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## Pipelines of the Skies

Errol Olivier

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Advances in fixed satellite technology are enabling oil and gas concerns to enhance the efficiency of offshore operations with cost-effective voice and data network solutions.



As drilling, exploration, and production of oil and gas have expanded throughout the world, companies have been seeking a new pipeline solution to improve efficiencies and lower costs. And they found it. In addition to the traditional pipelines stretching across the ocean floors and continental terrain of many countries, oil and gas companies increasingly are turning to communications pipelines that reach thousands of miles up in the sky and through which flow billions of bits and bytes of communications traffic.

Today, telecommunications managers are teamed up with the information systems and automation labs within their companies to provide more than the traditional voice and fax services to the remote and harsh locations.

Access to information in real time gives managers the tools to evaluate their operations and determine where improvements can be made.

### **Data Networks for Oil and Gas**

Immediate relay of data allows immediate processing of invoices to achieve the cash flow required to support the overheads and operations of both large and small companies.

Less than a decade ago, the majority of companies drilling in the Gulf of Mexico were getting by with only an analog phone line and thermal paper fax machine.

Communications to the drilling rigs were primarily accomplished through the perplexing design of radio and microwave networks. Seamless as it may have seemed to the end user, the service was made up of a combination of technologies including the wireless local loop (otherwise known as DRT) tied back-to-back with analog microwave channels in a four-wire E&M configuration. The microwave channels rode a terrestrial network that was linked back to the beach some 20-30 repeater hops away.

Each repeater site introduced a multitude of potential problems including power outages, hardware failures, maintenance outages, perforation downtime, weather fades, and the inherent noise of analog networks. The probability of hurricanes and tropical storms in the Gulf of Mexico added unacceptable downtime risk to the high cost of operations to exploration, drilling and production companies.

A relatively small storm damaging one microwave site - a part of the daisy chain of repeater sites - could mean as much as a week to a month of minimal communications to every site down the line. This is a major problem when the storm damage is near the origination of the system on the beach side, which could result in a network outage of approximately 90 percent. (see diagram 1)



Fig. 1: Terrestrial microwave network configuration

## The Satellite Solution

The most dynamic solution for communications serving the remote and harsh parts of the world is a network supported by a satellite backbone infrastructure. When properly engineered, the end result is improved reliability, flexibility and capability. In comparison to the backhaul via terrestrial microwave and wireless local loops, the potential points of failure when transiting through satellite infrastructures can be reduced by more than 10 times.



With improvements in drilling processes, vessels tend to move from location to location on an average of every 30-60 days. These frequent moves cause chaos for operators struggling to schedule and coordinate the mobilization of major structures, personnel and supplies while maintaining safe and profitable operations. With high rates paid for leasing drill ships, semi-submersibles and jack-up drilling rigs, every hour of downtime is an expense against the bottom line. The last thing these operators need is the burden of coordinating the mobilization of communications equipment and support personnel.

Properly engineered satellite networks are designed to provide connectivity immediately upon arrival at a new location. Depending on the technology used and the local regulatory rules, satellite networks can be designed to provide continuous connectivity prior to, during, and after towing to a new drilling site. Within the energy industry, there are numerous applications for these information "pipelines in the skies."

These pipelines of bits and bytes incorporate a multiplexed stream of voice, fax, data, and video of varying capacity. With the most recent launch of higher power satellites and the continuous increase in volume manufacturing of hardware, satellite connectivity has become much more feasible and competitive with terrestrial networks.

Gas transport companies require the monitoring of their pipelines to meet government safety regulations, while controlling the flow of gas and metering usage in real time for quick and efficient turn of revenue. Point to multi-point VSAT (Very Small Aperture Terminal) architecture provides efficient connectivity for monitoring and controlling the overall SCADA (supervisory control and data acquisition) network.

### **Very Small Aperture Terminal Networks**

These metering and control points are typically in remote areas with limited access and power resources. Due to power limitations, these networks must be optimized for minimal current drain in order to be operated on solar-charged battery power systems.

Unlike the need for data from remote sites - which averages only 9.6 kbps - exploration and production companies need significantly more bandwidth. Less

than a decade ago, drilling operations managed with a simple POTS (plain old telephone service) facsimile capability, but this same industry has recognized that access to an abundance of voice, fax and data circuits can effectively improve competitiveness and profits. Today it is not uncommon to see a typical drilling operation supported with four to six voice lines, a dedicated fax line, a 56 kbps data circuit for WAN (wide area network) connectivity and an ISDN interface for 128 kbps video conferencing.

In recent years, significant improvements have been made in the development of voice compression algorithms. This has been an instrumental part of the formula that makes satellite-based networks much more feasible than they were just five or six years ago.

High-speed data access through INMARSAT Standard 'B' terminals provides a quick solution for very short-term projects requiring multiple voice and data connections. Utilizing the latest in frame relay multiplexers over these transportable or marine terminals provides the user with the benefit of simultaneous calls while having a data extension off the LAN (local area network) of the home office.

Unfortunately, this configuration is a metered service, meaning that the user is charged by the minute. When operations require extensive communications with the office, a full duplex high-speed data connection via INMARSAT can introduce serious financial risk to the user.

In comparison to operations in the Gulf of Mexico, connectivity to drilling or production facilities in other parts of the world are basically identical from a system engineering perspective. Ku- and C-band spectrum in the capacities required to provide voice and data to these remote and hostile locations are generally available from satellite operators around the world. There is no shortage of satellite hub Earth stations in each footprint with reasonable connectivity to the PSTN (public switch telephone network).

### **Global Operations**

While focusing on their core business, drilling, explorations and production companies look to service providers to provide turnkey solutions to their telecommunications requirements. Whether operations are domestic, such as those in the Gulf of Mexico, or off the coast of West Africa, in the middle of Ecuador or on Sakhalin Island, companies expect service providers to support their technical, logistical and political needs.

