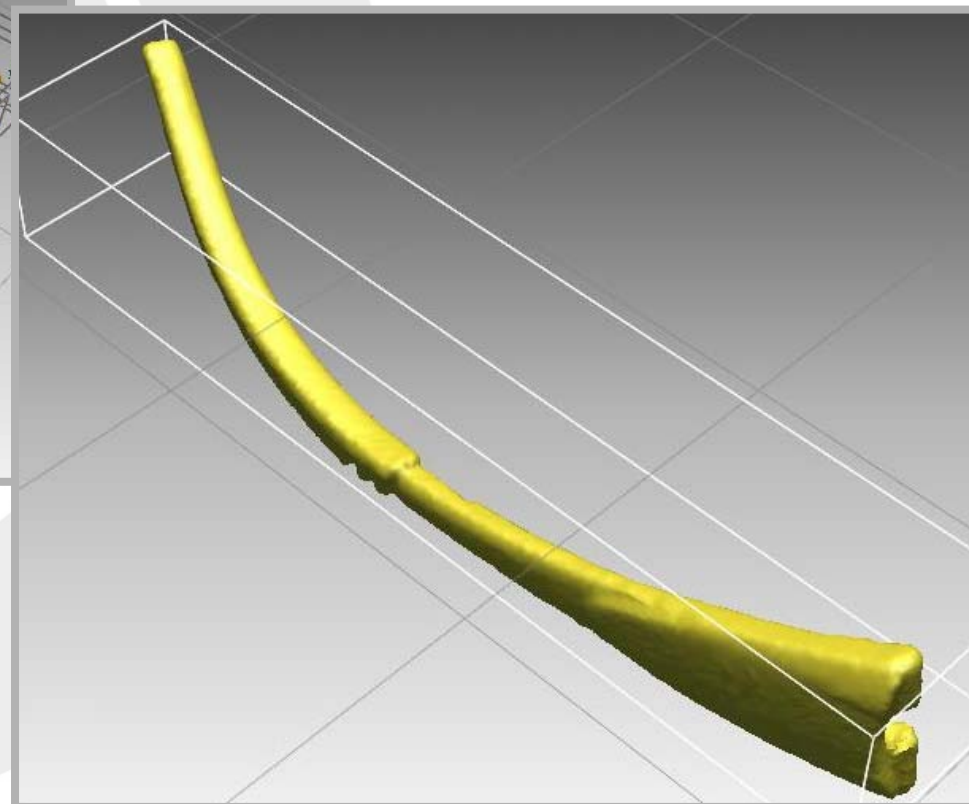




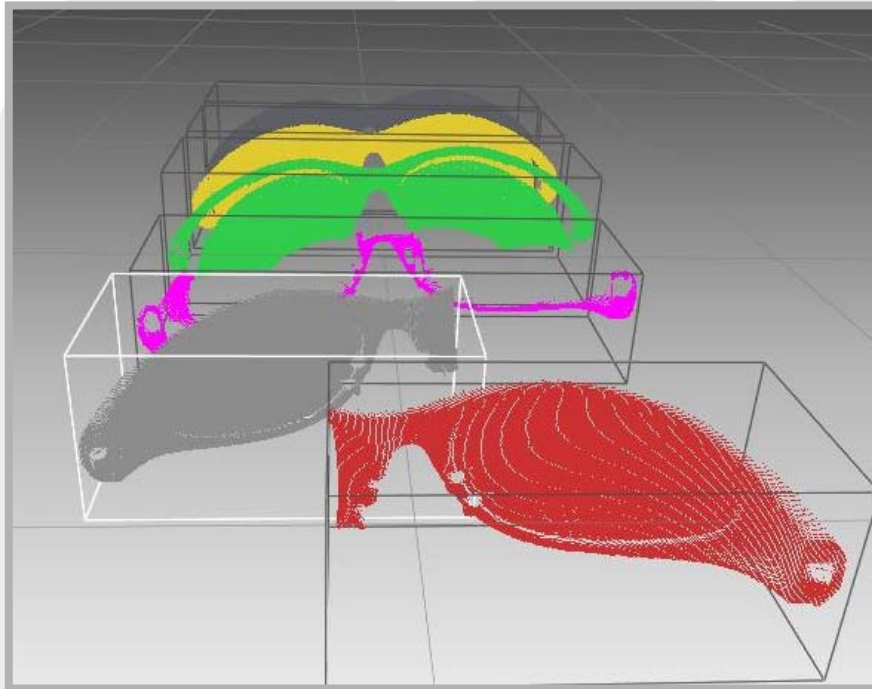
## Merge point clouds to form a product



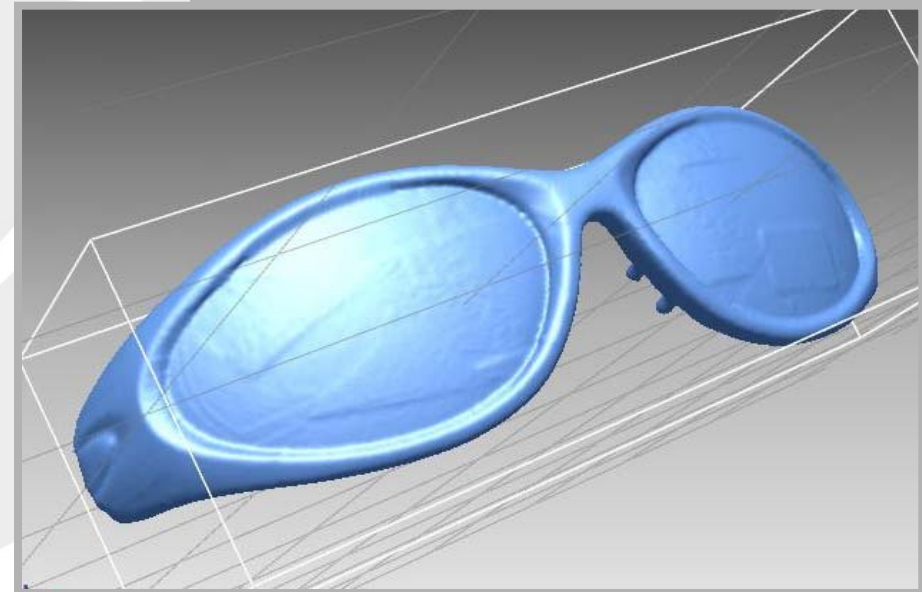
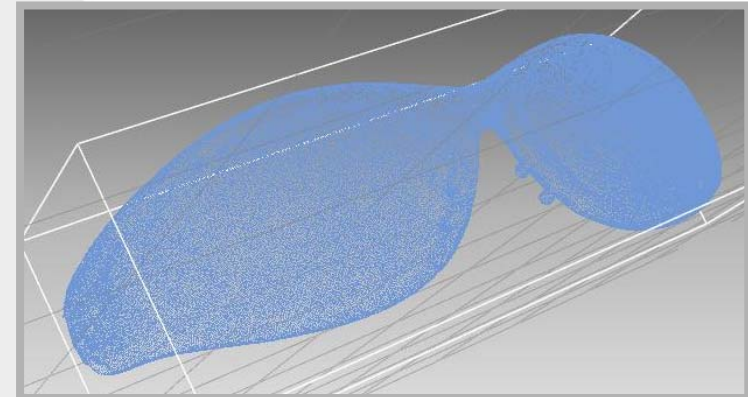
**Scan the sample from different angles and merge them together to form a full detailed Facet model**



