AIR COOLED CONDENSER
Midlothian Texas

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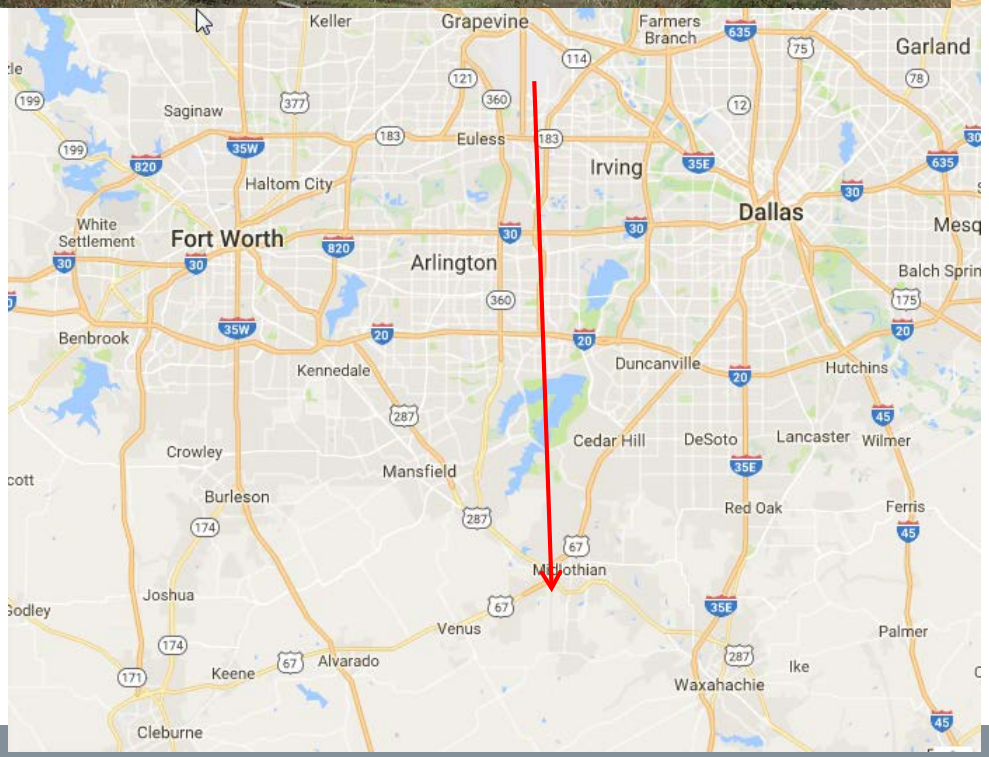
05-OCT-2016