### **Turning the key**

Provision of turnkey fixed satellite communications solutions in the offshore environment has become a mature service offering, and CapRock Communications is a good example of the advanced state of the industry.

For over two decades, the Houston, Texas-based CapRock company has been providing turnkey communications services. These include all equipment, space segment, frequency coordination and licensing administration for the telecommunications networks used to support the drilling, exploration, and production operations of major oil and gas companies around the world. Typically, drilling operations require:

- Telephones on the drilling rig, and at a dispatcher base at a local dock facility
- Two-way radios on the rig, on the supply and crew boats, and at the dispatcher base
- Facsimile, scanners, copier, and printer at the rig and base
- Ethernet connectivity on the rigs for corporate data access
- Computers and routers
- Videoconferencing systems
- Voice, Internet, fax, and data connectivity provided via satellite infrastructure

Depending on the type of vessel, a remote satellite terminal includes antenna, radio, modem and voice and data routers. For jack-up type drilling rigs (see diagram 2), remote fixed antennas average 1.8- 2.4 meters in diameter.



Fig. 2: Typical network configuration

For drillship (see diagram 3) and semisubmersible type drilling rigs that are not stable enough to maintain pointing accuracy, turnkey networks include sophisticated stabilized satellite antennas. These antennas provide a high degree of accuracy and stabilization for continuous connectivity. For transiting service to customers around the globe, CapRock operates multiple satellite hub Earth

stations (teleports) in strategic locations such as Houston, Texas; Aberdeen, Scotland; and Hawaii.

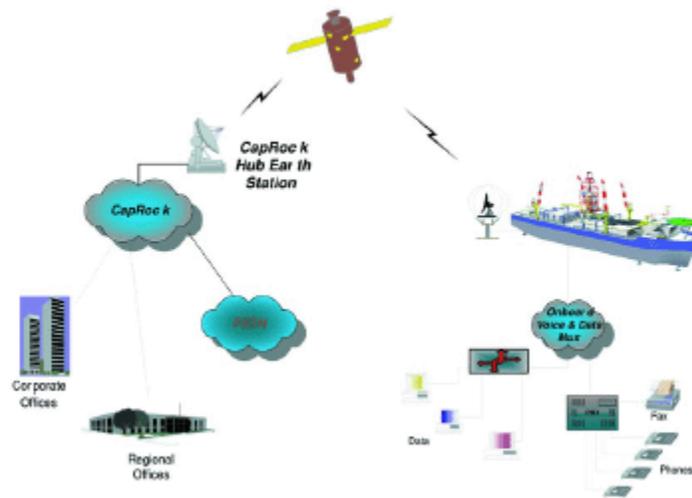


Fig. 3: Typical network configuration

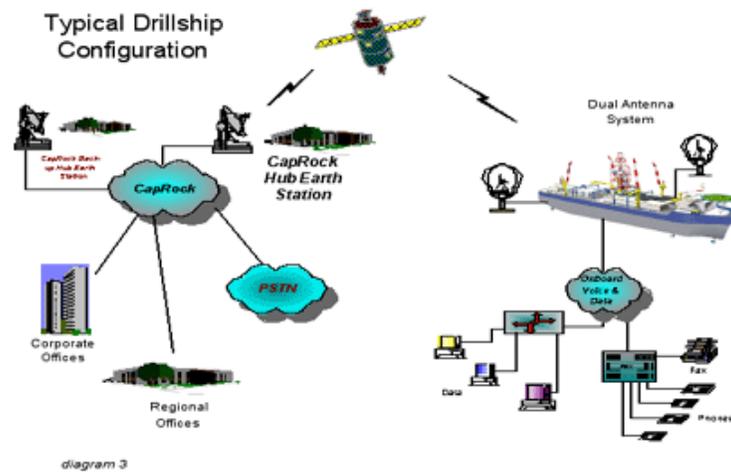
### Licensing and International Approvals

Perhaps the most complex aspect of turnkey telecommunications service provision is the vast difference in each country's government regulations. Some nations still regard satellite communications solutions as a threat to local terrestrial telephone service interests, overlooking the extensive benefits that accrue to an economy where efficient communications are available. But increasingly there is a recognition by regulators that new job opportunities, foreign investment, and economic strength are counted among the many advantages of permitting the provision of effective satellite communications in the oil and gas and other important industries.

Still, other regulatory challenges remain. When it comes to operations in the offshore world, each country claims different territorial boundaries, especially when defining where international waters begin. There is no generally recognized international standard to this definition, nor is there any standard to the licensing procedures and fees from country to country. Further, there is no single guideline agreed to by satellite operators around the world when it comes to satellite antenna specifications. But solutions are at hand. The manufacturers and service providers in the fixed satellite industry formed the Global VSAT Forum, a non-profit international association that is promoting harmonized regulatory policies throughout the world.

Significant gains already have been realized. A case in point is Western Europe where regulatory barriers and high license fees were once established to prevent the use of satellite-based solutions. From the beginnings of pan-European

deregulation, however, Europe rose from being the second worst regional market (the worst being Africa) to challenging North America for the top spot.



Today, the Global VSAT Forum is promoting similar progress in Africa, the Middle East, Latin America and Asia. Many of the member companies (Asiasat, BT, SES Americom, CapRock, Hughes Network Systems, Gilat, MCI-Worldcom, and Scientific-Atlanta, to name but a few) represent some of the largest corporations in the world, whose combined weight in a single organization is helping push back unfair regulatory barriers and ad hoc government restrictions. For oil and gas industry end-users, this means the cost efficiencies afforded by the use of VSAT technology increasingly can be realized in mission-critical applications.