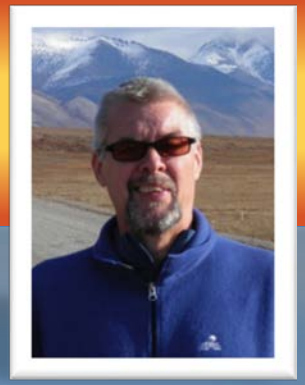
TrendWords
Contextual Failure Analysis

Brings the power of a contextual search to your trend analysis.

PFS

- PFS is a woman-owned / employee-owned, small business located in Littleton, CO
- We are a Facilities Support, Logistics and Project Management Company
- We specialize in remote locations across the Arctic, the US and Pacific

Jeff Wahl, CMRP



- Applies reliability concepts to improve equipment availability & reduce safety incidents
- Develops, designs, & manages CMMS to ensure reliable assets & facilities in Alaska, Greenland.
- Develops Lifecycle Replacement Program for customer assets and budgeting.
- Specializing in creative solutions

"Maintaining equipment in general industry is not the same as maintaining equipment in the Arctic. Much of equipment maintenance is about context, and this is a whole different context."

What is *CFA?*

- CFA allows for quick and dynamic analysis of Work Orders
- Highlights systemic failures in and across Sites, Facilities, Systems and Equipment
- *CFA does what failure codes can't*

Failure Code PCR Examples

Problem	
PC01	NO FAILURE-ACCEPTABLE
PC02	ADJUSTMENT-ALIGNMENT-VIBRATION
PC03	FAILS TO OPERATE-NO POWER-SHUTS DOWN
PC04	FROZEN-ICE BUILDUP-HEATER FAILURE
PC05	LEAKS-NOISY
PC06	OVERHEATED-BURNED-SHORTED
PC07	RUSTED-CORRODED-ROUGE
PC08	WORN-BROKEN-PITTED-DAMAGED-RUPTURED
PC09	OTHER: DOCUMENT ON WORK ORDER

Cause	
CC01	NORMAL WEAR
CC02	CORROSION-BUILDUP-EXCESSIVE MOISTURE
CC03	DEFECTIVE COMPONENT-WRONG MATERIAL
CC04	FATIGUE-OVER-PRESSURIZED-OBSTRUCTED
CC05	FAULTY DESIGN OR INSTALLATION-GALLED
CC06	IMPROPER ADJUSTMENT-ALIGNMENT-TENSION
CC07	LOOSE-PINCHED
CC08	MISSING COMPONENT-PROGRAMMING ERROR
CC09	POWER FAILURE-SURGE-OVERHEATED-SHORTED
CC10	OTHER: DOCUMENT ON WORK ORDER

Remedy	
RC01	CLEAN-POLISH-PASSIVATE
RC02	LUBRICATE
RC03	REDESIGN REQUIRED-REPROGRAM
RC04	REPAIR-REBUILD
RC05	REPLACE
RC06	TIGHTEN-LOOSEN-ADJUST- ALIGN
RC07	OTHER: DOCUMENT ON WORK ORDER

The time spent assigning codes when repairs crossed multiple categories was enormous.

Reliability Initiative

Monthly Analysis of Work Order Failure Codes

Using failure codes to identify related failures did not work for us.

I wanted to understand why...

Failure Code Design

Failure codes are applied in broad categories.
(Broad categories work against your failure analysis)

Subjective interpretation because focus is on the immediate repair.

Speculation means sometimes the answer will be right, sometimes wrong.

Correcting misapplied failure codes on closed work orders is costly and very time consuming.

Failure Code Flow Chart

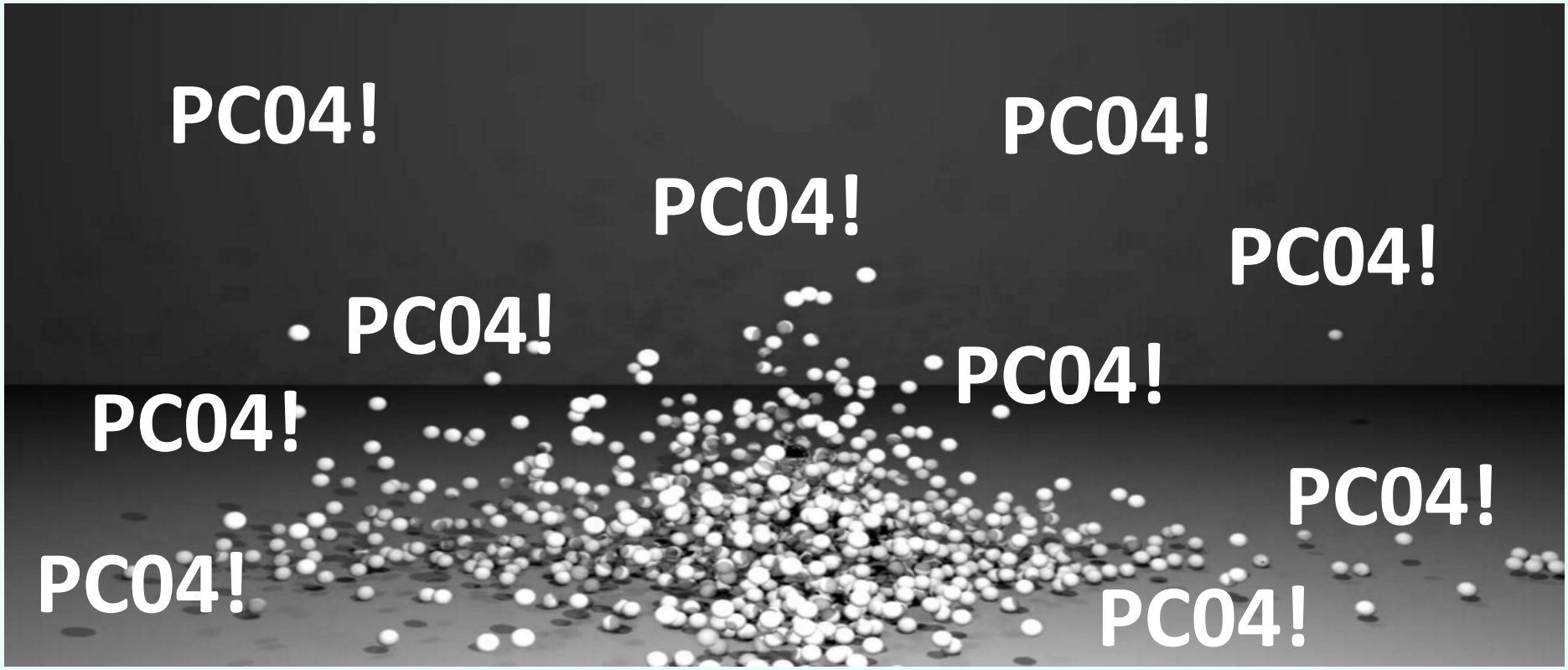
Vertically applied failure analysis is slow…

PC04!

