

Inmarsat-A

(A) Introduction:

Inmarsat-A is 20 years old. Yet it has stood up well and actually benefited from improved and newer technologies. This means that the infrastructure is capable of fulfilling modern needs well into the 21st century.

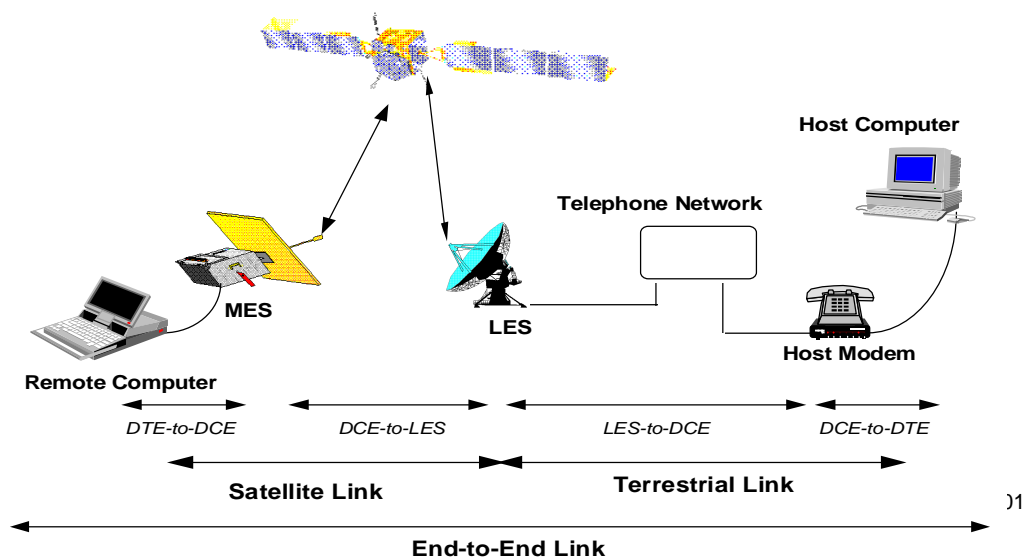
(B) Summary of service: *The Inmarsat-A mobile Satellite communications (satcoms) system provides two-way direct-dial phone (high quality voice), fax, telex, electronic mail and data communications to and from anywhere in the world with the exception of the poles. It also provides distress communication capabilities. It is based upon analogue technology. It supports data rates of between 9,600 bps through up to 64,000 bps depending upon different elements of your end-to-end connection.*

(C) THE SYSTEM – Service Description:

The Inmarsat-A service comprises 3 components:

- **The mobile-earth station (MES):** An Inmarsat-A terminal is a small, self-contained satellite earth station comprising a lightweight parabolic antenna, electronic units, power supply interface, and direct-dial telephone, fax and telex connections.
- **The satellites:** The transmission and reception of signals are co-ordinated by four network co-ordination stations (NCS), one for each satellite coverage region - Atlantic Ocean East and West, Indian Ocean and Pacific Ocean.
- **The Land-Earth station (LES):** A call from a mobile or transportable Inmarsat-A terminal is routed via the Inmarsat satellite system to a land earth station (LES) for connection to the national and international phone and data networks.

Terminals receive and transmit in the L-band (1.5/1.6GHz). Each NCS monitors the flow of communications traffic through its satellite to ensure that calls are set up correctly and that all LES's are working correctly.



(D) TERMINALS – Product Description:

The maritime terminals typically consist of the above-deck equipment comprising the stabilized antenna (enabling it to stay locked onto the satellite even in heavy sea conditions) and the below-deck equipment comprising the telephone, telex, fax and data interfaces. A number of models also feature a High Speed Data (HSD) option, capable of supporting data rates of up to 64kbit/sec.

