MANUAL

DRILLING COMMUNICATIONS

DEP 32.71.00.13-Gen.

October 1995

DESIGN AND ENGINEERING PRACTICE

PREFACE

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Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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1. INTRODUCTION

1.1 SCOPE

This new DEP gives minimum requirements for telecommunication equipment and systems used for drilling operations onshore and offshore and provides guidance for the selection and specification of equipment and systems meeting these requirements.

Telecommunication systems for a specific drilling rig normally form part of a total telecommunications network. Hence this DEP supplements DEP 32.71.00.10-Gen., DEP 32.71.00.11-Gen. and DEP 32.71.00.12-Gen.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of the Royal Dutch/Shell Group or managed by a Group company, and to Contractors nominated by them (i.e. the distribution code is "C", as described in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil and gas drilling facilities.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement

The word **should** indicates a recommendation

1.3.2 Specific definitions

AZIMUTH, EPIDORIS and **WICON** are Group common systems used in support of drilling operations.

The **campsite** is the residential and administrative area sited separately from the rigsite but normally within a radius of five kilometres from the rigsite.

Company office is the location from where the Drilling Contractor directs the activities of his personnel at the rigsite.

A **hazardous area, 426-03-01, IEC 50** is an area in which an explosive gas atmosphere is or may be expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

Head Office is the location where the Principal's management team are located. This is

often also where the majority of engineering and technical support personnel are based.

An **intrinsically safe** appliance is one that has been specifically manufactured to operate without risk of explosion in a hazardous area.

A **non-hazardous area, 426-03-02, IEC 50** is an area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

The **operations office** is the location from where the non-routine activities at the rigsite are directed; it may be located at the Head Office.

Principal's telecommunication facilities are those facilities rented by or belonging to the Principal.

Public network is the telecommunications infrastructure in an operating area/region provided by a government, regulatory authority or private company.

The **rigsite** is the location of the drilling rig.

The **sea area** is the area of the sea in which an offshore drilling rig is located. Sea areas A1, A2, A3, and A4 are defined in the GMDSS amendments to the SOLAS convention.

A **single-string venture** of the Principal has the task of drilling a very restricted number of wells (usually one but in some cases more) in an exploration area where there are no existing Group drilling/production operations.

The **supply base** is the location from where equipment and materials are dispatched to the rig.

1.3.3 Abbreviations

GMDSS	-	Global marine distress and safety system
HF	-	High frequency
IMO	-	International Maritime Organisation
MODU	-	Mobile Offshore Drilling Unit
PABX		Private Automatic Branch eXchange
SOLAS	-	Safety of life at sea
TDMA	-	Time division multiple access
UHF	-	Ultra high frequency
VHF	-	Very high frequency
VSAT	-	Very small aperture terminal system

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced in this DEP are listed in (5).

2. GENERAL

2.1 PURPOSE OF DRILLING TELECOMMUNICATIONS

The general requirements and purpose for plant and offshore telecommunications are given in DEP 32.71.00.10-Gen. and DEP 32.71.00.12-Gen. Drilling telecommunications facilities may be grouped and prioritised as follows:

- safety telecommunications for compliance with the Principal's safety policy and mandatory national and local regulations;
- operational telecommunications to enhance the efficiency of drilling operations;
- non-essential telecommunications to enhance personnel welfare and recreation, and provide administrative data systems.

2.1.1 Mandatory communications systems

Communications systems specifically designated as mandatory for safety reasons include:

- public address (mainly for offshore installations);
- general alarm systems;
- emergency radio communications.

Offshore, there is a requirement for equipment to operate on international maritime distress frequencies in accordance with IMO, SOLAS and MODU regulations. Emergency shutdown (ESD) requirements are sometimes necessary in simultaneous production and drilling situations. Where this is required, high integrity radio links should be used.

Onshore, there is the requirement to provide reliable communications with the operational office.

The specifications of mandatory equipment are often covered by official regulations.

2.1.2 Operational telecommunications

Certain telecommunications services are provided specifically to support drilling operations. These include voice and data communications with the supply base and Head Office.

