NOVA Chemicals®

polyethylene

3D Printing at NOVA Chemicals

Case Studies

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Chicago IL

Agenda

- NOVA Chemicals
- NOVA and 3D Printing
- Dimension SST1200
  - -When (and why) NOVA bought into 3D printing
  - -Type of printer bought
  - -Operating costs, build media, build sequence and build envelope
  - -Typical design-to-build sequence
- Case Study 1. COSMO
  - -Background
  - -Scaling consideration
  - -Build times and costs
  - -Results and uses
- Case Study 2. Dumpster Mate 5 Slides
  - -Background
  - -Scaling consideration
  - -Build times and costs
  - -Results and uses
- Summary

Introduction

NOVA Chemicals

Focused on polyethylene products and markets

Annual sales in 2013: $5.3 billion (USD)

Number of Employees: 2,600 worldwide

Headquartered in Calgary, Alberta

Corporate Strategy

A foundation of world-class Responsible Care® and talented people, combined with:

cost-competitive feedstock

best in class assets utilizing proprietary technology,

and focused market leadership

Support NOVA Chemicals' aspiration to be a great company.

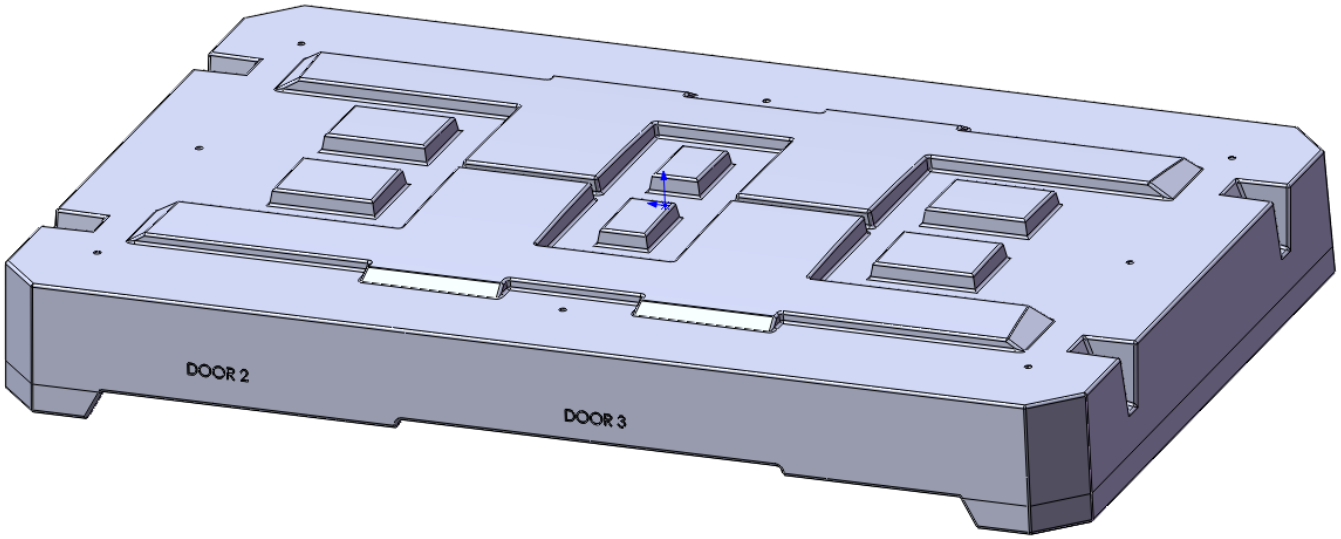
NOVA and 3D Printing

- FMD Team formed in 2008
- Team charged with expanding the rotomolding market through innovation
- 3D Printing introduced in 2009