CC04!

RC01!

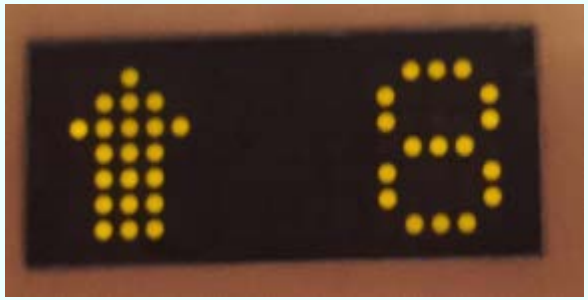
RC01!

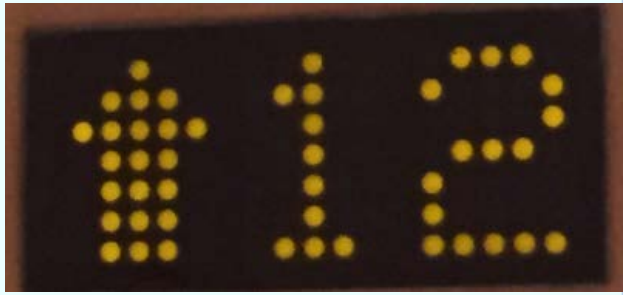


Common Cause Failure Analysis applies corrective actions across like-equipment for accelerated payback.

Did you hear the one about?

Real Life: Three reliability engineers at the International Maintenance Conference get on an elevator…





Guy #1 pushes the button for the 8th floor.

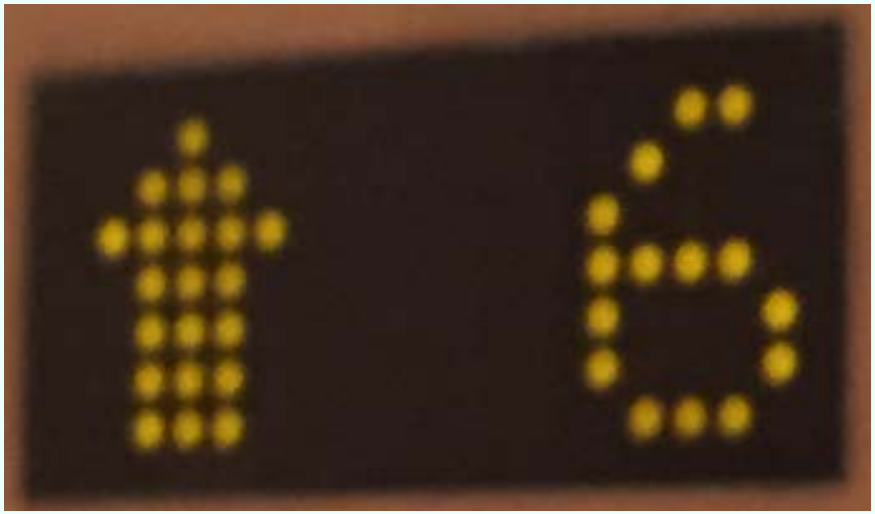
Guy #2 pushes the button for the 10th floor.

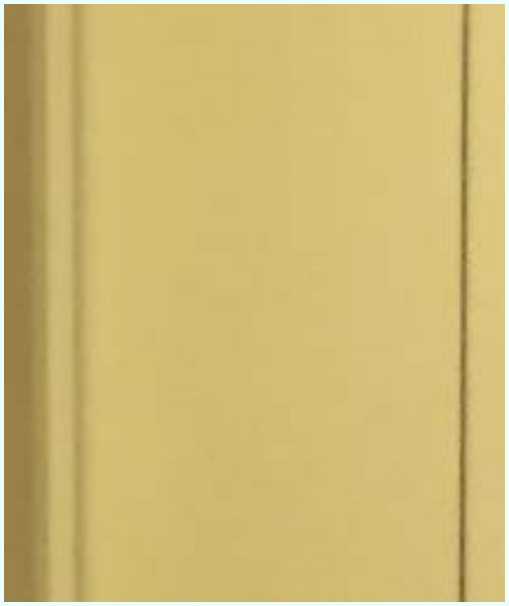
Guy #3 pushes the button for the 12th floor.

The elevator stops and guy #1 starts to step out, but then stutter steps in a confused fashion.

He is trying to reconcile the floor numbers he sees. Floor #8 on the light. Floor #6 on the placard. He looks back and forth several times.

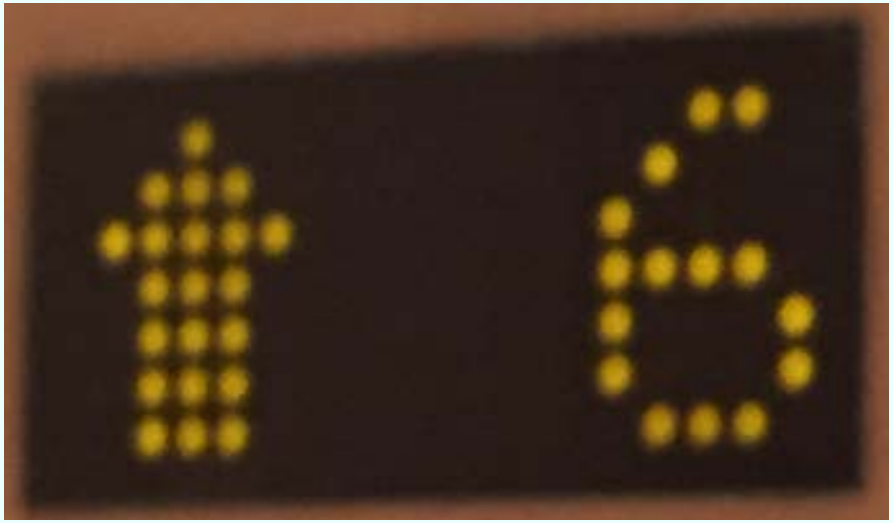
Guy #2 wonders if the Guy #1 had too much to drink tonight because of what he sees.