2.1.3 Support telecommunications

There should be sufficient communication capacity to support the logistics necessary for the smooth running of the rig. This is usually the responsibility of the Drilling Contractor and he should make the necessary arrangements. However, the Contractor may be allowed to use the Principal's telecommunications facilities at the discretion of the Principal.

There is also often a requirement to provide facilities for personal telephone calls for staff at the drilling camp or rigsite.

2.1.4 Drilling environment

There are three kinds of drilling environment:

- **Onshore drilling**, where each rig usually has its own camp. In some operating areas the camp moves with the rig. In this case the camp and rig are positioned close to each other. For batch drilling of production/development wells, the drilling programme is arranged so that the camp remains static to avoid the expense and disruption of moving while the rig will drill several holes in the vicinity. The regular movement and the variable distance between rig and camp is best covered by means of a radio link.
- **Offshore drilling**, where the accommodation is actually contained on the rig. In the case of a tender-assisted rig, the accommodation is on the barge part. There is no communication distinction between camp and rig as they are effectively combined.
- **Swamp drilling**, where a slot is dredged to make the location accessible by water and the drilling barge contains both the rig and the accommodation. As in the offshore case, communication is only required from one location which is the drilling barge itself. However, house boats sometimes provide the living accommodation.

2.2 CAPACITY REQUIREMENTS AND TECHNOLOGIES USED

The telecommunications capacity required to support drilling operations should be considered carefully since this has a major impact on the cost and may limit the choice of technologies which can be used. The use of digital circuits should be considered carefully with advantage being taken of compressed digital voice technology for some or all of the services which are needed. Consideration should be given to techniques for dynamically assigning timeslots (or bandwidth) between voice and data to further utilise the available capacity more efficiently. In the past, a land-based drilling rig required a minimum of two voice frequency channels - one channel for the Principal's representative and the other for general traffic including telex. With the introduction of digital systems, this now can be replaced by a 32 kbit system - in a 25 kHz bandwidth - offering data and multiple voice channels (dependent upon whether the voice quality is acceptable). Appendix 1 details the technologies which may be used for drilling telecommunications.

3. COMMUNICATION SERVICES

3.1 REQUIREMENTS

Drilling rigs shall have the following basic telecommunications requirements:

- Voice contact with the operational office and supply base;
- Voice contact with support services in the local area such as vessels, vehicles and aircraft;
- Emergency back-up communications (usually voice and usually with the operational office);
- Transmission of record communication (facsimile, E-Mail, and electronic file transfer) to and from the operational office and supply base;
- Transmission of electric wireline log data from the wellsite to the operational office or Contractor's facility for evaluation;
- Communications link between camp and rig if the rig is some distance away from the camp.

3.1.1 Voice communications to head office

For safe, efficient drilling there is a need for good, reliable communications between rigsite and Head Office with 24 hours per day availability. The prime use is for voice. The preferred interface is by telephone because this provides the flexibility to dial directly to different departments. Two-way VHF or UHF radio with operator intervention should be avoided or minimised, since delays and congestion can adversely impact on the efficiency of the drilling operation. HF cannot be relied upon as the prime means of communication but may be used as back-up. For single-string ventures, satellite communications should be used.

3.1.2 Voice communications for the local area

The rig and/or camp needs to be able to contact ships, vehicles, and aircraft in the vicinity. VHF and/or HF should be used. Radios for this purpose are usually only suitable for non-hazardous areas and should be fixed inside the drilling office or camp. Intrinsically safe portable radios should be used for local contact between personnel in the vicinity of the site or on the rig.

3.1.3 Voice contact with a supply base

Once a link is established into the corporate telephone network, calls can be made to all the different departments and locations. In the special case of single-string ventures, no corporate communications network is available and contact with the supply base must be arranged separately from the Head Office if located separately.

3.1.4 Emergency and back-up communication

An adequate but separate means of emergency communications shall be provided. On offshore rigs this is mandatory, and it is strongly advised for the onshore environment. HF may be used for this application but satellite communication should also be considered.

