Large Aperture Trough (LAT) 73, engineered by Gossamer Space Frames and 3M, sets a new benchmark in solar collector technology for the CSP industry. Through advancements in materials technology, state of the art engineering, and superior design, the LAT 73 offers a step change in performance and reduced cost.
Why Large Aperture?

3M and Gossamer Space Frames have joined efforts to develop the most technologically advanced solar collector: Large Aperture Trough (LAT) 73.

Large Aperture Trough (LAT) 73 uses 3M™ Solar Mirror Film 1100 as a reflective surface and a frame support structure custom designed by Gossamer Space Frames. The result is an easy to assemble parabolic trough collector with the largest working aperture and the highest geometric concentration ratio in the world today.

Large Aperture Trough (LAT) 73, engineered by Gossamer and 3M, leads the industry in optical performance. Technical features include:

- Highly reflective Solar Mirror Film 1100, with a 94.5% Solar weighted hemispherical reflectance and 95.5% specular reflectance (25 mradian acceptance angle)
- High accuracy reflective panel constructions, with less than 1.5 mradian RMS slope error
- Integration with space frame that results in intercept factors exceeding 98% at a concentration ratio of 103.

With cost being a primary driver for CSP growth, LAT 73 has also been designed with a focus on both component and installed costs.

- Compared to a standard 5.7 m aperture system, the LAT 73 requires over 40 percent fewer components resulting in a 20 percent reduction in bill of materials costs
- The high optical accuracy of the LAT 73 enables use of widely available standard 70 mm receiver tubes
- The high concentration ratio (103) results in higher heat flux per unit length, reducing receiver losses
- High stiffness panelized reflectors enable high accuracy, even under wind load. The wider operating window increases effective capacity factor.
- Space frame and reflector assembly designed are self aligning, no need for mirror jigs or over tools in field. Installation time per reflector is less than 3 minutes.

<table>
<thead>
<tr>
<th>Component Counts</th>
<th>Current Standard</th>
<th>LAT</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trough Frames (SCEs)</td>
<td>288</td>
<td>224</td>
<td>22</td>
</tr>
<tr>
<td>Center Drives</td>
<td>24</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>Pylon Assemblies</td>
<td>264</td>
<td>176</td>
<td>33</td>
</tr>
<tr>
<td>Reflective Panels</td>
<td>8064</td>
<td>4480</td>
<td>44</td>
</tr>
<tr>
<td>HCE Tubes</td>
<td>864</td>
<td>672</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>9504</td>
<td>5568</td>
<td>41</td>
</tr>
</tbody>
</table>

Large Aperture Trough (LAT) 73 uses 3M™ Solar Mirror Film 1100 as a reflective surface and a frame support structure custom designed by Gossamer Space Frames. The result is an easy to assemble parabolic trough collector with the largest working aperture and the highest geometric concentration ratio in the world today.
3M™ Solar Mirror Film 1100

Large Aperture Trough (LAT) 73 Uses 3M™ Solar Mirror Film 1100*

<table>
<thead>
<tr>
<th>Property</th>
<th>3M Solar Mirror Film 1100 (%)</th>
<th>Thick Glass Mirrors (4 mm) (%)</th>
<th>Aluminum (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Weighted Hemispherical Reflectance (ASTM G173)</td>
<td>94.5</td>
<td>94.8</td>
<td>87-91</td>
</tr>
<tr>
<td>Specular Reflectance at 25 mrad Acceptance Angle</td>
<td>95.5</td>
<td>95.5</td>
<td>79-86</td>
</tr>
</tbody>
</table>


Proven to last:

3M™ Solar Mirror Film 1100 has long durability:

• Long term outdoor exposure at NREL (168 months)

Optical Accuracy

Optical accuracy of any CSP installation is a key component of its performance. To help evaluate the optical accuracy of the LAT 73, NREL was engaged to use their field version of the Video Scanning Hartmann Optical Tool (VSHOT). This tool was employed to measure local surface slope imperfections and expected amount of incident solar light that would strike 70 mm receiver tube. Through the use of this tool, the teams were able to investigate the quality of the shape of the installed reflectors as compared to their ideal design. The best results matched previous well-controlled lab tests at 3M. These data validate that the 3M and Gossamer design demonstrates, on average, an intercept factor of 99.3%. This figure assumes a 70 mm receiver that is perfectly aligned, surfaces with ideal specularity, SCA with no tracking errors, and a standard sun shape. This is a remarkable result since it includes errors, not only from the reflectors, but also from the frame. The RMS slope errors of less than 1.5 milliradians is equally impressive, since mirror-frame systems are often in the 5 milliradian error range.

Large Aperture Trough (LAT) 73 Applications

• Utility scale CSP
• Steam augmentation - solar hybrid
• Medium scale- distributed
• Industrial heat
Gossamer Space Frames

- Proven Solar Field Designs – (over 300 MW of systems deployed).
- Patented Organic Connector ™ system provides unparalleled frame accuracy and rigidity
- No initial or ongoing alignment required
- Glass-protective support structure
- Site-specific engineering