KINEMETRICS

Advancement through Innovation

Since 1969

Q8 WIRELESS EXPANSION

Modern HiFi Data Collection

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QUANTERRA DIGITIZERS RESILIENCE – PUSHING THE BOUNDARIES

Under Water for 5 days & 5 nights

Frozen In Ice until it melts

Survived Hurricane Katrina

Mean Time Between Failure Estimates from Repair & Warranty Records for Q330 Series

System	**Q330 Series**
Date of Analysis	12/31/2021
Years Analyzed	20
Total Units Shipped	7398

Year	Average Shipped	Cumulative Units	Estimated % in Use	Series Operational Hours	Repairs KMI	Estimated MTBF	
2002	412	412	50%	1,804,560	5	**360,912**	
2003	412	824	80%	5,774,592	5	**1,154,918**	
2004	412	1236	90%	9,744,624	1	**9,744,624**	
2005	412	1648	90%	12,992,832	20	**649,642**	
2006	412	2060	90%	16,241,040	23	**706,132**	
2007	412	2472	90%	19,489,248	33	**590,583**	
2008	412	2884	90%	22,737,456	24	**947,394**	
2009	560	3444	90%	27,152,496	38	**714,539**	
2010	605	4049	90%	31,922,316	52	**613,891**	
2011	444	4493	90%	35,422,812	45	**787,174**	
2012	390	4883	90%	38,497,572	73	**527,364**	
2013	221	5104	90%	40,239,936	61	**659,671**	
2014	222	5326	90%	41,990,184	70	**599,860**	
2015	267	5593	95%	46,544,946	67	**694,701**	
2016	278	5871	95%	48,858,462	71	**688,147**	
2017	230	6101	95%	50,772,522	68	**746,655**	
2018	287	6388	95%	53,160,936	75	**708,812**	
2019	351	6222	95%	51,779,484	38	**1,362,618**	
2020	374	6475	95%	53,884,950	72	**748,402**	
2021	285	6673	95%	55,532,706	104	**533,968**	
TOTAL	7398		89%	664,543,674	945	**703,221**	**Hours**
					MTBF:	80	**Years**

BACK TO THE FUTURE…

Q330

+

VIE (houses Baler44 and QEP)

=

Twenty years later…

Q8

+

QME

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35 years and 8 generations of Quanterra processors" evolved together with network requirements.

Volts-to-bits technology is now unchanged in decades, but ***SWPP*** (Size/Weight/Power/Performance) evolution relative to Q680 systems in the 1990's networks improves reliability, data recovery, and siting options.

Attribute	Q8 vs Q680
Sample rate	12.5 × higher
Storage	1000 × more
Physical Volume	50 × smaller
Power (< 300mW)	200 × less
Weight (< 1kg)	25 × less
Cost (Constant $)	5 × less
Combined Merit	**> 10^{10}!**

Q8

Q8 IS DIFFERENT

“Never miss an earthquake”

- Internal 3-component ±2g MEMS accelerometer
- Internal supercapacitors for data loss prevention when power is lost
- Average <2 minutes startup time
- Up to 100 GB internal storage (4+ years of storage)
- 7th high resolution channel for digitizing calibration signal or as a main channel
- Independent power management of the frontend and of the backend
- <300mW power consumption in Stand-Alone Recording Mode
- ***Mesh option for high fidelity stations (de-couple pressure from seismic)***

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Q8 MESH OPTION

Extend your reach

The modern way to add ancillary sensors

- **Wirelessly (IEEE standard)**
- **With Mesh Net ID**
- **100m range**

Meteorological sensors attached to QME

- ✓ Temperature sensor
- ✓ Barometric Pressure sensor
- ✓ Relative Humidity sensor
- ✓ Wind speed and direction sensor

Other sensors attached to QME

- ✓ Tiltmeter and Inclinometer
- ✓ Extensometer
- ✓ External voltage monitoring
- ✓ Strain sensor

