“Transforming Asset Condition Monitoring and Proactive Maintenance with Ultrasound Technology”

UE SYSTEMS INC

ABOUT UE SYSTEMS

Founded in 1973 in Elmsford New York, USA

50+ Years Experience with Ultrasound

Predictive Maintenance Solutions Based on Ultrasound Technology

Presenter Bio

1. **Name:** Ahmed Moataz
2. **Job Title:** Middle East and North Africa Regional Manager at UE Systems

Certifications:

1. Airborne/Structure borne Ultrasound ISO Category I, II & III
2. Vibration Analyst ISO Category II and ASNT Level II - Reliability Improvement and Condition Monitoring
3. Asset Reliability Practitioner (ARP) ISO CAT I

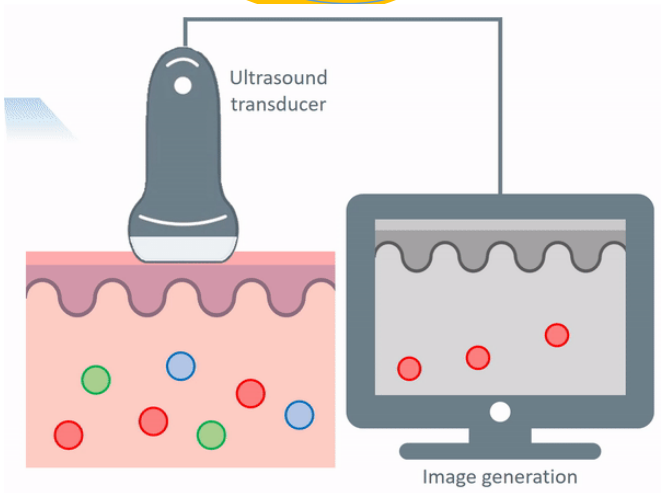
Education & Expertise:

1. Bachelor's degree, Mechanical Engineering.
2. Master’s degree: MBA, Master of Business Administration
3. More than 9 years’ Experience in the field of Condition Monitoring and Reliability.
4. Conducted more than 450 Ultrasound Technology case studies, training courses and workshops in different plants & Industries all over the Middle East Region during the last 12 years.

The Divisions of Ultrasound

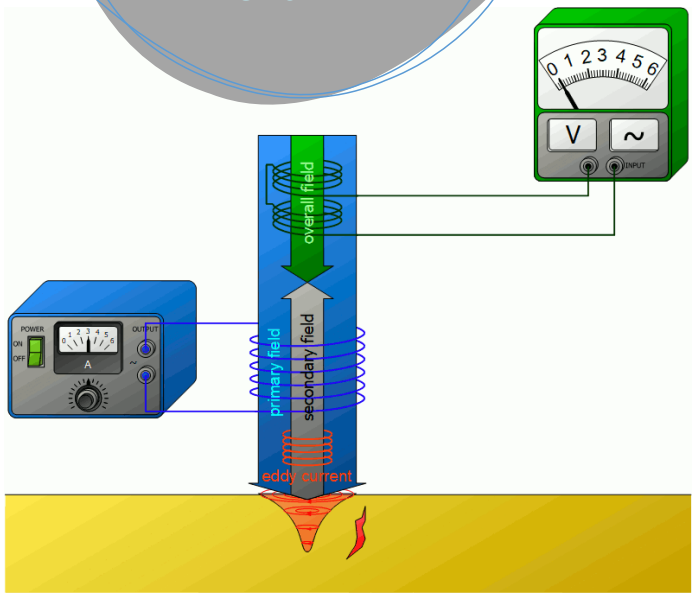
Pulse & Echo Ultrasound

ENERGY IS EMITTED & RECEIVED

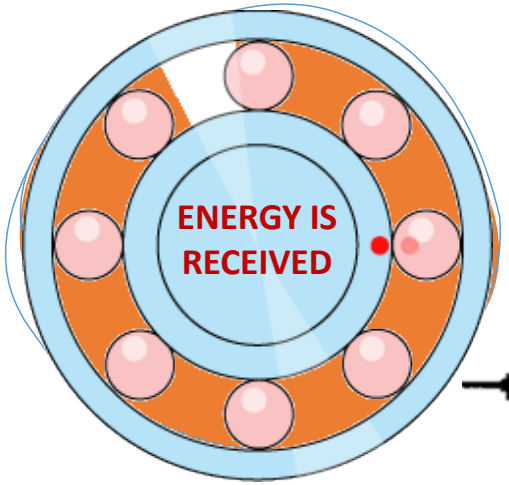


Power Ultrasound

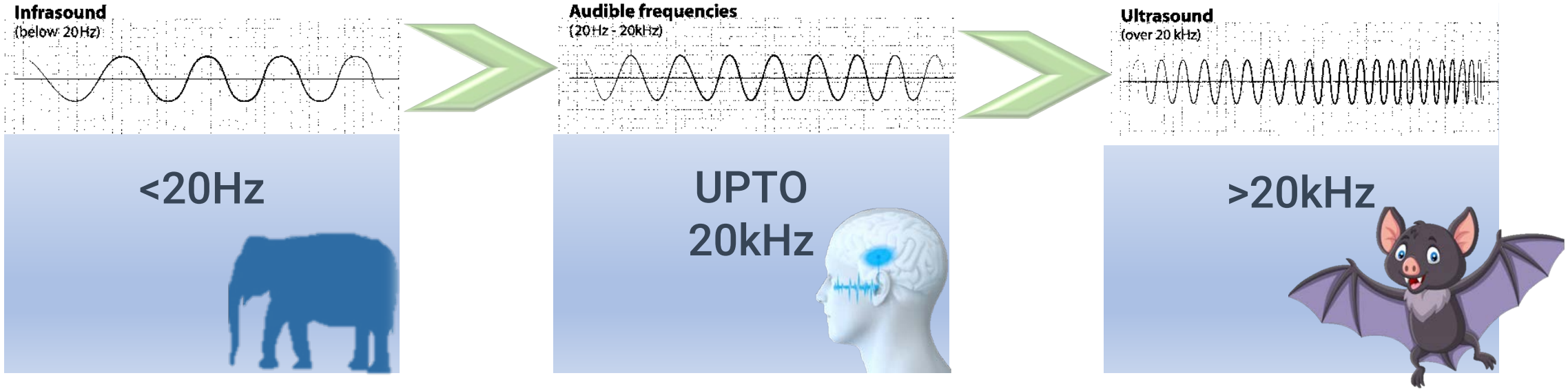
ENERGY IS EMITTED



Airborne / Structure Borne Ultrasound



What Is Ultrasound?



INFRASONIC

Below the Human Hearing Capability - Ultra Low Frequency Sound

SONIC

This is the Hearing Range of Humans – Low Frequency Sound

ULTRASOUND

Above the Human Hearing Capability – High Frequency Sound

WHY ULTRASOUND?

Ultrasound detects faults at the earliest stage.

Ultrasound is defined from 20khz to 100khz and beyond.

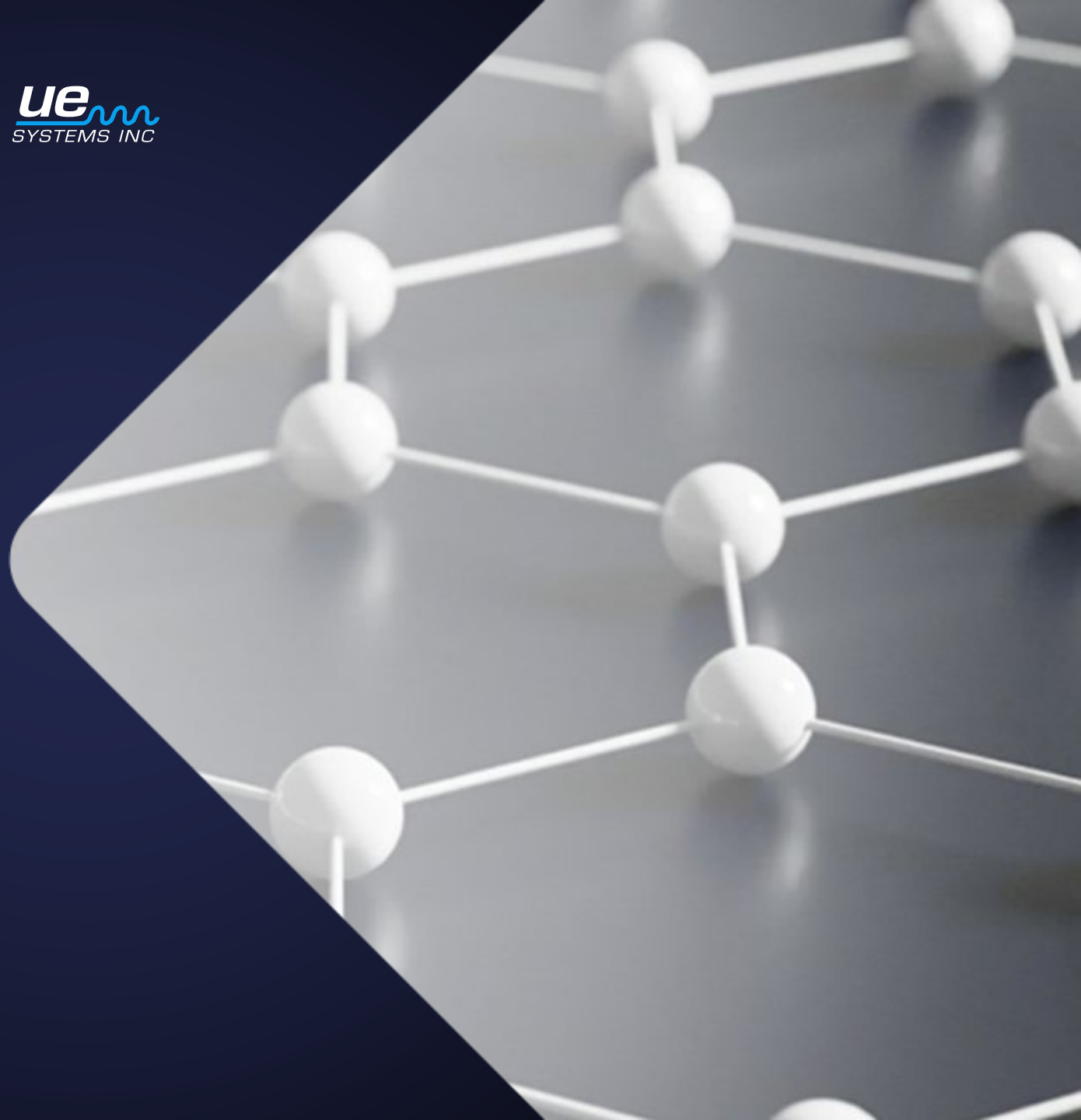
ADVANTAGES ARE:

<> **Easy to Use**: considered the easiest technology to learn, implement, and use.
<> **Versatile**: with a single device, you can handle all your plant's needs.
<> **Cost Effective**: Ultrasound's advance warning gives you ample time to order parts, plan downtime, and allocate labor.

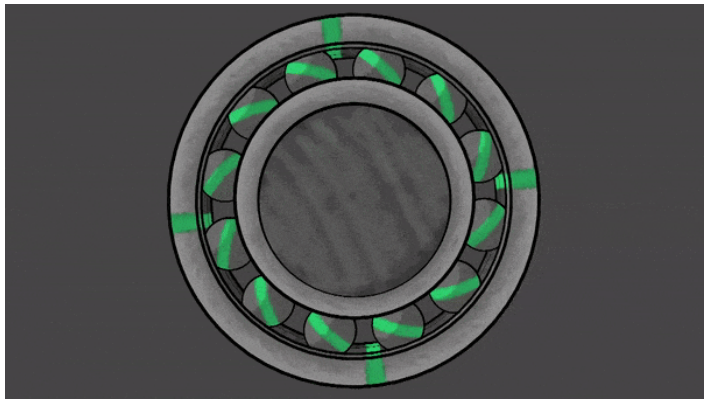
Two ways to detect ultrasound with our instruments:

AIRBORNE MEDIUM - STRUCTURE BORNE MEDIUM

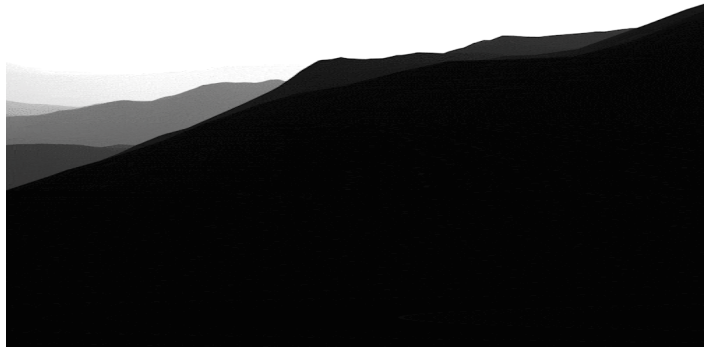
APPLICATION AREAS WHERE IT CAN BE USED?



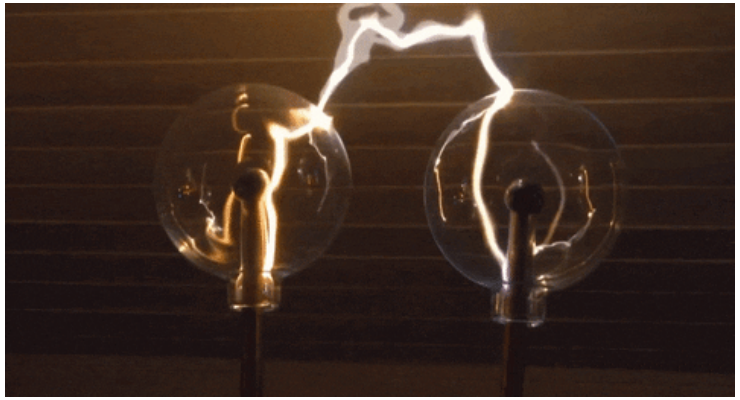
What Ultrasound Can Detect ?



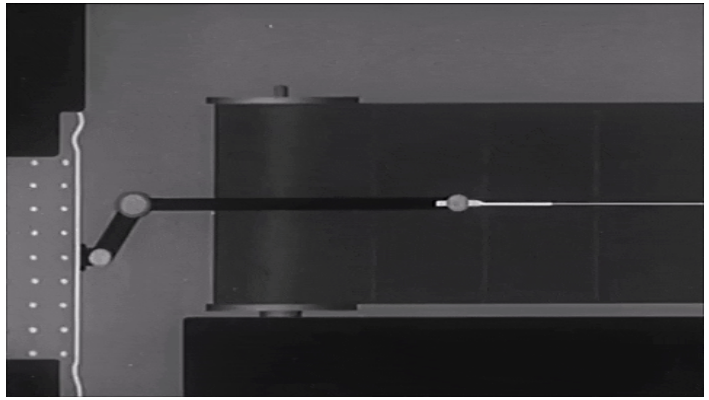
Friction – Rotating Equipment / bearings in need of lubrication



Turbulence – compressed Gas leak or valve/steam trap leakage



Ionization – electrical faults like corona, tracking, and arcing



Impacting – All Speeds & Other Applications

TYPICAL APPLICATION AREAS

ULTRASONIC LEAK DETECTION

<> Compressed air systems
<> Compressed gas systems
<> Vacuum systems
<> Air & water tightness testing

PARTIAL DISCHARGE DETECTION

Electrical Discharge detection on:

<> High voltage systems
<> Medium voltage systems
<> Low voltage systems
<> Handheld instruments & online monitoring systems

STEAM TRAP & VALVE INSPECTION

<> Valve leak detection
<> Steam trap inspection
<> Handheld instruments & online monitoring systems

BEARING CONDITION MONITORING & LUBRICATION

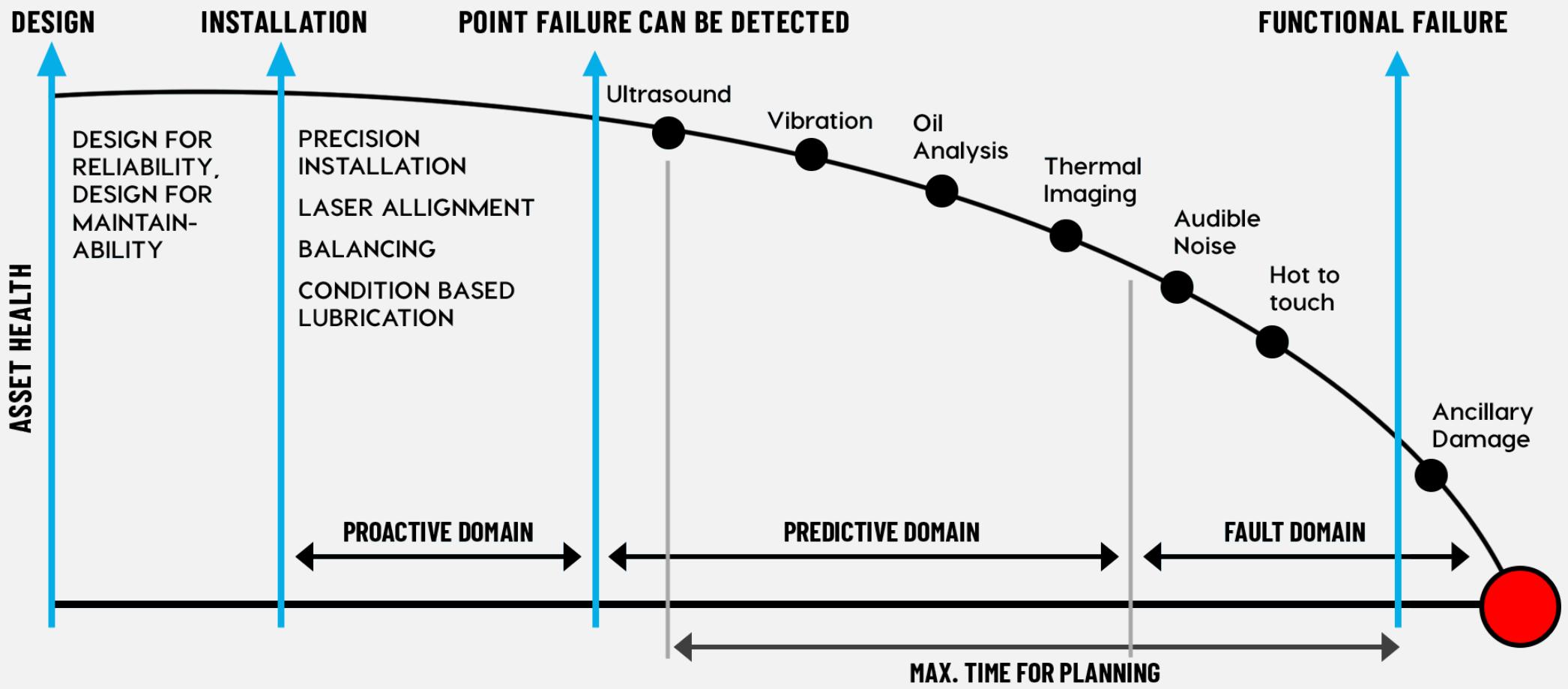
<> Condition monitoring of bearings
<> Condition based lubrication
<> Cavitation effect in pumps
<> Conveyor belt systems
<> Handheld instruments