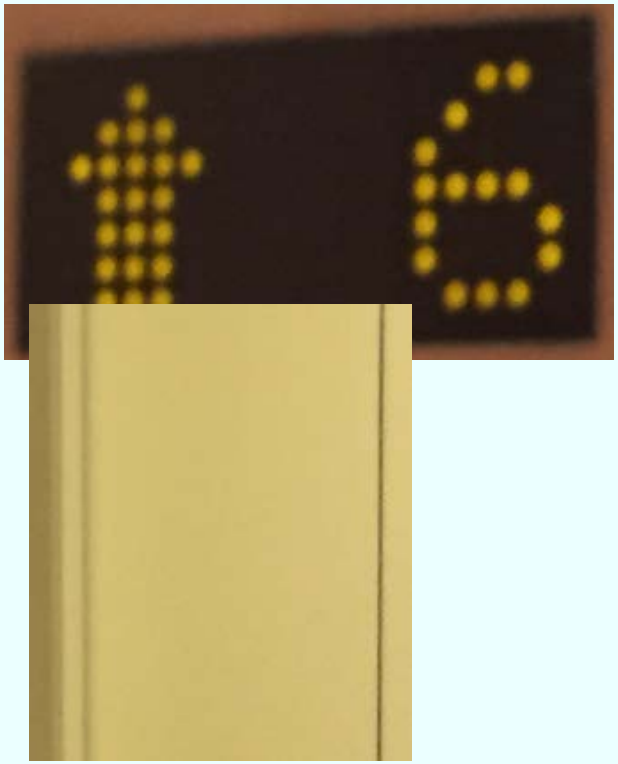
Guy #2 sees floor #6 on the light and no placard at all on the elevator door frame.

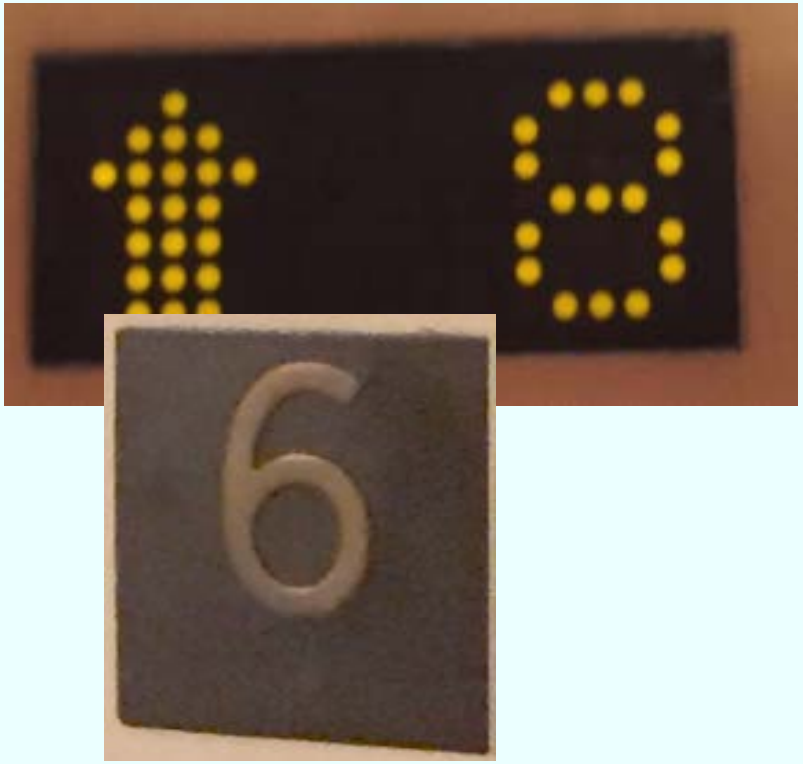
Guy #3 has a better vantage point and exclaims, “Hey look. The floor indicator lights are 2 floors off from one another!”



And because reliability guys do their best work after a few beers… they get out to investigate.

They laugh it off as they interpret their problem codes for what just happened.





This is the way real life works. We're not in the movies. Who's problem codes would be right?

Credits: Real life – The Failure

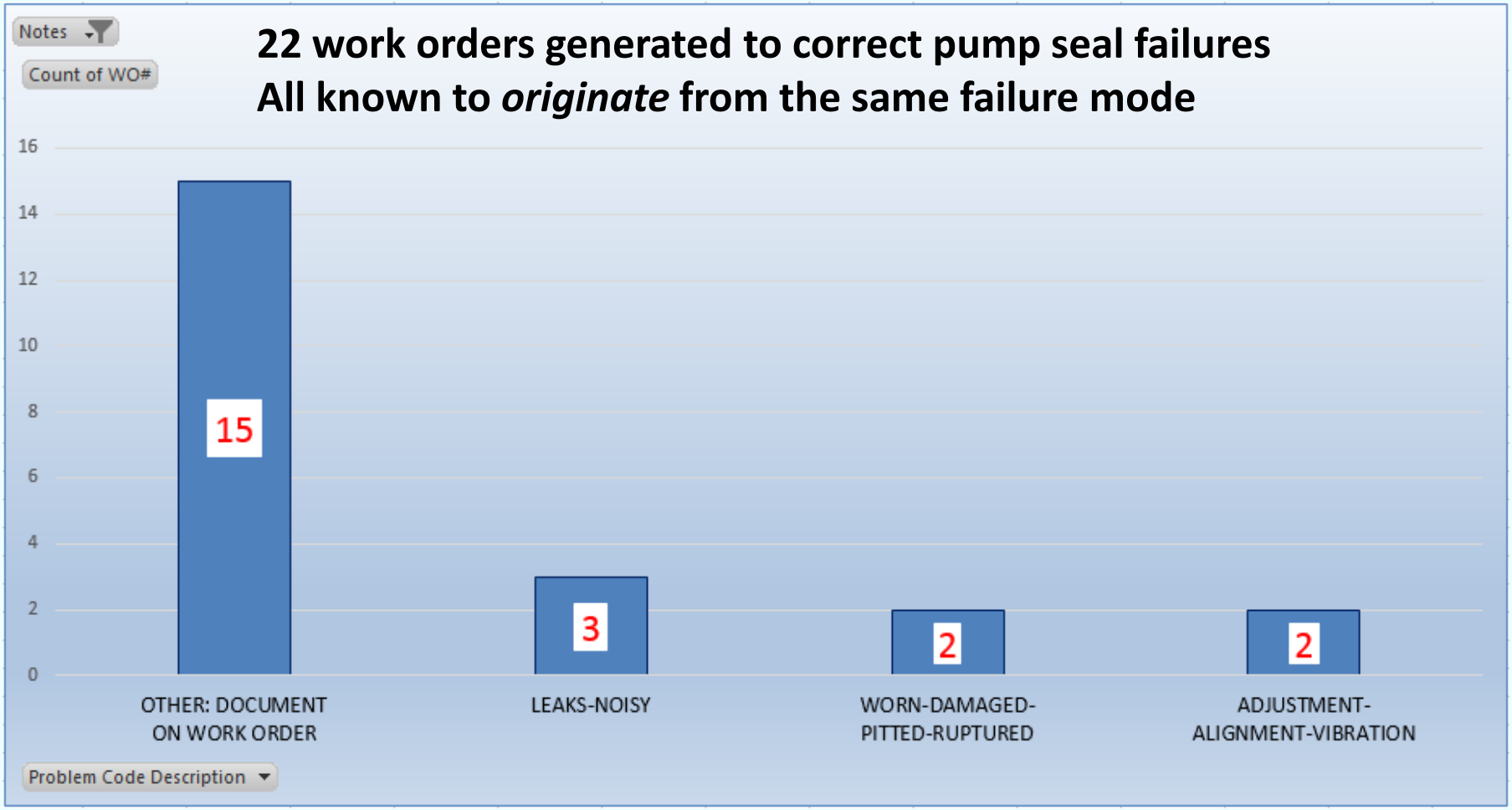
RE #1 was played by (name?). Please step up if you happen to be in the audience.