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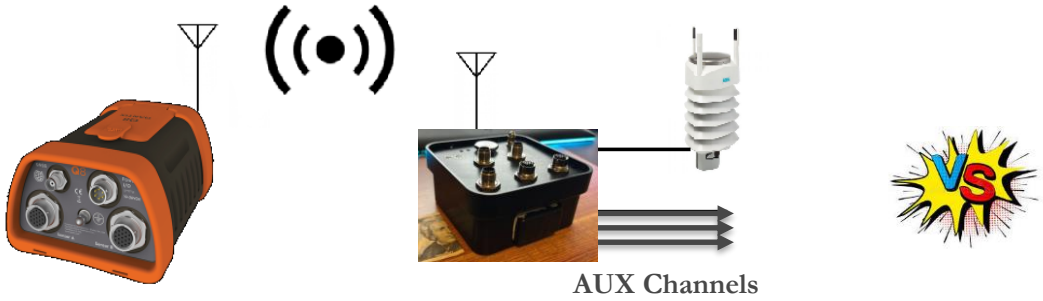
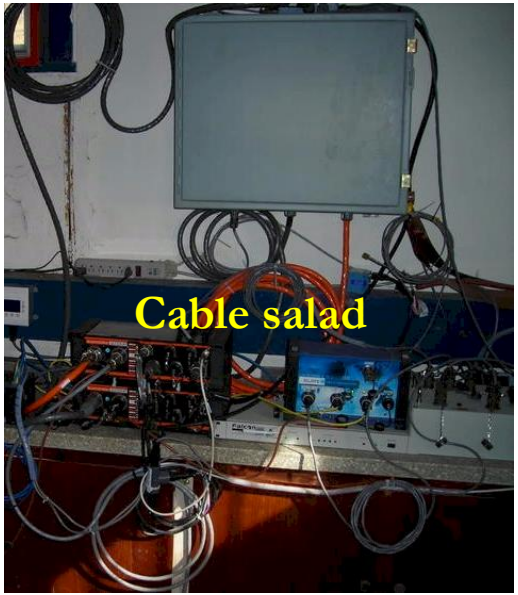
MESH NETWORKING

Become fully connected





* Decouple pressure for HiFi seismic recording
* Internal barometer
* QME is 25mW

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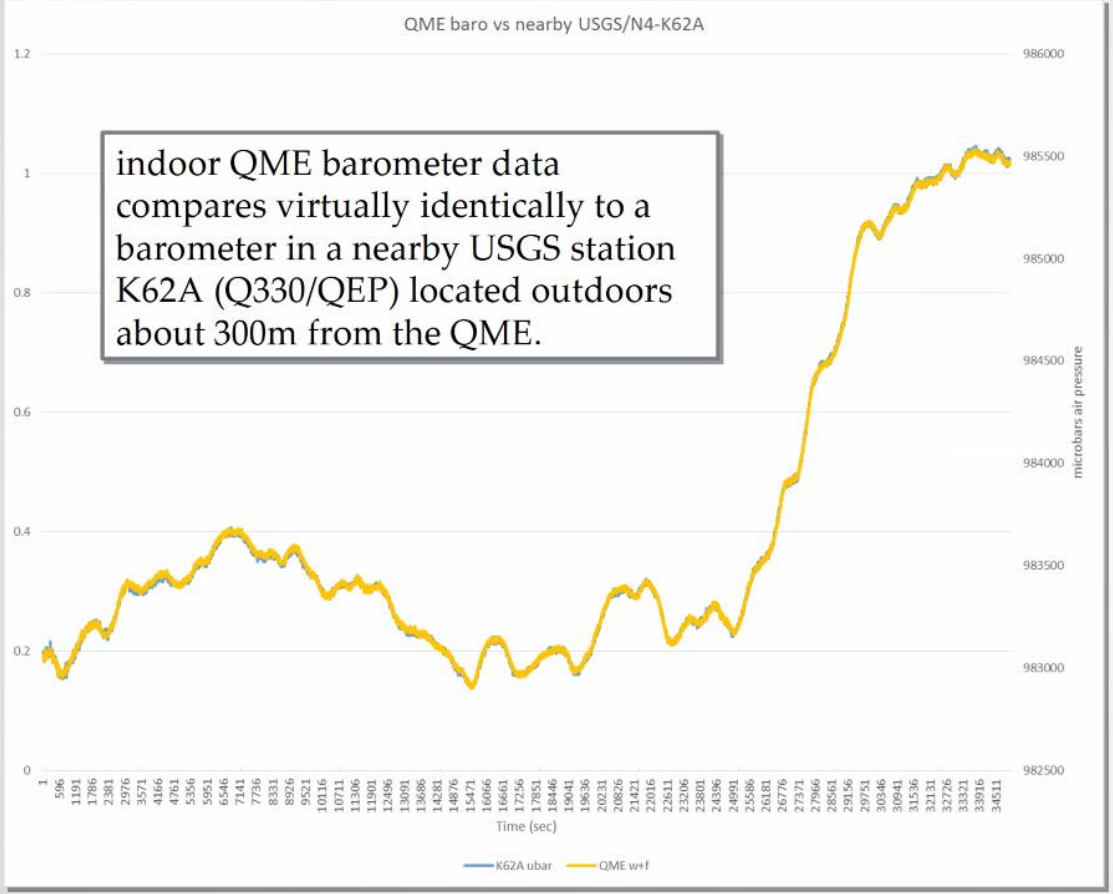


