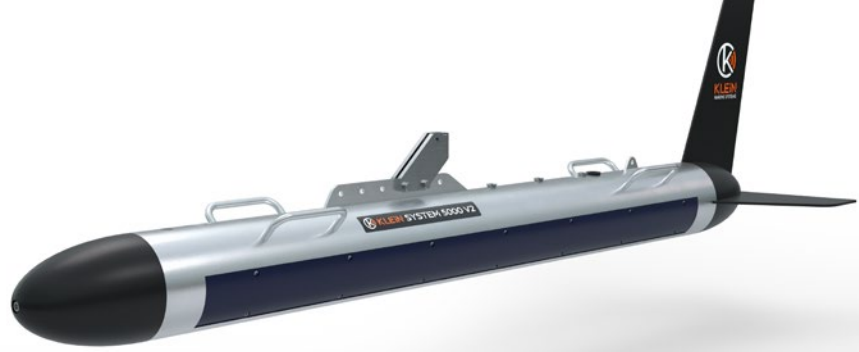




KLEIN
MARINE SYSTEMS



KLEIN SYSTEM 5000 V2

High-Resolution, Dynamically Focused, Multi-Beam Side Scan Sonar.

The Klein 5000 was the first commercial sonar system to employ cutting-edge multi-beam, side scan technology. In the years since it was first introduced, we've been continuously working to make improvements in all aspects of its technology. In keeping with our long, undisputed record of providing the best high-resolution imaging in the industry, we're proud to offer the Klein 5000 V2.

The 5000 V2 simultaneously generates five adjacent, parallel sonar beams on each side of a towfish or AUV while employing advanced beam steering and dynamic focusing techniques. This produces extremely sharp along-track resolution at high tow speeds, with 100% bottom coverage. No single-beam side scan sonar system can match this performance.

Key Features

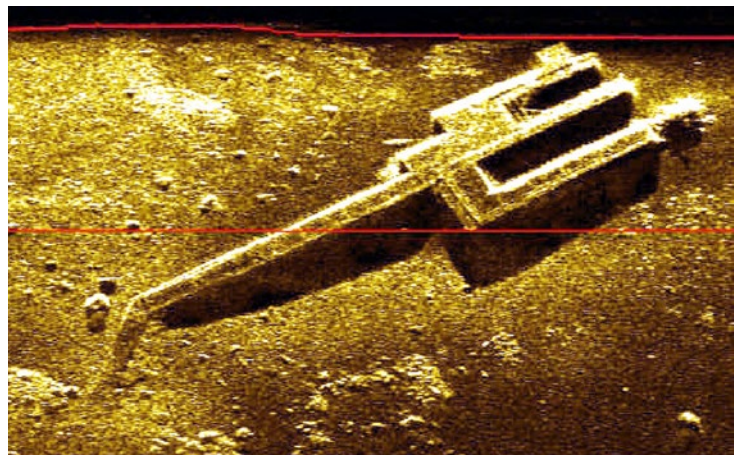
- Long-range reconnaissance mode up to 250 meters
- High-speed with 100% bottom coverage
- Highest resolution, multi-beam technology of any commercial side scan sonar
- Phase differencing swath bathymetry
- Rugged stainless steel construction - built like a tank... not a toy
- 500 meter depth rating (200 m with bathymetry option)

APPLICATIONS:

- Surface Mine Counter Measures (SMCM) and Q-route surveys
- Port and harbor security
- Hydrographic surveys
- Geophysical surveys
- Pipeline and offshore survey
- AUV version available



The wreck of the Bungsberg. Range: 150 meters. Depth: approximately 36 meters. Speed: 5 knots



Seafloor Structure

You've come to expect the very best from Klein, and the 5000 V2 has everything you would expect from a top-of-the-line side scan sonar (SSS). With peaked performance and extended range capability, no single beam SSS comes close. Our Reconnaissance Mode provides extended or long-range coverage to 250 m* per side while maintaining along-track resolution of 36-61 cm at ranges from 150 m to 250 m.

The Reconnaissance Mode employs 16 msec frequency modulated Chirp technology coupled with beam steering and dynamic focusing techniques to provide the new extended range capability. A further advantage to this technique is a significant reduction to the system noise level resulting in much better image quality.

The 5000 V2 overlaps sonar beams and displays only integral, non-overlapped beams. Regardless of the number of beams displayed, all new data can be stored on the PC hard drive for future processing, as desired.

Conventional side scan sonar systems use a single sonar beam per side to generate an image of the seafloor. The physics of this type of sonar results in the degradation of image resolution as range increases. Additionally, operating speeds of 5 knots or less are required to ensure 100% bottom coverage. Sometimes, low-cost multi-pulse and dynamically focused transducer technologies are used to slightly enhance the performance of single-beam systems. However, the result is nowhere near the high quality achieved by Klein's multibeam technology. This methodology is still lacking, and is not capable of providing the along-track resolution and image quality of a multi-beam system.