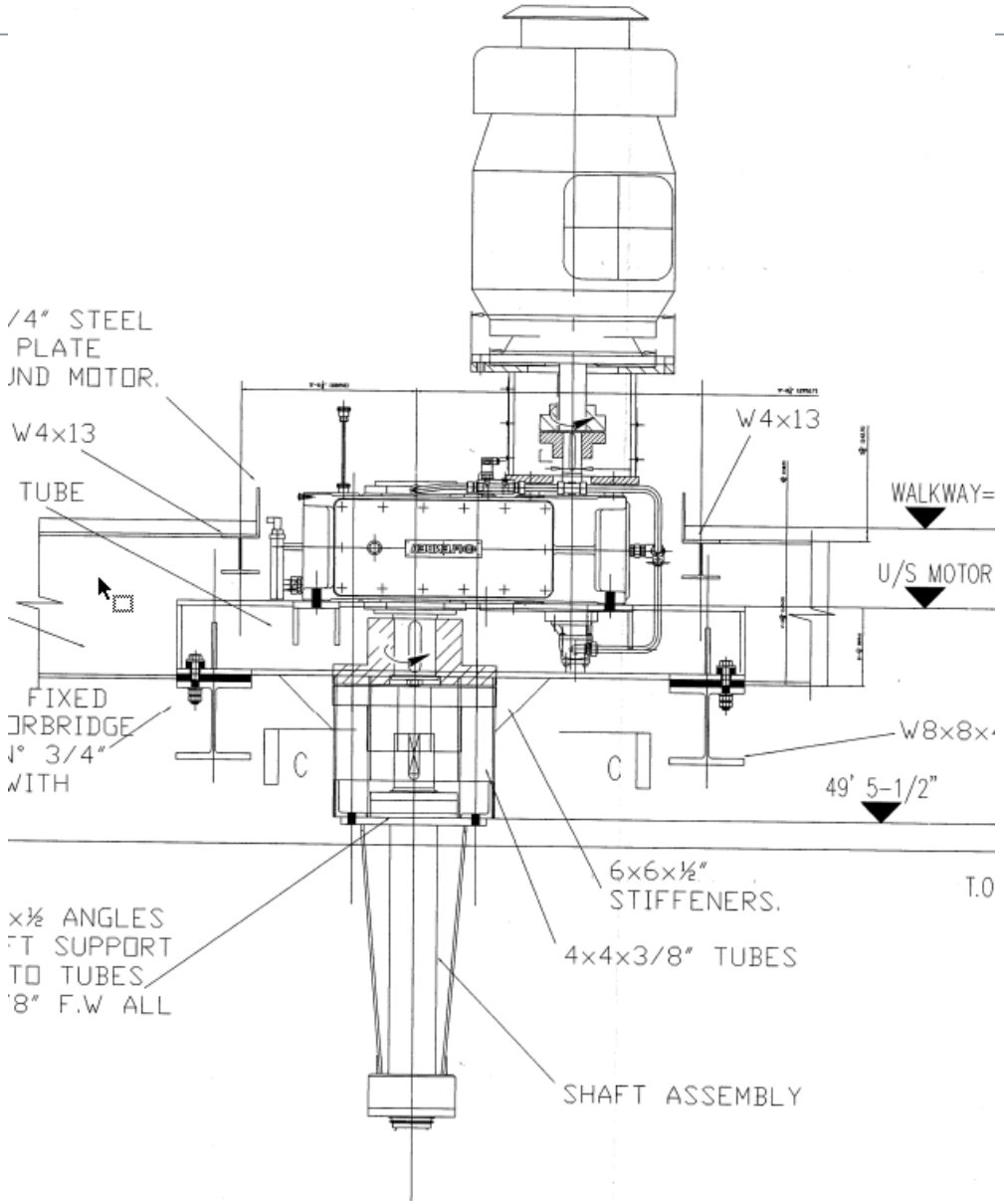
Midlothian

- **6 Units – 1,495 mw's**
  - Commercial 2001 & 2002
  - Alstom GT24 Gas Turbine
  - 1 on 1 Design

- **Balcke Duerr ACC**
  - Howden Fan Blades (ELD)
  - Geha Bearing
  - Flender Gear Box
  - Loher Motor
  - Wind Screens
  - Inlet Fogging System



Motor / Gear Box / Bearing Assembly



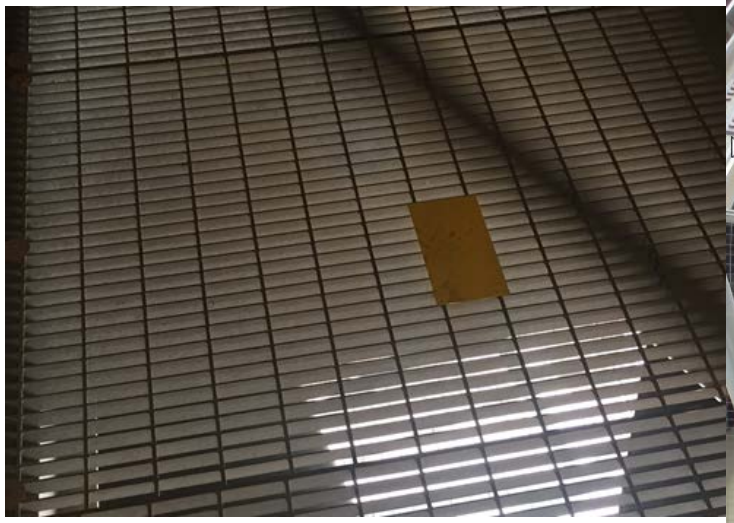
ACC Agenda

- **Maintenance Activities**
  - Component Rigging Improvements
    - Trolley Beam South Wall Extensions
    - Motor & Gear Box Low Profile Lifting Devices
    - Grating Rigging Access for Inlet Screen
  - Equipment Failure History
  - Preventative Maintenance Summary
- **Instrumentation**
  - Gear Box Oil Pressure Transmitters
  - Fan Cell Temperature RTD's
- **Wind Screens**
- **Fogging Project: 2012 - 2015**
- **Next Steps – Direct Drive / Hudson Fan Conversion**

