



# Improved Coast Guard Communications using Commercial Satellites and WWW Technology

LT Gregory W. Johnson

ET1 Mark Wiggins

*USCG R&D Center Groton, CT*

Presented at IMSC '97, June 18th



# Outline



- *Background/Problem*
- *Solution - OWL Proof of Concept*
  - *Communications Links*
  - *WWW Architecture*
  - *Security*
- *Demonstration*
- *Performance*

# Background



- Law Enforcement Operations in the First District

- ▶ Aircraft
- ▶ WMEC
- ▶ WPB



- Primarily Fisheries Enforcement





# LE OPS Concept





# Problem



- Lack of reliable comms between aircraft and the WMEC.
  - *Sometimes the information is not reported until the aircraft lands*
- Operational commander needs access to the information in the operational databases ashore (historical information as well as current lists of wanted vessels).



# Proof-of-Concept Goals



- *Minimize user actions to enter data (minimal typing, quick, easy).*
- *Provide one time data entry—eliminate voice relays and multiple entries.*
- *Minimize the amount of data to be transferred (utilize links to static databases).*
- *Provide a simple user interface for the mobile users.*
- *Develop a system that is easy to modify as needed, keeping complexity at a central server.*
- *Give users only the information they need, when they need it.*
- *Provide automatic data transmittal into the main Coast Guard law enforcement database.*

