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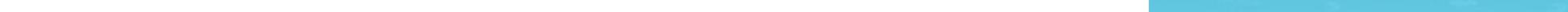
SAND2021-3727PE

GMS PI 13 Open Source Release - Station SOH Monitoring



PRESENTED BY

J. Mark Harris



US NDC – IDC Bilateral Technical Meeting
5-8 April 2021



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SAND2021-XXXX

GMS PI 13 Open Source Release Status



Open Source release approval process is underway

- Will be posted to GitHub with PI 7 release

Release includes:

- Source code for PI 13 Station SOH Monitoring capability
- User Guide
- Configuration Guide
- “Genericized” for release
- SOH configuration updated for IMS networks
- Transitioned from Docker to Kubernetes (PI 13 release was still in Docker)
- Tested to build, deploy, and run in a generic environment

Monitors Station State-of-Health Use Case and UI Storyboards

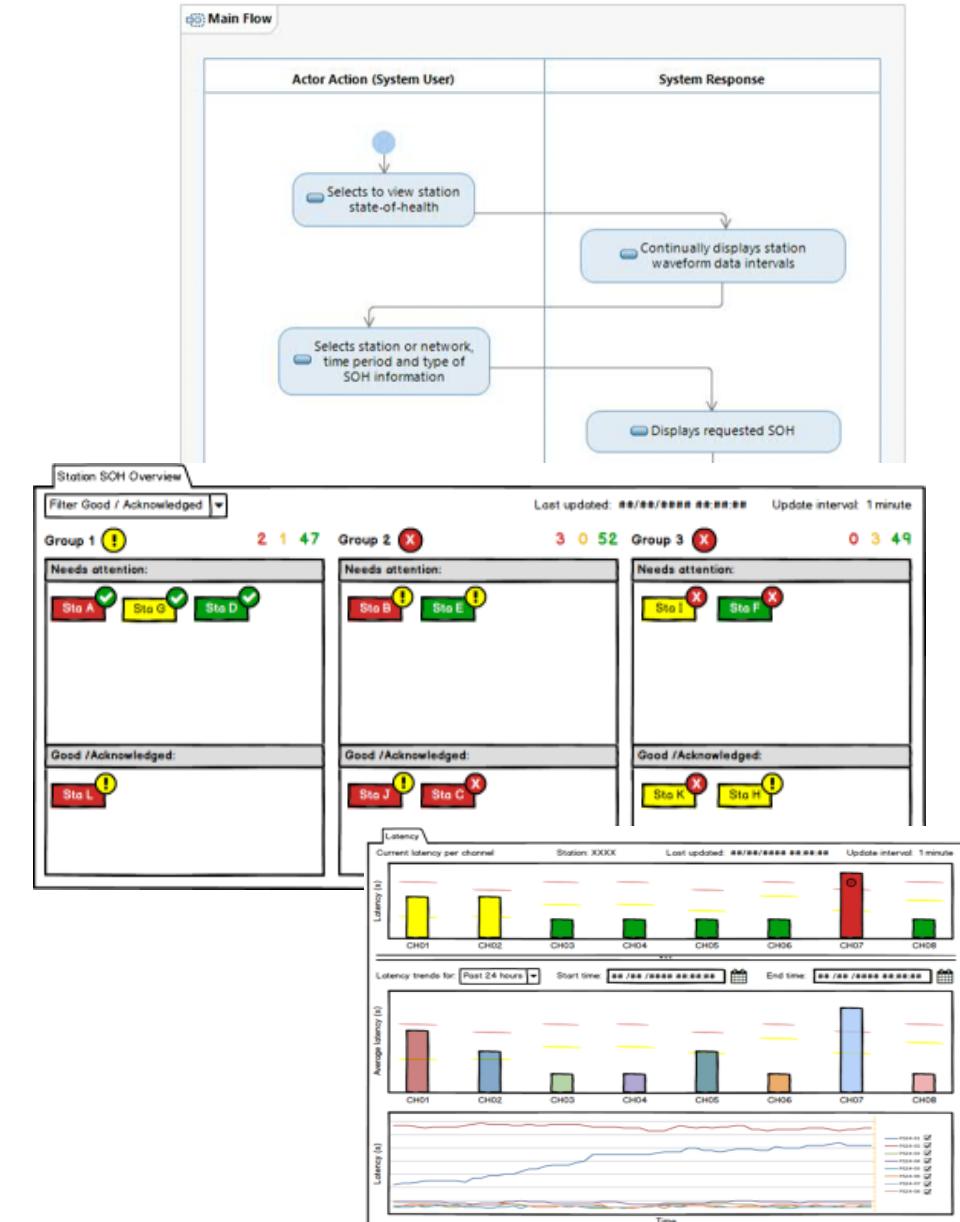


UC Brief Description:

- This use case describes how the System User monitors station state-of-health (SOH). The System User views current station state-of-health (e.g., state-of-health values reported by the station, timeliness of waveform data intervals, station processing statistics and thresholds, and waveform QC masks) to detect problems with station data quality and availability.

Key concepts from the UIS:

