



Domes & Shutters Preventative/Predictive Maintenance Tools

John Baldwin

W.M. Keck Observatory





Advanced Tooling

- Keck Observatory utilizes the following tooling to assist us in better maintenance practices:
 - KrautKramer Ultrasound
 - Flir E60 Infrared Camera
 - UE 10000 Ultrasonic Tool





KrautKramer Ultrasound





KrautKramer Ultrasound

Approximately every 6 weeks all 42 bogie shafts in each dome are inspected with the KrautKramer Ultrasound tool.

- This tool tells us if a crack has begun, its depth, and how large it is.
- We archive this information and trend log cracks over time.
- Allows us to plan for replacement of Bogie Wheels before they fail





Flir E60 Infrared Camera





Flir Infrared Camera

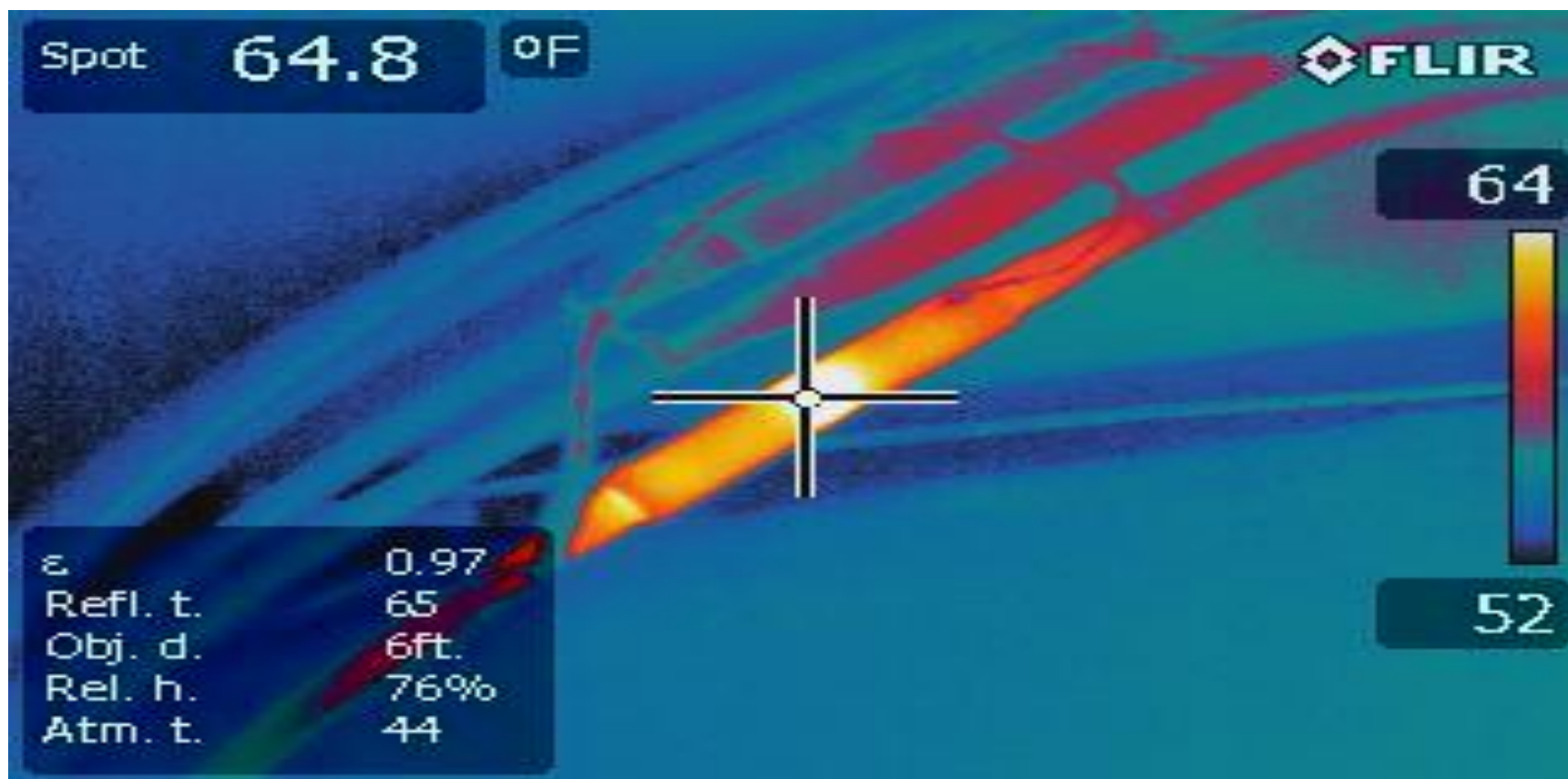
- The Flir camera has been an excellent tool for our electrical maintenance program.
 - Easily scan panels to look for hot spots
 - Safer for the electrician
 - Is more efficient than checking each circuit with a multi-meter
 - Can locate loose wires and connections
 - Can be used to scan facility equipment controls as well
 - Can detect serious electrical hazards within large voltage plant mains