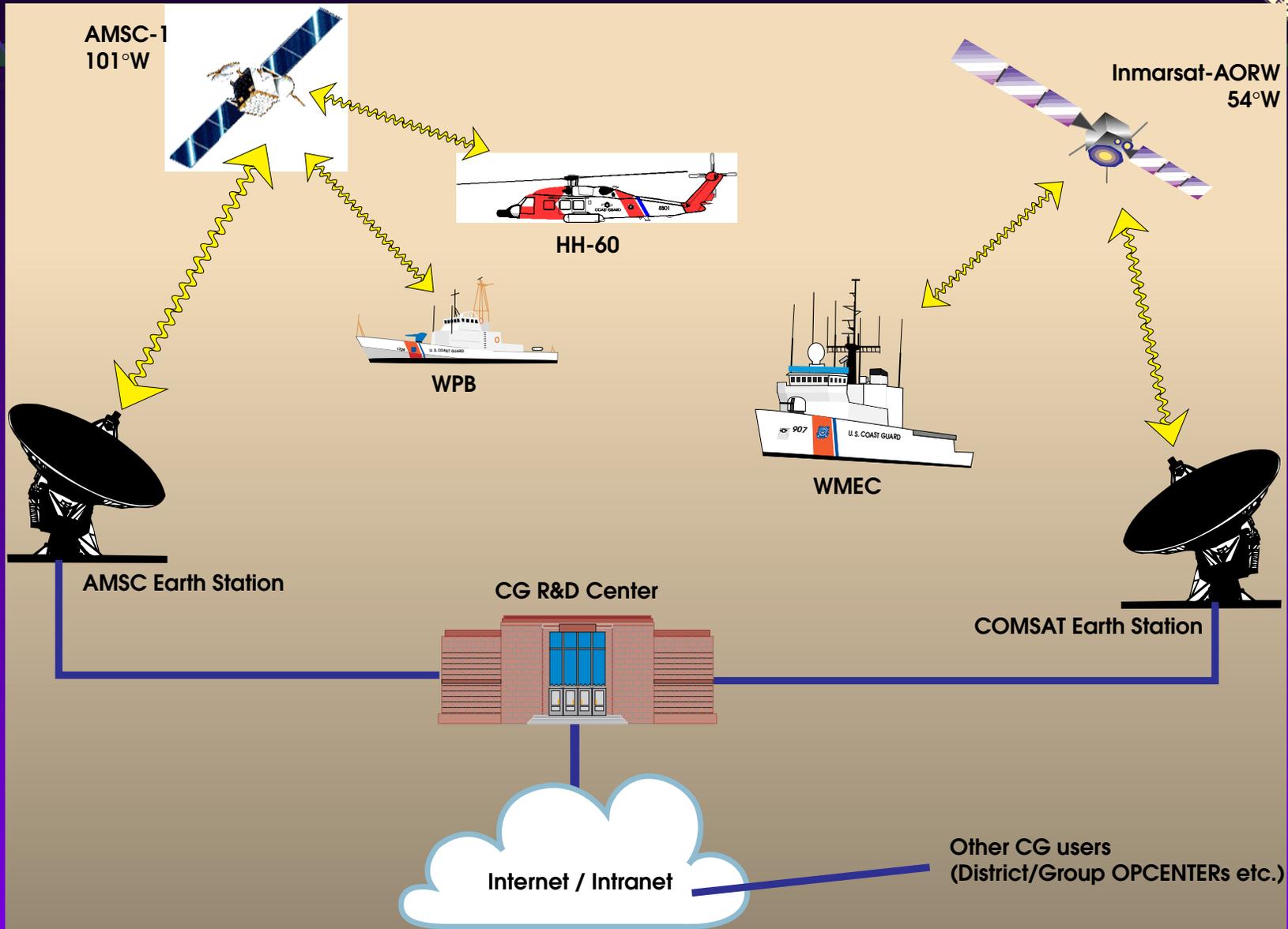


# OWL Solution



- Commercial Satellite Links
- Intranet architecture
- COTS
- Rapid prototyping

# OWL Concept Diagram





# Client-side



- **Hardware**

- ▣ *Communications Link*
  - PPP connection
- ▣ *Laptop computer*

- **Software**

- ▣ *commercial WWW browser*
  - TCP/IP over PPP
- ▣ *HTML forms*
  - pre-cached



# Communications Links



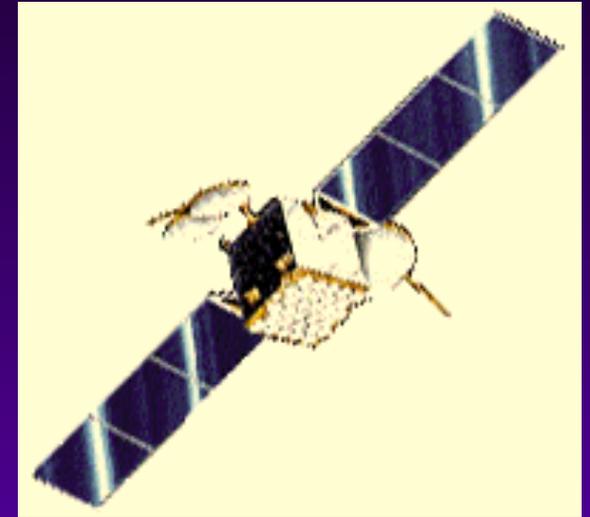
- Aircraft (HH-60 Jayhawk)
  - *AMSC*
- WMEC (270' and 210' cutters)
  - *Inmarsat-A*
- WPB (110' patrol boat)
  - *AMSC*
- Land (Airstation, District, Group, HQ)
  - *Dial-up or Network*



# AMSC



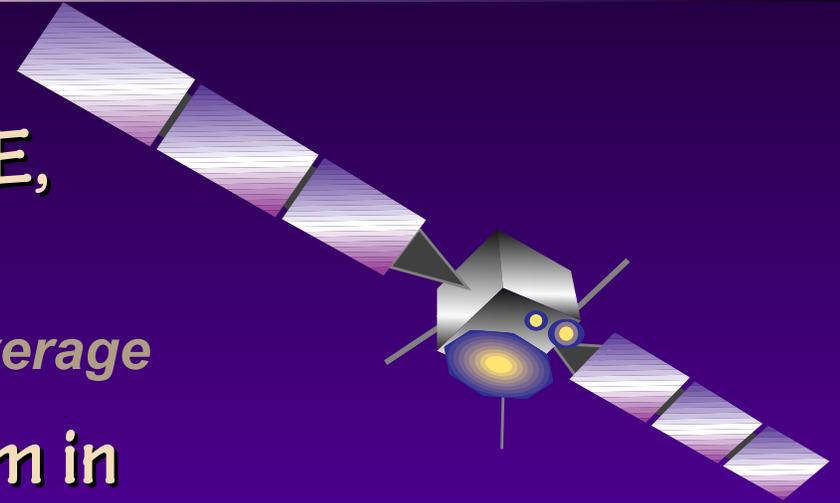
- L-band GEO satellite, 101°W
  - CONUS plus 200mi coverage
- Antenna ~.6m
- digital voice and data system
  - 2400/4800 bps
- usage cost of approximately \$1.50/min.



