SUBORBITAL AND SPECIAL ORBITAL PROJECTS DIRECTORATE

Inmarsat-C Transceiver Interface Control Document for the ULDB/Tiger Mission

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Inmarsat-C ICD 0005

Check the Code 820 Controlled Documents List to verify that this is the correct version prior to use

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CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	01/2000	Initial release

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Inmarsat-C Transceiver
Interface Control Document (ICD) 0001.0
for the ULDB/TIGER Mission

1.0 Operations Description

The Thrane & Thrane Landmobile Capsat Transceiver (TT-3022C) and the Thrane & Thrane Maritime Capsat Antenna (TT-3005A) provide global communications and GPS (not used) capabilities for the ULDB Balloncraft via the Inmarsat-C network of satellites.

The ULDB Operations Control Center (OCC) and Remote Operations Control Center (ROCC) will receive Balloncraft data and transmit commands via this link.

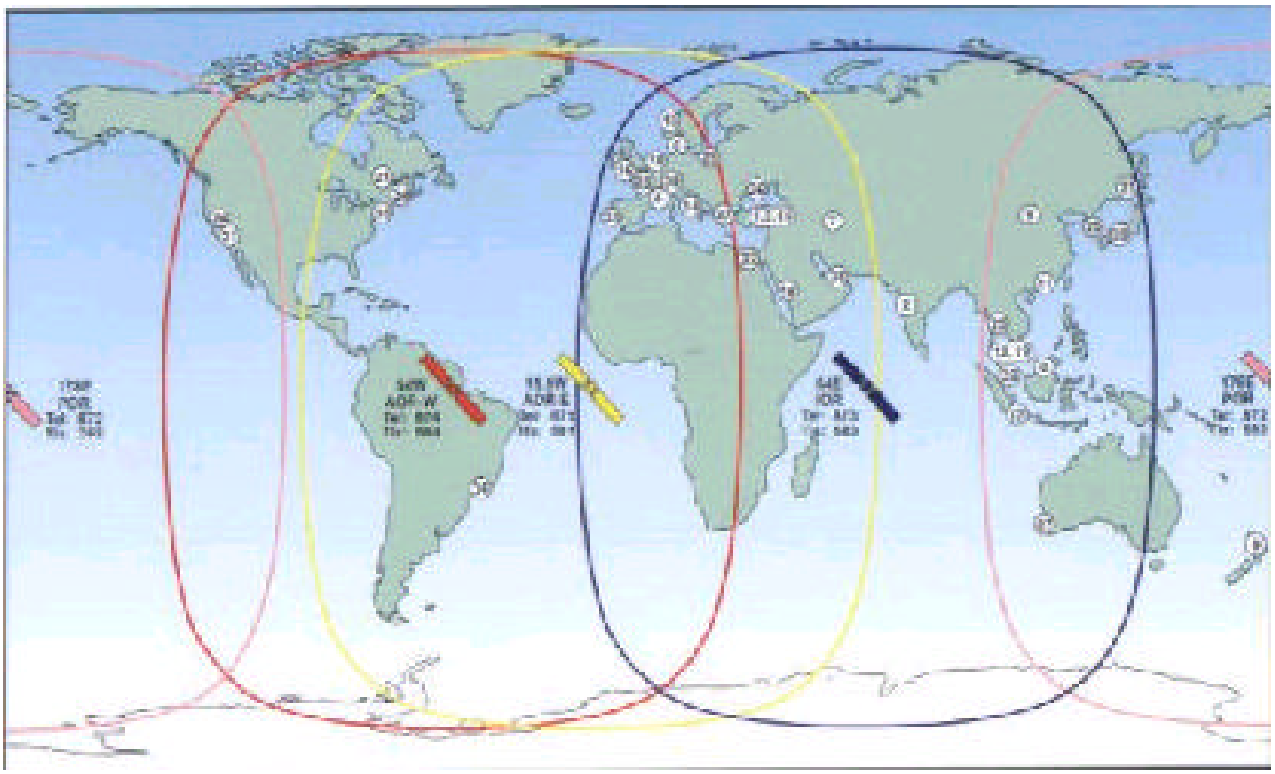


Figure 1. Inmarsat-C Coverage Map

Ocean Region Coverage	Operational Satellite	On Orbit Spare(s)
Atlantic West (Red Circle)	Inmarsat-3 F4 (54W)	Inmarsat-2 F2 (98W)
		Inmarsat-3 F2 (15.5W)
Atlantic East (Yellow Circle)	Inmarsat-3 F2 (15.5W)	Inmarsat-3 F5 (25E)
		Inmarsat-3 F4 (54W)
Indian (Black Circle)	Inmarsat-3 F1 (64E)	Inmarsat-2 F3 (65E)
Pacific (Gold Circle)	Inmarsat-3 F3 (178E)	Inmarsat-2 F1 (179E)

The Inmarsat-2 communications payload is comprised of two transponders supporting satellite-to-mobile (service) links in L-band (1.6-GHz uplink, 1.5-GHz downlink) and satellite-to-earth station (feeder) links in C-band (6.4-GHz uplink, 3.6-GHz downlink). Effective L-band isotropic radiated power (EIRP) is 39 dBW.

