NIST Standards Requirements Workshop for Natural Language Analysis

Michael P. Brundage

Systems Integration Division, Engineering Laboratory

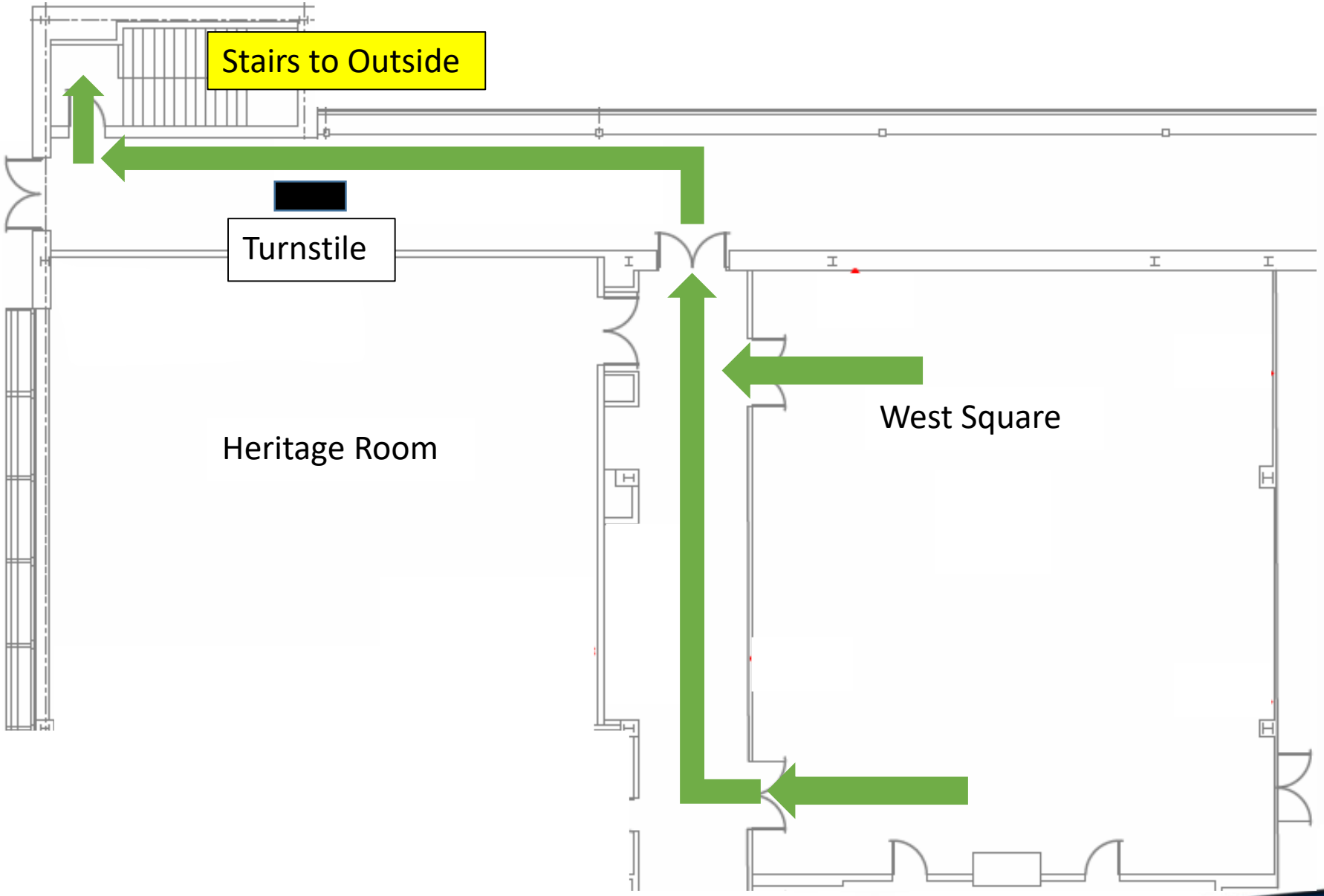
ASME Standards Subcommittee Meeting on Advanced Monitoring, Diagnostics, and Prognostics for Manufacturing Operations

Brian A. Weiss

Intelligent Systems Division, Engineering Laboratory

NIST Guest WIFI

Safety



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- Place your *Dash Pass* on your vehicle's dashboard.
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- Do not follow someone with a NIST badge into an access-controlled area unless the individual is your NIST sponsor or designated NIST escort.
- Cameras and recording devices are prohibited in some NIST locations; request permission from your NIST sponsor before taking pictures or recordings.

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NIST Standards Requirements Workshop for Natural Language Analysis

Michael P. Brundage

Systems Integration Division, Engineering Laboratory

Agenda

Start Time	Time	Presenter/Activity	Session
7:30:00 AM	30	Registration/Breakfast	Welcome
8:00:00 AM	10	Mike Brundage	
8:10:00 AM	5	Brian Weiss	
8:15:00 AM	15	Howard Harary	
8:30:00 AM	15	Introductions from Audience	
8:45:00 AM	80	Presentations	Data Collection/Storage
10:05:00 AM	45	Brainstorming Session 1	
10:50:00 AM	20	AM Break	
11:10:00 AM	80	Presentations	Data Cleaning/Parsing
12:30:00 PM	45	Brainstorming Session 2	
1:15:00 PM	75	Lunch	Lunch
2:30:00 PM	80	Presentations	Data Analysis/Visualization
3:50:00 AM	20	PM Break	
4:10:00 AM	45	Brainstorming Session 3	
4:55:00 AM	20	Brainstorming Leads	Closing
5:15:00 AM	3	Brian Weiss	
5:18:00 AM	2	Mike Brundage	

Agenda

- Unofficial Dinner/Happy Hour at Dogfish Head Alehouse
- Shuttle will take people there from NIST at 545PM
- Shuttle will depart Dogfish around 730PM to go back to Courtyard Marriott
- If you are not attending dinner, there is a hotel shuttle to take back to Courtyard Marriott from NIST
- https://goo.gl/maps/Pgyd18PwHdk6bTj56
- https://dogfishalehouse.com/locations/dfha-gaithersburg

Why are we here?

Maintenance Work Order Data

"Hydraulic return line replaced"

"Turret removed, cleaned, reinstalled, and aligned"

"Marine door seal leaking / Leak from seal on basket shaft"

"Retrieved motor from spare automation and installed"

"Head removed and cleaned thoroughly. Found cam action spring binding on one tool station. Removed spring and cleaned up burring on spring; Reset and reinstalled"

"Bearings bad; removed spindle and replaced bearings"

"At 27bar; Charged to 30bar No issue"