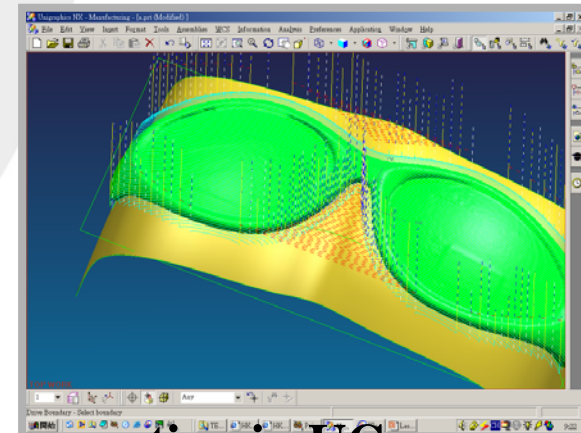
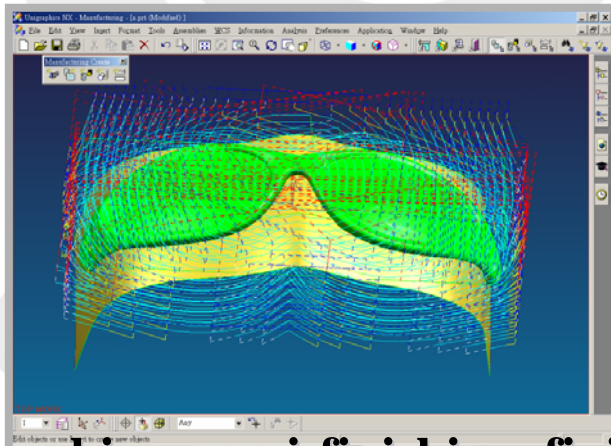
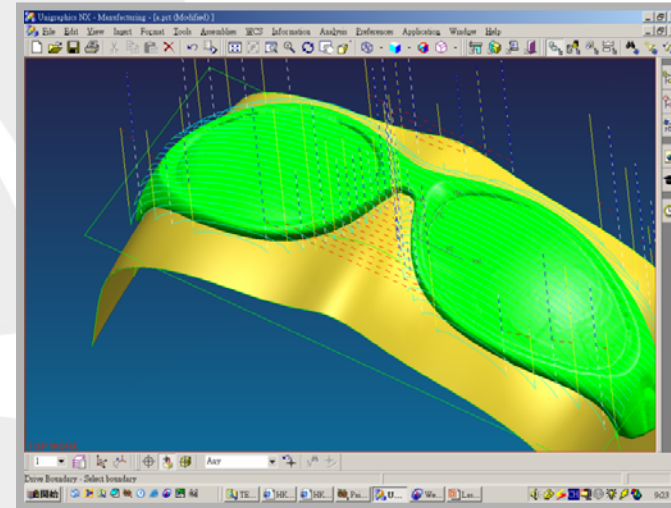
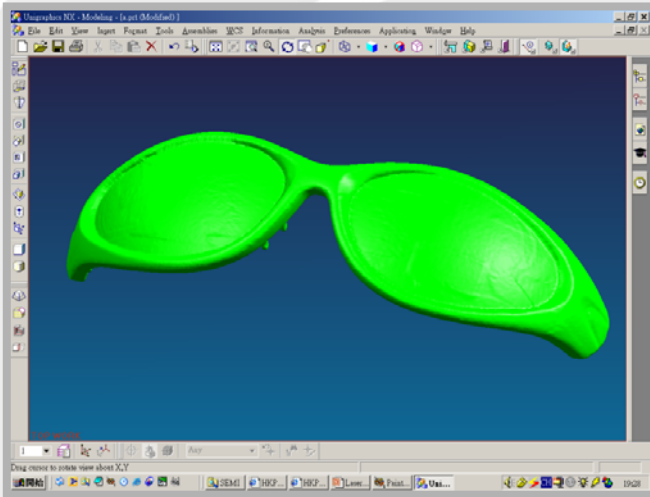
## Merge point clouds to form a product



