



GLOBALWAVE

Products & Services

**Technology for the Marine and Transportation
Industry**

TRANSCORE[®]

Networks, Mobile Satellite Terminals, Applications

T. Houtman, D. Roscoe
January 17, 2006

GlobalWave Background

- Founded in 1993, first GlobalWave system commissioned in 1999.
- Location: Ottawa, Canada
 - Design and Engineering, Network Operations and Customer Support, Manufacturing
 - ~85 Employees
 - Strong engineering team with track record of innovation
 - 20 patents
- A leading global provider of satellite packet data systems and products for remote asset and fleet management.
 - dual satellite mode (S/L band) mobile terminal for Comtech Mobile Datacom
 - dual mode (satellite/terrestrial) mobile terminal (MobileMax2)
 - MT-1000 Global Wave satellite terminal
 - MT-2000 Global Wave satellite terminal



MDC terminal



MobileMax2



GlobalWave MT2000

GlobalWave Capabilities

Design and Development



Radio Terminals
RF Design
Digital Signal Processing
Circuit Design and Prototyping
Real Time Software

Wireless Packet Data Systems



Systems Design
Channel Units
Packet Switching
Networking
Network Management

Facilities:



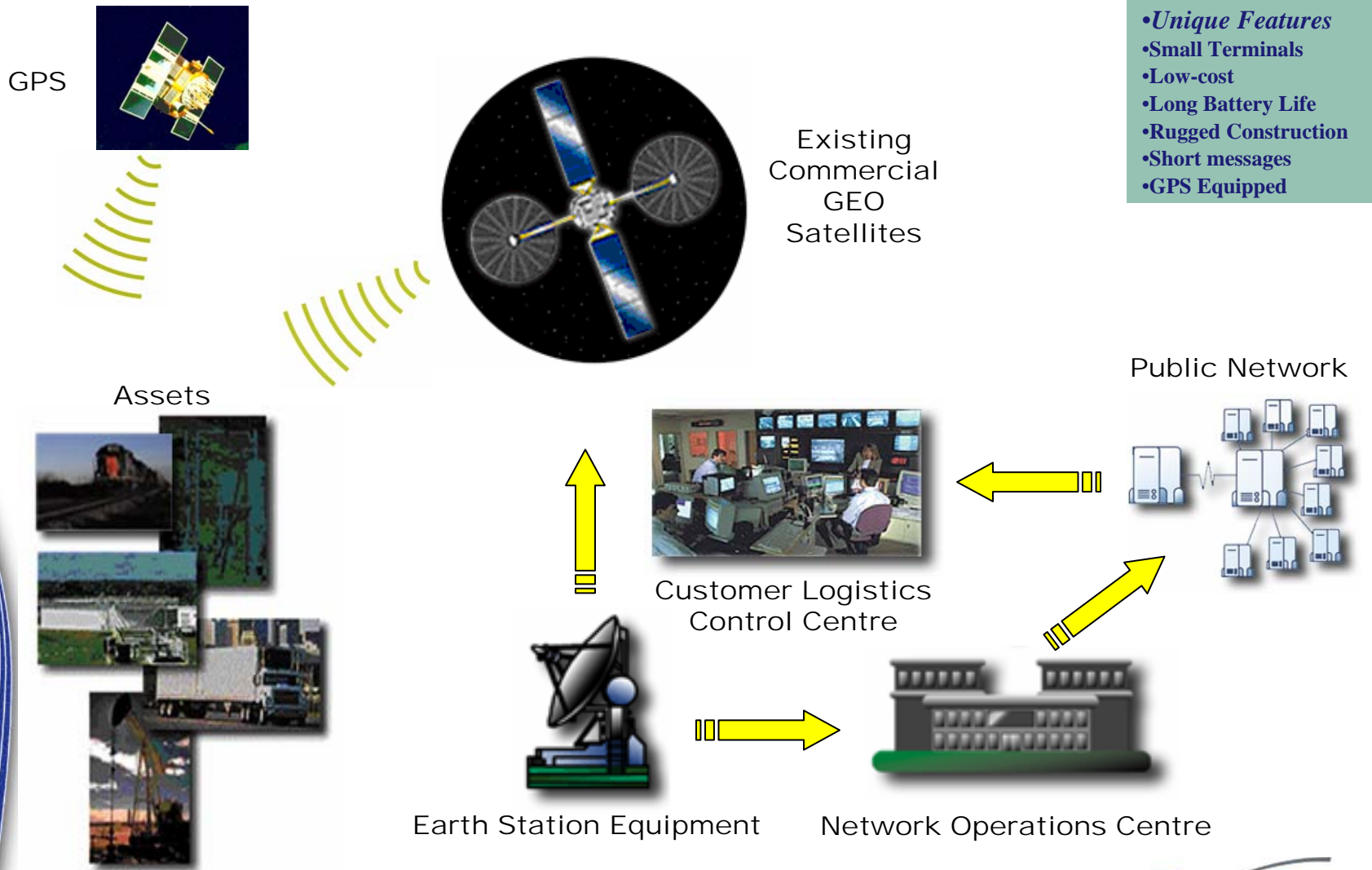
**Ottawa, Ontario
(26,000 sq ft., 85 people)**