The Inmarsat-3s use the latest spot-beam technology and provide higher power (ERIP of up to 48 dBW – eight times the Inmarsat-2 level) for voice and data communications to mobile terminals as small as pocketsize messaging units.

Located in geostationary orbits at 22,223 miles (35,786 km), each satellite's global beam covers roughly one-third of the earth's surface.

For more details visit the URLs listed below:

http://www.inmarsat.com/toolbox.html

or

file:////WFF-ORION/Code820/Public/BCorbin/INMARSAT/Capsat Library Ver2.20

Table 1. Inmarsat-C Service Providers and Access Codes

Service Provider	Country	AOR-W	AOR-E	POR	IOR
Beijing Marine	China			211	311
British Telecon	UK	002	102	202	302
CAT	Thailand				319
Comsat Mobile Communications	USA	001	101	201	
CP Radio Marconi	Portugal		118		
Eik Global Communications	Norway	004	104		304
Embratel	Brazil		114		
France Telecom	France		121		321
KDD	Japan	003	103	203	303
Korea Telecom	S. Korea			208	308
OTE	Greece		120		305
Polish Telecom	Poland		116		316
Turk Telecom	Turkey		110		310
Singapore Telecom	Singapore			210	328
Station 12	Holland	012	112	212	312
Tele Danmark	Denmark		131		
Telecom Company of Iran	Iran				314
Telecom Italia	Italy		105		335
Telstra	Australia	022	122	222	322
T-Mobil	Germany		115		333
VSNL	India				306

Table 2. Land Earth Station Operators Contacts and Services

Land Earth Station Operators Contacts and Services

Operator	Country	LES Name/ Sces offered	Customer Services Points of contacts	Customer Services email
Beijing Marine	China	Beijing A,B,C,m,M,	Tel: +86 10 6529 3692 Fax: +86 10 6421 3509 Telex: +85 22462	mcninm@public.bta.net.cn
British Telecom	UK	Goonhilly / Netley A,B,C,m,M	Tel: +44 1278 772 342 Fax: +44 1278 772 222	customer.services@satmail.bt.com
Cable & Wireless HKT (ex Hong Kong Telecom)	China	Cape D'Aguilar A,B,M	Tel: +852 2888 2939 Fax: +852 2366 0059 Telex: +802 83111	michael.sl.tung@cwhkt.com
C.A.T.	Thailand	Nonthaburi B,C,M	Tel: +66 2 506 4411 Fax: +66 2 506 4407 Telex: +86 80000	
COMSAT Mobile Communications	USA	Santa Paula / Southbury / Anatolia / COMSAT Eurasia A,B,C,m,M	Tel: +1 301 214 3100 Fax: +1 301 214 7284 Telex: +23 229717	cmc.customersupport@comsat.com
CP Radio Marconi (Telecom Portugal)	Portugal	Sintra C	Tel: +351 1 500 5220 Fax: +351 1 500 5897/5219	servicios.moveis@telecom.pt
Datastream Technology	Brunei	Brunei B,M	Mr Poi Yin Foo (contact) Tel: +673 2 338 888 Fax: +673 2 338 371	poidsti@brunet.bn
DeTeSaT - Deutsche Telekom	Germany	Raisting A,B,C,E,m,M	Tel: +49 228 519 2201 Fax: +49 228 519 2209 Telex:	inmarsat@detesat.com
Eik Global Communications (Telenor Satellite Sces AS)	Norway	Eik / Netley A,B,C,m,M	Mr Katil Sandvei Tel: +47 22 77 99 00 Fax: +47 22 77 71 78 Telex: +56 72666	Customer-support@in.eik.com or mobiq@oslo.satellite.telenor.no
Embratel	Brazil	Tangua A,C	Mr Marcos Nora Tel: +55 21 519 8103 Fax: +55 21 233 8572	minora@embratel.com.br
ETISALAT	UAE	Towi Al Saman B,M	Tel: +971 2 2084 535 Fax: +971 2 772 930	mopsho@emirates.net.ae
Far East Shipping Company	Russia	Nakhoda A	Tel: + 7 4232 521137 Fax: + 7 504 91 52336	iscc@fesco.ru
France Telecom	France	Pleumeur Bodou / Aussagual A,B,C,m,M	Tel: +33 5 56 22 32 21 Fax: +33 5 56 83 61 76 Telex: +42 560078	arcachon.spinmarsat@francetelecom.fr
Indosat	Indonesia	Jatiluhur B,m,M	Tel: +62 21 384 8310 Fax: +62 21 386 5651 Telex: +73 46274	csb@indosat.co.id
KDD	Japan	Yamaguchi A,B,C,m,M	Tel: +81 3 3345 3116 Fax: +81 3 3275 4430	inmarsat@kdd.co.jp
KTA	Korea	Kumsan A,B,C,m,M	Tel: +82 342 727 1955 Fax: +82 342 727 1959	yongju@kt.co.kr
Malaysia Telecom	Malaysia	Kuantan A, B,m,M	Tel: +60 3 731 7822 Fax: +60 3 731 7899 Telex: +84 36700	Mobility@telekom.com.my
Morsviasputnik	Russia	B,m,M	Tel: +7 095 795 3209/3217 Fax: +7 095 967 1852/3001	
OTE SA	Greece	Thermopylae A,B,C,m,M,	Tel: +30 1 683 5053/4 Fax: +30 1 685 5880 Telex: +601 214171	info@otesat.gr
Polish Telecom	Poland	Psary A,B,C, m, M	Tel: +48 22 826 8815 Fax: +48 22 826 3665	www.psary.tpsa.pl
Saudi Telecom Co.*	Saudi Arabia	Jeddah A*, B, C, M, m	Tel: +966 1 452 6809 Fax: +966 1 452 6552	
Singapore Telecom	Singapore	Sentosa A,B,C,m,M	Tel: +65 481 6231 Fax: +65 481 8050 Telex: +87 34842	sentosacsc@singtel.com
Station 12	Netherlands	Burum A,B,C,D,m,M	Leo Maarse (contact) Tel: +31 255 545 111 Fax: +31 255 545 100 Telex: +44 41400	station12@wxs.nl
Stratos Mobile Networks	Canada	Staten Island / Niles Canyon / Laurentides / Gnangara A,B,E,m,M	Tel: +1 709 748 4226 Fax: +1 709 748 4320 Telex: +21 0192 1524	support@stratos.ca

