

Unmanned Maritime Systems Growing Applications--Naval, Security and Commercial

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Agenda

- ❖ AMI Introduction, Presentation Objectives
- ❖ Opening Remarks
- ❖ Types of Unmanned Maritime Systems
- ❖ UMS Market Scope and Missions
- ❖ Future Outlook for UMS in Civil, Security and Naval Markets
- ❖ Closing Thoughts

Who is AMI? What Do We Do?

- ❖ U.S.-Based global naval market analysis and advisory
 - Tracking 93% of new naval procurement funds to be spent
 - By 151 Navies & Coast Guards
 - On 650 new build ship programs and all related systems:
 - *USV, UUV**
 - Plus records on 17,000+ hulls: 14000 existing + 3000 forecasted to be built to 2031
 - 26 years serving industry and governments worldwide

*If it's naval or security...
 And under/on/over the water...
 Or will be...
We count it*

Briefing Objectives

- ❖ To examine current drivers shaping the world market for unmanned maritime systems (UMS)
- ❖ To provide information on current and future UMS systems and capabilities
- ❖ To forecast future applications of UMS capabilities in commercial, security and military markets

Opening Remarks: Recent UMS Headlines

- “AUVs Aid in Discovery of Air France Flight 447 Wreckage in Atlantic”
- “Japan Coast Guard orders ISE Explorer AUV”
- “US-Japan Ocean Research Team uses ROVs to survey radioactivity levels in ocean off Fukushima”
- “US companies announce large order from Japan for chemical sensors...for UUVs in offshore radiation monitoring”
- “Egg-Sized UUV to scan danger in aging nuke plants”
- “Japan: Eco Marine Starts Development of Unmanned Surface Vessel”
- “Millions watch live ROV camera feeds from Leaking BP well”


UMS for Civil Infrastructure Security: On/Near Water

2008	Nuclear Plants	Nuclear % of Electricity	New Plants Under Construction
USA	104	9%	1
France	59	77%	1
Japan	55	28%	1
Russia	31	16%	6
South Korea	20	35%	3
UK	19	15%	0
Canada	18	16%	0
Germany	17	26%	0
India	17	3%	6
Bulgaria	2	32%	2
Argentina	2	6%	1
China	11	2%	6
Total	355		27





Defining Our Terms: UMS

- **“Unmanned Maritime Systems”** refer to:
- **“Unmanned Surface Vessels” (USV)**
- **Unmanned Underwater Vehicles (UUV)**
- **UUV further divided into**
 1. AUV (A=autonomous)
 2. ROV (R=Remote...tethered to the mothership)








Unmanned Surface Vessels: Comparative


Model	Common USV	Draco	Piranha	Spartan Scout
Manufacturer	AAI	GD	Zyex	USMI
Snapshot				
Length (m)	11.9	11.0	16.3	11.0
Beam (m)	3.12	3.4	3.2	3.2
Endurance (hrs)	24+	24	96	48
Displacement (kg)	8000	10430	3856	8000
Max Payload (kg)	1200	2267	6804	2267
Max Speed (km/hr)	28	34	45+	40+


Small UUVs: Comparative



Electric Glider



Hermes UUV



Spray



Jeddie



LUTUC



HUMAC 300



Kevlar


EcoMapper


Iver2


Fetch 2.9


Fetch 3.5


Seaglider

Name	Manufacturer	Weight (kg)	Diameter (cm)	Length (m)	Depth Max. (m)	Range (km)	Speed (m/sec)	Endurance
Electric Glider	Webb Research (Teledyne)	52	21.3	1.5	1000	1500	0.4	days
Thermal Glider	Webb Research (Teledyne)	60	21.3	1.5	2000	40000	0.4	5 years
Spray	Bluefin	52	n/a	n/a	1500	4000	n/a	6 months
Bluefin 9	Bluefin	50	23.5	1.7	198.12	n/a	2.57	13 hours
CETUS	Lockheed Martin	100	8	1.8	4000	40	2.57	n/a
REMUS 100	Hydroid (Kongsberg)	37	19	1.6	100	n/a	2.6	22 hours
Galva	Halmind	44	n/a	1.7	200 (1000)	n/a	3	n/a
EcoMapper	OceanServer Technology	20.41	14.73	15.2	n/a	n/a	2.06	8 hours
Iver2	OceanServer Technology	20	14.73	1.26	n/a	n/a	2.06	10 hours
Fetch 2.9	Sias Patterson (Prizm)	73	29	1.96	150	92.6	6.5	20 hours
Fetch 3.5	Sias Patterson (Prizm)	98	35	2.1	150	229	5	30 hours
Seaglider	iRobot	52	30	1.8	1000	4600	25	n/a

Range and Mission Demands for larger UMS

- **Commercial and Security/Military Customers seek larger UMS to for larger cargoes, longer ranges, deeper dives:**
 - **USV:** From 7M RHIB to more robust/longer range hulls 11-16M...with new materials to lighten ship
 - **UUV:** From original torpedo form to “large diameter” UUVs
- **Technical Challenges Limiting Vehicle Growth:**
 - Launch/Recovery still the hardest bit
 - Followed closely by C2/autonomy

UMS Future Market Scenarios...

