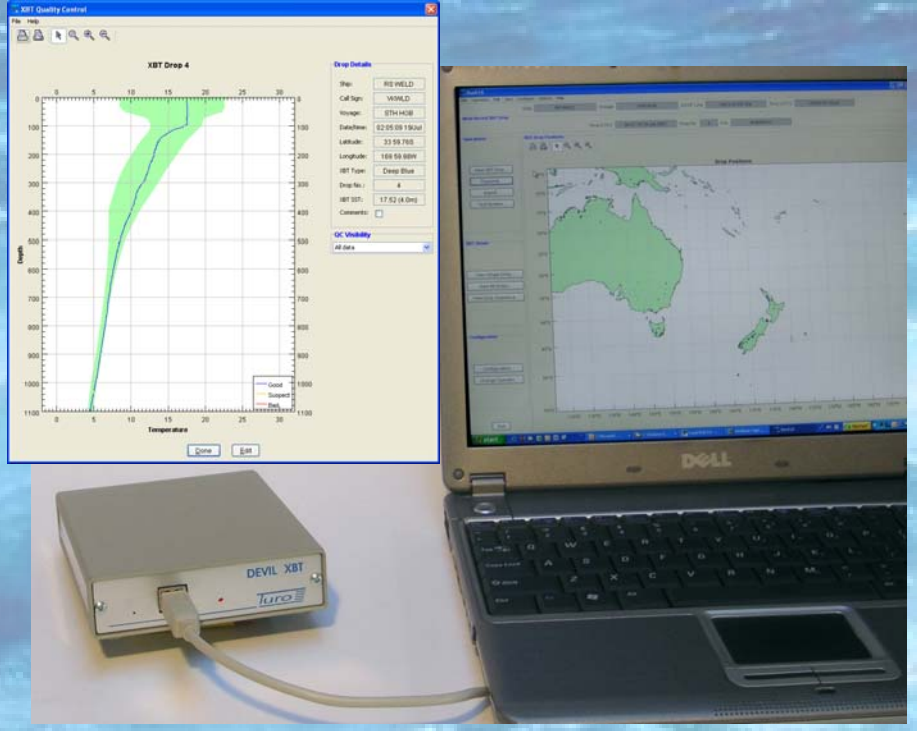

Devil XBT
Iridium Transmissions

Alex Papij

Turo

Devil Satellite Systems

Devil XBT System supports 2 Satellite systems

Argos:

- 1 way (2 way coming soon?)
- uplink 32 bytes per message
- availability ~2 hour intervals at equator (more frequent at poles)

Iridium Short Burst Data:

- 2 way
- up/down 340/270 bytes per sbd*
- availability on demand
- Cost in Australia (AUD):
  $25/month + $0.0025/byte
  => typical jjvv 250 bytes = $0.62

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Devil Satellite Messages

Argos:

- with 2 hr satellite revisit time – XBT drop rate can be too rapid for transmissions to keep up with

Iridium SBD:

- no satellite revisit time issues - satellite is always available globally
- in practice the rate of dropping XBT probes will not exceed the transmission rate

Devil Satellite Message Formats

Argos:

- max number of inflection points in JJVV message up to 34
- fixed 4 Argos messages per JJVV
- can queue multiple messages
- only supports messages for JJVV construction

Iridium SBD:

- max number of inflection points in JJVV message up to 63
- variable number of sbd packets per JJVV
- can queue multiple messages
- outgoing general text message
- Incoming general text message
- outgoing binary file of any length can be loaded (cost & time factors for large files)

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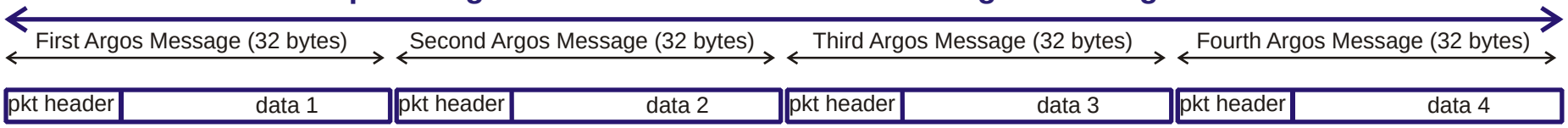
Devil Satellite Message Formats

