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Computer Support for Petroleum and Natural Gas Industries

The paper presents computer tools usage for supporting petroleum and natural gas industries. These tools are the most effective on infrastructure design and monitoring, as on financial management problem solution.

Описано применение компьютерных средств моделирования в нефтяной и газовой промышленности. Эти средства наиболее эффективны при формировании инфраструктуры и мониторинге, а также при решении задач финансового менеджмента.

Key words: petroleum and natural gas, computer analysis.

The technological revolution supplies the global energy market with solutions influencing on continuous its development. P. Bijur, the Texaco president notices, that new technologies do not make hydrocarbons an archaic energy source, just the other way round. Technology development lets us go towards the uneconomic, difficult for extraction or remote sources of hydrocarbons and make them fully operational energy source [1]. Moreover achievements of the technology allow us to exploit today raw material beds which were regarded as exhausted, uneconomical to exploration in the past. Undoubtedly due to technology development, it will be possible to reaching for more and more unconventional reserves as well as more and more and difficult reserves.

New technologies influence so many elements of the gas chain, that it is hard to list them all. However, it is worth to enumerate at least a few of them connected with IT and the Internet:

- enrich the range of searching techniques and geological reserves analysis (e.g. using of supercomputers for generating 3D and 4D reserves image);
- they make continuous monitoring of land and sea gas reserves conditions and the mining infrastructure possible;
- they give chances of the computer technology implementation for designing the oil and gas infrastructure (CAD type software);
- computer technologies make possible to remote measurements, data collecting during the transfer of natural gas in gas pipelines;
- they support the activity of wholesale oil and gas market;
- they adjust logistics management and financial administration [2].

