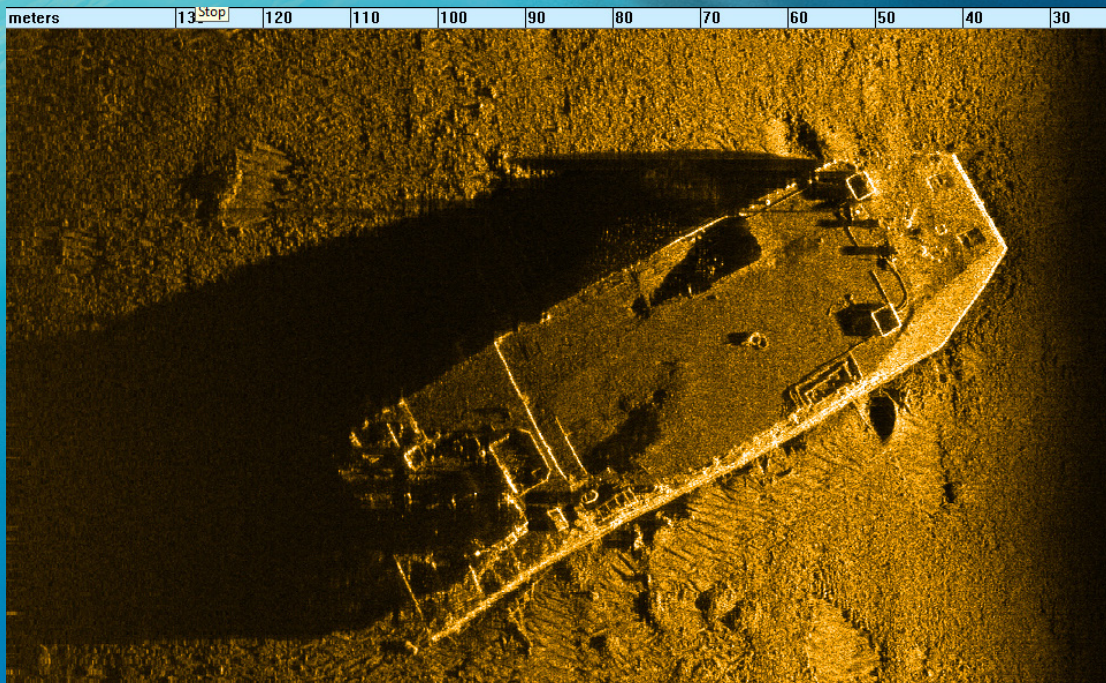


# System 5900

*The Difference Is  
In The Image*

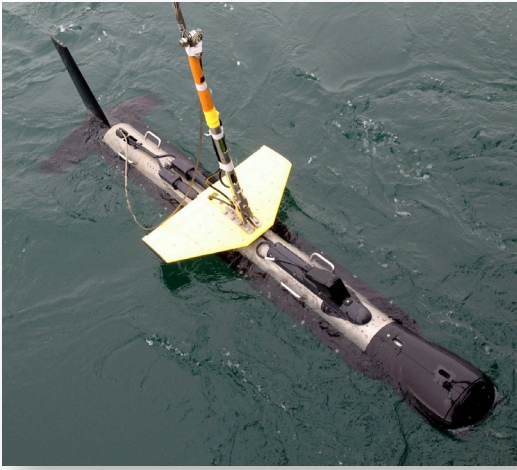


HIGH-RESOLUTION, DYNAMICALLY FOCUSED,  
MULTI-BEAM SIDE SCAN SONAR SYSTEM



**KLEIN MARINE SYSTEMS, INC.**





## MULTI-FUNCTION PLATFORM

The Klein System 5900 is a multi-functional platform that allows the operator to perform high-speed surveys with 100% bottom coverage. Only multi-beam side scan sonar systems can truly support high-speed data acquisition. The increased coverage rate supports overall efficiency, reduces survey time and provides significant cost savings. The large footprint of the tow body provides a completely stable towing environment, thus increasing both acoustic performance, natural depression capabilities and overall robustness. The variable multi-beam feature allows the number of beams to increase with tow speed as needed to maintain 100% bottom coverage with up to 20 beams per side.

