



Introduction: Rowe Technologies, Inc.

Doppler Pinging The World's Water

With New ADCP Technologies for Oceanographic and Navigation Applications

- Founded in Sept, 2009 by Dan & Steve Rowe
- Product development led by Fran Rowe, co-founder of Teledyne RD Instruments
- Over 250 years of acoustic system development experience
 - Staff listed on more ADCP patents than any other company
 - Pioneers of ADCP/DVL Profiler technology
- Located in San Diego, CA

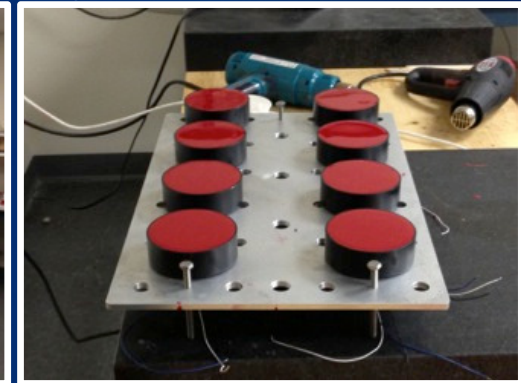
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RoweTech Facilities

- Main office located in Poway, CA
- 7100 ft² for development, manufacturing, service and support
- Transducer Production and unit assembly
- Satellite office in Shanghai – sales/service
- Factory Authorized Service Centers in China, India, Australia, France, Canada