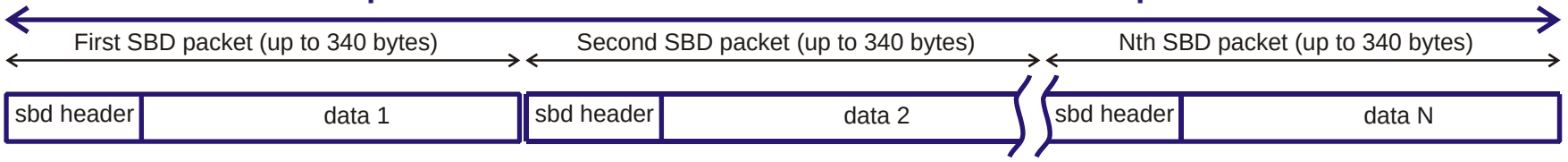
Outgoing Binary

Complete Argos XBT Transmission - fixed 4 Argos Messages



data 1 + data 2 + data 3 + data 4 = complete XBT information (max of 116 bytes)
= up to 31 or 34 temperature/depth points

Complete Iridium XBT Transmission - 1 or more SBD packets

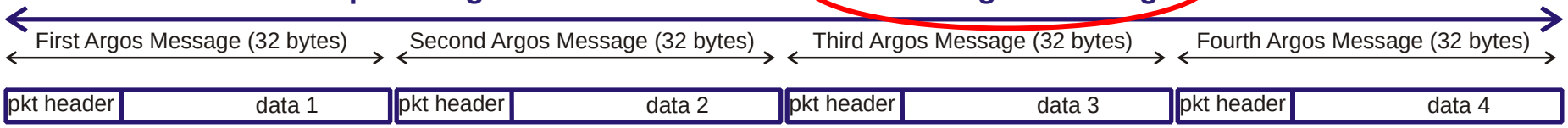


data 1 + data 2 + ... data N = complete XBT information
= up to 63 temperture/depth points
(or 2262 bytes or 16383 bytes in future)

Devil Satellite Message Formats

Outgoing Binary

Complete Argos XBT Transmission - fixed 4 Argos Messages



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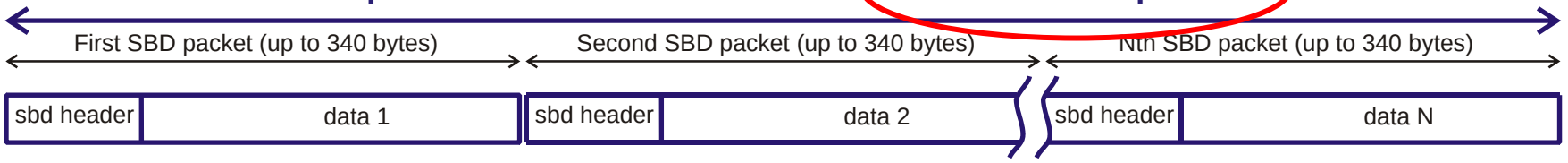
Complete Iridium XBT Transmission - 1 or more SBD packets



data 1 + data 2 + ... data N = complete XBT information
= up to 63 temperture/depth points
(or 2262 bytes or 16383 bytes in future)

Iridium Message Delivery

Two Delivery Methods

1. Email attachments:
   - send an email to: data@sbd.iridium.com
   - receive an email from: sbdservice@sbd.iridium.com
2. Direct IP connection:
   - user has client software to log into Iridium server to send a message
   - user has server software for Iridium to log into to deliver a message

NOTHING IS DIFFERENT AT MOBILE END (SHIP END)

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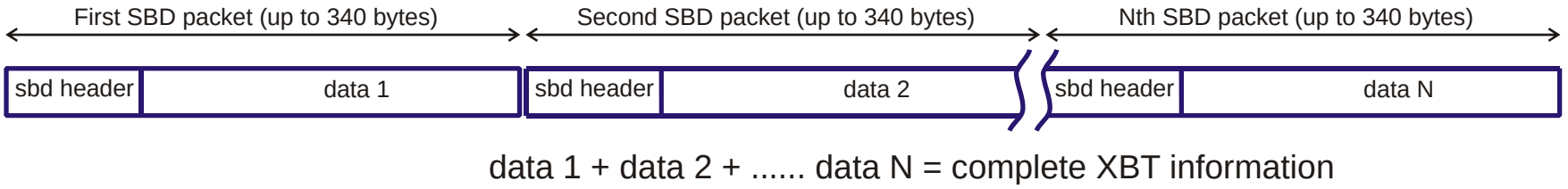
Devil JJVV Reconstruction

