



**ARTES Application Workshop
Container Tracking
ESA Contract AO/1-5153/06/NL/AD**

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SkyWave



Agenda

- Introduction
- Commercial Concept
- Major Technical Issues
- Implementation
 - Hardware description
 - Software
- Results
 - Power Consumption
 - Range Measurements
 - End-to-End Validation
- Summary/Commercial Update

Commercial Concept

- Market – 18M containers world-wide accounting for 90% of non-bulk commercial trade
- Value – Security (hazmat), logistics, fleet management (inter-modal)
- Technology – satellite uniquely positioned to provide real-time data with ubiquitous coverage
 - GlobalWave – robust protocol with low power consumption vs. competitors

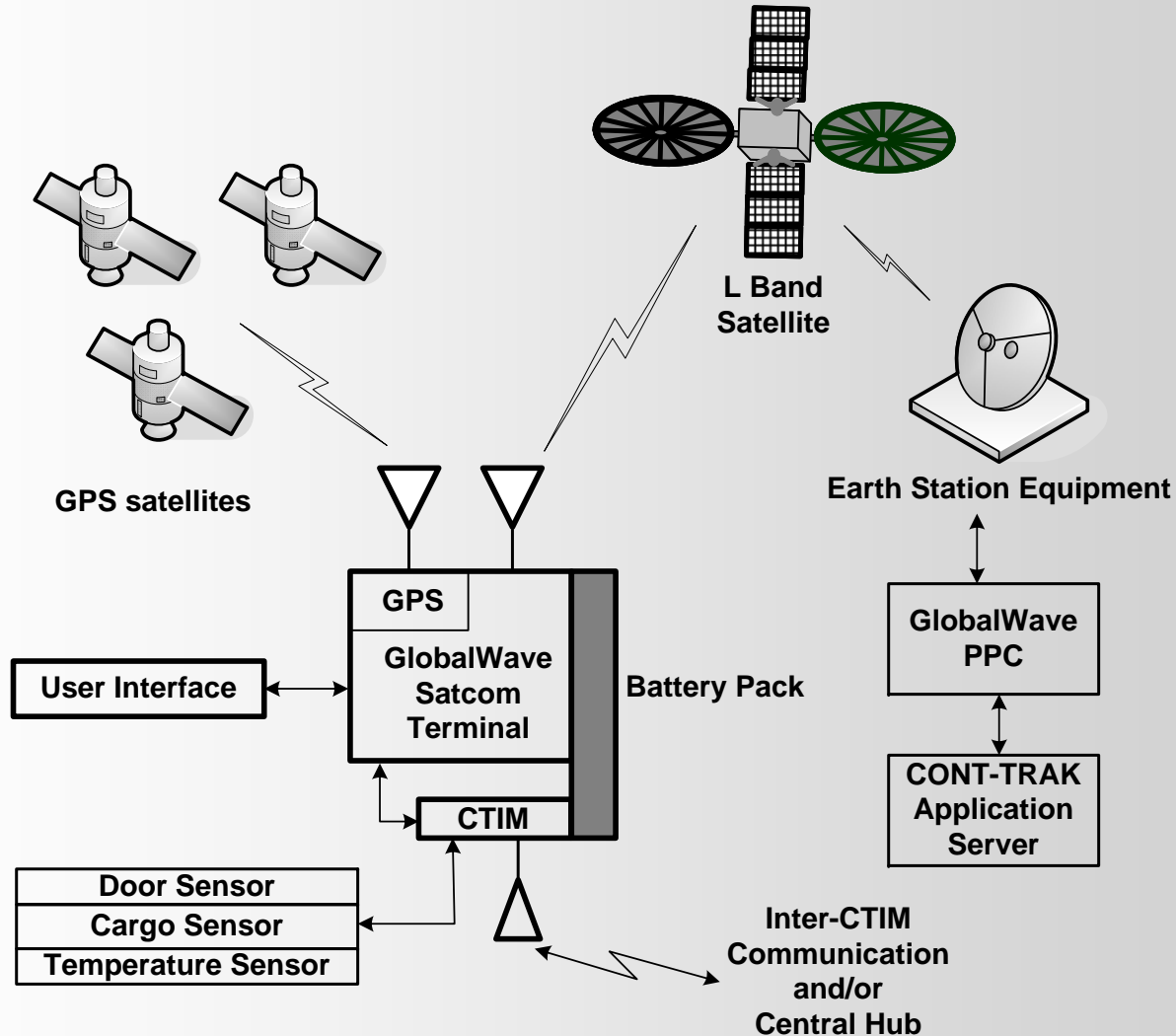


Commercial Solution

- GlobalWave (SkyWave)/Novacom Services Partnership
 - Global (land mass) Satellite Coverage
 - Proven track record of high quality and reliable network infrastructure
 - Commercial service commencement 1999
 - >120,000 fielded L-band satellite terminals (2008)
 - Operate over Inmarsat/MSV/Optus satellites
 - Several regional networks
 - Experienced integrators
 - Ability to offer complete solution
 - Terminal → Back Office Application



System Description



Technical Challenge (I)