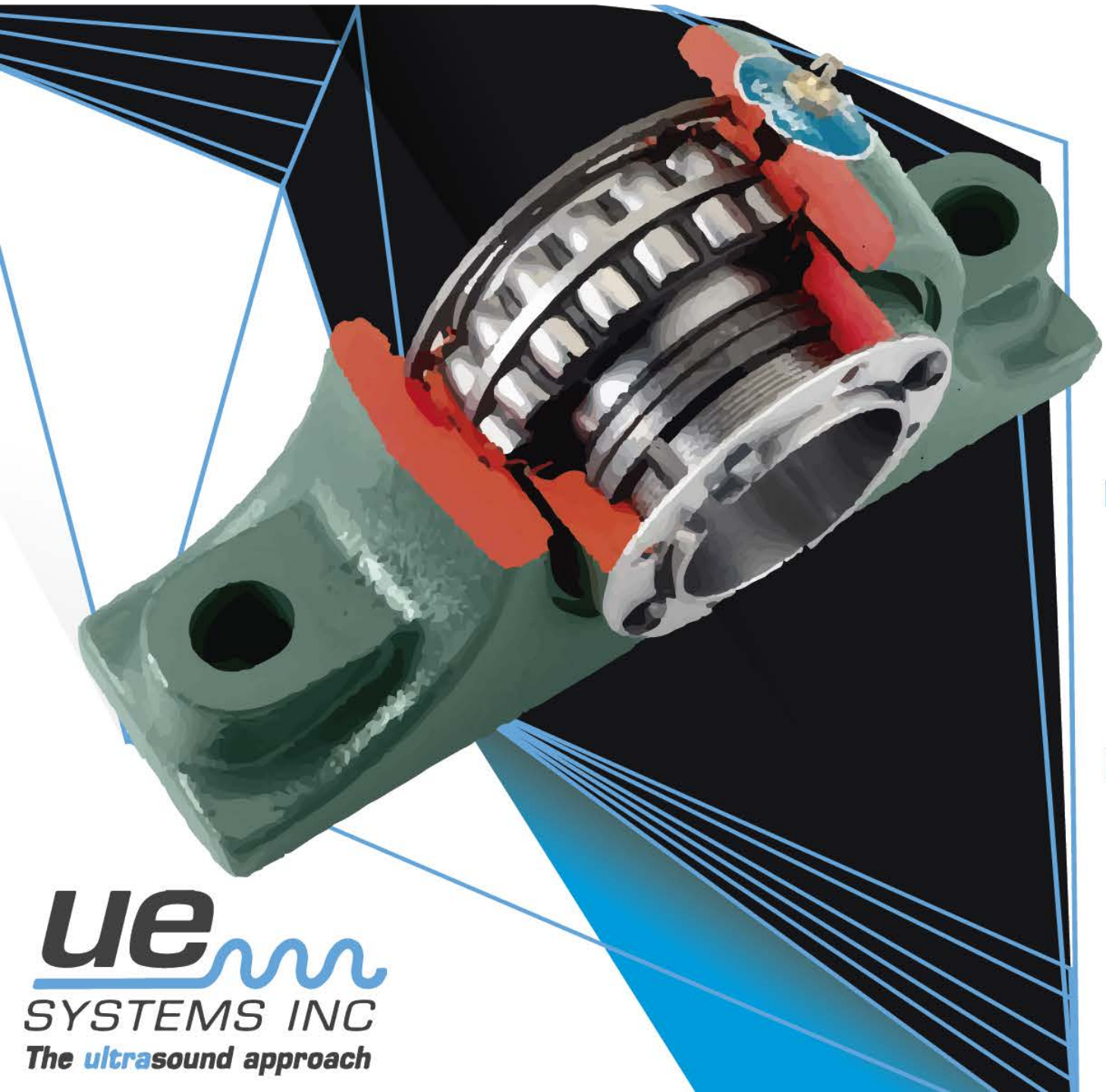
BEARING CONDITION MONITORING & LUBRICATION: ONLINE

<> Monitoring & remote lubrication system
<> Fixed sensors for valve monitoring
<> Fixed sensors for bearing monitoring
<> Ethernet compatible bearing monitoring systems

BEARING CONDITION MONITORING & CONDITION-BASED LUBRICATION

PRINCIPLE OVERVIEW





Bearing Reliability

- Optimizing Bearing Life
  - Correct Bearing
  - Correct Operation
  - Correct Maintenance
- Reducing Catastrophic Failure
  - Correct PdM Technology(s)
  - Correct Frequency

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Bearings fail for many reasons !!

Lubrication Failure ➡ Bearing Failure ➡ Breakdown

Main causes of premature bearing failures

16%

Poor fitting

Around 16% of all premature bearing failures are caused by poor fitting (usually brute force...) and maintenance personnel being unaware of the availability of the correct fitting tools. Individual installations may require mechanical, hydraulic or heat application methods for correct and efficient mounting or dismounting. SKF offers a complete range of tools and equipment to make these tasks easier, quicker and more cost effective, backed up by a wealth of service engineering know-how. Professional fitting, using specialised tools and techniques, is another positive step towards achieving maximum machine uptime.

36%

Poor lubrication

Although 'sealed-for-life' bearings can be fitted and forgotten, some 36% of premature bearing failures are caused by incorrect specification and inadequate application of the lubricant. Inevitably, any bearing deprived of proper lubrication will fail long before its normal service life. Because bearings are usually the least accessible components of machinery, neglected lubrication frequently compounds the problem. Wherever manual maintenance is not feasible, fully automatic lubrication systems can be specified by SKF for optimum lubrication. Effective lubrication and using only recommended SKF greases, tools and techniques helps to significantly reduce downtime.

14%

Contamination

A bearing is a precision component that will not operate efficiently unless both the bearing and its lubricants are isolated from contamination. And, since sealed-for-life bearings in ready-greased variants account for only a small proportion of all bearings in use, at least 14% of all premature bearing failures are attributed to contamination problems. SKF has an unrivalled bearing manufacturing and design capability and can tailor sealing solutions for the most arduous operating environments.

34%

Fatigue

Whenever machines are overloaded, incorrectly serviced or neglected, bearings suffer from the consequences, resulting in 34% of all premature bearing failures. Sudden or unexpected failure can be avoided, since neglected or overstressed bearings emit 'early warning' signals which can be detected and interpreted using SKF condition monitoring equipment. The SKF range includes hand-held instruments, hard-wired systems and data management software for periodic or continuous monitoring of key operating parameters.

SKF

5

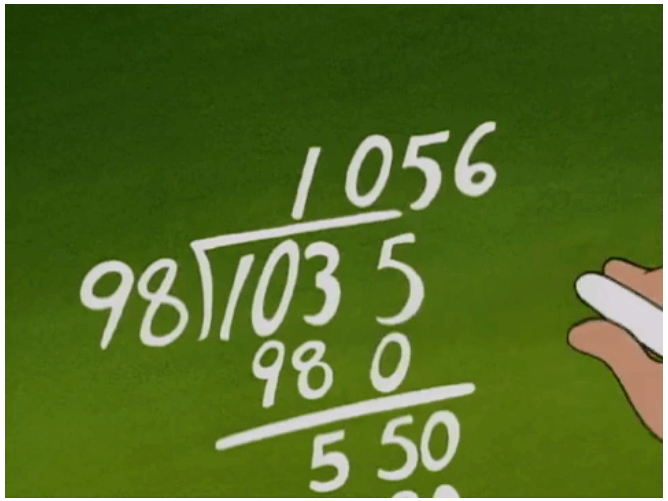
To determine the appropriate course of action, it is crucial to have a clear understanding of our current location and our desired destination.

Time Based Lubrication

- Bearing companies have formulas for greasing volumes and frequencies.
- Equipment suppliers often recommend lubrication schedules based on hours of operation.
- These are subjective and often not efficient for

long life of the bearing.

ARE YOU SURE? Adding The Right Amount? The Right Time?

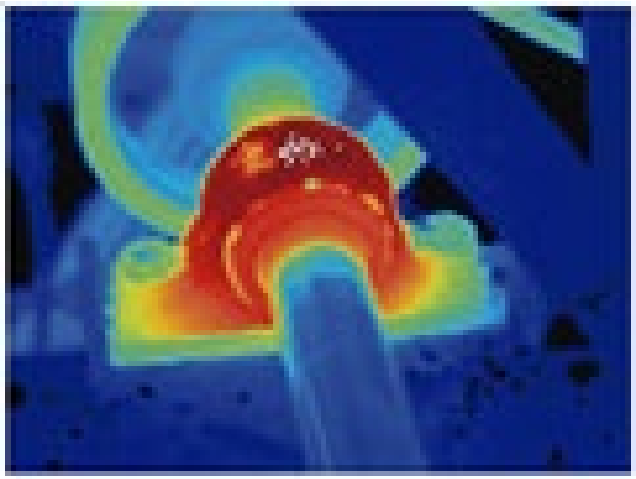


- Is it better to:
- ASK YOUR TIME SHEET? OR ASK YOUR BEARINGS?

Over Lubrication & Under Lubrication

Over Lubrication & Lack of Lubrication

Figure 9. Over-greasing caused inside of motor to fill with grease.



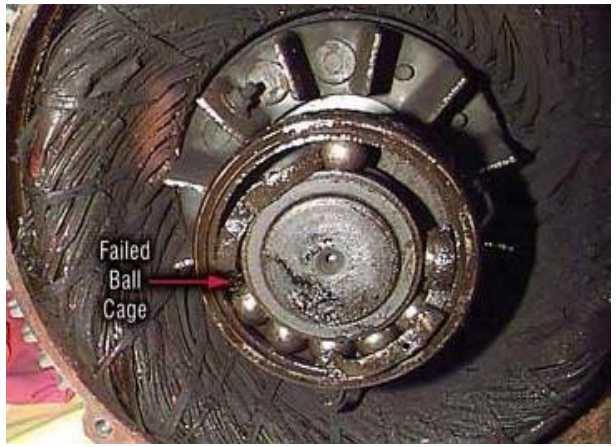
Condition Based Lubrication…

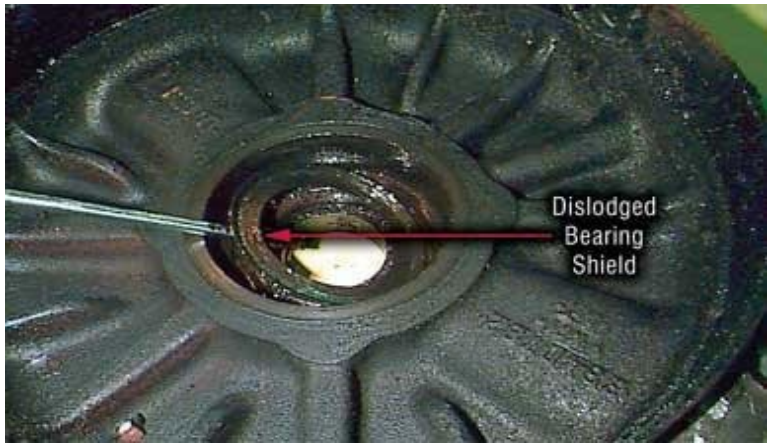
- Ultrasound devices can let you know when and how much.
- Can tell you when the bearing needs grease.
- Can let you know how much is needed.
- Can let you know If the bearing is over greased
- Lubricating the bearings as per the condition

Greasing Best Practices

- Only grease a motor while it is operating
- Keep the grease gun and connector clean
- Use a manual (not battery powered) grease gun
- Slowly add the grease to the bearing

  Adding grease too quickly (especially with an automatic gun) will over pressurize the bearing housing and can cause the failures below
- Use an ultrasonic sensor to listen to the bearing and decide if it needs lubricating. If it does need lubrication, add grease while continuing to listen.





Best Practices – Cross Contamination

ROTARY AIRLOCK BEARINGS

SHELL GADUS S3 V 460

LX-2-460-M-EP

SCREW CONVEYOR BEARINGS

FAN BEARINGS

SHELL GADUS S2 V100
LI-2-100-M-AW

LOBE BLOWER

SHELL GADUS S2 U1000

BC-2-1000-M-EP

ALL MOTORS

AREA C HAZELTON PUMP

SHELL GADUS S2 V100
LI-2-100-M-AW

ALL MOTORS

MOBIL POLYREX EM
PU-2-115-M-AW

ALL GREASED COUPLINGS

SHELL GADUS S2 HIGH SPEED COUPLING GREASE
LI-1-3200-M-CG

ALL CONVEYORS, AUTOMATIC GREASING SYSTEMS & GENERAL PURPOSES

SHELL GADUS S3 V 220C
LX-2-220-M-EP

TOYO SUBMERSIBLE PUMPS

MOBIL POLYREX EM
PU-2-115-M-AW

Best Practices – Cross Contamination

- Use a color coded cap to keep the grease fitting clean.
  The color code will also prevent cross-contamination (adding the wrong kind of grease)

Best Practices – Cross Contamination

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Defect Elimination: *Grease Purge* In the upcoming weeks, we will be going through all tool cabinets, flammable cabinets, and storage bins to find all grease guns and cartridges.

If during the "purge":

- A grease gun is clean and in working order, it will be color coded according to the type of grease it has.
- A grease gun is too dirty to clean, it will be replaced by a new color-coded one according to the type of grease it will be used for.
- A cartridge of grease if found that we do not use, it will be disposed of.
- All grease guns will be fitted with rubber caps to keep out contaminants.

Removing old grease cartridges and color-coding all guns will help prevent cross-contamination and lubrication related failures.

Best Practices – What Does Good Look Like?

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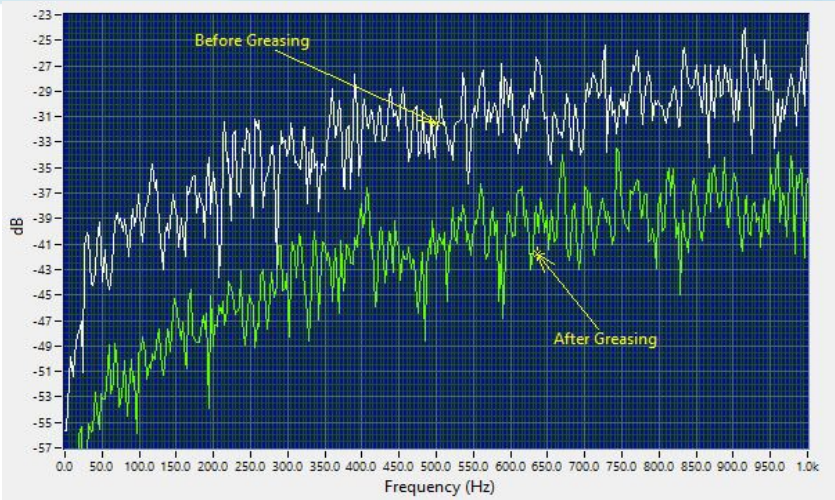
WORLD CLASS STANDARD FOR ALL ELECTRIC MOTORS

- Correct oil level and lubricant ID tag if oil bath lubricated
- Color coded grease cap if grease lubricated
- No exposed wiring
- Conduit in good condition
- Clean exterior
- Fan in working condition

WORLD CLASS STANDARD FOR ALL GREASE GUNS

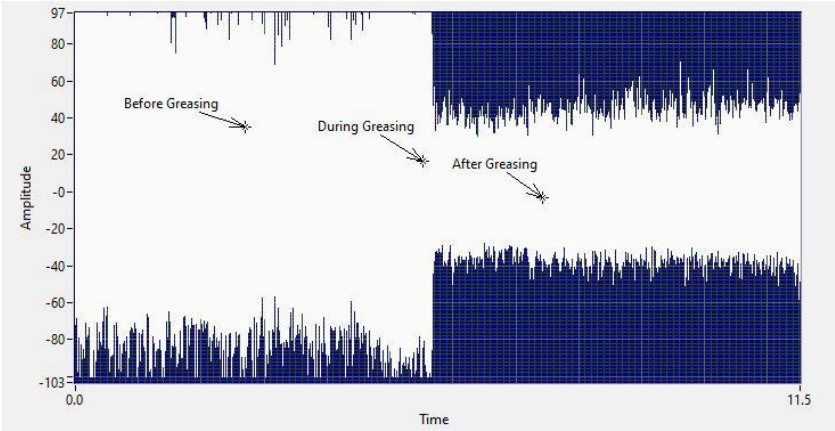
- CLEAR AND COLOR CODED TUBE
- PROTECTIVE CAP ON COUPLER
- IN WORKING ORDER
- CLEAN