High: 8.8B 2008 USD total revenues (Military/Comm) by 2020
Bharat Book Bureau (India)

Mid: 1.8-3.7B annual market (Mil/Comm) 2018
Douglas-Westwood (UK)

Low: 500M annual sales (Mil) by 2017
Frost & Sullivan (US)

Our View: Most UMS Market Growth Forecasts Remain Overoptimistic ...Especially WRT Military Market

Most Global Military UMS Spending will still be US...but procurement spending growing in Asia-Pacific region, which will become big UMS market by 2020

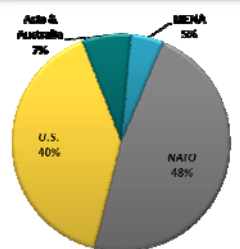
Current UMS Market Snapshot-UUV

- **UUVs: Existing Market Population = 6000+ ROV, 400+ AUV**
 - ✓ Commercial UUVs make up 70-80% of total existing market
 - ✓ ROVs in the oil and gas industry last 30 years
 - ✓ 3 UUV Types/Segments:
 - Large: Comm/Research/Oil & Gas
 - Medium: Research/Mil/Oil & Gas
 - Small: Research/Mil: Half of all AUVs are <50KG
 - Today's Military UUV market: mostly AUVs for Mine Warfare
- ❖ **Military AUVs =25% of current global AUV inventory**
- ❖ **Military AUVs: portable and/or “Gliders”—torpedo heritage**
- ❖ **Industry seeing some growth potential—M&A up last 5 years:**
 - Hydroid (Kongsberg)
 - Bluefin (Batelle)
 - Sea Glider (iRobot)
 - Webb Research (Teledyne)
 - Sias Patterson (Prizm)
 - Seeye (Saab)

Current UMS Market Snapshot-USV

Key Manufacturer Countries by Known USV Models

Asia & Australia	6
Japan	2
Singapore	3
Unknown	1
Middle East & North Africa	4
Israel	4
NATO	39
Canada	6
France	6
Germany	3
Norway	2
Portugal	2
Sweden	2
Turkey	2
U.K.	16
United States	34
Total	83



Identifying UMS Capability & Market Gaps

4 USV Classes as Defined by U.S. Navy

USV Mission	X-Class (small)	Harbor Class (7M)	Snorkeler Class (7M SS)	Fleet Class (11M)
Mine Countermeasures (MCM)		MCM Delivery, Search/Neutralization	MCM Search, Towed, Delivery, Neutralization	MCM Sweep, Delivery, Neutralization
Anti-Submarine Warfare (ASW)			Maritime Shield	Protected Passage & Maritime Shield
Maritime Security		ISR/Gun Payloads		7M Payloads
Surface Warfare (SUW)		SUW, Gun	SUW (Torpedo)	SUW, Gun & Torpedo
Special Operation Forces (SOF)	SOF Support	SOF Support		Other Delivery Missions (SOF)
Electronic Warfare		Other ID	High Power EW	High Power EW
Maritime Interdiction Operations (MIO) Support	MIO USV for 11M L&R	ISR/Gun Payloads		

Primary Missions supported by

X-Class	Harbor Class	Snorkeler Class	Fleet Class
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Secondary Missions of each class that are possible

USV Market Segments: X-Class USVs

- ❖ 3 meters in length or smaller
- ❖ Small, special purpose craft; not standardized for modularity
- ❖ Limited endurance, payload, and sea-keeping ability

X-Class USVs

X Class

- No Internal standardization
- Maximum Size 3M
- Deployable from an 11M RIB or CRRC
- MRO, SOF Support and Special Purpose
- Endurance to several hours, limited payload

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USV Market Segments: Harbor Class USVs

- ❖ 7 meter RIB with moderate endurance
- ❖ Hosted by warships to perform maritime security and ISR missions
- ❖ ISR payload is arch-mounted such that it can remain in place for manned operations of craft

Harbor Class USVs

Harbor Class

- 7M Size (RIB)
- 35+ knots
- 12 hour typical endurance
- ISR / Com Payloads
- Maritime Security is the driving mission

Also capable of supporting:

- MCM
- ASW
- SUW
- MIO
- SOF

Trailable with a 10 Ton pickup

Deployable on all decks with the 7M P115 structure

- DDG / CGC
- MCM
- etc.

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USV Market Segments: Snorkeler Class USVs

- ❖ 7 meter semi-submersible
- ❖ Need driven by MCM & ASW missions
- ❖ Submerged during operation with only snorkel above surface
- ❖ Provides more stable platform in high sea states than other surface hull types

Snorkeler Class USVs

Snorkeler Class

- 7M Semi-Submersible
- 15+ knots

Also capable of supporting:

- ISR
- MCM Delivery
- ASW Maritime Shield
- SUW (Torpedos)

24 hour typical endurance

Towed Payloads: mine Search & the driving mission

Deployable on a DDG and CGC

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USV Market Segments: Fleet Class USVs

- ❖ 11 meter planing or semi-planing hull craft
- ❖ Moderate speed & endurance when towing MCM sweep gear
- ❖ High speed/very long endurance when supporting ASW, SUW, or EW missions

Fleet Class USVs

Fleet Class

- 11M Size (purpose built, not a RIB)
- 30-35 knot (max) (30-35 knot)
- 30-35 knot (max)
- 26-28 knots (cruising)
- 48 hour typical endurance
- Towal / Dropped / Launching Payloads

Also capable of supporting:

- MCM Delivery / Resupply
- ASW
- EW
- Other Delivery Missions (VOP)

Deployable on LCC

Supporting LCC vessel (not on deck) to allow use of mid-deck beam. Very well made a large difference in performance. Support 2000 payload vs about 1000 payload on LCC.

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