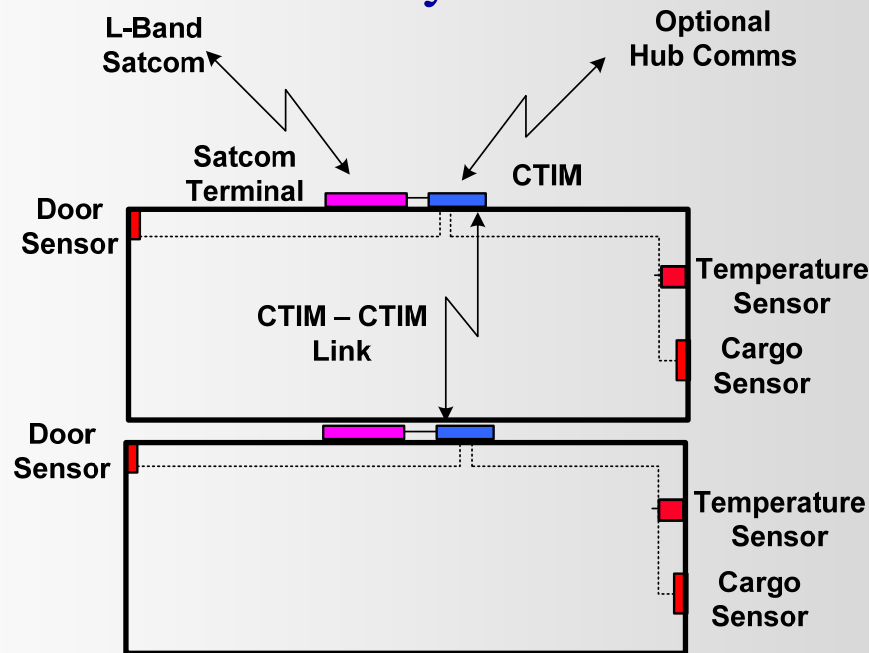
- **Wireless Network Frequency Selection**
 - ITU considerations and propagation characteristics provided 2 alternatives:
 - Dual frequency 868/915 MHz
 - Single frequency 2.4 GHz
 - Options investigated/validated via
 - Propagation modeling – ray tracing model/simulation (CRC Ottawa)
 - Field measurements – working container yard (Halifax)

Technical Solution (I)

- 2.4 GHz
 - Difference in propagation not quite as bad as modeling predicted
 - ~ -15 dB on average vs ~ -30 dB in modeling
 - > 100 measurements in several configurations
 - Multi-path did not appear to be a significant factor
 - Reasonable range (up to 200 m (non LOS) in some cases) based on receiver sensitivity of -98 dBm
 - Abundant COTS hardware
 - World-wide operation

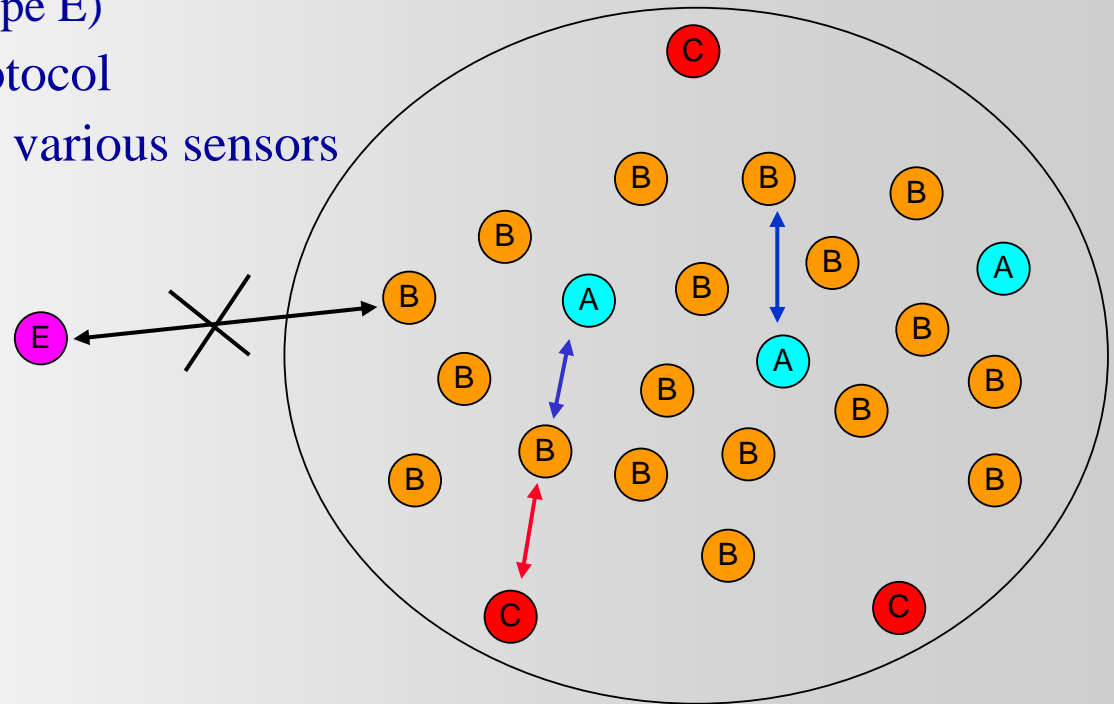
Technical Challenge (II)