Maintenance Work Order Data

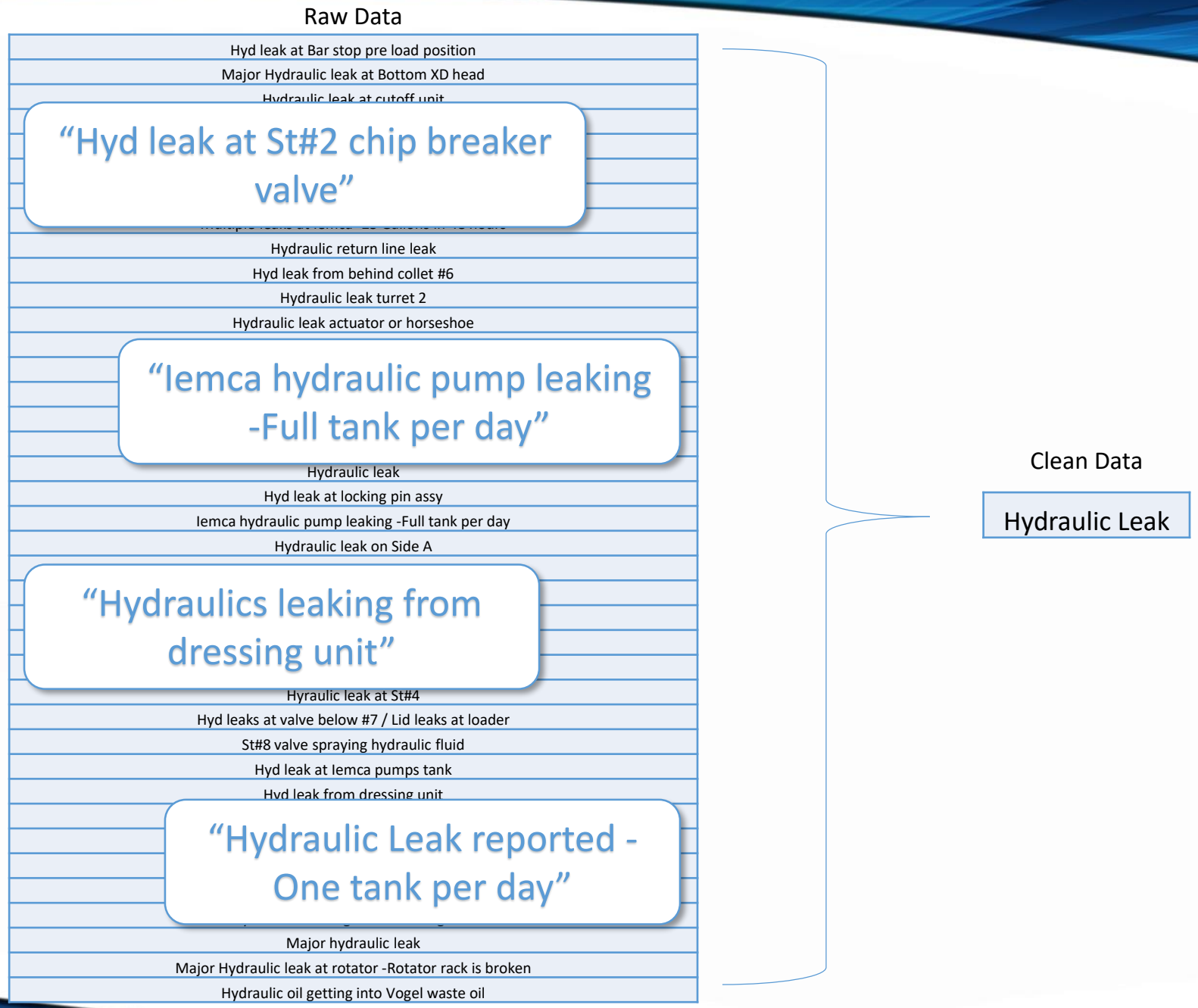
Raw Data

Effect	Number of Instances
Accumulator check requested	14
Vogel lube faults	7
Base cleaning requested	4
Table index O/T faults	3
Iemca will not load in Auto	3
Chip conveyor INOP	3
Chip conveyor jammed	3
St#2 drill detector INOP	2
Table drifting at 1/2 table setting	2
Motor thermal overload fault -Hydraulic	2
Machine will not run in Auto	2
Part not loading into collet	2
St#8 Hyd flange not repeating	2
Power pack leak	2
Table index O/T at 1/2 table -Turning off Hydraulics	2

Clean Data

Effect	Number of Instances
Hydraulic Leak	39
Accumulator check requested	26
Coolant Leak	17
Bearings check	16
Chip conveyor INOP	15
Broken screw	14
Table index faults	13
Brush unit stuck forward	10
Vogel lube fault	9
Coolant Pressure Low	9
Oil leak	8
Base cleaning requested	4
Iemca will not load in Auto	4
Bearings noise	4
Inverter failing to return	4

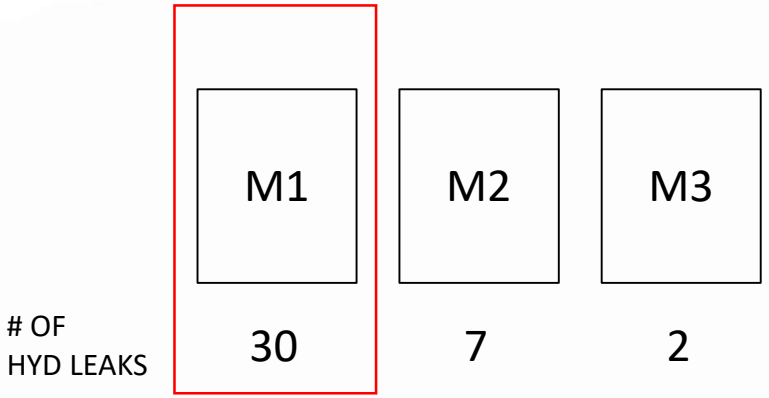
	Number of Instances	
Effect	Raw	Clean
Accumulator check requested	14	26


Raw Data
Hyd leak at Bar stop pre load position
Major Hydraulic leak at Bottom XD head
Hydraulic leak at cutoff unit
"Hyd leak at St#2 chip breaker valve"
Hydraulic return line leak
Hyd leak from behind collet #6
Hydraulic leak turret 2
Hydraulic leak actuator or horseshoe
"Iemca hydraulic pump leaking -Full tank per day"
Hydraulic leak
Hyd leak at locking pin assy
Iemca hydraulic pump leaking -Full tank per day
Hydraulic leak on Side A
"Hydraulics leaking from dressing unit"
Hyraulic leak at St#4
Hyd leaks at valve below #7 / Lid leaks at loader
St#8 valve spraying hydraulic fluid
Hyd leak at Iemca pumps tank
Hyd leak from dressing unit
"Hydraulic Leak reported - One tank per day"
Major hydraulic leak
Major Hydraulic leak at rotator -Rotator rack is broken
Hydraulic oil getting into Vogel waste oil
Clean Data
Hydraulic Leak

Why are we here

- Natural Language Documents – Maintenance Work Orders (MWOs)
  - Contain historical tacit knowledge
  - Contain domain-specific abbreviations and jargon
  - Often unstructured input

- Want to learn how to clean natural language data



M1	Hyd leak at Bar stop pre load position
M2	Major Hydraulic leak at Bottom XD head
M1	Hydraulic leak at cutoff unit
M1	Hyd leak at St#2 chip breaker valve
M1	Hyd leak reported
M1	Hydraulic leak at bar loader -Rubber seal on vacuum
M1	HP Hydraulic line ruptured
M1	Multiple leaks at Iemca -25 Gallons in 48 hours
M1	Hydraulic return line leak
M2	Hyd leak from behind collet #6
M1	Hydraulic leak turret 2
M1	Hydraulic leak actuator or horseshoe
M1	Hydraulic leak at chip breaker valve (? Valve station)
M1	Hydraulic leaks -from collets??
M1	Leak at High Pressure pump
M1	Hyd leak St#2 valve
M2	St#6 valve leaking hydraulic
M1	Hydraulic leak
M2	Hyd leak at locking pin assy
M1	Iemca hydraulic pump leaking -Full tank per day
M1	Hydraulic leak on Side A
M1	Hydraulic leak from power pack
M1	St#8 valve leaking Hyd fluid
M1	Hyd leaks -C/O unit, St#11 Valve, Collet #10 (Internal)
M1	Hydr pump? / Power pack leak / CNCs shuddering
M1	Hydraulic leak at inverter st#8
M1	Hyraulic leak at St#4
M1	Hyd leaks at valve below #7 / Lid leaks at loader
M1	St#8 valve spraying hydraulic fluid
M1	Hyd leak at Iemca pumps tank
M1	Hyd leak from dressing unit
M1	Hydraulic leak at Cutoff valve
M1	Hydraulic leak at power pack -per PM tix
M1	Hydraulic leak found by Doug -3.1 quill
M1	Hydraulic Leak reported -One tank per day
M1	Hydraulics leaking from dressing unit
M2	Major hydraulic leak
M3	Major Hydraulic leak at rotator -Rotator rack is broken
M2	Hydraulic oil getting into Vogel waste oil