(E) Range of Options & Value Added Services:

1. The MES interfaces can be connected to onboard data modems, PABX’s that route voice, fax or data calls to / from crew cabins, radio room and bridge.
2. Local Area Network (LAN) facilities can be setup via a server that interfaces to the medium or high-speed data ports of the terminal for sophisticated remote or mobile office operations.
3. Variety of cordless, DECT, encryption and other middleware can be deployed for specific benefits.

(F) APPLICATIONS:

Inmarsat provides the vital “missing link” in providing communications between ship and shore, anytime, virtually anywhere, TODAY! Inmarsat-A has been meeting the satellite communications needs of oceangoing ships for over 20 years.

Crews of some 18,000 ships operating super oil tankers, merchant ships, cruise liners, fishing trawlers and even leisure yachts use Inmarsat-A (and other services) for Commercial, Operational, Social and Safety & Distress communications.

Primary areas where Shipping Companies are using advanced communication capabilities to achieve their objectives:

<ul style="list-style-type: none"> • Messaging • Ship Management Applications • Weather Routing • Navigation / Electronic Charts • News • GMDSS – Global • Position reporting • Vessel monitoring • EDI Applications / E-commerce • Internet Access / Web Applications • Predictive & Preventative maintenance • Telemedicine 	<ul style="list-style-type: none"> • Insurance claims processing using email and digital cameras. • Mobile-friendly specialised maritime content providers • Corporate Intranet access • Software version updates • On-line vessel/engine monitoring • Training / distance learning • E-Commerce & information on demand • Pre-paid calling cards • Crew-calling & Social messaging. • Interactive / Batch Email
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(G) Data Communications – The Basics:

Data communications via Inmarsat-A can support 3 types of services:

1. Medium-speed data services at rates of 9600 and even upto 19200 bps with good shore-side connections.
2. High-Speed data services at rates of 56 or 64 Kbps
3. Facsimile services at medium or high speed data rates.

1. Medium Speed Data communications:

1. Requires a modem, a PC and suitable communications software (Usually built-in Windows operating systems). For Internet access you will also need to subscribe to an internet service provider.
2. An Inmarsat-A terminal that offers a suitable interface for plugging in your modem or fax. Usually a 2-wire interface via a telephone adapter (usually RJ45).
3. A fully functioning and well maintained Inmarsat-A equipment capable of operating the necessary fax/data channels (Uncompanded call type 02).
4. An appropriate LES service provider that offers the inter-connectivity required to successfully route the call to your destination via the most effective terrestrial network.

2. High Speed Data Communications:

1. In place of the modem, you will need a digital encoder and modulator that in many cases have been integrated into the Inmarsat-A MES itself.
2. This offers a range of interfaces for connecting your PC equipment to including CCITT V.35, RS-422 and the ISDN-type CCITT V.36.
3. Your Inmarsat-A terminal should have been provided with the appropriate HSD modem by the manufacturer to support this service.
4. An appropriate LES service provider that offers leased line or ISDN inter-connectivity required to successfully route the high-speed call to your destination.
5. Requires appropriate activation from the LESO and Inmarsat.

Hardware / Software Considerations for Developers:

Users must understand the following special features regarding the HSD service:

- Satellite delay time is 270 ms for a single hop. This delay can be further increased if the interconnection with the terrestrial network happens to be a fixed satellite link.
- Potential data-rate asymmetry when using HSD means that data packets or blocks in the return direction (MES to LES) should be kept very short.
- The communications protocol should allow a sufficient number of outstanding data blocks so that the high-speed path does not have to pause to wait for acknowledgments.

- The standard HDLC protocol is adequate in most cases. Highest throughput will only be obtained if selective-repeat (rather than go-back-N) protocols are used in combination with extended frame numbering.