- Communication in a stacked environment
 - Containers are stacked when shipped
 - No satellite visibility



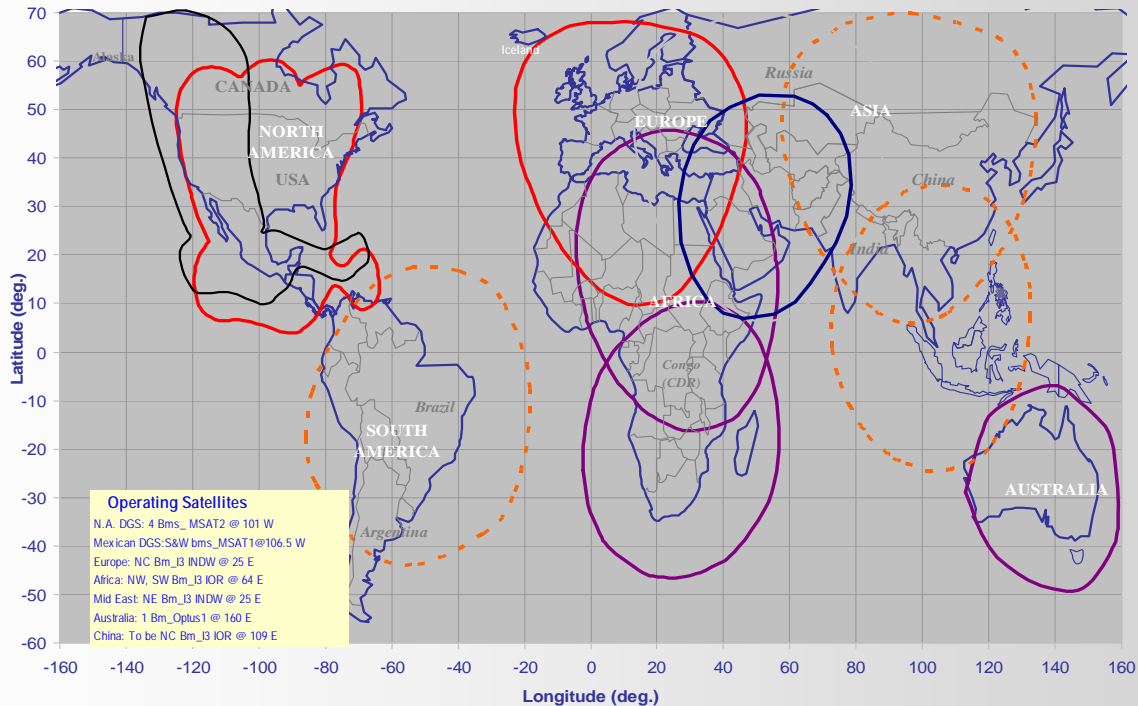
Technical Solution (II)

- CTIM: Container Tracking Interface Module
 - Ability to establish/join a wireless network
 - Terminal/CTIM with satcom link (Type A) will provide routing of data to/from blocked terminals (Type B/C)
 - If a terminal is unable to communicate with an “A” or “B” terminal , it is truly blocked (Type E)
 - Power efficient protocol
 - Ability to interface various sensors