Klein sonar, using frequency modulated Chirp, yields consistent cross track resolution at all range settings and speeds. Multi-Ping, without Klein technology, sacrifices cross-track resolution. Each additional pulse effectively decreases cross-track resolution by a factor equal to the number of multi-pulses.

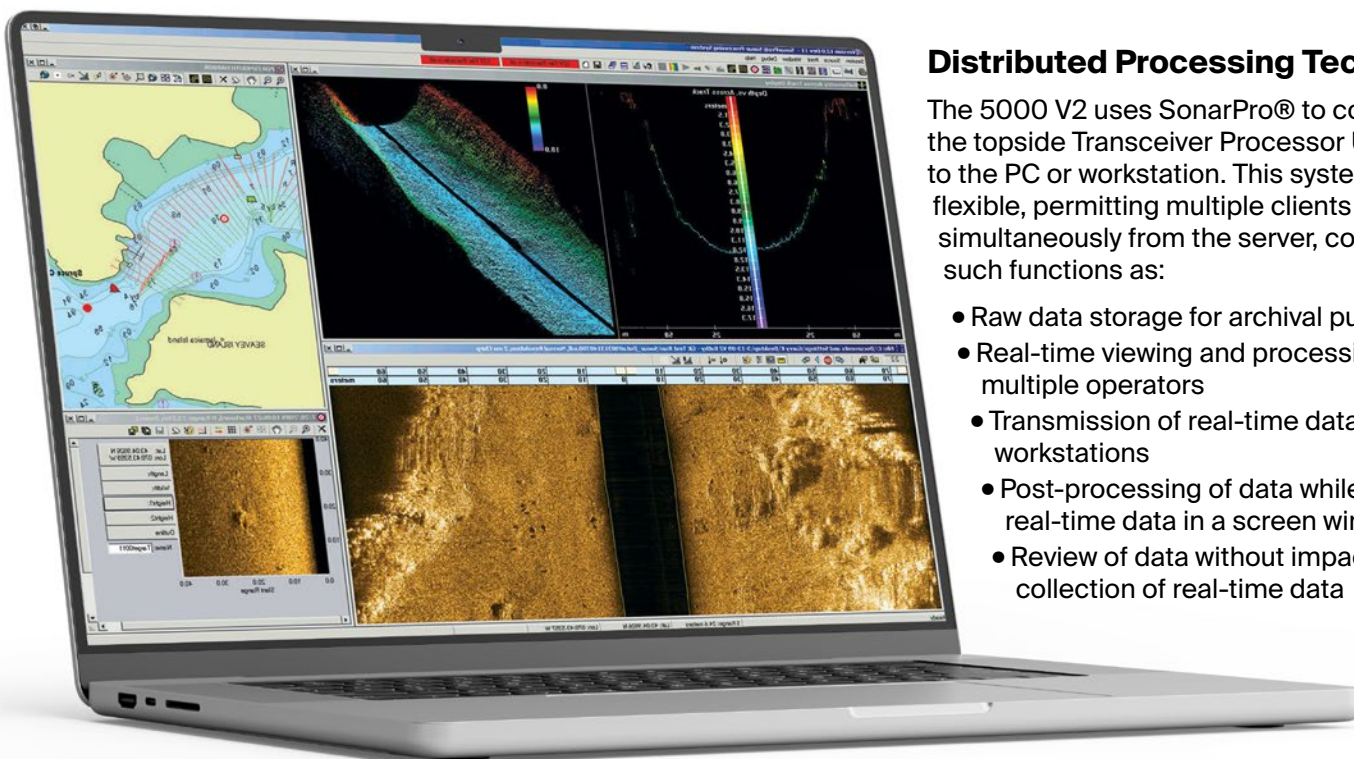
* in typical Northeastern USA seas, conditions permitting

Sonarpro® Visualization Software

Klein's SonarPro® software has long been recognized in the industry as the benchmark for visualization software. Feature sets not found in competitive systems include:

- Full control of sonar system set-up operation
- Data acquisition and recording
- Ability to launch multiple software applications on the same workstation
- Fully integrated viewer, navigation and target analysis

- Import raster and/or vector charts to navigation window
- Save targets as true GEO-TIFF with associated World file
- Survey grid setup
- Survey route setup
- User-friendly Graphical User Interface (GUI)
- Real-time transmission of target position information over network in UDP protocol