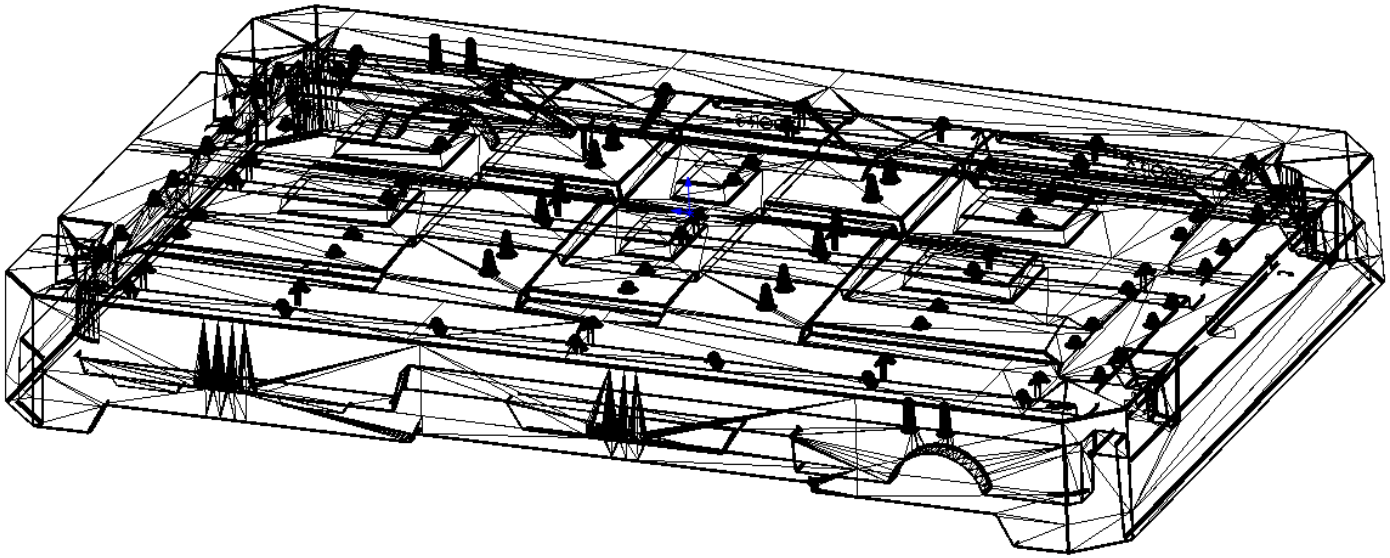
Dimension SST1200 3D Printer

- Purchased in 2009
- Micro Extrusion
- ABS monofilament (build material)
- MAH-modified ABS monofilament (Soluble support)
- 10” by 10” by 11” build envelope
- Material costs are about $4.50 per cubic inch, less if hollow or sparse parts are made

