NWSC Facility
Successes & Lessons Learned

Aaron Andersen
iCAS 2015
NWSC Recognition

• National and International Recognition
  – Uptime Institute Facility Design Innovation
  – US Green Building Council LEED Gold
  – DataCenter Dynamics Green Data Center of the Year
  – ASHRAE Regional Winner, National Honorable Mention

• Invited Talks
  – 24x7 Exchange
  – Supercomputing Conference
  – International Supercomputing Conference
  – Uptime Symposium

• Corporate and Collaborative Visitors
  – Microsoft, Intel, Verizon, HP, JP Morgan
  – ECMWF, ORNL, LBNL, LLNL, NREL,
  – KISTI, DKRZ, LRZ, DWD, Australia BoM, PNNL
NWSC is Highly Efficient
PUE
August 2014 – September 2015

Energy Recovery Heat Pumps

Facility Events

Yellowstone Maintenance
Yellowstone is Well Utilized
Facility has been Very Reliable

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Events</th>
<th>Facility Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>4 Events</td>
<td>99.63%</td>
</tr>
<tr>
<td>2014</td>
<td>3 Events</td>
<td>99.73%</td>
</tr>
<tr>
<td>2015</td>
<td>3 Events *</td>
<td>99.73%</td>
</tr>
</tbody>
</table>

* Only one event affected the entire facility all measured events did affect Yellowstone
Internal Lessons Learned

Issues That We Have Some Control Over
Electrical Consumption Condensing Water Pump vs. Time
Pipe Geometry Issues & Air Infiltration
Air Infiltration

• Design is focused on very low pressure drop and minimizing both drag and pump energy

• Green Filtration System

• Problem - too much of a good thing
  – Air bubbles absorbed easily in cooling towers
  – Minimal height difference between tower and pump
  – Filter system requires service roughly 4~7 days

• Solution
  – Refill & bleed process when cleaning filters
Fire Alarm System

• Required to have two fire alarm tests per year
• Must exercise the alarm system proving that it is working correctly

• Problem – Emergency Power Off
  – Test Sequence
  – Method of Procedure
  – Infrequency of testing

• Solution
  – Added Two Person MOP Walkthrough
  – Added a physical “keyed” EPO bypass switch
External Lessons Learned

Issues That We Wave Little Control Over
Invasions of the Animal Kind
Why This is Significant
Facilities Can Have Bugs Just Like Software
Miller Moth (Army Cutworms) & Strainer
Impacts from Weather
There is a Little Wind at Times
Three Victims
Questions ?