Clean Data

Hydraulic Leak

	M1	M2	M3
# OF HYD LEAKS	30	7	2
BOB	5	4	1
BILL	20	3	0
TOM	3	0	0
MIKE	0	0	1
TIM	3	0	0

Bob	M1	Hyd leak at Bar stop pre load position
Mike	M2	Major Hydraulic leak at Bottom XD head
Bill	M1	Hydraulic leak at cutoff unit
Mike	M1	Hyd leak at St#2 chip breaker valve
Bill	M1	Hyd leak reported
Bill	M1	Hydraulic leak at bar loader -Rubber seal on vacuum
Bill	M1	HP Hydraulic line ruptured
Bill	M1	Multiple leaks at Iemca -25 Gallons in 48 hours
Mike	M1	Hydraulic return line leak
Bob	M2	Hyd leak from behind collet #6
Tom	M1	Hydraulic leak turret 2
Mike	M1	Hydraulic leak actuator or horseshoe
Mike	M1	Hydraulic leak at chip breaker valve (? Valve station)
Mike	M1	Hydraulic leaks -from collets??
Bill	M1	Leak at High Pressure pump
Bill	M1	Hyd leak St#2 valve
Mike	M2	St#6 valve leaking hydraulic
Mike	M1	Hydraulic leak
Mike	M2	Hyd leak at locking pin assy
Mike	M1	Iemca hydraulic pump leaking -Full tank per day
Mike	M1	Hydraulic leak on Side A
Bill	M1	Hydraulic leak from power pack
Tim	M1	St#8 valve leaking Hyd fluid
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Mike	M1	Hydraulic leak at Cutoff valve
Bill	M1	Hydraulic leak at power pack -per PM tix
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Mike	M1	Hydraulic Leak reported -One tank per day
Mike	M1	Hydraulics leaking from dressing unit
Bill	M2	Major hydraulic leak
Tom	M3	Major Hydraulic leak at rotator -Rotator rack is broken
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Clean Data

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Mike	M1	Hydraulics leaking from dressing unit
Bill	M2	Major hydraulic leak
Tom	M3	Major Hydraulic leak at rotator -Rotator rack is broken
Tim	M2	Hydraulic oil getting into Vogel waste oil

Clean Data

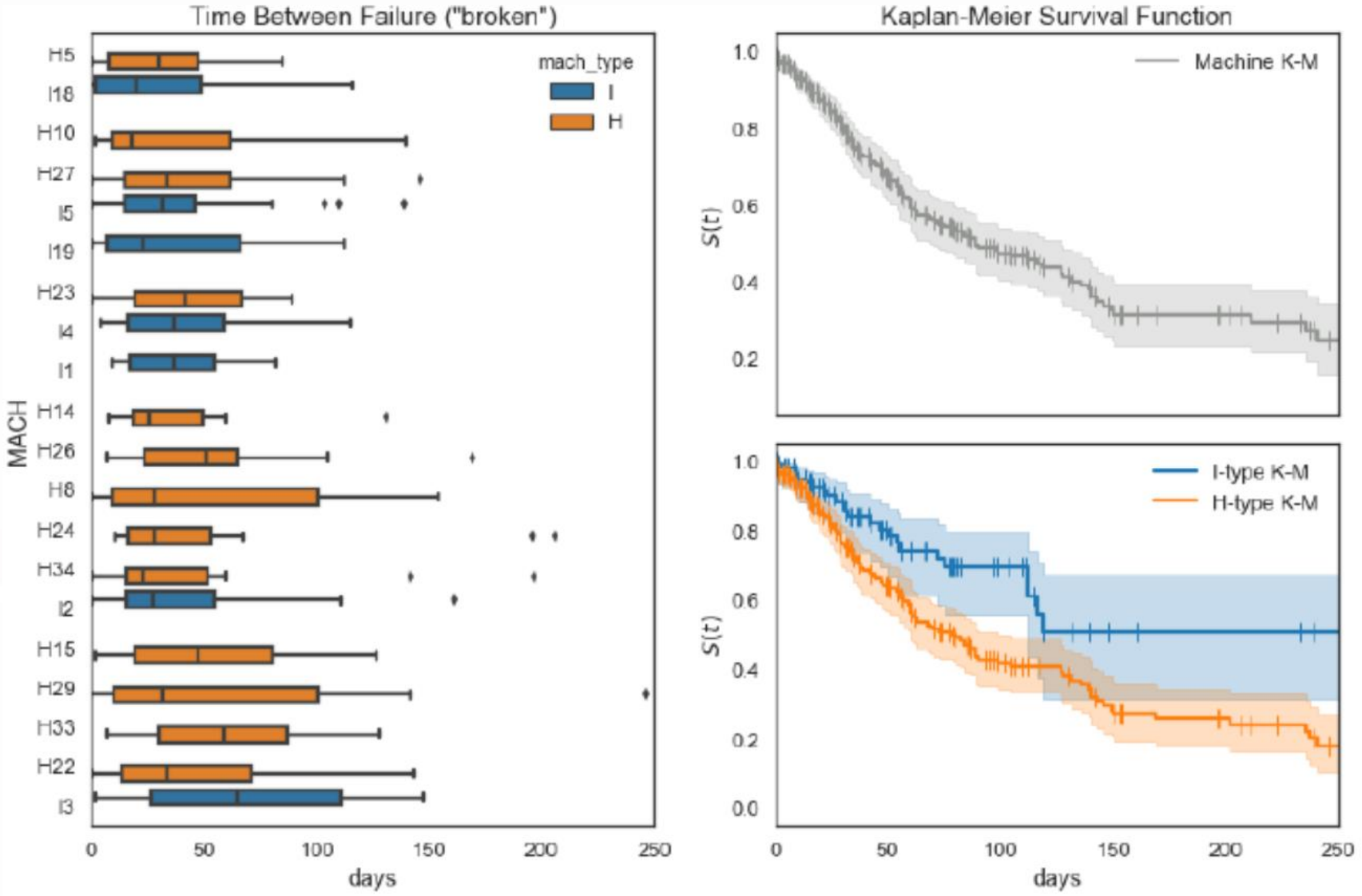
Hydraulic Leak

Example:

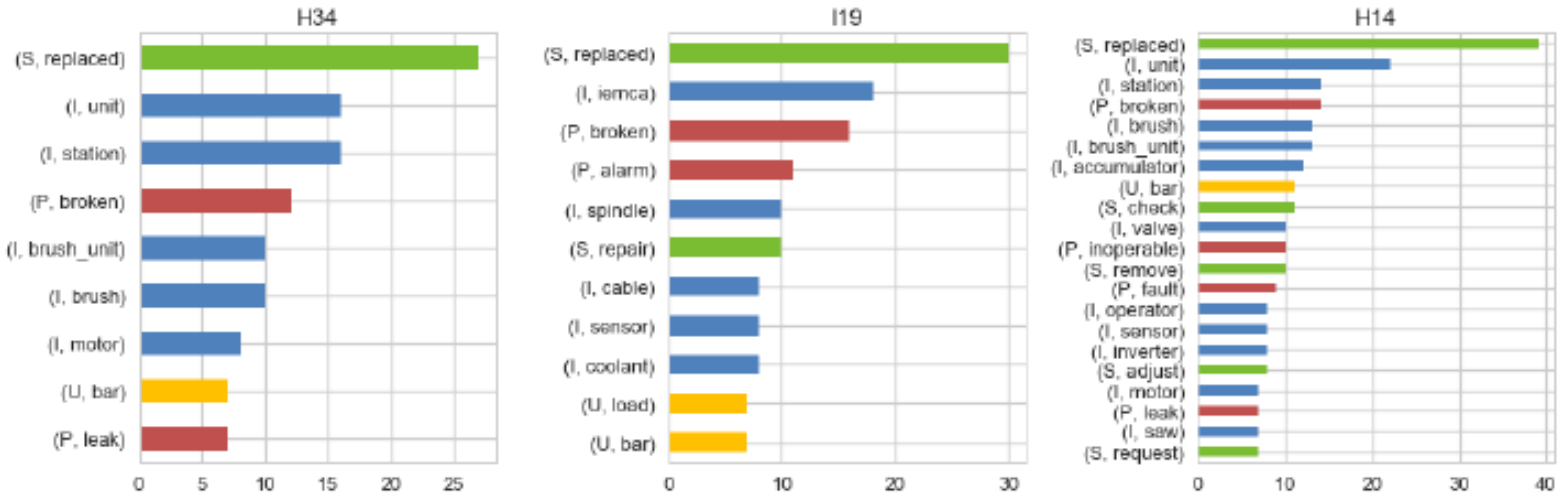
Once occurrences of “broken” were aggregated, patterns emerge:

- Some machines “reliably” fail significantly more often
- Unusual dip in survival at the 100-day mark…PM-induced corrective work?

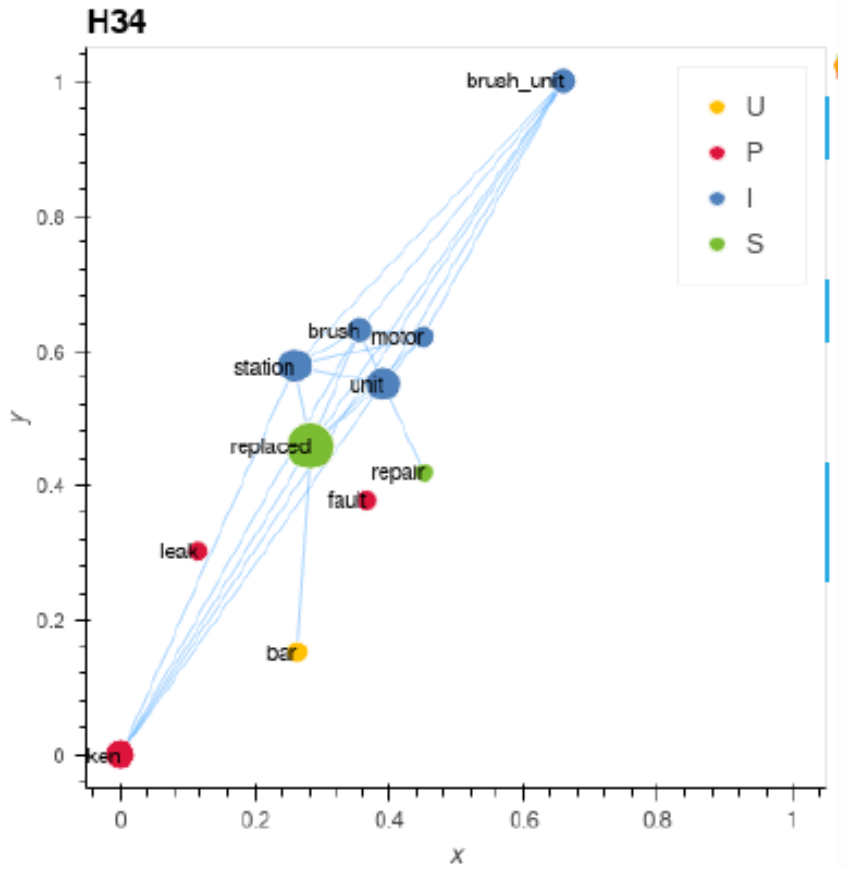
→ Investigate!