Bearing Sound Greasing

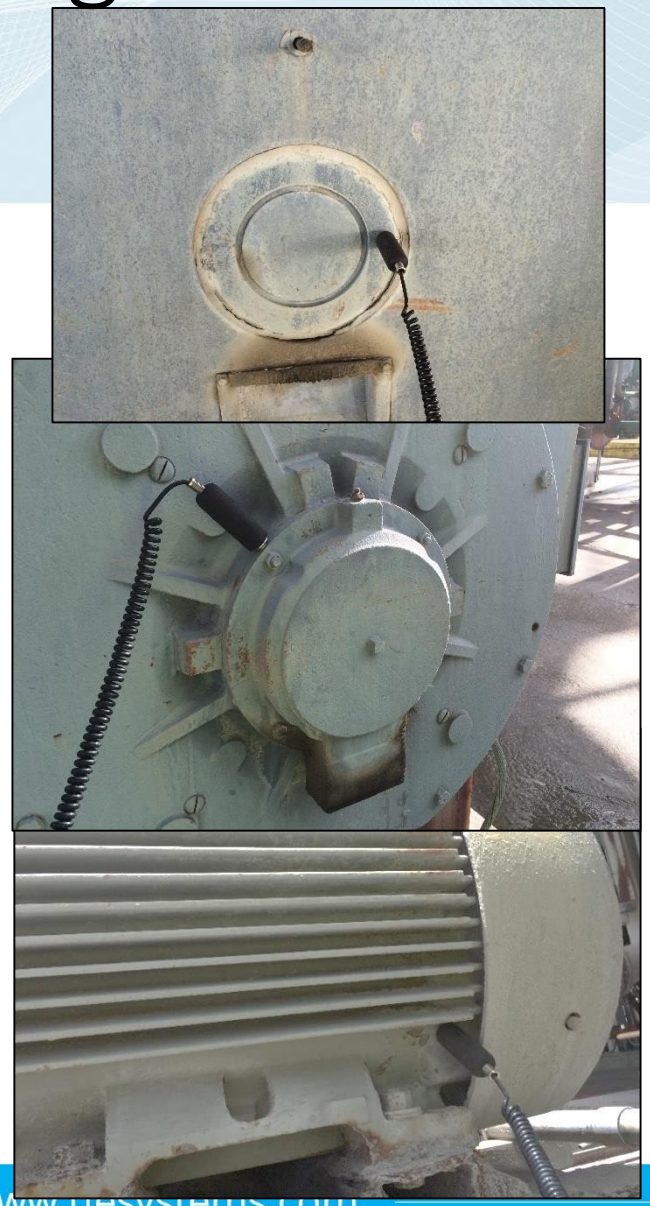


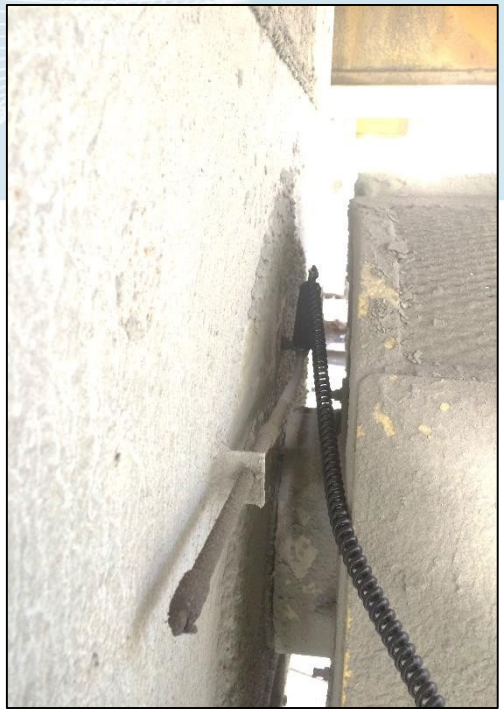
What Ultrasound Can tell us during greasing?

Is it about listening only?



Using Ultrasound





BEST PRACTICE

-Location: ODE & DE bearing.
-Always use clean surface.
-Always use the same location, mark the spot for future readings.
-Do not put sensor on fan shroud, cover, cooling fins,

The Challenge !!
The Questions Now Is?

When To Lubricate?

How Much Grease?

Start With A Baseline

- Setting a baseline is the point where we start our CBL program
- Setting baseline will allow you to trend your bearings condition and to set alarms for Lubrication or taking further actions

Setting Up the Base Line for Trending by using:

1. COMPARITIVE
2. DURING LUBRICATION
3. HISTORICAL

Use the action dB Levels for Re-Greasing the Bearings

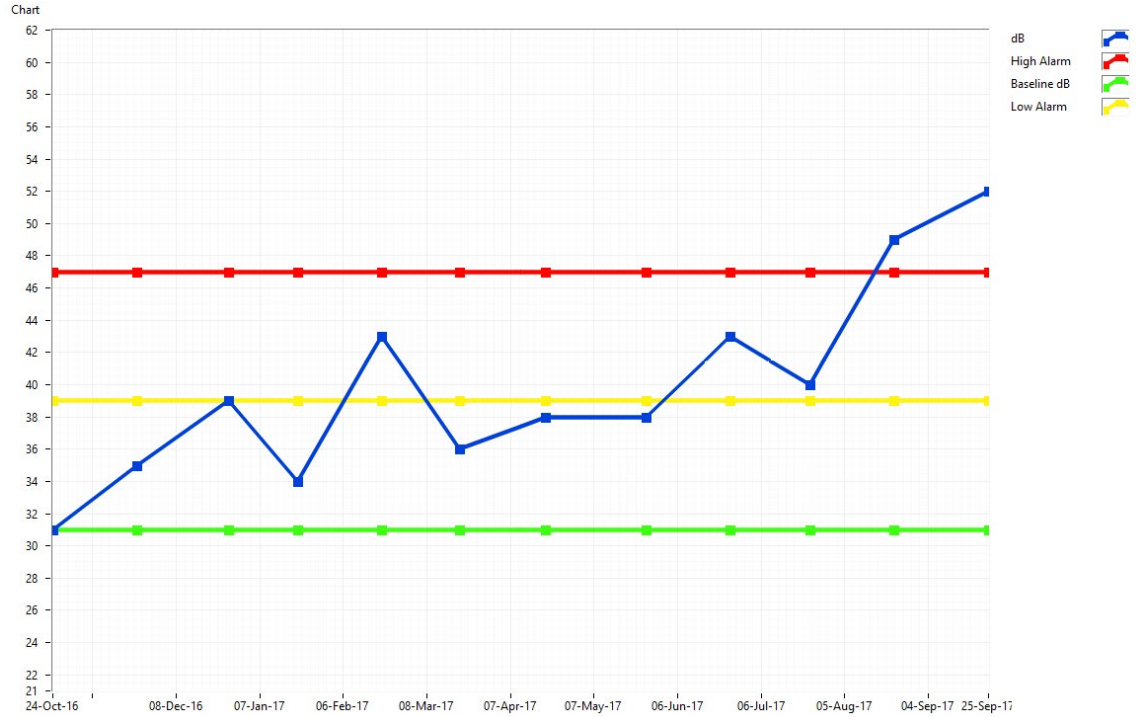
After Setting Base Line ? When & How Much?

- Follow the Action dB Levels

8dB……Lubrication
(ABOVE BASELINE)

16dB……Damage/Visual Faults in FFT
(ABOVE BASELINE)

35dB+……Extreme Damage
(ABOVE BASELINE)



The Paracetamol Effect

- When establishing the baseline, it is important to exercise caution and be mindful of the Panadol Effect.
- Panadol is known for providing Temporary relief from minor aches, pains, and headaches. Similarly, when greasing faulty bearings, the same effect can occur. The grease will reduce friction and fill in any microscopic faults, resulting in a decrease in bearing friction and dB (decibel) levels.
- To ensure the reliability of the baseline, it is considered best practice to wait for 3 to 5 minutes and then retest the dB levels.

MECHANICAL INSPECTION Lubrication

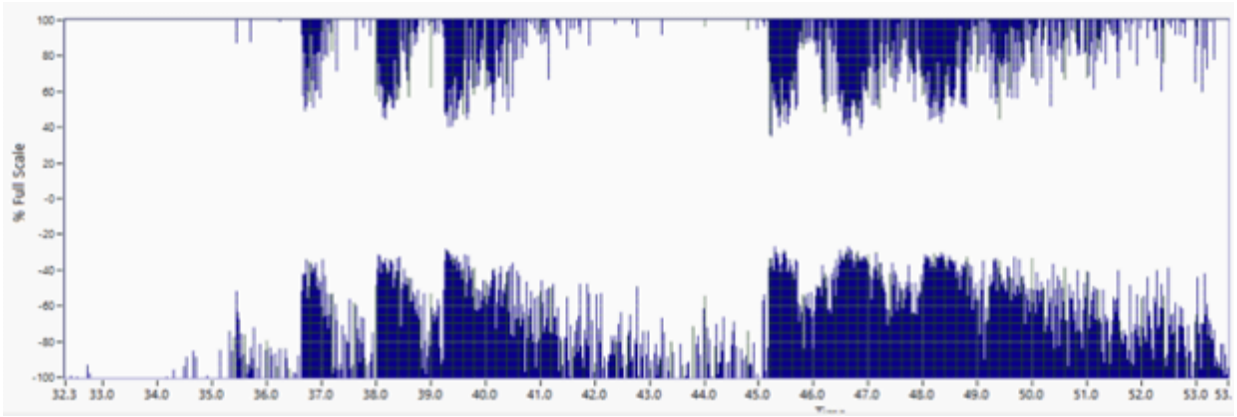
Determine bad actors Using Ultrasound Assisted Lubrication

While greasing, we can hear and observe the bearing behavior.

Further Investigation was performed – results in following slide.

Paracetamol Effect

Bearing Being Lubricated:



What is the Ultrasound approach?

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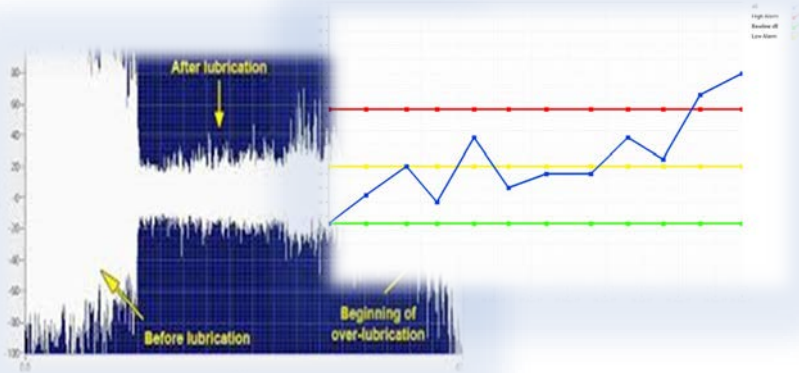
Procedures

Setting a baseline

Follow Action Levels – CBL & Trending



Lubricate when required

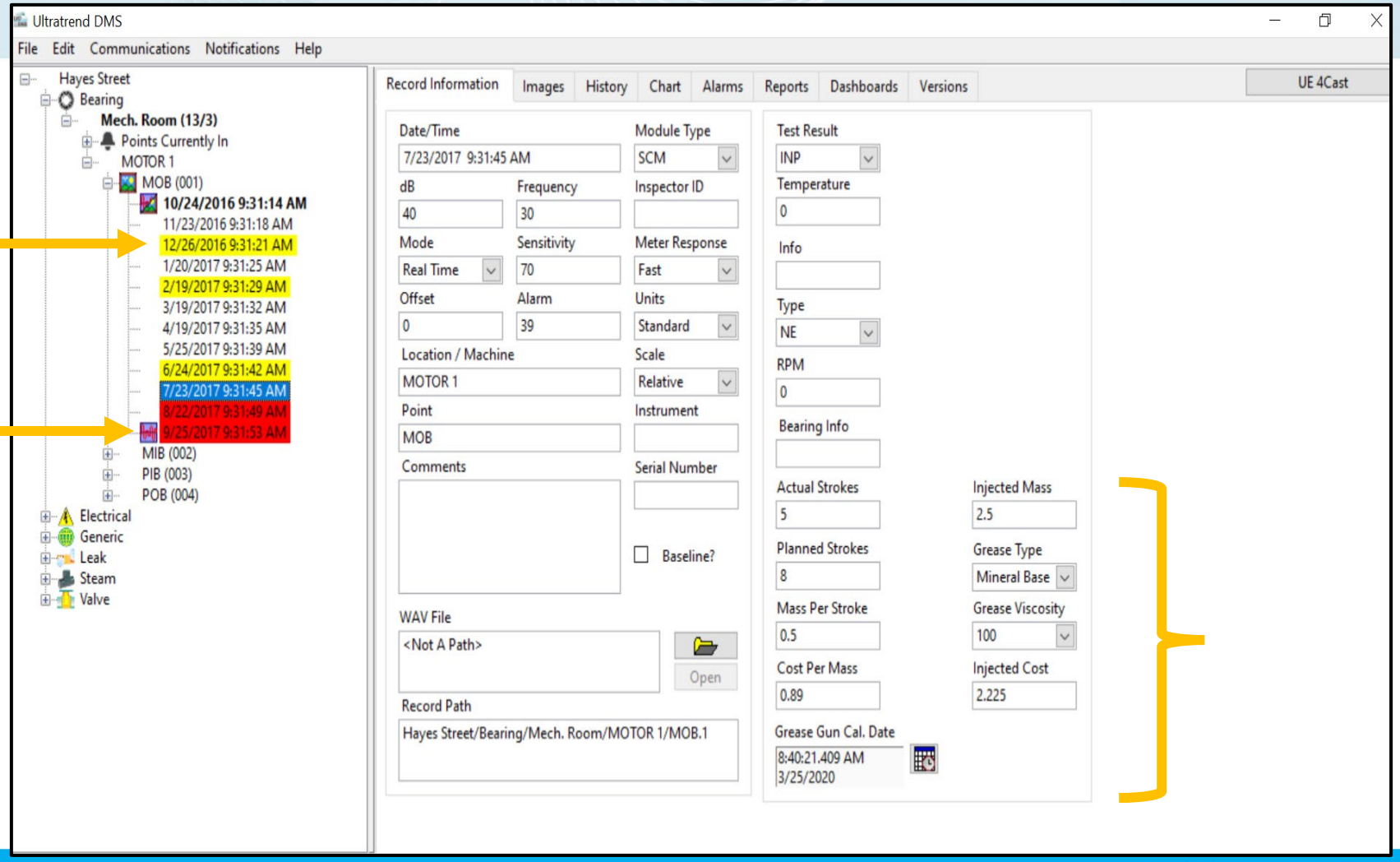
Time Based VS Condition Based Lubrication

Time Based Lubrication
1- Over Lubrication May Occur
2- Lack of Lubrication May Occur
3- Lubrication Frequency as per the manufacture Recommendations
4- Lubricating Blindly
5- What if there are other problems wrong with the bearing that lubrication is not the solution for?

VS

Condition Based Lubrication
1- Over lubrication will Give you a sign of dB increase
2- Lack of lubrication will increase friction = Higher dB level
3- Lubricating as per the bearings demand
4- Listening and monitoring friction levels during lubrication
5- Let us know if there are other problems with the bearing

Reporting & Documentation



Low Alarm

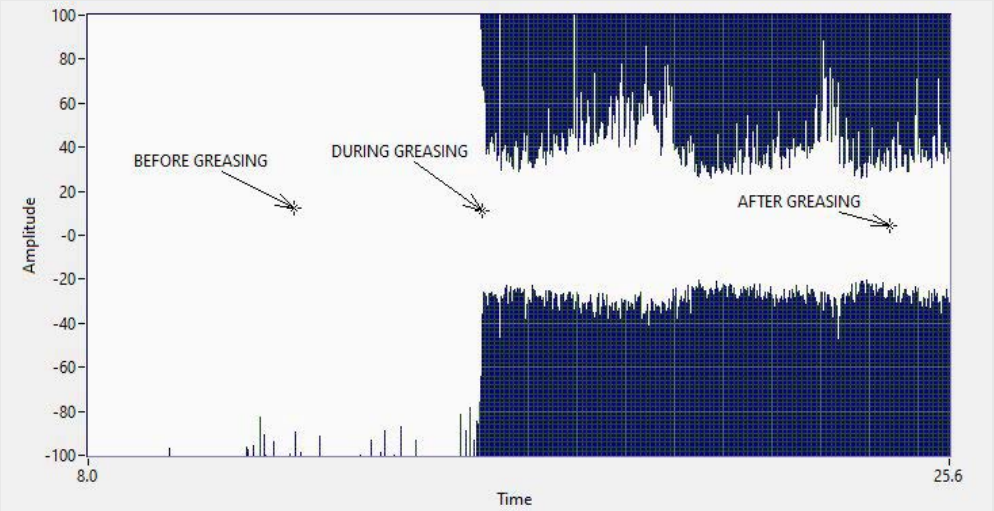
High Alarm

Configure UE 4Cast

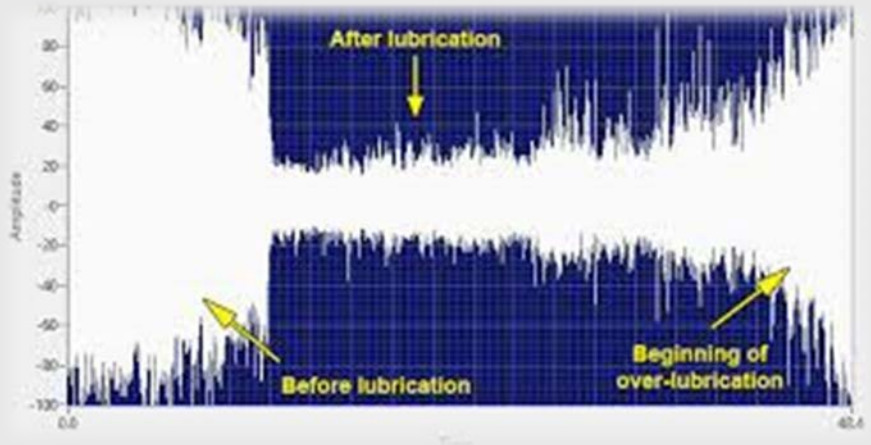
Lubrication Specific Fields

Case study:
Motor bearing during lubrication.

