

ES109 Large Seismic Instrument

Science & Technology Management Department

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CHINA NATIONAL PETROLEUM CORPORATION

*The preeminent Seismic Instrument
provides you with integrated services!*





Contents

Introduction	3
Equipment Composition and Functions	5
Application Cases	7
R&D Equipment	8
Qualification and Standard	9
Expert Team	10



China National Petroleum Corporation (CNPC) is a state-authorized investment agency and a state holding company. As an integrated oil company of cross-regions, cross-industries and cross-countries, it adopts modern enterprise system to realize the integration of upstream and downstream operations, internal and external trade and production and marketing. CNPC has 17 upstream companies, 33 downstream companies and 36 large-scale marketing companies. It is China's largest producer and supplier of oil and gas, and also one of the largest refined oil products and petrochemicals. In 2010 CNPC produced 105 million tons of crude oil and 72.5 billion cubic meters of natural gas, while crude processing volume reached 135 million tons. The total revenue of RMB1, 720 billion with a profit of RMB172.7 billion had been achieved the same year. Its profit is among the highest of the domestic enterprises in China.

CNPC was ranked 10rd in Fortune Global 500 in 2010 and 5th among global top 50 oil companies.

CNPC strictly follows by the combined strategies of increasing resource capacity, expanding market shares and consolidating the international role, and persists in regarding technical innovation as a key framework to advance technological progress. To develop its core businesses, focuses will be placed on the solutions of key bottleneck technologies and key proprietary technologies. Thanks to continuously improving of the technical innovation system, optimizing the configuration of technological resources and strengthening the construction of strong talent teams, CNPC's technological creativity has been considerably upgraded. Consequently, a large number of technologies have been developed independently, with its own intellectual property.

ES109 Large Seismic Instrument is one of representatives for major innovations of CNPC.

CLEAN ENERGY SUPPLY FOR BETTER ENVIRONMENT

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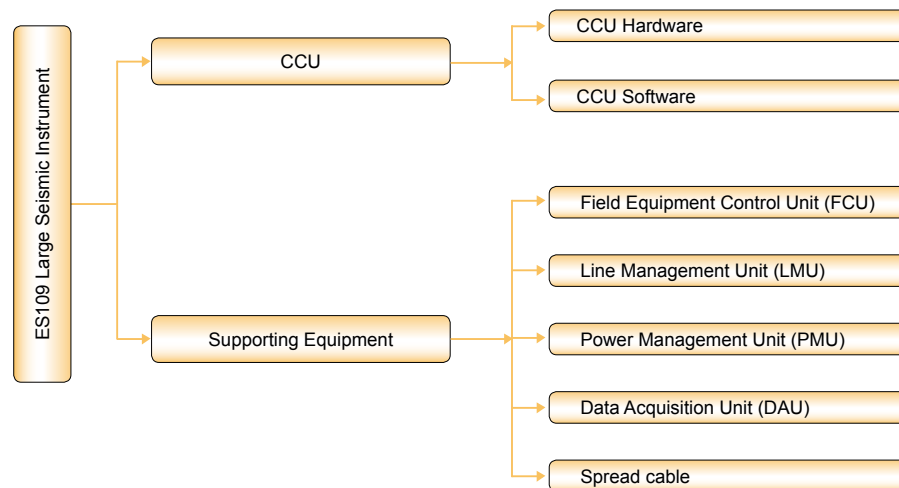
INTRODUCTION

CNPC can provide complete geophysical exploration solutions and possesses a batch of excellent professional and technical personnel. In addition, CNPC is fitted with the advanced geophysical exploration tools and equipment, capable of providing a complete set of high-quality geophysical exploration services.

ES109 Large Seismic Instrument is a large seismic acquisition and recording system developed independently by CNPC. The Seismic Instrument, which has the acquisition capacity of over 10,000 traces and advanced telemetry network technology,

can meet the demand of current conventional seismic data acquisition as well as the requirements of seismic acquisition with high density and large trace number. Thus, the Seismic Instrument is ideal geophysical exploration equipment for coal, oil and gas exploration.