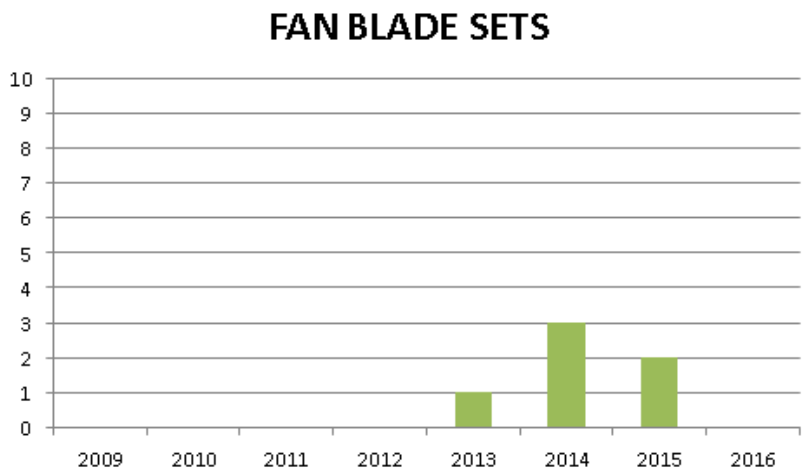
South Wall Trolley Beam Extension

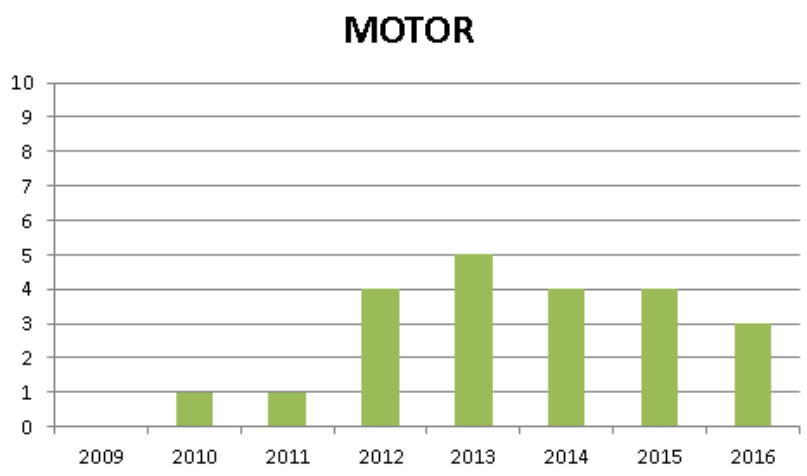
Motor & Gear Box Low Profile Lifting Devices

