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Geo-spatial Data Activities in the United Arab Emirates

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Summary

The United Arab Emirates is making rapid progress in the development of its physical infrastructure due to national focus on building industrial sector. This has increased the economic activity of the country. Many local and federal agencies are participating in the process. Digital techniques are used to manage the information required for such developmental projects. As a result huge amount of digital data is generated and maintained. As this information mostly deals with the physical developments of the country, the major data content is spatially related.

The great deal of autonomy that existed in the functioning of federal and local agencies in the country resulted in stand-alone information systems, thus limiting the sharing and exchange of data among these agencies. In recent years, as part of increasing efficiency and productivity, government promotes e-government initiatives. The approach has encouraged the geospatial data agencies in the country to coordinate the creation, maintenance and dissemination of geospatial data sets. The activities related to these initiatives involve collaborative efforts by the federal and local authorities. All these efforts are expected to contribute towards the development of important components of the UAE Spatial Data Infrastructure. The paper describes the activities of all the agencies involved in the production and distribution of geospatial data in the country, with a special reference to their contribution to the implementation of NSDI.

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1. Introduction

The U.A.E. is making rapid progress in the development of its infrastructure, thus facilitating more advanced civil services. The discovery of oil, in the early 1960s, opened the door to rapid urban growth accompanied by a spurt in new real estate developments. As part of its strategy to make the country self reliant, the U.A.E. has now shifted its focus towards the development of the industrial sector. This process has further increased economic activities. Most agencies depend on computer-based system for managing the information generated from such developmental activities. As this information mostly deals with the physical development of the country, the major data content is spatially related.

Agencies responsible for maintaining these data sets -- such as local governments, utilities departments, and oil companies -- have developed them independently. The characteristic of these organizations is that most of them have a great deal of autonomy in their functioning. In fact, this principle was adopted to speed up the data production activity so that it could cope with the increased demand for the data required for the developmental activities.

In recent years, however, there has been a definite change in the attitude of the geospatial data agencies in the country. Most of them realize the potential of coordinated efforts to promote and facilitate the sharing, exchange, dissemination and use of geospatial data. The activities related to these initiatives involve collaborative efforts by the federal and local authorities. All these efforts contribute towards the development of important components of the UAE SDI.

2. Status of Geospatial Data Activities in the U.A.E.

The names and the areas of mapping and surveying jurisdiction of the major data producing agencies in the UAE are shown in Table 1.

SN	Name	Area of Jurisdiction
1	Military Survey Department (MSD)	All of U.A.E.
2	Abu Dhabi National Oil Company (ADNOC)	Abu Dhabi Emirate
3	Abu Dhabi Town Planning Department (ADTPD)	Middle and western region of Abu Dhabi Emirate (65% of Abu Dhabi)
4	Abu Dhabi Water and Electricity Authority (ADWEA)	Abu Dhabi Emirate
5	Ajman Municipality (AM)	Ajman Emirate
6	Al Ain Town Planning Department (AATPD)	Al Ain Municipal Territory
7	Dubai Municipality (DM)	Dubai Emirate
8	Emirate Telecommunication Corp. (ETISALAT)	All of U.A.E.
9	Environmental Research & Wildlife Development Agency (ERWDA)	Abu Dhabi Emirate
10	Fujairah Municipality	Fujairah Emirate
11	Ras Al Khaima Municipality	Ras Al Khaima Emirate
12	Sharjah Municipality	Sharjah Emirate
13	Umm Al Quwain Municipality	Umm Al Quwain Emirate

2.1 The U.A.E. Military Survey Department

The Military Survey Department (MSD) is considered to be the largest federal mapping agency in the U.A.E. It is responsible for collecting, processing, and disseminating up-to-date topographic, aeronautical, and nautical information over all of the U.A.E. territory. The U.A.E. MSD has a wider responsibility as a mapping agency of the country and it supports various government agencies, oil companies, and other organizations. It caters to the needs of these organizations in terms of supplying them with maps, aerial photographs, geodetic control data, and technical advice.