**Scan the sample from different angles and merge them together to form a full detailed Facet model**



# Direct toolpath generation from STL file

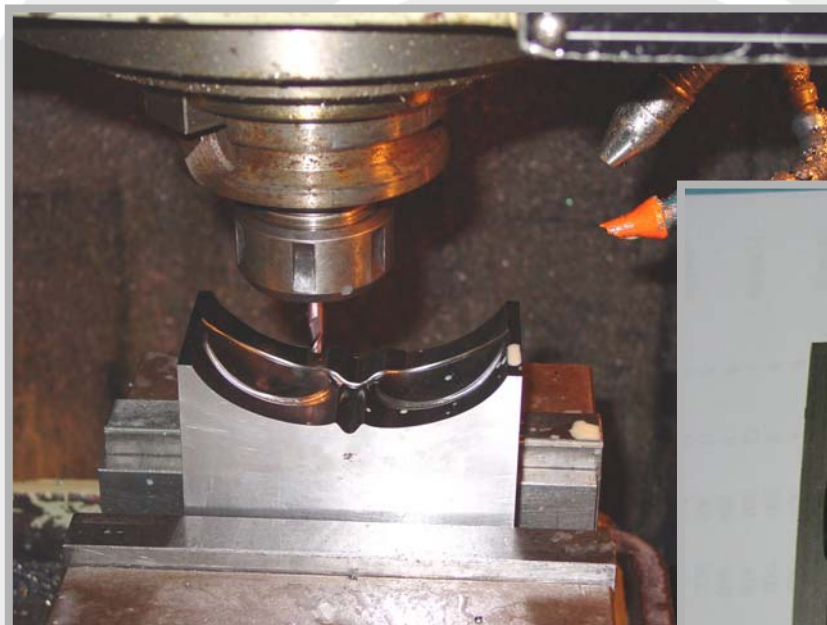


Direct roughing, semi-finishing, finishing toolpath generation in UG

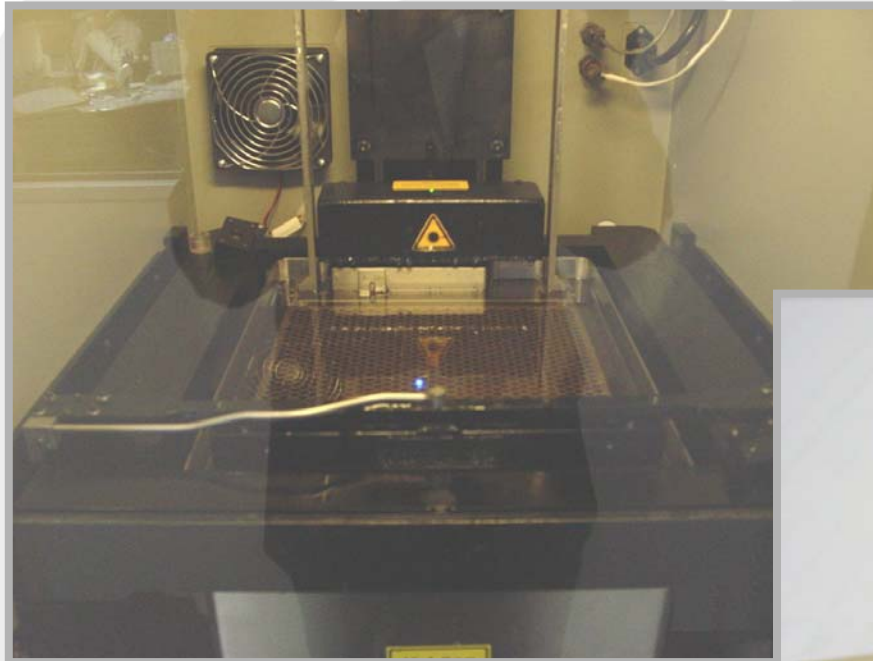




# Direct mill to fabricate mould



# Using RP machine to produce prototype



# Modify the design in CAID system

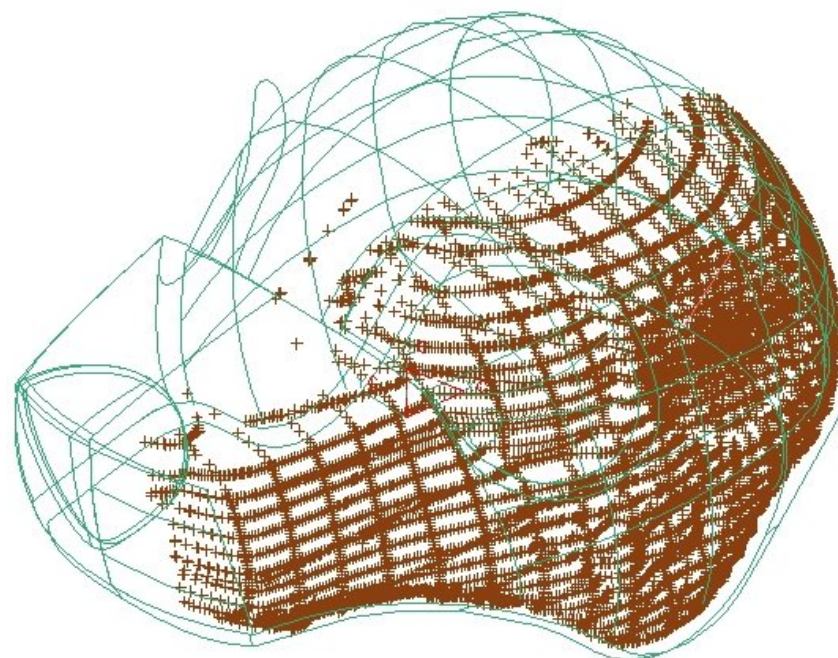




# Case Study

## Electronic Dog Product Development

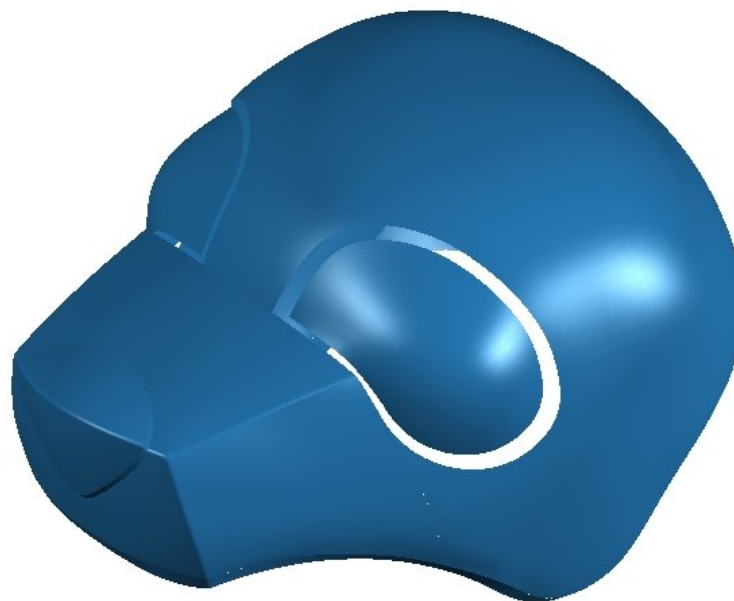