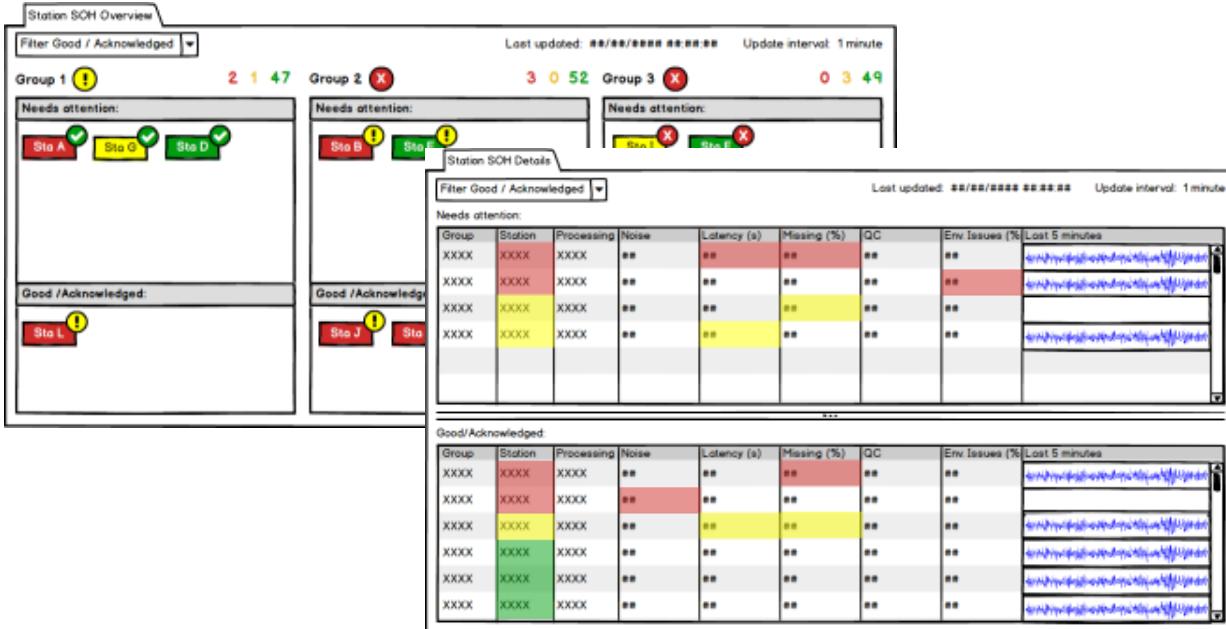
- The focus of this capability is on real-time station state of health (SOH).
- This capability is intended primarily for use by the System Controller. However, other system users (e.g., Analysts) will likely also find it useful.
- Incoming station data is monitored on a per-station basis and issues are addressed as needed.
- Users need to view both individual station status as well as the overall status of networks of stations.
- Displays provide users with an at-a-glance view of station SOH plus the ability to drill down into the details of a specific station.



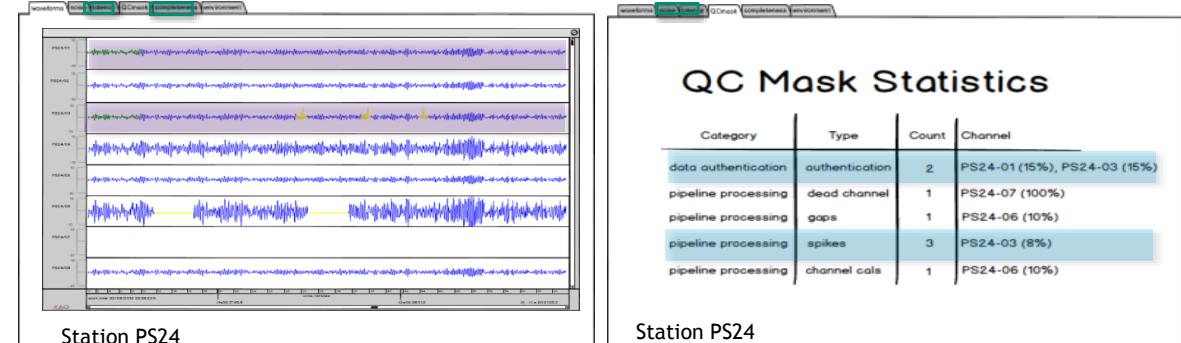
Station SOH Capability Displays



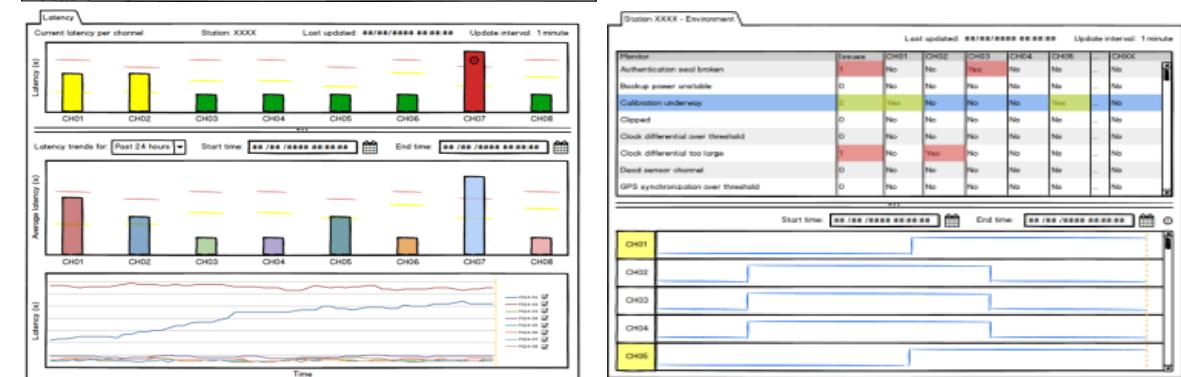
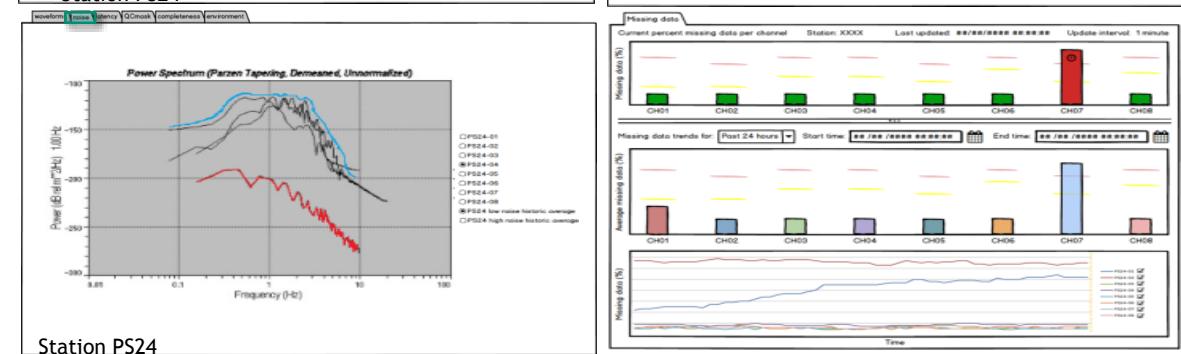
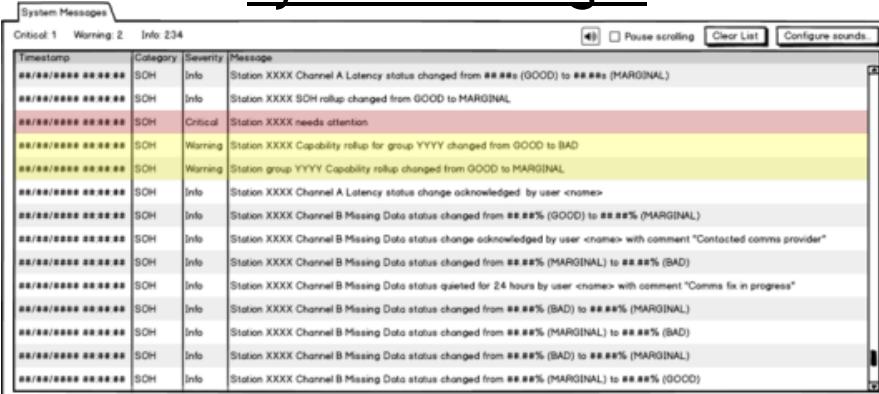
Summary Level