# Inmarsat-A



- L-band GEO satellite, AORE, AORW, IOR, POR
  - 4 satellites give worldwide coverage
- Maritime antenna is 1.244m in size
- analog voice and data capability
  - Channel rates of 12 kbps with V.34 modems
- usage cost of ~ \$6/min.



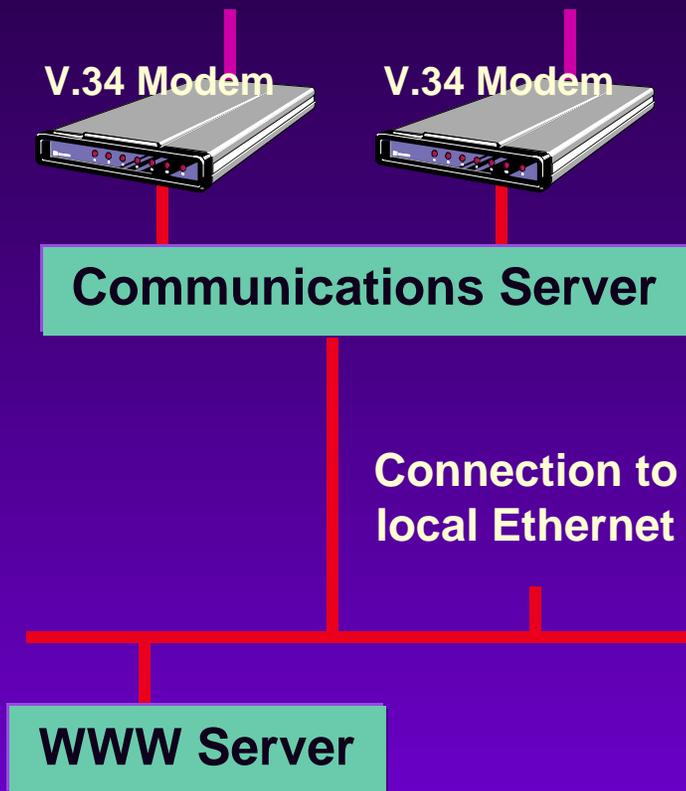


# Land connection



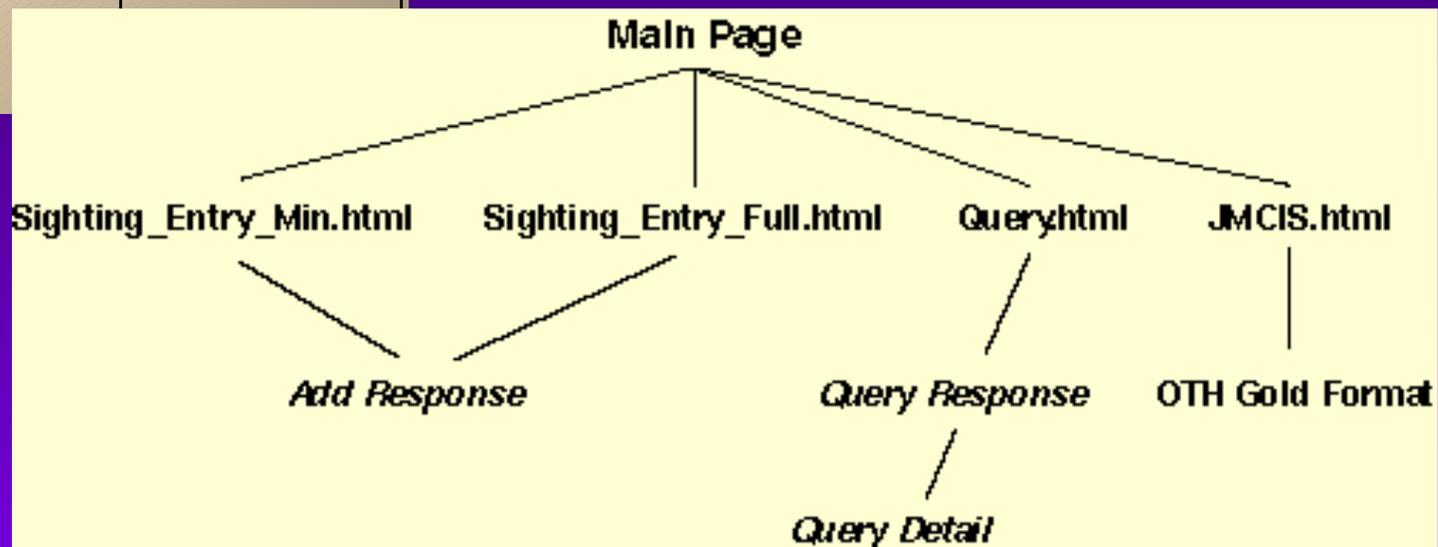
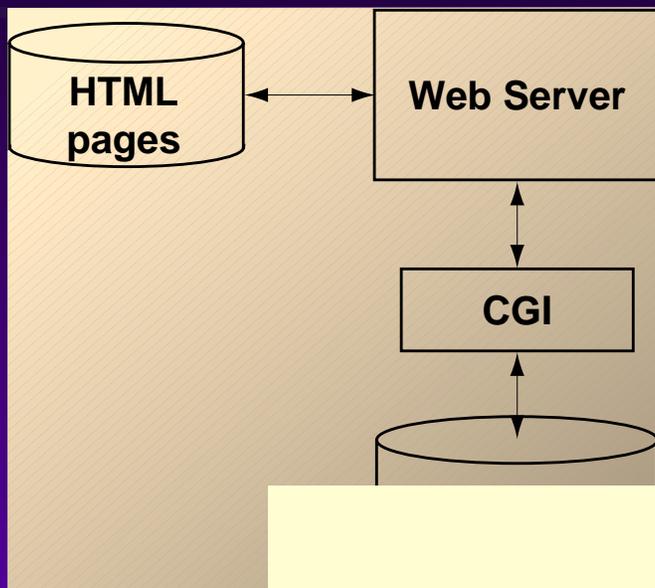
- Local connection to Internet
- Dial-up direct to RDC
  - ▶ *channel rates up to 33.6 kbps with V.34 Modems*

# Comms Server



- Pool of phone lines
  - *auto-forward on busy or no answer*
- Multiple modems
  - *V.34*
- Shiva RAS
  - *user name/password*
  - *access logging*
  - *STAC™ compression*
  - *pool of IP addresses*
- Quickstream RAS

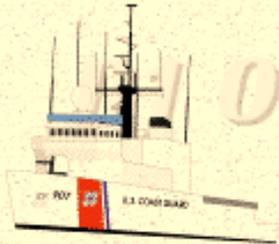
# Web Server



# OWL Home Page



## United States Coast Guard Research and Development Center First District Operational Web Link

	<p>Submit Vessel Sighting Report</p> <p><a href="#"><u>Minimum Report</u></a></p> <p><a href="#"><u>Full Report</u></a></p>
	<p><a href="#"><u>Query D1 Sightings Database</u></a></p>
	<p><a href="#"><u>Download Sightings in OTH-Gold Format</u></a></p>

# Sighting Entry



## Vessel Sighting Data Entry

For vessels already in the D1 Database

Unit <input type="text" value="AIRSTA Cape Cod"/>	Course <input type="text"/> (optional)
Document # <input type="text"/>	Speed <input type="text"/> (optional)
Latitude <input type="text"/> (ex. 3620)	Longitude <input type="text"/> (ex. 7001)
Activity <input type="text" value="Fishing"/>	<input type="button" value="Send Sighting"/> <input type="button" value="Reset"/>
Comments: <input type="text"/>	