2.1.1 Major Initiatives Supporting NSDI

Considering the current trends in geospatial data activities happening elsewhere in the world, the U.A.E. MSD has shifted its focus from conventional mapping practices. As a result, several steps have been taken to promote the NSDI activities in the country. Major initiatives undertaken to achieve the goal was as follows:

Determination of UAE Geoid

The precise geoid is important not only in geodetic applications, but also in geophysical and oceanographic and NSDI applications. The combination of GPS technology and precise gravimetric geoid determined by MSD facilitated efficient and accurate height information with reference to the mean sea level. This is very important for Aerial Triangulation (AT) and geodetic network control purposes .

National Geodetic Network

The geographic reference system, or geodetic datum, is a fundamental standard enabling integration of spatial data .The National Geodetic Network of the UAE consists of monument points distributed over the country. The country realized the potential of having more accurate and reliable geodetic datum compatible with satellite based navigation system. As a result, MSD established new geodetic network that consists of 16 stations distributed over the UAE and directly tied to the International Terrestrial Reference Frame (ITRF). The overall accuracy of the new geodetic network with reference to ITRF 97 datum is in millimeters in latitude, longitude and ellipsoidal height.

National Topographic Data Base

The U.A.E. MSD has expanded its activities to establish topographic databases for multi-purpose use, catering to the needs of the wide spectrum of geospatial data users in the country. These databases are expected to hold variety of data sets including ortho-photos and DTMs. The objective of the program of topographic data production is the seamless Topographic Database (TDB) with positional accuracy of +/-1m on well defined details and +/-3m on other details. By its content and accuracy, the database will be more than appropriate for production of topographic map at 1:25,000 map scale. Both aerial and ground survey methods are used to produce and maintain the data.

2.1.2 Geospatial Data sets Maintained by the U.A.E. MSD

The following data sets have been created and are maintained by the U.A.E. MSD:

- Digital topographic maps covering entire U.A.E. at various map scales from 50,000, 100,000, 250,000, 500,000 and to 1Million.
- Satellite imageries with 5 m, 10 m, and 30 m resolution for all of

the U.A.E..

- Digital Ortho-images for complete U.A.E. at various scales.
- DTM with 1 m to 5 m vertical accuracy for the entire country.
- Hydrographic charts (in both digital and manual forms).
- Aeronautical Maps JOG at 250,000, 500,000 map scales
- Tourists Maps of Abu Dhabi at 250,00 and 15000 map scale
- VMaP Level 1
- Global Map at 1 million Scale
- Geodetic Control Points.
- National geographic names databases (gazetteer)

2.2 The Abu Dhabi National Oil Company

Abu Dhabi National Oil Company (ADNOC) is a state-owned company that operates the oil and gas industries in all Abu Dhabi areas. As far as spatial data are concerned, the main unit responsible for its acquisition and management is the Exploration and Production Directorates (EPD) of ADNOC. The ADNOC maintains a huge amount of data generated from seismic surveys and related detailed information on oil fields and oil wells. Satellite imageries and aerial photographs are generated through private party contracts. The ADNOC receives digital topographic maps and other data sets from different utilities organization.

2.2.1 Geospatial Data sets Maintained by the ADNOC

The main spatial data sets available at the ADNOC include the following:

- Digital topographic and hydrographic maps for all concession areas.
- Digital spatial data for all oil/gas pipelines and oil/gas well positions.
- Digital geological maps of all concession areas with related attribute data.
- DTM data covering different areas with 1 to 5 meters accuracy.
- Large-scale digital maps for oil fields or industrial complexes.

2.3. Abu Dhabi Town Planning Department

The Abu Dhabi Town Planning Department (ADTPD) is mainly responsible for

maintaining the geospatial data as well related attribute data for the Abu Dhabi Emirate. The jurisdiction of this department covers the middle and western regions of Abu Dhabi emirate, which is about 65% of the U.A.E. The ADTPD GIS Center supports the acquisition and management of the spatial data. The Center has developed many GIS systems to handle various spatial analysis tasks. It also provides data services to various other departments and users.

2.3.1 Geospatial Data sets Maintained by the ADTPD

The ADTPD has the following data sets:

- Digital Ortho-photo covering the entire area of Abu Dhabi with 0.5 m resolution.
- DTM data covering about 30% of the area with 0.5 m vertical accuracy.
- Digital vector planning data at 1:500, 1:1000, etc., map scales.
- Road centerline network data captured using aerial survey method.
- Drainage and sewerage network data, spatial and attribute.
- Cadastral data produced in cooperation with Abu Dhabi Municipality.
- Topographic data set. This data set is available at 1:5000 and 1:10,000 map scales.