2.0 Technical Specifications

Table 3. Model TT-3022C Transceiver

General Specifications	Meets or exceeds all INMARSAT specifications for the Inmarsat-C Network landmobile requirements. EEC EMC and CE marking
Transmit Frequency	1626.5 to 1660.5 MHz.
Receive Frequency	1525.0 to 1559.0 MHz.
Channel Spacing	5 / 2.5 / 1.25 kHz.
Modulation	1200 symbols/sec BPSK.
Ambiguity Resolution	Unique word.
Coding	R 1/2 K=7 convolutional code, (interleaved code symbols RX).
Data Rate	600 bit/sec.
RX Frame Length	8.64 seconds.
TX Signaling Access Mode	Slotted ALOHA.
TX Message Channel	TDMA & FDMA, interleaved code symbol.
Antenna Interface	Standard 50-ohm female TNC-connector. Max 70-m cable with TT-3005B antenna or max 100-m cable with TT-3001B antenna, 3002L antenna or 3005L antenna.
Terminal Interface (DTE)	EIA/TIA-232-E DTE interface. CCITT Rec.V.24/28, 110-38400 Baud IA-5 code, DB-9F.
Printer Interface (X5)	Standard parallel Centronics, DB-25F connector. IEEE P1284-I
I/O Interface (X4)	• NMEA-0183 version 2.1 interface and multidrop addressing, max.100-m cable. • ArcNet 156Kbit token based I/O, max 120-m cable (ATA/ANSI 878.1) • Four general purpose In/Out pins and two Inputs pins to remote alarm box or SCADA I/O (RS-410N) • DB-15F connector
System Set-up	Flash memory
DC Power Source	• 10.5 to 32 V floating DC • RX: 3.8 W with GPS 4.4 W • TX: Typ. 80 W max. 90 W
Fuse	12A T
Ambient Temperature	• -25°C to 55°C operating • -40°C to 80°C storage.
Dimensions H x W x D	50mm x 180mm x 165mm.
Weight	1.3 kg
Inmarsat-C Protocol Support.	• Message transmission and reception with IA-5, ITA-2 and binary transfer to/from the following destinations: • Telex • PSTN (telephone modems and fax modems) • PSDN (X.25 network) • EGC message reception with automatically geographical area selection • Polling and data reporting with automatic transmission of position reports down to a recommended minimum of 1 per minutes. • Special Access Codes • DNID Messaging • Program Unreserved Data reporting • Pre-assigned Data reporting • Transmit message size: Max 32Kbyte • Receive storage: 128 Kbytes • Non-SOLAS distress calling facilities.

Note: Due to the lack of technical information on the TT-3005A Antenna, technical data for the TT-3005M Antenna has been provided for reference only. The TT-3005A Antenna is no longer supported by Thrane & Thrane, but is very similar in performance and electrical and mechanical interfaces.