Typical Build Sequence:
1. Part design in Solidworks™

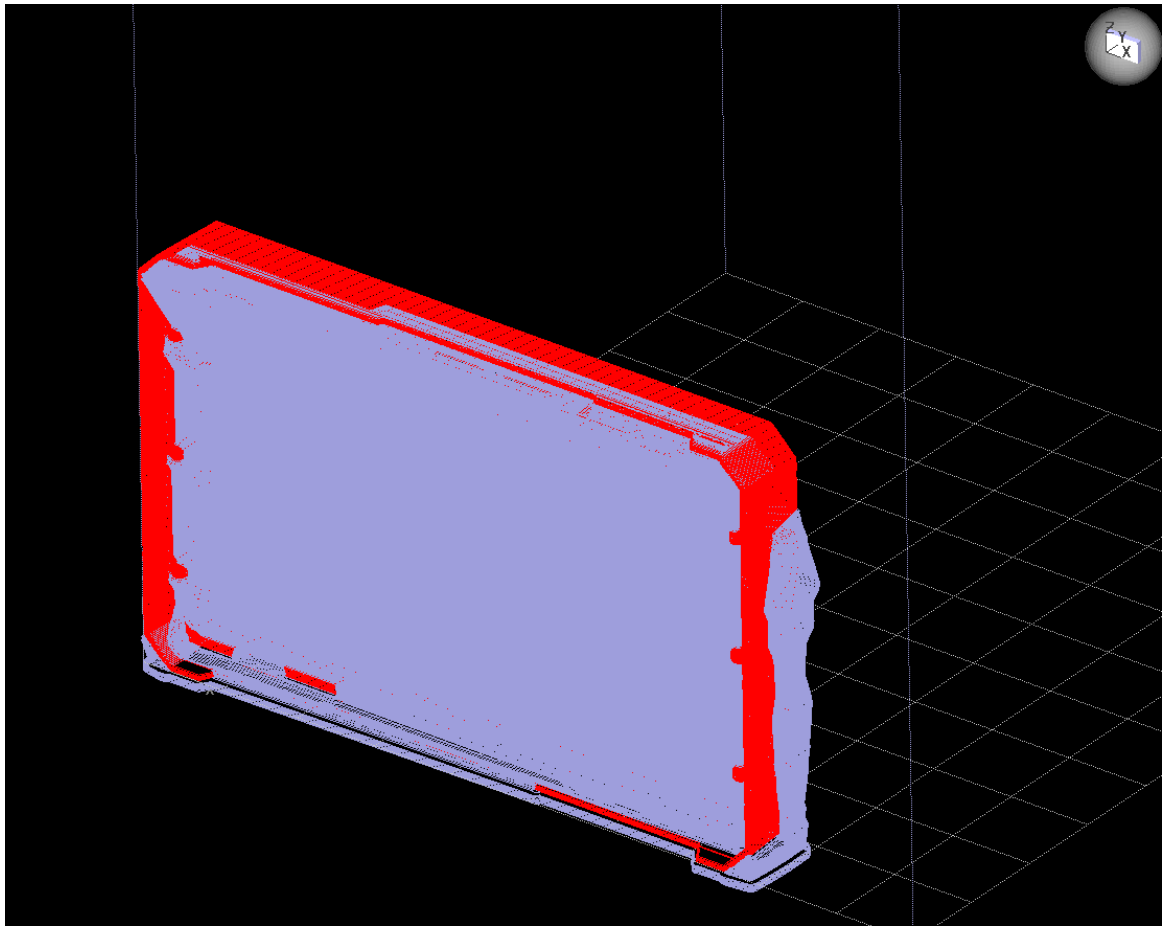


Typical Build Sequence:
2. Part saved in STL (stereo lithography) format



Typical Build Sequence:

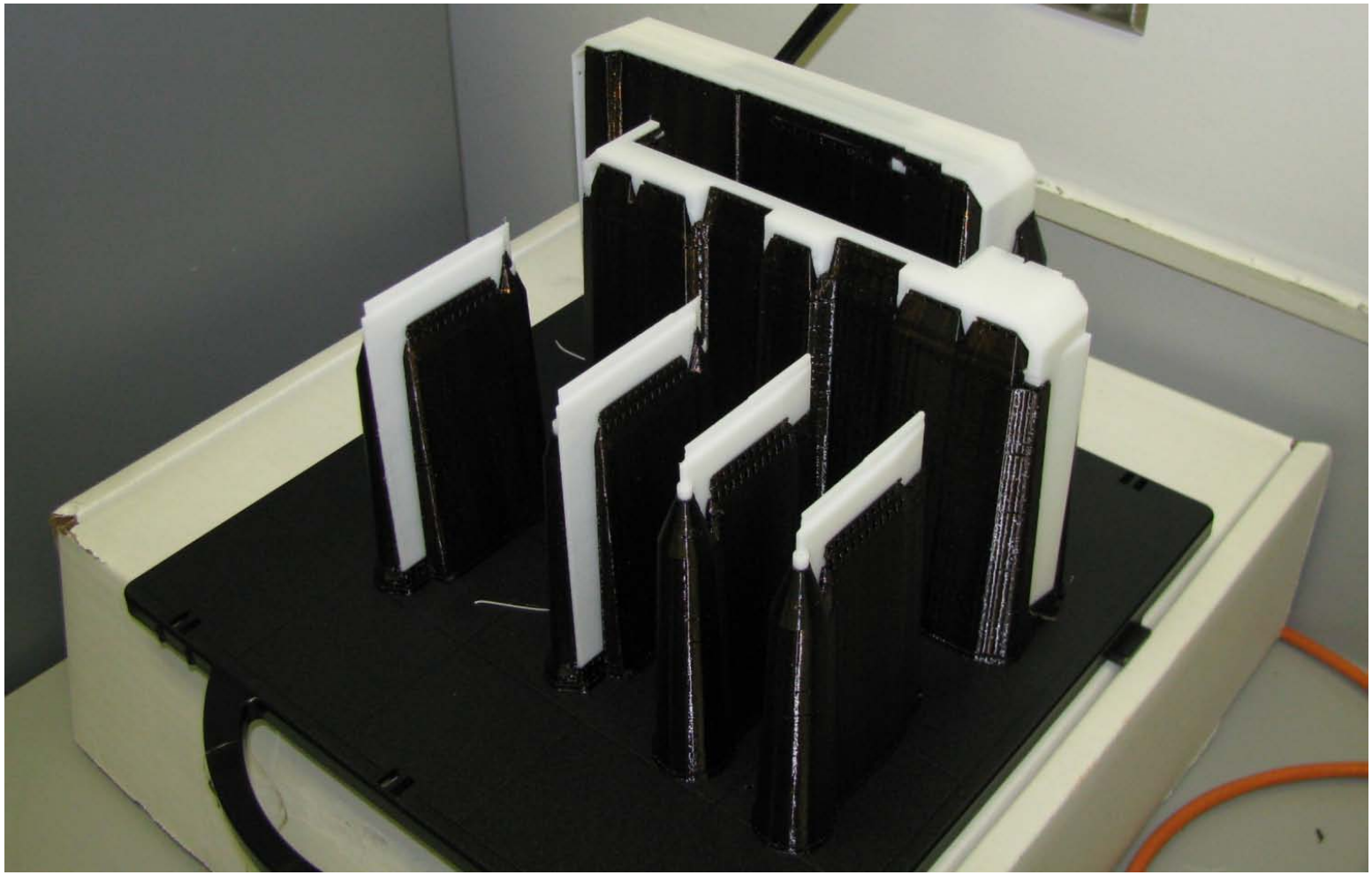
3. Tool paths, layout, material use and build times are calculated