- Equipment: Electric Motor
- Bearing: Anti Friction Bearing DGBB
- Strategy Used for Lubrication: TBL
- Amount of Grease As per the OEM: 20 Strokes every 3 months
- Initial dB: 46
- Ended by: 39 dB with 7 strokes of grease only



Well lubricated



Over lubricated

33

ROI Return on Investment

- Short Term ROI $$$
- Long Term ROI $$$

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CBL Benefit Results

Year to Date	5550.0	247.0	6.4	$ 90.44	$ 4.02	$ 86.40

Month	Planned Strokes	Actual Strokes	Injected Mass	Planned Injected Cost	Actual Injected Cost	CBL Benefit
Mar-17	5550	247	6.42	$ 90.44	$ 4.02	$ 86.40

Machine	Point	Date	Freq.	dB	Sens.	Alarm	Alarm	Status	Grease Type	Grease Viscosity	Lubed	Strokes	Strokes	Stroke	Mass	Mass	Cost	Injected Cost	CBL Benefit
		3/15/2017 9:22:58 AM	30	22	70	122	122	ok	Mineral Base	100	No	119	12	0.03	0.63	0.31	$ 1.94	$ 0.20	$ 1.74
		3/15/2017 9:25:07 AM	30	23	70	122	122	ok	Mineral Base	100	No	119	10	0.03	0.63	0.26	$ 1.94	$ 0.16	$ 1.78
		3/15/2017 9:26:52 AM	30	18	70	122	122	ok	Mineral Base	100	No	119	10	0.03	0.63	0.26	$ 1.94	$ 0.16	$ 1.78
		3/15/2017 9:28:35 AM	30	14	70	122	122	ok	Mineral Base	100	No	119	12	0.03	0.63	0.31	$ 1.94	$ 0.20	$ 1.74
		3/15/2017 9:33:40 AM	30	23	70	122	122	ok	Mineral Base	100	No	119	6	0.03	0.63	0.16	$ 1.94	$ 0.10	$ 1.84
		3/15/2017 9:35:02 AM	30	29	70	122	122	ok	Mineral Base	100	No	119	15	0.03	0.63	0.39	$ 1.94	$ 0.24	$ 1.70
		3/15/2017 9:38:13 AM	30	23	70	122	122	ok	Mineral Base	100	No	119	4	0.03	0.63	0.1	$ 1.94	$ 0.07	$ 1.87
		3/15/2017 9:39:32 AM	30	30	70	122	122	ok	Mineral Base	100	No	119	12	0.03	0.63	0.31	$ 1.94	$ 0.20	$ 1.74
		3/15/2017 9:42:57 AM	30	24	70	122	122	ok	Mineral Base	100	No	78	3	0.03	0.63	0.08	$ 1.27	$ 0.05	$ 1.22
		3/15/2017 9:46:41 AM	30	32	70	122	122	ok	Mineral Base	100	No	78	16	0.03	0.63	0.42	$ 1.27	$ 0.26	$ 1.01
		3/15/2017 9:48:52 AM	30	36	70	122	122	ok	Mineral Base	100	No	78	10	0.03	0.63	0.26	$ 1.27	$ 0.16	$ 1.11
		3/15/2017 9:50:16 AM	40	41	70	122	122	ok	Mineral Base	100	No	78	7	0.03	0.63	0.18	$ 1.27	$ 0.11	$ 1.16
		3/15/2017 9:52:44 AM	30	28	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 9:53:33 AM	30	32	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 9:55:30 AM	30	20	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 9:56:18 AM	30	22	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 9:58:52 AM	30	14	70	122	122	ok	Mineral Base	100	No	161	0	0.03	0.63	0	$ 2.62	$ -	$ 2.62
		3/15/2017 9:59:25 AM	30	13	70	122	122	ok	Mineral Base	100	No	161	0	0.03	0.63	0	$ 2.62	$ -	$ 2.62
		3/15/2017 10:01:26 AM	30	22	70	122	122	ok	Mineral Base	100	No	185	7	0.03	0.63	0.18	$ 3.02	$ 0.11	$ 2.90
		3/15/2017 10:02:36 AM	30	27	70	122	122	ok	Mineral Base	100	No	185	10	0.03	0.63	0.26	$ 3.02	$ 0.16	$ 2.85
		3/15/2017 10:04:29 AM	30	11	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 10:04:52 AM	30	13	70	122	122	ok	Mineral Base	100	No	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
		3/15/2017 10:16:47 AM	30	29	70	122	122	ok	Mineral Base	100	No	252	12	0.03	0.63	0.31	$ 4.11	$ 0.20	$ 3.91
		3/15/2017 10:18:26 AM	30	27	70	122	122	ok	Mineral Base	100	No	252	8	0.03	0.63	0.21	$ 4.11	$ 0.13	$ 3.98
		3/15/2017 10:21:48 AM	30	21	70	122	122	ok	Mineral Base	100	No	252	10	0.03	0.63	0.26	$ 4.11	$ 0.16	$ 3.95

Report | March 2017

Phosphate Industry / CBL Using Ultrasound

UE SYSTEMS INC
The ultrasound approach

Total Savings in Grease $1,919.47

Short Term ROI $$$

Machine	Point	Date	dB	Alarm Status	Planned Strokes	Actual Strokes	Mass Per Stroke	Cost Per Mass	Injected Mass	Planned Injected Cost	Actual Injected Cost	CBL Benefit
3 N CLEANUP	ODE	12/21/2017 9:42:55 AM	22	ok	78	12	0.03	0.63	0.31	$ 1.27	$ 0.20	$ 1.08
3 N CLEANUP	DE	12/21/2017 9:43:51 AM	14	ok	78	13	0.03	0.63	0.34	$ 1.27	$ 0.21	$ 1.06
1 DENSIFYING	ODE	12/21/2017 9:45:10 AM	23	ok	252	9	0.03	0.63	0.23	$ 4.11	$ 0.15	$ 3.96
1 DENSIFYING	DE	12/21/2017 9:45:33 AM	17	ok	252	0	0.03	0.63	0	$ 4.11	$ -	$ 4.11
3 DENSIFYING	ODE	12/21/2017 9:47:09 AM	26	ok	252	10	0.03	0.63	0.26	$ 4.11	$ 0.16	$ 3.95
3 DENSIFYING	DE	12/21/2017 9:47:33 AM	28	ok	252	0	0.03	0.63	0	$ 4.11	$ -	$ 4.11
1 S CLEANUP	ODE	12/21/2017 9:48:04 AM	21	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
1 S CLEANUP	DE	12/21/2017 9:49:30 AM	25	ok	78	30	0.03	0.63	0.78	$ 1.27	$ 0.49	$ 0.78
S FINE ROUGH	ODE	12/21/2017 9:54:53 AM	23	ok	161	12	0.03	0.63	0.31	$ 2.62	$ 0.20	$ 2.43
		12/21/2017 9:55:11 AM	26	ok	161	0	0.03	0.63	0	$ 2.62	$ -	$ 2.62
3 S CLEANUP	ODE	12/21/2017 9:55:42 AM	27	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
3 S CLEANUP	DE	12/21/2017 9:55:50 AM	26	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
W GMT SEAL	ODE	12/21/2017 9:56:16 AM	28	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
W GMT SEAL	DE	12/21/2017 9:56:25 AM	31	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
E GMT SEAL	ODE	12/21/2017 9:56:51 AM	37	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
E GMT SEAL	DE	12/21/2017 9:56:59 AM	35	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
2 S CLEANUP	ODE	12/21/2017 9:58:06 AM	22	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
2 S CLEANUP	DE	12/21/2017 9:58:16 AM	0	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
S FINE ACID W	ODE	12/21/2017 9:59:29 AM	26	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
S FINE ACID W	DE	12/21/2017 9:59:45 AM	24	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
GMT	ODE	12/21/2017 10:00:16 AM	22	ok	230	0	0.03	0.63	0	$ 3.75	$ -	$ 3.75
GMT	DE	12/21/2017 10:00:46 AM	14	ok	230	0	0.03	0.63	0	$ 3.75	$ -	$ 3.75
N FINE ACID W	ODE	12/21/2017 10:01:36 AM	16	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
N FINE ACID W	DE	12/21/2017 10:01:53 AM	15	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
S AMINE CONC	ODE	12/21/2017 10:02:50 AM	17	ok	252	0	0.03	0.63	0	$ 4.11	$ -	$ 4.11
S AMINE CONC	DE	12/21/2017 10:03:35 AM	29	ok	252	0	0.03	0.63	0	$ 4.11	$ -	$ 4.11
N AMINE CONC	ODE	12/21/2017 10:04:51 AM	21	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94
N AMINE CONC	DE	12/21/2017 10:05:32 AM	16	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94
2 N CLEANUP	ODE	12/21/2017 10:06:31 AM	21	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
2 N CLEANUP	DE	12/21/2017 10:06:40 AM	25	ok	78	0	0.03	0.63	0	$ 1.27	$ -	$ 1.27
S COARSE ACID	ODE	12/21/2017 10:07:37 AM	22	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94
S COARSE ACID	DE	12/21/2017 10:08:01 AM	26	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94
N COARSE ACID	ODE	12/21/2017 10:08:42 AM	9	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94
N COARSE ACID	DE	12/21/2017 10:09:10 AM	14	ok	119	0	0.03	0.63	0	$ 1.94	$ -	$ 1.94

Long Term ROI

- 1000s of Man Hours Saved
- Long-term protection of equipment.
- Accurate lubrication.
- Reduced maintenance costs.
- Increased profitability.
- The right lubricant volume per point.
- Increased Asset Reliability
- Increased Asset Availability

Culture change!

- Adding Ultrasound technology will help you a lot to get out the most of your resources and decrease downtime and increase bearings reliability and availability
- BUT if you still following the same Culture your money will be wasted

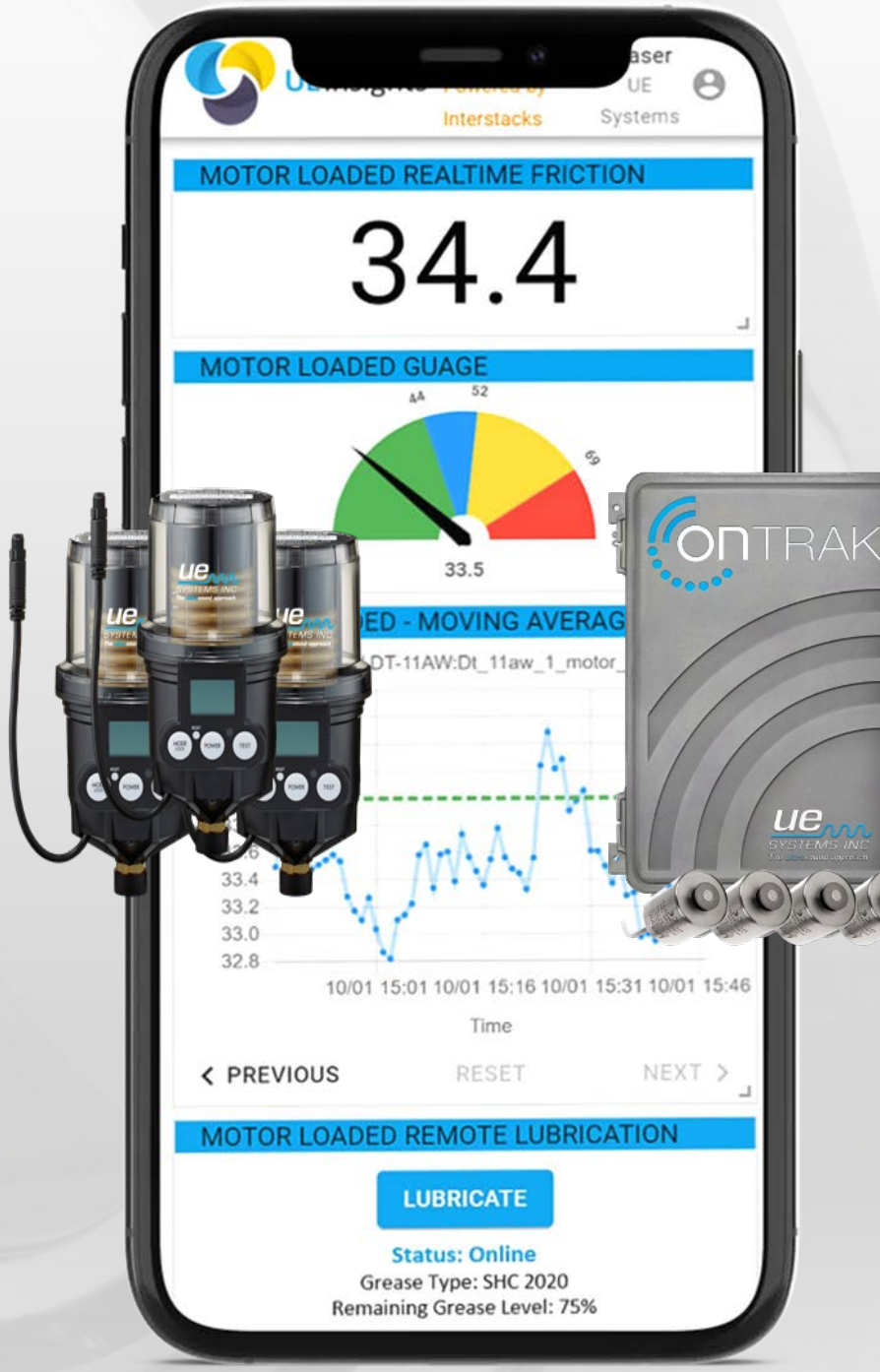
- ***Successful organizations have learned that they have to do more than dealing with just the technical barriers. They came to the conclusion that a healthy lifestyle is way better than just going on a diet in order to lose weight!!***

Key Points to fulfill the Culture Change:

- **Cleanliness / Avoid Contamination**
- Select the proper grease with the correct viscosity for the application.
- Grease equipment while its running
- **Calibrated or metered grease gun**
- **Remote access sensors** must be used if there is no direct access to the bearing housing when the asset is inaccessible due to guarding or distance
- **Repeatability**
  - Making contact in the same location
  - Using the same frequency setting
  - Using the same contact method
- **Select the right person & make sure that:**
  - They are trained
  - They understand the importance of proper lubrication to the reliability of the assets
  - They have been given clear instructions and procedures for how the assets will be greased and how the ultrasound instruments are used
  - Consider updating/rewriting lubrication PM's to reflect the use of ultrasound

BEARING LUBRICATION REIMAGINED

A SMART CONDITION BASED AUTOMATIC LUBRICATION SYSTEM



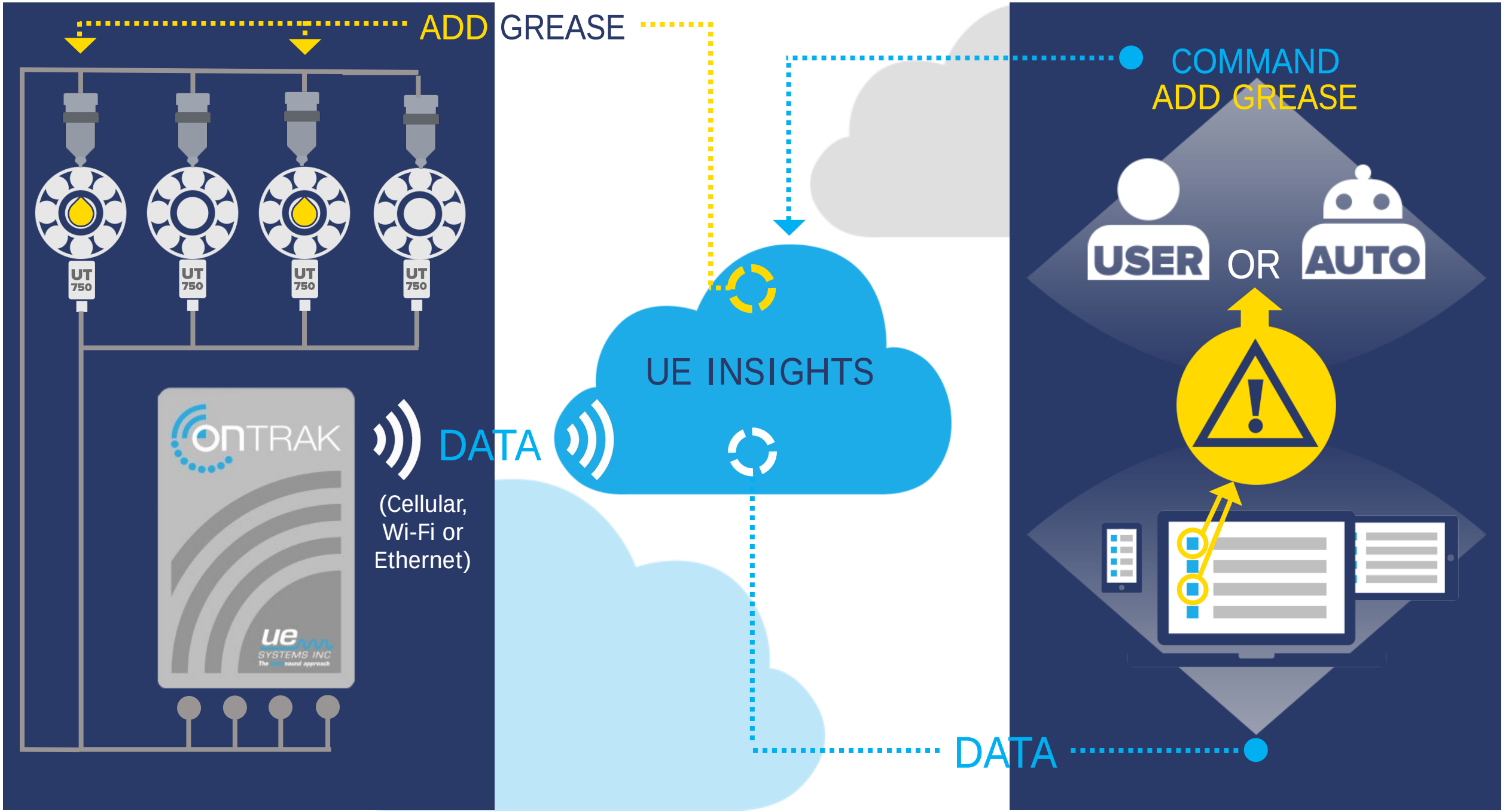
ONTRAK SMARTLUBE OVERVIEW

ONTRAK – 16 CHANNEL EDGE ANALYTICS DEVICE

SINGLE POINT LUBRICATION DEVICES

UE INSIGHTS - CLOUD-BASED DASHBOARD AND ALERTING PLATFORM (OPTIONAL)