Contract Manufacturer: Solectron

Engineering, Innovation, Commercialization

GlobalWave Network Overview



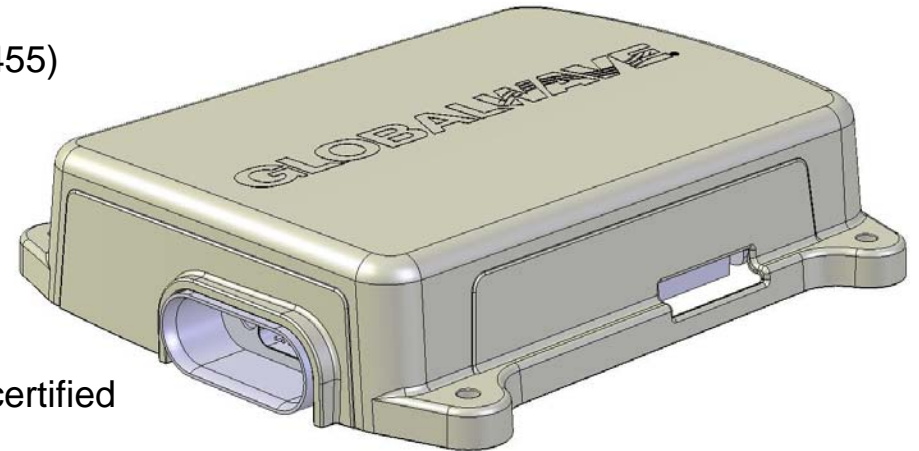
- *Unique Features*
- **Small Terminals**
- **Low-cost**
- **Long Battery Life**
- **Rugged Construction**
- **Short messages**
- **GPS Equipped**

System Features

- **Satellite Terminal (MT-2000):**
 - optimized for harsh environments (SAE J1455)
 - small: 1.5"x4"x6"
 - power efficient
 - integrated GPS
 - interfaces: 4 Digital, 2 Analog, RS-232
 - FCC, ETSI, IC, MSAT, Inmarsat, OPTUS certified

- **Network Services:**
 - polling on demand, event reporting, pre-scheduled reports, short text messages, geo-fencing
 - terminal parameters are configurable over-the-air
 - low latency, e.g. poll with position report ~60 sec.

- **Satellite Services:**
 - lease power and bandwidth from profitable GEO L-Band satellite operators
 - Inmarsat worldwide
 - MSV North America and Mexico



Regional Operators

The GlobalWave system has been franchised outside of North America, on a turn-key basis, to Regional Operators worldwide:

- **North America** - TransCore (operated by GlobalWave Network Operations in Ottawa)
- **Europe** - TransCore (operated by GlobalWave Network Operations in Ottawa)
- **Middle East** - Datastar (operated by GlobalWave Network Operations in Ottawa)
- **Australia, Africa** - Startrack
- **Mexico** – Proeza (operated by GlobalWave Network Operations in Ottawa)
- **Future** – China, Southeast Asia and South America

Development of GNSS Technology through ESA contract

Application Overview

- ◆ Purpose: to deliver trustworthy position information and position-based geofence alarms to users from remote terminals
- ◆ Target customers: marine pleasure craft initially
- ◆ Trailer tracking, heavy equipment, recreational vehicles etc.