3.1.5 Record communication and file transfer

Record communication covers the following subjects:

- Facsimile;
- E-Mail. E-mail is replacing telex but requires a datacommunications link either permanently or using a dial-up mailbox;
- Computer applications. Some applications will run entirely on a local machine and others require datacommunication links. Applications used locally include:
  - Spreadsheets;
  - Wordprocessing;
  - Drilling engineering applications;
  - Databases for data entry, validation and calculations.

The applications involving data transmission include:

- Drilling engineering applications for file transfer (daily report and well download);
- E-mail;
- Rig computer housekeeping from a central point (usually the base).

3.1.6 Transmission of electric wireline logs

Transmission of wireline log data from the rigsite to the Head Office or Contractor's facility is necessary for evaluation purposes. This information is normally given a high priority since its interpretation is usually required to determine further operations at the rigsite.

The transmission of wireline logs should normally use a standard telephone line as per (4.2.1). The reasons are as follows:

- The destination modem/computer may be off-net (outside the Principal's telecommunications system) in a Contractor's offices. This would be difficult to link via a datacom network and it may not be desirable to allow Contractors access to the Principal's computing network;
- The quantity of data to be transmitted and the speed needed is of a quite different order of magnitude from the other datacom requirements;
- The wireline logs are not transmitted on a regular basis but only as and when required, depending on rig operations, with a frequency which can be as low as one log per month or as high as 2 to 3 per week. This is different from the other datacom requirements, most of which are daily;
- There is no real disadvantage in the rig telephone being out of action for the duration of the wireline log transmission since the rig will generally be awaiting instructions till after the analysis of the log. In the event of an emergency on the rig, data transmission can be cancelled. In the event of an emergency call to the rig, there is in all cases an alternative means of communication. See (3.1.4);
- The wireline Contractor will often use his own proprietary modem and tape transmission unit. The protocol used can vary between Contractors and is often unknown to staff of the Principal;
- For wireline logs, effort should be concentrated on making it as easy as possible to use the system, preferably by automating the uploading process, in particular to avoid manual intervention at the host computer end. This will be either the Contractor's own computer or the Principal's computer. The Contractor may use his own satellite facilities. However, if the Principal has data communication facilities to the rig and external access is not required, then direct data transfer may be used.

3.1.7 Contractor's communications

The drilling contractor requires communications for logistics and reporting to his Company Office. The rig communications equipment is often shared. The rig contract shall specify who provides the equipment and shall detail the charging procedures.

Means shall normally be provided for rig personnel to make private calls to the public network. If calls are to be charged to individuals, this can be achieved by several methods e.g. prepaid phonecards or by toll-ticketing, in which case the necessary equipment shall be provided.

During an emergency, this means of communication shall be limited for both incoming and outgoing calls.

3.1.8 Drilling intercom system

An intercom system shall be installed between the critical working areas of the drilling rig. This system shall be supplied by the Contractor and shall meet Zone 0 classifications for hazardous areas.

3.2 SUMMARY - REQUIREMENTS FOR ONSHORE ENVIRONMENTS

The telecommunication requirements for rigs operating onshore are summarised in Appendices 2 and 3.

3.3 SUMMARY - REQUIREMENTS FOR OFFSHORE ENVIRONMENT

The telecommunication requirements for rigs operating offshore or in swamp locations are summarised in Appendix 4.

4. COMMUNICATION SYSTEMS

4.1 LINKS

4.1.1 Main link

The means to support communication to the rig/camp will use one or more of the communication systems outlined in Appendix 1. This will provide access to the Principal's telecommunication facilities or, if not available (e.g. single string ventures), access to the public network, and to the Head Office which is also connected to the public network.

The main link should be a full bandwidth voice channel. At the rigsite, the circuit should terminate in an ordinary two-wire telephone line to allow connection of conventional telephone instruments, fax machine, modems, etc. Small PABX systems (1+5 lines or 1+10 lines) should be used only after careful investigation since some types have been found to be not completely transparent within the voice circuit.