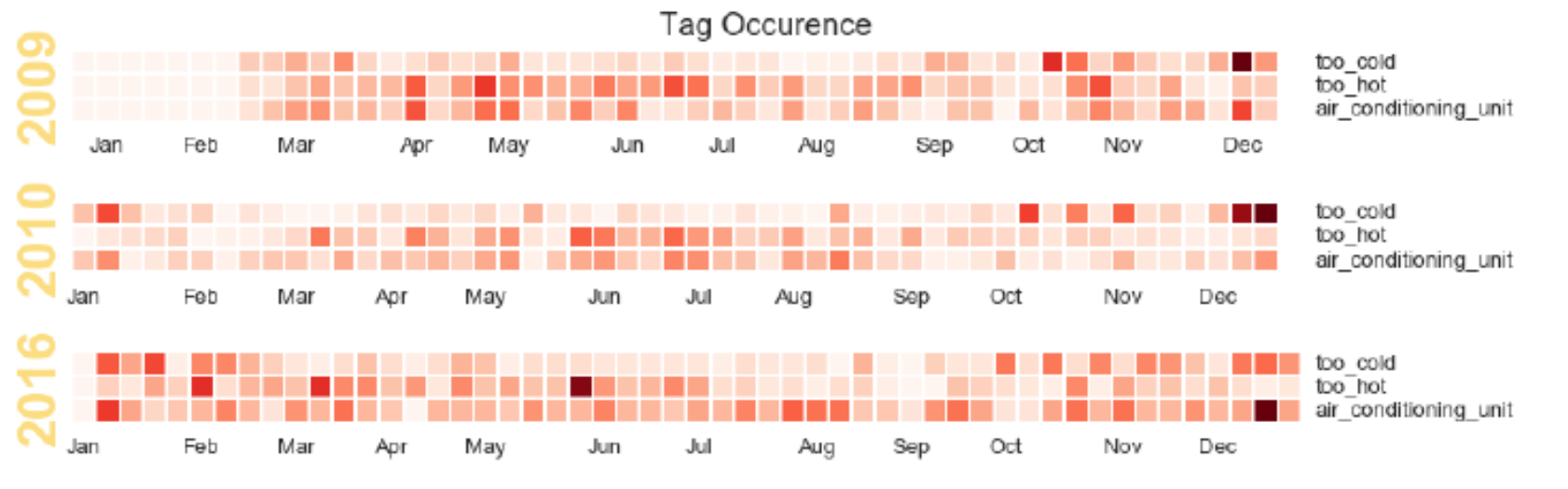


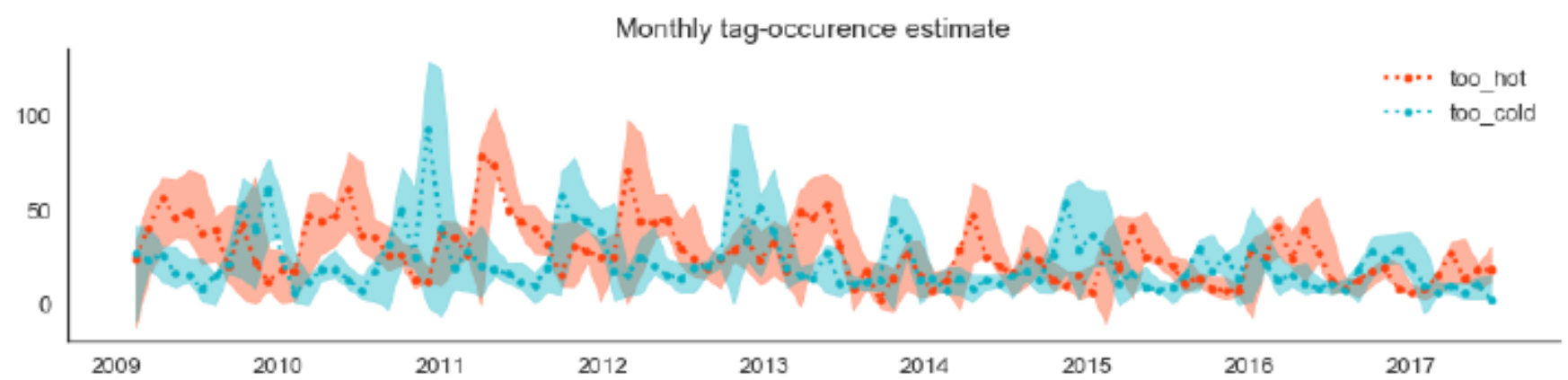
Top Tag occurences, by Machine

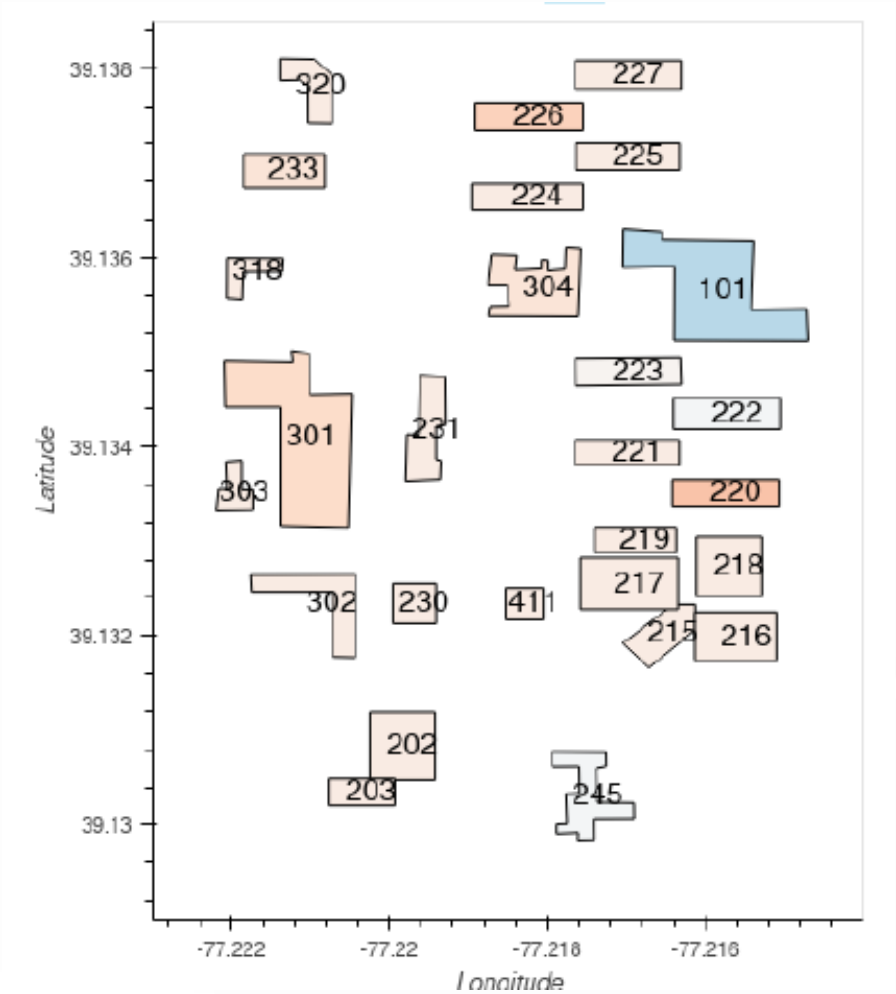


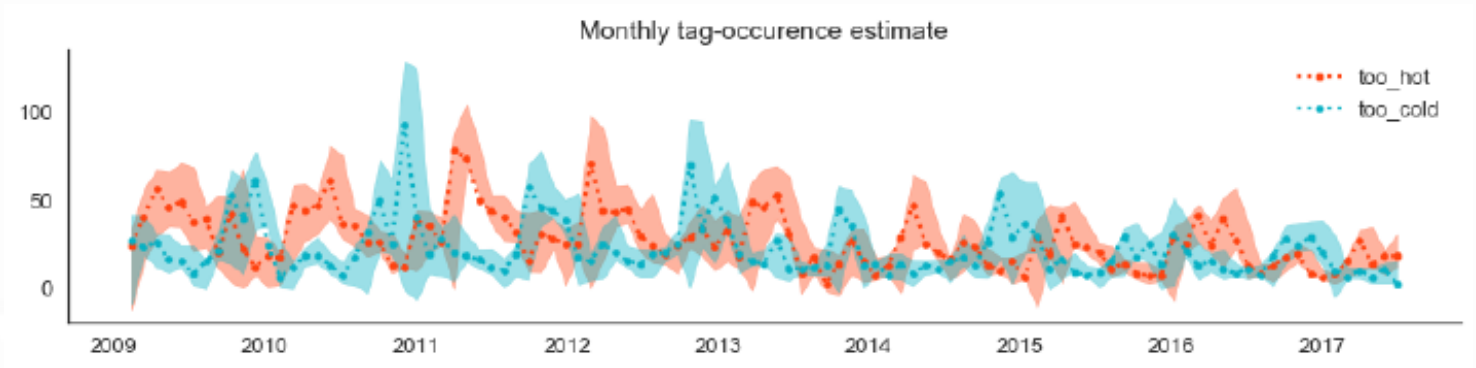
- `H34` issues with `motor`, `brush_unit`
- `I19` `alarms` and/or `sensors`, potentially coolant-related
- `H14` wide array of issues, including `operator` (!?)




Tag Occurence
2009
2010
2016
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
too_cold
too_hot
air_conditioning_unit


Monthly tag-occurence estimate
too_hot
too_cold
100
50
0
2009
2010
2011
2012
2013
2014
2015
2016
2017


39.138
39.136
39.134
39.132
39.13
Latitude
-77.222
-77.22
-77.218
-77.216
Longitude
320
227
226
225
233
224
318
304
101
223
222
301
231
221
303
220
219
218
217
302
230
411
215
216
202
203
245


Monthly tag-occurence estimate
too_hot
too_cold
100
50
0
2009
2010
2011
2012
2013
2014
2015
2016
2017

Why are we *actually* here

- Want to analyze MWOs to improve maintenance decisions!
  - Scheduling
    - better predictions of failures
    - better PM cycles
  - Dispatching
    - link technicians to problems based on experience
    - provide training to technicians
  - Problem Hot Spot Identification
    - identify machines with high number of issues
    - determine where to place sensors
  - Among others….