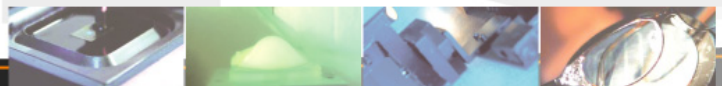
Laser Scanner and Point Cloud Data

Mockup created by craftsman





Laser Scanner and Point Cloud  
Data







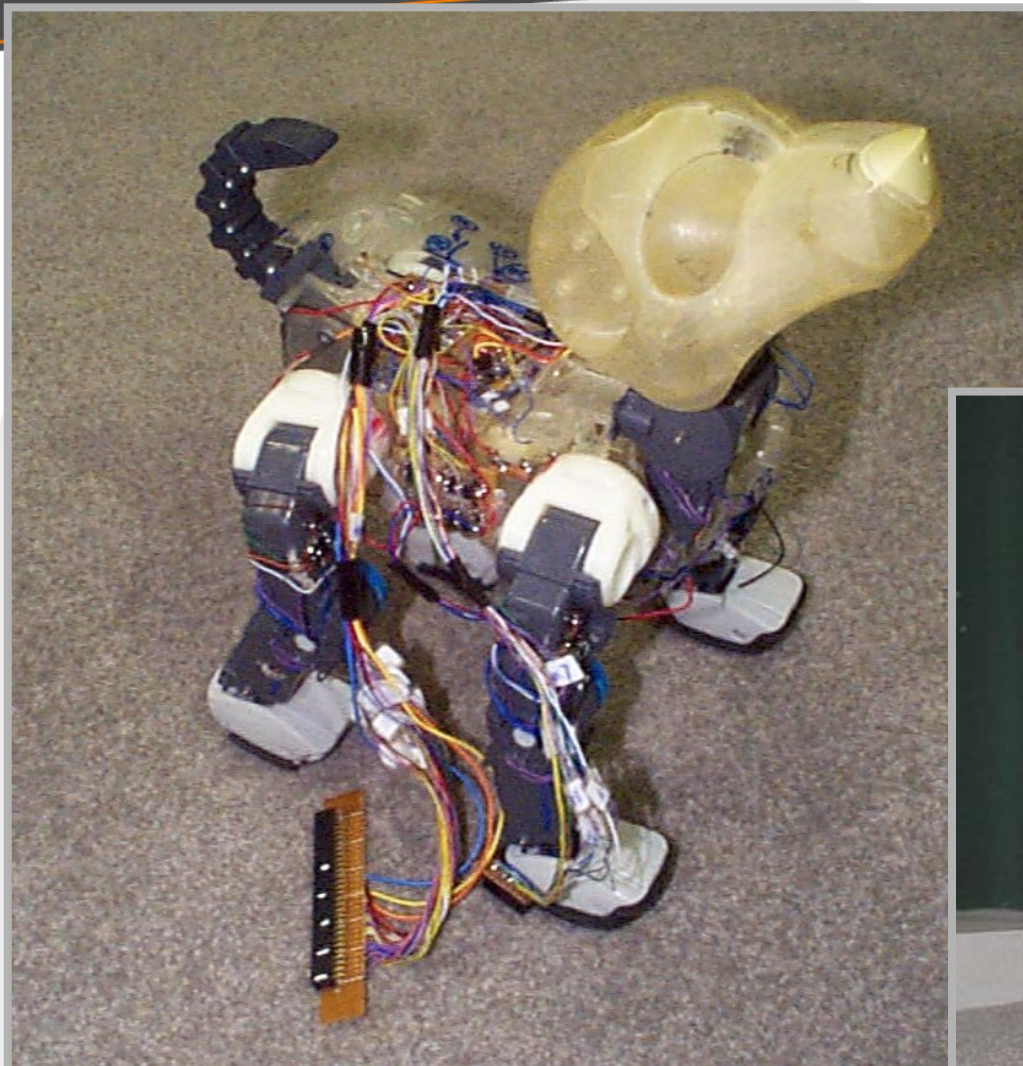
Rapid Prototyping Model



Quick Mould PU Model

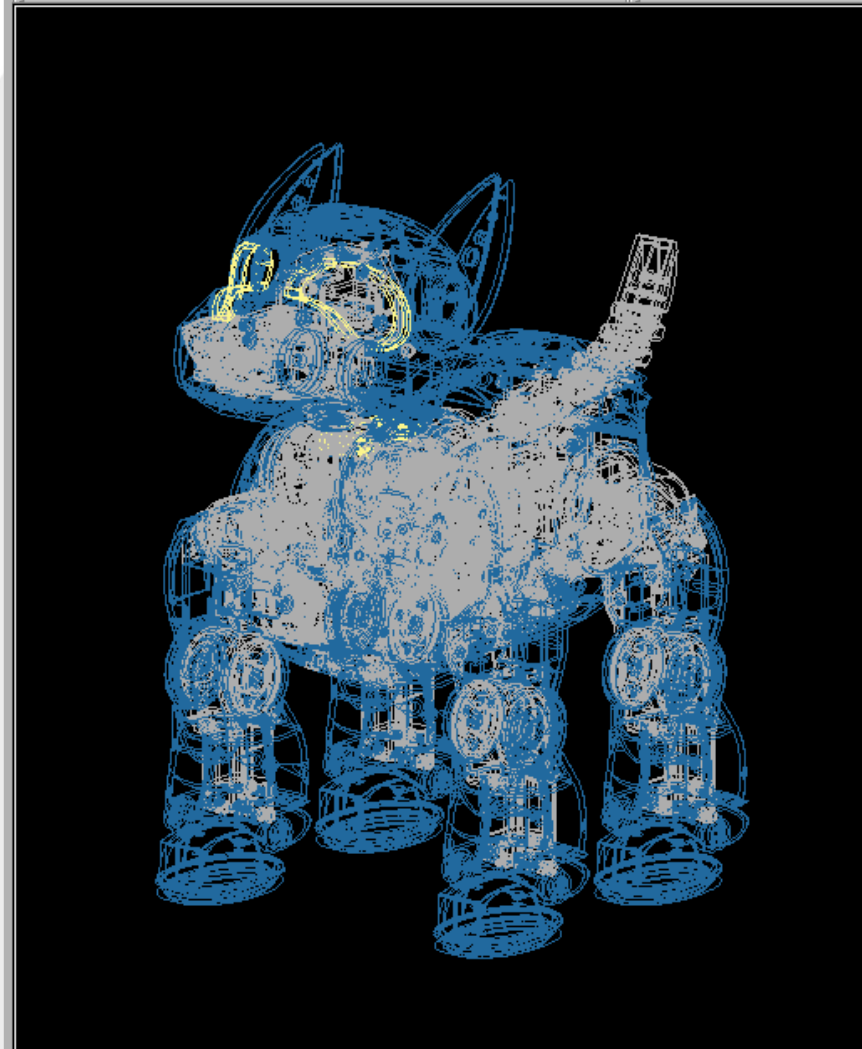






## Components fitting and functional testing



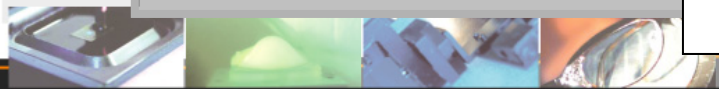


TOP WORK



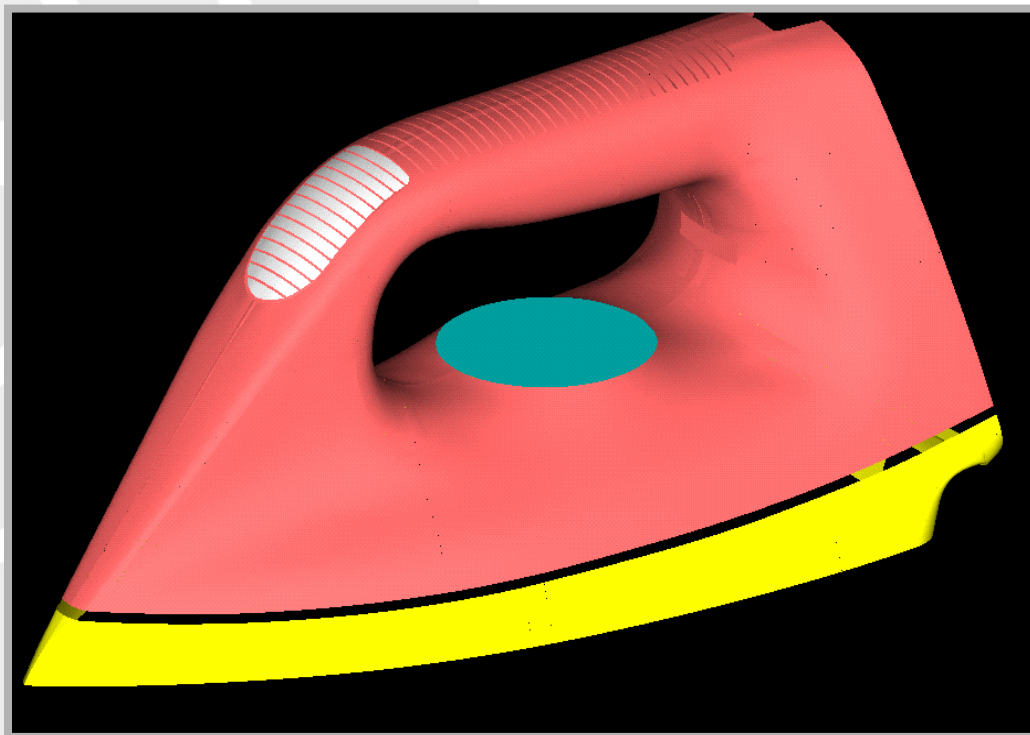
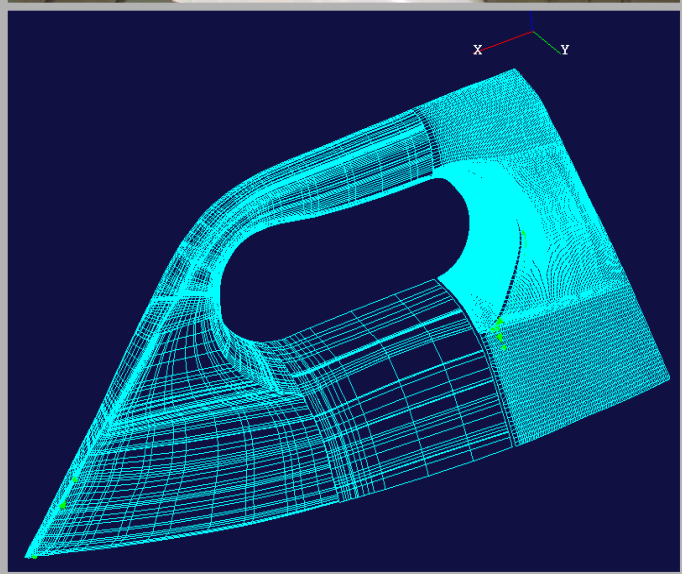
TOP