2. 4. Abu Dhabi Water and Electricity Authority

The Abu Dhabi Water and Electricity Authority (ADWEA) involved in electric power generation, desalination sale and distribution of water and electricity in the Emirate of Abu Dhabi. The ADWEA maintains huge amounts of data mostly generated from large-scale maps. The data are captured from the physical drawings through private contracts. It also receives data from town planning departments and municipalities. All maps and as-built drawings received from these organizations are either digitized or translated into the required formats to update the database.

2.4.1 Geospatial Data sets Maintained by the ADWEA

The geospatial data set pertaining to the complete network of electricity and water is generated and maintained by the ADWEA. Details of the available spatial data components are listed below:

- Electricity transmission encompasses all elements including power stations, overhead and underground transmission lines, transformers, switches, circuit breakers, etc.

- The water transmission network consists of pump stations, pipes, valves,

fittings, hydrants, tanks, wells, etc.

- The electricity distribution network includes substations, underground and overhead distribution lines (primary and secondary), transformers, bus bars, switches, fuses, generators, meters, joints, service connections, etc.

- The water distribution network includes pumps, tanks, wells, reservoirs, valves, fittings, distribution lines, service points, etc.

2.5 Ajman Municipality

The Ajman municipality is responsible for providing geospatial data services to the various users for mapping and surveying areas coming under its jurisdiction.

2.5.1 Geospatial Data sets Maintained by the Ajman Municipality

Following are the available data sets of the Ajman Municipality:

- Cadastral large scale map 1:500 covering the town centre area of Ajman
- Digital Vector data at 1:2000 m sub-urban area
- Digital Vector data at 1:5000 m covering entire emirate
- DTM covering whole area with accuracy of 0.5 m to 2m
- Ortho-image at various scales covering whole emirate

2.6 Al Ain Town Planning Department

The Al Ain Town Planning Department (AATPD) is mainly responsible for maintaining the geospatial data as well related attribute data for the Al Ain City and sub-urban areas. The AATPD GIS Center supports the acquisition and management of the spatial data. It also provides data services to various other departments and users.

2.6.1 Geospatial Data sets Maintained by the AATPD

The AATPD has the following data sets:

- Digital aerial photo covering the entire area of Al Ain 60 cm – 1 m. accuracy
- Digital vector planning data at 1:500 to 1:25,000 map scales.
- Utility network data, spatial and attribute.

- Land Base and Land use data sets with plot ownership details.

2.7. Dubai Municipality

The Dubai municipality is considered to be one of the largest government organizations in the Dubai emirate. It is responsible for providing geospatial data services to the various users for mapping and surveying areas coming under its jurisdiction. The scope has further increased from a mere data provider to a GIS service provider, in the advent of e-governance activities initiated by the Dubai government. With this vision in mind GIS center was established with a wide scope and broad objectives. One of the main objectives of the center is to generate and maintain geospatial data for all the Dubai emirate, in addition to its traditional members belonging to the Dubai municipality. Other responsibilities are to provide various GIS services, digital base maps, data integrity, data availability, and technical support to all users. It also ensures that the common data standards are enforced in the development and use of geospatial data in the emirate [www.dubai-municipality.org.ae]. Most of the spatial data are received through three main sources: private contracts, different departments in the Dubai municipality, and several utility agencies in the emirate. These various data sets are maintained and managed by the GIS center according to derived data standards and formats.

2.7.1. Geospatial Data sets Maintained by the Dubai Municipality

Following are the available data sets of the Dubai Municipality:

- Digital ortho-images for the entire Emirate maintained at various map scales.
- DTM data that cover most of the emirate including the urban areas.
- Topographic base map for the entire emirate maintained at 1:20,000 map scale.
- Cadastral data, both spatial and attribute.
- Transportation network, this includes road centerline.
- Planning data,
- Address data that covers most of the urban areas in the emirate.
- Utility data that includes drainage and sewerage networks.