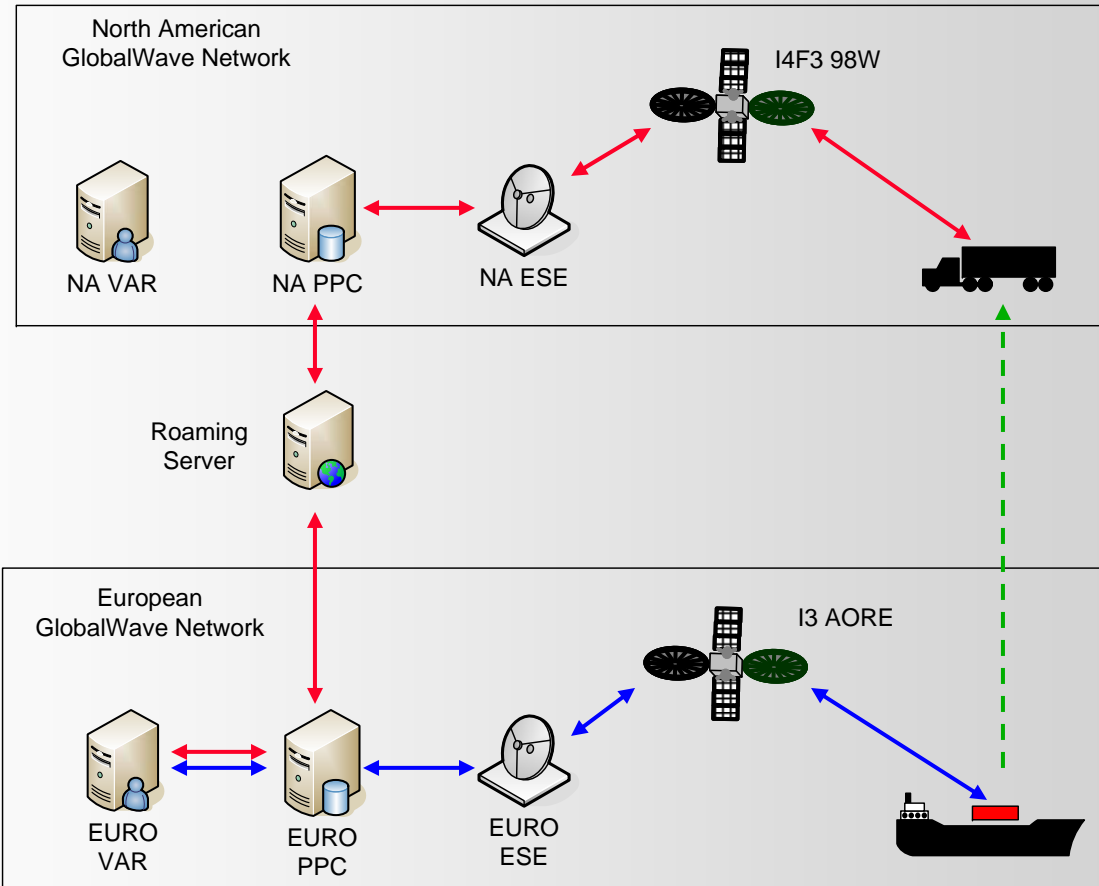


Technical Challenge (III)

➤ Continuous Global Tracking/Coverage



Technical Solution (III)



Technical Challenge (IV)

- Back Office Application and Integration
 - Integration of Cont-Trak application server with existing applications
 - Interface to GlobalWave PPC to
 - Send data to terminals/CTIM's
 - Polls, configuration etc
 - Receive data from terminals/CTIMS
 - Position reports, sensor alarms, in-transit profiles (ex. temperature)
 - Provide a WEB accessible and feature-rich front end customized for container tracking



Technical Solution (IV)

NOVACOM - Windows Internet Explorer

http://novacom-recette-32.cls.fr/novaserv/servlet/novaserv

File Edit View Favorites Tools Help

Google

NOVACOM

novacom services

Latest values received

5 messages found.

Asset	Altitude m	Battery V	CTIM Battery V	CTIM ID	CTIM Message type	CTIM Temperature °C	Heading ° (angle)	Linked CTIM	Location dd.ddd	Speed km/h	Temperature °C	Text message
00313010V/TI97B7	187	6.81	6.9	14/01/2009 12:14:20	15/01/2009 15:59:00	16.0	61	ABC0	43.54957N 1.485916E	0.0	3.0	DABC0
00313012V/TI9FC1	200		7.0	27/11/2008 14:48:21	27/11/2008 14:48:21	26.0	21	0	43.54955N 1.4858167E	0.0		DABC2
00313014V/TI67CB				08/01/2009 13:56:00	08/01/2009 13:56:00			0				DABC4
00313015V/TI2BD0	210	6.81		23/12/2008 23:09:06	23/12/2008 23:09:06	18.0	39	0	43.549583N 1.48475E	0.0	1.0	
00313016V/TI6FDS	0		7.0	09/12/2008 12:16:36	22/12/2008 10:01:06	18.0	184	0	43.5473N 1.4846E	0.0		

5 messages found.

Date and time are displayed with respect to the GMT time zone.

start

Inbox - Microsoft Out... C:\Documents and Se... Microsoft Project - Fis... NOVACOM - Windows... Microsoft PowerPoint ...

Internet 90%

8:56 AM



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Sensor Data Integration

NOVACOM - Mozilla Firefox

http://novacom-recette-32.cls.fr/novaserv/servlet/novaserv

Les plus visités À la une PF NS Corpo RDP10 Status JDB Ops PATROL Ntest Secure NS NS-SITA Balancer Manager RDP10 direct NS Intranet GeVeriwise™

NOVACOM services

Date : 24/06/2005
Heure : 17:22:31
Fréquences (KHz) : 2,085
11001
11001

CONT TRAK ARKEMA Français

Consultation Analyse Configuration Administration Supervision

Aide | Imprimer | Quitter

Dernières valeurs reçues pour SECU 124106.0

Dernières mesures :

Temperature °C	6,0
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ERROR: Can't connect to Corda Server commport - Connection refused

Date / Heure	Capteur	Valeur
12/03/2009 16:03:49	Altitude m	250
23/12/2008 09:50:56	Battery V	6,81
13/03/2009 15:34:49	CTIM ID	ABC;
13/03/2009 15:34:49	CTIM Message type	Registration
12/03/2009 16:03:49	Heading ° (angle)	104
13/03/2009 15:34:49	Linked CTIM	0
12/03/2009 16:03:49	Location dd.ddd	39.121532N 94.48123W
12/03/2009 16:03:49	Speed km/h	0,0
23/12/2008 09:50:56	Temperature °C	6,0
26/01/2009 14:45:43	Text message	QABC;
Date / Heure	Capteur	Valeur

Alertes en cours :

Aucune alerte trouvée

Commandes :