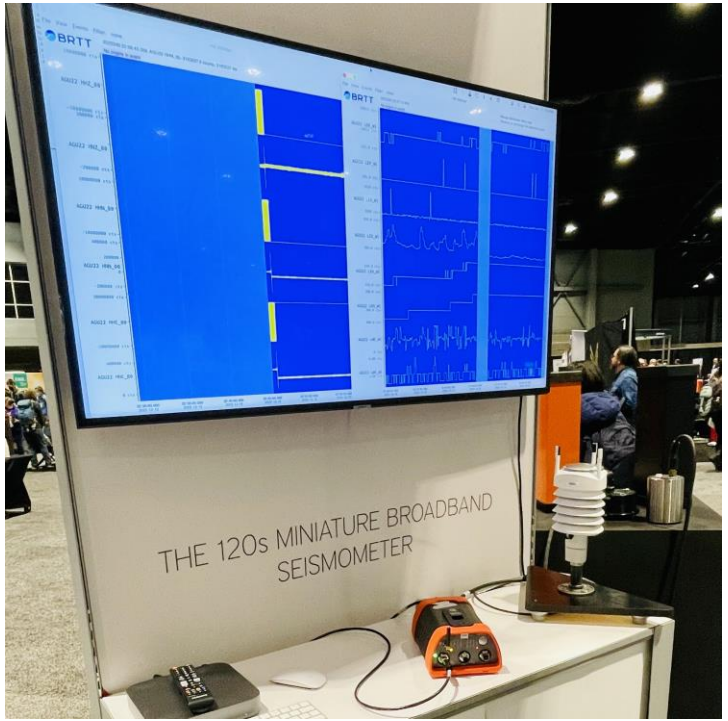
QME data

QME Tx Data, 16-bit values.

	Ch_Name	Description	
0	LDW	Barometric pressure	(whole hPa)
1	LDF	Barometric pressure	(fract hPa)
2	LX1	Digital Inputs bit mask	
3	LY1	Analog1 Single-ended	(millivolts)
4	LY2	Analog2 Single-ended	(millivolts)
5	LY3	Analog3 Single-ended	(millivolts)
6	LE4	Analog4 Single-ended	(QME supply mV)
7	LY5	Analog5 Differential	(millivolts)
8	LY6	Analog6 Differential	(millivolts)
9	LK1	QME Temperature	(C x100)
10	LWD	WX Wind Dir	(Wx val x10)
11	LWS	WX Wind Speed	(Wx val x10)
12	LKO	WX Temperature	(Wx val x10)
13	LIO	WX Humidity	(Wx val x10)
14	LDO	WX Barometer	(Wx val x10)
15	LRR	WX Rain Intensity	(Wx val x10)