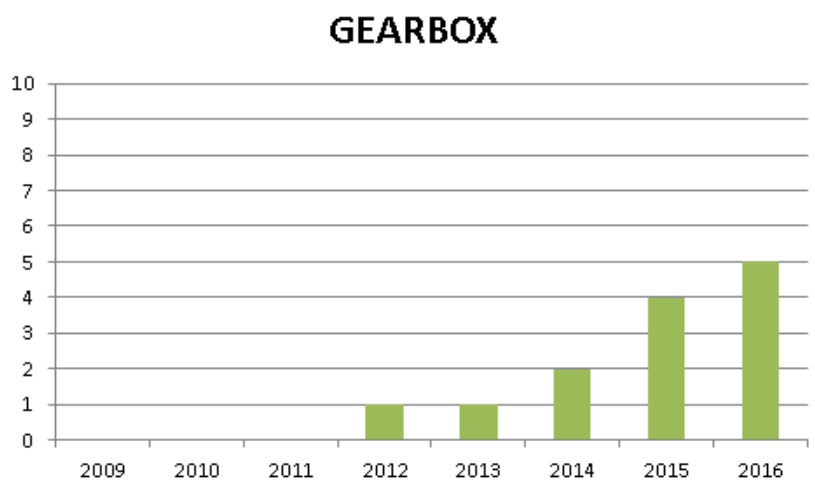
Grating Rigging Access

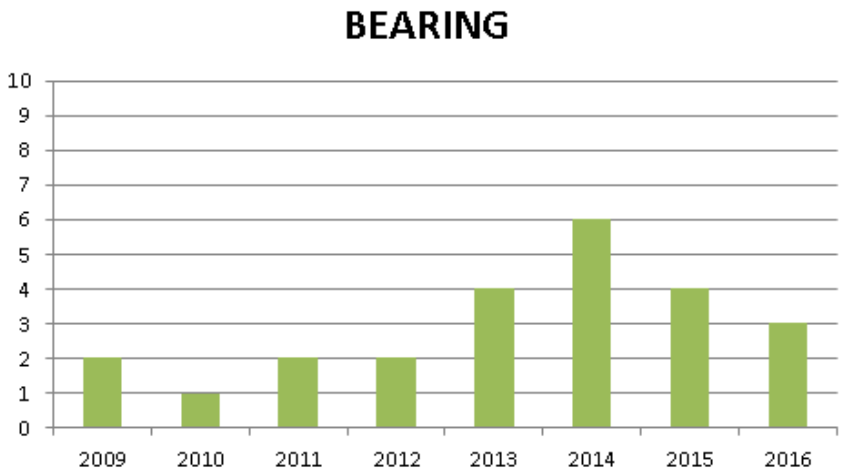


Equipment Failure History









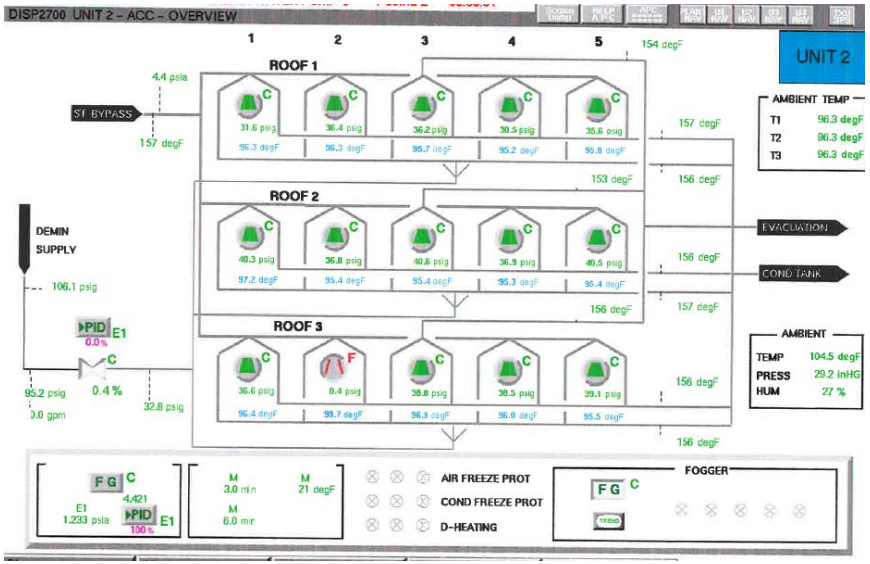
Preventative Maintenance Summary

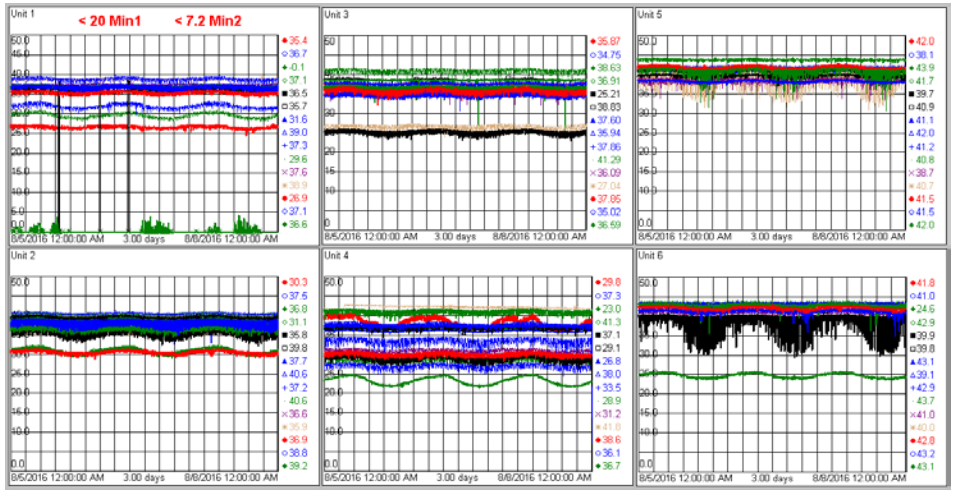
PM Task	Frequency
Geha Bearing Lubrication	Annual
Fan Blade Inspection	GT Major Inspection
Gearbox Oil Sample	Quarterly
Vibration Data Routes	Quarterly
High Pressure Finned Tube Cleaning	≈3 Years
Winterization Layup / Fogging System	Annual
Operations Walk Down	Shift

Instrumentation

Gear Box Oil Pressure Transmitter

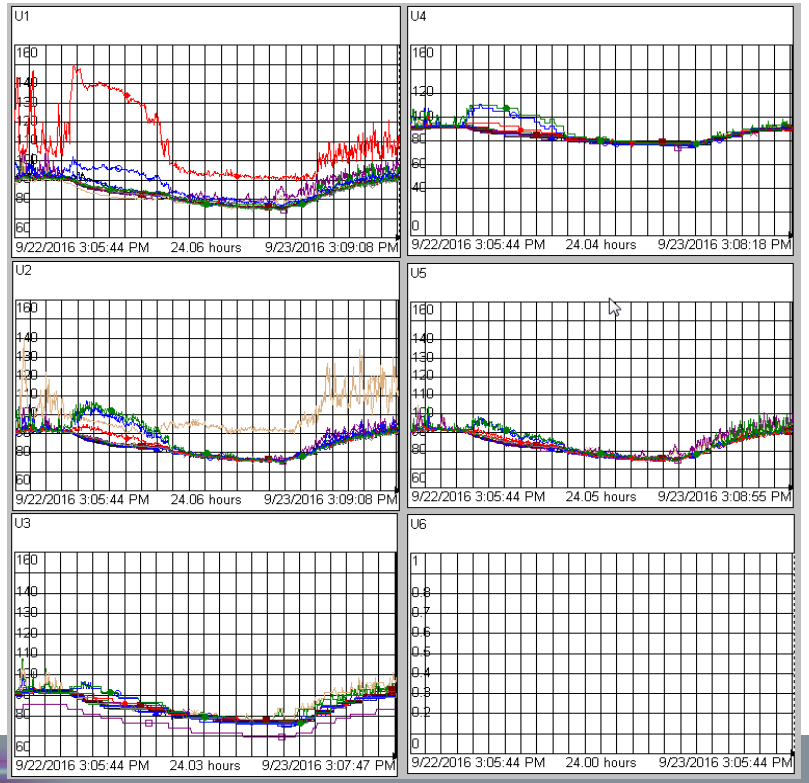
- Replaced original pressure switch with transmitter (Cerabar PMC131).
- Improved gear box reliability: trouble shooting, monitoring, trending, etc.