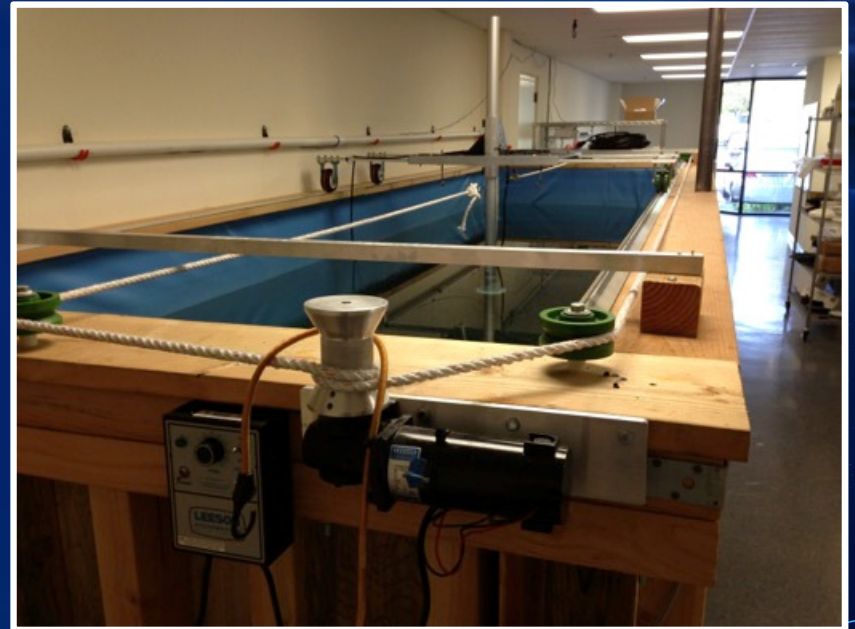




RoweTech Calibration and Testing



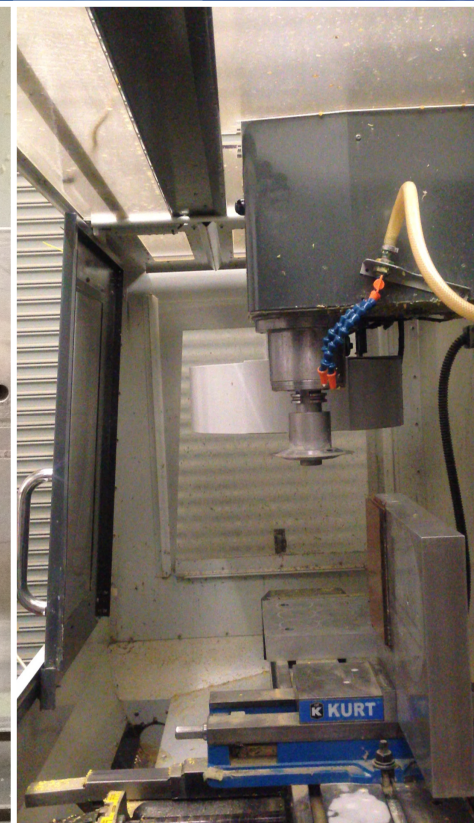
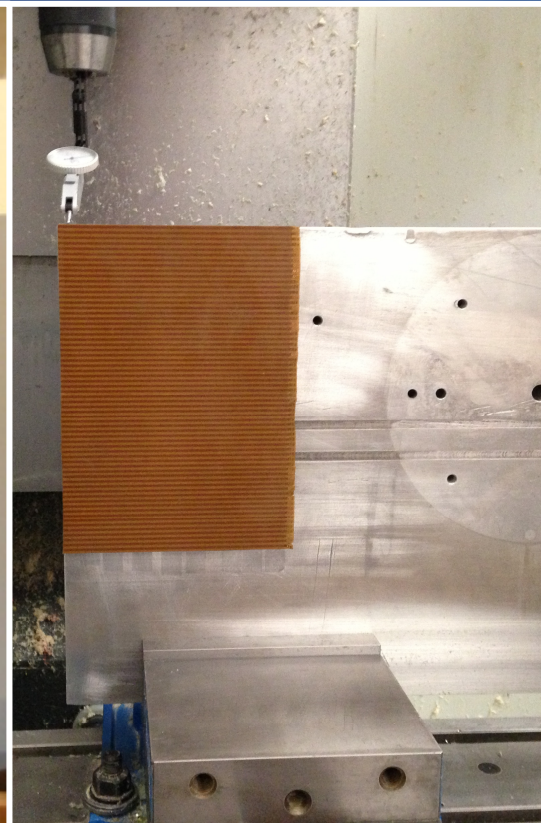
- 4500 gallon tow tank used for automated Doppler calibration and unit test