3. Facsimile Data Communications:

1. In place of the modem (digital encoder / modulator) you will need a Facsimile machine that has been recommended (by the MES manufacturer) to operate successfully across the Inmarsat network.
2. PC integrated fax devices can work but once again you need to ensure that cheaper equivalents are not being used. For High-Speed Fax at 64 Kbps you will need a Group IV Fax machine. This will need to connect to a Fax port provided by the 64 Kbps adapters.
3. The fax machine is connected to the same ports as used for data communications. An Inmarsat-A terminal offers a suitable interface for plugging in your modem or fax. Usually a 2-wire interface via a telephone adapter (usually RJ45).
4. A fully functioning and well maintained Inmarsat-A equipment that is capable of operating the necessary fax/data channels (Uncompanded call type 02).
5. A LES service provider that offers the appropriate inter-connectivity required to successfully route the call to your destination via the most **effective** terrestrial network.

(H) Data Communications – Optimizing:

To get the most out of your investment, you should optimize your system. It is recommended that all modifications, upgrades or replacements of satellite or PC equipment done, be undertaken by someone who is experienced and/or qualified in data communications & Inmarsat networks.

Your terminal manufacturer and/or preferred service provider will be able to recommend suitable modems, interfaces and connection equipment or software.

The key parameters to take into account to assess the effectiveness of your data communications links are:

- *Effective data throughput of your link*
- *Percentage of successful connections achieved*
- *Amount of overheads per communications session. These include Application, transfer and network overheads.*

Optimisation is determined by:

- 1. Choice of Modem / Facsimile**
- 2. Installation of equipment**
- 3. Error Correction**

4. **Data Compression**
5. **Flow Control**
6. **Selection of Data/Fax channels**
7. **File transfer protocols**
8. **Timers or Timeouts built into your communicating software**
9. **Length of time to Handshake / Negotiate**
10. **Other Tips**

1. Choice of Modems:

Latest V.34 / K56 modems are very robust and widely available and have a higher resilience to noise on the line and can offer between 28.8 and 56 Kbps data rates. Due to the inherently complex components of a typical end-to-end data connection the maximum data rates that can be consistently available are between 9.6 Kbps and 19.2 Kbps if all these components have been optimized.

Modems must provide a range of configuration options – particularly with regard to managing the length of time it takes to **Handshake / Negotiate** with the remote modem. Modems capable of supporting V.90, must have this feature switched off.

List of Recommended Modems:

Besides the traditional workhorses - Motorola Codex 3265 series and US Robotics Courier, most good quality modems are considered suitable for data communications via Inmarsat. This is mainly subject to the range of configuration options it allows the user to make.

2. Installation of Equipment:

Many modems are built to meet national PSTN specifications – which can differ per country. This is particularly relevant for the **Audio-Transmit levels** which if set incorrectly can cause distortion. This level can vary from 0 to –15 dBm. Ensure that the modem is firstly capable of this adjustment and that it is optimized by your data specialist. **(See Appendix)**

3. Error Correction:

To counter the noise and distortion present in communication links, it is essential that you have enabled data error-correction either through your communications software or the modem's internal firmware. The most common technique operates on the basis of ARQ basis. This means that corrupted data blocks are re-transmitted in a process called Automatic Retransmission request. **V.42** is a CCITT standard that is now fully supported on all modems. Ensure that this is switched on.

4. Data Compression:

Most computer-generated data contains redundant information that can be compressed into smaller packages without loss of information. This is particularly useful for textual data, spreadsheets, documents, database and financial information. Further compression can be achieved but results in loss of some information. However it is particularly useful for digital Pictures, Video and audio. There are two types of data compression that can be used:

1. **Software Compression:** is usually done before the actual transmission using off-the-shelf packages like PKZIP/PKUNZIP or ARJ. This can add to the overall processing time but can be done offline. These are now well integrated into a number of messaging and communicating software packages and can be executed automatically prior to setup of communications exchange.
2. **Hardware Compression:** is built into the modem and is activated (if enabled) during the real time transmission. The recommended scheme to use is the **V.42bis**. It not only provides a way to compress quite effectively un-compressed data but also detects whether the data being transmitted is compressed already and turns itself off automatically.