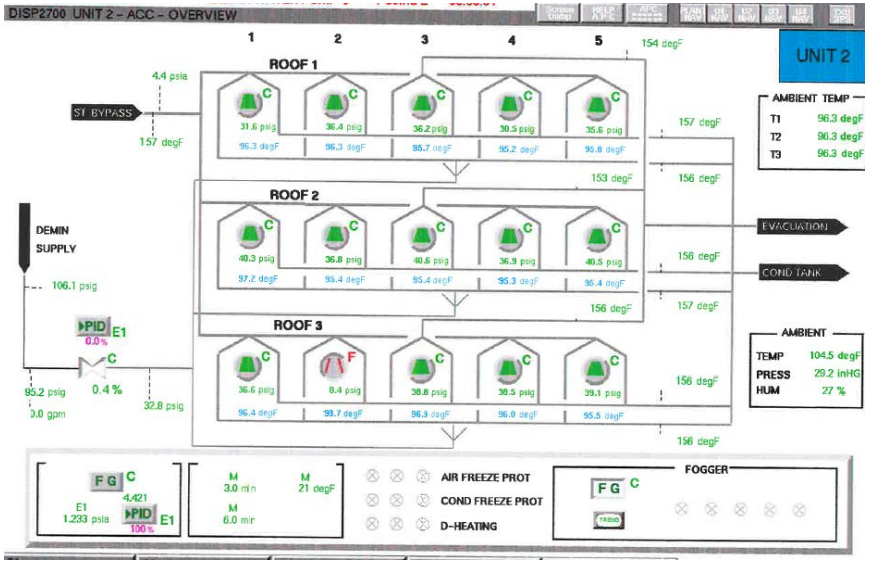




Instrumentation

- **Fan Cell Air Temperature RTD**
  - Trend fogging system performance
  - Fan stall due to wind velocity & direction.





Wind Screens

- Improved capacity output
- Removable for maintenance access & outage laydown
- Computer model – optimized placement

West

STAGE

	5	4	3	2	1	
	3.5	3.4	3.3	3.2	3.1	3
South	2.5	2.4	2.3	2.2	2.1	2 ROOF
	1.5	1.4	1.3	1.2	1.1	1

East

Fogging Project: 2012 - 2015

- **2012**
  - Fogging system installed on Unit 6 to prove concept.
  - Technology selected: MicroMist system employing 12 stages, 1500 psi @ 600 gpm (demin)
  - Installed at 12 levels below ACC. (≈ 18,000 total nozzles / 1,200 per fan)
  - Predicted Performance 8.5 MW @ 100F @ 30%RH
  - Demonstrated Performance: Variable, average 5.8MW @100F @ 30%RH

Fogging Project: 2012 - 2015

- **2013**
  - Installed on Units 3 & 5. Demonstrated performance similar to Unit 6 in 2012
  - Investigated alternative technology employing nozzles immediately below and above ACC fans.

Fogging Project: 2012 - 2015

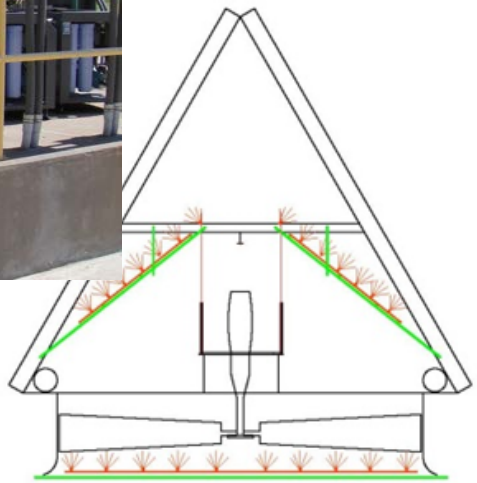
- **2014**
  - Unit 5 ACC Fogging system converted to hybrid concept
  - Hybrid Concept – Relocated ≈ 50% existing MicroMist nozzles immediately below fans and installed a separate lower pressure (500 psi) nozzle arrangement above the fans.
  - Hybrid concept performance results:

	Below Fan	Above Fan	Total MW's
Expected	3.0	3.0	6.0
Actual (Concurrent)	4.5	1.5	6.0
Actual (Independent)	4.5	3.0	
GPM	250	150	450

  - Demonstrated > Predicted Performance @ at 100F for the Below Fan Fogging Nozzle Design