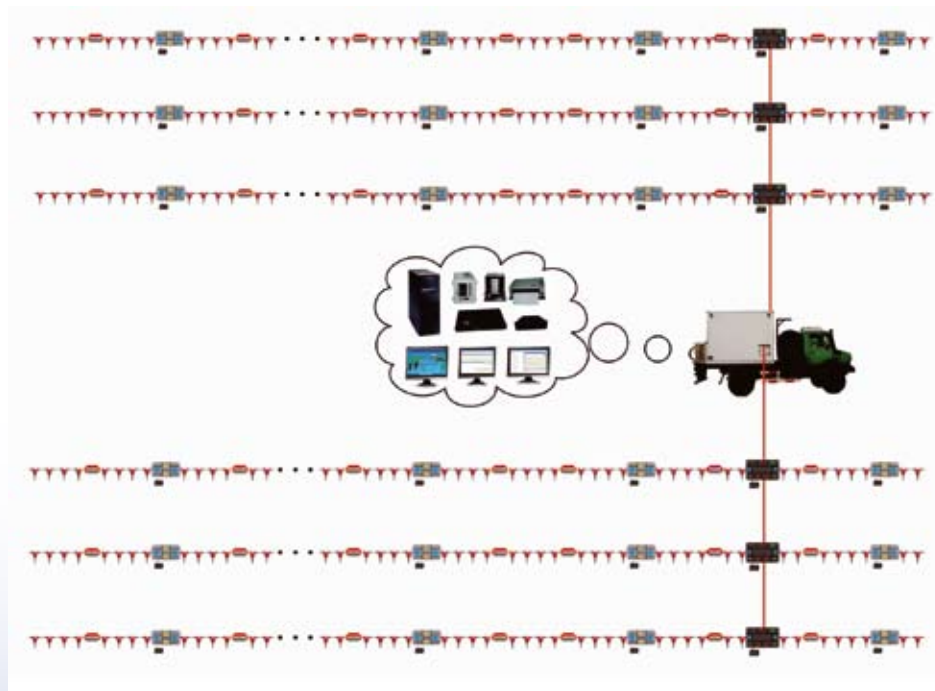
ES109 Large Seismic Instrument has yielded 11 patents for invention, 11 registered copyrights and 16 accepted technical secrets. Various technical performance indexes reach the advanced level of international products of the same kind.



System Composition Architecture Diagram

INTRODUCTION

ES109 Seismic Instrument has five major features: (1) 40Mbps data transmission rate and strong band/trace capacity; (2) quick real-time correlation capacity of 8,000 traces@2ms, and supporting high efficiency acquisition with vibroseis; (3) real-time management capacity of flexible and quick field equipment to improve exploration efficiency; (4) compatibility with multiple shooting modes such as dynamite source, vibroseis and air gun source, etc. and meeting the requirements of seismic exploration in complex regions; (5) functioning in complete testing of field equipment and guaranteeing equipment quality.

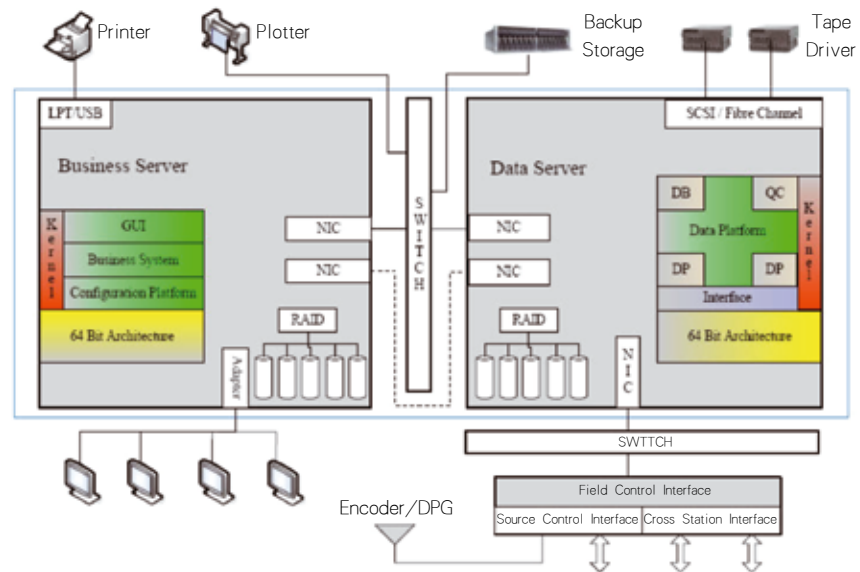


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EQUIPMENT COMPOSITION AND FUNCTIONS

2.1 Central Control Unit (CCU)

The CCU system, consisting of a high performance server group with C/S architecture, mainly completes the field station unit management and seismic data acquisition and processing.



Clients: Use Windows operating system, provide a human-computer interface and carry out parameter configuration, field spread monitoring, acquisition control and data show in multiple modes.

Servers: Use Linux operating system and take charge of information interaction with field equipment and background processing of various businesses, e.g. data acquisition, data processing, data storage, data correlation and stacking.

Main features:

- Single trace capacity 2,000 traces @2ms;
- System trace capacity 20,000 traces @2ms (extensible);
- Real-time quality control;
- Real-time correlation and stacking;
- Online geophone testing;
- Acquisition component testing;
- Supporting multiple shooting modes;
- Supporting recording formats such as SEG-D and SEG-Y, etc.;
- Supporting multiple input/output devices;
- Supporting multi-screen display;
- Dynamic monitoring of spreads



2.2 Line Management Unit (LMU)

An LMU is the junction of the overall system. All LMUs are mutually connected via high speed Ethernet switching modules, and together with the CCU system, form a local area network of relatively strong real-time performance. The LMU uses the hardware exchange scheme of exchanging chips. Excessive intervention of the main control CPU of this LMU is not needed for retransmission of the data uploaded by other LMUs so that the main processing capacity can be used for data and command management of this station, thus making the LMU be of relatively strong data preprocessing capacity, alleviating the burden of the central control and processing unit and ensuring the real-time requirements of the system.



