Section I: Company Intro.
Section II: R&D
Section III: Manufacturing & Production
Section IV: Quality Assurance
Section V: PLT Multi-sensor Combination Tool
Section I: Company Intro.
Focus on cased hole logging solution
Location

• Located in Xi’an, China
• Convenient transportation, climate optimum
• The 8th wonder in the world - Terracotta Warriors
• Largest Oilfield in China– Changqing Oilfield
• Xi’an Shiyou University

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Company Intro.

- 186 Staffs
- Registered Capital 66 Million in RMB
- Current Assets 210 Million in RMB
- Production Area 10000 m²
Keep concern on technologies and tools development in cased well to provide whole solutions; Earn customers’ trust with high quality and liability.

Real-time/Memory Logging suitable for different jobs respectively provide more options to user.

Standard and modular design of tool bus and connections are good at optimum tools combination.
Section II: R&D
R&D Capability

Yearly RMB 12 million investment
Yearly 3-5 new products launched in market

550+ patented and non-patented technologies
50% products are exclusive

Approx. 50 electronic/mechanical/software engineers
50% of them having 10+ experience in the industry
Create a R&D strategy plan based on requirement change and technology improvement.

Draw a top design for new products based on end-user experience and future requirements.

Enhance the depth and width of new products in the direction of resource share and cooperative win.

Establish corporate design standard embodying the principle that quality comes from design.
Standardization

Establish corporate design standards embodying the principle that quality comes from design.

Following standards to design products can control each phase in production process like devices purchasing, inventory management etc.

Following standards to design products can reduce manufacturing cost effectively.
Future Development
From Case Hole Logging to Cased Hole Solution;
From Wireline Well Logging to integrated applications of wireline, slickline and coiled-tubing (WL/SL/CT);

Concern
Keep close concern with the market demand of shale gas, coal-bed gas for new technologies, methods, materials, processes and tools;
Keep close concern with the niche market between different sub-sectors of the cased-hole industry — information, resources, technologies and products;

Target
To develop new cased-hole logging technologies, methods and products to replace the traditional methods, and help service companies set up new industry standards of logging and servicing by using the new technologies.
Section III: Manufacturing & Production
Production, Manufacturing

- 1600m² anti-ESD Assembly and Calibration Shop
- 2000m² Machining Shop
- Production and Manufacturing Equipment
1. Data Acquisition System
2. PLT
3. Casing inspection tools
4. Cement Bond Tools
5. Intelligent Perforating tools
6. Motor-driven Tractor tools
7. Free Point Indicating Tool
8. VSP seismic imaging system

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Data Acquisition System

- Truck-loaded and portable models
- User-friendly
- Chinese and English user interface
- Compatible with multiple data formats: AMI, Manchester……
- Good adaption to different cables
- Open low-level software
Comprehensive cased hole solutions; custom HPHT, H²S resistant tools to customer.
Software

Containing acquisition, processing, back play, edit, interpretation and evaluation software.
Section IV: Quality Assurance
Quality System

Acquire API Certificate and ISO 9001 in 2008

Follow API Q1 to control quality

Pass certificate audits in 3 years continuously
Procurement Control

- Core parts 100% procured from international renowned suppliers
- Sensors 100% procured from international renowned suppliers
- Design and Manufacturing of Inductor, Transformer, Power Supply for 200℃ applications
- Follow supplier management process identified in API Q1 spec
Production Control

- ERP Information Management System
- API Production Control
- Company Wide 6S Management
- Anti-ESD Soldering, Calibration
Quality Control    Electronics Test

Power Module Inspection

Capacitor, Transformer Inspection

Electric Device Inspection

HT Aging Test

HT Test For a Single Tool

Products Process Inspection
Quality Control

Machine Parts
Precision Inspection

Machine Parts
Common Inspection

Metal Material
Analysis

Material Hardness
Analysis

Material Resilience
Test

High Pressure Test
Quality Control PCB

1. SMT Soldering
2. Plasma Clean
3. Auto-SMT
4. 3D Inspection
5. RMA Working Station
6. Three Proofing Coating
After-sales Service

- Guarantee period: 24 months
- Life-long warranty of electronics
- Respond to customer enquiry within 24hrs
- On-site technical support arrived within 48 hrs (in China)
- Free tool maintenance (charge materials cost only)
Section V: PLT Multi-sensor Combination Tools
Brief Intro.