Fogging Project: 2012 - 2015

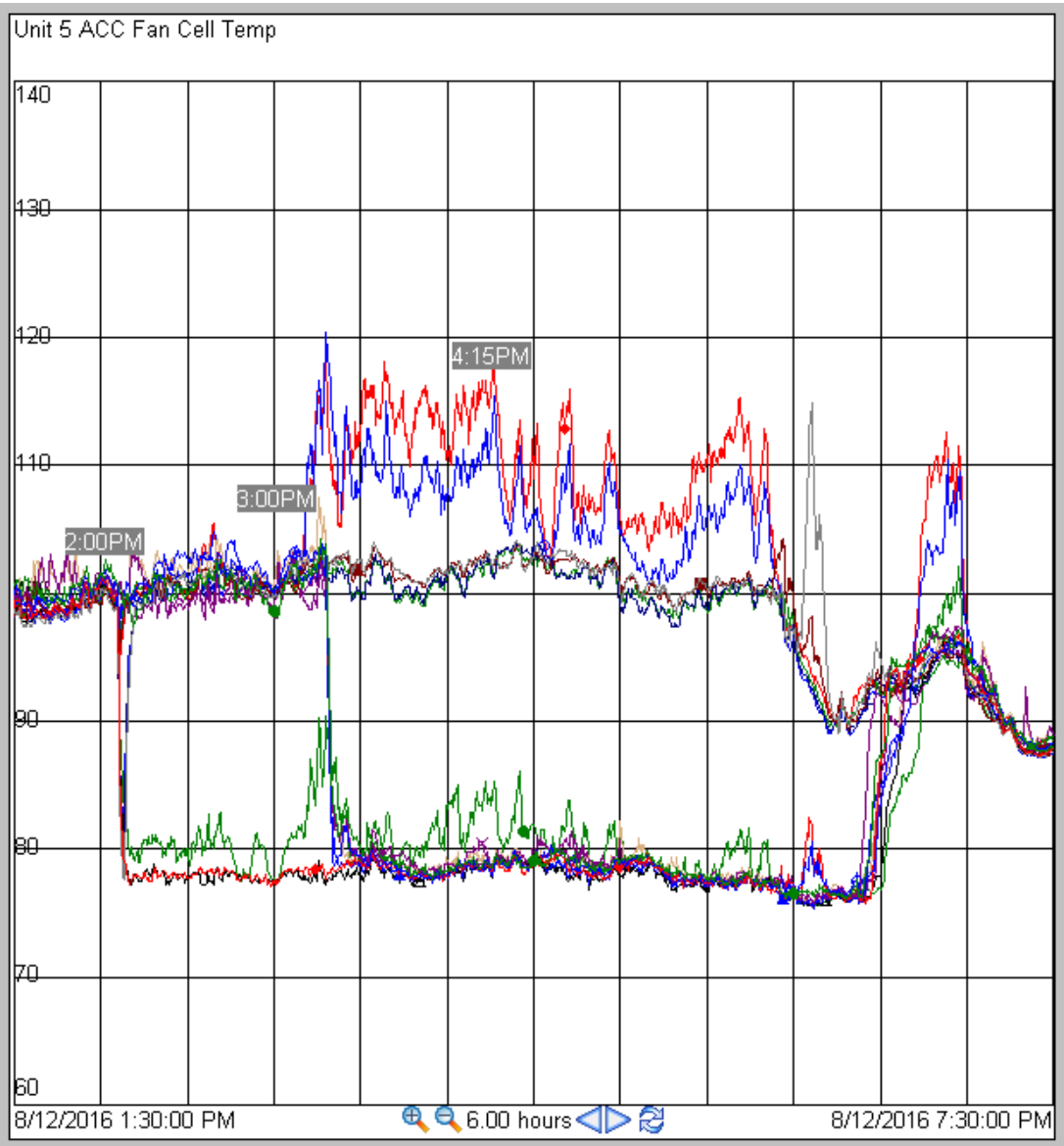
- 2014 (continued)



Fogging Project: 2012 - 2015

- **2015**
  - The “Below Fan” nozzle design was implemented on all the remaining units.