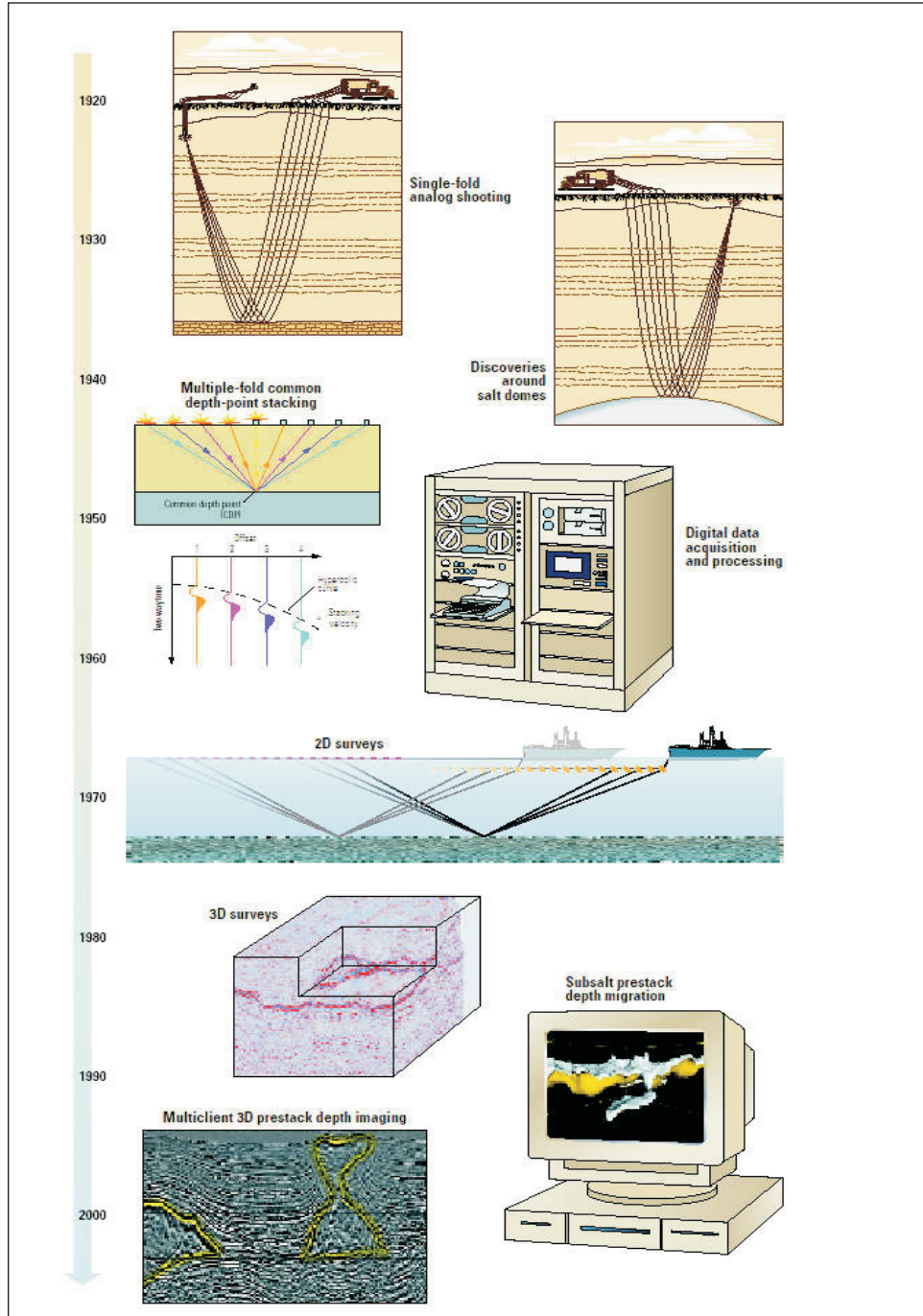


Fig. 1. Chronological expression of chosen seismic methods of gas and crude oil reserves exploration

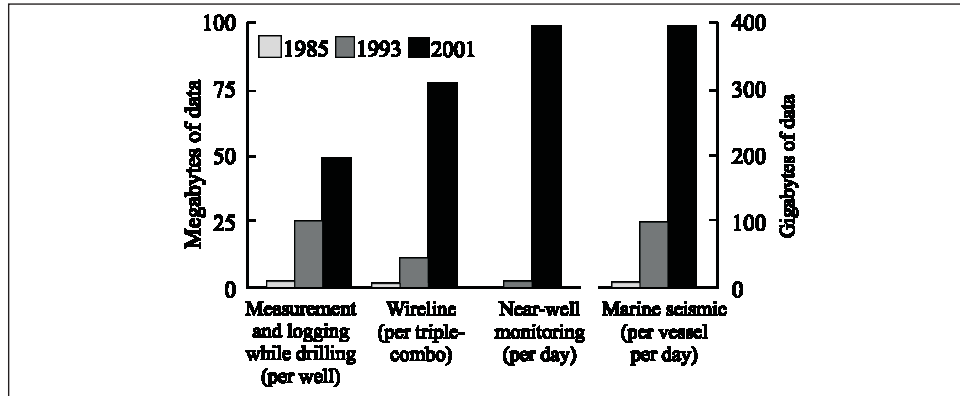


Fig. 2. Computer data quantity increase from various land and sea operations in the natural gas industry in 1985, 1993, 2001

Modern technologies elaborated for needs of gas and crude oil industries let to localize sources of this raw materials more precisely, to exploit them more effectively minimizing losses and the environments pollution. Technological innovations allow to recognize geological formations better due to still improved analysis of reflected acoustic waves, radarscope images and other technologies. Exploration and production (E&P) companies depend on timely, high-quality data to identify exploratory prospects, optimize well locations, avoid drilling hazards and pinpoint reservoir targets. Today, many of these reservoirs are found in difficult geological settings and in some of the most forbidding environments on earth [3]. It is possible to reach the sea for depth below 7000 feet in depth, and to make more far-away gushers — even side — for depth of 20,000 feet on the base of seismic data subjected to the 3D visualization. Techniques development of seismic examinations is presented on Fig. 1 [4].

IT technology allows for deep imaging of oil and natural gas resources as well as seismic analysis. Imaging is the process that brings seismic reflections into focus at their proper positions. It consists of two main elements - stacking and migration. Stacking increases signal-to-noise ratio by summing records obtained from several seismic shots reflecting at the same point. The simplest case to illustrate is a flat layer of uniform velocity overlying the reflector [4].

