General Atomics Inertial Fusion Technology (IFT)

Partners in the Target Fabrication Community

FI

LANL

LLE

LLNL

NLUF

SNL

Presentation by Brian Vermillion
OLUG
LLE, Rochester, 4/30/09
General Atomics IFT has an experienced ICF target fabrication team

- LLNL: 10
- LANL: 1
- SNL: 7
- LLE: 2
- San Diego: 80 + 22 students

**Total Staff**

<table>
<thead>
<tr>
<th></th>
<th>100 GA and subs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 Students/Ints</td>
</tr>
<tr>
<td></td>
<td>3 Consultants</td>
</tr>
<tr>
<td></td>
<td>10 collaborators</td>
</tr>
</tbody>
</table>

**Education**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>22</td>
</tr>
<tr>
<td>MS</td>
<td>10</td>
</tr>
<tr>
<td>BS</td>
<td>27</td>
</tr>
<tr>
<td>AA</td>
<td>27</td>
</tr>
</tbody>
</table>

**Experience**

- Invited presentations: 7 (2007-08)
- Peer-reviewed publications: 231 since 2000
- ~900 person-years

**GA staff are both in San Diego and onsite at various facilities**
GA produces targets for all the major NNSA ICF facilities

- **Three major new ICF facilities**
  - NIF Project
  - OMEGA-EP Building (completed in February 2005)
  - Z-R

- **The facilities use thousands of high precision targets/year**
  - OMEGA ~ 4000 targets/year
  - ZR ~ 200 targets/year
  - NIF ~ many hundreds targets/year, starting 2009

**GA has over 19 years of ICF target fabrication experience**
GA annually produces thousands of components for OMEGA under a stringent Quality Management System

- Reliable fabrication of 4,000 components/year for ~70 categories
- **ISO 9001:2000 sets a management structure**
  - Customer interactions
  - Change controls
  - Documented work procedures
  - Regular internal/external audits
  - Quality Control
  - Staff training and publications
  - Quality Assurance
  - Management Review

**Continual Improvement is a Key Objective**
Commonality of technologies at one facility improves fabrication efficiency and reduces duplication of resources.

- Metal Coatings
- Electroplating
- CH/Glass Coatings
- Mass Spectrometry
- Interferometry
- XRF
- Spheremaps
- Auger
- PSDI
- SEM/EDAX
- XRadia
- Precision Assembly
- WYKO
- Diamond Turning
- Milling
- Laser Machining
- Microscopy
- Contact Radiography
GA produces many target components for OMEGA

- Foam capsules with fill tube for FoamImp
- Capsule and cone for Fast Ignition
- Inner trenched capsule for DImE
- Embedded features for Astroshock
- Double Shell for DynHohl
GA produces many target components for OMEGA

- NIF Direct Drive Fill Tube Target
- Laser Machined Calibration Grid for 20keV BL
- Machined perturbations for Supernova RT
- Cryo shell for NIC
- 1 micron thick Au hohlraum for ICE
GA makes many of the NIF ignition target components and is a partner in the National Ignition Campaign
OMEGA target request process starts with the target request form: TRF
Omega target request process starts with the target request form: TRF

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Fab. Center</th>
<th>Best Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order</td>
<td>GA</td>
<td>Non-GA</td>
</tr>
<tr>
<td>General Descriptor</td>
<td>WONO</td>
<td></td>
</tr>
<tr>
<td>Primary Descriptor</td>
<td>GA Order</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>External</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Check here if any component requires assembly.

<table>
<thead>
<tr>
<th>GA</th>
<th>Fab Center</th>
<th>Component Type</th>
<th>General Descriptor</th>
<th>Primary Descriptor</th>
<th>Group</th>
<th>Secondary Descriptor</th>
<th>Due date</th>
<th>Qty.</th>
<th>Usage</th>
<th>Best Effort</th>
<th>WONO</th>
<th>GA Order</th>
<th>Cust. #</th>
<th>Order Specs</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Capsule</td>
<td>CH</td>
<td>CHsingle</td>
<td>A</td>
<td>40 micron SCD to CPM, 2 racks of 12</td>
<td>03/05/2009</td>
<td>24</td>
<td>Internal</td>
<td>None</td>
<td>C30272-9570</td>
<td>DC-LLE-296-Int-Fi-09D Rev 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capsule</td>
<td>CH</td>
<td>CHsingle</td>
<td>A</td>
<td>40 micron SCD for TCC and neutronics reference</td>
<td>04/05/2009</td>
<td>7</td>
<td>External</td>
<td>None</td>
<td>C30272-9570</td>
<td>DC-LLE-296-Int-Fi-09D Rev 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Micromachining</td>
<td>Cone/Shield</td>
<td>Cone</td>
<td>ABC</td>
<td>20 mic thick Cu Cone 25 mic thick Cu Cone 30 mic thick Cu Cone</td>
<td>04/13/2009</td>
<td>5</td>
<td>External</td>
<td>None</td>
<td>C30272.9490</td>
<td>COM-Int-Fi-09D Cone &amp; Shell</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capsule</td>
<td>Cryo</td>
<td>SCG</td>
<td>A</td>
<td>CD shells</td>
<td>04/15/2009</td>
<td>6</td>
<td>External</td>
<td>None</td>
<td>C30272 3020</td>
<td>DDC 296 DiagDev-CIS-09A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2008 Laboratory for Laser Energetics
High level scheduling completed in close partnership with laboratory POCs, TRFs, and PIs

- New TRFs
- GA Production meeting
- Lab POC meeting
- National OMEGA CCB meeting

**OMEGA change control board process**

- Discuss all OMEGA targets:
  - Track status
  - Flag and resolve issues
  - Planning

**Shot plan/ Lab POCs**
Sample of component variety shipped Q1-FY09

http://fusion.gat.com/ift/ICF_Catalog/index.html