QME DEMO

Proof of concept at AGU



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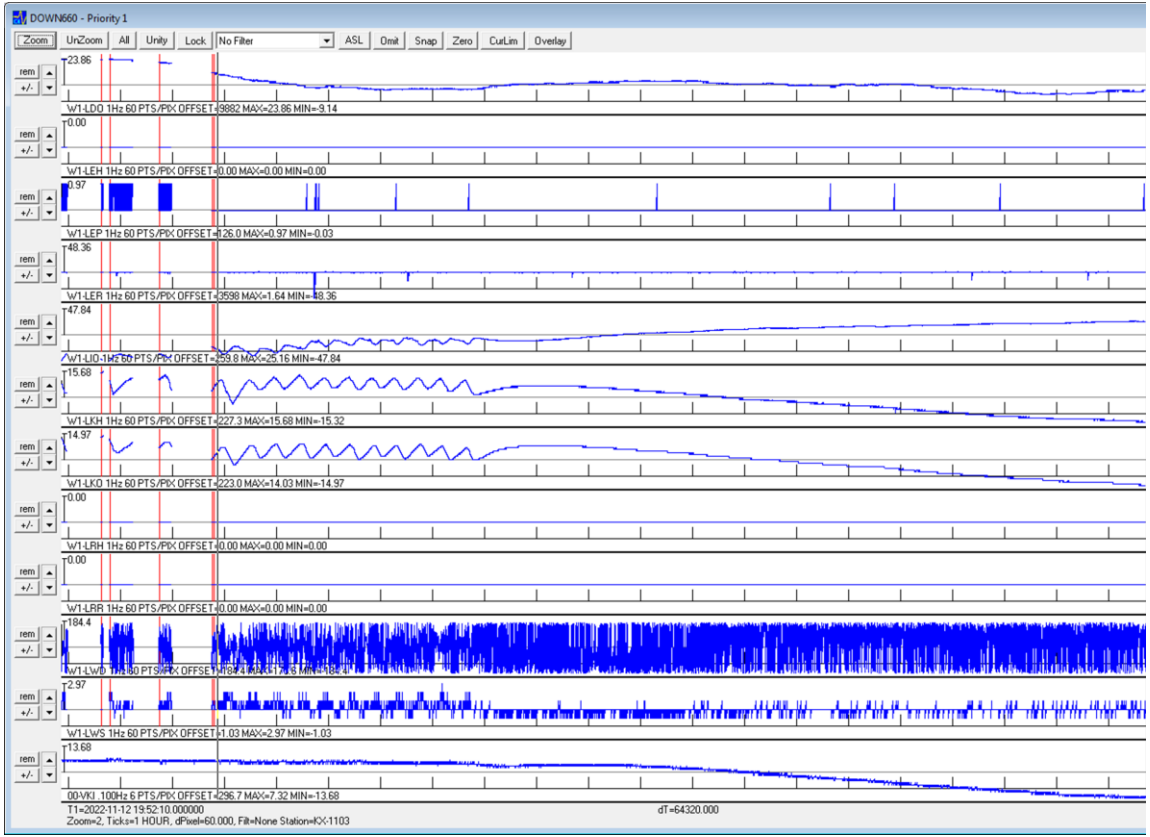
QME DATA DISPLAY

Data appear as additional channels in software



Channel Codes

LDO – Pressure
LEH – Heater Volts
LEP – Supply Volts
LER – Reference Volts (3.5V)
LIO – Humidity
LKH – Heater Temp.
LKO – Temperature
LRH – Hail Intensity
LRR – Rain Intensity
LWD – Wind Direction
LWS – Wind Speed