Drill-down



System Messages



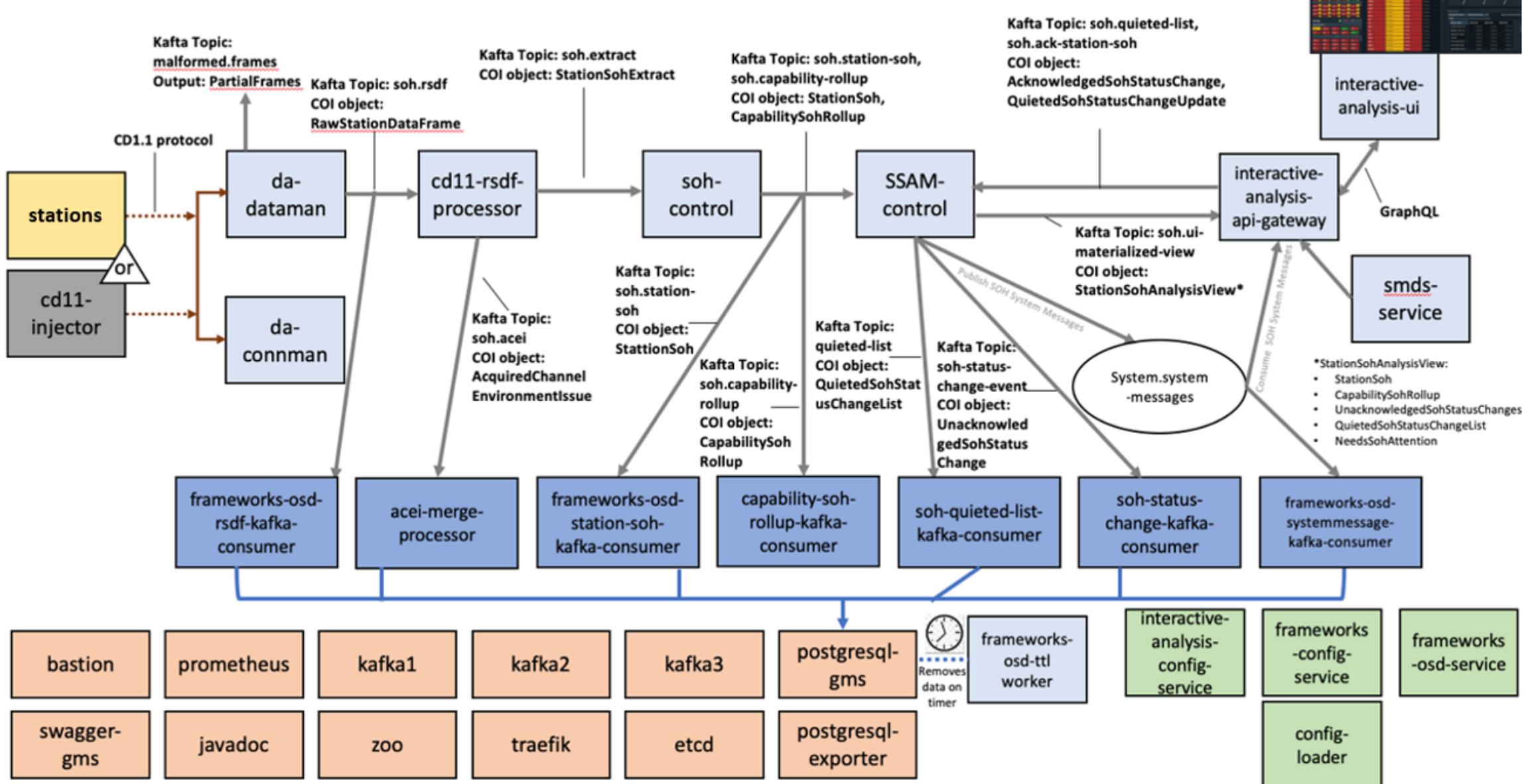
Station SOH Monitoring Capabilities



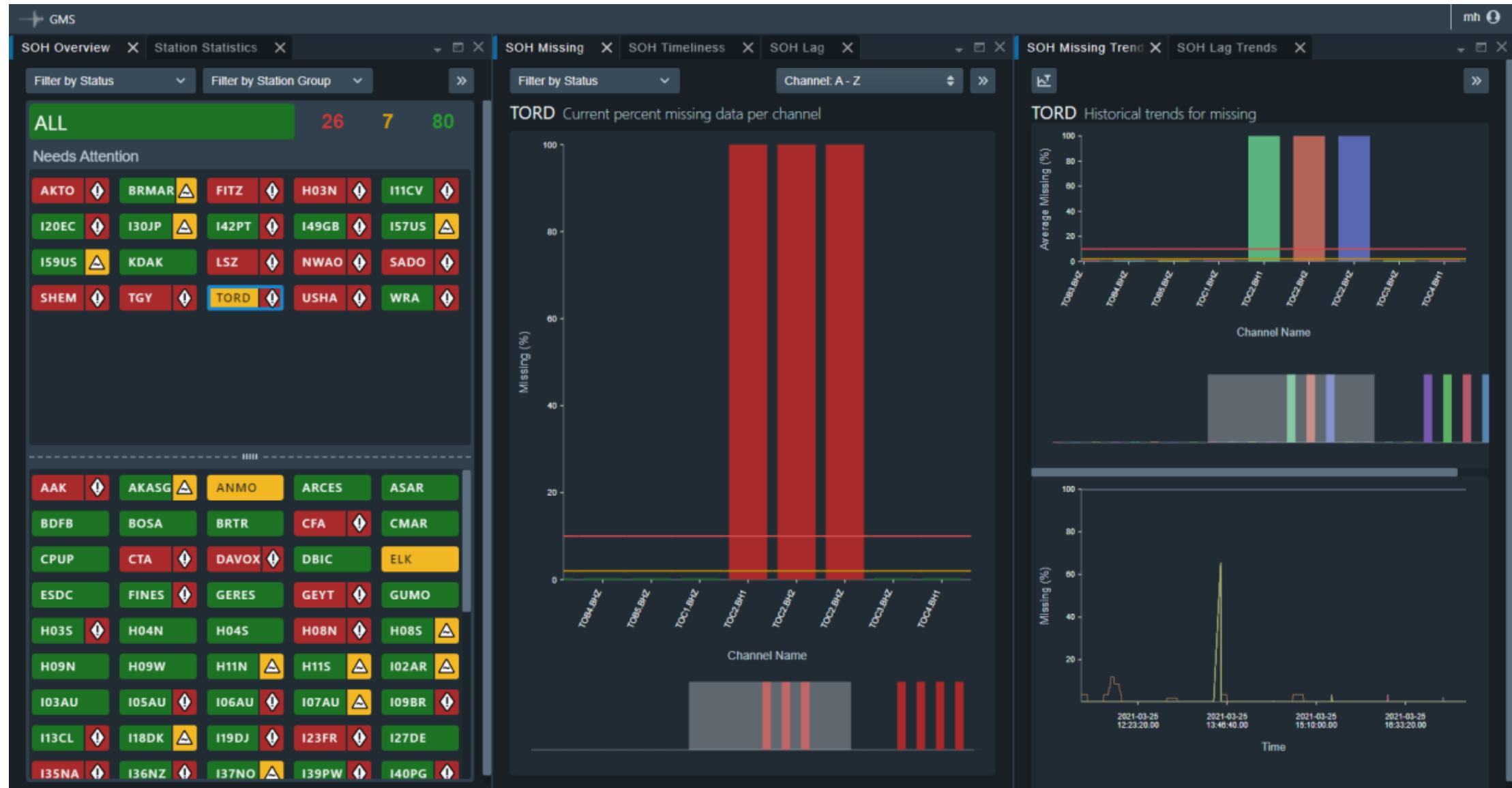
- Acquires CD1.1 protocol data only (tested with 300+ stations)
- Computes SOH metrics, configurable for each channel and metric type:
 - Missing Data
 - Data Timeliness
 - Communications Lag
 - Station Environment Issues
- Computes roll-up statuses, configurable by station and station group:
 - Worst-of SOH status roll-up for each Station
 - Capability status roll-up for Station Groups and Stations
- Stores SOH data for trend plots and to restart w/ state

- Overview Display – current status with change notification/acknowledgement
- Station Statistics Displays – roll-up statistics for each SOH category
- Missing, Timeliness, Lag, and Environment drill-down displays – current SOH metrics per channel
- Missing, Latency, and Environment Trend Displays – averages and trend plots over time
- System Messages Display – shows information and error messages and audible alarms

Station SOH Monitoring System



SOH Workspace



SOH Overview Display



GMS SOH Overview Station Statistics System Messages mh ⓘ

Last Updated: 2021/03/25 17:37:21 Update Interval: 20 seconds

ALL 26 8 79

Needs Attention

AKTO ⓘ	CFA ⓘ	CMAR ⓘ	ELK ⓘ	FITZ ⓘ	H03N ⓘ	H11N ⓘ	I11CV ⓘ	I20EC ⓘ	I30JP ⓘ	I42PT ⓘ	I49GB ⓘ	I51GB ⓘ	I57US ⓘ	I59US ⓘ	KDAK ⓘ	LSZ ⓘ	MATP ⓘ
MJAR ⓘ	NWAO ⓘ	SADO ⓘ	SCHQ ⓘ	SHEM ⓘ	TGY ⓘ	TORD ⓘ	USHA ⓘ	WRA ⓘ									