RoweTech Facilities

CNC Machine



8/26/2016

ROWETECH CONFIDENTIAL INFORMATION



RoweTech Engineering

Local Facilities – Lake & Sea testing

Ocean rated vessel for deep sea testing,
low frequency and deep water systems



Instrumented boat for testing high
frequency and shallow water systems

ATION



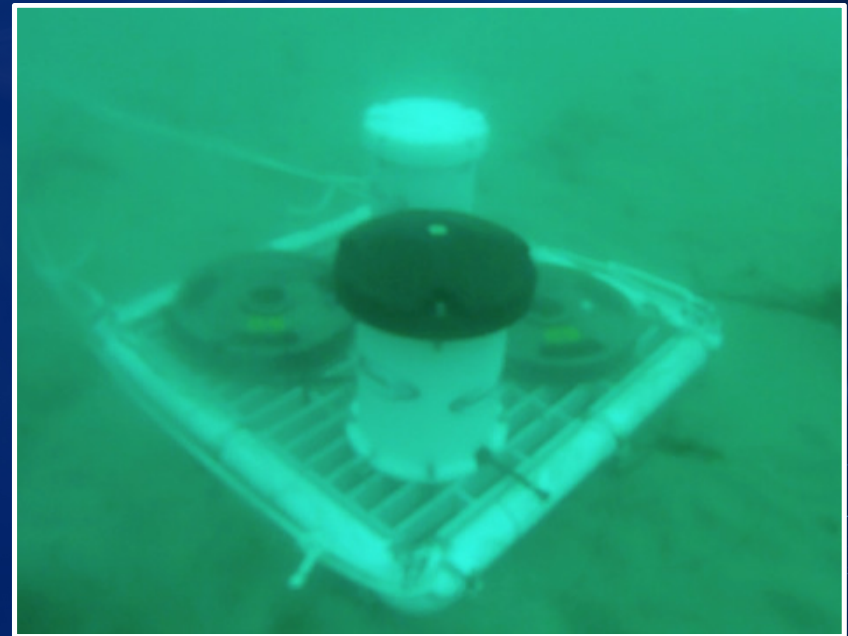
RoweTech Overview

External Resources – Sea Test

Long term deployments aided through the use of local facilities



Scripps Pier – La Jolla



SC600DP w/ External Battery Pack on long-term deployment



RoweTech ADCP/DVL Application Summary

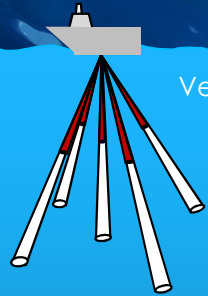
MOBILE VEHICLES

FIXED MOORING

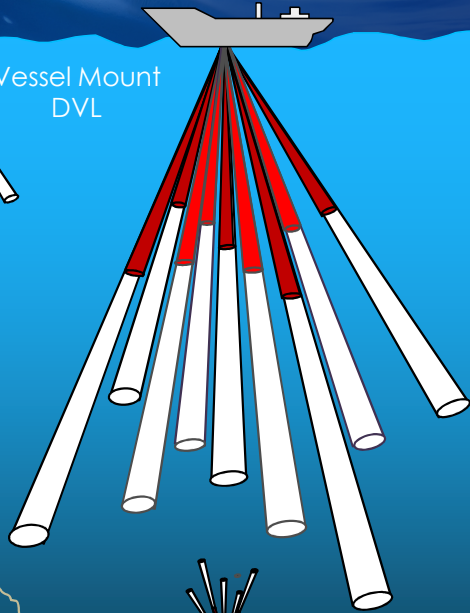
Vehicle Bottom Velocity -- Current Profile Spatial Cross Section

Current Profile Time-Series

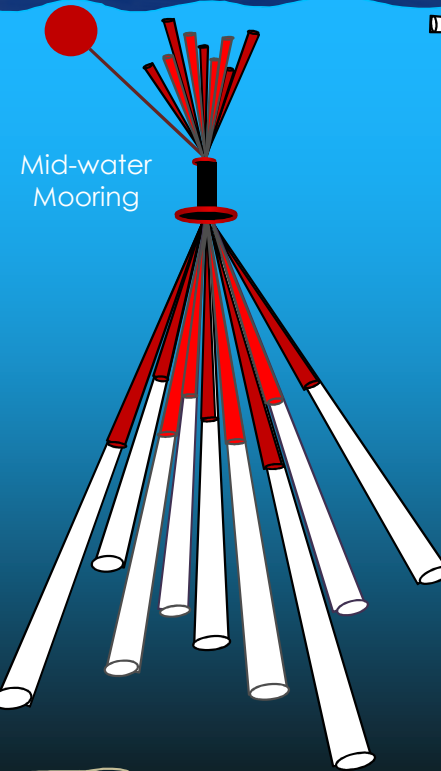
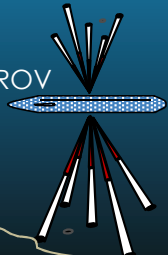
Wave Directional Spectrum