Potential Customer Applications

- ◆ Tracking
- ◆ Anti-theft monitoring
- ◆ Marine anchor dragging alarm
- ◆ SOS with position
- ◆ Transport endpoint/waypoint entry/exit monitoring
- ◆ Transport corridor monitoring
- ◆ Detect unauthorized use of heavy equipment
- ◆ Fuel tax

Application Architecture

- ◆ Components:
 - ❖ Existing Globalwave mobile satcom networks
 - Application data carried via bidirectional text messaging between back-office and GNSS receiver board
 - ❖ Integrated satcom/GNSS terminal with EGNOS capability
 - Includes existing MT2000 satcom transceiver and new GNSS receiver boards within a single enclosure
 - ❖ Back-office web server
 - Existing product modified for this application
 - Independent position reporting possible from both MT2000 and GNSS receiver, allowing performance comparison

Back-office Server

- ◆ Web-based interface
- ◆ Username/password authentication
- ◆ Message viewing
- ◆ Polling and mapping
- ◆ Alarm management and viewing
- ◆ E-mail alarm notification
- ◆ Control of geofence alarms
 - ❖ Whether to allow terminal local control and notification
 - ❖ Whether to perform remote notification
 - ❖ Sample interval (continuous to 60 minutes)
 - ❖ Turn on/off remotely

Alarm Configuration Screen Capture

Address: http://www.globalwave.com/gwvas/site/main-screen

VISTAR Datacom

Account Management
Home
Logout

Fleet Management
Fleet Copy
Alarm Management
Dwell Time

Asset Management
Asset Assignment
Asset Health

View Messages
View Alarms
Command Status
Asset Search

View Serial Data
Fleet/Asset Status
Send Poll
Send Command
Set Geo-Fence

General

- Vistar-00260
- houtman-12724
- houtman-12737

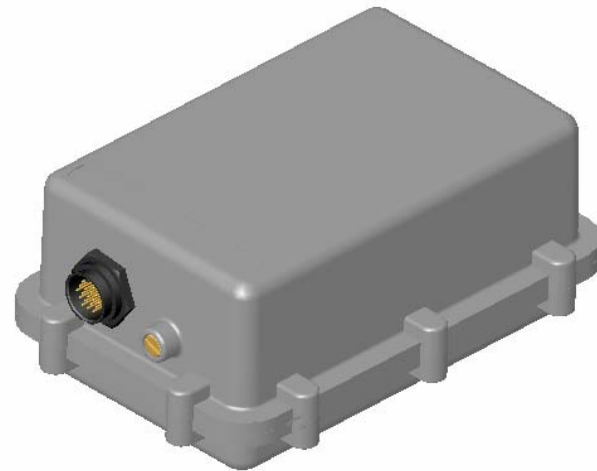
Asset :houtman-12724

I/O Settings for Alarms			
<input checked="" type="checkbox"/>	Dig0	<input checked="" type="radio"/> 1	<input type="radio"/> 0
<input type="checkbox"/>	Dig1	<input type="radio"/> 1	<input checked="" type="radio"/> 0
<input checked="" type="checkbox"/>	Dig2	<input type="radio"/> 1	<input checked="" type="radio"/> 0
<input type="checkbox"/>	Dig3	<input type="radio"/> 1	<input checked="" type="radio"/> 0
<input type="checkbox"/>	Serial Port Connect	<input type="radio"/> 1	<input checked="" type="radio"/> 0
<input type="checkbox"/>	Analog Port (Analog)	High <input type="text" value="3.0"/>	Low <input type="text" value="0.0"/>
<input checked="" type="checkbox"/>	Battery	High <input type="text" value="16.0"/>	Low <input type="text" value="4"/>
<input type="checkbox"/>	Temperature	High <input type="text" value="85.0"/>	Low <input type="text" value="-40.0"/>
	<input type="radio"/> Fahrenheit (Max 185F)		
	<input checked="" type="radio"/> Celsius (Max 85C)		
<input type="checkbox"/>	Speed and Velocity	High <input type="text" value="0.0"/>	
	<input checked="" type="radio"/> mph <input type="radio"/> km/h		