AAK ⓘ AKASG ⓘ ANMO ⓘ ARCES ⓘ ASAR ⓘ BDFB ⓘ BOSA ⓘ BRMAR ⓘ BRTR ⓘ CPUP ⓘ CTA ⓘ DAVOX ⓘ DBIC ⓘ ESDC ⓘ FINES ⓘ GERES ⓘ GEYT ⓘ GUMO ⓘ
H03S ⓘ H04N ⓘ H04S ⓘ H08N ⓘ H08S ⓘ H09N ⓘ H09W ⓘ H11S ⓘ I02AR ⓘ I03AU ⓘ I05AU ⓘ I06AU ⓘ I07AU ⓘ I09BR ⓘ I13CL ⓘ I18DK ⓘ I19DJ ⓘ I23FR ⓘ
I27DE ⓘ I35NA ⓘ I36NZ ⓘ I37NO ⓘ I39PW ⓘ I40PG ⓘ I41PY ⓘ I43RU ⓘ I44RU ⓘ I45RU ⓘ I46RU ⓘ I47ZA ⓘ I48TN ⓘ I50GB ⓘ I53US ⓘ I55US ⓘ I56US ⓘ I58US ⓘ
I60US ⓘ ILAR ⓘ KBZ ⓘ KEST ⓘ KMBO ⓘ KSRS ⓘ LPAZ ⓘ LZDM ⓘ MBAR ⓘ MKAR ⓘ NEW ⓘ NRIK ⓘ NVAR ⓘ PDAR ⓘ PETK ⓘ PMSA ⓘ PPT ⓘ PTGA ⓘ
QSPA ⓘ ROSC ⓘ SJG ⓘ SONM ⓘ SUR ⓘ TEIG ⓘ TSUM ⓘ TXAR ⓘ ULM ⓘ USRK ⓘ VNDA ⓘ YBH ⓘ YKA ⓘ ZALV ⓘ

SOH Overview Display – multiple Station Groups



Station Statistics Display



Station Statistics Display – filtered by Station Group HA



SOH Overview × Station Statistics × System Messages × mh 0 ...

Filter by Status ▼ HA ▼ Show columns ▼

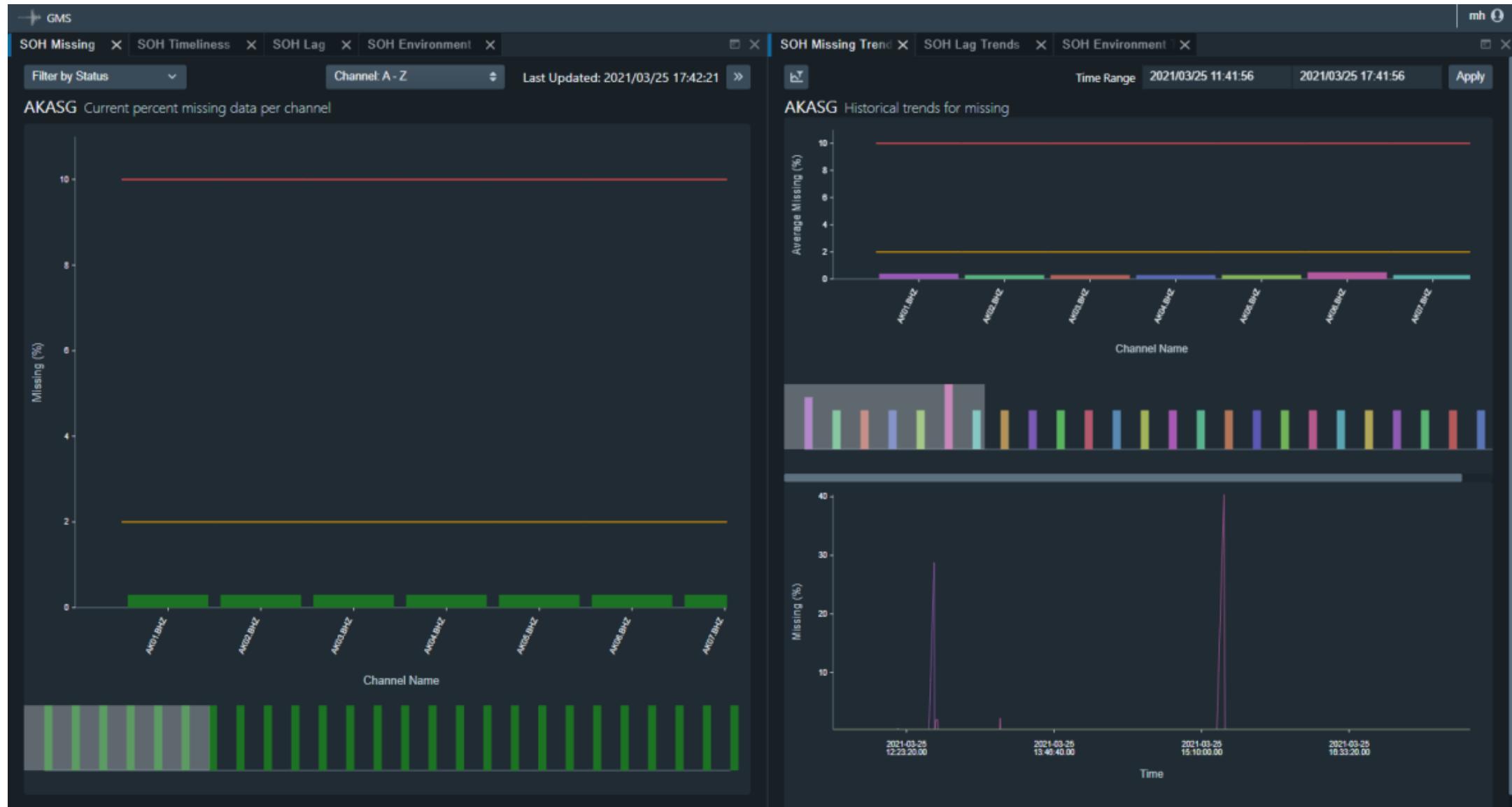
Last Updated: 2021/03/25 17:38:41 Update Interval: 20 seconds

Needs Attention

Station ↑	Station Missing (%)	Station Timelines...	Station Lag (s)	Station Issues (%)	Channel Missing ...	Channel Timeline...	Channel Lag (s)	Channel Issues (...)
H03N	100.00	2,291.57	Unknown	Unknown	100.00	2,291.74	Unknown	Unknown
H11N	0.04	21.57	23.10	0.00	10.00	22.25	51.63	0.00