Brainstorming Sessions – General Notes

- State your name/where you are in the first brainstorming session
- What types of text-based data are you collecting?
- NIST people please add in experiences from what you have seen in industry
- Each session is 45 minutes
  - 15 minutes – What is your current state?
  - 15 minutes – What are the challenges with your current system?
  - 15 minutes – What do you see as your future state?

- 3 Groups
  - GREEN Group: Thurston Sexton (Lead) + Joan Pellegrino (Data Collection)
  - RED Group: Thomas Hedberg (Lead) + Michael Hoffman (Data Collection)
  - BLUE Group: Bill Bernstein (Lead) + Madhusudanan N (Data Collection)

Brainstorming Sessions - Leads

GREEN Group

Brainstorming Lead
Thurston Sexton

Brainstorming Data Collection
Joan Pellegrino

RED Group

Brainstorming Lead
Thomas Hedberg

Brainstorming Data Collection
Michael Hoffman

BLUE Group

Brainstorming Lead
Bill Bernstein

Brainstorming Data Collection
Madhusudanan N

Goals/Outputs of this Workshop

- Natural Language Document Analysis Standards Roadmap Report
- Website will be updated with information from the workshop
- A web-tool based forum to promote collaboration and discussion
- Potential Working Group for ASME PHM Subcommittee

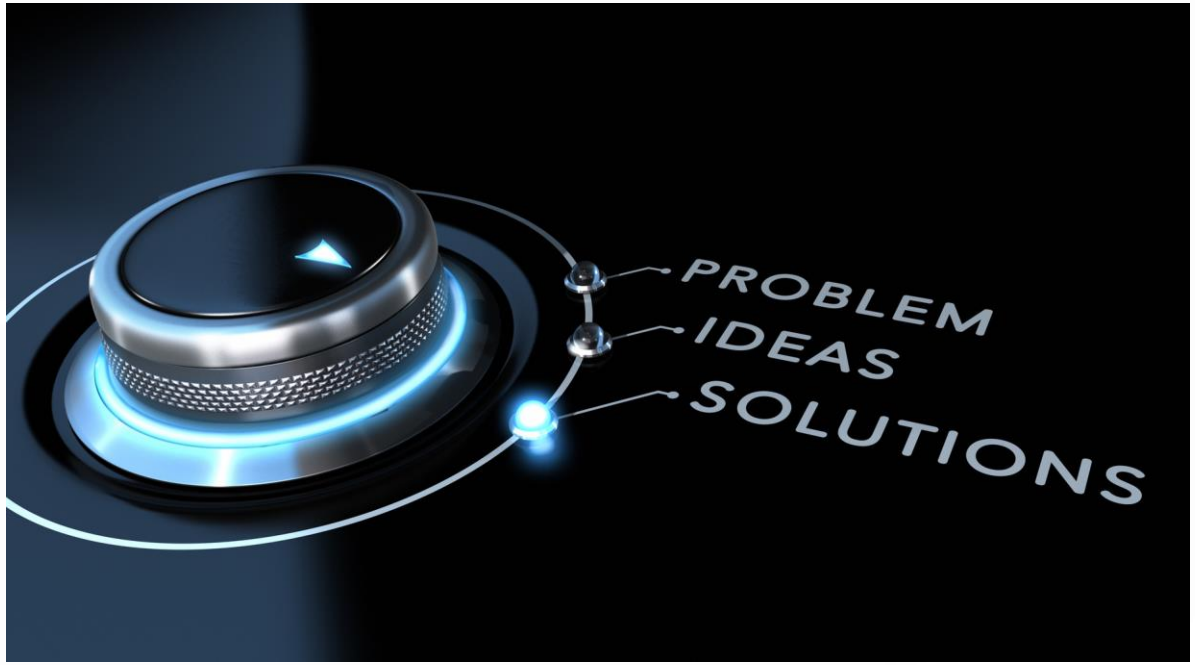
ASME Standards Subcommittee Meeting on Advanced Monitoring, Diagnostics, and Prognostics for Manufacturing Operations

Brian A. Weiss

Project Leader, *Prognostics and Health Management for Reliable Operations in Smart Manufacturing*

Benefits of Standards

- Reduce Costs
- Reduce Risk of Technological Adoption
- Anticipate Technical Requirements
- Increase Productivity
- Promote Efficiency
- Protect Health and Safety
- And Many More…



Motivations for Standards in Manufacturing

- Complex **interactions/relationships** within manufacturing systems **make it challenging to determine the specific influences** on the health and degradation of equipment and processes
- Increasing interest and ability to leverage data and analysis to **generate actionable intelligence** about system interactions/relationships for control
- **No uniform process exists** that guides sensing, monitoring, and control at all levels from the component to the system
- **Proprietary solutions exist**, but they apply to specific systems from one vendor and are often **expensive** and **inaccessible** to many manufacturers.

How do we know this is Important?

- Measurement Science Roadmapping Workshop
- Collaborator studies with university and industry partners
- Interactions with various technical organizations
- Manufacturing Standards Requirements Gathering Workshop

NIST Advanced Manufacturing Series 100-13

Summary Report on a Workshop on Advanced Monitoring, Diagnostics, and Prognostics for Manufacturing Operations

Brian A. Weiss
Donnie Alonzo
Steve D. Weinman

This publication is available free of charge from:
https://doi.org/10.6028/NIST.AMS.100-13

ASME
SETTING THE STANDARD

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Events Leading Up to Today

- First Event (Workshop) – June 2017 at ASME MSEC (Los Angeles)
- Second Event (Workshop) – Oct 2017 at the PHM Society Conference (St. Petersburg, FL)
- Third Event (Standards Meeting) – May 2018 at the NIST Industry Forum (Gaithersburg)

Approval of the ASME Subcommittee –Summer 2018

- Fourth Event (Standards Meeting) – Oct 2018 at TechSolve (Cincinnati, OH)
- **Fifth Event (Standards Meeting) – THIS WEEK, HERE!**

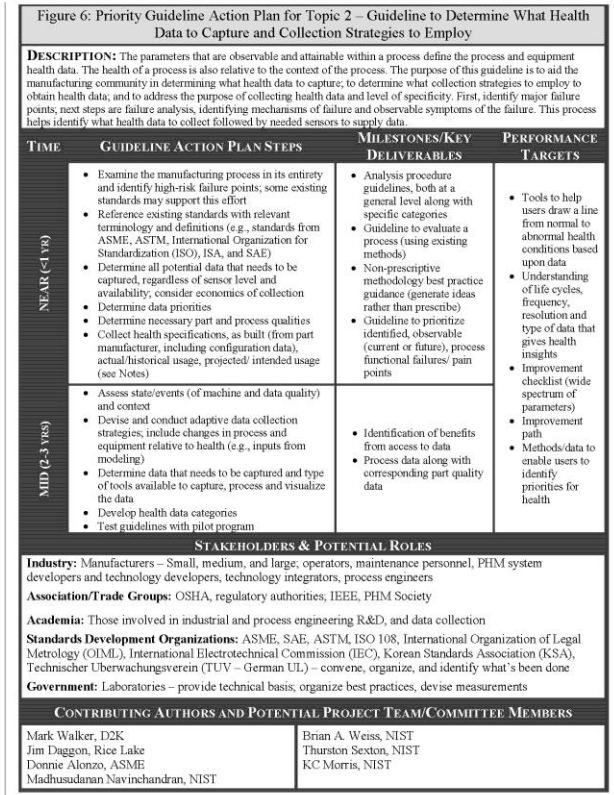


Figure 6: Priority Guideline Action Plan for Topic 2 – Guideline to Determine What Health Data to Capture and Collection Strategies to Employ

DESCRIPTION: The parameters that are observable and attainable within a process define the process and equipment health data. The health of a process is also relative to the context of the process. The purpose of this guideline is to aid the manufacturing community in determining what health data to capture; to determine what collection strategies to employ to obtain health data; and to address the purpose of collecting health data and level of specificity. First, identify major failure points; next steps are failure analysis, identifying mechanisms of failure and observable symptoms of the failure. This process helps identify what health data to collect followed by needed sensors to supply data.