4.1.2 Second link

A second voice channel may be provided if it is technically feasible and economically viable.

4.1.3 Data link

A data channel is required to transmit the services marked (*) in Appendices 2, 3, and 4. This requires a data speed of 1.2 Kbit/sec or higher and should be continuously available and accessible from both the rigsite and Head Office ends. Where constraints on available circuits exist, the second link may be used for this purpose.

NOTE: In some cases (Inmarsat connection) it will not be possible or economic to provide either a second voice channel or the separate data channel. In this case, the single telephone line must be shared by all services. Every effort should then be made to reduce 'air time' by simplifying and automating logon to the host computer, to aim for file transfer, and to minimise interactive working.

4.1.4 Frequencies

In planning services to rigs, adequate time should be allowed for obtaining the necessary frequency allocations and licences from the responsible authority. If satellite services - Inmarsat - are to be used, careful consideration should be given to operating costs against the capital cost of other services.

4.2 FORMATS

4.2.1 Speech or data over one analogue voice channel

The simplest connection is a single telephone line provided over a satellite or terrestrial link. For the transmission of voice and data this must be shared, some of the time for speech, some of the time for data. When it is being used for one service it cannot be used for the other. This is generally unsatisfactory since it does not optimise use of the transmission facility.

4.2.2 Speech and data on separate channels

This system allows speech and data to run concurrently without interfering with one another. There are several techniques which can be used to separate the traffic, as follows:

- physically separate bearer links, e.g. two separate radio links, one for speech and the other for data;
- same bearer link but frequency division multiplex, e.g. splitting the frequency using different audio frequencies;
- same bearer link but time division multiplex, e.g. separating the bit stream to create several virtual circuits. A bit rate of 64 Kbit/sec could be split into one speech channel of 32 Kbit/sec plus a second speech channel at 16 Kbit/sec plus several data channels making up the balance of 16 Kbit/sec. Splitting circuits this way needs a few bits/sec overhead to separate the various services.

4.3 COMPUTER HARDWARE

Applications can be accessed by two methods: terminal access or local computer. For use on rigs in most cases, terminal access to the office computers is unlikely to give adequate response due to the maximum data transfer rates available via the communications links.

Rigs shall employ local computing equipment using a platform of sufficient computing power in accordance with the current harmonised target environment (HTE) requirements (ref. EP 93-0995). If the Principal has a high speed link (9.6 Kbit/sec or better), terminal access may be viable but should only be seen as a short-term solution. Use of graphics with terminal access is not recommended as this may impact on the use of future applications.

4.4 COMMUNICATIONS PROTOCOLS

Where necessary, a communications protocol shall be used for improving marginal communications circuits. Such a protocol shall have features such as the ability to declare 'unwanted characters', have them removed from the output bit stream, converted to a combination of 'legal' characters and then re-assembled at the distant end. This means that transmission can take place over non-transparent circuits. Unwanted characters could be ASCII Control S and Control Q (also known as X-off and X-on). Very little data communication equipment nowadays offers full transparency. Even dial-up modems have buffers for data compression and error detection/recovery. These buffers are typically controlled by X-on X-off. Another useful feature is the ability to undertake data compression to increase the throughput. A sliding window technique of acknowledging data blocks also is required for use over satellite circuits. Another technique which should be considered is check point restart, i.e. if a block of data is interrupted the transmission restarts at the point of interruption without returning to the start of the file.

Where Inmarsat circuits are used, every effort shall be made to improve throughput. Over dial-up telephone lines there is no need for data transparency, and advantage can be taken of the more advanced modems now available.

4.5 PHYSICAL INSTALLATION

The accommodation and offices (and therefore the radio room) are positioned upwind of the rig floor for the prevailing wind direction in the area. Unfortunately, this often means that the radio path to the base station is through the derrick. Offshore, it may be the derrick, or rig legs in the case of a jack-up. Tender-assisted drilling barges represent a particularly difficult problem since they lie rather low in the water and, when the adjacent drilling platform is positioned in a radio link path or so as to shield an antenna, this can result in a major reduction in reliable radio range.