Unit 5 Fogging Performance



Temperature Cooling E 3:00 PM

ROOF	1	2	3	4	5	
1	-2.8	-1.2	-23.6	-0.5	0.9	
2	-3.1	-1.1	-23.1	-0.2	0.9	S
3	-2.0	-0.6	-22.9	0.2	0.9	

Temperature Cooling E 4:15 PM

ROOF	1	2	3	4	5	
1	-22.9	-22.9	-22.6	2.2	3.4	
2	-22.6	-22.9	-22.4	1.9	2.3	S
3	-22.1	-22.5	-17.0	11.7	16.3	

Ambient Temp (°F)	102
RH (%)	30
Wind Speed (mph)	15 - 20
Wind Direction	S - SW

ACC Fogging System – By the Numbers

ACC FANS

90 ACC Fans Total
15 ACC Fans / Unit
6 Units

FOGGING PUMPS INSTALLED

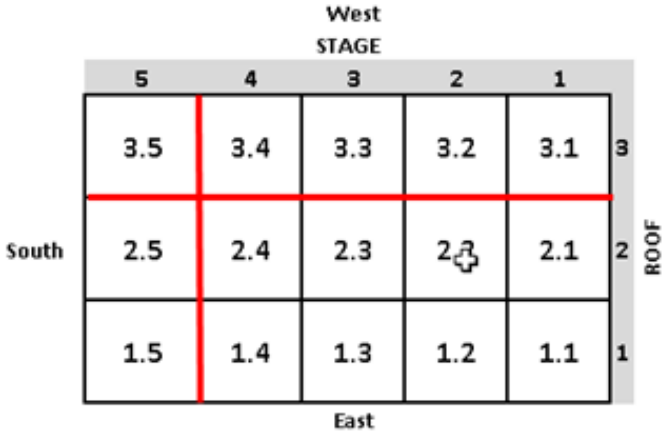
180 Pumps
30 Pumps / Unit
5 Stages / Unit
3 Fans / Stage
6 Pumps / Stage

FOGGING PUMP PERFORMANCE

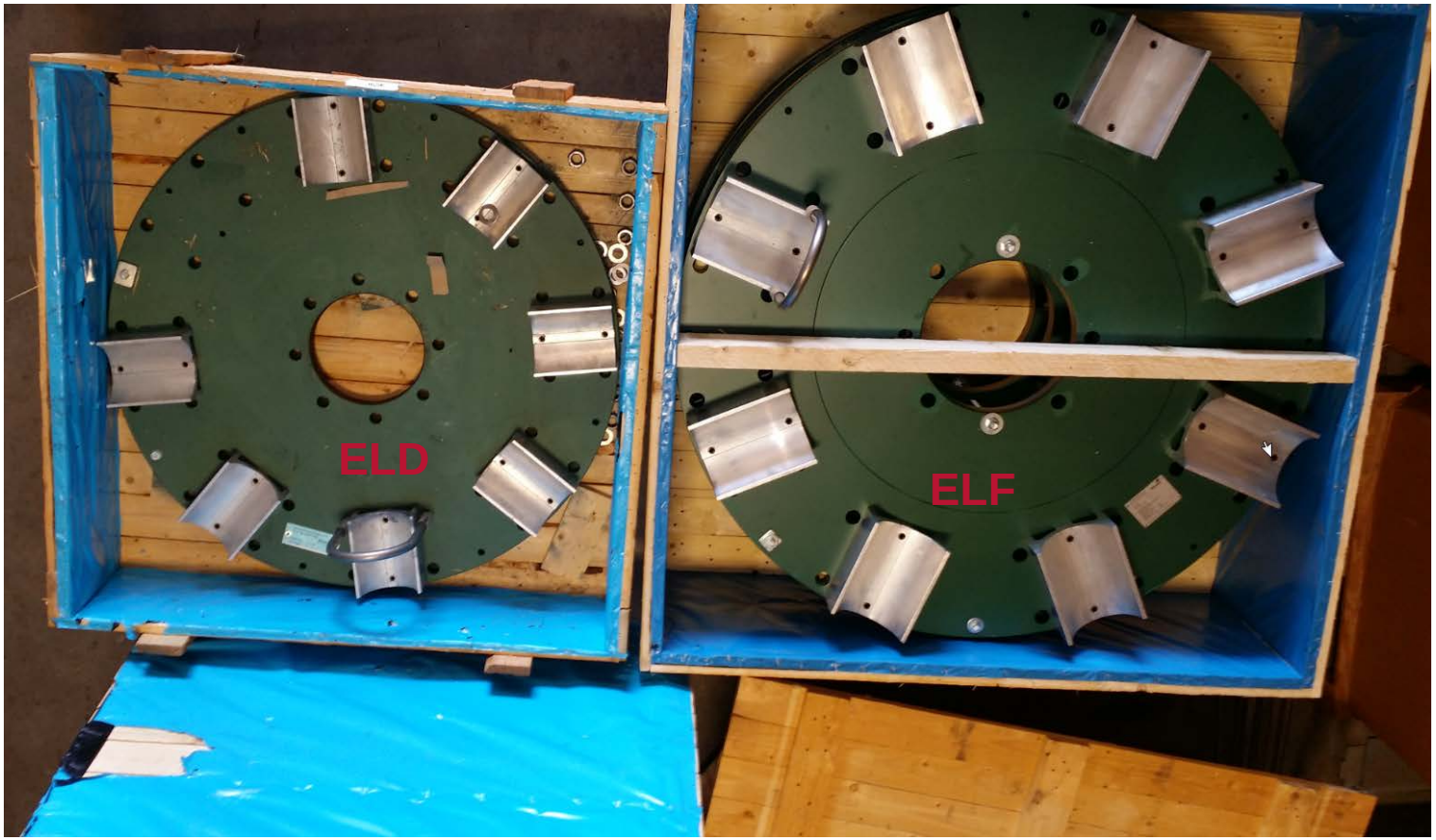
10 GPM / Pump
5 Run 5 Pumps / Stage
10 GPM / Pump
50 GPM / Stage (3 Fans)
250 GPM / Unit (15 fans)