Devil sends data in binary

1. Assemble the single binary message from multiple SBD's. Usually only 1 SBD per message.
2. Decode the binary message, get the inflection points etc
3. Reconstruct the JJVV.



data 1 + data 2 + ... data N = complete XBT information

Devil Iridium Operation

Devil Operations

1. Do an XBT drop (save in netCDF file)
2. Automatic QC
3. Generate a JJVV (save the JJVV file)
4. Transmit binary data for JJVV reconstruction

Shore Operations (Non Devil)

1. Reconstruct the JJVV
2. Deliver the JJVV

Devil Iridium Procedures

In Transmit part of the Devil Iridium Operation:

Proceeds to:

- Measure satellite signal strength
- Attempt a satellite SBD session (transmit/receive)
- Determine session outcome

Then Retry if:

- Low signal strength
- SBD Session outcome, error in transmit/receive session

Devil Iridium Text Messaging

Supports 2 way simple text messaging

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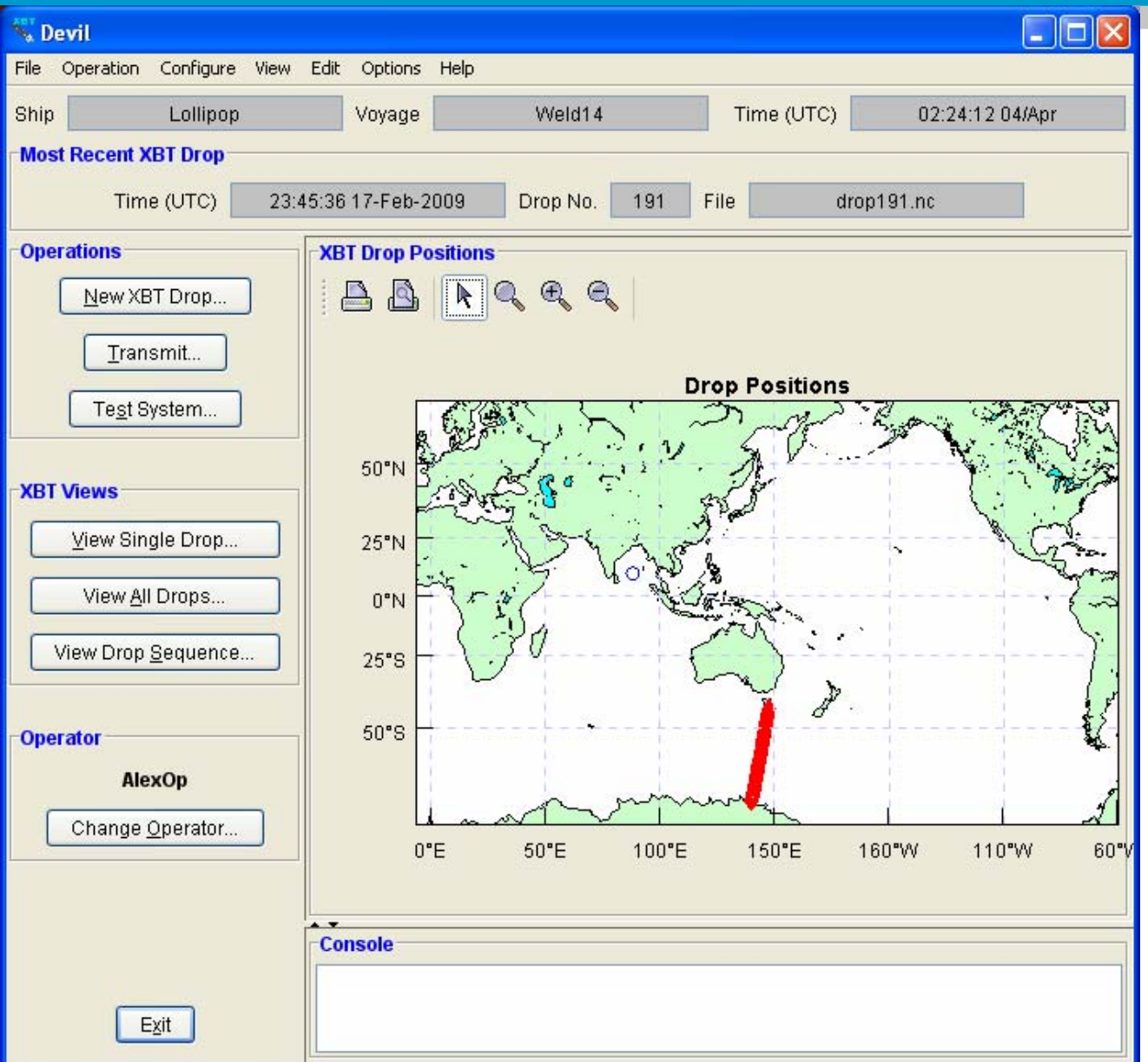
Devil Iridium Operations & Tests