5. Flow Control:

Flow control is used to control the information exchange between the different elements in a data communications link. **V.42** handles the end-to-end modem flow control besides error-correction. For local control, **hardware flow control** (RTS/CTS) is recommended.

DTE/DCE speed: This is directly linked to flow control management. It must be always be higher than the maximum bandwidth of the channel. Sometimes incorrectly described as the maximum Modem speed in windows. Typical settings include 19,200 bps (for Inmarsat-B/M/minim), **38,400, 57,600 or 115,200 bps** for Inmarsat-A connections.

6. Selection of Data/Fax Channels:

(a) Ship-to-Shore Uncompanded Data Channel Selection: In order for the Inmarsat partnership to offer the best possible data & fax channels via Inmarsat-A, Inmarsat offers optimized uncompanded data channels (Channel Type 02). Improved performance of fax and data calls can be expected via those channels on the condition that the user equipment (MES, fax machine or data modem) is properly interfaced.

*If you don't know how to select the **Channel Type 02** or you require your equipment to be interfaced properly, you should contact your service provider or satellite terminal supplier, or the Inmarsat Helpline numbers.*

The simplest test to determine whether your equipment is properly interfaced is to measure the performance of your transmission. If it is good or better than before then it is correctly interfaced otherwise it may indicate that the Audio-Transmit level from the Fax or modem connected to your MES needs adjustment. This is often a minor adjustment but may still require assistance to do this. **(NEVER USE CHANNEL TYPE 02 FOR VOICE CALLS)**

(b) Shore-to-Ship Uncompanded Data Channel Selection: For Shore-to-Ship communications (from a fixed communication networks), Channel Type 02 for fax or data can be selected by inserting **81** after the Ocean Region code and before the MES ID number in the dialling string (example: 00 871 81 1234567).

Please note that not all countries around the world provide this '81' option to select Channel Type 02. Contact the local telephone network operator if you experience problems selecting '81'.

7. File Transfer Protocols:

Due to the relatively higher delays associated with a satellite channel – protocols that are delay or time resistant like Zmodem should be used. TCP/IP is quite resilient but performance varies from version to version.

8. Timers or Timeouts built into your communicating software:

Software & applications used for communications or messaging, possess various timeouts that are used to control sequence of processes and data transfer management. These are usually set very low – as they are designed for far higher bandwidth services, channels or networks.

9. Length of time to Handshake / Negotiate

This is the process that takes place between two modems when establishing a call. The beeps and high-pitched tones indicate that this process is taking place and usually is an attempt by the modems to **(a)** determine each other's capabilities **(b)** establish at the highest rate possible. Each second lost to negotiation is a second lost to valuable data transmission time. Therefore it is important that this is optimized. One particular method of optimization is to manually set the **highest** and **lowest speeds** that the modem should negotiate so that it does not “waste” time going through the whole range of possibilities.

10. Other Tips:

Regularly Check your Log-files: if you are using automatic re-dial facilities (or a fax bureau) for your fax or data calls, check the log files on a regular basis to see if failures to specific recipients tend to occur.

Scheduling non-urgent transmissions during off-peak hours: increases the probability of a successful transmission with higher throughput (shorter transmission time) and saves you costs.

Key Facsimile Hints & Tips:

- Off-Hook Time (T1 Timer): When fax machine is calling, the time from user dialling and pressing START button - to expecting the called end to go off-hook - should be as long as possible (e.g. 2 mins). When fax machine is called, ringing time should be set to the minimum possible (e.g. immediate answer).
- Turn off the Error Correction Mode (ECM) facility at one fax machine
- Turn off the use of V.21 Signals.
- Must support use of Command Repeat (CRP) Signal.
- First DIS (Digital Information Signal) must not be ignored.
- Must support V.21 Preamble flags – to keep fax off-hook beyond 3s.
- Ensure that “Post Message Signals” are transmitted.
- Repeat Signal Time-Outs
- Ensure that CED (Called Station Identification) Tone is 2100Hz.