RE #2 was played by Jeff Wahl.

RE #3 was played by Malcolm Hide.

Disclaimer: No reliability engineers were harmed during the investigation of this failure.

Case Study



Inconsistently applied codes makes failure trending extremely difficult

Text-based Trend Analysis...

By adding “Document on WO”,
maintenance crafts were required to:

1) Explain their actions in concise, natural language
2) Select Failure-Cause-Remedy codes

Text-Based Analysis is a more natural way to find failures

OTHER: DOCUMENT
ON WORK ORDER

I needed a way to decipher text into meaningful data with…

...the simplicity of a word search...

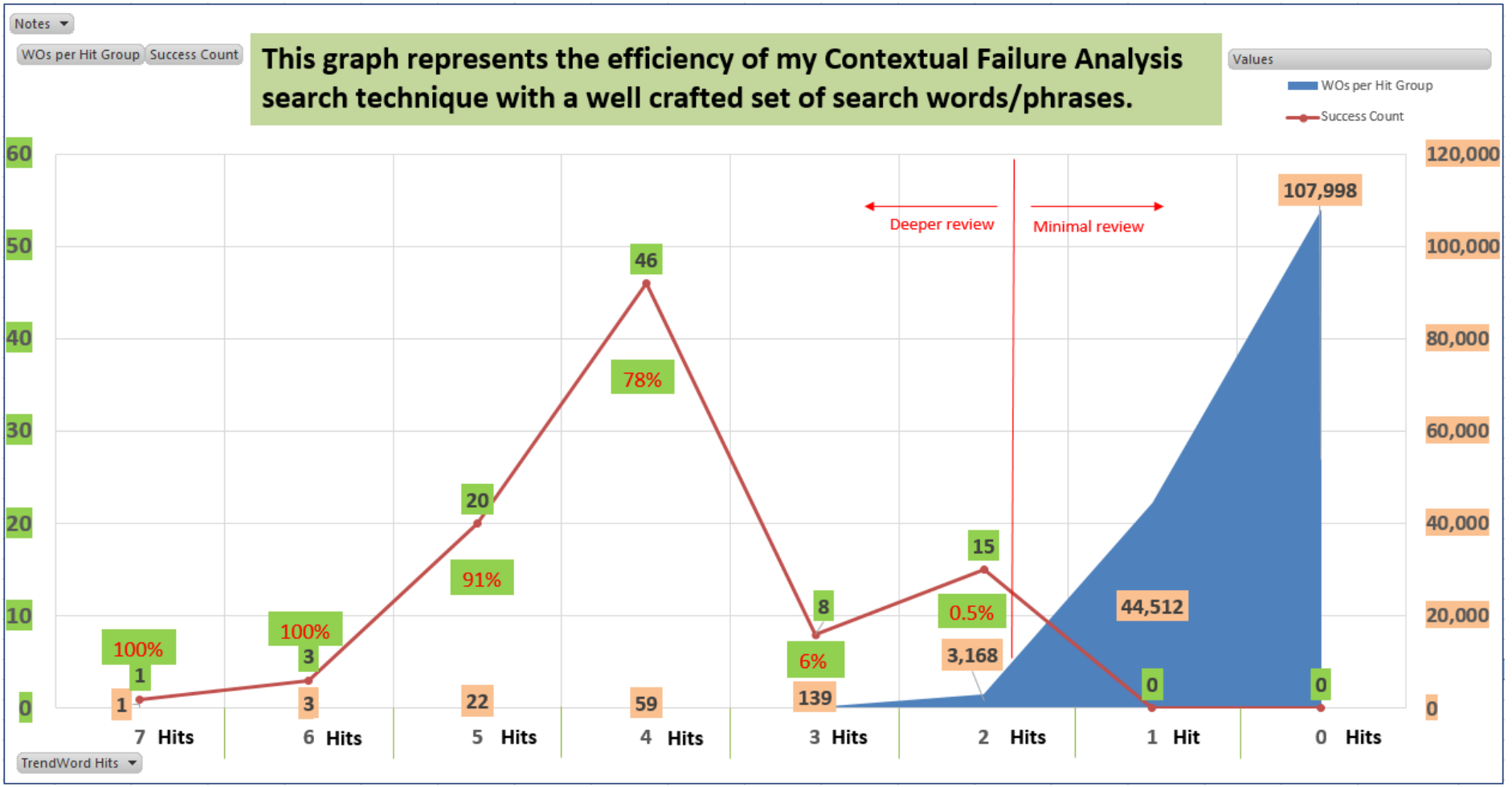
1. Define your keywords.
2. Review your results.