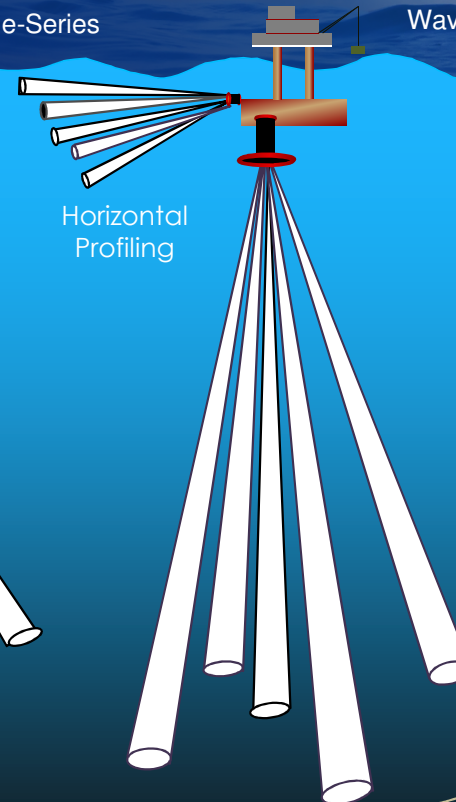
Vessel Mount
DVL



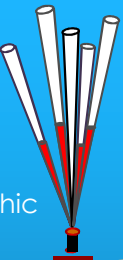
AUV/ROV



Mid-water
Mooring



Horizontal
Profiling



Coastal
Oceanographic



RoweTech Systems Overview

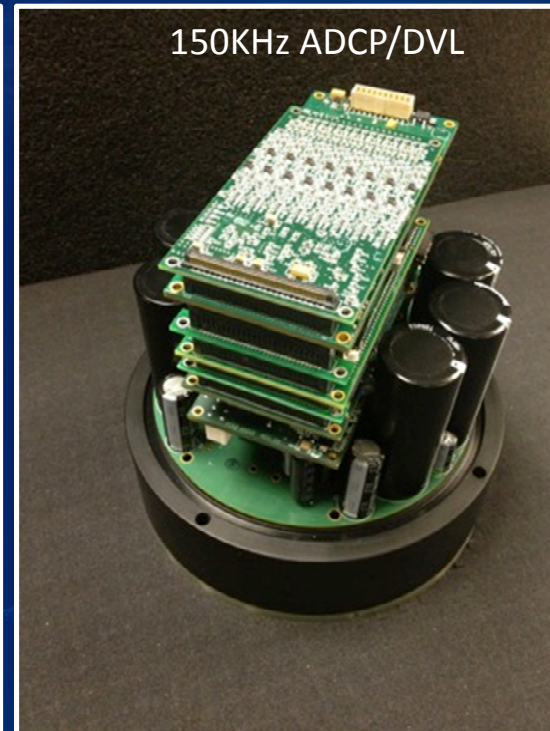
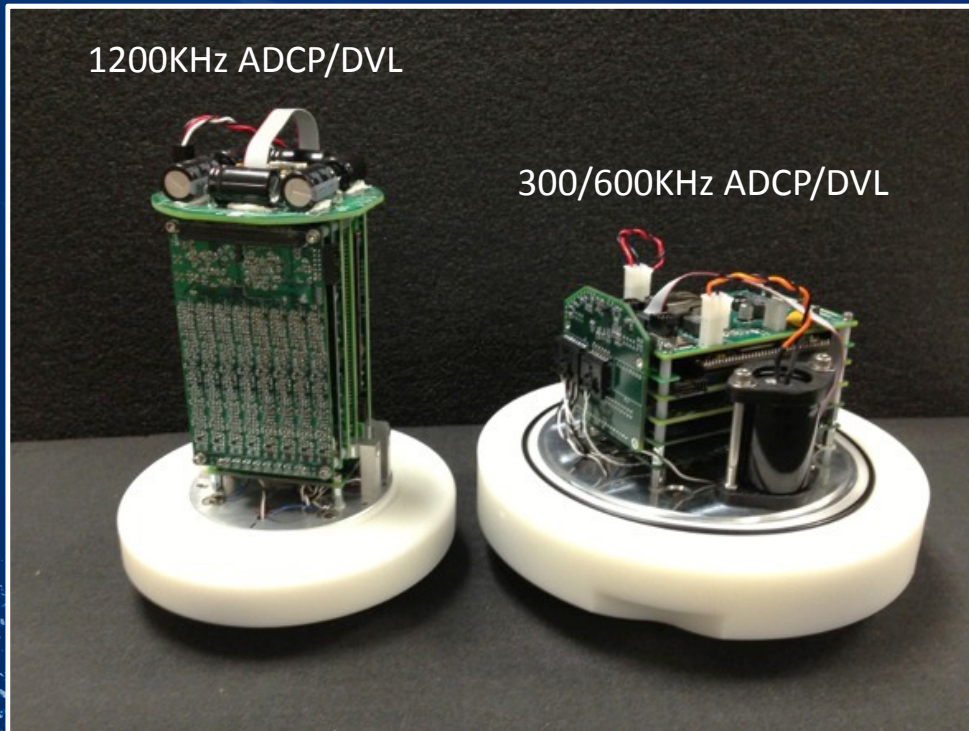
- All systems use a core set of electronics
- Current Profiling, Pulse to Pulse Coherent and Bottom Tracking standard
- Various packaging options for shallow water and deep water (6000 m) applications (Titanium and Aluminum)
- 8-channel receiver board
- 24-bit A/D allows higher quality data
- 12 independent configurations
- Replaceable beams
- 10/100 Ethernet output, 900 kBaud serial RS232 and 422 simultaneously
- 32 Gbyte recorder



RoweTech Product Overview

Common Electronics

Electronics packaging for 1200KHz, 300/600KHz, and 150KHz Systems uses same core electronics modules





RoweTech Data comparison

Data Comparison of RoweTech ADCP's to Teledyne ADCP

RoweTech SeaWATCH

Teledyne Sentinel 300

Magnitude

Direction

Velocity East

Velocity North

Vertical Velocity

Error Velocity

Correlation

Echo Intensity

RoweTech SeaWATCH 300's and a Teledyne Sentinel 300 were deployed in Tateyama Bay, Japan simultaneously, two kilometers apart. They were at the same depth with identical configurations. The data analysis showed they both approximately made the same measurements. The RoweTech system showed an overall higher signal to noise return than the Sentinel. This contributes to increased range in normal conditions, or better sensitivity in regions or times when there is less backscatter. This is seen in the black regions where the Sentinel data is decorrelated.