Flir Infrared Camera

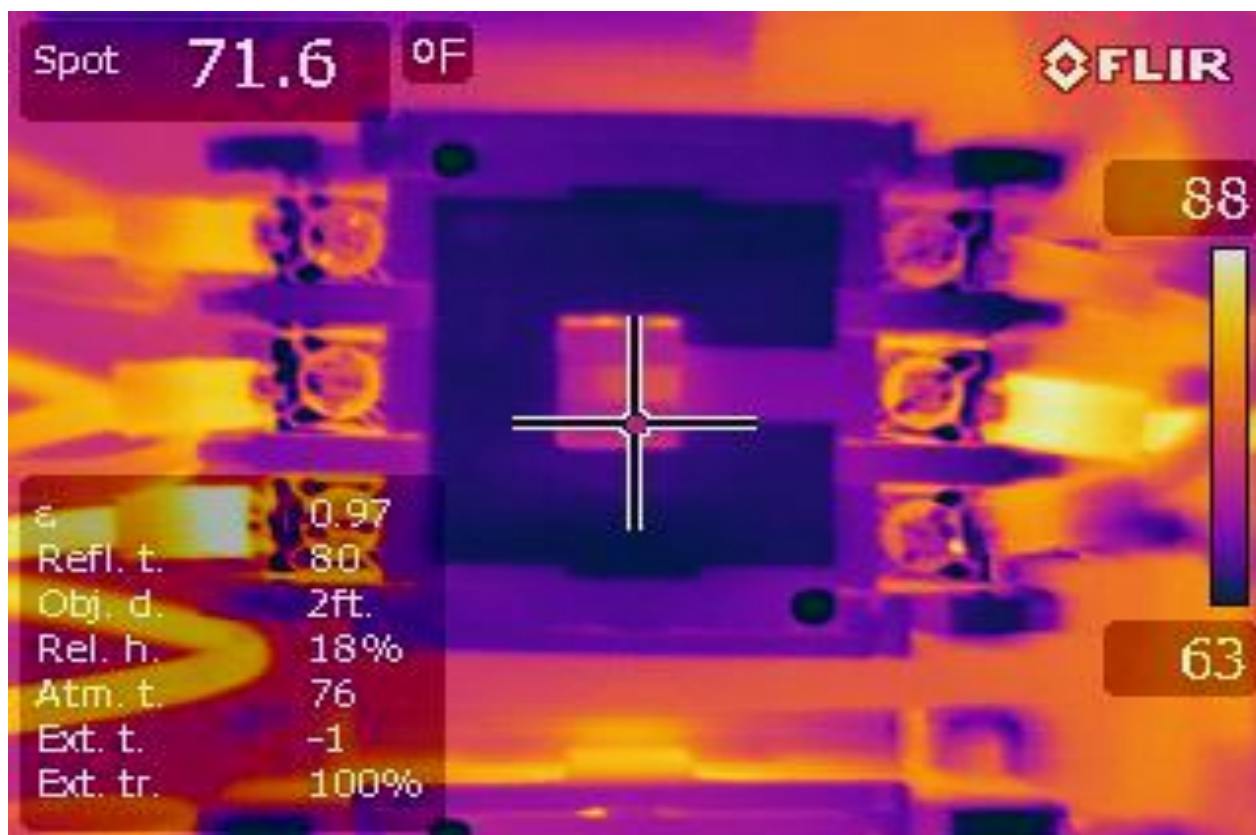
- One phase of our building main splice is much warmer.