ULTRA-TRAK 850S ULTRASOUND SENSORS

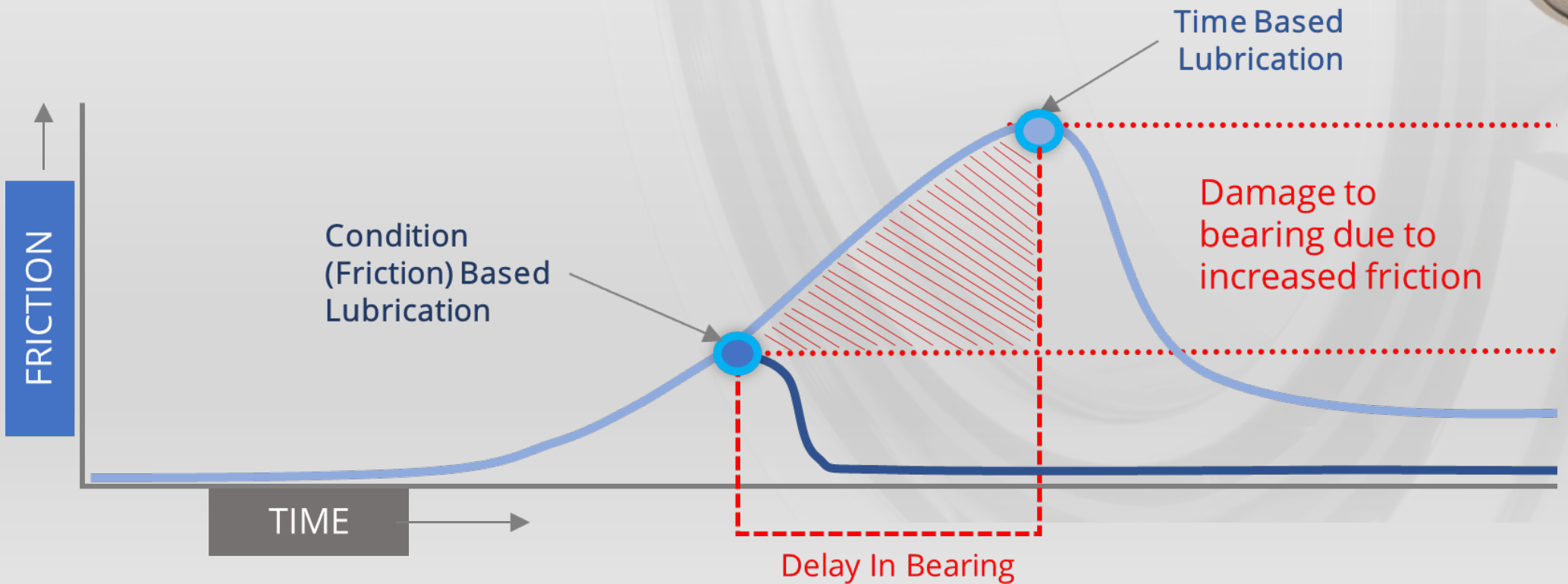

ADD GREASE
UT 750
UT 750
UT 750
UT 750
onTRAK
ue SYSTEMS INC
DATA
(Cellular, Wi-Fi or Ethernet)
UE INSIGHTS
COMMAND
ADD GREASE
USER
OR
AUTO
DATA

HOW WE MEASURE FRICTION

IT IS SIMPLE, AS THE FRICTION IN THE BEARING INCREASES DUE TO LUBRICATION ISSUES OR THE ONSET OF FAILURE, THERE WILL BE A CORRESPONDING RISE IN ULTRASOUND (dB)

USING **ULTRASOUND TECHNOLOGY** TO CONTINUOUSLY MONITOR THE **BEARING FRICTION**

- **KNOW WHEN GREASED IS REQUIRED**
- **KNOW PRECISELY HOW MUCH IS REQUIRED**



MONITOR AND TREND DECIBEL LEVELS
CAUSED BY FRICTION

+8dB

ABOVE BASELINE INDICATES A LACK OF LUBRICATION.

+16dB

ABOVE BASELINE INDICATES DAMAGE TO THE BEARING – A FAILURE MODE BEYOND LUBRICATION ALONE..

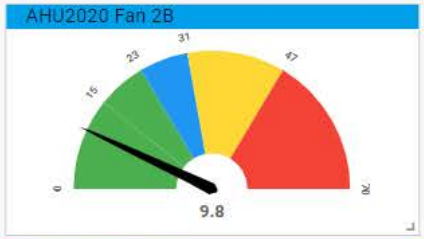
+35dB

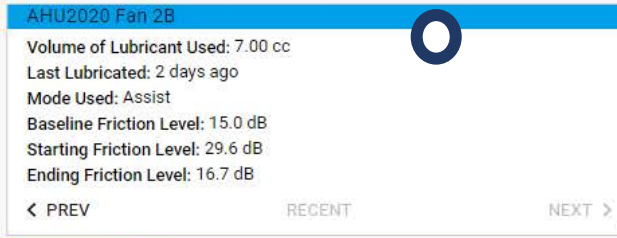
ABOVE BASELINE MEANS THE ASSET IS CRITICAL – IT IS CLOSE TO FAILURE.

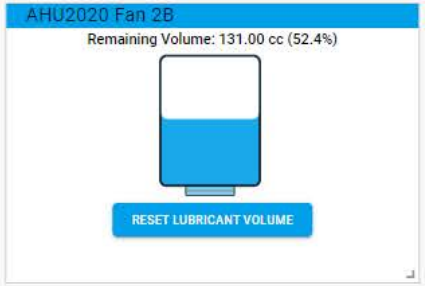
UE SYSTEMS INC
The ultrasound approach

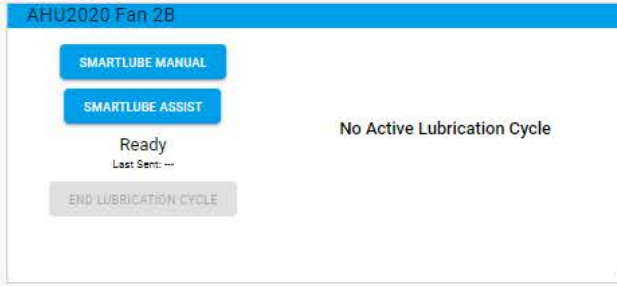
REMOTE CONDITION BASED

LUBRICATION



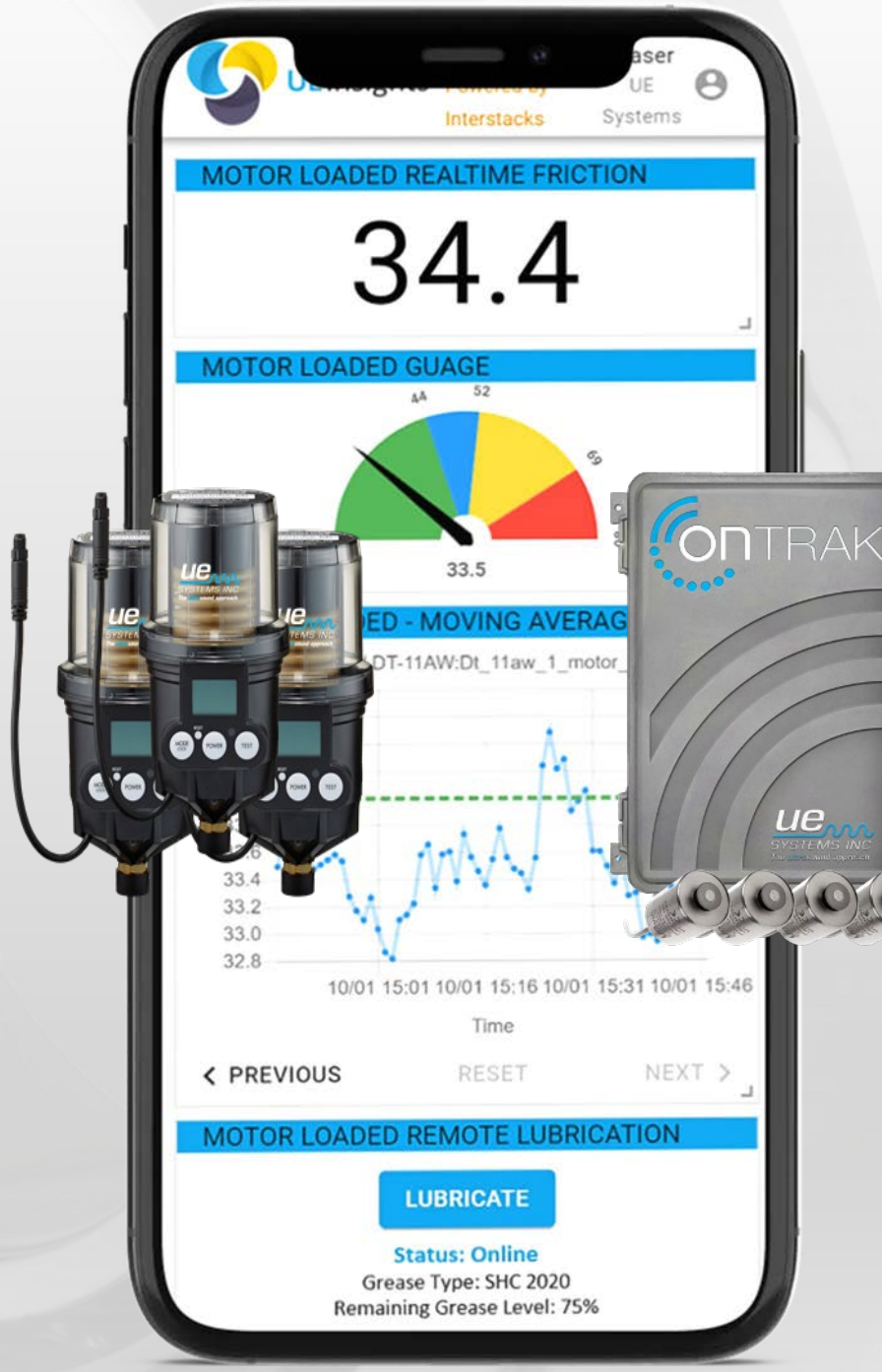






ONTRAK & SMARTLUBE
CASE STUDIES

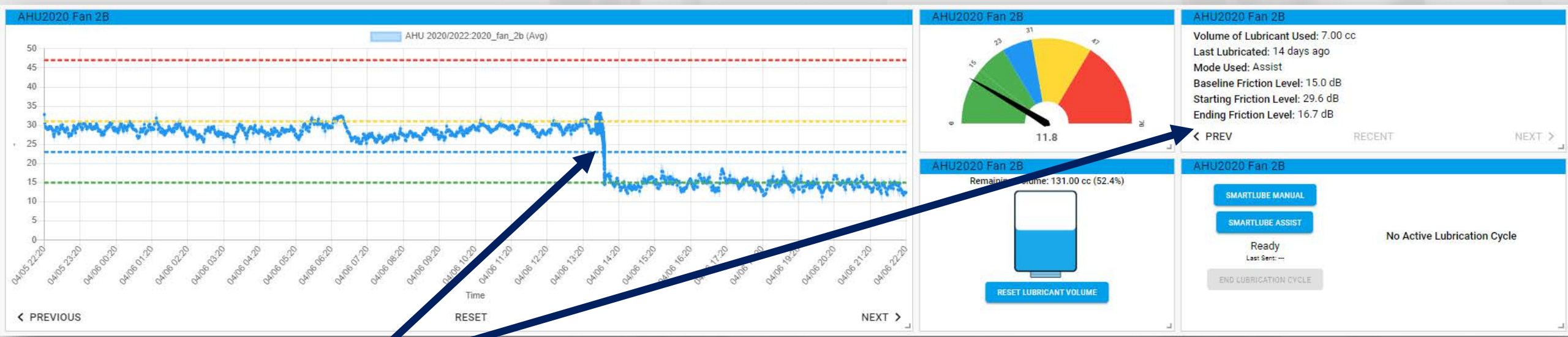
REAL DATA FROM OVER 8.5 BILLION DATA POINTS COLLECTED



USE CASE
UNDER LUBRICATED BEARING

- DRIVE END OF MOTOR
- ONTRAK SMARTLUBE SYSTEM

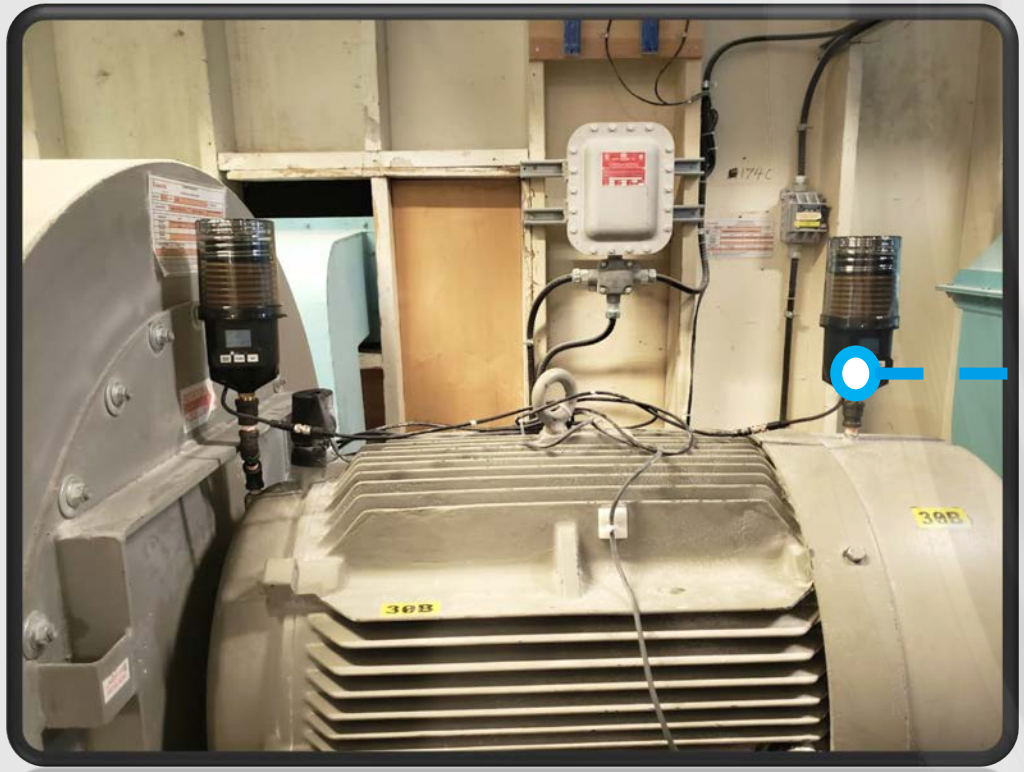
USE CASE
UNDER LUBRICATED BEARING



NOTICEABLE DECREASE IN FRICTION AFTER LUBRICATION

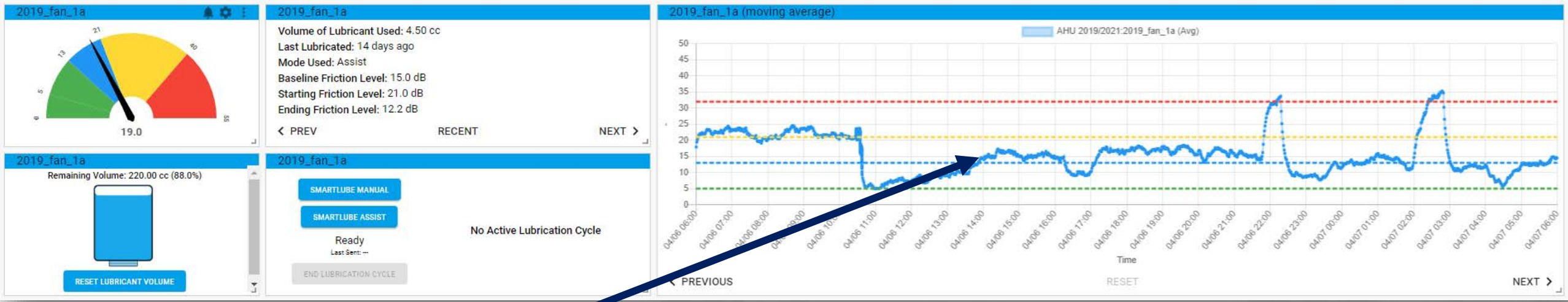
USE CASE

UNDER LUBRICATED WITH A BAD BEARING



- NON-DRIVE END OF MOTOR
- ONTRAK SMARTLUBE SYSTEM

USE CASE
UNDER LUBRICATED WITH A BAD BEARING



WITHIN A FEW HOURS OF LUBRICATION, THE FRICTION WAS BACK UP!