[\[Minimum Sighting\]](#) [\[Full Sighting\]](#) [\[Query Database\]](#) [\[D1 ATI Home\]](#) [\[Help\]](#)



# Sighting Added Response



**Sighting Number 273 successfully added to the database.**

**This vessel was last boarded on 3/28/97**

**This vessel is on the Lookout List.**

# Query



## Search D1 Sightings Database

Sighting # <input type="text"/>	Vessel Type <input type="text"/>	<b>Find Sightings</b>
Latitude <input type="text"/>	Longitude <input type="text"/>	
Document # <input type="text"/>	Activity <input type="text"/>	On Hotlist? <input type="text"/>
<b>Clear Form</b>	Name <input type="text"/>	Unit That Sighted Vsl <input type="text"/>



[\[Minimum Sighting\]](#) [\[Full Sighting\]](#) [\[Query Database\]](#) [\[D1 ATI Home\]](#) [\[Help\]](#)

# Query Response



## D1 Database Query Result

*FOR OFFICIAL USE ONLY*

Sight #	Name	Vsl Type	Doc #	Lat	Long	Hotlist?	Date	Time
10	CONCORDIA	FTE	<a href="#">250168</a>	4127	6922	No	3/7/97	10:37
9		NON	<a href="#">68639840</a>	4050069	6906	No	3/7/97	10:09
8	CHALLENGE	FTS	<a href="#">293748</a>	4259.2	7002.6	No	3/4/97	16:42
7	KIRSTEN LEE	FTS	<a href="#">680488</a>	4306.5	7011.9	No	3/4/97	12:10
6	STELLA DEL MARE	FTS	<a href="#">625489</a>	4235.5	7032.9	No	3/4/97	09:35
5	SS MELLON II	FGN	<a href="#">509149</a>	4233.1	7039.1	No	3/3/97	20:11



# Linked Databases



- **Looked-up fields**

- ***NMFS Database***

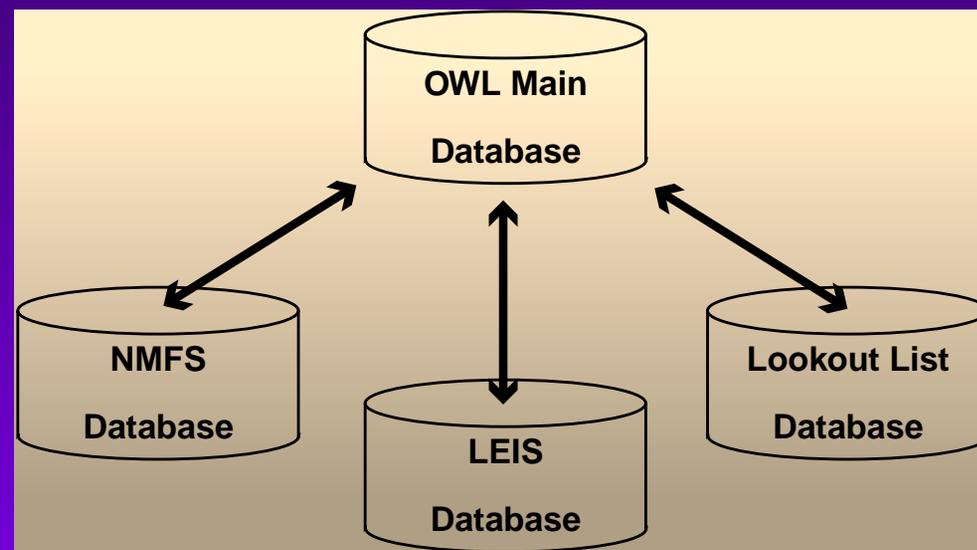
- name
- homeport
- state
- length
- NMFS permits and gear codes

- ***Atlantic Area Lookout List***

- Lookout Category and Number

- ***LEIS Database***

- hull and superstructure color
- vessel type
- flag
- date last boarded





# OWL Database Structure



- **Auto-entered fields**
  - *date, time, sighting number*
- **Calculated fields**
  - Zulu date and time
  - DTG
- **HTML fields**
  - Add Response
  - Query Response
  - Fisheries Table
  - Query Detail
  - NMFS Info
  - OTHG Format
  - LEIS entry