Flir Infrared Camera

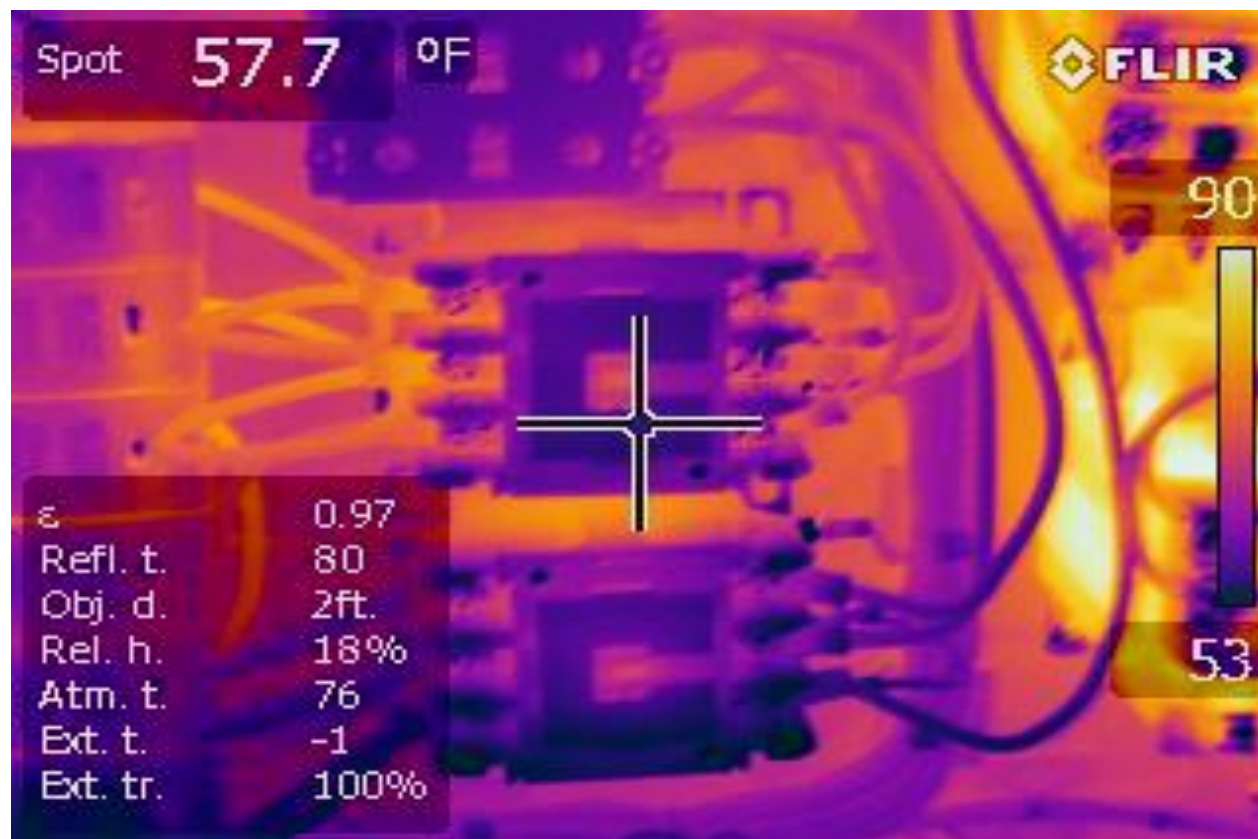
- The brighter orange connections indicate a possible problem.