Terminé



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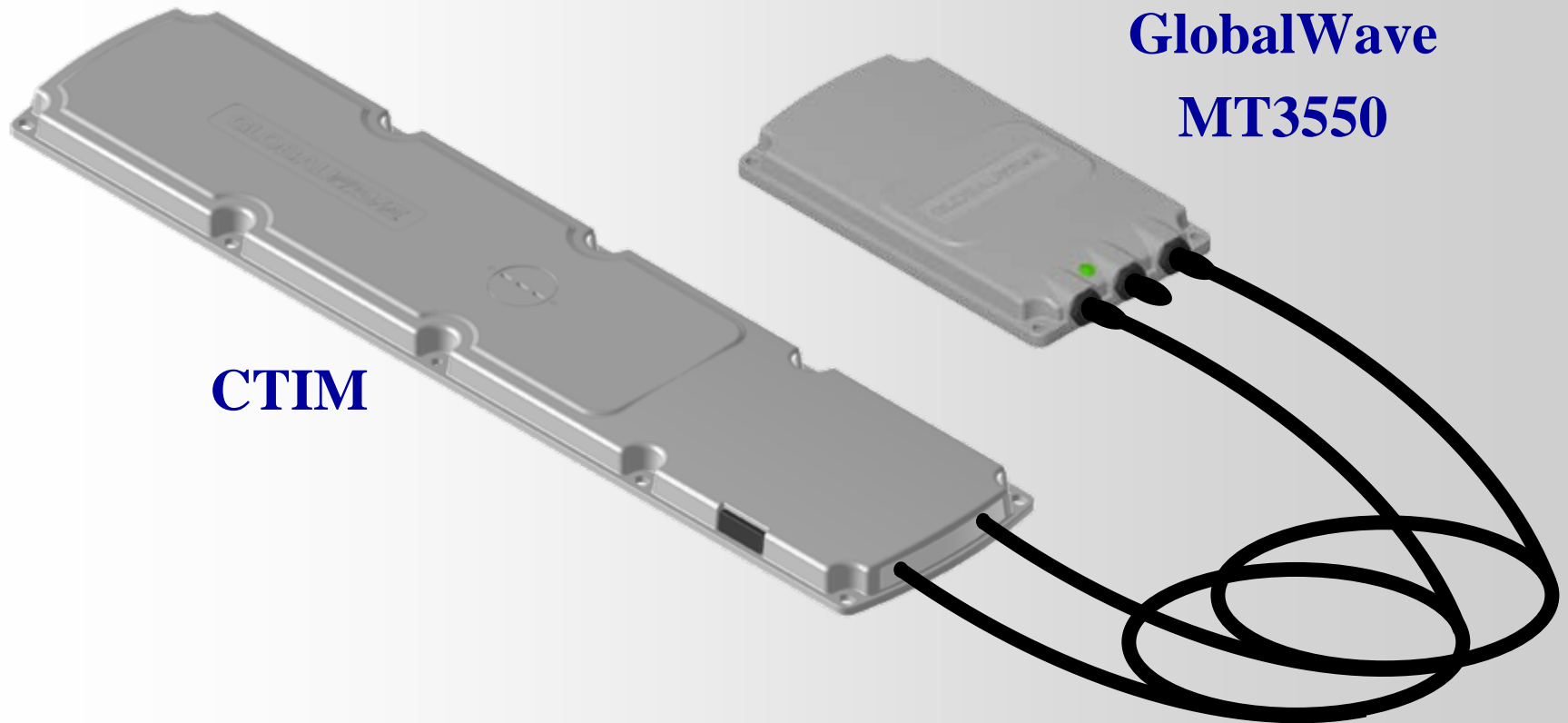
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Position Data Integration