# Benefits



- COTS
- Simple Interface
- Easy data entry
  - *no codes to memorize*
  - *picklists*
- Responsive
  - pre-cached
  - only data transmitted



# Security



- **Server security**
  - *no FTP, TELNET, or SMTP*
  - *no file uploads or directory indexing*
- **Secure domains**
  - *IP filtering or user name/password to access*
- **Encrypted Transmissions**
  - *SSL server using 128 bit encryption*
  - *end-to-end encryption on a per-session basis*
  - *digital site certificate*



# Demonstration



- **Initial Demonstration**

- *March 1997*

- CGC Escanaba and CGC Monomoy
    - HH60's from Air Station Cape Cod
    - RDC, First District, Air Station, HQ

- **Numerous Briefings**

- *District, Area, HQ, COMDT*

- **Follow-on**

- *CGC Vigorous (April)*
  - *CGC Campbell (June)*



# HH60 Jayhawk





# USCGC Monomoy



# USCGC Escanaba



*IMSC, 18 June 1997*



# OWL User





# Performance Issues



- TCP/IP Overhead
- SSL Overhead
- Response Times
  - *Latency*
  - *Transfer time*
- Connect Times



# TCP/IP Overhead



- Handshaking protocol
  - *SYN, ACK/SYN, ACK sequence to open connections*
  - *ACK for received data*
- This is why link latency is the primary factor in the response time —not link speed



# SSL Overhead



- Need to establish the SSL connection once the TCP/IP connection opened
- RSA Digital Site Certificate needs to be transferred
  - *About 5 additional TCP/IP packets each direction*
  - *Site certificate is about 1300 bytes to be transferred*
  - *adds from 6-12 seconds depending upon link latency and speed*



# Latency



Communications System	min. (sec)	max. (sec)	avg. (sec)
Inmarsat-A	.82	1.2	1.0
AMSC (2400 bps)	1.92	2.43	2.22
AMSC (4800 bps)	1.65	1.95	1.79
Modem (2400 bps)	.69	.91	.80
Modem (14,400 bps)	.28	.63	.38



# Transfer Times



	AMSC (2400 bps)	AMSC (4800 bps)	Inmarsat-A
Submit Minimum Sighting	20 sec	18 sec	16 sec
Submit Full Sighting	20 sec	19 sec	17 sec
Query Database	32 sec/4 48 sec/11	31 sec/4 45 sec/11	20 sec/4 22 sec/11
Retrieve Full Report	29 sec	28 sec	17 sec



# Connect Times



- **Modem Init**
  - 5 sec
- **Satellite System Delay**
  - *AMSC—12-13 sec*
  - *Inmarsat—60 sec on Escanaba, 40 sec on Vigorous*
- **Modem connect phase**
  - 5-7 sec
- **RAS login**
  - *AMSC—20 sec*
  - *Inmarsat—15 sec*



# Conclusion



- *OWL works!*
- *Concept has been proven*
- *Well-received by operators and staff elements*
- *Improved operational effectiveness and efficiency*



# Acknowledgment



- **OWL Team**

- ▣ ***Don Cundy***
  - **MOTD Division Chief**
- ▣ ***LCDR Tom Pedagno***
  - **Project Management**
- ▣ ***Ned Reute***
  - **Human Factors**
- ▣ ***CWO Dennis Strock, Jon Turban***
  - **Aircraft Installations**
- ▣ ***LT Greg Johnson, ET1 Mark Wiggins***
  - **Telecommunications**



# Questions?



- E-Mail

[gjohnson@rdc.uscg.mil](mailto:gjohnson@rdc.uscg.mil)  
[mwiggins@rdc.uscg.mil](mailto:mwiggins@rdc.uscg.mil)

- Web Site

<http://comms.rdc.uscg.mil/>

- Mail

USCG R&D Center  
1082 Shennecossett Rd.  
Groton, CT 06340