## APPLICATIONS

- Mine Countermeasures (MCM) mission support
- Intelligence, Surveillance and Reconnaissance (ISR) missions
- Route surveys
- Rapid environmental (bathymetry) assessment surveys
- Port and harbor security
- Hydrographic surveys

With advanced embedded data compression built directly into the data acquisition software, the system can drive up to 750 meters of copper cable, reducing the need in many applications for more costly fiber-optic cables.

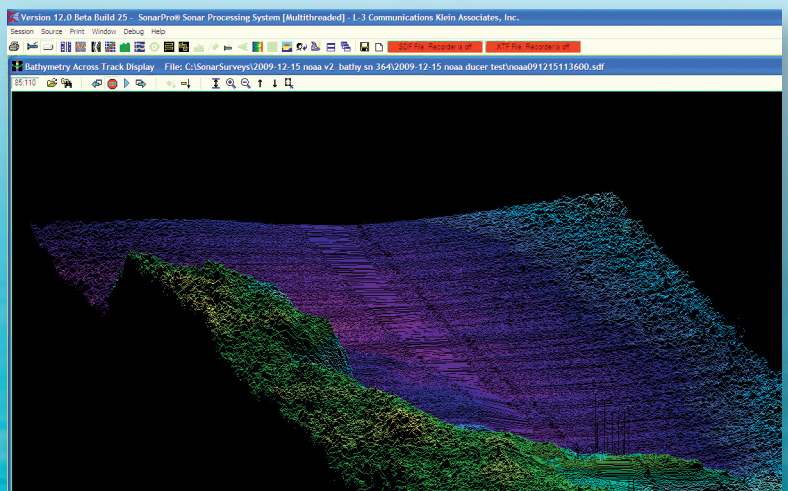
Klein's System 5900 standard towfish sensors provide increased performance and functionality. The magnetic heading compass is removed from the EMI environment and located outside of the pressure housing, eliminating electromagnetic interference, while the acoustic altimeter provides a strong bottom-track resolution, which is independent of the side scan sonar and ensures safe towing operations.

Beam forming is performed at the surface. Raw data is recorded, allowing for advanced post-processing, and if needed, reprocessing.

## SWATH BATHYMETRY

Klein's System 5900 can be configured with an optional swath bathymetric sonar, which uses phase differencing signal processing to produce simultaneous estimates of the seabed topography out to the full-swath extent of the sonar, typically 10 to 12 times the overall altitude of the tow fish. Changes in topography are easily recognizable with the co-registered 3-D model of the ocean floor. The real-time co-registered data provides for instant fusion with side scan, backscatter imagery and can be used to more accurately position seabed targets.

Bathymetry data @ 455 kHz.





## STANDARD TOWFISH ACCESSORIES

- Compass – Heading 0.5 ° RMS
- KMS-02 Motion Reference Unit,
- 100 kHz (6-degrees-of-freedom; roll, pitch and yaw rates; heave, surge and sway accelerations)
- Dedicated Acoustic Altimeter – 170 kHz
- Depth Pressure Sensor
- Water Temperature Sensor
- Responder Interface
- Magnetometer Interface