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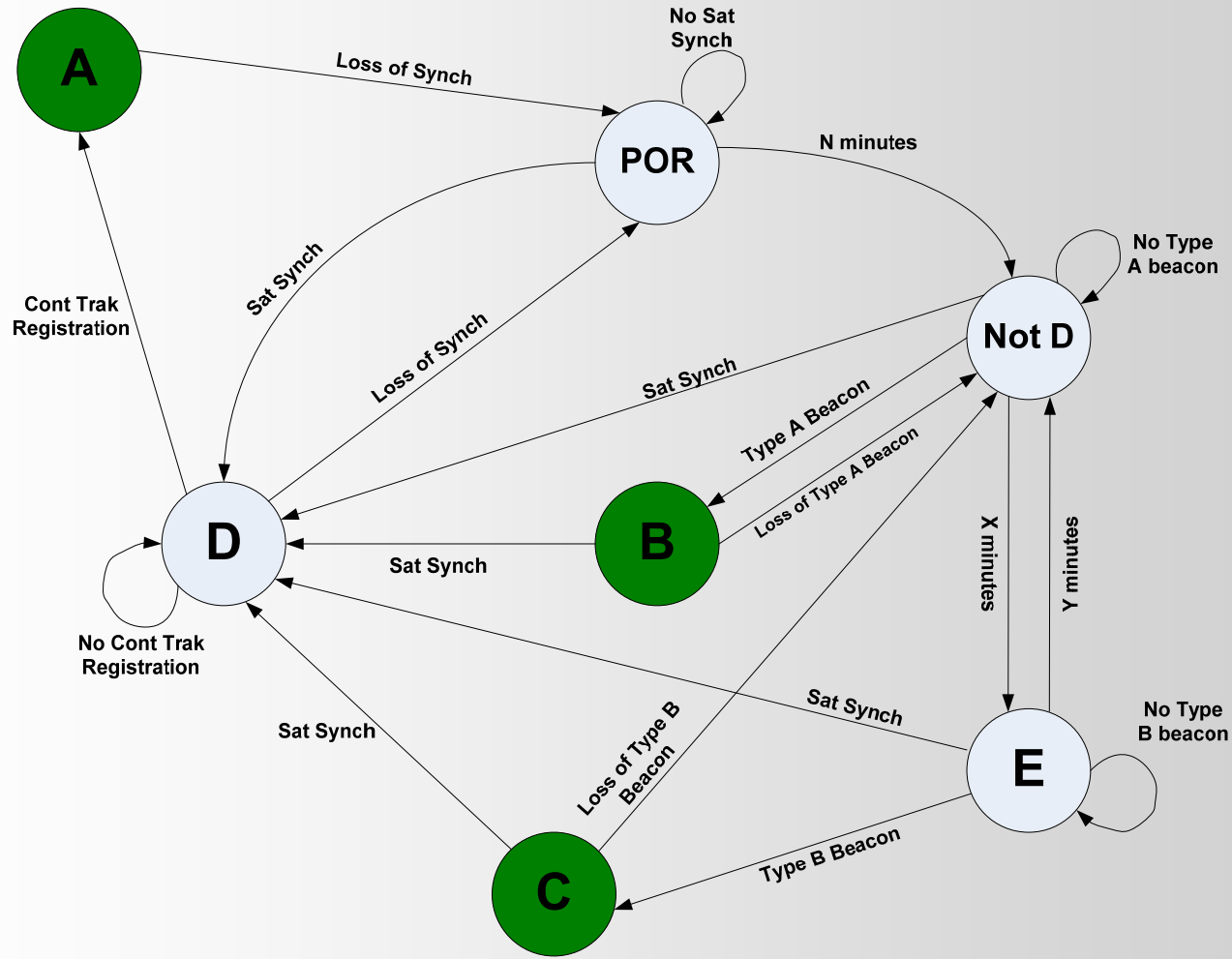
Implementation - Physical Design



CTIM

**GlobalWave
MT3550**

CTIM Network Establishment



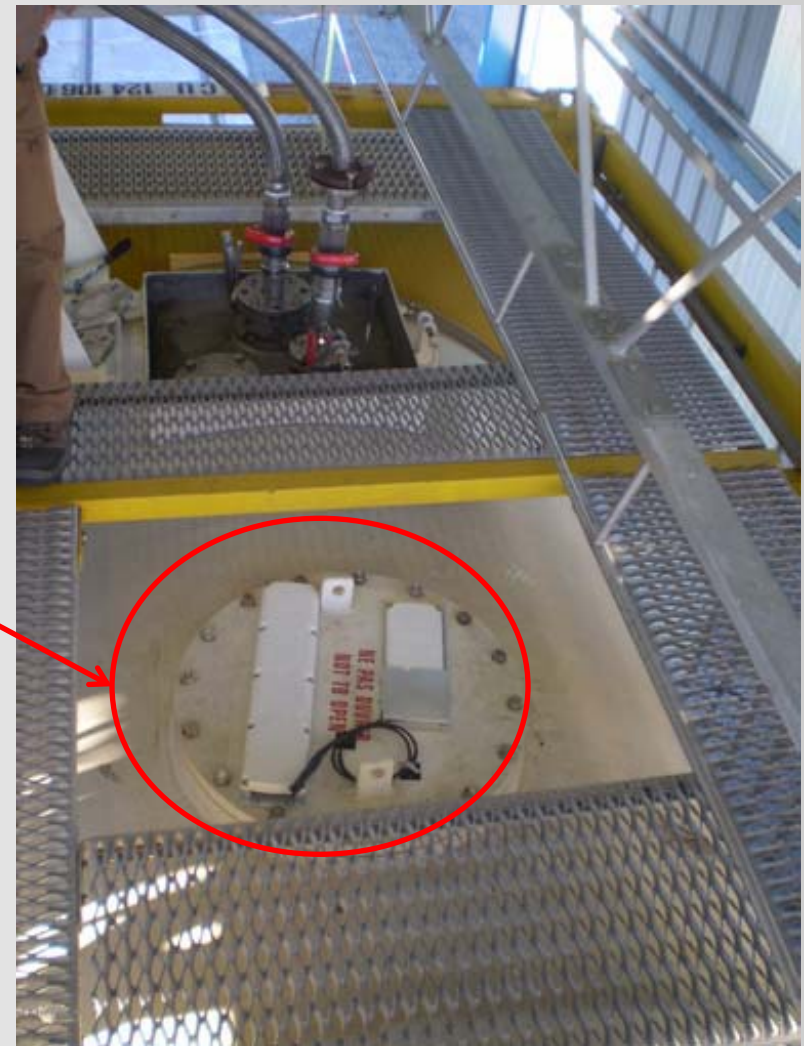
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Key Performance Data