Station ↑	Station Missing (%)	Station Timelines...	Station Lag (s)	Station Issues (%)	Channel Missing ...	Channel Timeline...	Channel Lag (s)	Channel Issues (...)
H03S	0.04	21.57	22.20	2.08	0.04	21.57	59.69	100.00
H04N	0.04	31.58	27.37	0.00	0.04	31.58	54.79	0.00
H04S	0.04	31.58	32.04	0.00	0.04	31.58	49.87	0.00
H08N	100.00	Unknown	Unknown	Unknown	100.00	Unknown	Unknown	Unknown
H08S	0.04	21.57	16.16	0.00	10.00	22.20	17.03	0.00
H09N	0.10	31.58	26.41	0.00	0.10	31.58	49.93	0.00
H09W	0.10	31.58	26.81	0.00	0.10	31.58	44.85	0.00
H11S	0.04	21.57	17.42	0.00	10.00	22.18	37.55	0.00

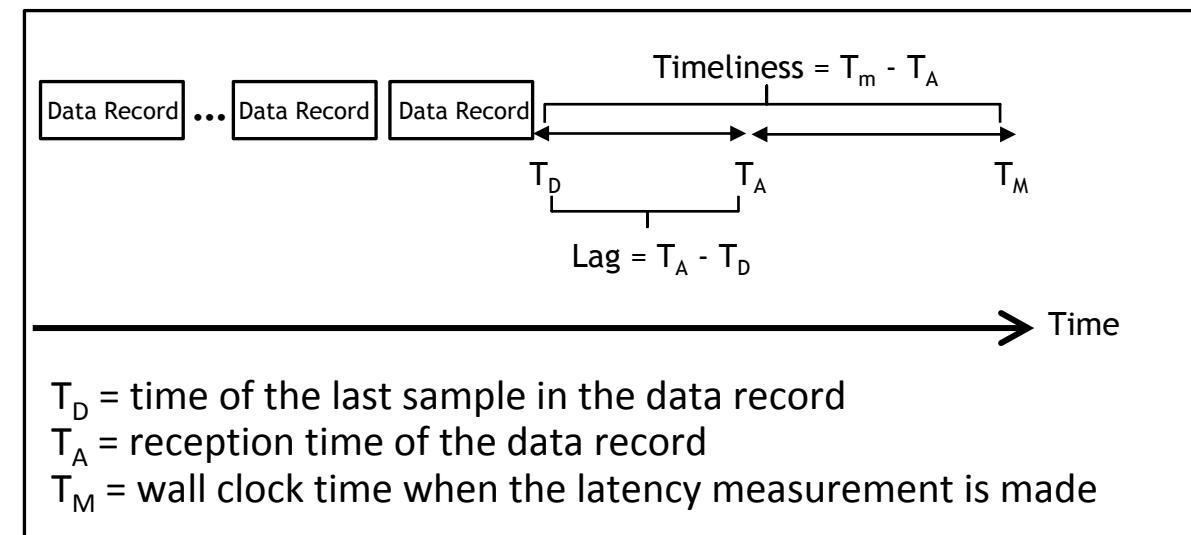
SOH Missing and SOH Missing Trends Displays



SOH Timeliness Display (no trend display in this release)