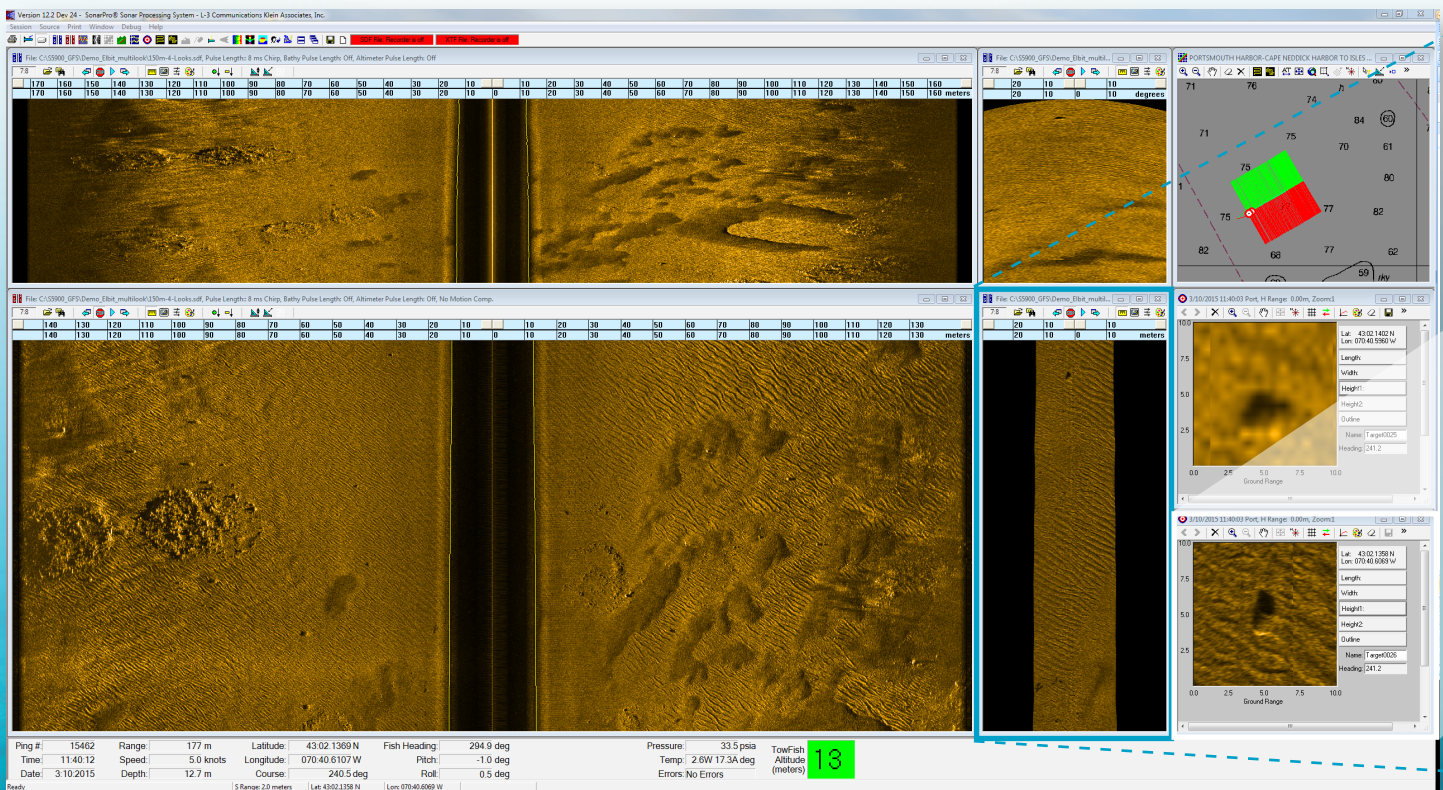
## OPTIONAL TOWFISH ACCESSORIES

- K-Wing IV
- Gap Filler Sonar – Nadir coverage
- Interferometric Swath Bathymetry Sonar
- Sound Velocity Sensor (recommended when bathymetry sonar is purchased)