Typical Build Sequence:

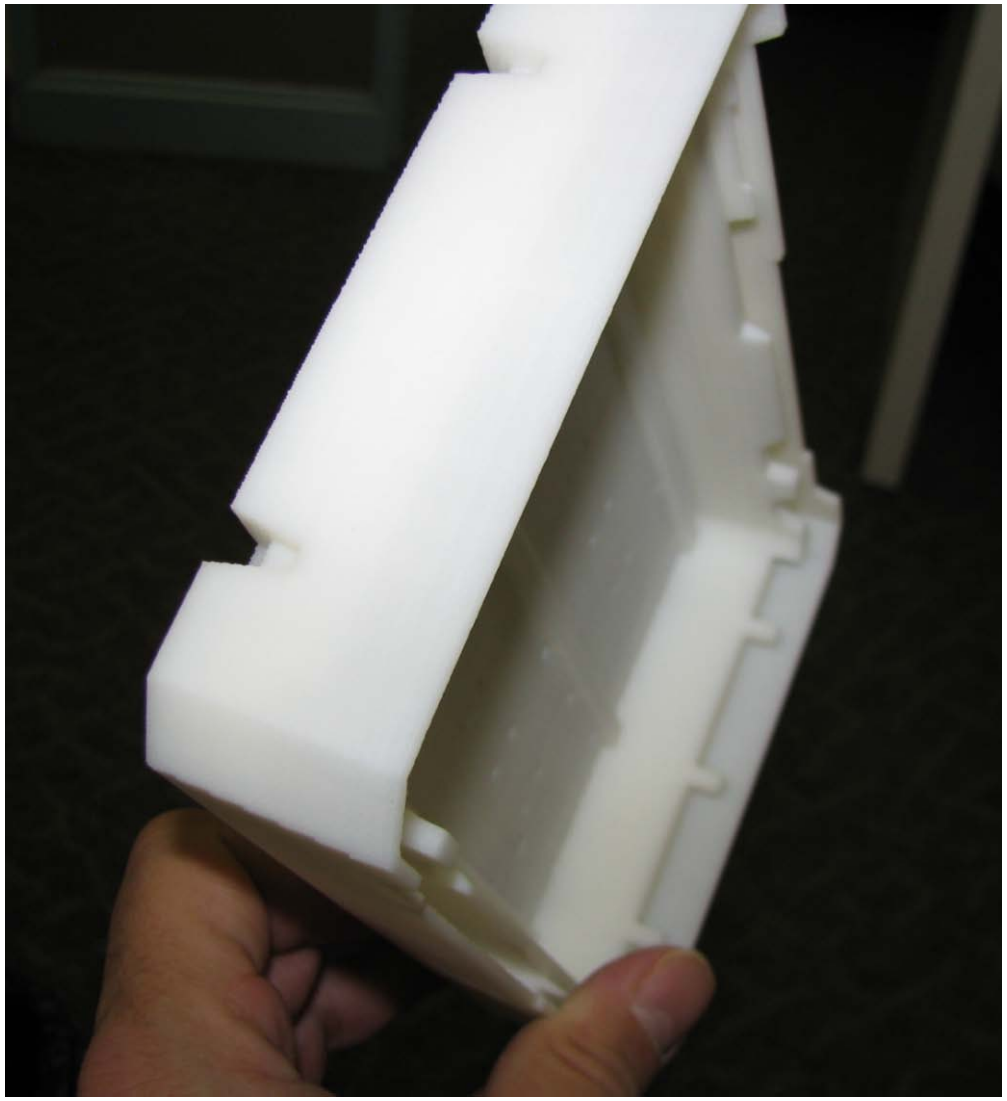
4. Parts printed on a removable platform (model material is white, support material is brown)