Onshore, in a depression in the desert or with nearby sand dunes, or in jungle areas with high trees, radio communication can also be difficult. These problems also apply to satellite communications and, particularly if the antenna elevation is below 15°, can result in poor performance.

For offshore (and swamp) environments there is only one location but the actual equipment and telephones may be in different parts of the rig or barge, the Principal representative's office and radio room for instance. It is becoming normal to connect the Inmarsat terminal to the rig PABX. Choice of the correct service class prevents unauthorised use of the satellite service. All Inmarsat terminals should be ordered with the dual telephone number option. This allows a facsimile machine to be permanently connected to the second number and incoming calls will be routed correctly. There is still only one speech channel, which is shared between fax and telephone.

Rig power supplies should be carefully considered when used for telecommunication services. Telecommunications equipment shall be protected against:

- supply unreliability
- surges and spikes
- low and over-voltages
- poor earths and configuration changes.

Offshore, rig emergency power requirements are specified by regulation. Onshore, the

provision of back-up power for telecommunications should, as a minimum, provide eight hours service for the emergency communications as in (3.1.4).

Prior to deciding on rig locations, the Principal's telecommunications specialists shall be consulted to allow for any required changes in physical arrangements since the location can often make a substantial difference to communications reliability.

4.6 CONNECTIVITY

For onshore applications the logical connectivity will be from rigsite to Head Office and from campsite to Head Office. The physical connectivity will be from rigsite to campsite and then campsite to Head Office. The campsite is regarded as the main communication node because it moves less frequently than the rigsite so it is more economical to provide service from the campsite. It also remains operational during rig moves. The campsite will remain in communication for routine or emergency contact with the Head Office.

4.7 SAFETY DURING HANDLING OF EXPLOSIVES

Certain down-hole tasks, such as perforating, require the use of explosives and detonators. While there is a growing trend to use detonators which are unaffected by extraneous radio and electrical energy, their use is by no means universal and precautions shall be taken to avoid premature detonation. Refer to BS 6657. Of most concern is the lower spectrum of radio frequencies such as MF, HF and VHF and the relative high power associated with transmitters using these frequencies. The power feeds to such equipment shall be clearly identified. A simple method of isolation shall be provided and all safety procedures adhered to. Onshore, particular attention shall be given to restricting entry to the immediate area of vehicles fitted with HF or VHF radios.

Since negligible hazard exists from line-of-sight microwave antennas facing away from the site, normal operation of these links and area radio systems during perforation activities is acceptable.

5. REFERENCES

In this DEP reference is made to the following publications:

NOTE: Unless specifically designated by the date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Plant telecommunications	DEP 32.71.00.10-Gen.
Telecommunication standards	DEP 32.71.00.11-Gen.
Telecommunications for offshore platforms	DEP 32.71.00.12-Gen.
EP (Harmonised Target Environment) Product List	EP 93-0995 Rev. 1.3, July 1994

BRITISH STANDARDS

Guide to prevention of inadvertent initiation of electro-explosive devices by radio frequency radiation	BS 6657

Issued by:
British Standards Institution
Linford Wood
Milton Keyes MK14 6LE
United Kingdom.

INTERNATIONAL STANDARDS

IEC STANDARDS

International Electrotechnical Vocabulary	IEC 50

Issued by:
International Electrotechnical Commission
3, Rue de Varembé 1211
Geneva 20
Switzerland.

Copies can also be obtained from national standards organizations.

IMO STANDARDS

Code for the construction and equipment of mobile offshore drilling units, 1989 with 1991 amendments	MODU
Conference of contracting governments to the international convention for the safety of life at sea, 1974 with 1988 amendments	SOLAS

Issued by:
International Maritime Organisation
4 Albert Embankment
London SE1 7SR
United Kingdom.