## KEY FEATURES

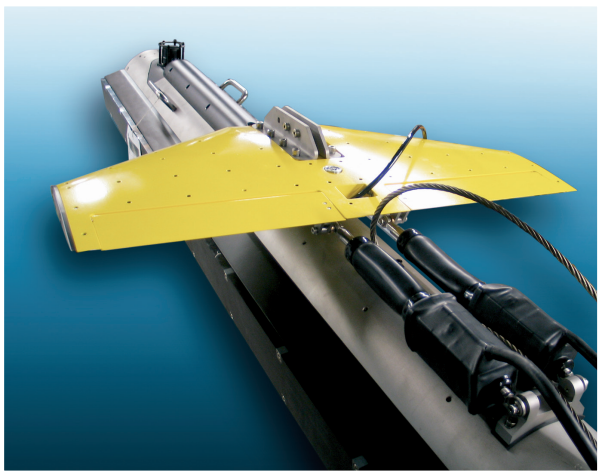
- Variable multi-beam (up to 20 beams per side, per ping) for high-speed, high-resolution coverage
- 1.8 m long array, 600 kHz operating frequency, provides twice the resolution of the System 5000
- Integrated 6-degrees-of-freedom motion reference unit (MRU) for dynamic digital beam stabilization
- FM-Chirp transmit coding, extremely low-noise acquisition and 28-bit analog-to-digital converter contribute to a very high dynamic-range sonar system
- Dynamic focusing, high-pixel density imagery provides enhanced contrast for target/shadow definition
- Swath bathymetry for rapid environmental assessment
- K-Wing IV depressor provides stabilization, roll offset, depression and emergency fast-rise capability
- Optional Gap Filler Sonar provides full bottom coverage and extremely fast area coverage rates
- SAS-ready composite array fabrication optimized for multi-path and surface reverberation suppression
- BITE – Built-in test equipment

Klein System 5900 with optional Gap Filler Sonar (quality control and processed beam displays) at 150 m range.

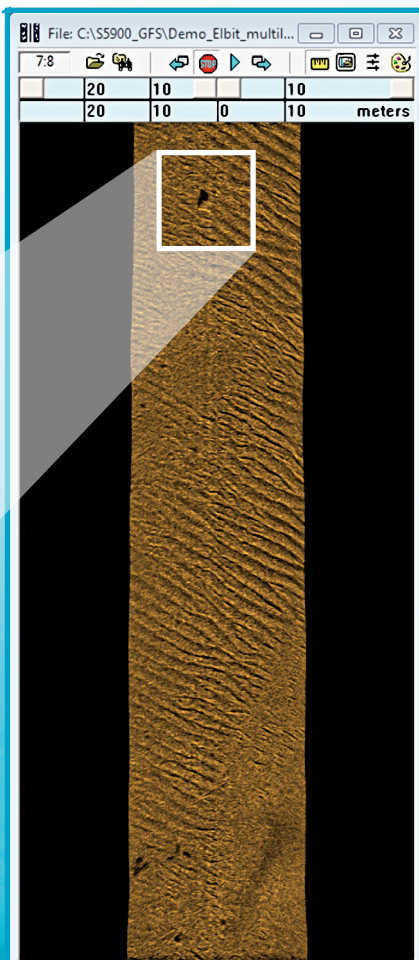


DYNAMICALLY FOCUSED, MULTI-BEAM





The K-Wing IV uses hydrodynamic forces to depress and steady the towfish while underwater. Dual ailerons are integrated and adjustable in software to compensate for roll bias and add fast-rise capability.



### K-WING IV (OPTIONAL)

Construction	Aluminum
Dimensions	30.5 in x 15.625 in x 2.5 in
Weight	In air: 38 kg (84 lb) In water: 12 kg (27 lb)