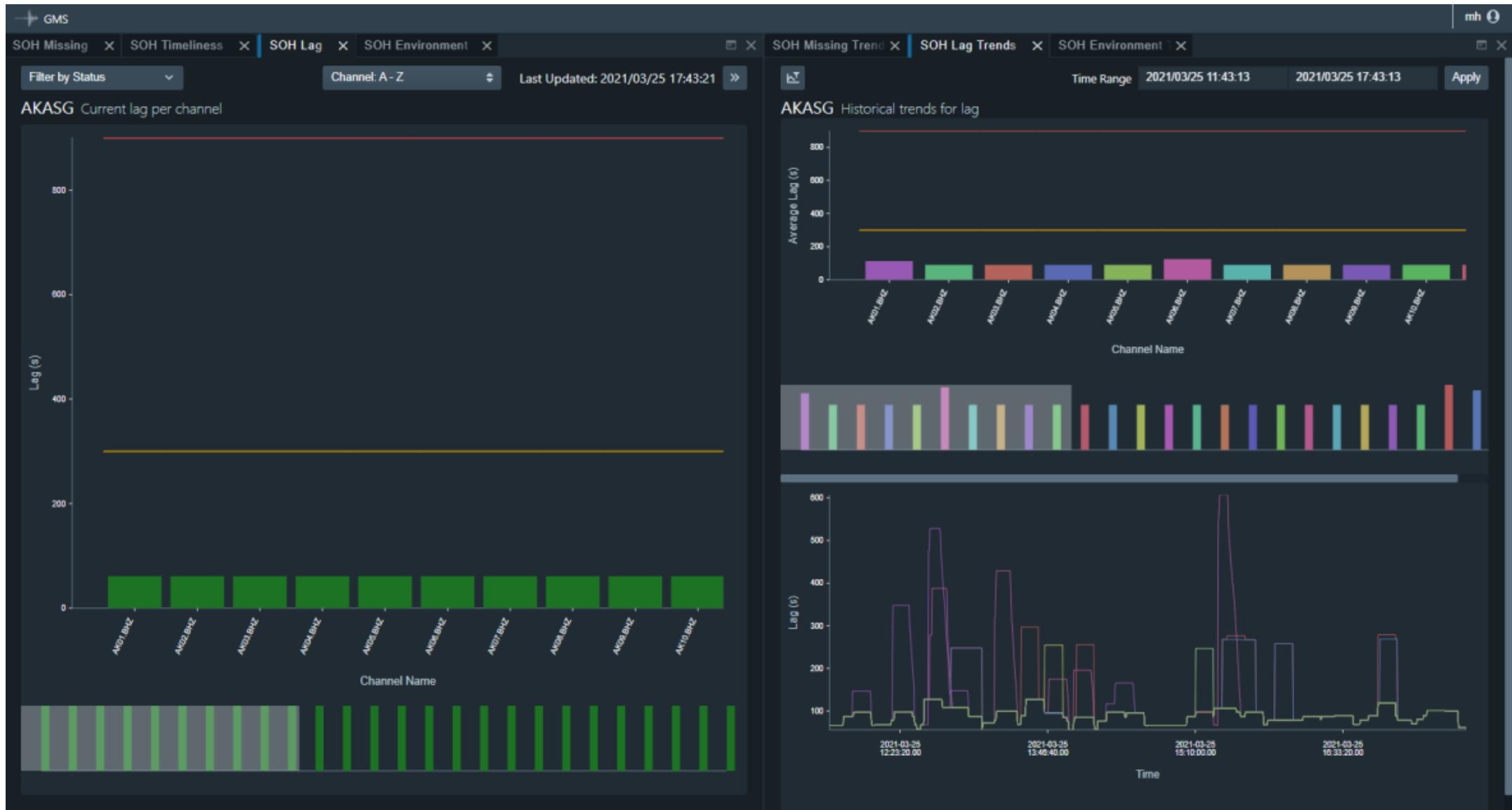


Latency: Data Timeliness vs. Communications Lag

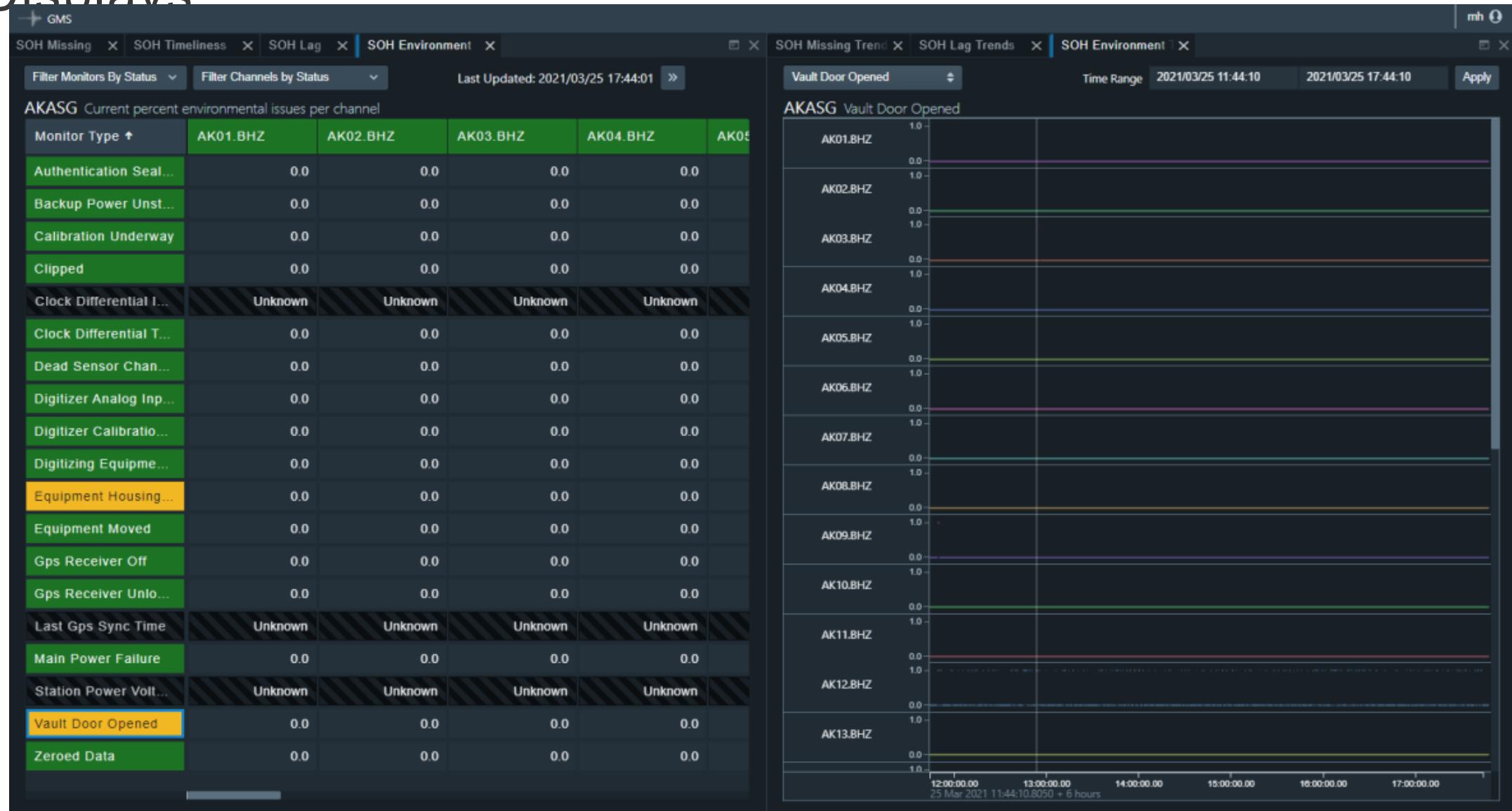


Adapted from <http://ds.iris.edu/ds/nodes/dmc/data/latency/>

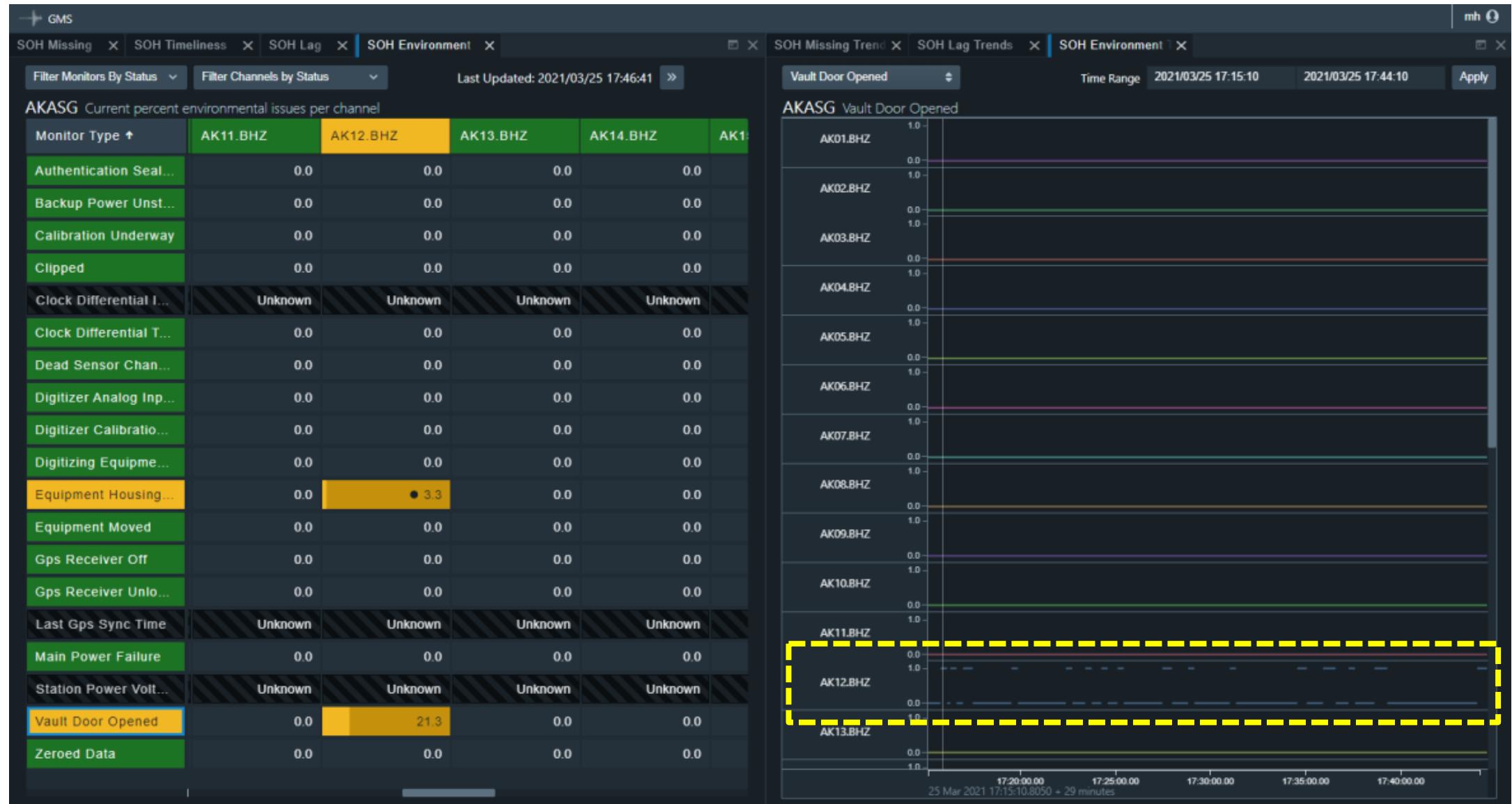
SOH Lag and SOH Lag Trends Display



SOH Environment Issues and SOH Environment Trends Displays



AK12.BHZ Vault Door Open zoomed in time



SOH Missing Trends expanded



System Messages Display



System Messages X

INFO: 4978 WARNING: 0000 CRITICAL: 0000

Auto scroll: Clear list Configure sounds

Timestamp ↑	Category	Subcategory	Severity	Message
2021-03-25 17:36:22.65	SOH	STATION	INFO	Station I42PT Channel I42PT.I42H1.BKO Clock Differential Too Large status changed from 0.0% (GOOD) to 3.23% (MARGINAL)
2021-03-25 17:37:02.74	SOH	STATION	INFO	Station CMAR SOH status changed from GOOD to MARGINAL
2021-03-25 17:37:02.74	SOH	STATION	INFO	Station CMAR Channel CMAR.CM03.SHZ Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.64% (MARGINAL)
2021-03-25 17:37:22.68	SOH	STATION	INFO	Station SCHQ SOH status changed from GOOD to MARGINAL
2021-03-25 17:37:22.68	SOH	STATION	INFO	Station SCHQ Channel SCHQ.SCHQ.BHE Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.61% (MARGINAL)
2021-03-25 17:37:22.68	SOH	STATION	INFO	Station SCHQ Channel SCHQ.SCHQ.BHZ Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.61% (MARGINAL)
2021-03-25 17:37:22.68	SOH	STATION	INFO	Station SCHQ Channel SCHQ.SCHQ.BHN Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.61% (MARGINAL)
2021-03-25 17:37:42.77	SOH	STATION	INFO	Station ELK SOH status changed from GOOD to MARGINAL