Data collected January 2016 by:
SEA Corporation Chiba Prefecture Tokyo Japan



RoweTech Product Overview

SeaPRODUCTs





RoweTech Product Overview

SeaPROFILER – Direct Reading ADCP

- Multi-Use Configuration –
 - 3-Axis Current Profile and
 - Bottom Track or Water Track Velocity Measurements
- User Programmable Acoustic Transmission –
 - Broad Band, Narrow Band, and Pulse-to-Pulse Coherent Technologies
- System requires external power and communications,
 - external battery pack available to convert to a self-contained system
- PD0 and PD13 formats for easy integration
- Can be used for moving boat applications





RoweTech Product Overview

SeaWATCH, SeaPROFILER, SeaSEVEN Dual Frequency ADCP

Dual Frequency 1200kHz and 300kHz Direct Reading and Self-Contained ADCP's



Approx. 12" (302mm) Diameter

Other DF models available

- 300kHz / 600kHz
- 600kHz / 1200kHz
- 300kHz / 1200kHz (w/ 2" Pistons)
- SeaSEVEN with vertical beam



RoweTech Product Overview

SeaWATCH HF & LF – Self-Contained ADCP

- Multi-Use Configuration - 3-Axis Current Profile and Bottom Track or Water Track Velocity Measurements
- User Programmable Acoustic Transmission - Broad Band, Narrow Band, and Pulse-to-Pulse Coherent Technologies
- Systems are easily deployable on buoys, moorings, or sea floor (to 6000m)
- Optional Wave acquisition package available (extra beam)
- PD0 and PD13 formats available for easy integration
- External battery case options available

HF High Frequency



LF Low Frequency





RoweTech Product Overview

SeaWAVE Doppler Piston ADCP

Single Frequency with Vertical Beam and Pressure Sensor

- Imbedded pressure sensor allows for PUV measurements
- Vertical beam and new algorithm for first order wave statistics
- Standard and real-time deployments
- SeaWAVES available in 300KHz, 600KHz, 1200KHz
- Compatible with **WaveForce Technologies** software (Xwaves, AutoWaves, and Wavector)



XWaves



AutoWaves



Wavector





RoweTech Product Overview

SeaPILOT -- Doppler Velocity Log

- Multi-Use Configuration - 3-Axis Current Profile and Bottom Track Velocity Measurements Simultaneously
- 8-channel board set allows for up-looking and down-looking applications or Dual Frequency systems
- OEM Kit available in 300 KHz, 600KHz and 1200KHz for AUV applications
- Provide industry standard output formats for easy integration (PD0, PD4, PD6, PD13... others available)
- Measurements of backscatter intensity, error velocity and altitude for every ensemble
- RS232, RS485, RS422 and Ethernet Communications

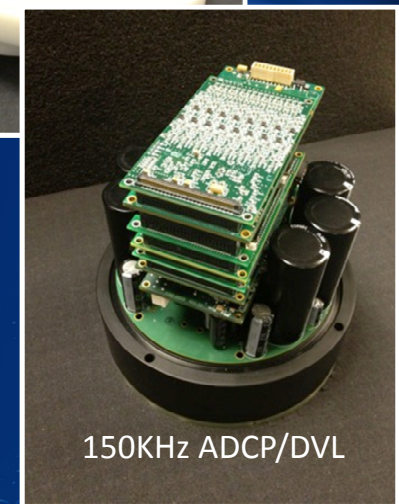
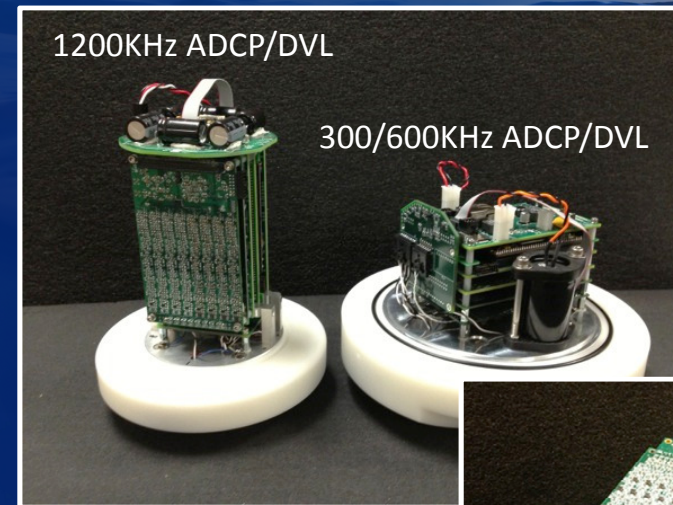