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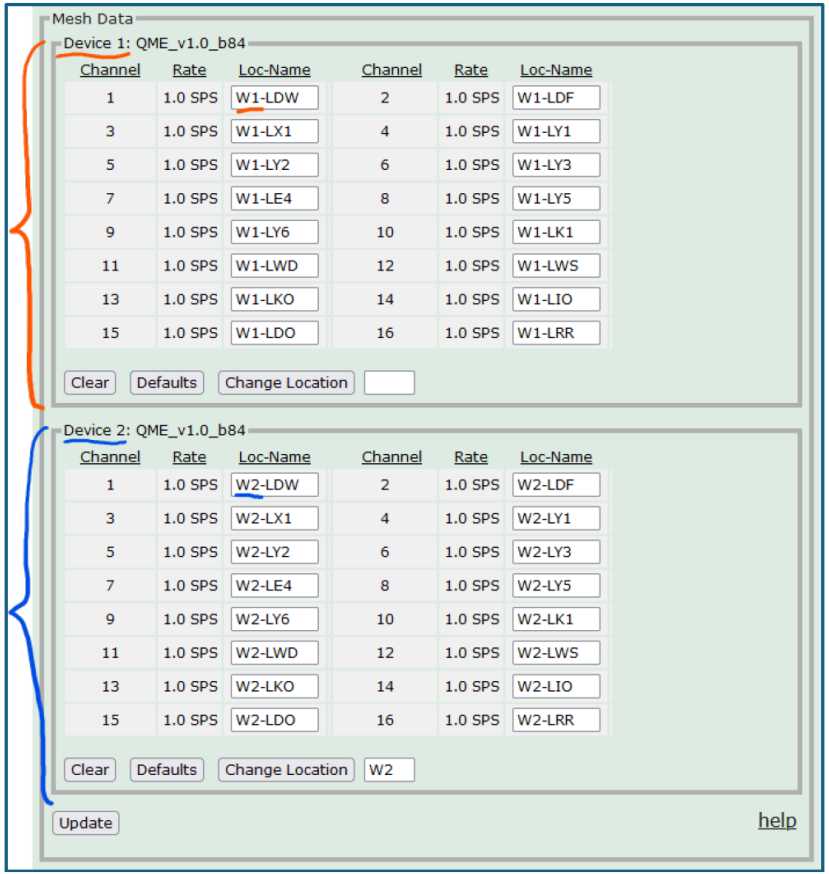
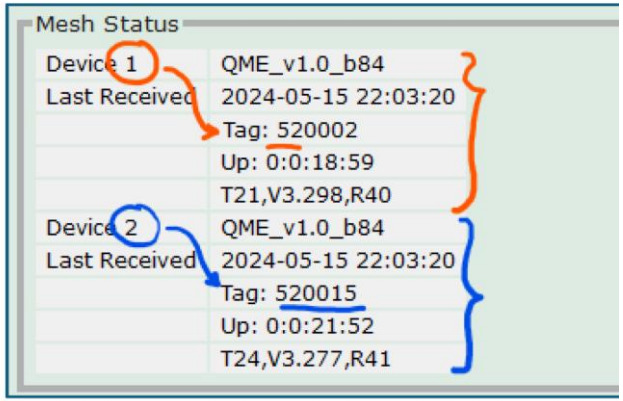
QME(s) PLURAL





Metcalfe's Law

Two telephones can make only one connection, five can make 10 connections. **The more things that are connected to a network, the more valuable that network becomes…..**

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THE WAY OF THE FUTURE

Wireless HiFi

1. *Easier deployment logistics*
2. *Sensor positioning freedom*
3. *No additional software*
4. *No trenching, conduits, or ground loops*
5. *Pristine seismic signal*

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Thank you !

Q&A

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NEW INSTRUMENTATION

The newest and the coolest

- Q330HRS — Datalogger with ALL 6 channels at 26-bit resolution
- Q330M+ — IMS-compliant CTBTO datalogger of the present and future
- Qantix Q8 — The wunderkind
- QME — Quanterra Mesh Extension for additional environmental sensors in Q8
- Pebble — Small, light, cost effective 3 channel datalogger
- MBB-2 — Cost effective miniature broadband seismometer (made in Switzerland)
- Omnisensor — MBB-2 and Episensor accelerometer in one borehole package

NEW INSTRUMENTATION

MBB-2 Broadband Seismometer

Spend less on vaults !

- Small (Ø=10 cm) and light (<3 kg)
- 290 mW power consumption
- 120 sec to 140 Hz passband
- No mass lock, no mass centering, by design
- X,Y,Z configuration
- IP68 for direct burial
- Operational temperature -40°C to +60°C