Save Alarm Settings Cancel

Integrated Terminal Hardware

- ◆ Five components:
 - ❖ GNSS receiver board
 - ❖ Power supply/interface board
 - ❖ Existing MT2000
 - ❖ Commercial active patch antenna for GNSS receiver
 - ❖ Enclosure, modified from existing design well-received in marine market



Navigation Algorithms on GNSS Board

- ◆ GNSS signal detection, code and carrier phase tracking, data demodulation, pseudorange measurement, terminal PVT
- ◆ EGNOS integrity monitoring, corrections and position error estimation
- ◆ EGNOS-based error estimates are used to compute protection level, to ensure low probability of false geofence alarm

Navigation Verification Test Beds

- ◆ Independent test lab (University of Calgary)
- ◆ Transcore rooftop antenna and terminal platform
- ◆ NRCan monuments (Ottawa Basenet)
- ◆ TERESA/Pegasus with Spirent simulator
- ◆ Car-top mobile testing with magnetic mounting

University of Calgary Simulator

- ◆ Spirent GSS6560 simulator
- ◆ Used to test performance with controlled signal levels and vehicle dynamics
- ◆ Measured pseudorange jitter and dynamic position error; verified acquisition and time to fix under minimum required signal level



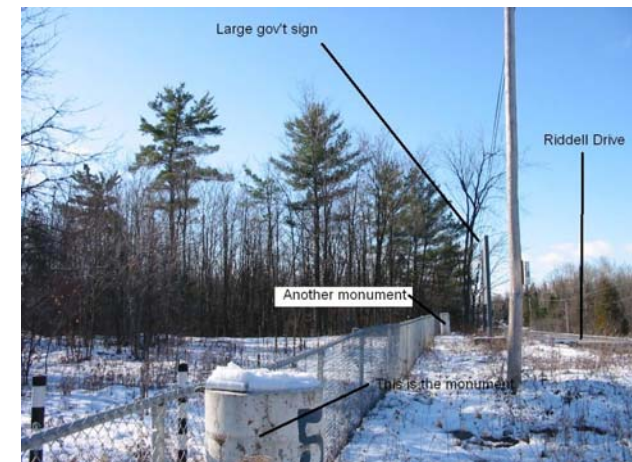
Transcore Ottawa Rooftop

- ◆ In-building L-band distribution network from QFH receive antenna
- ◆ Platform for terminal testing with integral antennas
- ◆ Five surveyed locations



Natural Resources Canada Monuments

- ◆ NRCan has several networks of monuments created for GPS validation
- ◆ Coordinates are given in NAD83 datum



Car-top Testing

- ◆ Primarily used for land mobile availability and TTFB testing with patch antennas

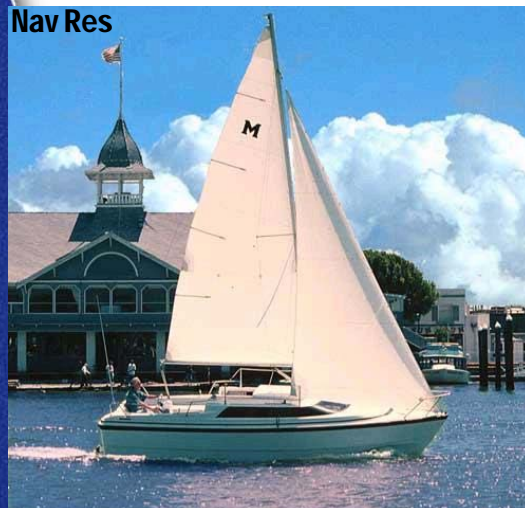


TERESA/Pegasus and Simulator

- ◆ Terminal code has been modified to output EGNOS message stream and Rinex observation files
- ◆ Simulator currently being used with TERESA and Pegasus for terminal EGNOS validation