# Assembled Drawing

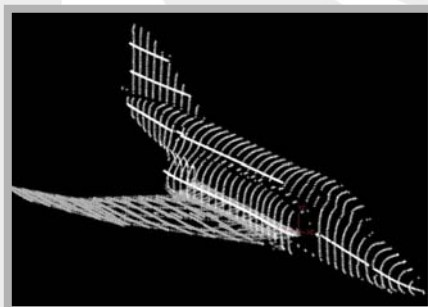
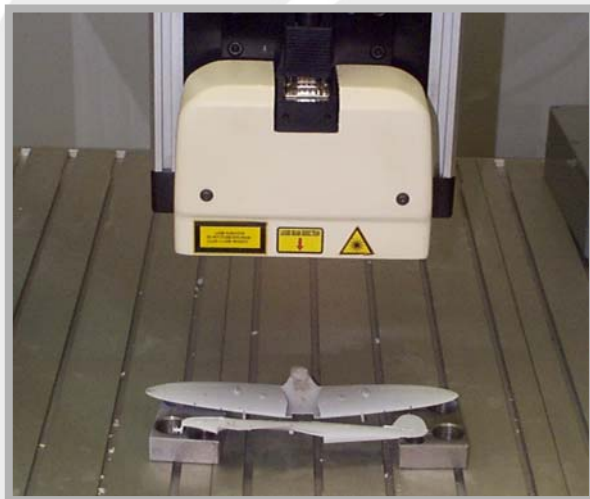




# Laser Scanning Case Study - Iron



# Laser Scanning Case Study - Toy



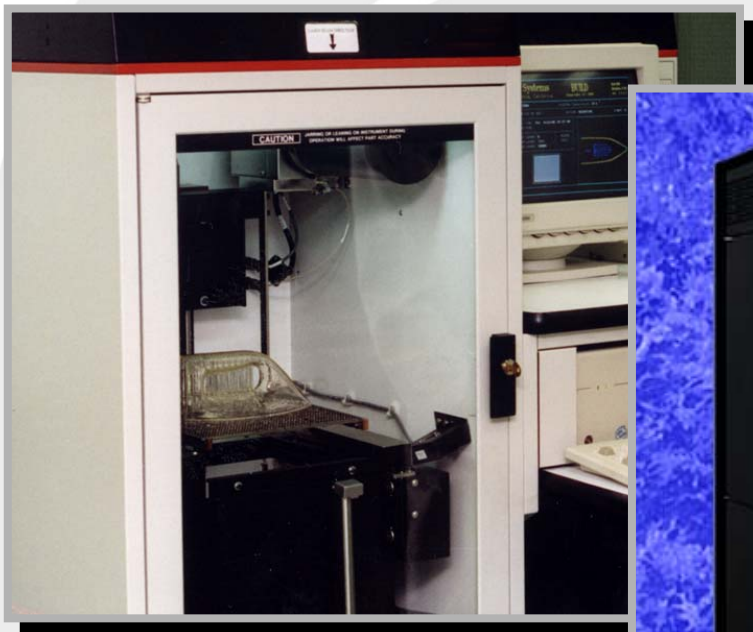
# Rapid Prototyping Technology Center (RPTC)

Rapid prototyping technology in RPTC



# Rapid Prototyping Technology Center (RPTC)

## Rapid prototyping technology in RPTC



**SLA**



**FDM-Titan**



**DLP**





# RP Benefits 好處

- **Shortening the product development cycle and time to market**  
縮短產品開發時間
- **Better communication with customers and market**  
幫助溝通
- **Reducing manufacturing problems and cost**  
減低生產及開發成本
- **Better quality due to the adoption of the same product model and database for design, engineering and manufacturing**  
改善產品質素
- **Design Verification, fitting & interference checking**  
產品驗正測試







## Common RP Systems in the World

### 常用快速原型系統

- **Laminated Object Manufacturing (LOM) 層堆成型**
- **Selective Laser Sintering (SLS) 燒結成型**
- **Fused Deposition Modeling (FDM) 擠壓成型**
- **Stereolithography (SLA) 激光樹脂成型**
- **Digital Light Process (DLP) 數碼投影成型**