APPENDIX 1 TELECOMMUNICATIONS TECHNOLOGIES

The following technologies may be used to communicate between the rigsite, Head Office and Company office:

- Line of sight multichannel UHF or microwave
- Over the horizon multichannel UHF or microwave
- Dedicated VSAT channels
- INMARSAT services
- TDMA subscriber radio
- Trunked radio
- Cellular radio
- VHF/UHF single channel
- HF radio.

A number of factors must be considered for each rigsite before deciding on the use of any particular technology. These include:

- Distance
- Licencing and frequency allocation
- Costs
- Length of requirement
- Availability of equipment
- Grade of service required.

Line of sight multichannel UHF or microwave

These systems are normally used for more permanent solutions such as platforms or production facilities and should only be considered if facilities are already available to the rigsite.

Over the horizon multichannel UHF or microwave

These systems are normally used for more permanent solutions such as platforms or production facilities and should only be considered if facilities are already available to the rigsite.

Dedicated VSAT channels

As VSAT services become more widely available with the deployment of higher power satellites, the use of either a dedicated network using a mesh configuration or leased circuits using a hub configuration becomes economically viable. If a dedicated network using a mesh configuration is installed, then the control centre would normally be located at the Head Office with other communications links to Contractor's offices.

Leased circuits will terminate in the satellite service providor's hub and will require terrestrial circuits to the Head Office. If hub systems are used, the installation of another VSAT terminal in the Head Office is not recommended since it will involve double satellite hops with delays in excess of at least one second, resulting in poor quality speech and problems with data communications. If the use of a system with a double hop cannot be avoided, then the use of specialist echo cancellation equipment should be considered.

INMARSAT services

The INMARSAT system is a global satellite communications system originally designed for ship-to-ship and ship-to-shore communications. This service has been extended in most countries to include land-based terminals. The system currently provides four types of service suitable for rig communications - INMARSAT A, B, M and C.

INMARSAT A is the older analogue system providing speech, telex, data and facsimile services. Data rates of 9.6 kbits/sec are possible but, under normal circumstances, 2.4 and 4.8 kbits/sec are more common. Service costs per minute are high and use of this system should be minimised.

INMARSAT B is the digital successor to INMARSAT A and provides 16 kbit/sec digital voice, and facsimile and data at 9.6 kbit/sec. High speed data services at 64 kbit/sec will be available as an option at a later date. This system is recommended for new installations where high traffic rates (especially for facsimile) are expected. Service costs per minute are

approximately half of INMARSAT A charges.

INMARSAT M is a digital system based on a compression rate of 4.8 kbits/sec. Speech and facsimile services are provided at a service cost usually half that of INMARSAT A. The terminals for this system are extremely compact and are useful for early deployment. For longer term use, it is recommended that an external antenna is used as reduced rates are available for this application ("big" dish service).

INMARSAT C is a store and forward data service operating at 600 bytes/sec. This system is ideal for electronic mail services and can be linked to the Shell International Message Interchange Service (SIMIS). Service costs per minute are low but, because of the low data rate, costs for transmission of long messages can accumulate.

It is recommended that INMARSAT M be combined with INMARSAT C to provide speech, facsimile and electronic mail if facsimile traffic is low, and that INMARSAT B be used for all other applications.

TDMA subscriber radio

TDMA systems can be used to provide speech, facsimile and data services to rigs in areas where the system is already installed. This would normally be so for a well-established Principal. Being a microwave system, consideration should be given to path topology and length. Whilst space diversity would optimise reliability, this may not be possible due to tower height constraints. It is recommended that a minimum fade margin of 30 dB be used for link calculations.

Trunked radio

Trunked radio systems are used where mobile radio traffic is large enough to justify the use of multiple radio channels - normally not less than three since one channel is dedicated to signalling. The use of a trunked radio system for rig communications is dependent on traffic loading since rig traffic is usually heavy by comparison to normal mobile communications. This is especially the case if the system is used for data and facsimile. In general, it is recommended that the use of trunked radios be minimised for rig communications unless no other form of communications is economically viable.