Ontrak Smart Lube Mounting

ULTRASOUND

UE SYSTEMS INC
The ultrasound approach

ULTRATRAK 950BT

Unmatched Ultrasound Precision.
Enhanced Insights.

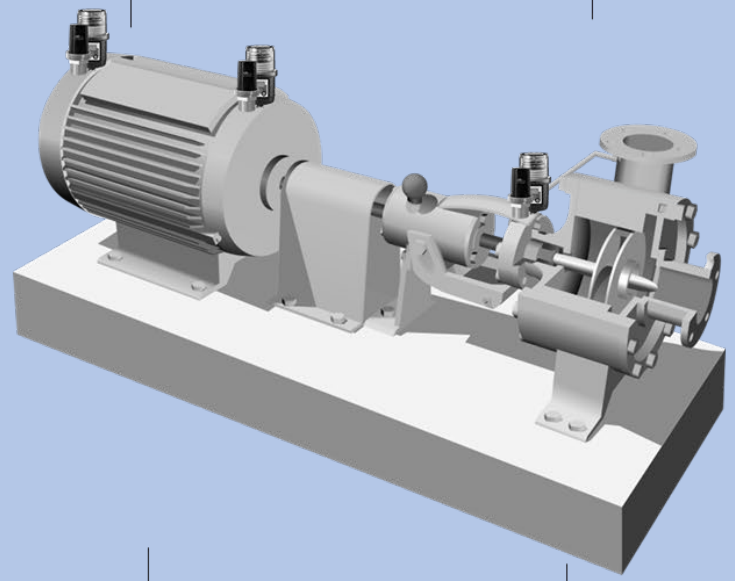
ULTRASOUND | VIBRATION | TEMPERATURE

BEARING FAULTS

- Early Stage Bearing Defect
- Bearing Mechanical Defect
- Bearing Impacting Severity

LUBRICATION FAULTS

- Lack of Lubrication
- Over Lubrication



MACHINE FAULTS

- Misalignment
- Mechanical Looseness
- Imbalance
- Belt Issues

PRECISION LUBRICATION

- Condition-Based Automatic Lubrication

UE SYSTEMS INC
The ultrasound approach

EXPERIENCE THE FUTURE OF ULTRASOUND SENSING, WHERE SIMPLICITY DOESN'T MEAN A COMPROMISE ON CAPABILITIES

- ULTRASOUND
  - FRICTION
  - IMPACTING
- VIBRATION
  - VELOCITY
  - ACCELERATION
  - SPEED
- TEMPERATURE
  - SURFACE TEMPERATURE

ue SYSTEMS INC
The ultrasound approach

ONTRAK WIRELESS OVERVIEW

UE SYSTEMS INC
The ultrasound approach

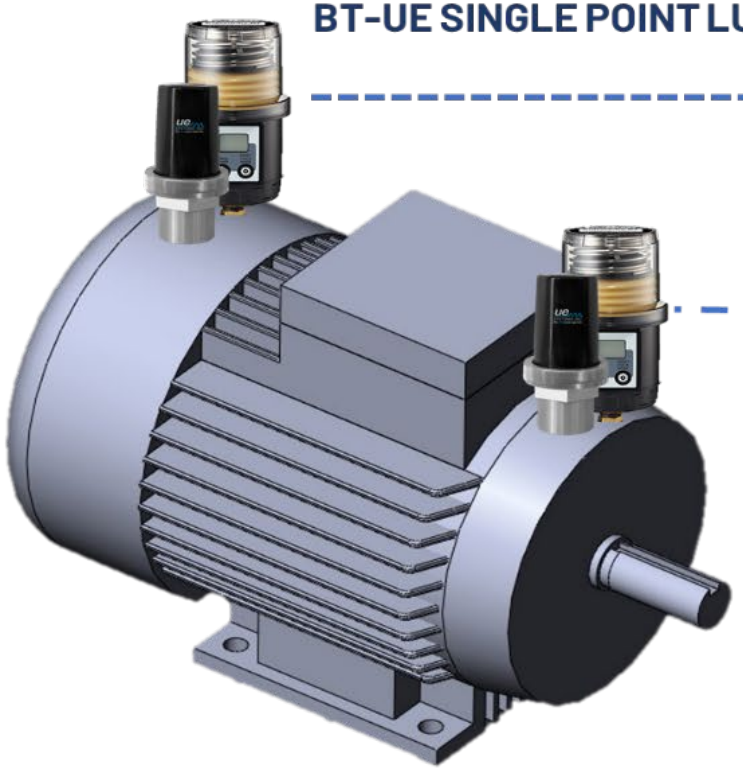
ONTRAK BT
EDGE ANALYTIC GATEWAY

BT-UE
WIRELES SINGLE POINT LUBRICATOR

UE INSIGHTS
CLOUD OR ON PREMESIS DASHBOARD AND ALERTING PLATFORM

950BT
WIRELESS ULTRASOUND, VIRBATION, SPEED AND TEMPERATURE SENSOR

ULTRA-TRAK 950BT SENSOR & BT-UE SINGLE POINT LUBRICATOR



UP TO 1300 FEET

ONTRAK BT GATEWAY

(UP TO 40 DEVICES PER GATEWAY)

ETHERNET
WI-FI
CELLULAR

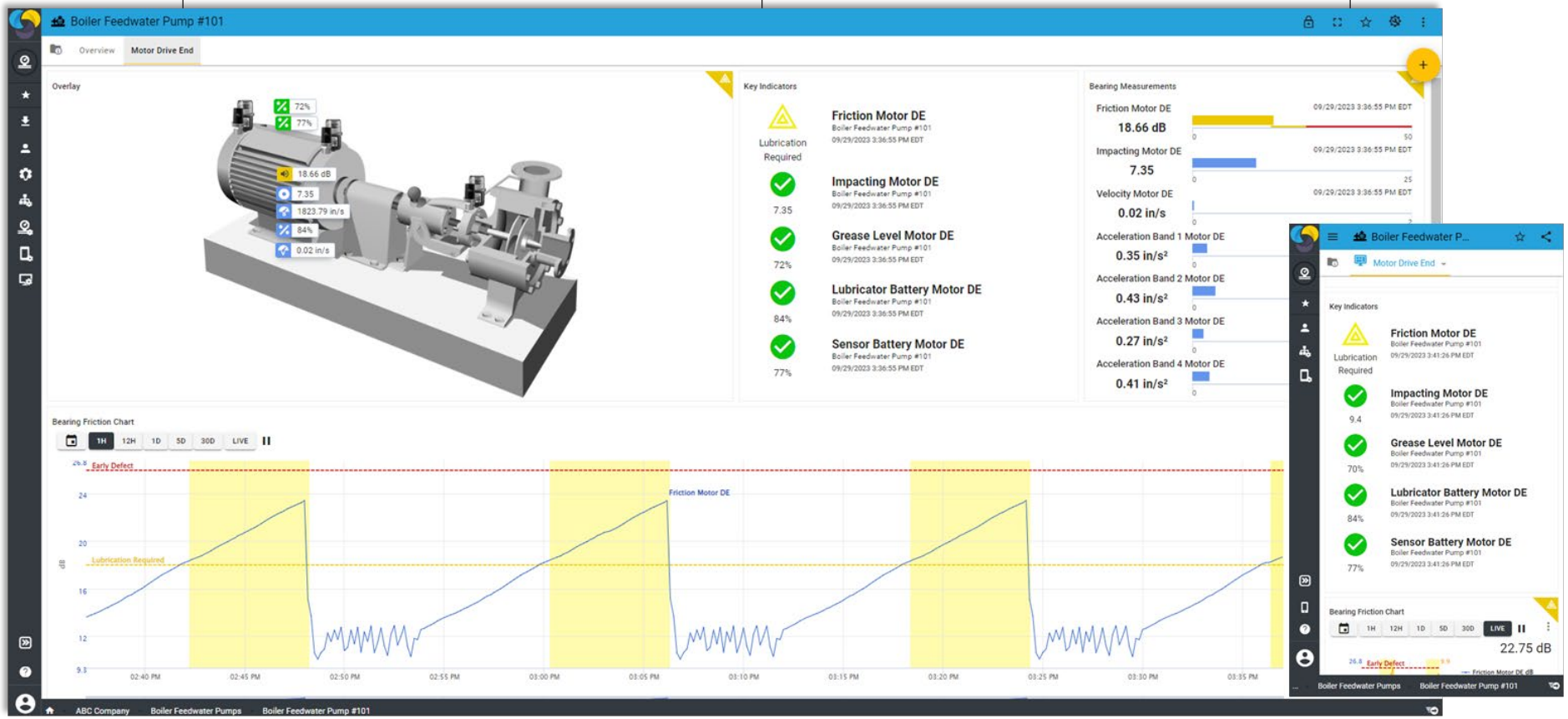
UE INSIGHTS

(CLOUD OR ON PREMISES)

throughout your entire organization.

insights for a complete perspective.

identified issues.