**DTM**  
CORPORATION



# Laminated Object Manufacturing(LOM)

## 層堆成型

**Laminate sheet paper or plastic sheet**

每層由紙張或膠片重疊成型

- **High speed CO<sub>2</sub> Laser cutting**

- 高速二氧化碳激光切邊

- **No need for Support**

- 不須支撐

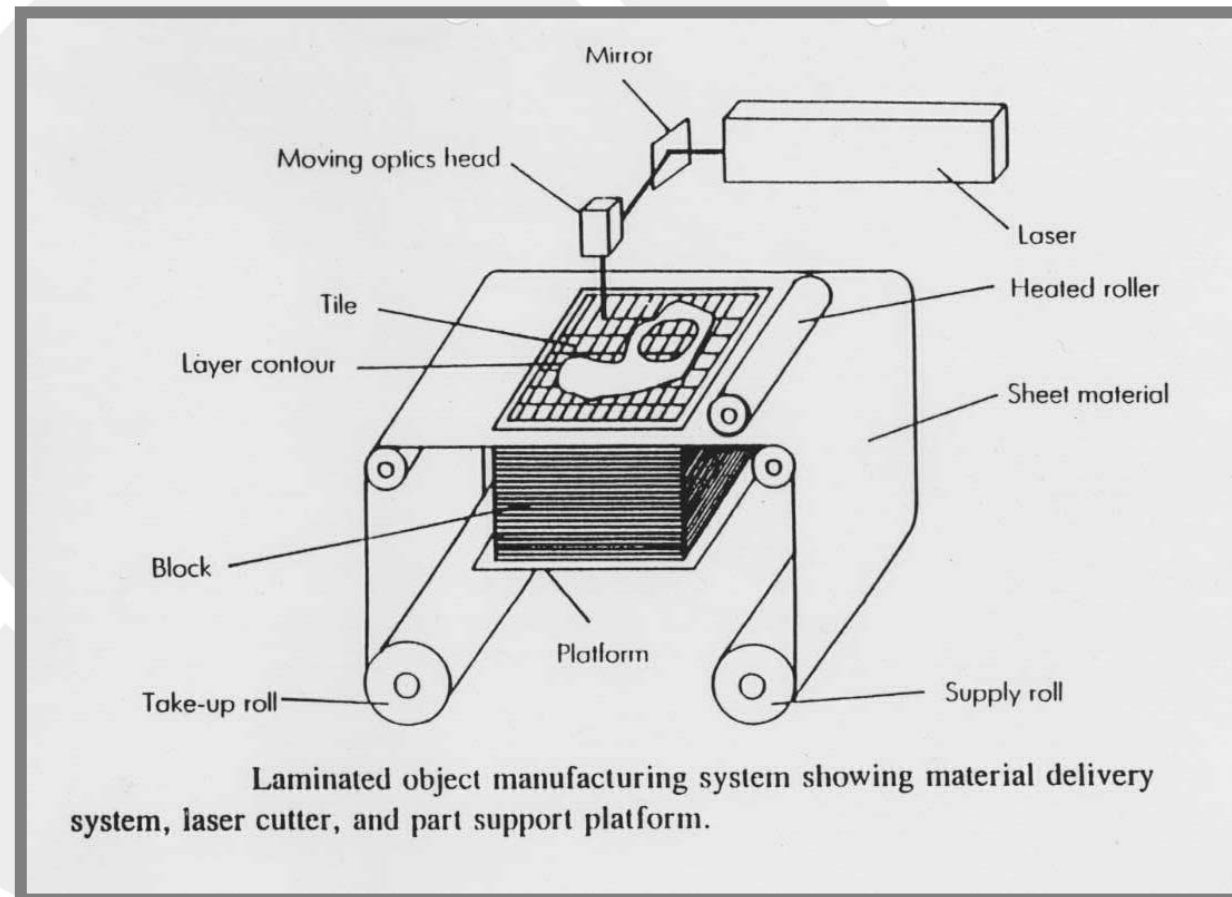
- **Less expensive**

- 成本較低



# Laminated Object Manufacturing Principle

## 層堆成型原理



# Selective Laser Sintering (SLS)

## 燒結成型

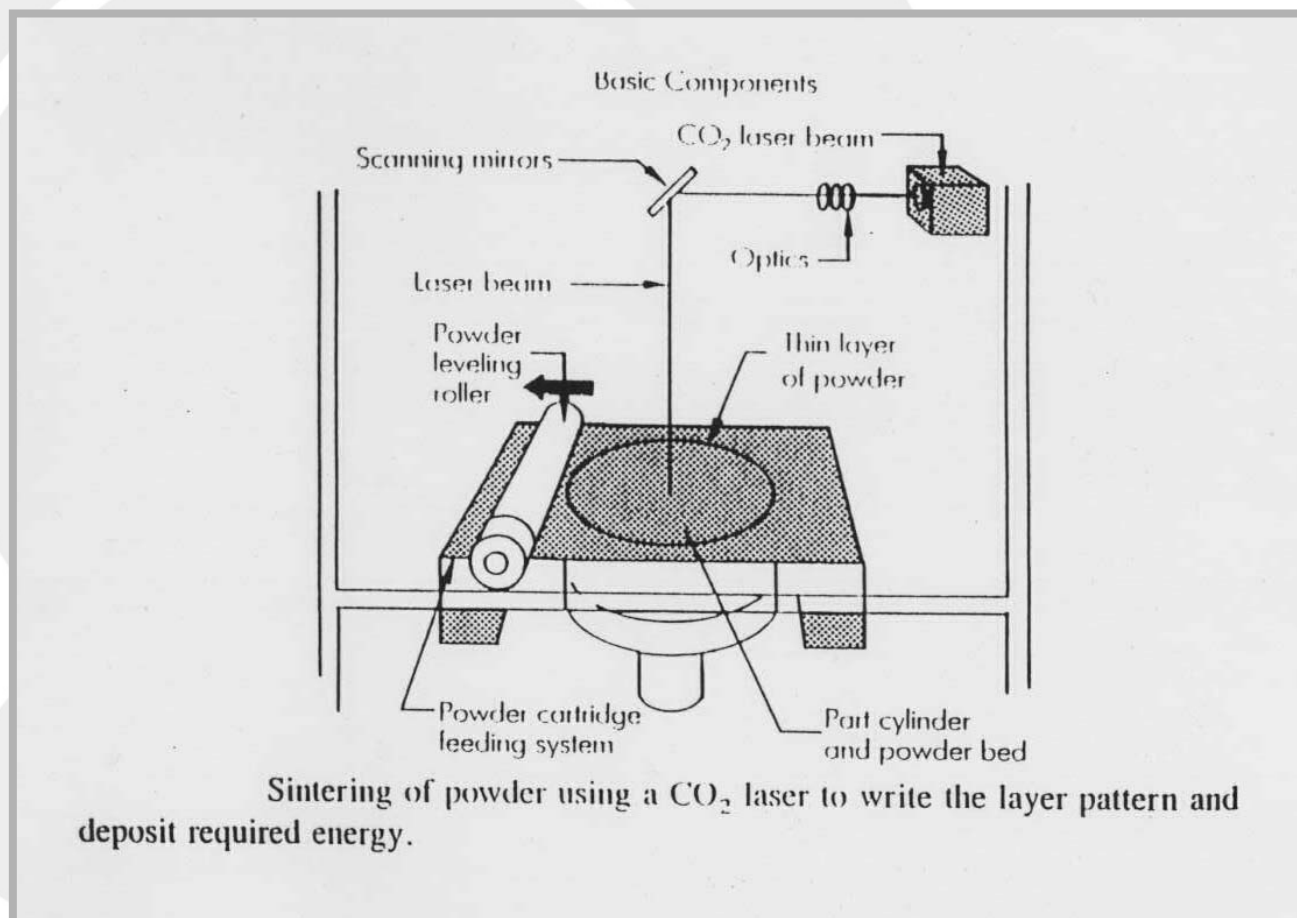


- **Use high power CO<sub>2</sub> Laser** 利用二氧化碳激光
- **Inorganic binder and powdered material is to be sintered**  
燒結無機粉末
- **Various choice of material e.g nylon (PA)**多種材料可供使用
- **Achieve functional testing (similar engineering plastic properties)**  
可用作產品功能測試



# Selective Laser Sintering Principle

## 燒結成型原理





Rapid Prototyping Technology Center (RPTC)

# Rapid prototyping technology in RPTC

## – Fused deposition modeling (FDM)

- Max. size of prototype: 350mm X 400mm X400mm
- Resolution: 0.25mm per layer



Model brand: TITAN



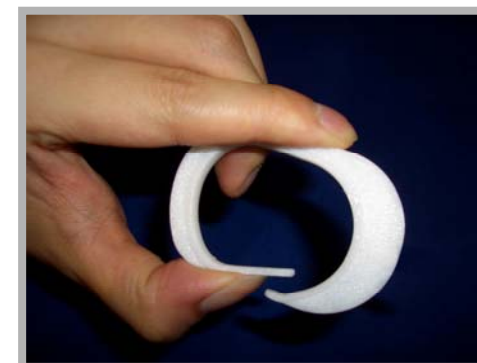
Model brand: DIMENSION



## Fused deposition modeling (FDM)

Mechanical Properties	Unit	ABS	Polycarbonate
Tensile Strength	psi	3,132	7,635
Tensile Elongation at Break	psi	3.18%	3.6%
Flexural Strength	psi	4,975	11,068
Hardness	psi	78	78
Liquifier Temperature	F°	290°	340°

- **ABS and PC can be similar as final product material**
- **ABS 和 PC 物料與市場產品相附合**
- **High Strength and Ductibility**
- **ABS 和 PC 物料有高強度和延展力**
- **Material can satisfy your client's requirement e.g clamp**
- **ABS 和 PC 物料能附合客人的要求**



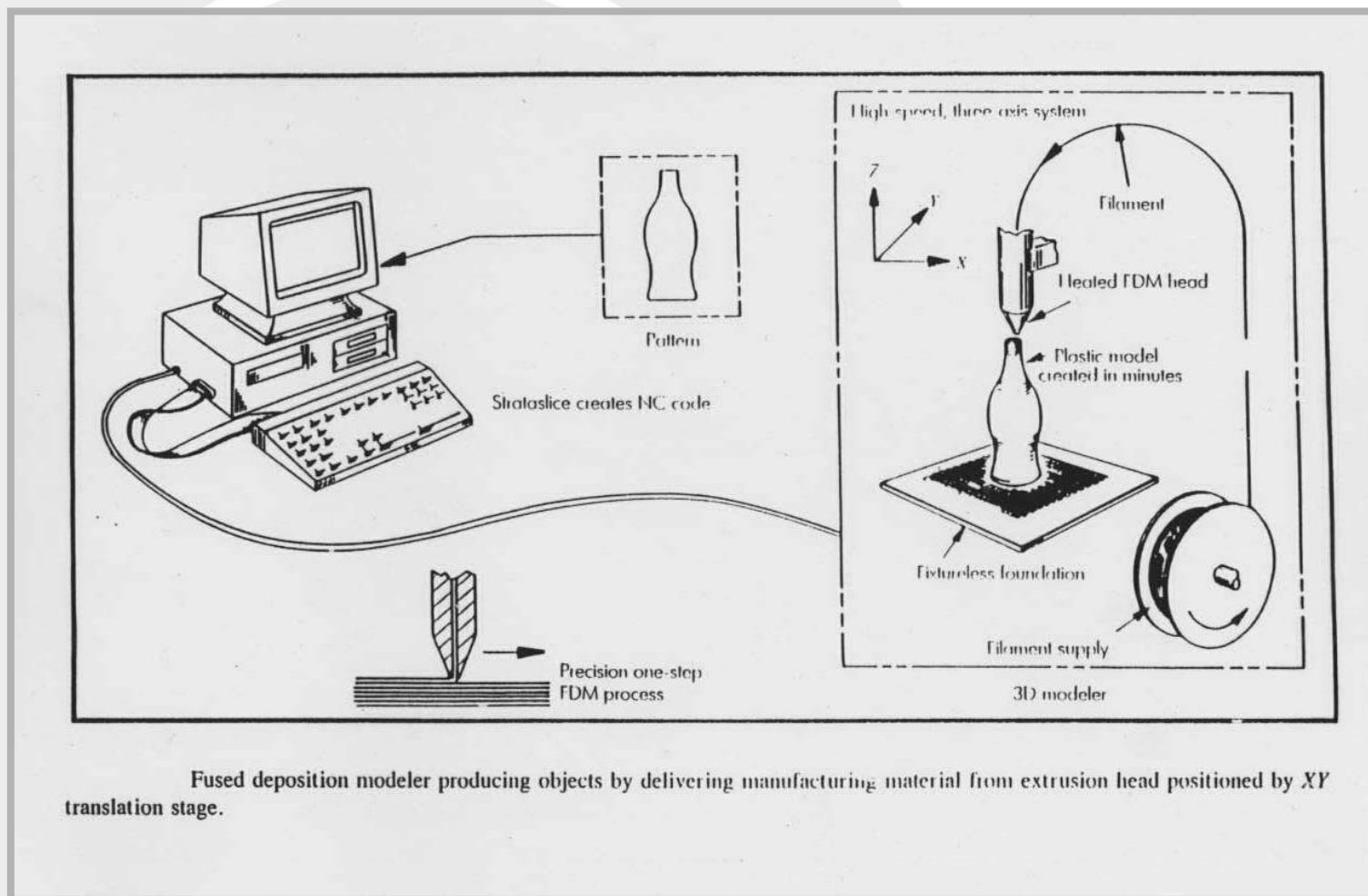
## Fused deposition modeling (FDM)