NOZZLES

67,500 Nozzles Total (90 Fans)
4,500 Nozzles / Unit
750 Nozzles / Fan
50 GPM / Stage (3 fans / 5 pumps)
16.7 GPM / Fan
0.02 GPM / Nozzle



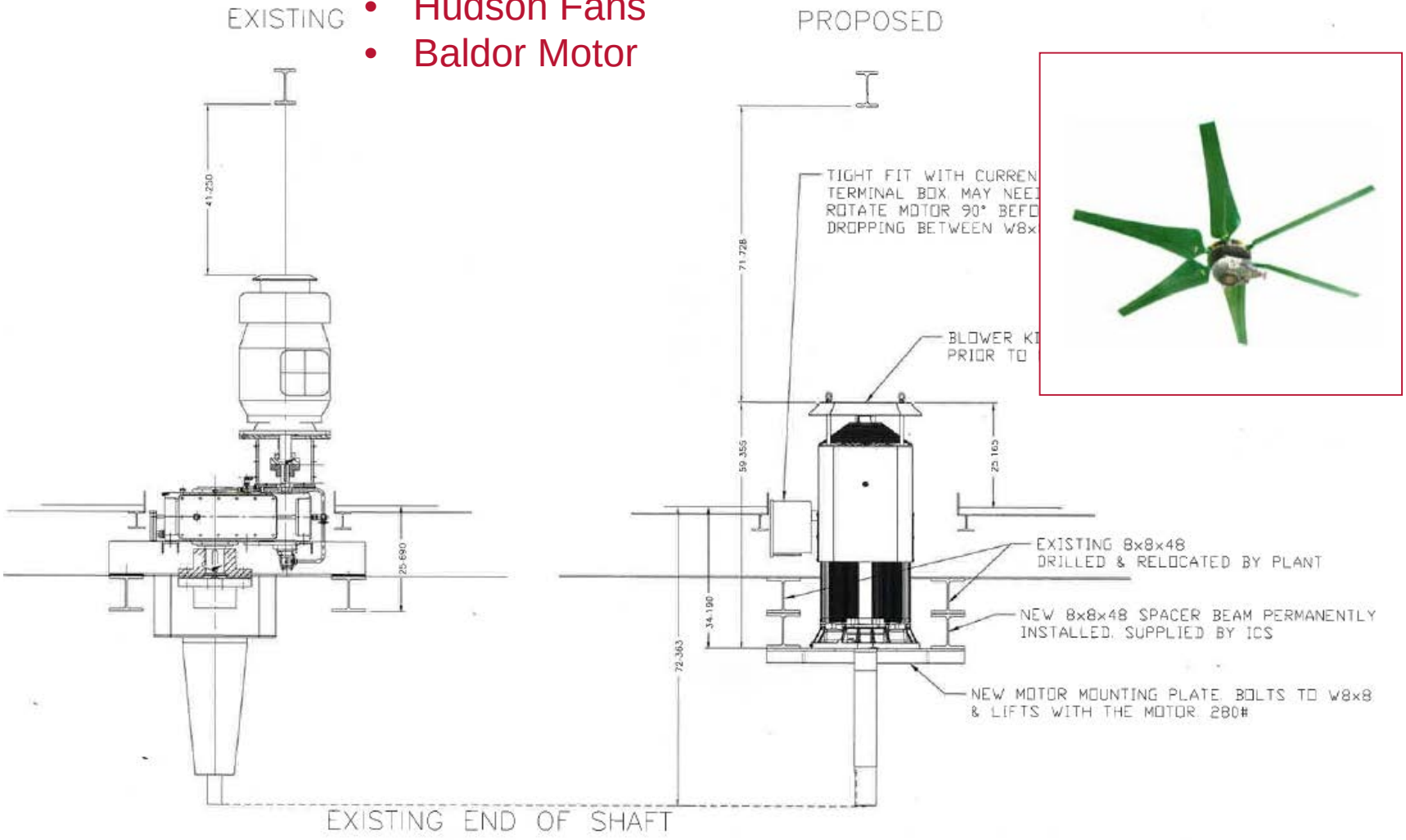
Next Steps – ELD vs ELF (?)



Next Steps – Direct Drive / Hudson Fan Conversion

Industrial Cooling Solutions

- Hudson Fans
- Baldor Motor



Plant Tour

- **Safety**
  - Hard Hat, Safety Glasses, Hearing Protection will be provided
  - Substantial Foot Wear, appropriate work clothes
  - No smoking in plant except in designated areas
  - Caution for uneven walking surfaces
  - ACC access by stairs (70 steps)
  - Hazards
    - Slip, Trips, Falls
    - Hot Surfaces
    - High Noise Level
    - Rotating Equipment
    - High Wind Velocity
  - In the event of a plant evacuation, your tour guide will direct you to the designated evacuation meeting area.