Based in Northern Ireland

Opened January 1983 (35 years in Business)

Privately owned & profitable

60 staff

(Mechanical Engineers, Electronic Engineers, Software Developers, Production Staff, Sales/Marketing, Finance/Admin)

Systems are sold all over the world (primarily USA and China)

Cater for Low Power Telecoms/Data Center and High Power Industrial Devices
Yelo is based in Northern Ireland, in a new 25,000 sq ft Manufacturing Facility. This opened in July 2017.

New sales and customer support office to open in China in 2019/20
Burn-in and life test system range

Y1000 Low Power System

Y2000 High Power System

LIV Tester
To be commercially successful, optoelectronic devices need to be reliable.

In the very early days of laser manufacture...
- there was an unfeasibly high reject rate.
- there were so many possible failure mechanisms not understood.
- manufacturing control was poor.

Today...
- laser manufacture has a much higher yield.

However...
- the consequences of a premature laser failure can still be very expensive since they are incorporated into such a wide variety of complex (and often very expensive) equipment.
It can be argued that there are two major mechanisms that result in a failed laser.

Lasers emit light at very high intensity from a very small area

- The emitting surface can be damaged by the high electric fields present, which appears as a drop in emission. One cannot detect the likelihood of the laser experiencing facet damage other than through subjecting the laser to high emissions for an extended time - preferably at an elevated temperature.

Device overheating

- This is usually caused by either the laser chip not being properly soldered onto its heat sink (there may be an air void under the chip) or the laser heat sink itself is not properly bonded onto its larger heat sink.

In either case, the deterioration can be very slow or catastrophic.
Manifestation of failure

How does failure manifest itself?
- Reduced output power
- Shift in threshold current
- Change in beam divergence
- Difficulty focusing to previously attained spot sizes
- Ultimate failure to lase

With burn-in, we can ensure that only good, known devices make it to the customer?
Burn-in involves running components under a continuous period of operation, under controlled conditions, to...

- Identify infant mortalities
  - devices that will fail very early in their use

- Stabilize operating parameters
  - thus ensuring that every device shipped meets quality standards
There are 4 common screening criteria for detecting a failed laser. These parameters either refer to an absolute number on post burn-in or change pre and post burn-in.

- Threshold Current (Ith)
- Optical Output Power at Specified Operating Current
- Current Required to Achieve Specified Optical Output
- Slope Efficiency
The earlier that burn-in and test is done in the manufacturing process – the more cost effective it becomes.
Challenges being faced

As device manufacturers continue to push back along the production cost curve, new challenges are being faced by burn-in equipment manufacturers:

- Device Power Dissipation
  - °C / Watt / mm²
- Size of device (getting smaller!)
- Methods on how to probe the device (electrical & force)
- Baseplate
  - manufacturing limitations on surface flatness
- Thermal resistance

- Output light management
Solutions for thermal management

25 → 150°C (Low Power)
- Chilled Air
- Ambient Air

20 → 80°C (High Power)
- Water cooled base plate
- Direct water cooling
- TEC control
TYPICAL TESTS
Typical tests for burn-in

- **LIV**
  - Temperature cycling, burn-in at one temperature, measure at a different temperature.

- **Wavelength**

- **In-situ monitoring of**
  - Variation of light output over time (constant current)
  - Variation of current over time (constant power)
### Mindready Cartridge Results Analyst.vi

#### Results Tab

<table>
<thead>
<tr>
<th>dev</th>
<th>chan</th>
<th>LotNo</th>
<th>SerNo</th>
<th>Type</th>
<th>Status</th>
<th># Fails</th>
<th>IF_STAN</th>
<th>ITH-L_ST</th>
<th>ITH_STA</th>
<th>MODULI</th>
<th>PO-L_ST</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>D161205</td>
<td>XAE728</td>
<td>OK</td>
<td>0</td>
<td>100.044r</td>
<td>12.020m</td>
<td>13.463m</td>
<td>54.950</td>
<td>2.873m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>D161205</td>
<td>XAE728</td>
<td>OK</td>
<td>0</td>
<td>100.041r</td>
<td>12.629m</td>
<td>13.852m</td>
<td>54.950</td>
<td>2.885m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>D161205</td>
<td>XAE730</td>
<td>OK</td>
<td>0</td>
<td>100.036r</td>
<td>13.251m</td>
<td>14.154m</td>
<td>54.969</td>
<td>3.628m</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>D161205</td>
<td>XAE730</td>
<td>OK</td>
<td>0</td>
<td>100.035r</td>
<td>13.144m</td>
<td>13.366m</td>
<td>54.940</td>
<td>3.471m</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>D161205</td>
<td>XAE731</td>
<td>OK</td>
<td>0</td>
<td>100.046r</td>
<td>12.283m</td>
<td>13.526m</td>
<td>54.940</td>
<td>2.899m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>D161205</td>
<td>XAE731</td>
<td>OK</td>
<td>0</td>
<td>100.025r</td>
<td>11.615m</td>
<td>12.900m</td>
<td>54.940</td>
<td>2.685m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>D161205</td>
<td>XAE732</td>
<td>OK</td>
<td>0</td>
<td>100.043r</td>
<td>12.747m</td>
<td>13.943m</td>
<td>54.888</td>
<td>3.311m</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>D161205</td>
<td>XAE732</td>
<td>OK</td>
<td>0</td>
<td>100.036r</td>
<td>11.874m</td>
<td>12.129m</td>
<td>54.888</td>
<td>3.104m</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>D161205</td>
<td>XAE899</td>
<td>OK</td>
<td>0</td>
<td>100.038r</td>
<td>12.250m</td>
<td>13.473m</td>
<td>54.889</td>
<td>2.947m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>D161205</td>
<td>XAE899</td>
<td>OK</td>
<td>0</td>
<td>100.036r</td>
<td>12.452m</td>
<td>13.914m</td>
<td>54.889</td>
<td>2.870m</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

#### Timing Information Tab

![Graph showing temperature cycling results over time]
Variation of light output over time
LIV sweep
LIV sweep for Threshold
Summary

- Low Power Burn-in up to 1A available today.
- High Power Burn-in up to 500A available today.
- Flexible fixture design to handle many different device types and packages in same test system.
- Different approaches to thermal management
ANY QUESTIONS?