2.3 Power Management Unit (PMU)

The PMU mainly supplies power for sections and relays the signals on lines. Based on Embedded Operating System Software, the software can support testing or diagnosis of spreads with the peripheral equipment such as spread helpers, etc. in addition

to the basic functions with which the PMU should be provided. Each PMU supplies power for 8 to 10 DAUs of the closest connection with it. The PMU is the control center of an acquisition section and has two spread line interfaces connecting front and rear spreads, one 12V DC battery interface supplying power for two sections and one interface connecting spread helpers.



2.4 Data Acquisition Unit (DAU)

The DAU, as the most front equipment of the overall system, mainly takes charge of seismic signal digitalization and transmission and relaying of spread cable data and as needed, simple packing, processing and storage of local data. In addition, if necessary, the DAU can retransmit the stored data. The DAU is internally fitted with a high-precision signal source and testing program, which can complete DAU self-checking and geophone testing.



3 APPLICATION CASES

Two 2D seismic lines were deployed in Sidaogou region in Hami sag and vibroseis operations were performed from Nov. 7, 2009 to Dec. 10, 2009, with the workload of 61.26km and the design shot number of 1,658.

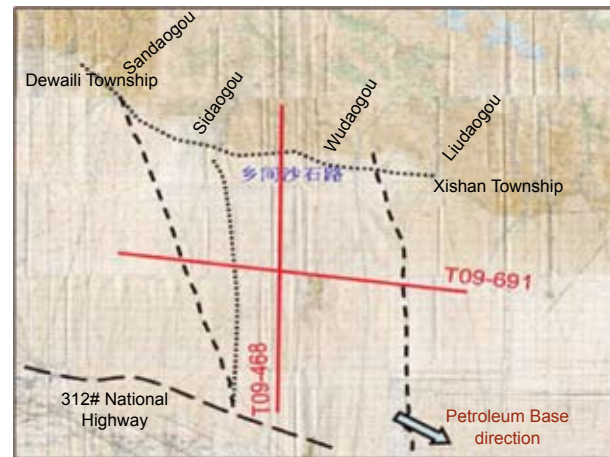
Distributed in the northwest of Hami Petroleum Base in Hami City and within the border of Dewaili Township and Xishan Township, the 2D seismic lines reach the Bogda Mountain northward and enter the Bogda Mountain by about 5km in depth.

The field profile has good continuity, clear interlayer contact relationship and distinct structural features. The overall quality of the profile is good.

Hami Sidaogou 2D project deployed by Tuha Oilfield Company was completed favorably using the ES109 Instrument System on Dec. 3, 2009.

Two shooting modes such as vibroseis shooting and dynamite shooting were adopted during the production. Conventional 2D, wide-line 2D (3-line receiving) and conventional 3D (geophone string comparison test) receiving modes were adopted.

The ES109 Instrument System has good stability, overall performance and powerful band/trace capacity and can complete field acquisition work with high efficiency. The ES109 Instrument System shows high efficiency in field spread layout and line checking. The CCU's speed of seismic data acquisition, processing, tape recording and plotting can meet the requirements of field operations. The tape record format is accurate, and review records can achieve the purpose of field quality monitoring. The CCU has complete software functions, which can meet the requirements of field operations basically.



T09-691 2D Field Profile



4 R&D EQUIPMENT

CNPC has the largest geophysical and geological method research & software development center in Asia and a technically advanced and experienced specialized geophysical research team. CNPC has the capacity of manufacturing 6 major series of equipment, i.e. seismic instruments, vibroseis, seismic rigs, seismic geophones, special transport equipment and auxiliary engineering instruments, which can meet the demands of exploration in different complex topographies and different operation environments such as mountain lands, swamps and deserts.

CNPC, equipped with an internationally first-class geophysical exploration equipment R&D platform shared by apparatus and large software, is devoted to R&D of the equipment such as seismic instruments, vibroseis, digital geophones, deep-sea tow cables and 3D electromagnetic instruments. CNPC detects, tests and verifies key technologies, unique technologies, core technologies and conventional working procedures during the equipment development and can carry out prefect functional and performance tests on the developed products.



5

QUALIFICATION AND STANDARD

CNPC holds 14 national qualifications of Class A in EPC and engineering investigation design, etc. CNPC has obtained Grade AAA Credit Certificate and passed the GB/T 19001 Quality Management System Certification. 34 units of CNPC have carried out the HSE Management System while 20 units have passed HSE System Certification.



The technical materials of the ES109 Seismic Data Acquisition and Recording System are detailed and elaborate. Besides its good technical indexes, the ES109 Seismic Data Acquisition and Recording System has innovative performances such as high data transmission rate, strong trace capacity and online analysis of geophone performance and is characterized by strong practicability and good reliability. On the whole, the system has reached the internationally advanced level.

6

EXPERT TEAM



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Senior engineer. He once served as the head of an instrument repair station and the Chief Engineer of the Equipment Division. He has been engaged in applications, studies and manufacturing of seismic instruments for many years. He has organized the development of a GPS seismic timing analyzer and held multiple patents. He now serves as the executive vice leader of the instrument R&D project group, the leader of the seismic instrument industrialization project group and the Chief Engineer of the Equipment Manufacturing Division of BGP.

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