# Oil Field Geographical Information System Based on Remote Sensing, GIS and GPS

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**Abstract:** Oil Field Geographical Information System (OFGIS) manages multiple spatial data, attribute data, and topographic data, which include almost every kind of ground information and underground information. Subsystems managed by OFGIS include petroleum exploration subsystem (PESS), petroleum development and engineering subsystem (PDESS), petrochemical subsystem (PCSS), petroleum storage and transportation subsystem (PSTSS), petroleum sale subsystem (PSSS), etc. A basic OFGIS framework consists of oil field infrastructure coverage (OFIC), oil field specialized information coverage (OFSIC) and oil field synthesis and decision service coverage (OFSDSC). Basic function of OFGIS includes database management, geographic information management, spatial information processing and application.

**Keywords:** Geographic Information System (GIS), Spatial Information, Oil Field, Database.

## 1. Introduction

A great number of spatial and attribute data are accumulated in the exploration and development of oil fields. Those surface and underground data are changing and require renewal lively. To handle with those large amount of data from oil field exploration and development, special database for exploration and development have been employed in some large oil fields, such as Daqing and Shengli oilfields in China. However, those database or software packages lack the necessary linkage and cannot realize the uniform inquiry and spatial analysis. Geographical information system (GIS) integrates functions of data collection, data storage, spatial data management and spatial information analysis thus has the unique superiority in managing spatial and attribute information.

Applications of Remote Sensing (RS), GIS, Global Position System (GPS) for researches of oil field exploration and development have been carried out by a number of oilfields in China. This direct and precise system combines the aerial and space remote sensing technologies, GIS and communications technology and plays an important role in the management of oil field.

## 2. Frame of Oil Field Geographical Information System (OFGIS)

The system is different from pure scientific research and it has many special technologies, which composes of integrated database of oil field geographical information, comprehensive information management, construction of computer network and information service. Oil field geographical information has the characteristics of multi-coverage and distributed network. In general, a basic OFGIS framework consists of oil field infrastructure coverage (OFIC), oil field specialized information coverage (OFSIC) and oil field synthesis and decision service coverage (OFSDSC)(Fig.1).

### 1) Oil Field Infrastructure Coverage (OFIC)

This coverage mainly manages those big scale terrain diagrams and plane charts, and provides the uniform reference system for the spatial position, which is planned by the special sector in oil field according to the national standard.

### 2) Oil Field Specialized Information Coverage (OFSIC)

This coverage includes petroleum exploration subsystem (PESS), petroleum development and engineering subsystem (PDESS), petroleum chemistry subsystem (PCSS), petroleum storage and transportation subsystem (PSTSS), petroleum sale subsystem (PSSS), etc.

### 3) Oil Field Synthesis and Decision Service Coverage (OFSDSC)

This coverage deals with and comprehensively analyzes the spatial information and provides decision support for related sectors.

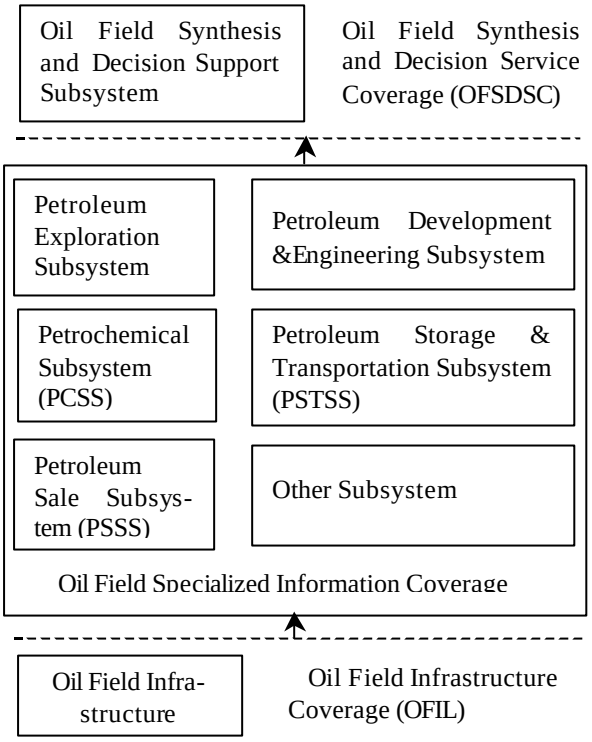


**Fig. 1. Frame of Oil Field Geographical Information System.**

## 3. Main functions of Oil Field Geographical Information System

### 1) Management of Oil Field Database

Oil field spatial database mainly includes infrastructure information, images and specialized subjects, etc. The metadata database includes metadata of infrastructure information, remote sensing images, GPS data and specialized information. The infrastructure information database includes geographical data of multiple scales. The remote sensing and GPS data includes the original data, output data, application data and control point data. Specialized and distributed databases are managed by different sectors of oil field, for example, petroleum exploration sector, petroleum development and engineering sector, petrochemical sector, petroleum storage and transportation sector, petroleum sale sector, etc. Currently, the spatial database of oil field is usually managed by special software; the attribute database is usually managed by Data Base Management System (DBMS), such as ORACLE database, while the top of the manage system is the GIS application software (fig.2).

### 2) Geographical Information Management

OFGIS has some key functions in managing geographical information. It can be used to manage multiple scale of maps, such as Digital Elevation Model (DEM), Digital Orthophoto Quadrangle (DOQ), Digital Line Graph (DLG) and Digital Raster Graph (DRG), etc. Furthermore, it also can be used to select scales of spatial database and effectively manage the data of multi-resource, multi-scale and multi-temporal. Anymore, it is employed to select and optimize the method for spatial data inquiry based on vector and attribute data. In addition, it can provide effective statistical method to extract and analyze the spatial information. What's more, the visualization of 2D and 3D maps provides convenient tools for data management.

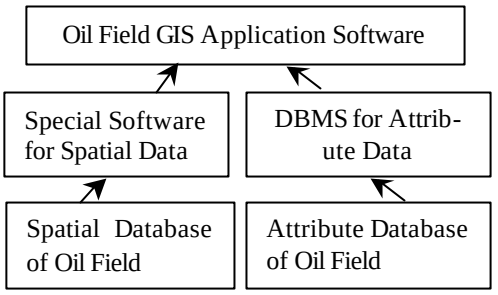


**Fig.2. Management Frame of Oil Field Database.**

### 3)Geological Information Processing and Application

The system Standardizes the format of original and geocoding data thus can give standard spatial information. It can also provide some ways to conduct buffer area analysis, network analysis, statistical classification analysis and overlaying analysis. The product manufacturing system provides application models and visualized maps for customers.

## 4. Conclusions

Oil Field Geographical Information System manages petroleum exploration subsystem, petroleum development and engineering subsystem, petrochemical subsystem, petroleum storage and transportation subsystem, petroleum sale subsystem, etc. The basic framework consists of oil field infrastructure coverage, oil field specialized information coverage and oil field synthesis and decision service coverage.

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