### SWATH BATHYMETRY SONAR (OPTIONAL)

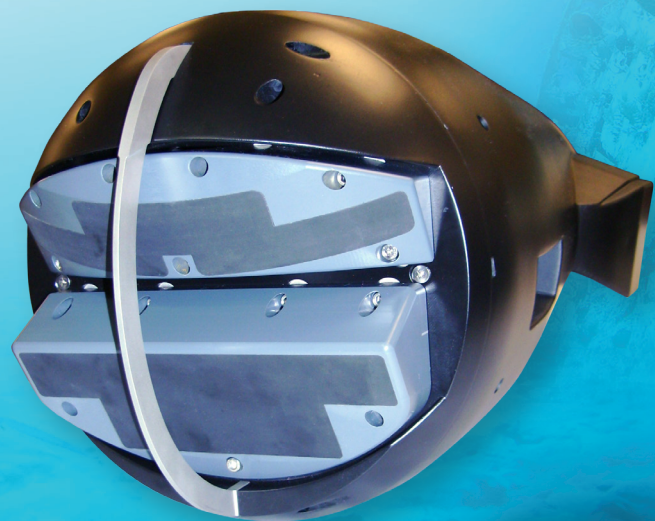
Frequency	455 kHz
Transmit Pulse	CW, FM-Chirp
Along-Track Resolution	0.4° [single swath per ping]
Swath Coverage	10 to 12 times altitude

### GAP FILLER SONAR (OPTIONAL)

Frequency	750 kHz
Transmit Pulse	CW, FM-Chirp
Along-Track Resolution	4.8 cm
Across-Track Resolution	< 0.5° (dynamically focused)
Gap Coverage	To 45° each side
Declination	Tilted down 30° from horizontal

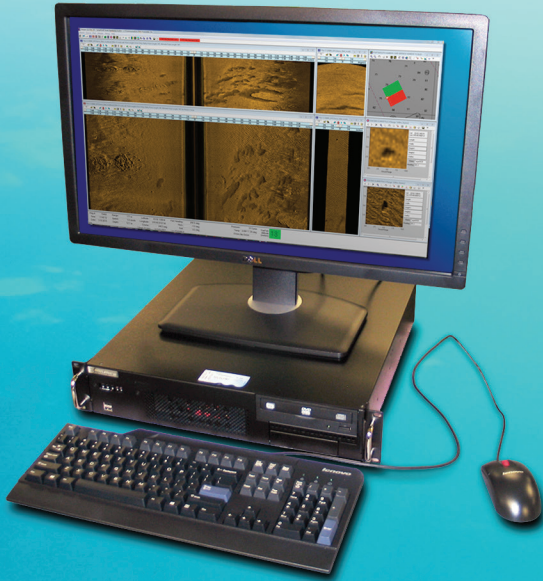
### OPTIONAL GAP FILLER

The optional Gap Filler increases the rate of coverage by 40%, providing a full swath with gapless coverage.





# HIGH-RESOLUTION, DYNAMICALLY FOCUSED, MULTI-BEAM SIDE SCAN SONAR SYSTEM



Klein Marine System's 5900 sonar is the flagship in our exclusive family of multi-beam technology-based side scan sonar systems. In the mid-1990s, Klein pioneered, developed and introduced the multi-beam side scan sonar with our extremely successful 5000 product series. Unlike conventional side scan sonar that uses "a single beam per side" to generate seafloor images, our multi-beam family of side scan sonar systems produces multiple beams, per side, per ping, which increase in number as the tow speed is increased, thereby providing speed-independent, constant high-resolution images (along and across track), in near and far fields, with 100% bottom coverage (no data gaps) and fast tow speeds to 14 knots depending on the sonar model. The benefits are clear — reduced survey times and costs while collecting higher-resolution seafloor images that are far superior to those generated by any single-beam system.