Flir Infrared Camera

- After repair all connections are equal in color





UE 10000





UE 10000

- The UE 10000 Ultrasonic tool is our newest addition to our maintenance program. Using airborne and structure borne ultrasound we can:
 - Can detect small compressed air leaks which otherwise would go undetected.
 - Can detect electrical issues such as corona, tracking, and arcing
 - Allows you to begin a world class lubrication program for bearings
 - Detect Vacuum leaks





UE 10000

ue
SYSTEMS INC
The ultrasound approach

Copyright 2008 by UE Systems Inc. Patent Pending.

This is for the year 2012

Cost Calculations	
Location =	Hawaii
Electricity Cost =	\$ 0.37 Per kWh
Air Cost =	\$ 1.22 Per 1000 cu ft

Capturable Rate	100%
-----------------	------


Operational Times	
Hours Per Day	24
Days Per Year	365

Capturable Rate	100%
-----------------	------

Operational Times	
Hours Per Day	24
Days Per Year	365



UE 10000

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	 <p>Copyright 2008 by UE Systems Inc. Patent Pending.</p> <p>Ultrasound Survey Results</p>														
2															
3	Year to Date	39.4	\$25,225.60	\$12,638.28	\$25,225.60	50%	Air		Carbon Dioxide		Nitrogen Oxide		Sulfur Dioxide		
4							Leaks Repaired		CO2 (lbs)		NO (lbs)		SO2 (lbs)		
5	Month	Identified CFM Total	Identified Leaks Cost Avoidance	Repaired Leaks Cost Avoidance	Capturable Energy Cost	% Complete	CFM	Cost	Identified Avoidance	Realized Avoidance	Identified Avoidance	Realized Avoidance	Identified Avoidance	Realized Avoidance	Focus Area
6	February 2015	39.4	\$25,225.60	\$12,638.28	\$25,225.60	50%	19.8	\$12,638.28	117494	58866	377	189	286	143	