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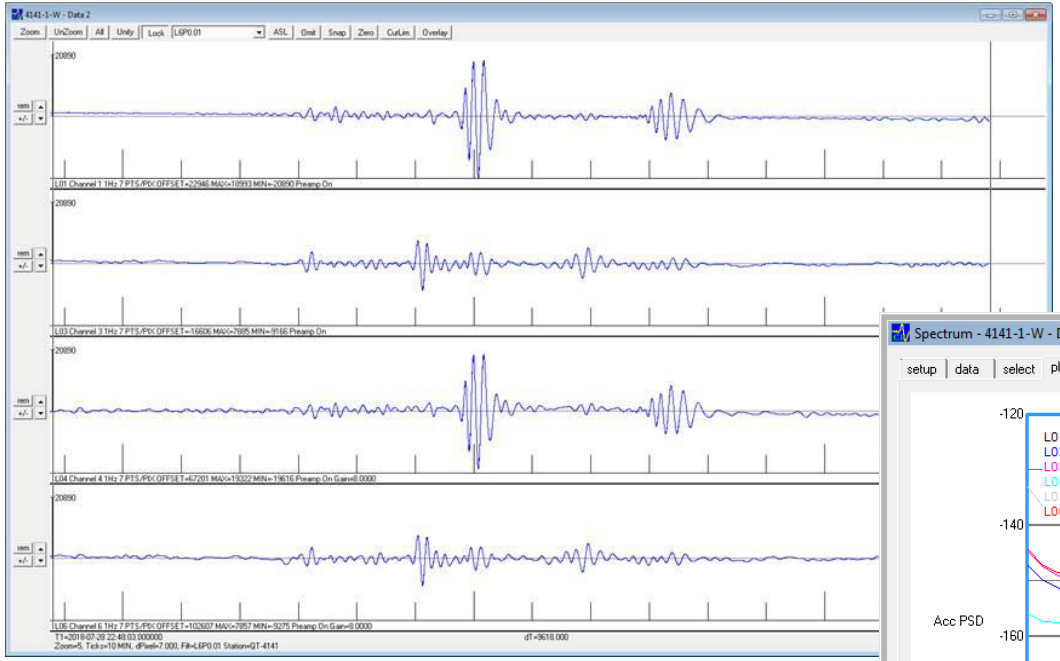
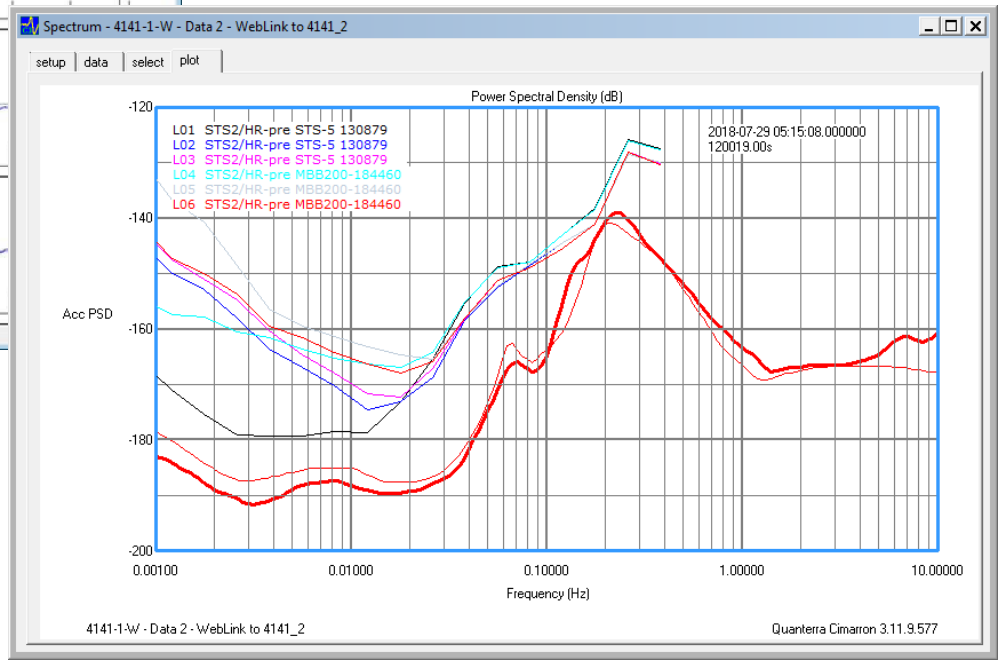
BROADBAND SEISMOMETERS