RoweTech Electronics Platform

Competitive Advantages

- **Smallest and most compact on the market**
 - Ideal for AUVs and ROVs (up/down-looking with one board set)
- **Latest in electronics and signal processing Technologies**
 - Current Gate Array technologies facilitates sophisticated on-board signal processing
 - Embedded firmware supports in-situ computation of complex functions
 - Broadband, narrowband and pulse coherent processing
 - Subsystem deployments

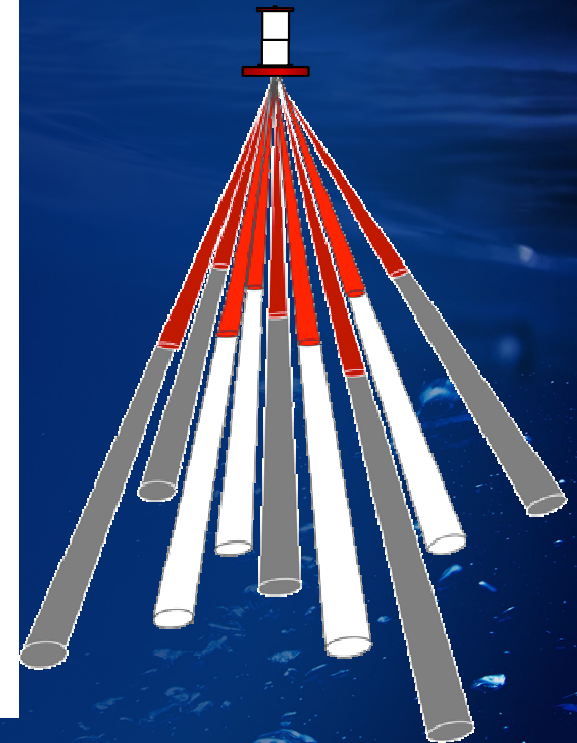
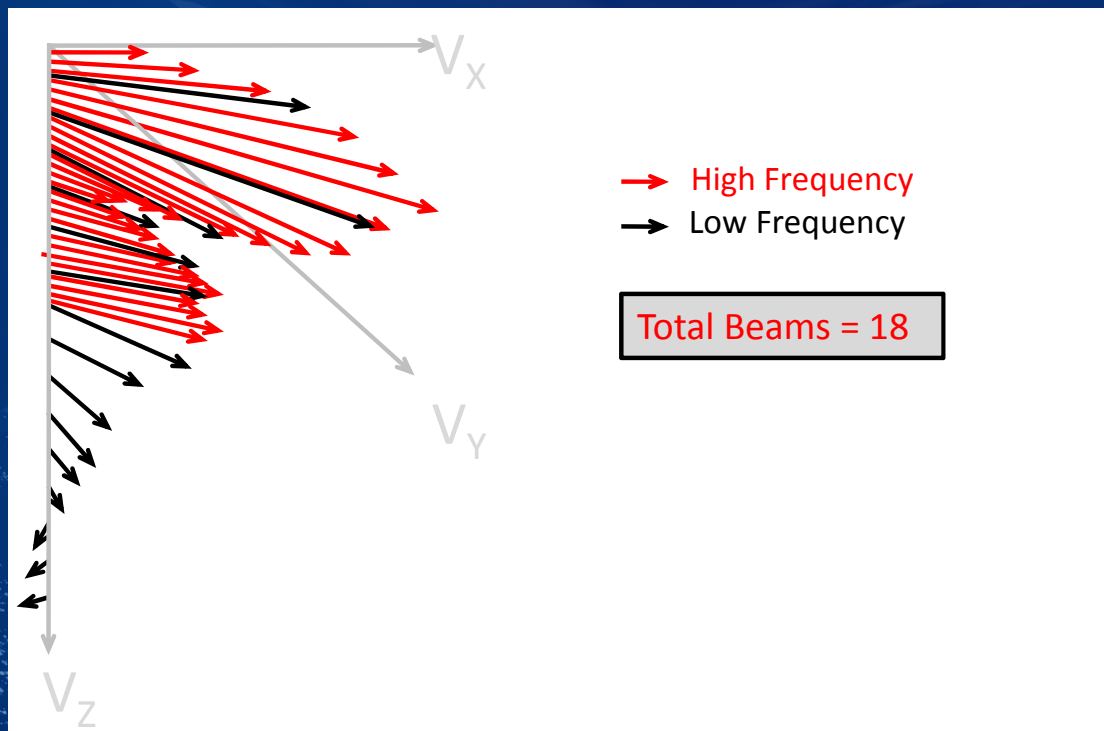




RoweTech Electronics Platform Cont.