After years of production, mature fields also benefit from continued exploitation of seismic data. Taking time-lapse (4D) seismic «snapshots» at various stages throughout the life of a reservoir allows asset teams to observe dynamic changes in the reservoir resulting from production and enhanced-recovery techniques [5]. This proven technology is applicable in oil and gas fields worldwide, but interpretations have been largely qualitative, describing where reservoir changes take place, but not how much the reservoir has changed. Recent ad-

vances allow quantitative mapping techniques to extend the productive life of fields by uncovering bypassed or unswept reserves [5].

However new techniques needs larger and larger number of specialists for their results analysis. Fast and prompt analysis needs fast and unfailing communication between specialists. It is possible to apply new technologies to avoid travel and common meetings costs of large number of specialists.

The infrastructure of wires, cables, aerials, satellites and software systems created the chance of fast communication, so necessary in the business environment. Communication safety is the bottom line, when data coming from seismic examinations or production reserves in real time are simultaneously discussed on two continents [6].

The data quantity exchanged between units of the company rises quickly (Fig. 2) [6]. Information processing, analysis and presentation requires substantial computing power and specialists' support. The Internet is extremely helpful instrument which support logistics side of analysis allows for the access to necessary data from almost every places of the globe.

The most important benefit of the Internet as the global network is fact that the Internet supplies ideas, solutions for whole spectrum of the branch members, having started from the executive management, engineers, representatives of governments, dealers, large consumers, to service units, producers of the equipment or independent energy producers [7]. The work of gas and petroleum industry based on the Internet:

- let for fast and cheap collaboration dispersed al over the world enterprise units;

- give the chance different distributed units for the access to the same information source;

- make visual and verbal communication possible (videoconferences) at a any time, from the any places at the same time for many units;

- allow for the contact and data exchange in places far away from local telecommunication networks thanks to the satellite contact and the Internet;

- users can adjust the range and the complexity of information to current needs;

- make precise communication possible on the basis of the complicated, technical language used in the branch.

In spite of common opinion, application of IT technologies and the Internet allows for development of such «old» industries as petroleum and natural gas industry. The application allows for many measurably economic benefits as increase of exploratory success rate, exploratory costs reduction or more effective well placement. The application gives also many environmental benefits as less drilling wastes generation or improvement of earth's natural system characterization.

Описано застосування комп'ютерних засобів моделювання у нафтовій та газовій промисловості. Ці засоби є найефективнішими при формуванні інфраструктури і моніторингу, а також при розв'язуванні задач фінансового менеджменту.

1. *Bijur P. I.* A New Era for Energy Suppliers: Challenges and Opportunities// Remarks by Conf. of the Center for Strategic and International Studies the Geopolitics of Energy into the 21-st Century, December 8-9, 1999. — http://www.chevron.com/news/archive/texaco_speech/1999/pib_csis.asp.
2. *Grabara J., Kot S.* Computer Tools for Material Flows and Plants' Planning// MicroCAD 2002. Intern. Scient. Conf. — Hungary Miskolc, 2002. — P. 85—91.
3. *Breton P., Crepin S., Perrin J. C. et al.* Well-Positioned Seismic Measurements//Oilfield Review. — Schlumberger: Spring, 2002. — P. 32—45.
4. *Albertin U., Kapoor J., Randall R., Smith M. et al.* The Time for Depth Imaging/Oilfield Review. — Schlumberger: Spring, 2002. — P. 2—15.
5. *Alsos T., A. Eide; D. Astratti S. et al.* Seismic Applications Throughout the Life of the Reservoir, Oilfield Review. — Schlumberger: Summer 2002. — P. 48—65.
6. *Groner J., Gutman L., Halper M. et al.* Networking with the World, Oilfield Review. — Schlumberger: Summer 2002. — P. 18—29.
7. *Lang M., Manor D.* GTI Online — Matching Gas Technologies With Global Gas Markets. — Washington: IEA International Centre for Gas Technology Information (ICGTI), 2007. — P. 1—6.

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