3. Identify failure trend notes.
4. Clear, refine, repeat...

...and flexible...

Multilingual Support	Hello	Welcome	Thank you
English	Hello	Welcome	Thank you
Chinese (Simplified)	您好	欢迎	谢谢
Chinese (Traditional)	你好	歡迎	謝謝
Danish	Hej	velkommen	Tak
Italian	Ciao	Ben arrivata	grazie
Spanish	Hola	Bienvenida	Gracias
Dutch	Hallo	welkom	Dankjewel
Portuguese	Olá	bem-vindo	obrigado
Japanese	こんにちは	ようこそ	ありがとう
Icelandic	Hello	Velkomin	Þakka þér fyrir
German	Hallo	Herzlich Willkommen	Danke
Finnish	Hei	Tervetuloa	Kiitos
Irish	Dia duit	Fáilte	Go raibh maith agat
Korean	안녕하세요	환영	고맙습니다
Mongolian	Сайн уу	тавтай морилно уу	та бүхэнд баярлалаа
Polish	Halo	Witam	Dziękuję
Romanian	Alo	Bine ati venit	Multumesc
Russian	Здравствуйте	Добро пожаловат	спасибо
Persian	سلام	خوش آمدی	متشکرم
French	Bonjour	Bienvenue	Merci
Greek	Χαίρετε	Καλώς ήλθατε	Ευχαριστώ

…and efficient…



Every successfully identified work order line represents an opportunity.

…the familiarity of a spreadsheet…

Notes	N	WORKTYPE	FAILURE CODE	ACTUAL TOTAL COST	CRAFT	Keyword Count
Cooling Problem	IT REPAIR EE POC	URGENT		$83	RA	6
Cooling Problem	IT REPAIR EE POC	URGENT		$413	RA	6
Cooling Problem	IT REPAIR EE POC	URGENT		$2,615	RA	6
Cooling Problem	AC UNIT EAKER &	EMERGENCY		$412	EN	6
Cooling Problem	AC UNIT EAKER &	EMERGENCY		$412	EN	6
Cooling Problem	HANGE FFICE : HVAC	EMERGENCY		$618		6
Cooling Problem	MOTOR	EMERGENCY		$1,341	RA	6
Cooling Problem	MOTOR	ROUTINE		$36	RA	6

- [x] (Select All)
- [x] A/C;
- [x] A/C; AC; Building; No; Not working;
- [x] A/C; AC; Compressor; Replace;
- [x] A/C; Breaker; Circuit; INOP; Inop; No; Pin; Trip;
- [x] A/C; Breaker; Pin; Repair; Trip; Trouble;
- [x] A/C; Building;
- [x] A/C; Hot; Repair;
- [x] A/C; INOP; Inop; No;
- [x] A/C; INOP; Inop; No; UPS;
- [x] A/C; No;
- [x] A/C; No; Not working;
- [x] A/C; No; Not working; Repair;

Traditional filters add another level of intelligence to CFA

The benefits of working with the gear ratio rather than against

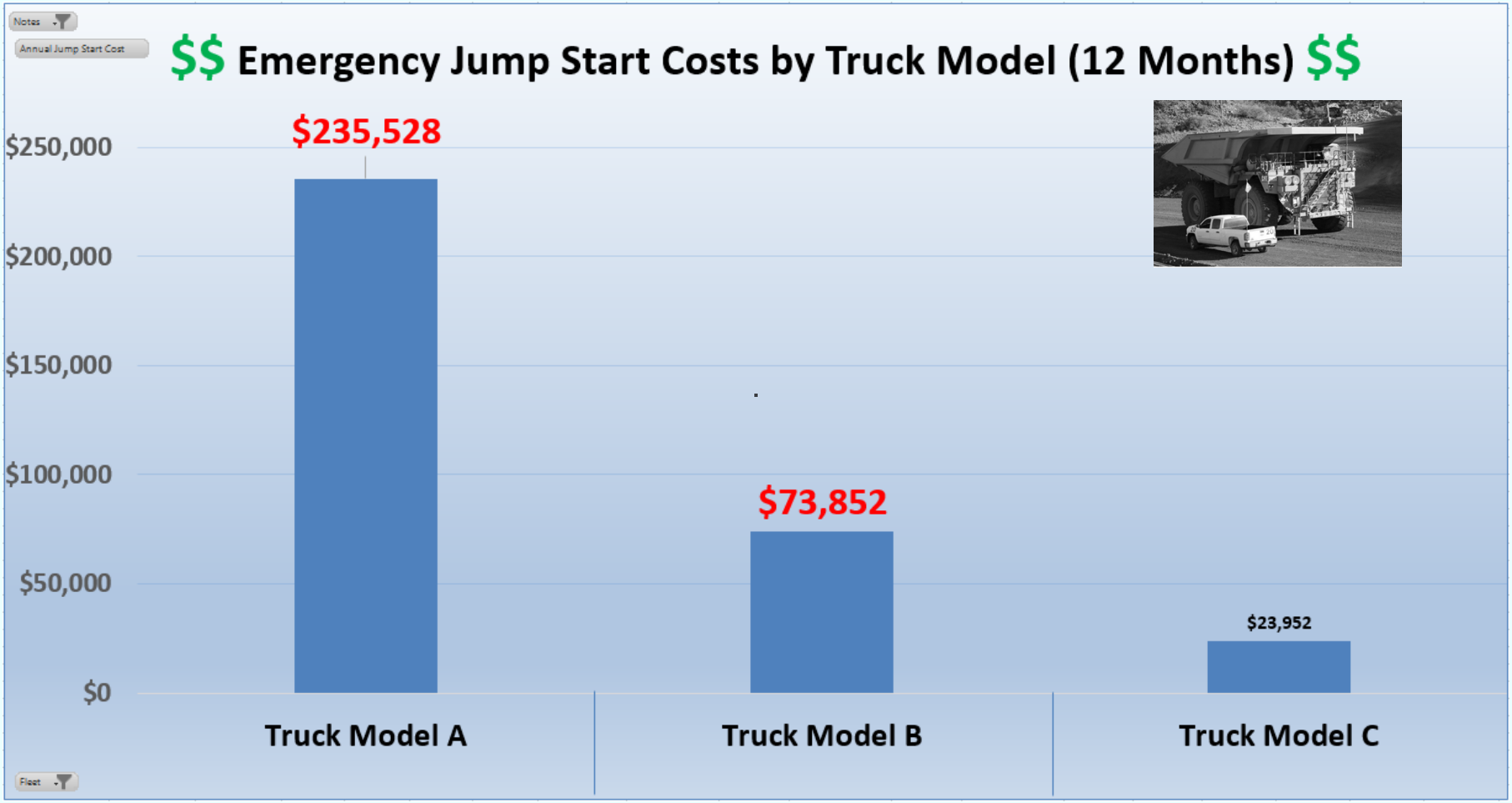
CFA Pivot Charts

- Tell the financial story (strategic)
- Drive the problem down to the individual units (tactical)