Competitive Advantages

- **Eight processing channels**
 - Provide options for industry's only dual-frequency system
 - Easily upgraded to 16 channels (upward and downward looking systems)

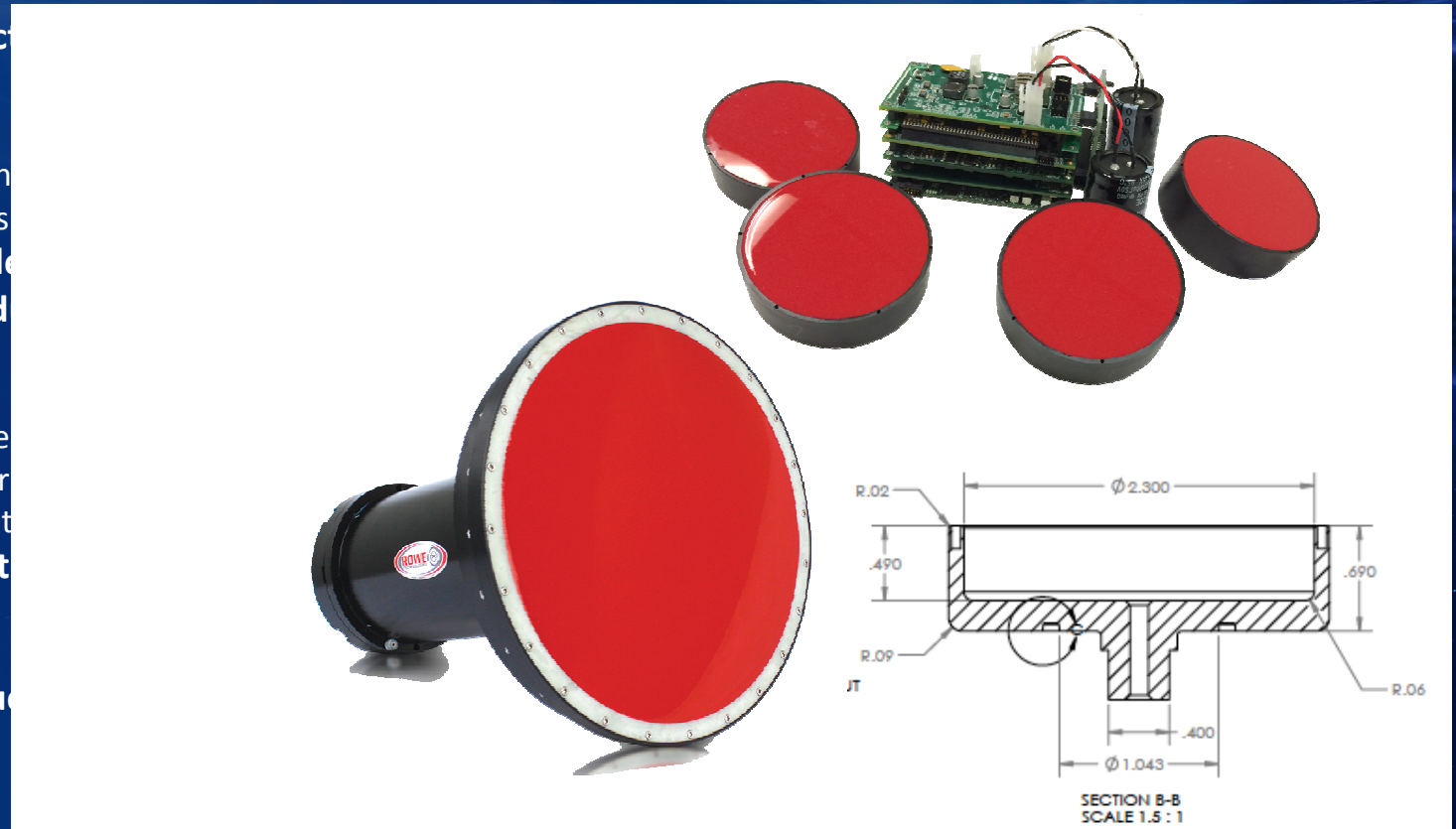




RoweTech Transducers

Competitive Advantages

- Traditional piston product distance in the industry
- Planar/Phased array
 - Single and dual frequency
 - Selectable beam angles
- Transducer Engineer re-designed ceramics for ADCP transducer
 - Materials
 - Adhesives
 - Construction technique
 - Replaceable transducer
 - Yields are now greater than
- More robust end product
 - Bandwidth
 - Durability
- RoweTech uses 4 transducers minimizing errors