Typical Build Sequence:
5. Parts are removed for cleaning of support material



Typical Build Sequence:

5. After washing, parts are ready for paint and assembly



Case Study 1.
COSMO Collapsible Container

- Moving and storage container
- Collapsible, lockable
- Designed in 2008-09

COSMO Model

A. Scaling considerations, designing the model

- Bolt holes were scaled up to allow small rods to be used at hinge points
- All other dimensions were accurate to scale
- 1:12 Scale decided

COSMO Model :
B. Build Time and Costs

Build Summary-COSMO Model, 1:12 Scale				
Part	**No. needed**	**Build Time**	**Material**	**Mtl. Cost**
		total, hr.	**total, cu. In.**	**total, $**
Roof	1	22.5	18.6	$101
Base	1	19	17.8	$97
Door 2	2	4.2	5.6	$31
Door 3	2	4.2	5.6	$31
U Scissors	2	12.2	8	$44
L Scissors	2	11	8	$44
Corner	2	15.2	7.8	$43
	Total	**88.3**	**71.4**	**$389**

COSMO Model

C: Result and Uses

COSMO Model
C: Result and Uses (Cont.)

- Used in assembly process design (forklift, etc.)
- Internal proof of concept sales tool
- Tolerencing discussions
- External sales demonstration models
- Resulted in commercial military and civilian sales
- Design errors were found and corrected prior to cutting metal

Case Study 2:
Dumpster Mate
(photo courtesy of Dumpster mate LLC)

NOVA Chemicals

Dumpster-Mate Model
A. Scaling considerations, designing the model

- Assembly holes were sized for stock thin aluminum anchor poles.
- All other dimensions were accurate to scale
- 1:12 Scale selected

Dumpster Mate Model
B: Build Time and Costs

Build Summary-Dumpster Mate Model, 1:12 Scale				
Part	**No. needed**	**Build Time**	**Material**	**Mtl. Cost**
		total, hr.	total, cu. In.	total, $
Main panel	8	89.6	51.2	$279
Corner	4	46.8	25.2	$137
Swing doors	2	13	5.4	$29
Inserts	8	11.2	16.8	$92
Access door	1	11.2	6.1	$33
	Total	**171.8**	**104.7**	**$571**

Dumpster Mate Model

C: Result and Uses

Dumpster Mate Model
C: Result and Uses (Cont.)

- Used as proof of concept and for design acceptance
- Used to help in tooling estimates, and manufacturing planning (arm usage, machine selection)
- Used to pre plan assembly process
- Resulted in hand off to inventor and commercial sales

Summary

- 3D Printing has been a useful tool for NOVA
- Used for
  - -One off lab items
  - -Proof of concept models
  - -Tolerencing and fitment aids
  - -Design acceptance
  - -Assembly and manufacturing planning
  - -Sales tools

thank you

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