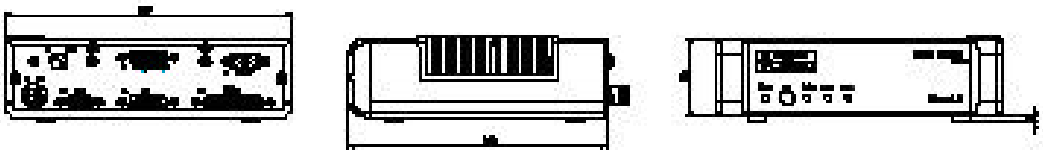
Table 4. Model TT-3005M Antenna

TT-3005M Maritime Antenna	Inmarsat-C/GPS omni-directional antenna, RHC polarized. G/T: -23 dB/K at 5° elevation. Temperature: -35°C to 55°C operating, -40°C to 80°C storage. Dimensions (H x D): mm x mm. Weight: kg.
Transmit Frequency	1626.5 MHz to 1646.5 MHz
Receive Frequency	Inmarsat-C: 1530.0 MHz to 1545.0 MHz GPS: 1576.42 MHz
Power Supply TX	VDC
Power Supply RX	15.0 VDC
Maximum transmission length	Max. 32K bytes.
Input Power Level TX	+ dBm
Output Power Level TX	EIRP: dBW ± 2dB at 5° elevation
Power Supply RX	
Solar Radiation	Max. flux density W/m2.
Relative Humidity	
Precipitation	
Ice	
Wind	
Vibration Operational	
Vibration Survival	
Shock	
Antenna Mounting	
Transceiver coax cable	TNC connectors.

3.0 Mechanical Interface

3.1 Dimensions

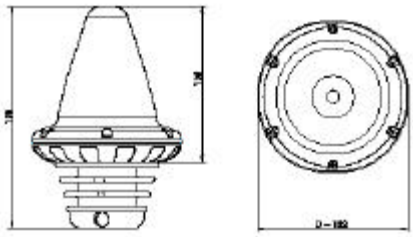
TT-3022C Transceiver: 180mm wide x 165mm deep x 50mm high



Back (width) Side (depth) Front (height)

Figure 2. Dimensional Views of the TT-3022C Transceiver

TT-3005M Antenna: 178mm high x 122mm wide



Vertical (height) Bottom (width)

Figure 3. Dimensional Views of the TT-3005M Antenna

3.2 Mass

TT-3022C Transceiver:
TT-3005M Antenna:

3.3 Mounting

TT-3022C Transceiver: Flange mount either vertical or horizontal. See figures 3, 4, and 5 on pages 2-22 and 2-23 of the TT-3022C Installation Manual for the correct hole spacing.

TT-3005M Antenna: Standard 1” tube mounting. See pages 3-1 and 3-2 of the TT-3005M Installation Manual for more mounting information.

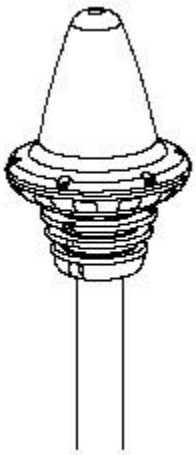


Figure 4. TT-3005M Antenna

The manuals, **TT-3022CinstalMan.pdf** and **tt-3005minstalman.pdf** can be downloaded from the links located in section 9.0 of this document.

3.4 Connectors

TT-3022C Transceiver:

X1 – DC Input, DB-15M
X2 – Antenna, TNC Female
X3 – DTE , DB-9F
X4 – I/O, DB-15F
X5 – Printer, DB-25F (Not Used)

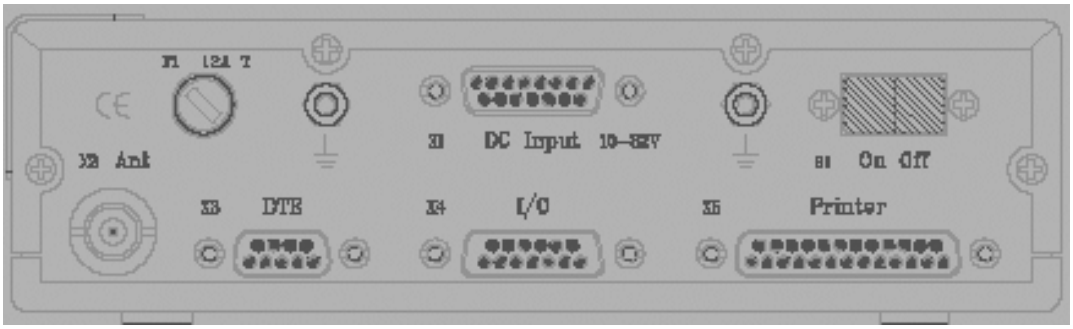


Figure 5. TT-3022 C Transceiver

TT-3005M Antenna:	TNC Connector, Female - located at the base of the antenna; the connection must be made before the antenna is mounted to the 1-inch diameter pole.