TIME	GUIDELINE ACTION PLAN STEPS	MILESTONES/KEY DELIVERABLES	PERFORMANCE TARGETS
NEAR (<1 YR)	• Examine the manufacturing process in its entirety and identify high-risk failure points; some existing standards may support this effort • Reference existing standards with relevant terminology and definitions (e.g., standards from ASME, ASTM, International Organization for Standardization (ISO), ISA, and SAE) • Determine all potential data that needs to be captured, regardless of sensor level and availability; consider economics of collection • Determine data priorities • Determine necessary part and process qualities • Collect health specifications, as built (from part manufacturer, including configuration data), actual/historical usage, projected/ intended usage (see Notes)	• Analysis procedure guidelines, both at a general level along with specific categories • Guideline to evaluate a process (using existing methods) • Non-prescriptive methodology best practice guidance (generate ideas rather than prescribe) • Guideline to prioritize identified, observable (current or future), process functional failures/ pain points	• Tools to help users draw a line from normal to abnormal health conditions based upon data • Understanding of life cycles, frequency, resolution and type of data that gives health insights • Improvement checklist (wide spectrum of parameters) • Improvement path • Methods/data to enable users to identify priorities for health
MID (2-3 YRS)	• Assess state/events (of machine and data quality) and context • Devise and conduct adaptive data collection strategies; include changes in process and equipment relative to health (e.g., inputs from modeling) • Determine data that needs to be captured and type of tools available to capture, process and visualize the data • Develop health data categories • Test guidelines with pilot program	• Identification of benefits from access to data • Process data along with corresponding part quality data	

STAKEHOLDERS & POTENTIAL ROLES

Industry: Manufacturers – Small, medium, and large; operators, maintenance personnel, PHM system developers and technology developers, technology integrators, process engineers

Association/Trade Groups: OSHA, regulatory authorities; IEEE, PHM Society

Academia: Those involved in industrial and process engineering R&D, and data collection

Standards Development Organizations: ASME, SAE, ASTM, ISO 108, International Organization of Legal Metrology (OIML), International Electrotechnical Commission (IEC), Korean Standards Association (KSA), Technischer Uberwachungsverein (TUV – German UL) – convene, organize, and identify what's been done

Government: Laboratories – provide technical basis; organize best practices, devise measurements

CONTRIBUTING AUTHORS AND POTENTIAL PROJECT TEAM/COMMITTEE MEMBERS

Mark Walker, D2K Jim Daggon, Rice Lake Donnie Alonzo, ASME Madhusudanan Navinchandran, NIST	Brian A. Weiss, NIST Thurston Sexton, NIST KC Morris, NIST

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GUIDELINES

CHARTER: *Develop standards and guidelines that advance the design and implementation of monitoring, diagnostic, and prognostic capabilities, along with ways of verifying and validating their performance, to* ***enhance adaptive maintenance and operational control strategies*** *within manufacturing.*

ASME
SETTING THE STANDARD


TODAY
TOMORROW

Howard Harary
Director of the Engineering Laboratory (EL)

Introductions

- Who are you?
- What is your affiliation?
- What is your job role?
- What is your biggest maintenance pain point?

Agenda

Start Time	Time	Presenter	Session
7:30:00 AM	30	Registration/Breakfast	Opening
8:00:00 AM	10	Mike Brundage	
8:10:00 AM	5	Brian Weiss	
8:15:00 AM	15	Howard Harary	
8:30:00 AM	15	Everyone	
8:45:00 AM	80	Presentations	Data Collection/Storage
10:05:00 AM	45	Brainstorm 1	
10:50:00 AM	20	AM Break	
11:10:00 AM	80	Presentations	Data Cleaning/Parsing
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4:55:00 AM	20	Brainstorming Leads	Closing
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5:18:00 AM	2	Mike Brundage	

Data Collection & Storage

Time	Presenter	Organization	Presentation
8:45 AM	Mike Brundage	-	Introduction to Data Collection/Storage Session
8:50 AM	Thurston Sexton	NIST Systems Integration Division	Human Factors Concerns in Data Collection
9:05 AM	Jack Fanneron	BP Mechanical Corporation	Novel Data Collection Strategies for Maintenance
9:20 AM	Ken Dunn*	British Petroleum (BP)	BP's Natural Language Document environment and challenges
9:35 AM	Farhad Ameri	Texas State University	A Thesaurus-guided Method for Smart Manufacturing Diagnostics
9:50 AM	Sarah Lukens	GE Digital	Maintenance Data Collection Challenges
10:05 AM	Brainstorm		
10:50 AM	Break 1		

Data Collection & Storage

1) Current State

What are you currently using to collect and store data? Are these working and meeting your requirements, and If not, why? (Examples: Database solutions, collection strategies, etc.)

2) Challenges

What are some of the challenges and limitations you are facing for data collection/storage? What kinds of problems are you trying to solve? (Examples: Hardware vs software concerns, human factors issues, etc.)

3) Future State

Given the current state and challenges for data collection/storage, what technologies, research, measurement tools, or standards are needed? (Examples: Standards needed for data collection; alignment of standards with proprietary data storage solutions, etc.)

Presentations and Brainstorming

Data Cleaning & Parsing

Time	Presenter	Organization	Presentation
11:10 AM	Thurston Sexton	-	Introduction to Data Cleaning/Parsing Session
11:15 AM	Mike Brundage	NIST Systems Integration Division	Small Data Tagging using the Nestor tagging tool
11:30 AM	Melinda Hodkiewicz	University of Western Australia	Semi-Automatic Processing of Unstructured Short Text in Maintenance Records
11:45 AM	Aaron Massey	University of Maryland Baltimore County (UMBC)	Natural Language Processing for Regulatory Compliance Requirements
12:00 PM	Maria Seale	U.S. Army Engineer Research and Development Center	Composite Learning Algorithm for Records Evaluation (CLARE)
12:15 PM	Ellen Vorhees	NIST Information Technology Lab	Using Challenge Problems to Drive Technology
12:30 PM	Brainstorm		

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12:30 PM	Break			
12:45 PM	Brainstorm			
1:30 PM	Lunch			Lunch
2:45 PM	Mike Brundage	-	Introduction to Data Analysis/Visualization Session	Data Analysis and Visualization
~~2:50 PM~~	~~Justin Fessler~~	~~Salesforce~~	~~NLP Use Cases in Manufacturing~~	
2:50 PM	James Waltner	Lockheed Martin	Merging NLP documents with operations data	
3:05 PM	Al Salour	Boeing	Challenges of using NLP in large manufacturing	
3:20 PM	Senthil Chandrasegaran	UC Davis	Visualizing Maintenance Work Order data	
3:35 PM	Radu Pavel	TechSolve	NLP and Decision Needs for SMEs	
3:50 PM	Break 2			
4:10 PM	Brainstorm			
4:55 PM	Brainstorming Leads	-	Summary of Brainstorming Sessions	Closing
5:15 PM	Brian Weiss	NIST Intelligent Systems Division	Discussion on PHM Group	
5:18 PM	Mike Brundage	NIST Systems Integration Division	Closing	

Data Cleaning & Parsing

1) Current State

What are you currently using for data cleaning and parsing? Are these working and meeting your requirements, and If not, why? (Examples: Large data solutions? How much annotation is needed? Small data solutions? How accurate are these?)