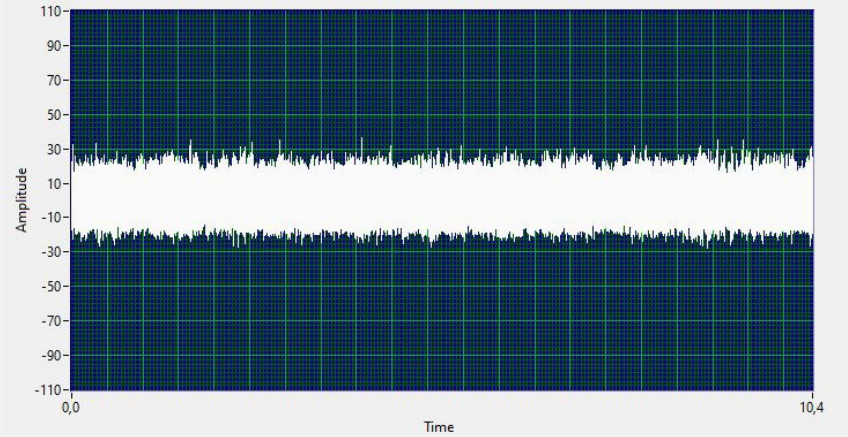
UE SYSTEMS INC
The ultrasound approach

THIS CHANGES EVERYTHING. AGAIN

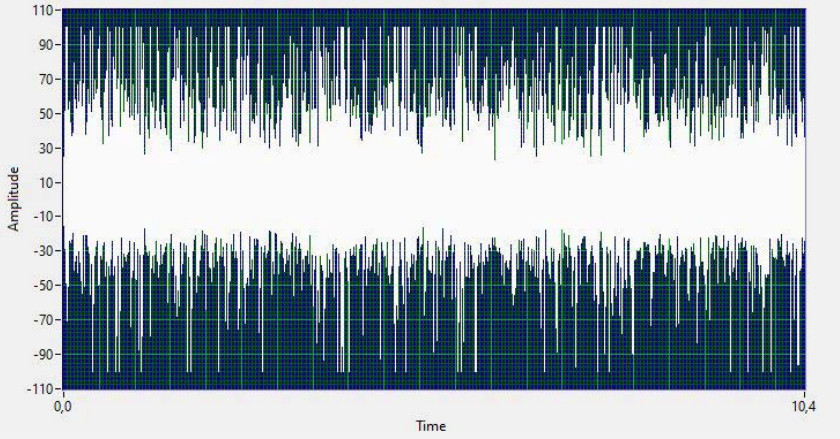
UE SYSTEMS INC

1465 RPM MOTOR 200 kW

BASELINE

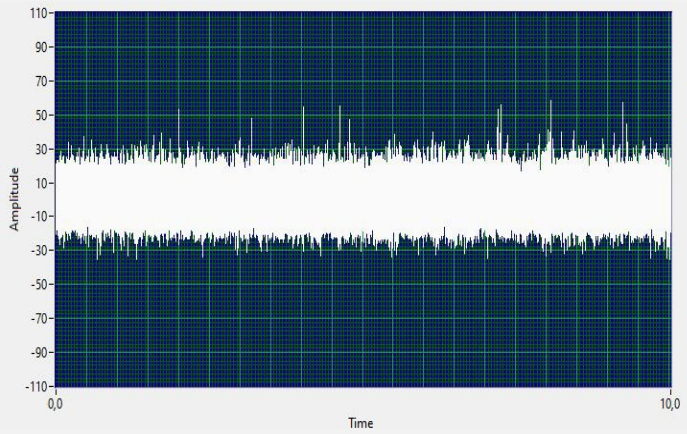


FAULT

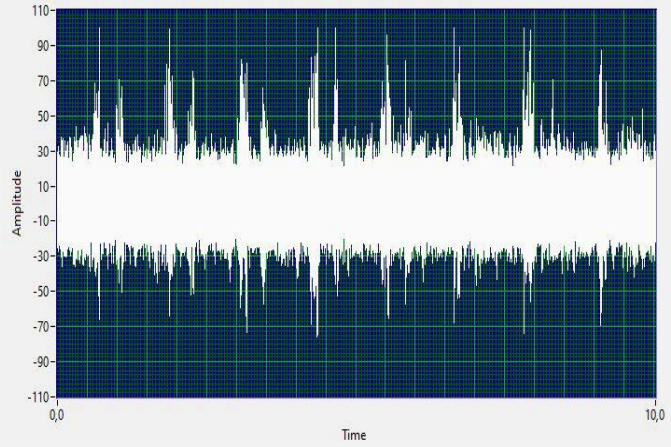


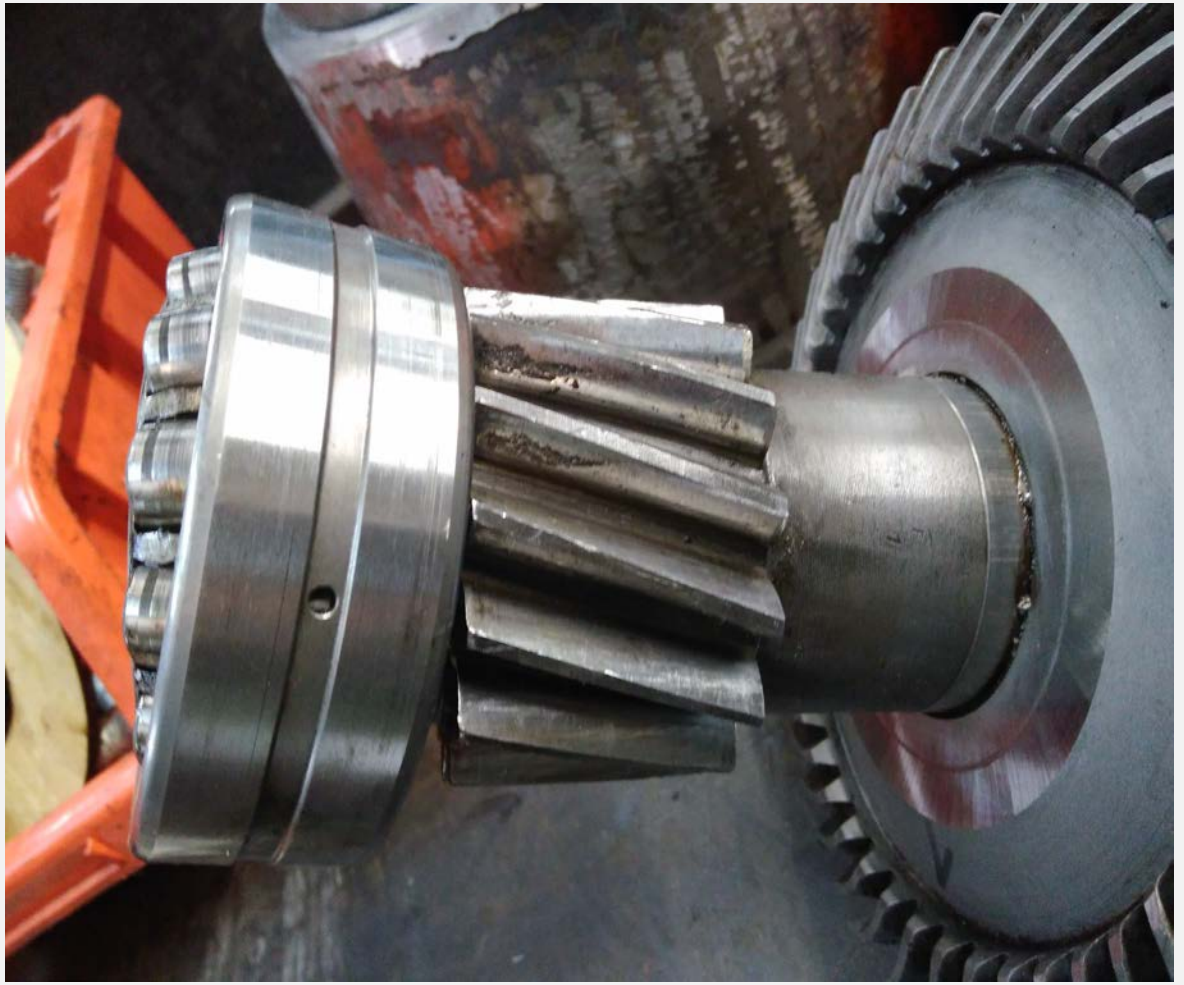
1465/70 RPM GEARBOX

BASELINE



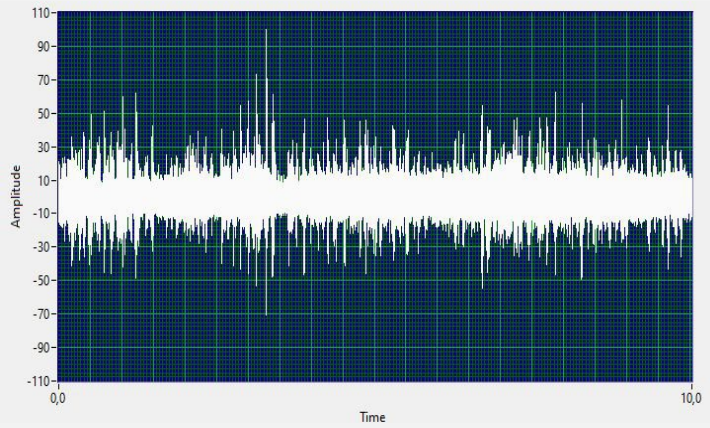
FAULT



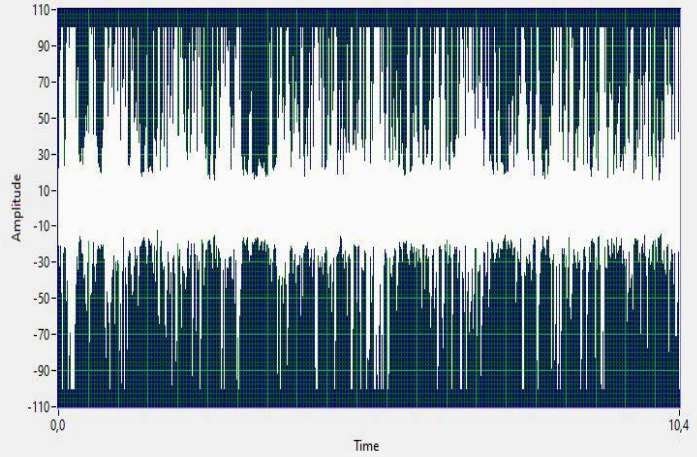


72 RPM BUCKET ELEVATOR

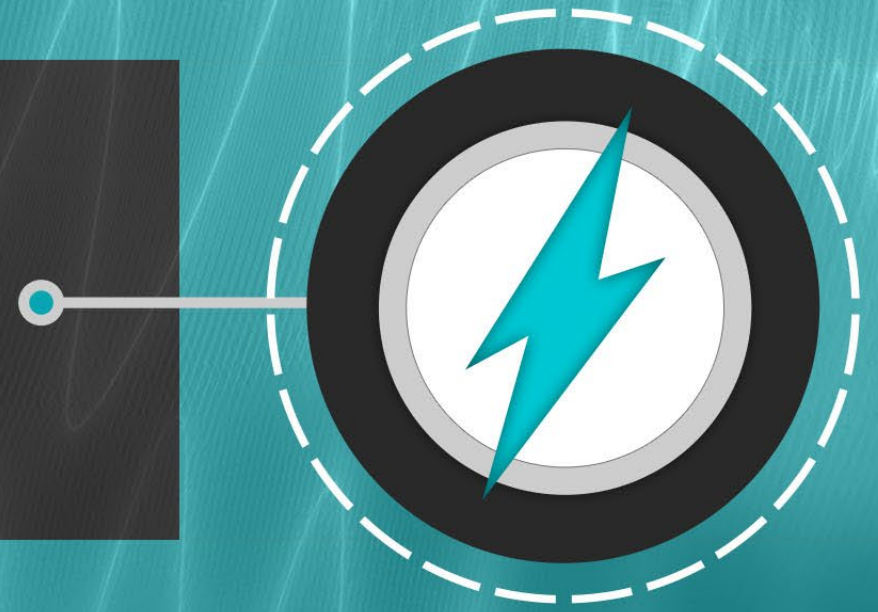
BASELINE



FAULT



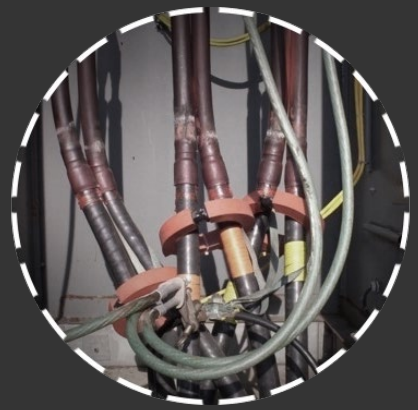
ELECTRICAL
APPLICATION



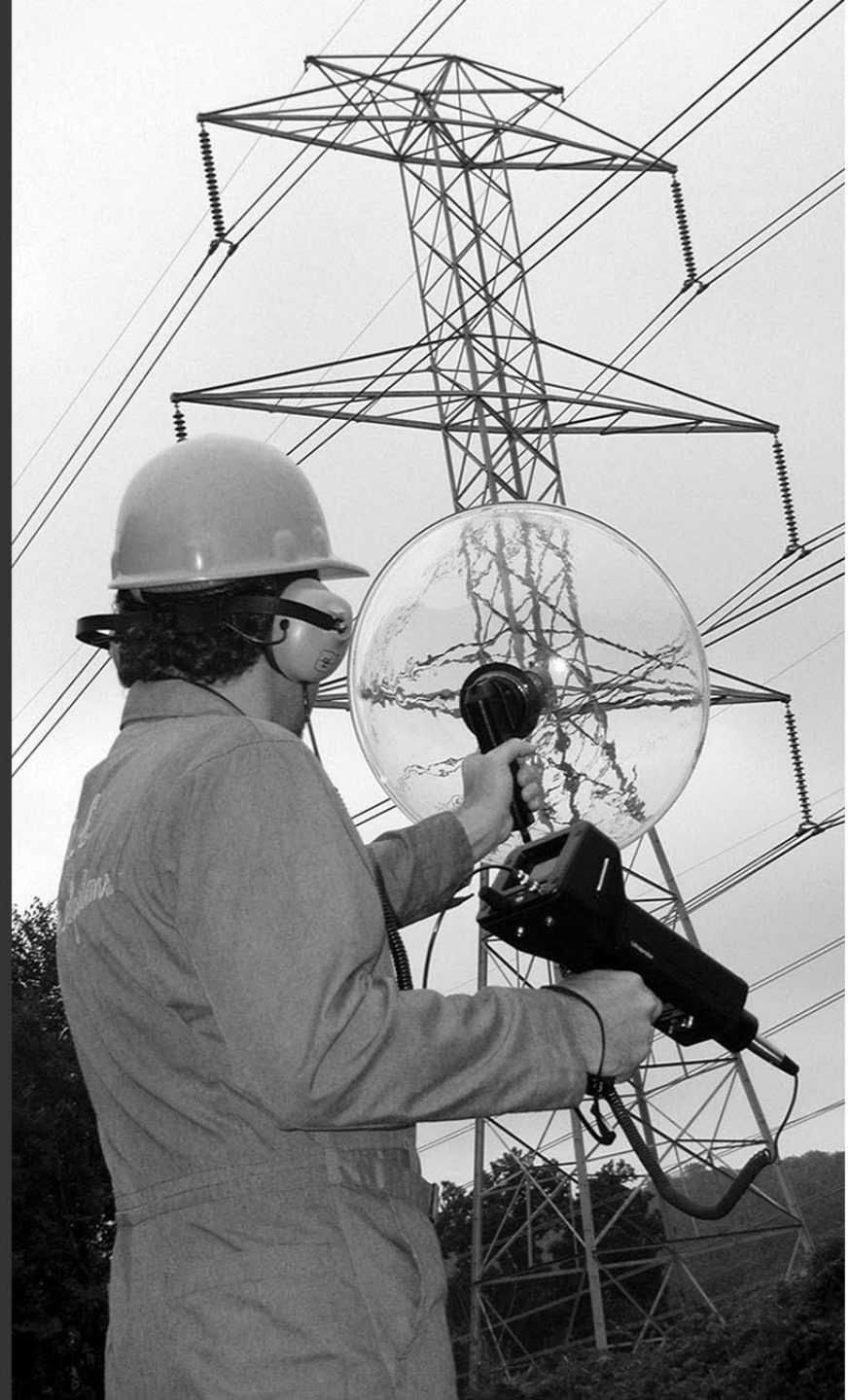
ELECTRICAL INSPECTION

THE ULTRAPROBE WILL FIND EARLY STAGES OF:

- **CORONA**
- **ARCING**
- **TRACKING**
- **MECHANICAL LOOSENESS**



This applies to any type of equipment and can be detected from a distance of up to 30 meters with help of the ***ULTRASONIC WAVEFORM CONCENTRATOR***

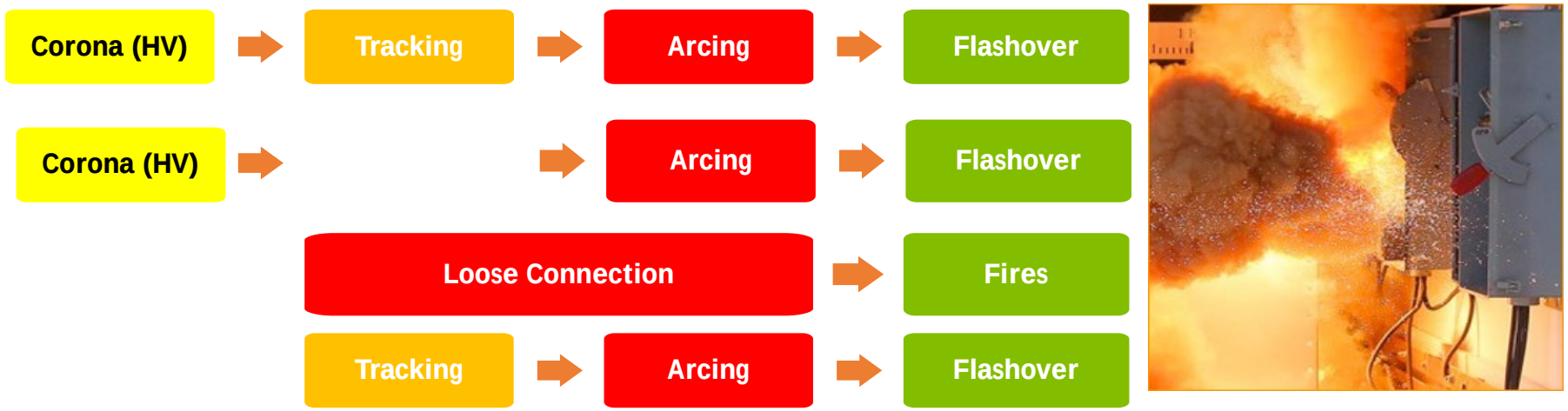


ELECTRICAL INSPECTION

There are situations **IR** is difficult to use for getting a visual line.
For **ULTRASOUND** all we need is an open air connection.

EARLY STAGES OF TRACKING, EVOLVING INTO ARCING.... **INTO CATASTROPHIC FAILURE!**

Electrical Flashovers



Current Mitigation actions:

1. Make sure electrical PMs are conducted
2. Utilize thermography if possible to detect hot spots

Electrical inspection using ultrasonic technology is an efficient method of detecting electrical faults in early stages.

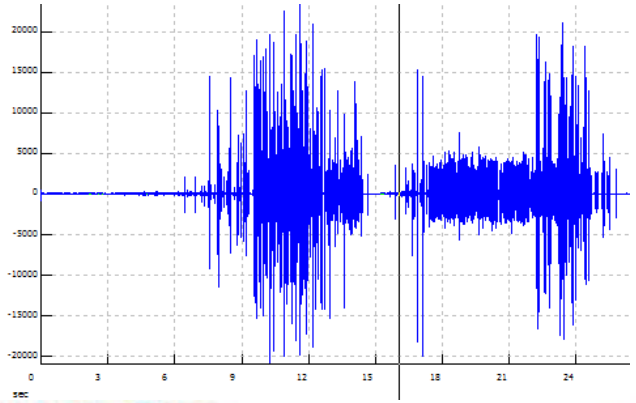
HEAT vs SOUND

Heat - Thermography

- Resistance Dependent anomalies
- Resistance produces Heat
- Loose Connections Resistance (Heat Generated)
- Arcing
- Enclosed Systems with IR Sight Glass

Sound - Ultrasound

- Voltage Dependent anomalies
- Ionization produces Ultrasound
- Corona
- Tracking
- Arcing
- Enclosed Systems

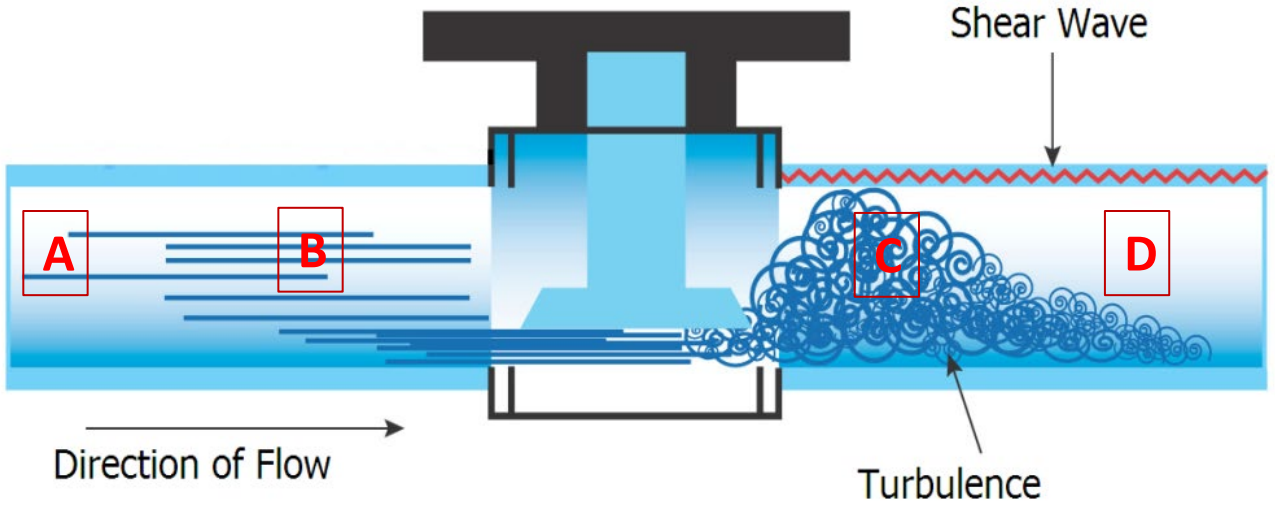


VALVE & STEAM TRAP
APPLICATION

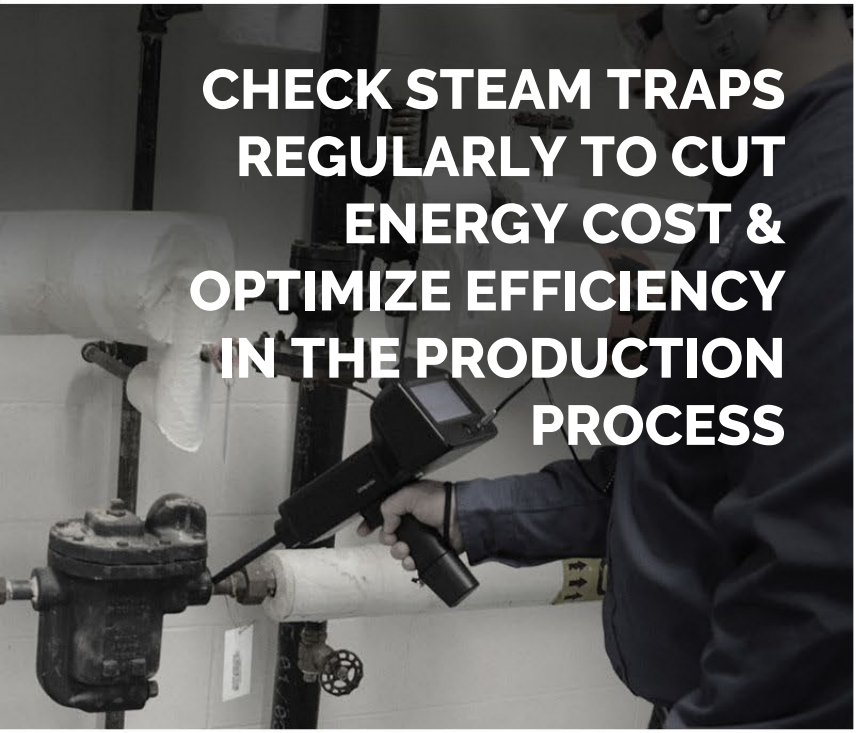
Valve INSPECTION

When Inspecting Valves, a Four Point Technique is Utilized Called the "A,B,C,D and Sometimes E Method".

Four Decibel Values are Assessed to Determine the Source of Turbulence.



STEAM TRAP INSPECTION



Steam systems, an inefficient but necessary form of energy

IT'S EXPENSIVE TO BUILD AND OPERATE....