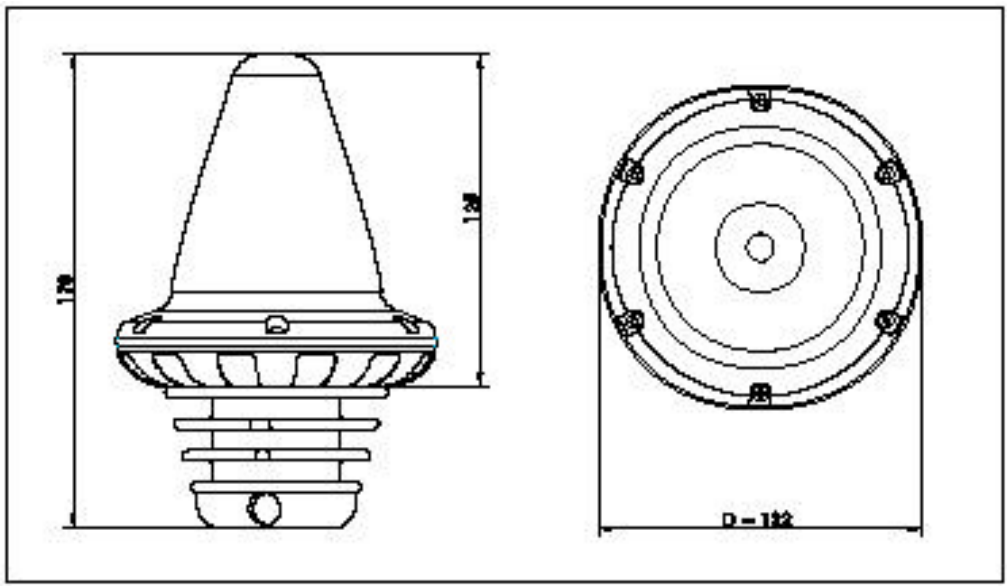


Figure 6. TT-3005M Antenna

3.5 Drawings

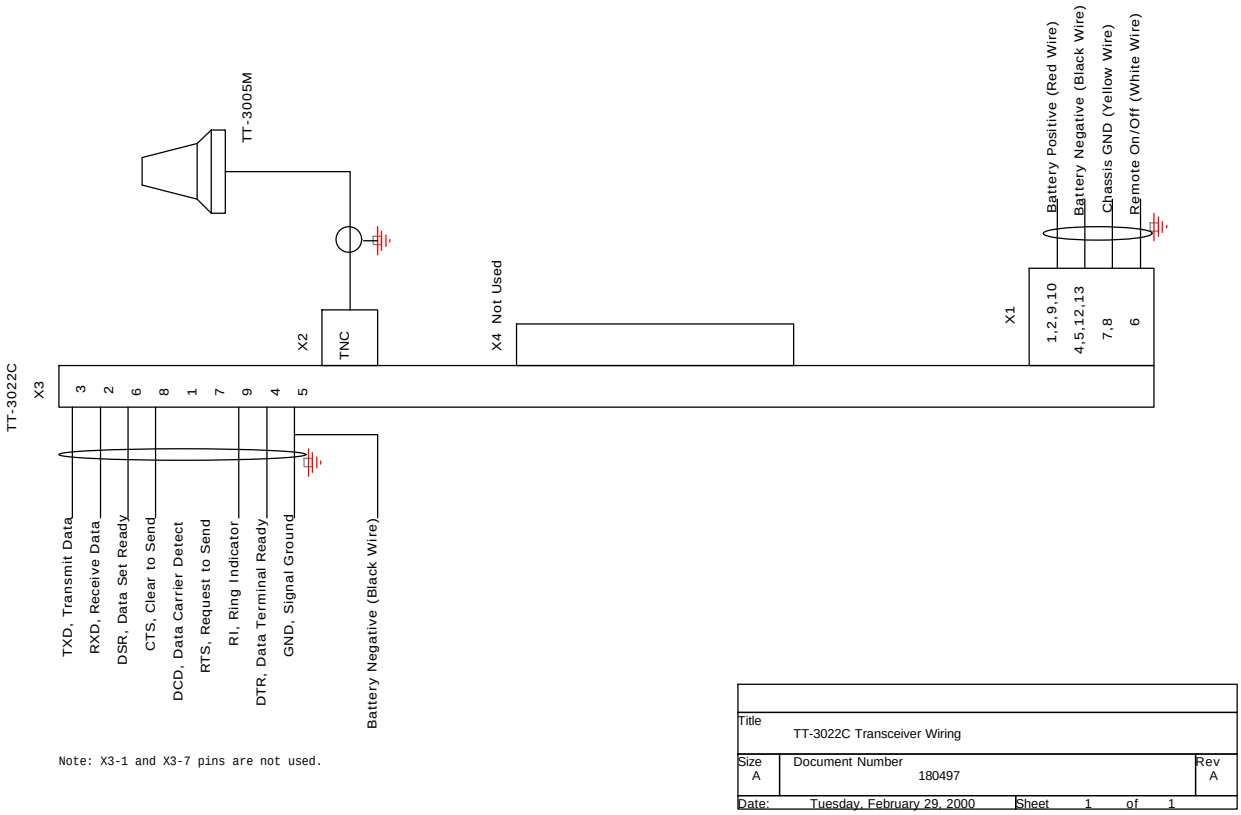


Figure 7. TT-3022C Transceiver Wiring Diagram

3.6 Mechanical Packaging

Use as received from the supplier:

LandSea Systems, Inc.
849 Seahawk Circle, Suite 103
Virginia Beach, VA 23452
Tel: (757) 468-0448
Fax: (757) 468-0625

3.7 Photographs

Figure 8. TT-3022C Inmarsat-C/GPS Land Mobile Capsat®

Figure 9. TT-3005M Capsat® Maritime Antenna

4.0 Electrical Interface

4.1 Connectors and Pin Assignments

Table 5. X1, Power Connector Pin Assignments

X1 Pin	Name	Signal Description	DC Cable 37-107881-A
1,2,9,10	SUP+	10-32 VDC (Battery Positive input)	Red
3		NC	
4,5,12,13	SUP-	DC RN (*Battery Negative input)	Black
6	ON/OFF	Remote ON/OFF (Connect to SUP- to turn on)	White (See Note 1)
7,8	SGND	Chassis (Secondary Ground)	(See Note 1)
11		NC	
14,15	9V out	Floating +9V out max 400mA on pin 14&15 ref to Chassis (Secondary GND) Note: Max load (400mA) is a combination of this output and X4 pin5.	
Ground	GND		Ground Shield

Note 1: This wire has to be connected to battery negative (black wire) to be able to turn on. See the TT-3022C Installation Manual section 2.3.1, On/Off features.

X2, Antenna: The TT-3005M Antenna has a TNC female connector and requires space rated 50-ohm cable not to exceed 100 meters in length.

Table 6. X3, DTE Connector Pin Assignments

X3 Pin	Name	Signal Description	Used	Levels	Direction
1	DCD	Data Carrier Detect		EIA/TIA-232-E	Out
2	RxD	Received Data	Yes	EIA/TIA-232-E	Out
3	TxD	Transmitted Data	Yes	EIA/TIA-232-E	In
4	DTR	Data Terminal Ready	Yes	EIA/TIA-232-E	In
5	GND	Ground	Yes		
6	DSR	Data Set Ready	Yes	EIA/TIA-232-E	Out
7	RTS	Request to Send		EIA/TIA-232-E	In
8	CTS	Clear To Send	Yes	EIA/TIA-232-E	Out
9	RI Note: See 2.4.2.3 of Installation Manual	Ring Indicator	Yes	EIA/TIA-232-E	Out

Table 7. X4, I/O Connector Pin Assignments

X4 Pin	Signal	Specification general purpose I/O
1	I/O 0 (IO)	Digital open collector output with pull-up/input with pull-up (RS-410N)
2	I/O 1 (IO)	Digital open collector output with pull-up/input with pull-up (RS-410N)
3	I/O 2 (IO)	Digital open collector output with pull-up/input with pull-up (RS-410N)
4	I/O 3 (IO)	Digital open collector output with pull-up/input with pull-up (RS-410N)
5	9VDC (O)	DC +9V, +/- 10%. Max 400mA. Floating Supply voltage for external devices. Note: Max load (400mA) is a combination of this output and X1 pin 14,15.
6,9	Ground	Ground Reference.
7,8	ArcNet A/B (IO)	ArcNet signal wires A/B (ATA/ANSI 878.1; ARCNET/TB).
10,11	NMEA Out A/B	NMEA 0183 output signal wires A/B (NMEA 0183 version 2.1).
12,13	NMEA In A/B	NMEA 0183 output signal wires A/B (NMEA 0183 version 2.1).
14	14 (I)	Digital input with pull-up (RS-410N)
15	15 (I)	Digital input with pull-up (RS-410N)

Table 8. X5, Printer Connector Pin Assignments

X5 Pin	Name	Signal Description
1	STRB	Strobe
2	DAT0	Data Bit 0
3	DAT1	Data Bit 1
4	DAT2	Data Bit 2
5	DAT3	Data Bit 3
6	DAT4	Data Bit 4
7	DAT5	Data Bit 5
8	DAT6	Data Bit 6
9	DAT7	Data Bit 7
10	ACKN	Acknowledge
11	BUSY	Printer Busy
12	PE	Paper End (out of paper)
13	SEL	Printer Selected
14	ALFD	Auto Line Feed
15	ERR	Printer Error
16	INIT	Initialize printer
17	SLCT	Select Printer
18	GND	Ground
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	GND	Ground
25	GND	Ground

Note: The Printer (X5) connector is not used. It must be jumpered so as to fool the transceiver into thinking there is a printer attached, otherwise the transceiver will lose messages.