2) Challenges

What are some of the challenges and limitations you are facing with data cleaning and parsing? What kinds of problems are you trying to solve? (Examples: Concerns with data validation? Lack of metrics?)

3) Future State

Given the current state and challenges for cleaning and parsing of natural language data, what technologies, research, measurement tools, or standards are needed? (Examples: Better interfaces with data collection software, e.g., Nestor interface with a CMMS; guidelines for NLP analysis, etc.)

Presentations and Brainstorming

Data Analysis and Visualization

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2:30 PM	Mike Brundage	-	Introduction to Data Analysis/Visualization Session
2:35 PM	Justin Fessler	Salesforce	NLP Use Cases in Manufacturing
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Data Analysis and Visualization

1) Current State

What data analysis and visualization tools are you currently using? Are these working and meeting your requirements, and If not, why? What types of analysis are you doing? (Examples: Visualizations for NLP analysis, out of the box solutions for using NLP for analysis, etc.)

2) Challenges

What are some of the challenges and limitations you are facing with data analysis and visualization? What kinds of problems are you trying to solve? (Examples: dispatching, scheduling, failure predictions, resource alignment, e.g. technician to job, etc.)

3) Future State

Given the current state and challenges for data analysis and visualization, what technologies, research, measurement tools, or standards are needed? (Examples: General guidelines for analysis vs. manufacturer-specific guidelines, new visualization techniques, etc.)

Presentations and Brainstorming

Summary

ASME Standards Subcommittee Meeting on Advanced Monitoring, Diagnostics, and Prognostics for Manufacturing Operations

Brian A. Weiss

Project Leader, *Prognostics and Health Management for Reliable Operations in Smart Manufacturing*

Committee Charter

Develop standards and guidelines that advance the design and implementation of monitoring, diagnostic, and prognostic capabilities, along with ways of verifying and validating their performance, to ***enhance adaptive maintenance and operational control strategies*** *within manufacturing.*

ASME SETTING THE STANDARD

Priority Topic Areas

1. Standardized Terminology for PHM Guideline
2. Guideline to Determine Where and When PHM Capabilities should be added/integrated
3. Guideline to Determine What Health Data to Capture and Collection Strategies to Employ
4. Guideline to Determine What Sensors and Where They Should Be Deployed to Inform on Process/Equipment Health
5. Guideline for Implementing Sensor Data Fusion/Multi-Modal Data Fusion
6. Expand MTConnect/Data Communications
7. Guideline to Determine Where to Perform PHM Data Analyses
8. Natural Language Analysis for Maintenance Documents??
9. **YOUR IDEAS??**

ASME PHM Subcommittee Meeting Agenda – May 22nd – 23rd, 2019

Wednesday, May 22nd, 2019

1. Coffee/Breakfast (7:45 AM – 8:30 AM)
2. Call to Order / Welcome (8:30 AM – 8:35 AM) – Brian
3. Introductions and Record of Attendance (8:35 AM – 8:45 AM) – Brian
4. Recap of Prior Meeting @ TechSolve (8:45 AM – 9:00 AM) – Brian
5. Proposed Priority Topic Areas and Guidelines 'Flow' Review (9:00 PM – 10:30 PM) – All

OUTPUT: Update, as necessary, the outlined priority topic areas, confirm the immediate efforts on the "Determining When and Where PHM Should be Integrated in Manufacturing Operations" and "Standardized Terminology for Availability and Maintenance of Manufacturing Operations" topic areas, and discuss any proposed additions to both the guidelines 'flow' and the immediate work items.

6. Break (10:30 AM – 10:45 AM)
7. Review of Standards and Terminology Research (10:45 AM – 11:30 AM) – Brian/Mike

OUTPUT: Understand the status of the NIST efforts to identify the existing standards that are relevant to manufacturing PHM and the corresponding defined terms that can be leveraged in this subcommittee.

8. Lunch (11:30 AM – 12:45 PM) – NIST Cafeteria
9. Review & Finalize White Paper (12:45 PM – 2:00 PM) – Mark/Louis/Al/Radu

OUTPUT: Achieve broad agreement on the overall content of the white paper "Determining When and Where PHM Should be Integrated in Manufacturing Operations" where the next step would be to submit it for publication.

10. Guidelines Development – "Determining When and Where PHM Should be Integrated in Manufacturing Operations" (2:00 PM – 3:30 PM) – All

OUTPUT: Finalize Working Group (WG) membership, assign a document sponsor (lead). Generation of a draft outline of the guidelines document with this scope including estimated time frames to complete each section and who will be responsible (the document sponsor) for leading the work in the overall document/sections.

11. Break (3:30 PM – 3:45 PM) – All
12. Daily Wrap-up (3:45 PM – 4:30 PM) – All

OUTPUT: Summarize the day's activities to ensure that everyone's priorities are captured whether they are acknowledged in existing priority topic areas or documented in emerging priority topic areas.

ASME PHM Subcommittee Meeting Agenda – May 22nd – 23rd, 2019

Thursday, May 23rd, 2019

1. Coffee / Breakfast (7:45 – 8:30 AM)
2. Morning Introduction (8:30 AM – 8:45 AM) – Mike/Donnie
3. Tour of the Prognostics and Health Management for Robot Systems Lab (8:45 AM – 10:15 AM, including walking time to/from the lab) - ALL
4. Break (10:15 AM – 10:30 AM)
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6. Lunch (12:30 AM – 1:30 PM) – NIST Cafeteria
7. Outstanding Discussion Items/Next Steps (1:30 PM – 3:00 PM)
    a. Future teleconferences and face-to-face meetings
    b. SC advertising opportunities – additional industries/personnel to target for participation

Meeting Agenda

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GUIDELINES

Thank You!!

- Brian A. Weiss
- Thurston Sexton
- Thomas Hedberg
- Bill Bernstein
- Michael Hoffman
- Madhusudanan N
- Sakina Laanani
- Gladys Arrisueno
- Pauline Truong
- Kevin Hill
- Hoyt Cox
- Karen Startsman
- Joan Pellegrino

Next Events

- ASME Manufacturing Science and Engineering Conference (MSEC)
  - June 10-14, 2019 – Erie, PA
- Measurement and Evaluation For PHM (ME4PHM) 2019
  - September 23, 2019 – Scottsdale, AZ
  - http://www.phmsociety.org/events/conference/phm/19/ME4PHM
- ASME PHM Subcommittee Face to Face Standards Meeting
  - Tentative October/November – Tentative St. Louis, MO at Boeing
- ME4PHM 2020
  - Tentative Spring/Summer 2020 – Gaithersburg, MD at NIST
- ASME MSEC 2020
  - June 22-26, 2019 – Cincinnati, OH

Dinner

- Unofficial Dinner/Happy Hour at Dogfish Head Alehouse
- Shuttle will take people there from NIST at 545PM
- Shuttle will depart Dogfish around 730PM to go back to Courtyard Marriot
- If you are not attending, there is a hotel shuttle to take back to Courtyard Marriot from NIST
- https://goo.gl/maps/Pgyd18PwHdk6bTj56
- https://dogfishalehouse.com/locations/dfha-gaithersburg

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