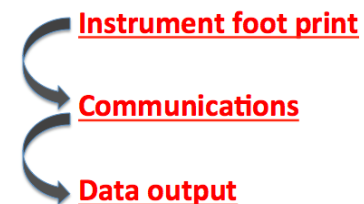
RoweTech Flexibility

Competitive Advantages

- **ADCP - DVL Crossover**
 - No need to purchase additional firmware
- **Direct Reading (DR) – Self Contained (SC) cross- over**
 - External Battery Pack for DR -> SC
- **Communication options**
 - RS232, RS485, RS422, Ethernet
 - RS232 and RS485 simultaneously
- **PD data outputs**
 - Turnkey solutions for replacing existing competitors' system
- **Customization**
 - Eight channels simultaneous processing
 - Sub-system deployments



Keys to Instrument Integration

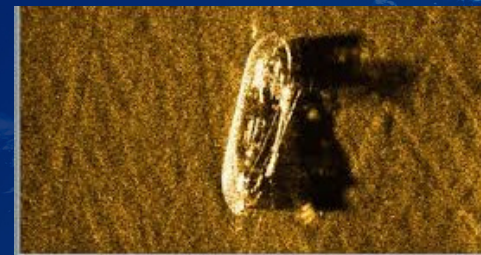
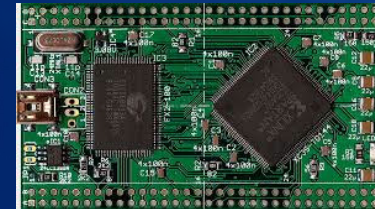
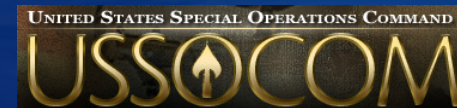




RoweTech R&D Team

Competitive Advantages

- **250+ total years of experience**
 - Started with the initial ADCP market development
 - History of Top Secret Security Clearance
 - Projects for NAVSEA, USSOCOM, NUWC
- **Previous company affiliations**
 - TRDI
 - SonTek
- **Core competencies**
 - Underwater acoustics
 - Acoustic imaging
 - Embedded signal processing
 - Advanced electronic design
 - Complex FPGA design
 - Transducer development and manufacturing
 - Deep ocean design





RoweTech Specification - Comparison

Competitive Advantages

Parameter	Rowe Technologies (SeaPilot)	Nortek	Teledyne RD1 (Workhorse Navigator)
Number of Cells	200	128	128
Range (m)			
1200kHz	20/30 ¹	20 ²	18
600kHz	45/70 ¹	40	50
300kHz	100/150 ¹	90 ²	110
Blanking Distance (m)			
1200kHz	0.2	0.2 ²	0.25
600kHz	0.4	0.5	0.7
300kHz	0.6	1.0 ²	1.0
Ping rate	8 Hz	1 Hz	7 Hz
Velocity Accuracy ³	0.25%	1%	0.25%
Velocity Resolution cm/s	0.01 cm/s	0.1 cm/s	0.1 cm/s
Bottom-tracking	Standard	N/A	Optional
Depth Ratings (m)	300, 1000, 3000 & 6000	300, 1000, 3000, 6000	200, 500, 1000 & 6000
Compass Tilt (degrees)	45	20	15
Compass Accuracy (degrees RMS)	1	2	2
Pressure Sensor (range/accuracy)	Selectable/0.1%	100 m/0.5%	Selectable
Temperature °C (operating/storage)	-5 to 45/-30 to 60	-5 to 35/-20 to 60	-5 to 45/ -30 to 75
Temperature accuracy °C	0.15	0.1	0.4
Input Power (VDC)	11-36	9-15	20-50
Communications	RS484, RS232, RS422, Ethernet	RS232, RS422	RS232, RS422

¹ RTI provides Broadband/Narrowband processing

² Nortek provides 1000 kHz and 400 kHz options

³ See manufacturers data sheets for details

• Me-too products but RoweTech offers*:

- ✓ Better vertical resolution – 200 cells
- ✓ Longer range
- ✓ Shorter blanking distance
- ✓ Faster ping rate
- ✓ Improved velocity resolution (0.01 cm/s)
- ✓ Improved compass tilt
- ✓ Replaceable transducer cups
- ✓ Ethernet comms
- ✓ Eight Channels
 - ✓ Profile/BT up and down looking
- ✓ Velocity profile and bottom-track at the same time

* Potential lock-out specs