- Optional OD 35/43mm
- Multiple Flowmeters, Density Tools
- Memory/Real-time Logging
- Max. Temperature 177°C
- Titanium Steel, 17-4 Stainless Steel
- Max. Pressure 16000Psi
Since 2012, more than 100 sets of PLT tools has been launched on market in China and overseas, and earn high reputation.
Bus Protocol
Improving Tools' Adaptability

- Bus standardization improves tools’ combinability and adaptability;
- WSCbus - mono-conductor cable bus protocol compatible with different logging system;
- WSTbus – mono-conductor tool bus protocol compatible with different tools;
- Memory /Slickline /Coil Tubing Logging;
Wireline Telemetry Cartridge

The telemetry cartridge serves as a bridge between the surface system and the downhole logging tools, sending commands and uploading data to realize bi-directional control and signal acquisition:

**WSCbus mono-conductor cable bus**
- Transmission Code: AMI code
- Uplink Baud Rate: 50, 75, 100Kbps
- Downlink Baud Rate: 300BPS

**WSTbus mono-conductor tool bus:**
- Transmission Code: AMI code
- Uplink Baud Rate: 500Kbps
- Downlink Baud Rate: 500Kbps
- Power Supply Voltage: 18V
- Power Supply Current: 1Am (may be upgraded to 2A)
The memory logging technology includes the memory cartridge, battery cartridge, depth measuring system and data reading/writing system to realize memory logging:

- Compatible with the WSTbus standard tool bus:

**Technical Specs:**

- Stand-by Current: 2mA
- Read/write Current: 15 - 30mA
- Data Download Rate: 4MB/min
- Sampling Rate: 20ms—24h preset
- No. of Channels: Compatible with 62 channels
- Memory Capacity: 512MB
- Communication Rate: 500kbps
The gamma ray tool measures the gamma rays generated from the earth formations. The tool is primarily used for depth correction purpose:

**Technical Specs:**
- Tool Length: 679mm (26.73"")
- Weight: 4.7kg (10.4lbs)
- Bus Voltage: 14VDC-18VDC
- Power Supply Current: 3mA ± 3mA
- Measuring Range: 0-10000 CPS
- Sensor: Sodium iodide (NaI)
- Repeatability: ± 7%
The quartz pressure and CCL combination tool are designed to measure the pressure in the formation and to locate casing collars:

**Technical Specs:**
- Tool Length: 475mm (18.7”)
- Power Supply Voltage: 14VDC-18VDC
- Power Supply Current: 35mA ± 3mA
- Pressure Measuring Range: 0-16000Psi
- Resolutions: ± 0.008psi
- Accuracy: ± 0.02% (FS)
Fluid Density Tool

* To measure the downhole fluid density;

* Radiative and non-radioactive density tools, i.e., Tuning fork and gradiomanometer, applicable to different well conditions and provide multiple options for users;

* There are americium and cesium sources available
Tuning Fork Tool

* Measuring the fluid density by using the tuning fork vibration principle
  * The tuning fork produces different resonance frequencies in different fluids, and by measuring the frequency, the fluid density is measured;

* Technical Specs
  - Tool Length: 538mm (21.18"
  - Power Supply Voltage: +18V ± 1V
  - Power Supply Current: 50 mA ± 5mA
  - Measuring Range: 0-1.25 g/cc
  - Resolutions: 0.01g/cc
  - Accuracy: ± 0.03g/cc (FS)
The gradiomanometer measures the fluid density by using the pressure difference principle;

* **Technical Specs:**
  - Tool Length: 825.0mm (32.48”)
  - Power Supply Current: 32 mA ± 5mA
  - Measuring Range: 0-1.25 g/cc
  - Resolutions: 0.01g/cc
  - Accuracy: ± 0.03g/cc (FS)
The radioactive tool measures the fluid density by using the radioactive source:

* The gamma ray generated from the radioactive source is scattered by the fluid in the sampling window and transmitted to the gamma ray sensor. Different fluids cause different rate of attenuation to the rays.

**Technical Specs:**
- Tool Length: 825.0mm (32.48”)
- Power Supply Current: 32 mA ± 5mA
- Measuring Range: 0-1.25 g/cc
- Resolutions: 0.01g/cc
- Accuracy: ± 0.03g/cc (FS)
- Source: Ame241 (Ce137)
Advantages of Ame Source:

Apart from the density-relevant Ame energy, the tool also measures the gamma rays emitted from other radioactive sources which lie in the formation when measuring. The energy strength of Ame241 is 60Kev. Most of the background radioactive sources in the formation is stronger than the Ame241. Through necessary processing of the signals by circuits, the interference of the nature background is removed, and thus the measurement accuracy is enhanced.

The energy strength of Cesium source is 600KeV. The same signal-processing circuit as used for the Ame source is unable to increase accuracy if the cesium source is used.
The gas hold-up tool integrates a 3mCi Cobalt source at the bottom. The gamma ray emitted from the source is scattered by the fluids around the tool and transmitted to the gamma ray sensor, and the scattering effect is much higher by liquids rather than gas. Thus the gas hold-up of fluids is presented.