- **Extrude molten plastic material** 擠壓塑料
- **Deposit through moving orifice or tube** 溶料由管口排出
- **Material cooled and solidified to form layers of object** 物料冷卻成型
- **Require support structure** 須支撐撐
- **Various choice of plastic filament** 多種材料選擇
- **Efficient machine time (about 1 – 2 days)**

快速成型時間 – 介乎 於一至兩天完成

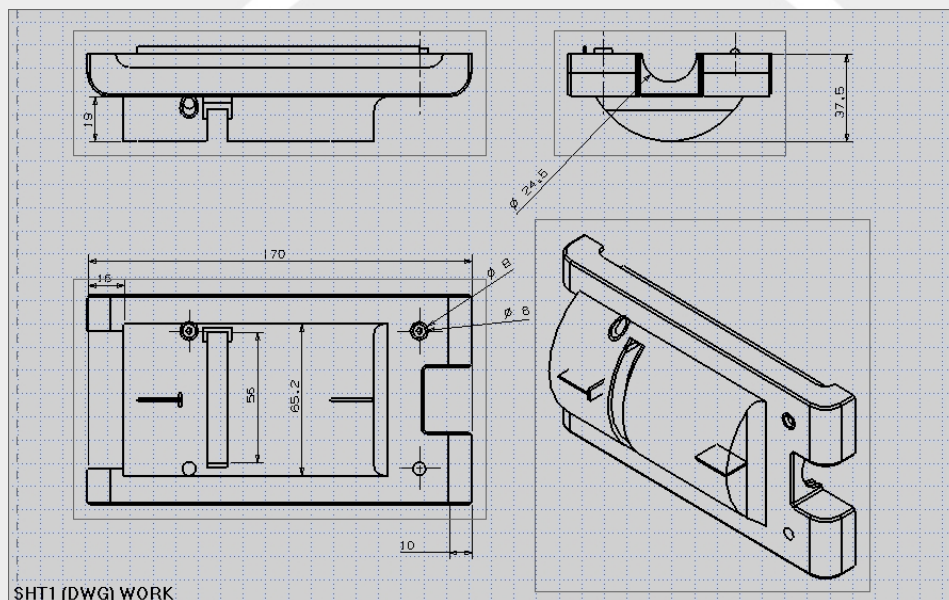


## Fused deposition modeling (FDM)

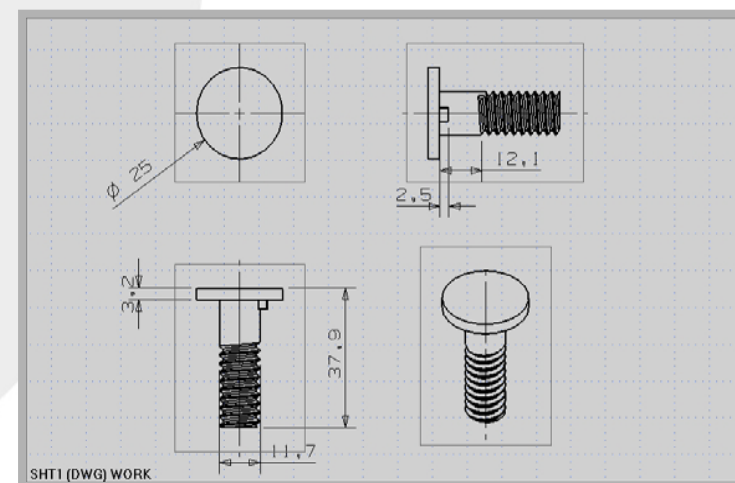




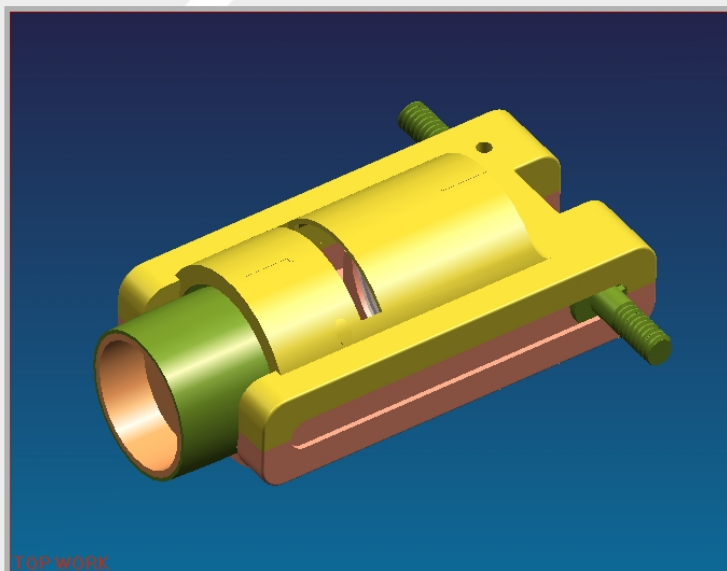
# FDM Case Study - Toy Grade projector



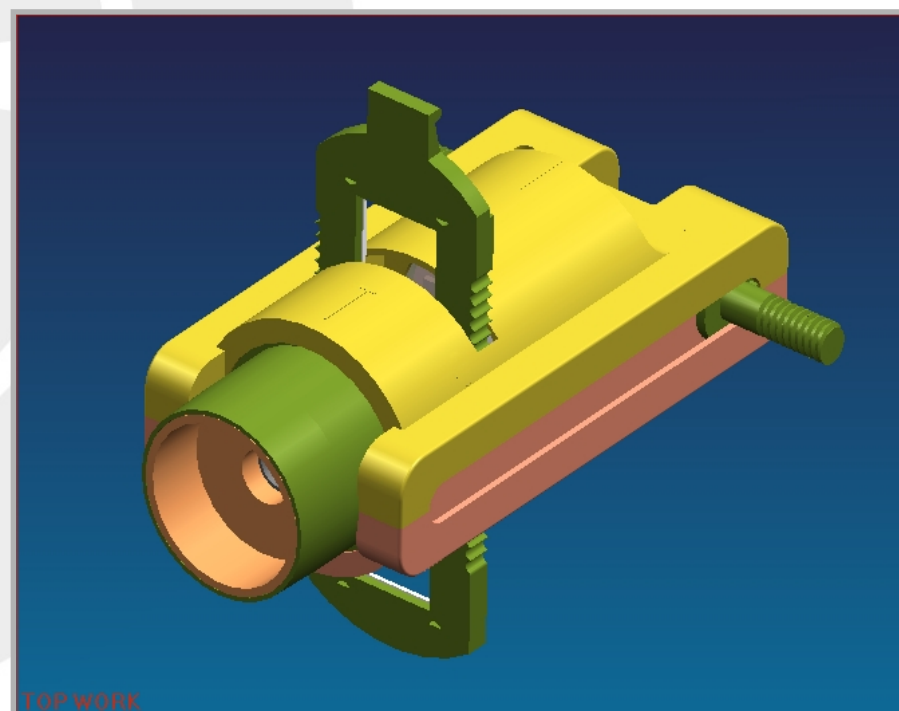
*2D drawing*



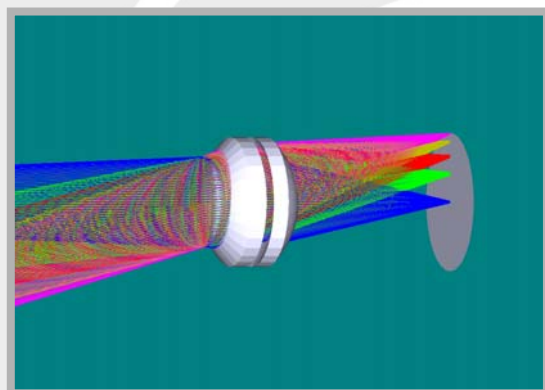
# FDM Case Study - Toy Grade projector



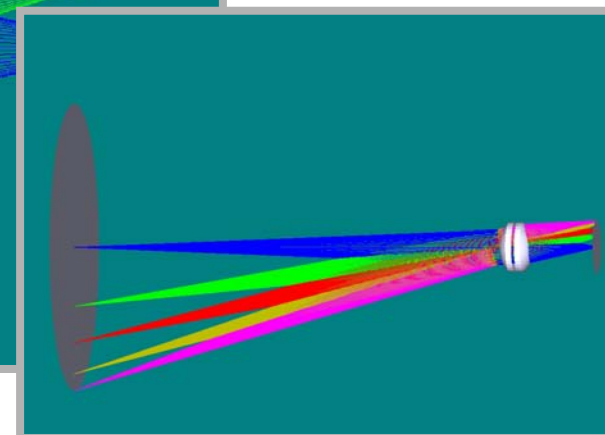
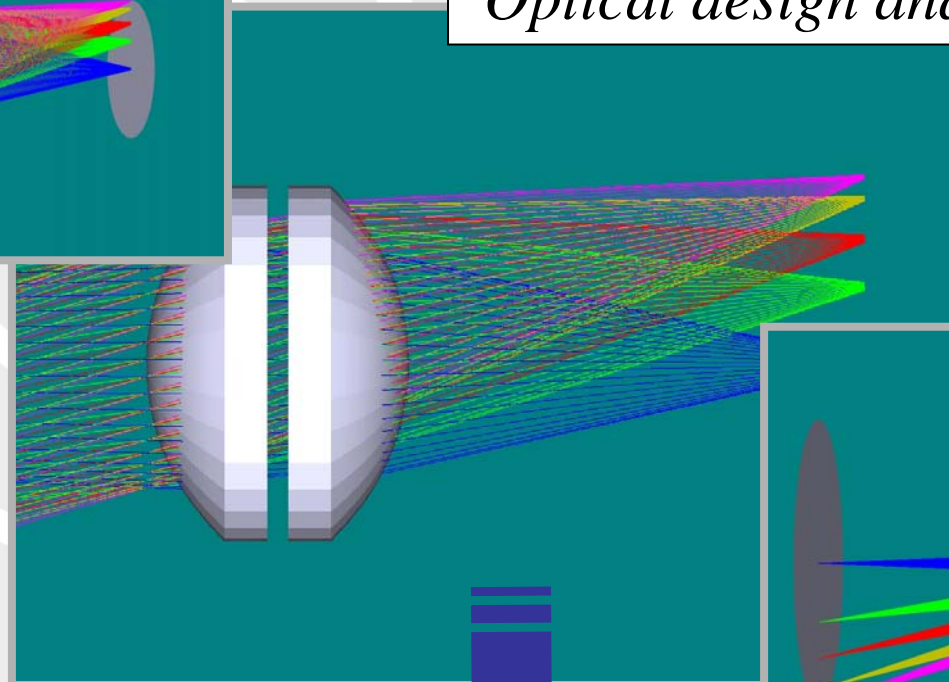
*3D modeling*



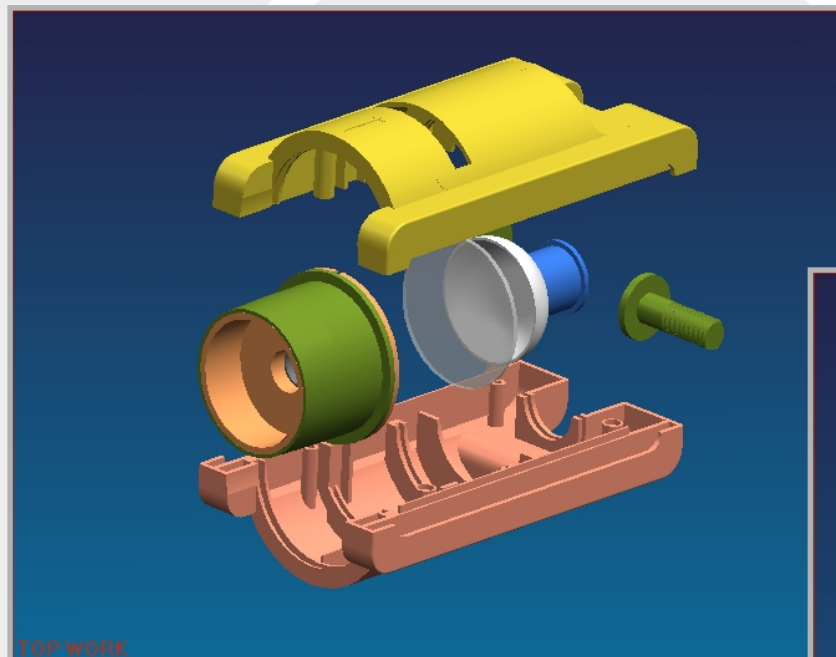
# FDM Case Study - Toy Grade projector



*Optical design and analysis*

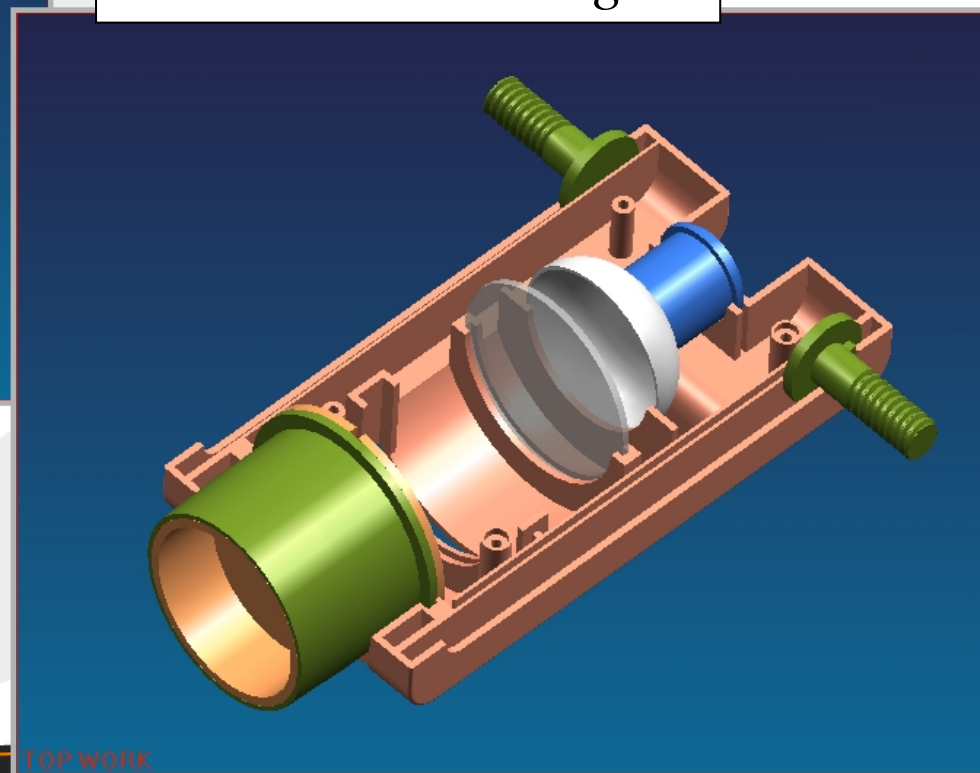


# FDM Case Study - Toy Grade projector



TOP WORK

*Mechanical Design*



TOP WORK

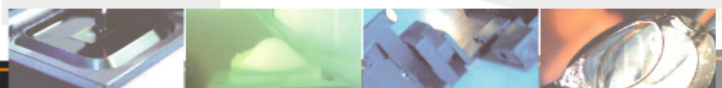




# FDM Case Study - Toy Grade projector



*ABS RP Samples*



# FDM RP Samples



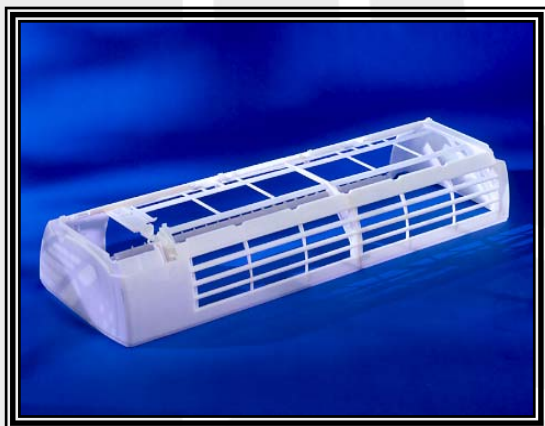
*ABS and PC parts by  
FDM Technology*



Rapid Prototyping Technology Center (RPTC)

# Rapid prototyping technology in RPTC

- Fused deposition modeling (FDM)
  - Examples



Rapid Prototyping Technology Center (RPTC)

# Rapid prototyping technology in RPTC

## – Stereolithography (SLA)

- Max. size of prototype: 250mm X 250mm X 250 mm
- Resolution: 0.05-0.15mm per layer