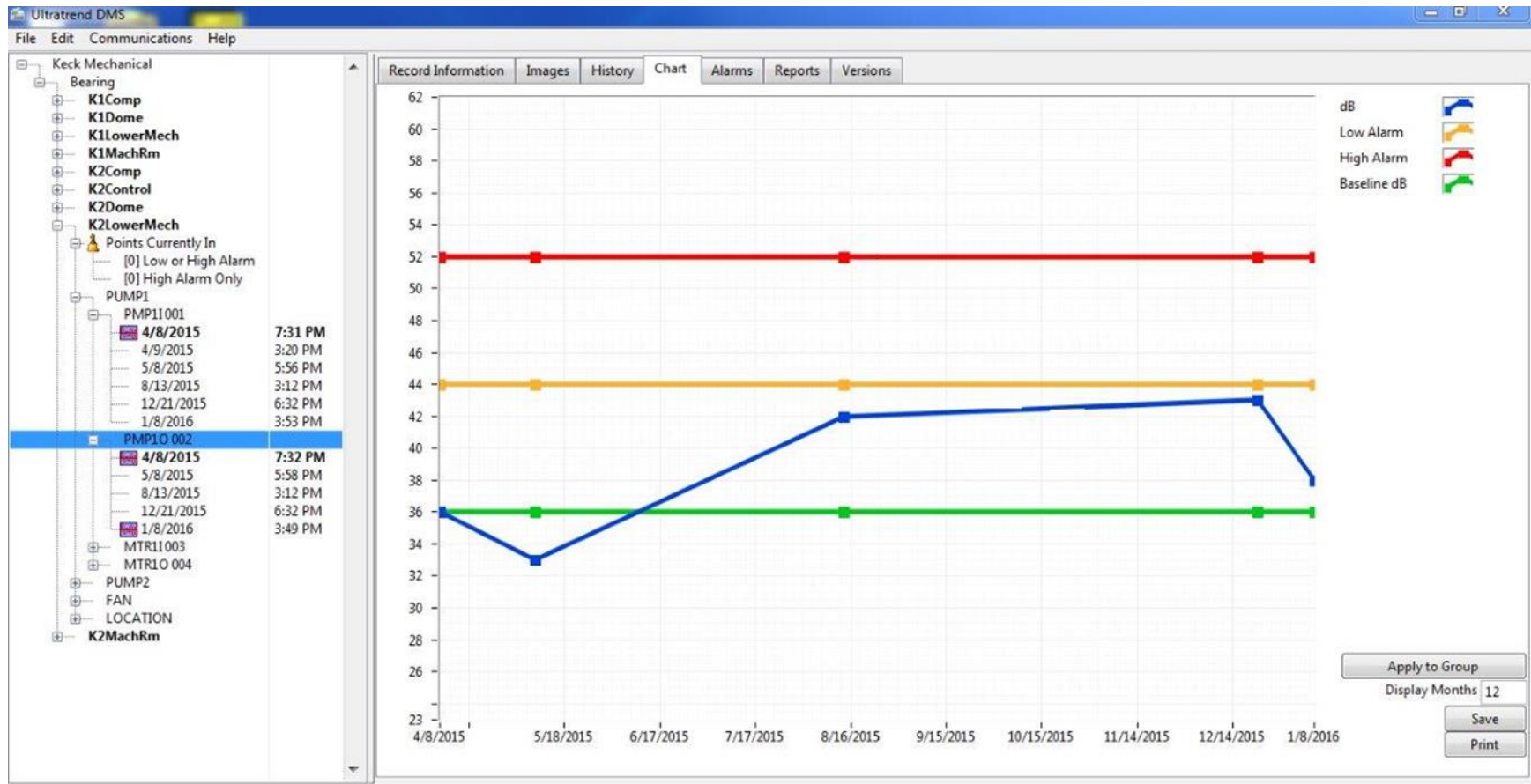
UE 10000

- Bearing lubrication. How much grease to use?
- Ultrasonic inspection reads a decibel level for each bearing tested.
- UE software, Ultratrend DMS, trend logs these readings and compares them to the original baseline.
- Once the bearing reads 8dB higher than its baseline its time to lubricate.
- Lubricate until the reading comes down to original baseline level.
- Slow moving bearings cannot utilize this trend log feature.





UE 10000, Ultratrend DMS Software





- Remote Access Sensors can be installed in hard to reach places.
- This removes the need for the technician to spend time taking readings.
- Safer for the technician as these can be installed in systems which would otherwise be dangerous for taking readings.
- Remote Ultrasonic Sensors allow for connection to a Building Automation System
 - These allow the system to read in real time and can alert the maintenance team of the need to lubricate







UE 10000

Device 1117
BACtalk Edit View Tools Help

A/C 5 BEARING HEALTH

VLC

11.0 dB	Fan Inboard Bearing Raw
20.9 dB	Fan Outboard Bearing Raw
0.0 dB	Motor Inboard Bearing Raw
75.4 dB	Motor Outboard Bearing Raw

1.0	<input type="checkbox"/>	Fan Inboard Bearing Calibration
1.0	<input type="checkbox"/>	Fan Outboard Bearing Calibration
1.0	<input type="checkbox"/>	Motor Inboard Bearing Calibration
30.0	<input type="checkbox"/>	Motor Outboard Bearing Calibration

24.7 dB	Fan Inboard Bearing in Actual
30.4 dB	Fan Outboard Bearing Actual
-1.0 dB	Motor Inboard Bearing Actual
46.6 dB	Motor Outboard Bearing Actual

26.0	<input type="checkbox"/>	Fan Inboard Bearing Baseline
32.0	<input type="checkbox"/>	Fan Outboard Bearing Baseline
28.0	<input type="checkbox"/>	Motor Inboard Bearing Baseline
41.0	<input type="checkbox"/>	Motor Outboard Bearing Baseline