Testing steam traps while in operation:

- TEST FOR CORRECT OPERATION (MODULATING VALVES)
- TEST FOR LEAKAGE WHEN IN CLOSED CONDITION
- FIND OUT FLOW DIRECTION
- DETERMINE LOCATION OF SOUND EMISSION (CONFIRMING DIAGNOSES)
- REPORT THE STEAM LOSS INTO YEARLY COST REPORTING

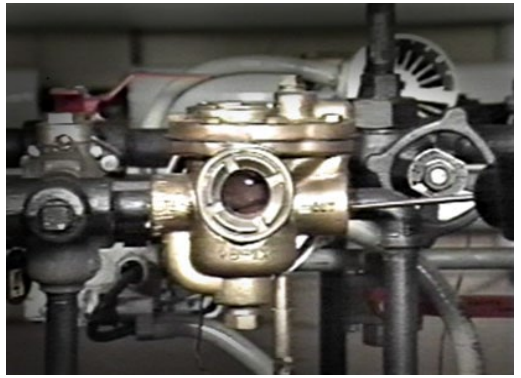
WORKS FOR ALL DIFFERENT TYPES OF STEAM TRAPS:

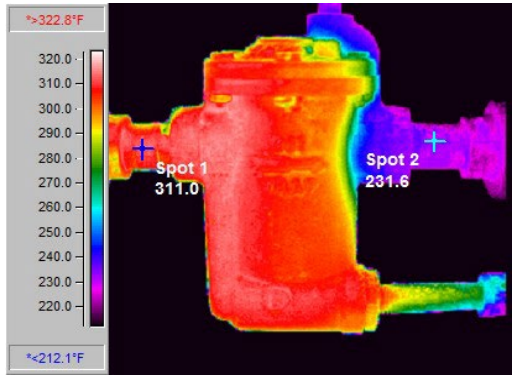
ON/OFF: Inverted bucket, Thermodynamic & Thermostatic valves

CONTINUOUS FLOW: Float & Thermostatic valves

STEAM TRAP INSPECTION

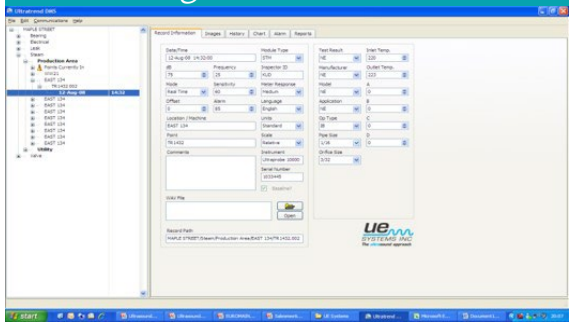
For evaluating steam traps we need **TEMPERATURE** ▶ **ULTRASOUND &**



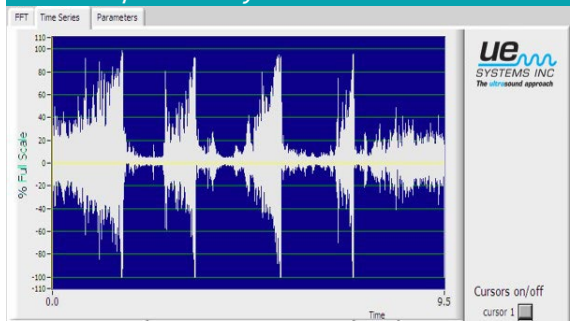


Analyze the condition and report the yearly losses with our **SOFTWARE** ▼

Data management software (DMS)



Spectralyser software



EXAMPLE ▶ **GOOD**

BAD

(note the airflow variation)

LEAK DETECTION
APPLICATION

ULTRASOUND LEAK DETECTION COVERS A WIDE RANGE OF LEAKS

UE SYSTEMS INC
The ultrasound approach

- Leak Detection is the Foundation of Ultrasonic Technology. Referred to as the "Low Hanging Fruit" of waste identification within facilities today.
- Using Ultrasound to Locate, Measure, Quantify, and Repair Leaks can have an immediate impact on Energy Conservation.

AVOID ENERGY LOSS BY FIXING LEAKS

Industry average: 31% of energy use can be avoided by just fixing leaks

EFFICIENCY & SAFETY

Using soap water creates simultaneously a safety hazard & extra work

COMPRESSED AIR LEAK SURVEYS

Report on cost estimation per leak and demonstrate the carbon footprint reduction.

AIR LEAK DETECTION USING ULTRASOUND?


LPG
LNG
STEAM
SOLVENT GAS
SYSTEMS INC
The ultrasound approach

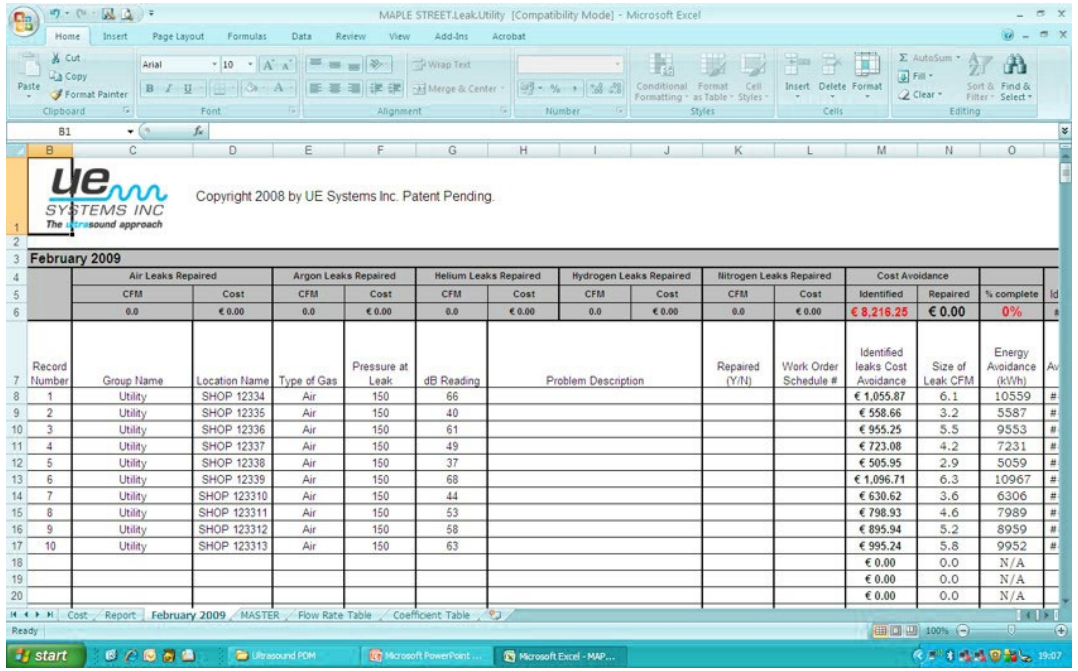
LEAK DETECTION

WHY LEAK DETECTION?

ECONOMICS:
Leaks cost money

ENVIRONMENT:
CO_2 reduction & specialty gasses

SAFETY:
Flammable gasses



Copyright 2008 by UE Systems Inc. Patent Pending.

February 2009

	Air Leaks Repaired		Argon Leaks Repaired		Helium Leaks Repaired		Hydrogen Leaks Repaired		Nitrogen Leaks Repaired		Cost Avoidance			
	CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	CFM	Cost	Identified	Repaired	% complete	
	0.0	€ 0.00	0.0	€ 0.00	0.0	€ 0.00	0.0	€ 0.00	0.0	€ 0.00	€ 8,216.25	€ 0.00	0%	

Record Number	Group Name	Location Name	Type of Gas	Pressure at Leak	dB Reading	Problem Description	Repaired (Y/N)	Work Order Schedule #	Identified leaks Cost Avoidance	Size of Leak CFM	Energy Avoidance (kWh)	Av
1	Utility	SHOP 12334	Air	150	66				€ 1,055.87	6.1	10559	#
2	Utility	SHOP 12335	Air	150	40				€ 558.66	3.2	5587	#
3	Utility	SHOP 12336	Air	150	61				€ 955.25	5.5	9553	#
4	Utility	SHOP 12337	Air	150	49				€ 723.08	4.2	7231	#
5	Utility	SHOP 12338	Air	150	37				€ 505.95	2.9	5059	#
6	Utility	SHOP 12339	Air	150	68				€ 1,096.71	6.3	10967	#
7	Utility	SHOP 123310	Air	150	44				€ 630.62	3.6	6306	#
8	Utility	SHOP 123311	Air	150	53				€ 798.93	4.6	7989	#
9	Utility	SHOP 123312	Air	150	58				€ 895.94	5.2	8959	#
10	Utility	SHOP 123313	Air	150	63				€ 995.24	5.8	9952	#
									€ 0.00	0.0	N/A	
									€ 0.00	0.0	N/A	
									€ 0.00	0.0	N/A	

Our digital Ultraprobes can report the cost per leak!

FIND IT ▶ TAG, RECORD & PICTURE ▶ REPORT!

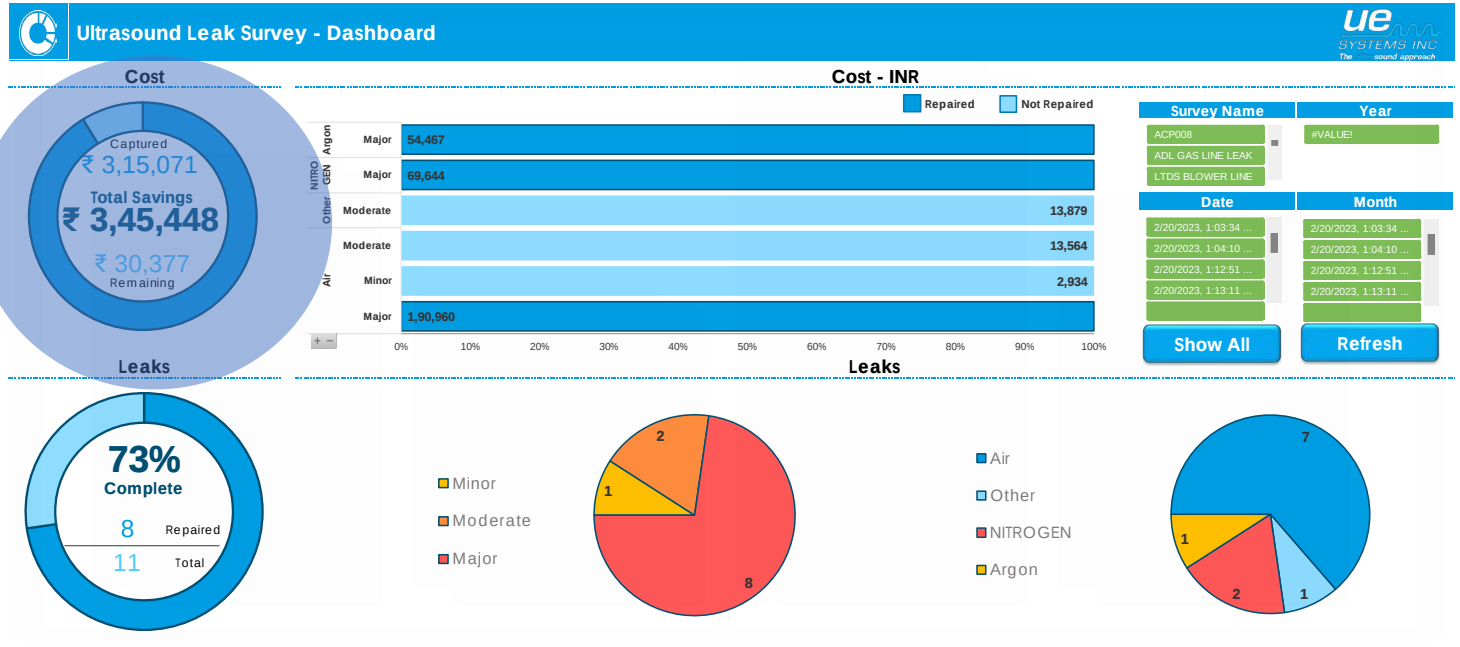
▶ THERE IS A FREE APP FOR THAT

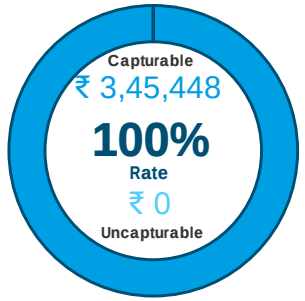
Get it on iTunes

Get it on Google play

SHOWING ROI

Images	Date	Survey Name	Location Name	Gas	Distance	dB	Leak Size (CFM)	Serial #	Tag #	Repaired	Severity	Leak Cost	Energy/Emissions Avoidance			
													Energy (kWh)	CO2 (lb)	NOx (lb)	SO2 (lb)
	2/20/2023, 4:39:44 PM	VT 102	UTILITY	Air	5.00	19	0.28	AC13U131			Minor	$ 2,934.33	489	223	0	0
	2/20/2023, 4:50:25 PM	VT 101	UTILITY	Air	10.00	35	1.31	AC13U131			Moderate	$ 13,563.71	2,261	1,031	1	0
	2/20/2023, 1:13:11 PM	NGP002	UTILITY	Air	2.00	62	2.41	AC13U131		✓	Major	$ 24,980.29	4,163	1,898	2	0
	2/20/2023, 1:03:34 PM	LTDS BLOWER LINE	UTILITY	Air	10.00	49	2.78	AC13U131		✓	Major	$ 28,801.60	N/A	N/A	N/A	N/A
	2/20/2023, 1:04:10 PM	LTDS BLOWER LINE	UTILITY	Air	10.00	51	3.23	AC13U131		✓	Major	$ 33,508.99	N/A	N/A	N/A	N/A
	2/20/2023, 1:15:55 PM	ACP008	UTILITY	Air	2.00	69	3.71	AC13U131		✓	Major	$ 38,539.96	4,800	2,189	2	0
	2/20/2023, 12:34:41 PM	NITROGEN LEAK	UTILITY	Air	10.00	62	6.28	AC13U131		✓	Major	$ 65,129.57	5,585	2,547	2	0
	2/20/2023, 12:56:38 PM	MAIN STEAMLINE SRS	UTILITY	Other	100.00	8	2.64	AC13U131			Moderate	$ 13,878.52	6,423	2,929	3	0
	2/20/2023, 1:16:47 PM	NGP002	UTILITY	NITROGEN	2.00	64	2.72	AC13U131		✓	Major	$ 28,614.92	N/A	N/A	N/A	N/A
	2/20/2023, 1:12:51 PM	NGP002	UTILITY	NITROGEN	2.00	70	3.90	AC13U131		✓	Major	$ 41,028.67	N/A	N/A	N/A	N/A
	2/20/2023, 5:05:53 PM	ADL GAS LINE LEAK	UTILITY	Argon	10.00	55	4.15	AC13U131		✓	Major	$ 54,467.16	10,855	4,950	5	1





Energy/Emissions Avoidance

	Energy (kWh)	CO2 (lb)	NOx (lb)	SO2 (lb)
Not Repaired	2,750	1,254	1	0
Repaired	31,827	14,513	14	2
	34,576	15,767	15	2

Identified CFM Total

Type of Gas	Not Repaired	Repaired	Total
Air	1.6	18.4	20.0
Other	2.6		2.6
NITROGEN		6.6	6.6
Argon		4.1	4.1
			0.0
	4.2	29.2	33.4

Case Study 3 Food Processing Plant

- Industry: Food Processing Plant
- No. of compressors: 11 Compressors
- No of Leaks: 206 Leaks
- Energy Cost: 0.3 AED/KWH
- Pressure: 7 Bar
- Operation: 365 Days/Yr
- Job Duration: 4 Days, 6 Hours/Day
- Savings (ROI): 409,876 SAR

	Air Leaks Repaired		Cost Avoidance			NO Identified	SO_2 Identified	Identified LPM Total			
	LPM	Cost	Identified	Repaired	% Complete	1894289	6947279	26269.9			
	0.0	$0.00	$112,295.57	$0.00	0%						
Record Number	Group Name	Location Name	Type of Gas	Pressure at Leak	dB Reading	Hours Per Day	Days Per Year	Repair Difficulty	Identified Leaks Cost Avoidance	Size of Leak (LPM)	Energy Avoidance (kWh)
1	compressors	COMP ROO	Air	7	55	24	365	1	$463.75	108.5	6625
2	compressors	COMP ROO	Air	7	41	24	365	1	$307.34	71.9	4391
3	compressors	COMP ROO	Air	7	43	24	365	1	$328.54	76.9	4693
4	compressors	COMP ROO	Air	7	59	24	365	1	$511.66	119.7	7309
5	compressors	COMP ROO	Air	7	54	24	365	1	$451.98	105.7	6457
6	compressors	COMP ROO	Air	7	55	24	365	1	$463.75	108.5	6625
7	compressors	COMP ROO	Air	7	51	24	365	1	$417.21	97.6	5960
8	compressors	COMP ROO	Air	7	55	24	365	1	$463.75	108.5	6625
9	compressors	COMP ROO	Air	7	48	24	365	1	$383.25	89.7	5475
10	compressors	COMP ROO	Air	7	53	24	365	1	$440.30	103.0	6290
11	compressors	COMP ROO	Air	7	61	24	365	1	$536.11	125.4	7659
12	compressors	COMP ROO	Air	7	66	24	365	1	$598.64	140.0	8552
13	compressors	COMP ROO	Air	7	54	24	365	1	$451.98	105.7	6457
14	compressors	COMP ROO	Air	7	65	24	365	1	$585.98	137.1	8371
15	compressors	COMP ROO	Air	7	66	24	365	1	$598.64	140.0	8552
16	compressors	COMP ROO	Air	7	68	24	365	1	$624.20	146.0	8917
17	compressors	COMP ROO	Air	7	72	24	365	1	$676.22	158.2	9660
18	compressors	COMP ROO	Air	7	72	24	365	1	$676.22	158.2	9660
19	compressors	COMP ROO	Air	7	59	24	365	1	$511.66	119.7	7309
20	compressors	COMP ROO	Air	7	51	24	365	1	$417.21	97.6	5960
21	compressors	COMP ROO	Air	7	44	24	365	1	$339.29	79.4	4847
22	compressors	COMP ROO	Air	7	23	24	365	1	$136.79	32.0	1954
23	compressors	COMP ROO	Air	7	29	24	365	1	$189.24	44.3	2703
24	compressors	COMP ROO	Air	7	62	24	365	1	$548.46	128.3	7835
25	compressors	COMP ROO	Air	7	38	24	365	1	$276.32	64.6	3947
26	compressors	COMP ROO	Air	7	67	24	365	1	$611.38	143.0	8734
27	compressors	COMP ROO	Air	7	67	24	365	1	$611.38	143.0	8734
28	compressors	COMP ROO	Air	7	50	24	365	1	$405.80	94.9	5797
29	compressors	COMP ROO	Air	7	48	24	365	1	$383.25	89.7	5475
30	compressors	COMP ROO	Air	7	56	24	365	1	$475.60	111.3	6794

MAESTRO

One Technology cannot do everything, while successful integration between different technologies will give you a clear picture and high confidence level before taking the action

using the right technology in the right time will lead you to take the right action

Thank you

Ahmed Moataz
Middle East North Africa & Turkey Regional Manager
Ahmedm@UESystems.com
UE SYSTEMS USA INC.
+966532812135
+971558486162
+201000036430

Thank you

Ahmed Moataz
Middle East North Africa & Turkey Regional Manager
Ahmedm@UESystems.com
UE SYSTEMS USA INC.
+966532812135
+971558486162
+201000036430