Hobart to

Dumont D'Urville

IX28

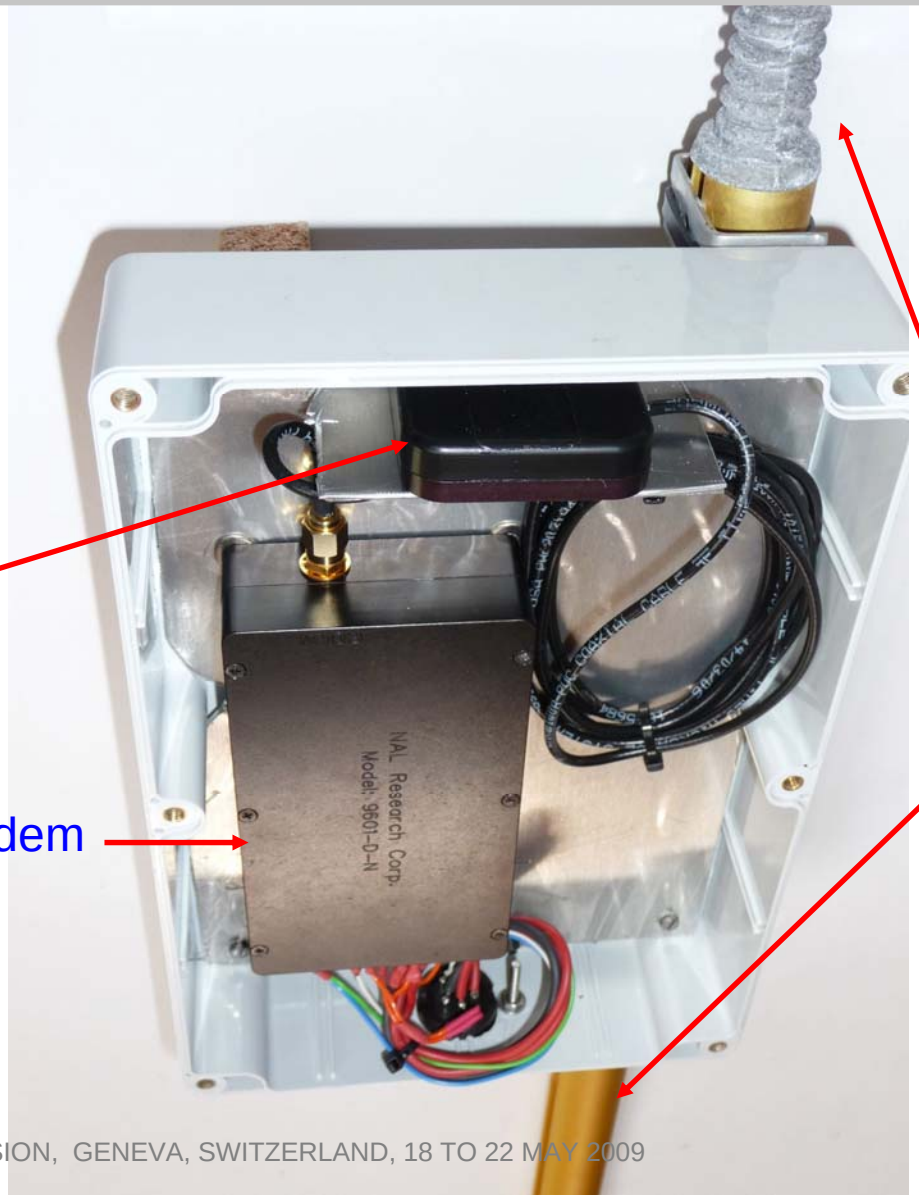
L'Astrolabe

December 2008

Turo

Devil Operations – IX28

Iridium Transmitter Test Unit



Internal patch antenna

NAL 9601 Iridium SBD modem

Mounting pole

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Two Iridium Transmitters

Hobart to Dumont D'Urville – IX28

L'Astrolabe

December 2008

Two Iridium Transmitters

Test Transmitter

(Internal Patch Antenna)

Operations Transmitter

(External Helical Antenna)