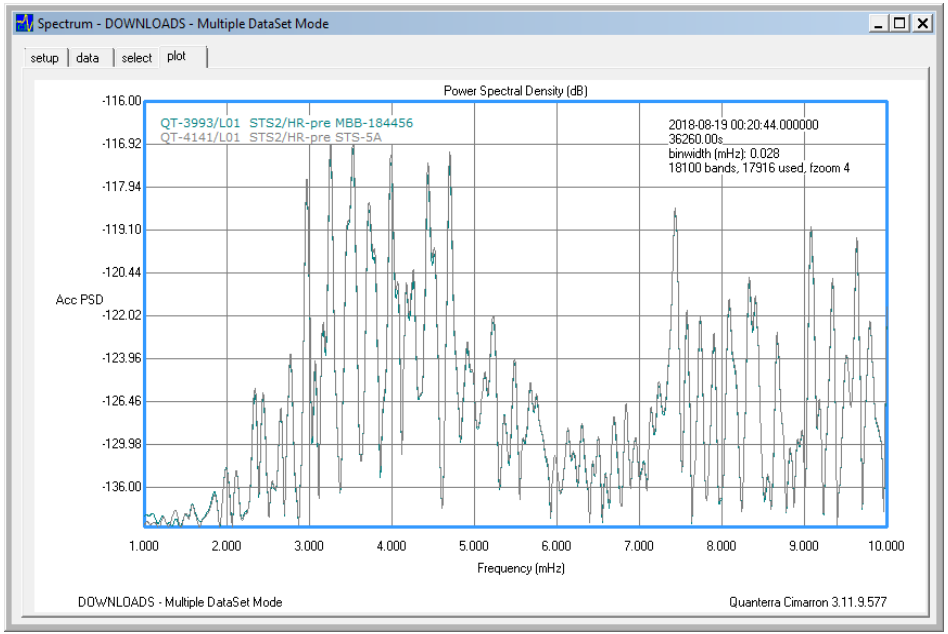




MBB-2 LF event data in comparison to the STS-5.
M 6.4 - 5km N of Lelongken, Indonesia Data are recorded at HRV.

In the timeseries, the top two traces are STS-5 Z and E; the bottom two traces are MBB-2 Z & E.
All data are low-pass filtered at 100s period. The waveforms are orbiting Rayleigh and Love waves.