Cellular radio

Cellular radio is a communications system developed mainly for mobile radio allowing travel over a wide geographical area independent of individual radio cell coverage limitations. As such, it has been widely installed throughout the world in digital and analogue formats. Whereas trunked radio systems are normally private systems operated by the Principal, cellular systems are in the public network. Whilst cellular radio often offers a very economical method of providing communications to rigs, careful consideration shall be given to the operating environment since the units commercially available are not intrinsically safe. In developed countries, the system is normally used for its designed purpose and capacity is ample. By comparison, in newly developing countries, it is often used as a substitute for normal telephone services and congestion can quickly occur. Services may also be subject to disruption during times of unrest.

VHF or UHF single channel

Single channel VHF or UHF radios can be arranged as point-to-point services. Omnibus networks can be provided using speech or selective calling to each station.

Single channel VHF or UHF offers a simple means of providing low capacity circuits which can be used for speech, facsimile and data services.

HF radio

HF should be regarded as a communication means of last resort. An HF system can provide some back-up but full 24-hour availability may not be possible over some distances or if the appropriate frequencies are not available.

Using specialist software it is possible to improve text transfer (telex) through error correction and automatic retry techniques.

APPENDIX 2 CAMPSITE TELECOMMUNICATION REQUIREMENTS

Service	Base	Rig	Interactive	Batch	File Size	Transfer Time		Speed
						Immediate	Delay	Kbit/sec
Speech	■	■	■			■		
Facsimile	■		■		1-10 pages /day	■		
Personnel Communications	■		■					
Contractor's Communications	■		■			■		
Messaging*	■	■		■	15 Kbytes /day		5 mins.	0.5

* Requires a data channel

NOTE: Local area communications and back-up communications have been omitted for the sake of clarity as they are separate, stand-alone communication subsystems.

APPENDIX 3 WELLSITE TELECOMMUNICATION REQUIREMENTS

Service	Base	Camp	Interactive	Batch	File Size	Transfer Time		Speed
						Immediate	Delay	Kbit/sec
Speech	■	■	■			■		
Facsimile	■		■		1 - 10 pages /day	■		
Wireline log	■		■	■	2 - 4 Mbytes	■	30-60 mins.	9.6
Mud log* (optional)	■				100 Kbytes /day		30 mins.	0.5
E-mail/telex*	■	■			15 Kbytes /day		5 mins.	0.5
Epidoris-* daily report				■	35 Kbytes		5 mins.	1.2
Epidoris* Wellfile				■	350 Kbytes		1 hour	1
WICON* (future)				■	15 Kbytes /day		5 mins.	0.5
AZIMUTH*				■	2 Kbytes	■		0.1
System Management*			■			■		

* Requires a data channel

NOTES:
1. Local area communications and back-up communications have been omitted for the sake of clarity as they are separate, stand-alone communication subsystems.
2. Wireline logs may be transmitted interactively if the Principal has data channel capacity and no requirement for direct access to the public telephone network.

APPENDIX 4 OFFSHORE/SWAMPSITE TELECOMMUNICATION REQUIREMENTS

Service	Base	Interactive	Batch	File Size	Transfer Time		Speed
					Immediate	Delay	Kbit/sec
Speech	▓	▓			▓		
Facsimile	▓	▓		1 - 10 pages /day	▓		
Contractor's Communications	▓	▓			▓		
Personnel Communications	▓	▓			▓		
Wireline log	▓		▓	2 - 4 Mbytes		30-60 mins.	0.5
Mud log* (optional)	▓			100 Kbytes /day		30 mins.	0.5
E-mail/telex*	▓			15 Kbytes /day		5 mins.	
Epidoris-* daily report			▓	35 Kbytes		5 mins.	1.2
Epidoris* Wellfile			▓	350 Kbytes		1 hour	1
WICON* (future)			▓	15 Kbytes /day		5 mins.	0.5
AZIMUTH*			▓	2 Kbytes	▓		0.1
System Management*		▓			▓		

* Requires a data channel

NOTE: Local area communications and back-up communications have been omitted for the sake of clarity as they are separate, stand-alone communication subsystems.