The Klein System 5900 is designed for hydrographic, military (Q-Route surveys and MCM missions) and commercial applications that require very high-quality data collection in short time periods. Narrow vertical transducer beam widths ensure outstanding shallow water performance by minimizing surface reflections, yet the system operates equally well in water depths up to 750 meters. An optional Gap Filler Sonar (GFS) is available in a removable nose cone assembly for collecting (filling in) seafloor side scan-like data in the sonar nadir region. When installed, coverage rates are improved (reduced) by as much as 40%. An interferometric swath bathymetry sonar is another available option with the 5900 system. Swath bathymetry provides the "third dimension" or topographic information, not available from side scan data alone, and it is co-registered with the side scan data. When both data sets are post-processed, side scan data can be accurately draped over the bathymetry mosaic, providing a complete, spatially accurate image of the seafloor. Identified bottom objects can be relocated and prosecuted with greater efficiency, as positional accuracy is increased when the bathymetry depths and contours are known.



# SYSTEM 5900 SPECIFICATIONS

## TOW FISH GENERAL SPECIFICATIONS

Construction	316 Stainless Steel
Length Without Gap Filler Sonar (GFS)	2.36 m (93 in)
Length With Gap Filler Sonar (GFS)	2.73 m (107 in)
Outer Diameter	20 cm (8 in)
Weight	In air: 170 kg (374 lb) In water: 106 kg (233 lb)
Maximum Depth Rating	750 m
Operating Speed Envelope	to 14 knots

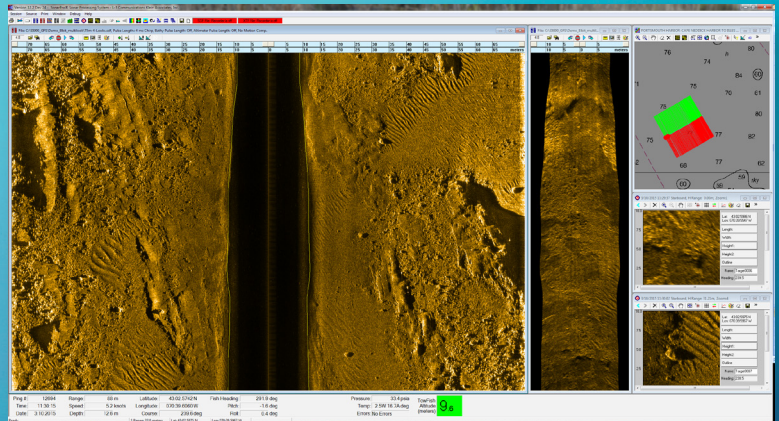
## TOPSIDE ASSEMBLY DIMENSIONS/WEIGHT

Towfish Interface Unit (TIU)	2U 19-in rack-mount chassis
Sonar Processing Unit (SPU)	2U 19-in rack-mount chassis
High-Voltage Power Supply (HVPS)	1U 19-in rack-mount chassis
Operator Workstation	SonarPro® and Windows 7® 2U 19-in rack-mount chassis
Monitor, Keyboard and Mouse	27-in diagonal 2560x1440 resolution 16:9 aspect ratio
System Power Requirements	100-125 or 200-250 VAC, 50/60 Hz at 1,000 W nominal

## MULTI-BEAM SIDE SCAN SONAR SPECIFICATIONS

Technology	Multi-Beam Sonar with dynamic focus and dynamic aperture (maintains 100% bottom coverage, up to 20 beams per side)
Operating Speed Envelope	2 to 14 knots (with 100% bottom coverage)
Frequency	600 kHz
Along Track Resolution	6.2 cm for 50 m range setting (constant) 9.3 cm at 75 m range scale 15.5 cm at 125 m range scale [0.07° beamwidth]
Across Track	3.75 cm
Transmit Pulse	CW, FM-Chirp
Maximum Operating Range	150 m (nominal)/side
Array Length	1.8 m
Vertical Beamwidth	Optimized for shallow water operations
Background to Shadow Contrast Ratio (CR)	> 10 dB - at detection range of 150 m > 15 dB - at classification range of 75 m
Output Data Format	Sonar Data Format (SDF)
Tow Cable	750 m coaxial; > 3,000 m fiber-optic cable

Klein System 5900 with optional Gap Filler Sonar (processed beam displays with targets) at 75 m range.



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