Typical Settings For Modems via Inmarsat-A Uncompanded Data Channel:

- | | |
|------------------------------------|--------------------------------|
| • DTE/DCE: | 38,400, 57,600 or 115,200 bps. |
| • Enable Flow Control: | Hardware (RTS/CTS) |
| • Local Error Correction: | ARQ ON |
| • Enable End-End Error Correction: | V.42 |
| • Enable Online Data Compression: | V.42bis |
| • Offline Data Compression: | PKZIP / ARJ |

(I) Call to Action:

Inmarsat:

For further information or details, please contact:

Customer Care Centre, Inmarsat,

phone +44 20 7728 1100,

fax +44 20 7728 1110,

e-mail: Inmarsat-a@inmarsat.com

Appendix

A-1 Glossary: (Bits & Bytes)

A BIT: is the smallest single units capable of holding information in 1's or 0's.

A BYTE / CHARACTER: consists of **bits** and comprised the basic unit which electronically represents a particular character of a selected alphabet. Common alphabets in use are **ASCII:** (American standard code for information interchange) comprising typically of 8-bits. **ITA2:** is used for telex communications and typically comprised of 5-bits.

Note: For full binary file transfer compatibility, only use 8-bit bytes or characters.

WHAT IS:

- **1 KILOBYTE?** = 1024 bytes
If 8-bits then 1Kbyte = 1024 x 8 = 8192 bits
If 5-bits then 1 Kbyte = 1024 x 5 = 5120 bits
- **1 MEGABYTE?** = 1000 kbytes = 1000 x 1024 bytes = 1,024,000 bytes
- **1 KILOBIT?** = 1,024 bits = 128 8-bit characters (204 5-bit characters)
- **1 MEGABIT?** = 1000 kbits = 1000 x 1024 bits = 1,024,000 bits
- **Typical Size of an A4-page:** 1 A4 page = 2,500 characters = 20 Kbits

A-2 National PSTN Signal Transmit Levels: (Audio level to/from modem)

Country	Signal Transmit Level (dBm)
Australia	-9
Belgium	-6
Denmark	-11
Finland	-10
Germany	-6
Hong Kong	-9
Ireland	-8
Israel	-6
Italy	-9
Japan	-15
Netherlands	-6

Norway		-10
Portugal		-9
Spain		-16
Sweden		-13
Switzerland		-9
United Kingdom		-9
USA	RJ11C	-9
	RJ45S	-12

A-3 Command settings for the Motorola Codex 326X series:

Command (preceded by AT)	Description
Recommended:	
&F	Factory Defaults
*FL3	Hardware Flow control (RTS/CTS)
X4	Call Progress
*RT0	Disable modem re-training
&C1	Carrier Detect DCD=normal
&D2	DTR handling modem hangs up DTR is low.
*SM1	Error correction V.42
*DC1	Enable data compression V.42bis
*MM0	Selects V32bis modulation
*MN5	Lowest/minimum rate = 9600 bps
*MX5	Highest/maximum rate = 9600 bps
Others:	
*DCn	Enable / Disable data compression
&V	Show current settings & link diagnostics
*Aan	Auto Answer after n rings
*XC2	Extended Reporting during call progress

A-4 Command settings for the US Robotics HST/COURIER:

Command (preceded by AT)	Description
Recommended:	
&F	Factory Defaults
&H1	Hardware Flow control (RTS/CTS)
X4	Call Progress
	Disable modem re-training
&C1	Carrier Detect DCD=normal
&D2	DTR handling modem hangs up DTR is low.
&M5	Error correction V.42 ARQ mode

&K1	Enable data compression V.42bis
&N0	Selects variable rates modulation
S0=0	Auto answer disabled
&B1	Fixed DTE/DCE rate
Others:	Others:
I4	Show current settings
I6	Show link diagnostics