2.8. Emirates Telecommunications Corporation

The Emirates Telecommunications Corporation (ETISALAT) is the official telecommunications service provider for the U.A.E. with the responsibilities to operate, maintain, and develop the entire telecom network for the country. The ETISALAT

maintains a huge amount of higher resolution spatial information on the entire telecom network of the country. ETISALAT receives data from town planning departments and municipalities. All maps and as-built drawings received from these organizations are either digitized or translated into the required formats to update the database.

2.8.1 Geospatial Data sets maintained by the ETISALAT

Most of the data produced by the ETISALAT is related to the communication services networks only. Following are the available data sets:

- All telecommunication lines and corridors with related attributes.
- The positional information of all communications towers with related attributes.
- Large-scale digital maps of telecom facility installation sites.

2.9 Environmental Research & Wildlife Development Agency

The Environmental Research & Wildlife Development Agency (ERWDA) was established to protect the natural environment of the emirate of Abu Dhabi. The environmental database (EDB) project was initiated to establish information infrastructure for ERWDA. In 2002, the United Arab Emirates government launched the Abu Dhabi Global Environmental Data Initiative (AGEDI) in response to an ever-increasing world-wide demand for quality environmental data. The vision of is to have a no data/information gap between and within developing and developed nations, and where people have easy and cost effective access to quality environmental data/information for decision makings. The implementation of AGEDI will be undertaken in national, regional and the global level.

2.10 Fujairah Municipality

The survey and GIS section department of the Fujairah municipality is responsible for providing geospatial data services to the various users for mapping and surveying areas coming under its jurisdiction.

2.10.1 Geospatial Data sets Maintained by the Fujairah Municipality

- Orho-image covering whole emirate at 1:5000 scale.
- Digital Vector map at 1:1000 map scale covering 40 Sq. Km of the Emirate.

- IRS Satellite Imagery covering whole Emirate at 1:25,000 map scale
- IKONOS satellite imagery covering coastal area at 1:10,000 map scale.

2.11 Ras Al Khaimah Municipality

Ras Al Khaimah Emirate has decided to implement Geographic information system (GIS) as part of e-government initiative in the country. The project intends to manage geospatial and other information in Ras Al Khaimah Emirate by linking various governments departments through a network. The GIS project would be launched in three phases over a period of three years. The first phase of the project, which is requirements identification will be completed by the end of 2005. A detailed mapping project will be initiated to build a comprehensive geospatial data base of the Emirate. At its final phase the system will offer public utility services to the Municipality, Lands Department, Public Works and Services Department and the Sewerage Authority. Various applications for resource management, developmental planning and emergency response planning, could incorporated within the system. When the system integrated to the government website, it is expected to deliver services to the local community.

2.12 Sharjah Municipality

Geographic Information System department of the Sharjah municipality is responsible for providing geospatial data services to the various users for mapping and surveying areas coming under its jurisdiction.

2.12.1 Geospatial Data sets maintained by the Sharjah Municipality

- Orho-image covering whole urban areas of emirate at 3-5 meter resolution.
- Digital Vector data of all 'Building Outline'
- 'Parcel Plots' and 'Roads' at scale suitable for Urban GIS applications.

2.13 Umm Al Quwain Municipality

The land and property department of Umm Al Quwain established a GIS centre unit to serve various development activities that are conducted in the emirates. Main objective of this centre is establishing base map as well as GIS applications for different

departments in the emirate.

2.13.1 Geospatial Data sets maintained by the Umm Al Quwain Municipality

Following are the available data sets of the Umm Al Quwain Municipality:

- Digital Vector data at various scales 1000 to 5000
- Ortho-image at 10,000 scale covering whole emirate
- DTM covering the whole emirate at a 1m accuracy.

3. The Functions of Non-Government Sector Data Producers.

Non-government sector, especially the commercial establishments, involvement in the geospatial data activities is very significant in the country. Public sector depends heavily on the private companies for the production of geospatial data. The trend is increasing as a result of the increased data needs that are beyond the production capacity of the respective government organizations. The companies, however, do not possess any right on data produced for the government. Private agencies are playing another important role in the geospatial data activities; to meet the demand for detailed street maps, location services and other geo-referenced land use information.

Moreover, private companies are the sole source of satellite imageries in the country. Government agencies fully depend on this sector to fulfill the organizational requirements for raster data..