Construct a dummy printer connector using a DB-25M connector with the following jumper wires:

Busy	11 – 17	Select Printer
Acknowledge	10 – 16	Initialize Printer
Paper End	12 – 14	Auto Line Feed
Printer Selected	13 – 1	Strobe
Data Bit0	2 – 15	Printer Error

5.0 Power and Thermal Interface

5.1 Operating Voltage(s)

TT-3022C Transceiver: 10-32V floating DC

TT-3005M Antenna has built-in low noise and high power amplifiers (LNA/HPA). The LNA requires 9 VDC or 14 VDC at 400ma max current during RX and the HPA uses 28 VDC during TX. (RX and TX voltages are supplied to the antenna via the RF cable from the TT-3022C transceiver.)

5.2 Power Consumption

TT-3022C Transceiver is rated as follows:

RX = 4.8W
TX = 80W (90W max)
Sleep Mode: <1mw
Power Profile factors:
- Data Rate = 600 (bps)
- Data packets up to 32 bytes (256 bits)
- Up to 32 KB message size transmission
- RX frame length 8.64 seconds

Power Profile Example:

Max Message Length:

((32 x 1024) x 8)/600 = 436.9 sec + 8 sec = 7.4 minutes

2K Message Length:

((2 x 1024) x 8)/600 = 27.3 sec + 8 sec = 0.58 minutes

Note: The transmitter turns on approximately 8 seconds prior to transmission.

5.3 Power Dissipation

Nominally the TT-3022C transceiver and the TT-3005M antenna use 80 watts of power during transmit. Seventy-two watts is used by the antenna and 8 watts is used by the transceiver. The antenna is rated at an ERIP: 14 dBw ± 2 dB (15 to 40 watts). Therefore, the antenna would dissipate (78-15 to 78-40) 63 to 38 watts depending upon the actual power out of the antenna.

5.4 Thermal Considerations

TT-3022C transceiver: –25 to 55 degrees C
TT-3005M antenna: –35 to 55 degrees C

The transceiver is located inside the CDM while the antenna is mounted external to it. The antenna will require a heater to keep within its nominal operating temperature range. The antenna cable will be space rated to meet ULDB requirements.

6.0 Data and Command Interface

6.1 Data Interface

The concept of the interface is to treat the TT-3022C transceiver as a message mailbox. All commands are formatted using ASCII character strings. There are commands to transfer files to and from the transceiver and commands to control the satellite link. When the transceiver issues the colon (**:**) prompt, just type in your desired command in a similar manner as the example command shown below:

nsc -r <nsc_id>

Where

nsc	is the command name.
-r	is the option switch.
<ncs_id>	is the parameter value that you should supply.

The command name, the option switches, and the parameter value are separated by one or more spaces. A single carriage return <CR> character terminates the command string.

6.2 Command Interface

The commands are divided into two lists (see tables 9 and 10):

Table 9. Inmarsat-C Commands

Command	Action
ALARM	Activate distress.
CONFIRM	Confirm request.
CLEAR <opt>	Abort current operation.
DATA	Send data report.
FX	Fixed positions.
HELP	This menu.
LI	Login at channel number.
LO	Logout.
NCS <opt>	Common channel management.
PG	Program setup.
ROUTE	Routing received files.
RS	Report setup.
RU	Remote units.
SET <opt>	Set parameters.
SLEEP <opt>	Sleep Mode.
STATUS <opt>	Various statuses.
TEST	Request link test.
TX <opt>	Transmission.
WP	Way points.
EM	Emergency mode.

Table 10. General Commands

Command	Action
DELETE	Delete a file.
DIRECTORY	List of files.
EDIT	Edit a file.
PRINT	Print a file.
TRANSFER <opt>	Transfer a file to transceiver.
TIME	Time and date.
TYPE <opt>	Type a file.

To activate a command, you need only type the first two letters of its name. The transceiver ignores the letter case of the command.

The transceiver will respond to a command within 2 seconds, but if the message log command is used, the response-time will depend on the log-size and whether the log was being used by the transceiver internally at that time. The response time could, in this case, be up to 45 seconds.

The TT-3022C transceiver communicates with the host flight computer via a serial communications port. Therefore, the host computer must support the INTEL 8259A Programmable Interrupt Controller and the National Semiconductor 8250, 16450, or 16550 UART chips.

The serial communication port parameters are factory programmed to 4800 baud, 8 data bits, no parity, 1 stop bit (4800 8 N 1). Hardware flow control is used (see Table 11).

Table 11. Communication Port Parameters

Comm Port	Address	IRQ
1*	03F8	4
2	02F8	3
3	03E8	5
4	02E8	7

* The default port setting on the TT-3022C Transceiver.

See section 4.2.2 of the TT-3022C Installation Manual to alter baud rate and protocol settings.

Reference Thrane & Thrane document number TT-99-108821-301, "Software Interface Reference Manual (Version 3.01)," for more complete interface information. It (**SoftInterRefManver3_01.pdf)** can be downloaded from the links on section 9.0 of this document.