- Up to 30 type A's per network
 - Up to 19 B's per A (no constraint on number of C's)
- B-C communication
 - Relative stagger to A of 0.5 seconds
 - Communication on a different channel
 - 60 MHz spacing
- 2.8 years expected life (19 Ah pack)
 - Assumes 20% A, 10% B, 10% C, 60% E
- Range Measurements (validated in container yard)
 - 280 m CLOS
 - 110 m obstructed

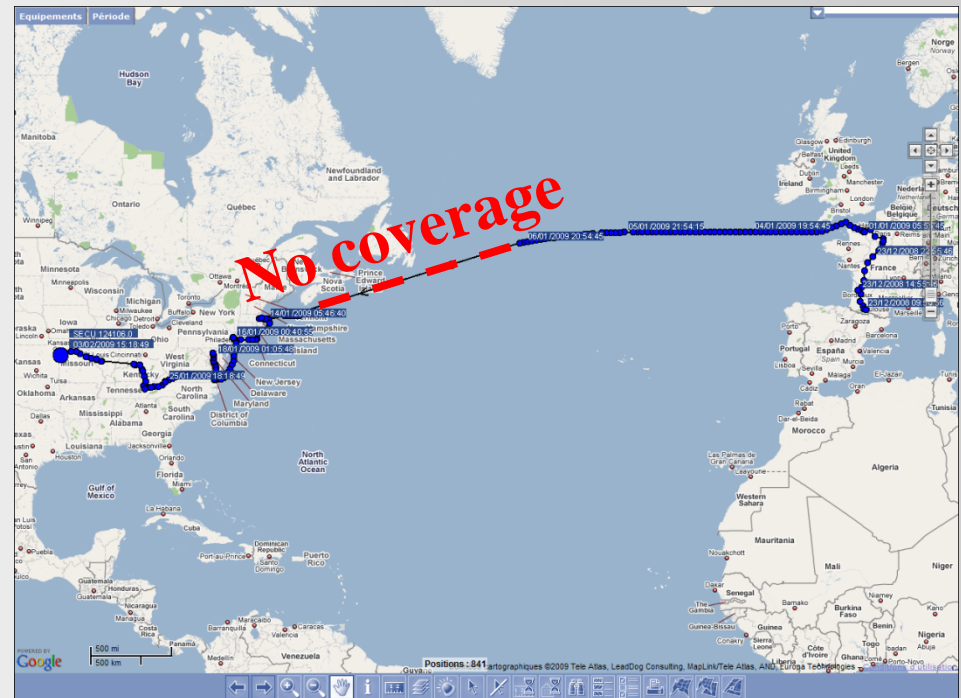
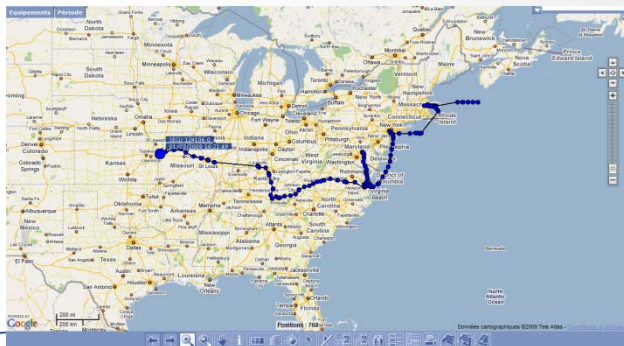
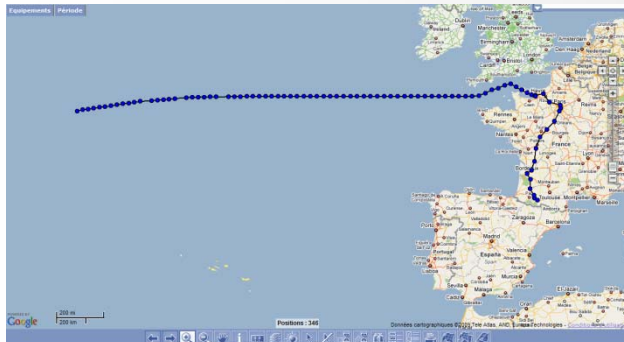
Installation Example



- Customer: Arkema
- Type: Cylinder-shaped tank
- Product: Chemical liquid
- Date : 23rd December 2008

Europe to North America Trial

- Customer: ARKEMA
- Unit installed in Lannemezan (South of France) 23 December 2008
- Left European coverage 6 January 2009
- Appeared on North American Network 8 January 2009



Commercial Update

- GlobalWave acquired by SkyWave in June 2009
- Commercialization deferred to focus company resources on new satellite network development
 - IsatData Pro – commercial launch Q3 2011
 - Seamless global coverage
 - Higher data capacity (optimized for 1000's of bytes vs. 10's)
 - Low latency
 - Broadcast Service
 - Low power mode(s) and capability