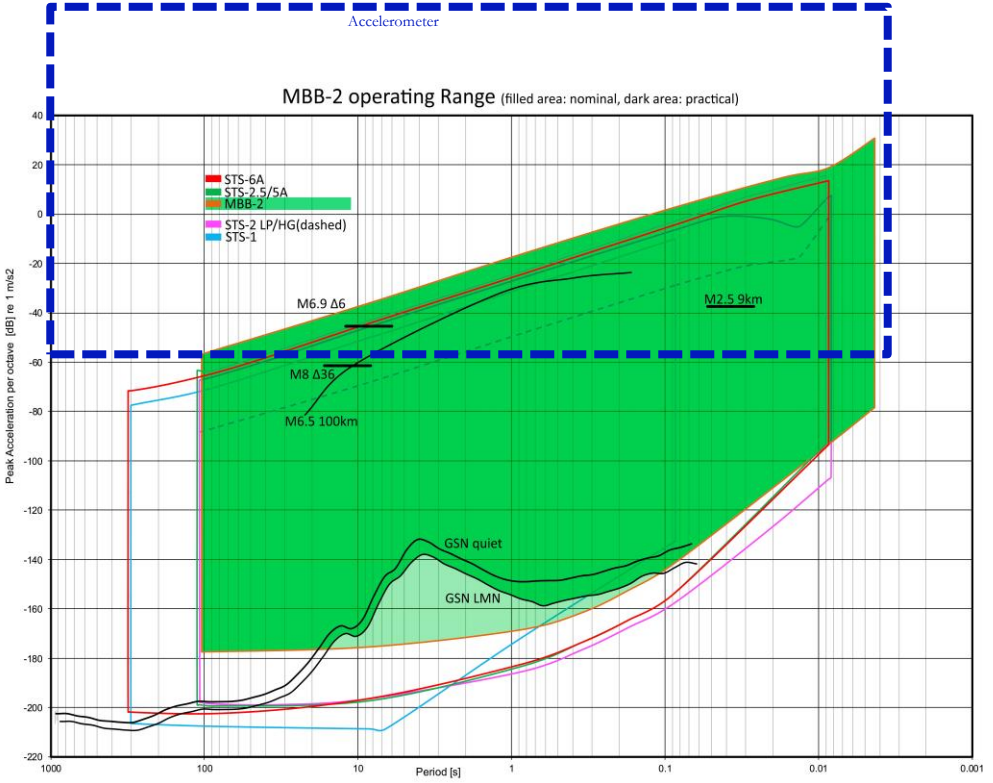
BROADBAND SEISMOMETERS



1000 s 100 s

Normal modes excited by a large event: STS-5A and MBB-2 at HRV

OMNISENSOR = EPISENSOR + MBB-2



Since 1969

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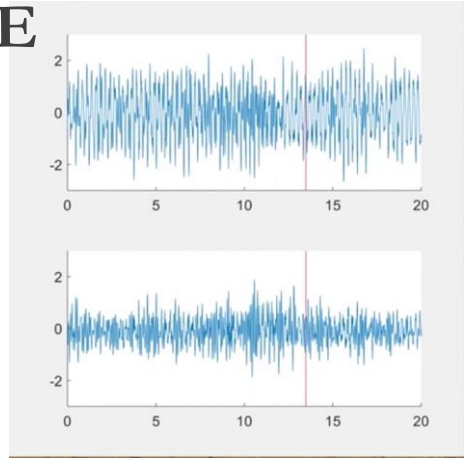
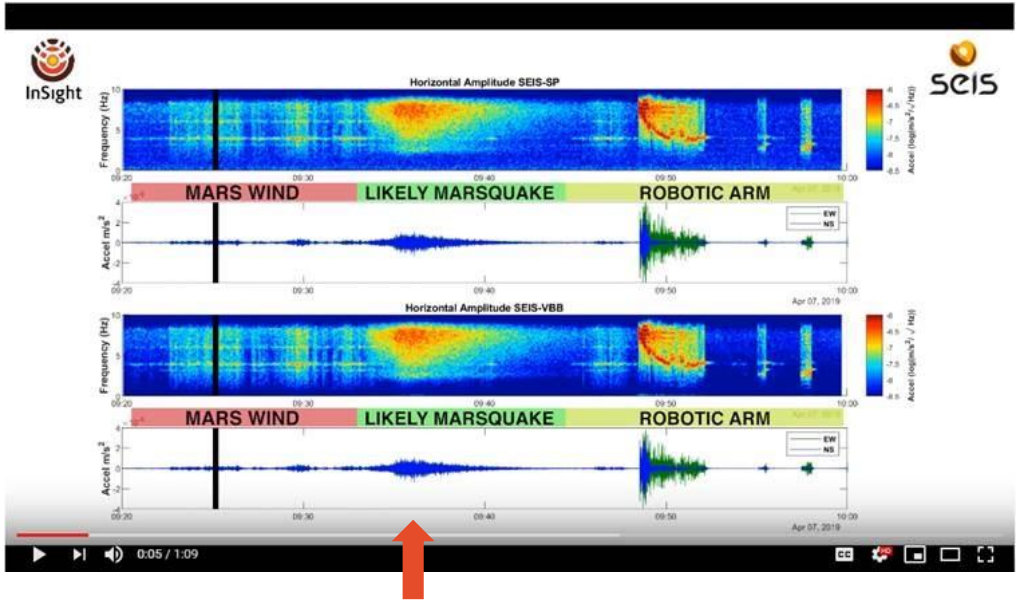
INNOVATIONS FOR THE FUTURE

SP-SEIS Seismometer for InSight

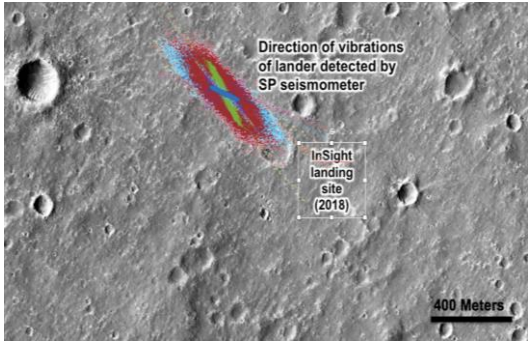
Recorded Martian wind immediately after landing



Time domain wind recordings



Recorded Marsquake (source NASA)



Calculated direction of the wind noise