Distributed Processing Technique

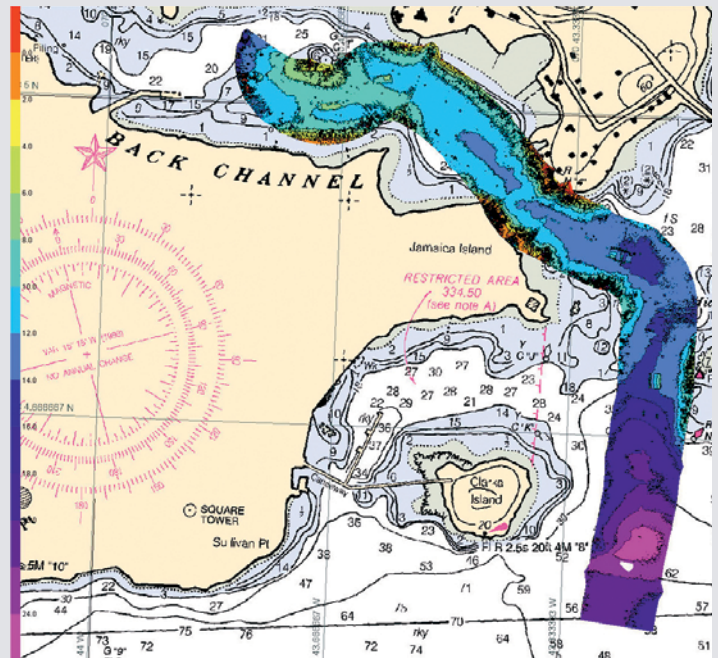
The 5000 V2 uses SonarPro® to connect the topside Transceiver Processor Unit (TPU) to the PC or workstation. This system is very flexible, permitting multiple clients to operate simultaneously from the server, conducting such functions as:

- Raw data storage for archival purposes
- Real-time viewing and processing of data by multiple operators
- Transmission of real-time data to remote workstations
- Post-processing of data while monitoring real-time data in a screen window
- Review of data without impact on collection of real-time data

Swath Bathymetric Sonar

The 5000 V2 can be configured with an optional Swath Bathymetric Sonar (SBS). This sonar uses advanced phase differencing signal processing to produce simultaneous estimates of the seabed topography out to the full-swath extent of the sonar, typically 10–12 times the overall altitude of the tow fish. This data is co-registered with the resulting side scan backscatter imagery and can be used to more accurately position seabed targets.

Side-looking sonars that do not have the ability to perform bathymetric measurements must assume a locally flat bottom when measuring the location of seabed targets. This can result in target position errors on the order of meters when surveying over sloped bottoms. This added seabed topographic measurement capability is extremely advantageous when performing missions involving shallow water, rapid area assessment.



Options/Accessories:

Swath Bathymetry	Consisting of: <ul style="list-style-type: none"> ● Bathymetry transducers and electronics ● Klein high-accuracy Attitude Sensor ● SonarPro® Bathymetry Software
Pressure Sensor	500 meter towfish depth rating
Responder/Transponder	<ul style="list-style-type: none"> ● Acoustic responder kit including transducer and electronics ● Responder/transponder interface kit for customer-supplied USBL beacon
Depressor Wings	K-Wings Depressors I and II are available for use with the 5000 V2 system. Depressor wings are used to develop hydrodynamic force to drive the towfish and cable down which allows for greater depth placement of the towfish with less cable required for deployment.
Tow Cables	Tow cable types and lengths: <ul style="list-style-type: none"> ● Lightweight coaxial (0.45 in) nominal diameter (250 m max length) ● Armored coaxial (0.40 in) nominal diameter (400 m max length) ● Armored coaxial (0.68 in) nominal diameter (900 m max length) ● Armored stainless steel (0.525 in) nominal diameter (400 m max length)
Other Options	<ul style="list-style-type: none"> ● Sealed slip ring assemblies (deck cable from slip ring to TPU) ● 5000 V2 on-board spare parts kits

Standard Scope of Supply

- Model 5250 V2 Towfish (500 m depth rating)
- Model 5105 V2 Transceiver Processor Unit (TPU)
 - Ethernet LAN hub (100 BaseT)
 - SonarPro Visualization software license
- Armored fully terminated 0.68 coaxial cable – 250 m
- 5000 V2 Workstation with:
 - Windows operating system software installed
 - SonarPro software installed
 - 17" flat panel LCD display
 - Keyboard and mouse
- Instruction manual on CD

General Specifications	
Array Length	120 cm (47.2 in)
Body Length	194 cm (76.4 in)
Body Diameter	15.2 cm (6 in)
Weight (in air)	70 kg (155 lbs)
Depth Rating	500 m standard, 200 m with Bathymetry option

Multi-Beam Side Scan Sonar Specifications	
Number of Beams	5 port & 5 starboard
Frequency	455 kHz
Pulse Type (CW/FM)	50 µsec CW, 4, 8, 16 msec Chirp
Resolution (along track)	10 cm @ 38 m 20 cm @ 75 m, increasing to 36 cm @ 150 m and 61 cm @ 250 (in the Reconnaissance Mode)
Resolution (along track)	3.75 cm at all pulse lengths
Operating Speed Envelope	2 to 10 knots at 150 m
Maximum Operating Range	250 m (500 m swath) in Reconnaissance Mode
Towfish Sensors:	
Heading	Standard
Pitch and Roll	Standard
Pressure	Standard
Altimeter	Standard