Two Iridium Transmitters

Iridium Transmits/Receives

13 - 27 December 2008, IX28

System 1:

Devil Operational XBT

- 10 SBD's received
- 2123 bytes total (average 212 bytes)

- 168 SBD's sent
- 38433 bytes total (average 229 bytes)

System 2:

Devil Test

- 112 SBD's received
- 23658 bytes total (average 211 bytes)

- 110 SBD's sent
- 30426 bytes total (average 277 bytes)

Iridium – Signal Strength

Satellite Signal Strength 0 – 5 scale

System 1
Operational XBT

- 192 attempts
- 188 good strengths (>= 3)

if strength < 3 then RETRY

- 4 retries

Signal Strength good
98% of the time

System 2
Test Unit

- 412 attempts
- 333 good strengths (>= 3)

if strength < 3 then RETRY

- 79 retries

Signal Strength good
81% of the time

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Iridium – SBD Session

SBD Session (Tx and/or Rx)

Retry on incomplete or failed SBD Session

	System 1 - Ops	System 2 - Test
Total SBD Session attempts *	188	333
Successfully sent (firstly or subsequently)	174	162
Successfully received (firstly or subsequently)	10	113
Send failure (later retried)	8 (5%)	34 (21%)
Receive failure ^	8 (80%)	3 (3%)

* Some sessions were both Tx and Rx, some were a mailbox check without any Tx or Rx.
^ System 1 most Rx were during a Tx, so a typical failure will affect both Tx and Rx.

No messages lost, all arrive error free

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Iridium Transmit/Receive Times

Some Observed Scenarios

SBD messages		Retry		Duration seconds
Outgoing	Incoming	Low Signal Strength	Failed SBD Session	
1 @ 276bytes (jjvv) *				9
1 @ 62 bytes			Yes	23
1 @ 340 bytes	1 @ 190 bytes		Yes	55
1 @ 221 bytes	1 @ 204 bytes			62
1 @ 108 bytes		Yes		23
1 @ 228 bytes		Yes (twice)		26
3 @ 895 bytes total			Yes	73
5 @ 1450 bytes total				103
	1 @ 254 bytes			11
	mailbox check			11

* This scenario from System 1 – Operational, all others are from System 2 - Test

Iridium Transmit/Receive Times

Some Observed Scenarios

9 seconds with better antenna unit

SBD messages		Retry		Duration seconds
Outgoing	Incoming	Low Signal Strength	Failed SBD Session	
1 @ 276bytes (jjvv) * typical jjvv				9
1 @ 62 bytes			Yes	23
1 @ 340 bytes	1 @ 190 bytes		Yes	55
1 @ 221 bytes	1 @ 204 bytes			62
1 @ 108 bytes		Yes		23
1 @ 228 bytes		Yes (twice)		26
3 @ 895 bytes total			Yes	73
5 @ 1450 bytes total				103
	1 @ 254 bytes			11
	mailbox check			11

* This scenario from System 1 – Operational, all others are from System 2 - Test

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Iridium Transmit/Receive Times

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1 @ 221 bytes	1 @ 204 bytes			62
1 @ 108 bytes		Yes		23
1 @ 228 bytes		Yes (twice)		26
3 @ 895 bytes total	340 + 340 + 215 bytes		Yes	73
5 @ 1450 bytes total				103
	1 @ 254 bytes			11
	mailbox check			11

Multi SBD message is handled as a single message by the operator

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Iridium Transmit/Receive Times

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1 @ 228 bytes		Yes (twice)		26
3 @ 895 bytes total			Yes	73
5 @ 1450 bytes total 340 + 340 + 340 + 340 + 90 bytes				103
	1 @ 254 bytes			11
	mailbox check			11

Multi SBD message is handled as a single message by the operator

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Iridium Transmit/Receive Times

Some Observed Scenarios

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single 2 way SBD session

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Iridium Transmit/Receive Times

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Iridium Transmit/Receive Times

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3 @ 895 bytes total			Yes	73
5 @ 1450 bytes total				103
	1 @ 254 bytes			11
	mailbox check			11

Iridium Transmissions – Devil XBT

- Very easy, convenient and user friendly
- Quick
- Error free, robust
- Know when it’s finished
- Antenna makes a small difference
- Can do very high XBT density lines maintaining transmissions
- Less chance of transmitter accidentally off, messing up transmissions
- Economical

Turo

thank you

Tasmanian Devil

Sarcophilis harrisii

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