Technical Specs:
- Tool Length: 623mm (24.53″)
- Weight: about 4.1kg (9.1 lb)
- Working Current: 36mA ± 3mA
- Sensor: Sodium iodide
- Source: Cobalt 57 (3mCi)
* The temperature tool measures the downhole temperature;

* Technical specs:
  
  Tool Length:
  Power Supply Current: 28 mA ± 3mA
  Measuring Range: 0 -177 °C
  Resolutions: 0.01°C
  Accuracy: ± 17°C (FS)
  Response Time: 0.6s
The water hold-up tool integrates a capacitor sensor, a fast-response temperature sensor and a flow-measuring sensor.

**Technical Specs:**

- Power Supply Current: $45\text{mA} \pm 3\text{mA}$
- Water Hold-up Range: 0-45%
- Temperature Range: 0 - 175°C
- Temperature Resolutions: 0.01°C
- Temperature Accuracy: $\pm 2°C$
- Response Time: < 0.5S
- Flow Sensitivity: 10 pulses/rev
Connection with Flowmeter

The capacitor tool bottom is coupled with a Hall device (flowmeter sensor) for flow rate measuring. The magnetic pin turns with the flowmeter and triggers the hall device to generate pulse signals which is proportional to the rate of turning.
Connection with Flowmeter

Different models of flowmeters are available to suit different conditions;
Each flowmeter can be coupled directly to the bottom of the capacitor tool;
To enhance reliability of flow measuring, the capacitor tool may be coupled with a centralizer onto its top, and then with other logging tools.
Fullbore Flowmeter

* The fullbore flowmeters are categorized into two types: the spring bow type and the roller type.

* The spring bow models include a 4-arm model and a 6-arm model;

* OD: 43mm, 35mm

* Applicable pipe sizes (ID):
  4.5, 5.5, 7.5, 9.5 inch
* The spinner flowmeters are categorized into two types: jeweled-bearing types and bearing types;
* By the way of flowing, the flowmeters may have sampling windows or without sampling windows;
* Tool ODs:
  - 43mm Body/43mm Shroud
  - 43mm Body/54mm Shroud
  - 43mm Body/62mm Shroud
  - 35mm Body/35mm Shroud
  - 35mm Body/43mm Shroud
  - 35mm Body/54mm Shroud
The spinner flowmeters are categorized into two types: jeweled-bearing types and bearing types, applicable to different well conditions and environments: the former is suitable for wells where sands are produced, and the latter is better for wells of big flows.
In-line Spinner Flowmeter

- The in-line spinner flowmeter provides a feed-through wire, and may be connected at any location in the tool string;
- The in-line spinner flowmeters may be categorized into two types; the jeweled-bearing type and the bearing type;
- Tool ODs:
  - 43mm Body/43mm Shroud
  - 43mm Body/54mm Shroud
  - 43mm Body/62mm Shroud
  - 35mm Body/35mm Shroud
  - 35mm Body/43mm Shroud
  - 35mm Body/54mm Shroud
## Tips for Flowmeter Selection

### Well-Sun Flowmeter Application Chart

<table>
<thead>
<tr>
<th>Medium</th>
<th>Gas</th>
<th>Oil</th>
<th>2/3Phase</th>
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<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
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<tr>
<td>Caged Fullbore</td>
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<tr>
<td>Jeweled Bearing</td>
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<td>Ball Bearing</td>
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<tr>
<td>In-line Spinner</td>
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<tr>
<td>Diverter Basket</td>
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</tbody>
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1. Always use the largest diameter impeller possible.
2. Always run an ILF as a backup to an CFF if possible.
3. Always run a centraliser immediately above the flowmeter.
Micro-sonde Water/Gas Hold-up Tool

* The tool includes 4 arms, each arm equipped with 4 micro resistivity sondes and 4 micro optical sondes. The tool measures oil bubbles and gas bubbles simultaneously, and by counting the No. and size of bubbles, to realize water and gas holdup measuring.

* WSTbus tool bus, compatible with regular PL tools;

* Technical Specs:
  - OD of Micro-sonde: 1.6 mm
  - Min Gas Bubble Measurable: 1mm
  - Min Oil Bubble Measurable: 1mm
The array spinner flowmeter is applied to horizontal wells, and measures the flow by strata.