Apply the 80/20 rule to focus your efforts

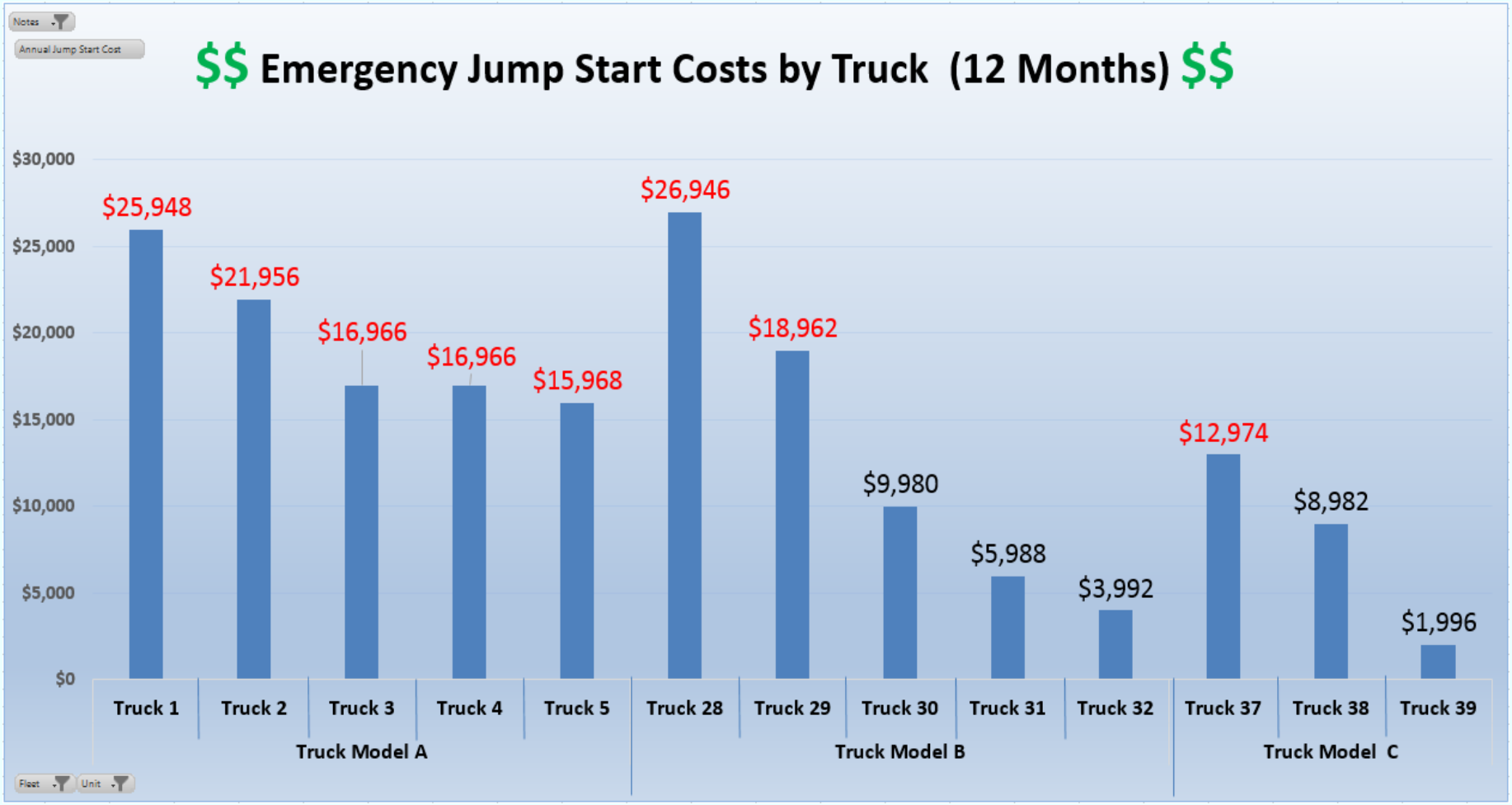
- 80% of your costs come from 20% of your assets