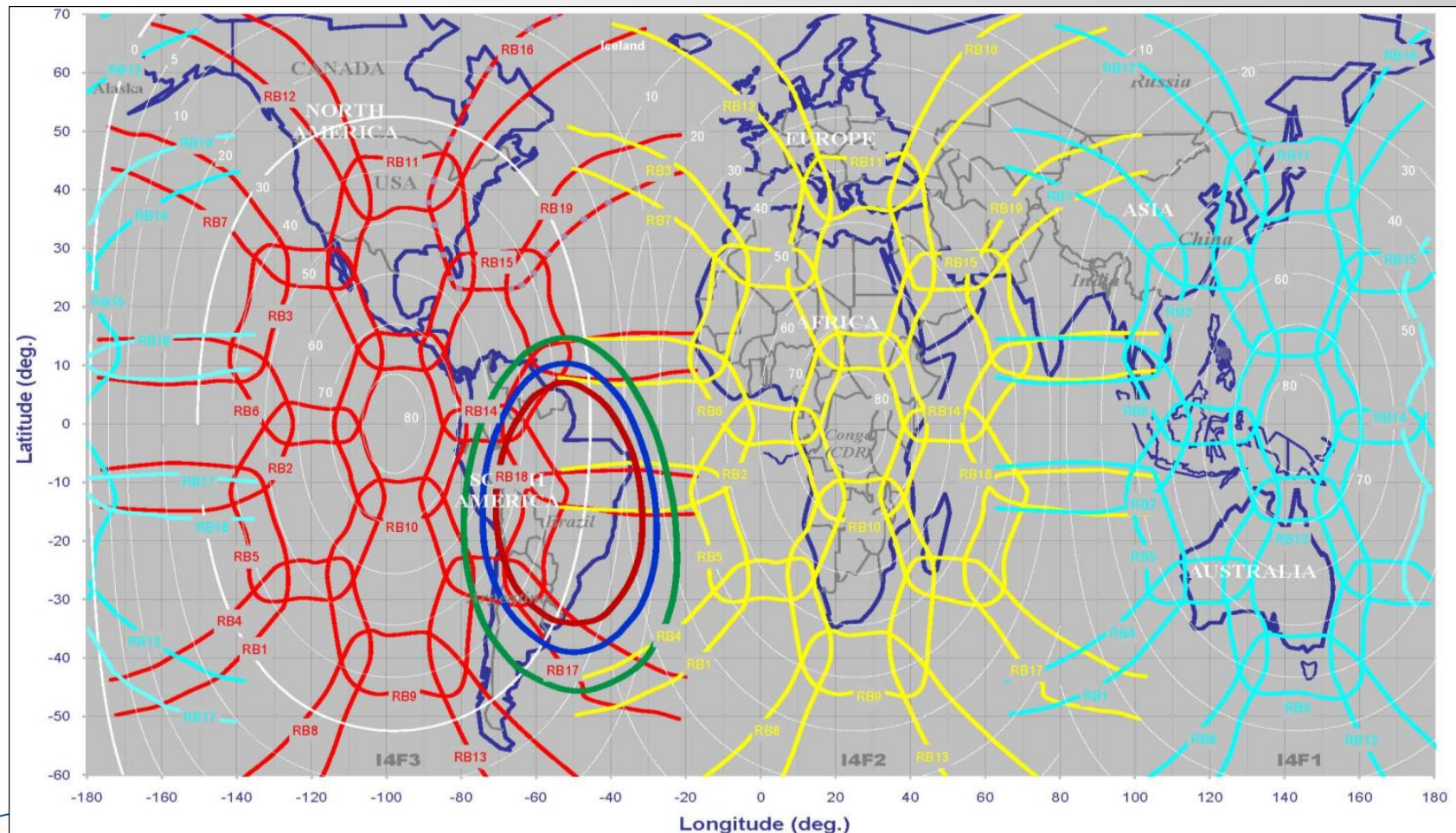


SkyWave Satcom Network Comparison

	ISATM2M	GlobalWave	IsatData Pro
Forward Message Length	100 Bytes	38 Bytes	10,000 Bytes
Return Message Length	10 Bytes	11 Bytes	6,400 Bytes
Latency	< 30 seconds	< 30 seconds	4 -18 seconds for 100 Bytes 38 - 48 seconds for 1 kB
Acknowledged	Optional	Yes	Yes
Broadcast	Yes	Bulletin Board	Yes
Coverage	Global, non-polar	Regional	Global, non-polar

Commercial Update (con't)

➤ IsatDataPro Global Coverage: 58 Beam Network



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Commercial Update (con't)

- Next steps:
 - Transition CTIM prototype product and protocol to commercial product
 - optimize power efficiency
 - finalize physical form factor
 - design expanded to support volume manufacturing
 - Factory introduction, functional test, etc.
 - Transition satellite technology to IsatData Pro Network
 - Entered 3-year partnership with Canadian Government to commercialize
 - Transport Canada – Security Division



SUMMARY

- A satellite based container tracking solution has been developed
 - Prototype product and protocol
 - Roaming capability to interconnect GlobalWave regions
 - User based application server
 - Initial trials in yard and end user environments
- Ongoing initiative to commercialize technology through migration to new Global IsatDataPro network