- 6 arms equipped with 6 miniature spinners;

- The miniature spinners are arranged in such a way across the limited 43mm space so that the spinner OD is maximized. The OD of a spinner is 15mm;

- WSTbus tool bus, compatible with regular PL tools.
The array fluid identifier is applied to horizontal wells, to recognize the nature of the fluids;

- 12 arms equipped with 12 array miniature sensors.
- RAT 12 set of micro-resistivity sensors;
- CAT 12 set of micro-capacitor sensors;
- WSTbus tool bus, compatible with regular PL tools
The metal basket flowmeter is applied to wells of low flow rate. The tool is designed to reduce the start up threshold by conducting the fluid using a basket;

WSTbus tool bus, compatible with regular PL tools;

Applicable pipe sizes: 4.5, 5.5 and 7.5 inch;

Startup threshold as low as 5 cubic meters per day
Metal Basket Flowmeter

* For stationary measuring of flow rate;

* When measuring, the basket is motored open;
  The fluid is conducted by the basket and drives the spinner for flow measuring;

* The basket is motored closed after measuring.
The head tension tool integrates a tension sensor to measure the pull and compression on the toolstring;

**Technical Specs:**
- Make-up Length: 714mm (28.11")
- Weight: about 5Kg (11.1lb)
- Working current: 24mA ± 3mA
- Measuring Range: -400kg - +1000kg
- Accuracy:
- Resolutions:
Multiple types of centralizers, swivel subs, knuckle joints provides multiple options for the application of multi-finger calipers – vertical, deviated and horizontal wells.

3-arm, 4-arm and 6-arm roller centralizers for vertical to horizontal wells;

4-arm, 5-arm and 6-arm spring bow centralizers for vertical wells.
Ultrahigh-temp PL Tools

* Max Working Temp: 260°C
* Max Working Pressure: 16000Psi
* Tool OD: 43mm
* Max Working Time at limit temperature: 10hrs
* Multiple flowmeters options;
* SRO/Memory modes
Anti-corrosion PL Tools

H2S –proof metal materials and seals are used for use in high H2S content up to 150,000 PPM!
SRO/Memory modes
The noise tool is used to determine the point of entry and nature of fluids by measuring the noise amplitudes and frequency spectrum when they flow behind the casing, through the channels or voids in the cement sheath, or through the earth formation.

**Technical Specs:**
- **Transducer:** Piezoelectric ceramics
- **Working Frequency:** 200Hz-15KHz
- **Frequency Resolutions:** 150 hz
- **Output Logs:** 200hz—25khz (set by user)
- **Mode of Measuring:** stationary
Typical Applications of Noise Tool

By measuring the amplitude and frequency spectrum of noise produced from fluid flowing in or behind the pipe, through the channels in the cement, or in the earth formation, the nature of the fluid and of the noise is determined.
R&D Capability

To meet the requirement of on-site evaluation, the noise tool transmits not only the noise signals by way of digital and frequency spectrum, but also by way of audible signals, using audio compression technology, for real-time monitoring.

Standard WSTbus for readily combined use with MCT, PLT, RBT and EMT.

SRO/Memory modes, to meet different requirements and provide more options.
Super-short 4-sensor Combination Tool

* The super-short 4-sensor combination tool integrates the wireline telemetry, plus the gamma ray, temperature, pressure and CCL in one tool.

* The tool is provided with a single-conductor thru-wire, to allow connection with other tools.

* Technical Specs:
  
  Make-up Length: 1240mm
  Weight: about 8Kg
  Working Current: 54mA ± 3mA
  Pressure Transducer: quartz or MEMS options;
  Signal Format: Manchester code
  Baud Rate: 5.72Kbps
X-Y Caliper

* X-Y caliper is used to measure the inner diameter of the pipe in the X axis and Y axis. The tool is primarily used for borehole correction and drifting when measuring the flow.

* When combined with weight bar to perform well drifting, the pipe ID may be worked out to be used as a reference for PL logging.

* Technical Specs:
  - make-up Length: 1240mm
  - Weight: about 8Kg
  - Working Current: 54mA ± 3mA
  - Signal Format: Manchester code
  - Baud Rate: 5.72Kbps
The 4-arm caliper is used to measure the ID of the pipe, or measure the ID of open hole at the time of well completion, or to offset the wellbore drift when measuring the flow.

The arms are motored open or closed;

When combined with weight bar to perform well drifting, the pipe ID may be worked out to be used as a reference for PL logging.

Technical Specs:
- Make-up Length: 1340mm
- Weight: about 10.2Kg
- Working Current: 54mA ± 3mA
- Measuring Range: 2.5 – 9.5 inch
- Accuracy: 0.5mm
The motored isotope release tool is used to release isotopes into the well using a motored releasing valve. The purpose of this is to measure the flow in very low flowrate wells.

When the isotope has been released, by measuring the time of peak value when the isotope is flowing in the well, the flow rate is calculated.

Technical Specs:
- Make-up Length: 1040mm
- Weight: About 10Kg
- Working Current: 54mA ± 3mA
- Isotope Volume: 200-800 cubic MM
- Isotope Type: Solid or liquid
- Mode of Release: May be released repeatedly if liquid isotope is used.
May be connected with different logging systems via the special IU interface panel.

May be connected via Well-sun’s WS3000.
Thank you