7.0 Flight Software Interface

7.1 Housekeeping

The flight software interface can incorporate the use of the CAPLIB (C source code library) furnished by Thrane & Thrane. It's used in CAPSAT, the Inmarsat-C terminal control program. The library can be viewed here:

\\WFF-CAJUN\Public\E108\BCorbin\INMARSAT\Capsat Library Ver2.20

The software is referenced in the Capsat Transceiver Software Interface Manual Version 3.01 (see Table 12).

Table 12. Flight Software Interface

Description	Stack Add.	Serial Add.	Serial Port	CPU Sample Rate	Digital	RES Bits
INMARSAT ON/OFF monitor	Internal	ID2-03		1/Min	1	1
INMARSAT Ant Heat Enable/Disable	External	ED1-09		1/Min	1	1
INMARSAT to FLT CPU #1, #2	Internal	ID2-13		1/Min	1	1
INMARSAT Login Status			3	1/Min		1
INMARSAT Sync Status			3	1/Min		1
INMARSAT Channel Status			3	1/Min		2
INMARSAT Origin Status			3	1/Min		3
INMARSAT BB Error Rate			3	1/Min		7
INMARSAT Signal Strength			3	1/Min		3
INMARSAT Protocol			3	1/Min		4

7.2 Command Interface (Revision 1.0, January 31, 2000)

Num	Description	Stack Addr	Ser Port	Sel Addr	CMDS	Description/ Comments
	Power					
#REF!	INMARSAT Power ON	IC2-0Fh			0Fh	B
#REF!	INMARSAT Power OFF	IC2-11h			11h	B
	Heaters					
#REF!	INMARSAT Ant. Heater Enable	EC1-27h			27h	BTBD
#REF!	INMARSAT Ant. Heater Disable	EC1-41h			41h	BTBD
Device Switching						
#REF!	INMARSAT to FLT Computer #1 Select	IC2-46h			46h	B
#REF!	INMARSAT to FLT Computer #2 Select	IC2-47h			47h	B
Flight Computer						
#REF!	FLT Computer – Shut down INMARSAT Comm.				01 04h	
#REF!	FLT Computer - Start INMARSAT Comm.				02 04h	

Num	Description	Stack Addr	Ser Port	Sel Addr	CMDS	Description/ Comments
	INMARSAT					
#REF!	INMARSAT To POR		3		40h 10h	Byte 5 of the command identifies a particular category of command and byte 7 of the command further specifies the action the flight software must take. (page 54 of LDB Flight Software User's Guide, 8/24/99)
#REF!	INMARSAT To IOR		3		40h 11h	
#REF!	INMARSAT To AOR-E		3		40h 12h	
#REF!	INMARSAT To AOR-W		3		40h 13h	
#REF!	INMARSAT Packet Xmit		3		40h 14h	
#REF!	INMARSAT LES #1		3		40h 15h	
#REF!	INMARSAT LES #2		3		40h 16h	
#REF!	INMARSAT LES #3		3		40h 17h	
#REF!	INMARSAT LES #4		3		40h 18h	
#REF!	INMARSAT Auto Select Mode		3		40h 19h	

8.0 Ground Software Interface

8.1 Supplied Software

Install the CAPSAT software (TT-10202 Ver. 3.03) from the 3.5” floppy disk to the hard drive of the computer that will be used to communicate with the TT-3022C transceiver via the INMARSAT-C network.

For more information about using this software, please refer to the Thrane & Thrane TT-10202 Message Handling Software Operators Guide. It can be downloaded via the links in section 9.0 of this document.

8.2 Wallops Software

The Ground Station Software Interface is still in the design stage. It will be added to this ICD at a later date.

9.0 Document References

9.1 Data Sheets

Antenna, TT-3005M: http://tt.dk/3/tt-3005m.html

Transceiver, TT-3022C: http://tt/dk/3/tt-3022C.html

9.2 Manuals

Installation Manual; Thrane & Thrane Landmobile Capsat Transceiver TT-3022C Doc # TT98-107307-B

Technical Reference Manual; Thrane & Thrane Landmobile Capsat Transceiver, Doc # TT-99-107308-A

Installation Manual; Thrane & Thrane Maritime Capsat Antenna TT-3005M, Doc # TT98-110705-A

Software Interface Reference Manual Version 3.01;
Thrane & Thrane TT- 3022C Capsat Transceiver, Doc # TT-99-108821-301

Operators Guide, Thrane & Thrane TT-10202 Message Handling Software, Doc # TT-99-102663D

The above manuals and data sheets can be downloaded from this Thrane & Thrane web site as Acrobat pdf-formatted files:

http://www.tt.dk/4/manuals.html

or

file:////WFF-ORION/Code820/Public/BCorbin/INMARSAT/Capsat Library Ver2.20

(If either link doesn't work from this page, try copying the link and pasting it into your browser's location window and hit the enter key.)

To read the pdf files you must have the Acrobat Reader installed. It's free and can be downloaded here:

http://www.adobe.com/products/acrobat/readstep.html