Transceiver Processing Unit (TPU)	
Width	Standard 19 in rack-mount
Height	13.2 cm (5.2 in)
Depth	54.6 cm (21.5 in)
Weight	12.7 kg (28 lbs)
Input Voltage	115/240 VAC, 50/60 Hz
Power	120 W
Data Output	100 BaseT Ethernet LAN

Workstation PC	
Workstation PC SonarPro® Installed Windows OS Installed	Optional, with SonarPro® software installed

Phase Differencing Bathymetric Specifications	
Frequency	455 kHz
Number of Beams	Single Beam (one per side)
Along Track Resolution	0.4°
Pulse Type (CW/FM)	FM Maximum 16 msec Chirp
Maximum Range	125 m nominal
Data Output	Generic Sensor Format (GSF) XYZ Format

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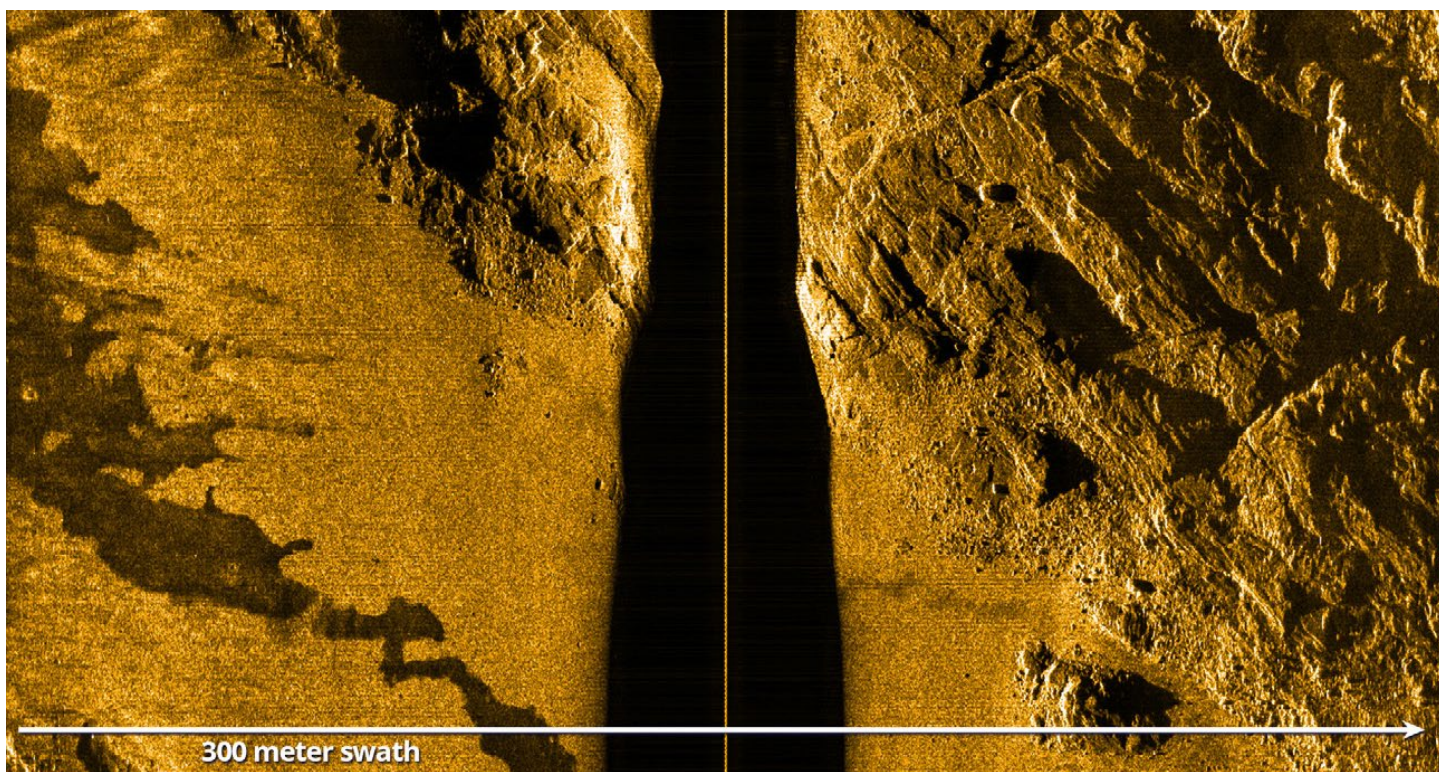


Image: S5000 V2 - Range: 150 m