CFA works independently of the CMMS Hierarchy



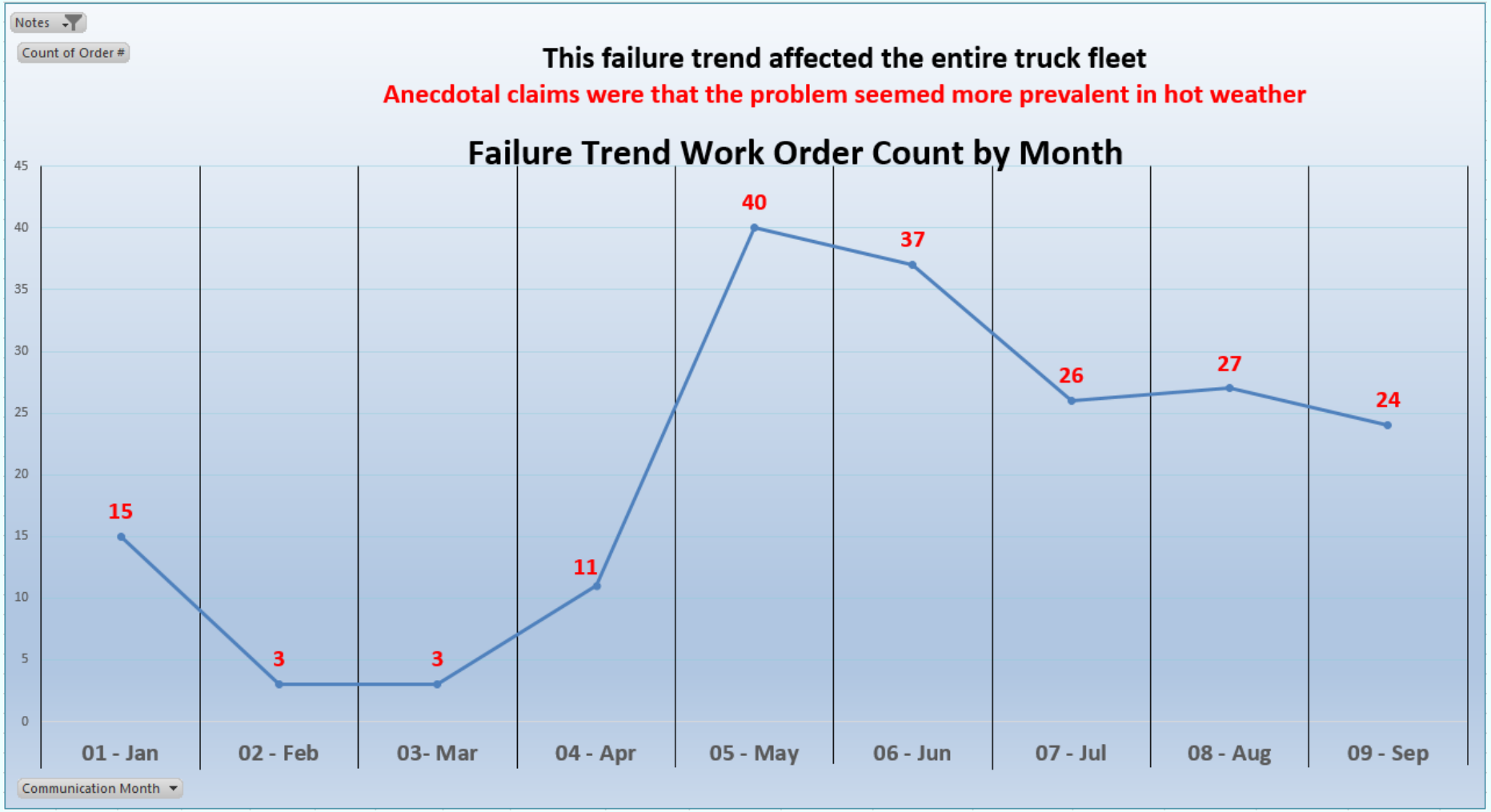
Focus on how much failures are really costing you

When we communicate problems in natural language



The common denominator becomes the failure mode

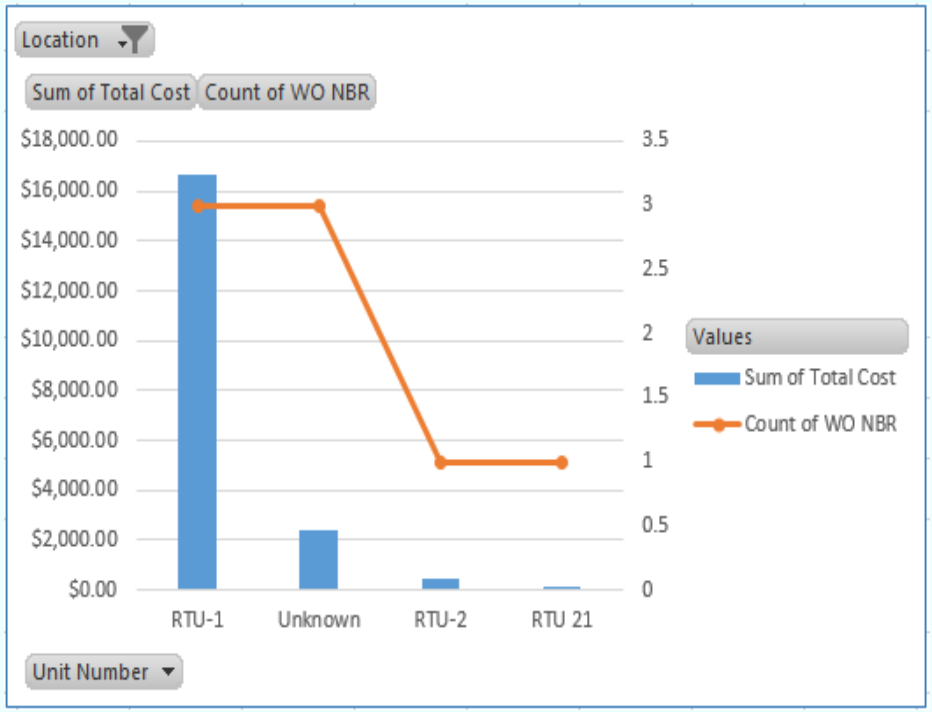
Once a WO is identified as being part of the trend…