Application Field Trial

- ◆ 5 pleasure craft in Canada/USA



Application Field Trial

- ◆ Terminals were shipped to users with an accessory cable/alarm box
- ◆ Users installed in their own boats
- ◆ Users were given login/password to web server
- ◆ Tracking and geofence alarm use commenced
- ◆ Problems encountered
 - ❖ Faulty power supply component caused reboots $>45^\circ$ – some terminals repaired
 - ❖ Remote boats caused deployment delay – actual trial durations ranged from 1.5 to 4.5 months
- ◆ Despite these problems lots of useful info and user feedback was generated
- ◆ In particular, allowed comparison with existing MT2000 product performance

Geofencing and Tracking

- ◆ Geofencing was used on many occasions
- ◆ No unexpected false geofence alarms
- ◆ Tracking was very attractive especially for family and friends

Tracking – Wawartok II



Commercialization

- ◆ Virtually the same functionality except for antennas



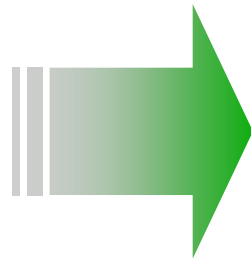
Commercialization

- Focus throughout 2005 was the development of third generation satellite terminal technology and its commercialization
 - developed GNSS technology through ESA contract no. 16872/02/NL/GS is a significant component of this development

2nd Generation

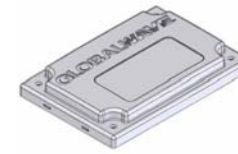


2003 - 2004

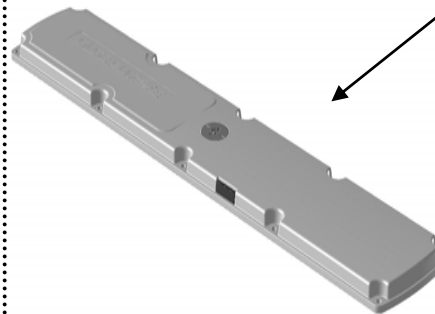


Major Corporate
Multi-million dollar
R&D Program

3rd Generation



Core Modem



MT-3300



MT-3550



MT-3000

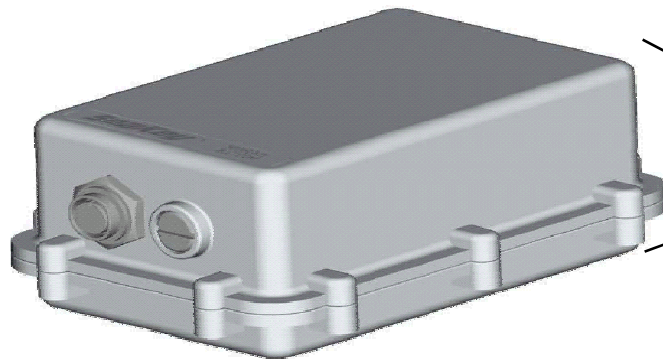
GlobalWave Terminal Product Family

2005 - 2006

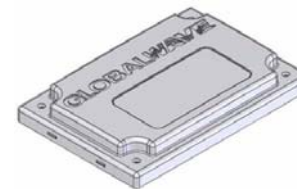
Commercialization (con't)

GNSS Component :

- ❖ current GPS capabilities within GlobalWave satellite terminals are based upon third party chip sets
- ❖ in-house GNSS technology was successfully developed through collaborations with the European Space Agency
- ❖ the developed technology was demonstrated on a MT-2000 based hybrid hardware platform which incorporated an additional external circuit board for the DSP and FPGA subsystems – suitable for technology development and demonstration, however not practical from a commercial product perspective
- ❖ TransCore GlobalWave undertook a significant investment to commercialize the developed GNSS technology with its integration within the Core Modem.
 - GNSS technology is the basis of all navigational features within GlobalWave's third generation satellite terminals. Fundamental terminal enhancements:
 - Time to Fix, reliability, and accuracy
 - simultaneous GNSS and Satcom receive
 - greatly improved power consumption



GNSS Hybrid Terminal
(l=21cm, w=15cm, h=10cm)



Core Modem with GNSS
(l=7.5cm, w=5cm, h=0.5cm)