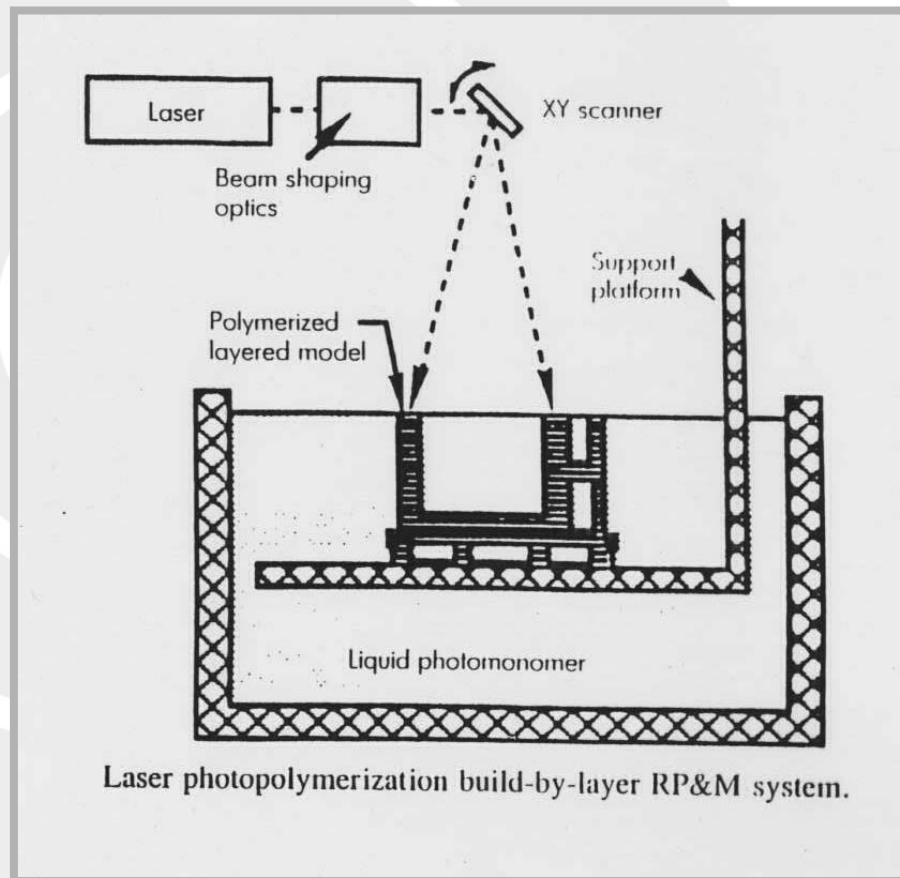


Model brand: 3D SYSTEM





# Stereolithography (SLA)



# Stereolithography (SLA)

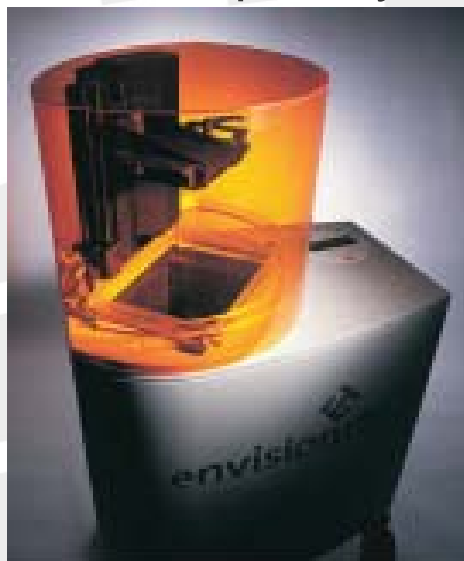
- **Laser: Solid state Nd:YVO, 354.7 nm, 1000 mW**
- **Optical system: Spot size (diameter): 0.20-0.29 mm**
  - **Maximum drawing speed: 762 mm/sec**
  - **Elevator: Vertical resolution: 0.0025 mm**
    - **Position repeatability: 0.0076 mm**
    - **Minimum layer thickness: 0.05 mm**  
(3 resolutions: 0.05, 0.10, 0.15mm per layer)
- **Materials: photocurable liquid plastic (resin)**



Rapid Prototyping Technology Center (RPTC)

## Rapid prototyping technology in RPTC

- Digital light processing (DLP)
  - Max. size of prototype: 142mm X190mm X 220mm
  - Resolution: 0.025mm per layer



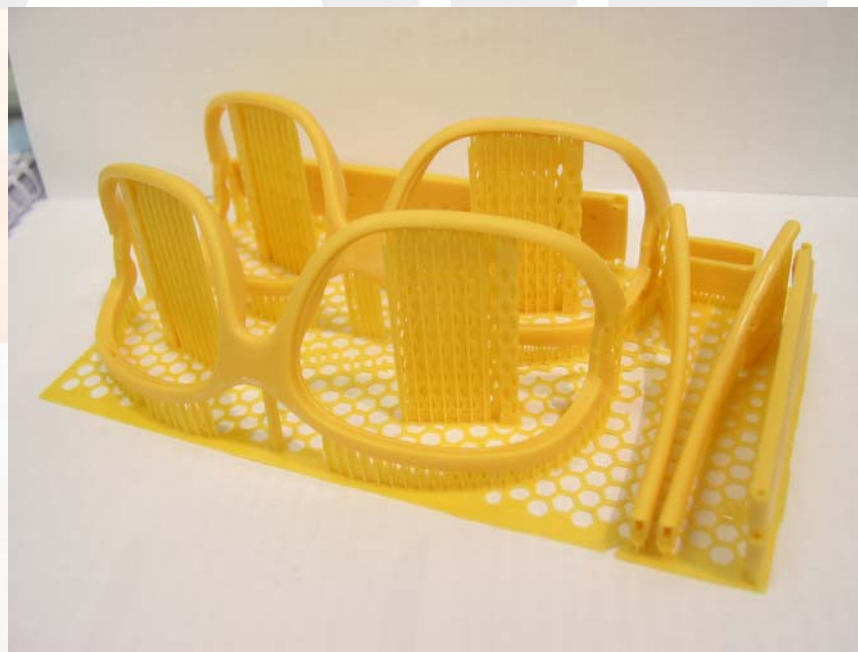
Model brand: Perfactory



Rapid Prototyping Technology Center (RPTC)

# Rapid prototyping technology in RPTC

- Digital light processing (DLP)
  - Example





# Rapid Prototyping Technology Center (RPTC)

Other RP Services



Rapid Prototyping Technology Center (RPTC)

## Other RP Service

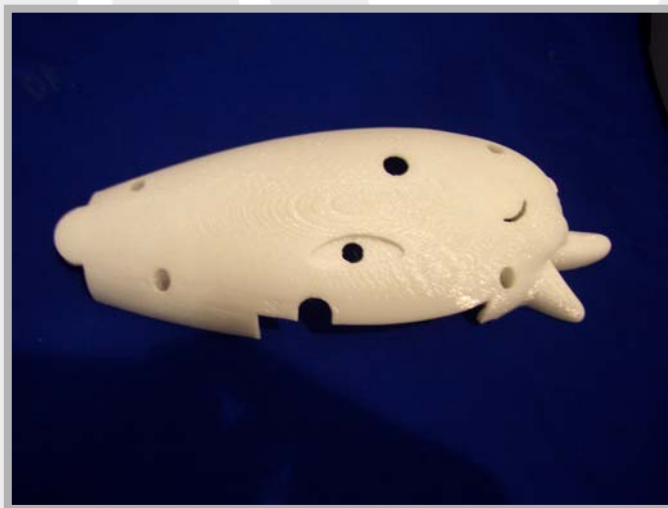
- Polishing & Painting(SLA)



Rapid Prototyping Technology Center (RPTC)

## Other RP Service

- Polishing & Painting(FDM)



Rapid Prototyping Technology Center (RPTC)

## Other RP Service

- Polishing & Painting(DLP)





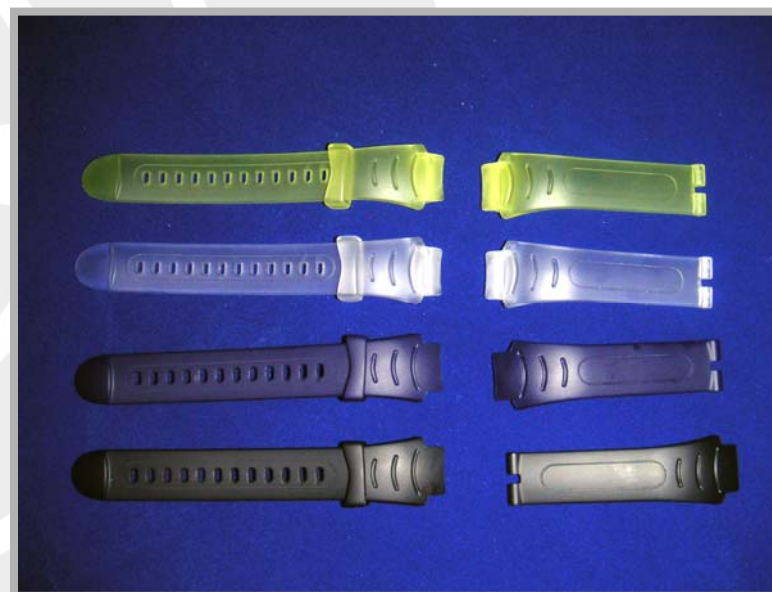
Rapid Prototyping Technology Center (RPTC)

## Other RP Service

- PU duplication & Silicon Mold



Silicon Mold



PU duplication



Rapid Prototyping Technology Center (RPTC)

## Other RP Service

- Titanium casting
  - Casting process



From wax model to final product



Titanium casting machine



Rapid Prototyping Technology Center (RPTC)

## Other RP Service

- Titanium casting
  - Other casting product



Watch Case



Ring



## Rapid Prototyping Technology Center (RPTC) Other RP Service

- Rapid jointing (Laser welding)

### Welding of highly polished surfaces

- 3D-Modification of moulds through exact material adhesion
- Alteration of Cracks and damaged gates
- Welding of high carbon steels
- Treatment of powder metallurgical steels
- Restoration of edges and corners
- Deposit of wear and corrosion resistant layers