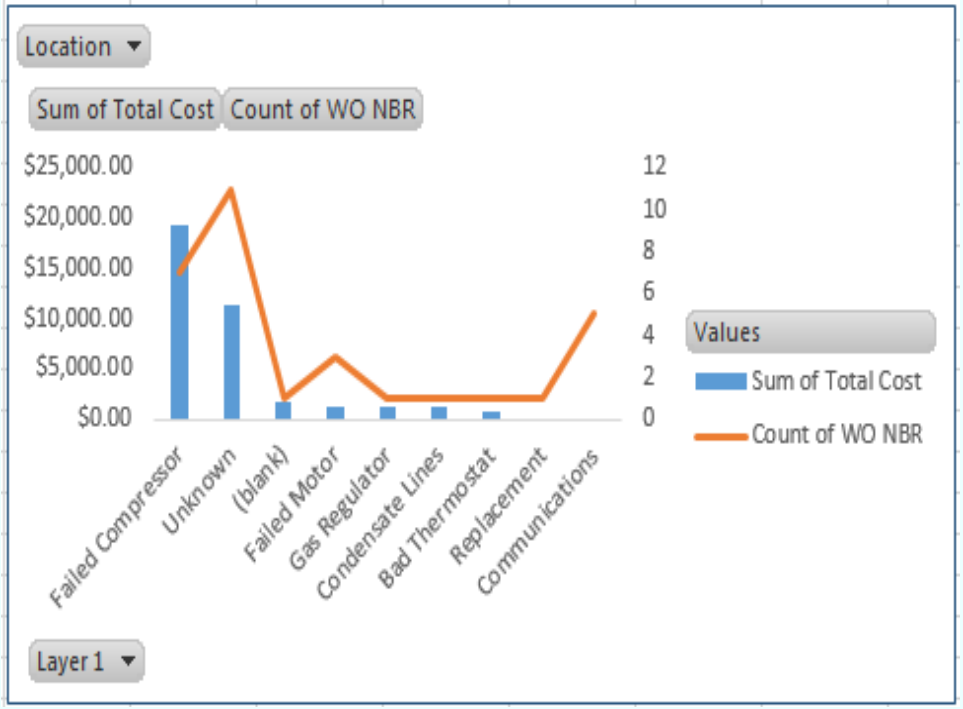


Your CMMS data can tell a powerful story

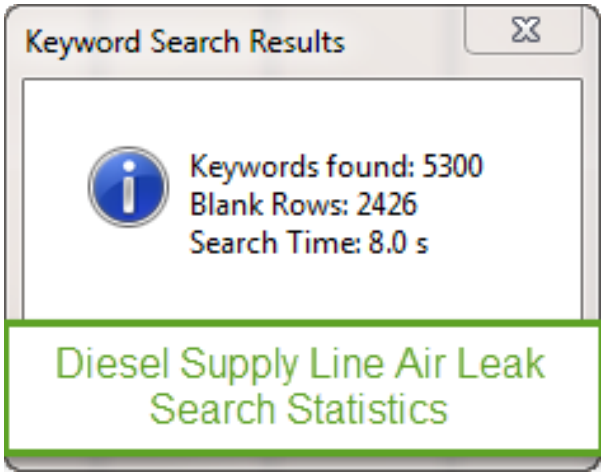
Missing data can be extrapolated from WO text

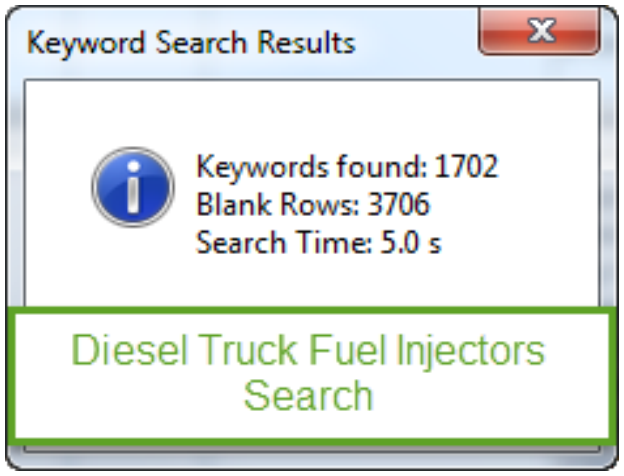
Notes	Layer 1	System	Unit Number	Key Word	Text
RTU Failure	Failed Compressor	HVAC	RTU 21	AC; Compressor; Replace; roof;	REPLACE COMPRESSORS ON ROOF TOP AC;
RTU Failure	Failed Compressor	HVAC	RTU 15	AC; Compressor; Replace; RTU;	REPLACE COMPRESSOR IN RTU 15;
RTU Failure	Failed Motor	HVAC	RTU 21	AC; Motor; Replace; RTU;	THIS IS AN URGENT TICKET REPLACE CONDENSER FAN MOTOR ON RTU-21;
RTU Failure	Failed Motor	HVAC	Unknown	AC; Motor; Replace; RTU;	REPLACE BLOWER MOTOR IN RTU;
RTU Failure	Failed Motor	HVAC	Unknown	AC; Motor; Replace; RTU;	REPLACE BLOWER MOTOR IN RTU;
RTU Failure	Failed Compressor	HVAC	RTU-1	Compressor; PLC; RPL; RTU;	RPLC COMPRESSORS ON RTU-1;
RTU Failure	Failed Compressor	HVAC	RTU-1	AC; Compressor; Replace; RTU;	REPLACE 2 DEFECTIVE COMPRESSORS RTU-1;
RTU Failure	Failed Compressor	HVAC	RTU-1	AC; Compressor; Replace; RTU;	REPLACE COMPRESSOR IN RTU - 1;
RTU Failure	Failed Compressor	HVAC	RTU 12	AC; Replace; RTU;	REPLACE COMPREESOR IN RTU 12;
RTU Failure	Failed Compressor	HVAC	RTU-2	AC; Replace; RTU;	REPLACE CPMPRESSOR ON RTU- 2;

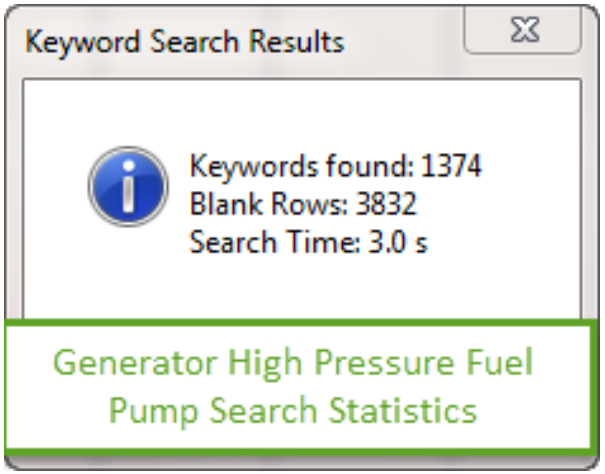




Unlike a web search, your company created every single work order line . . .







Don’t wait for lagging indicators.

Bring the power of a contextual search to your trend analysis.

Thank you

Jeff Wahl, CMRP
1.970.290.1616
jeffwahl1@gmail.com

CFA Endorsements

Hank Kocevar. CMRP I took Jeff up on his offer to look at the Excel based CFA tool he uses and was very impressed by the analysis he is able to QUICKLY perform on Work Orders. I've used other SQL based tools to analyze long text in work orders and trying to get the story behind a breakdown was a tedious task. The beauty of the CFA tool is that it doesn't care about codes it looks at text the operators and technicians used to describe the failure, just like Jeff has been trying to tell us. Seems that having the operators and technicians describe what happened would be an easier behavior change then getting them to pick the right codes.
I'm now 99% confident I would not use failure codes, if I had the CFA tool available. Thanks for enlightening me Jeff.

CFA Endorsements

Malcolm Hide Thanks to Jeff for showing me his Contextual Failure Analysis tool, which really simplifies the process of extracting key words from free text fields. With this kind of system it simplifies the failure identification process without loosing the original detail. The big advantage is that as it is free text fields, techs and operators can comment as much or as little as they like. Another advantage is that it also allows multiple failures to be reported in a single comment.