2021-03-25 17:37:42.77	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BH2 Timeliness status changed from 4 minutes 41 seconds (GOOD) to 5 minutes 1 second (MARGINAL)
2021-03-25 17:37:42.77	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BHZ Timeliness status changed from 4 minutes 41 seconds (GOOD) to 5 minutes 1 second (MARGINAL)
2021-03-25 17:37:42.77	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BH1 Timeliness status changed from 4 minutes 41 seconds (GOOD) to 5 minutes 1 second (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BH2 Missing status changed from 0.51% (GOOD) to 3.84% (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BHZ Missing status changed from 0.51% (GOOD) to 3.84% (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ELK Channel ELK.ELK.BH1 Missing status changed from 0.51% (GOOD) to 3.84% (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ULM SOH status changed from GOOD to MARGINAL
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ULM Channel ULM.ULM.BHZ Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.64% (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ULM Channel ULM.ULM.BHE Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.64% (MARGINAL)
2021-03-25 17:38:02.68	SOH	STATION	INFO	Station ULM Channel ULM.ULM.BHN Gps Receiver Unlocked status changed from 0.0% (GOOD) to 1.64% (MARGINAL)
2021-03-25 17:38:22.77	SOH	STATION	INFO	Station AKASG Channel AKASG.AK12.BHZ Equipment Housing Open status changed from 0.0% (GOOD) to 1.64% (MARGINAL)
2021-03-25 17:38:42.70	SOH	STATION	INFO	Station ELK SOH status changed from MARGINAL to BAD

Questions?