



Global Submarine Overview

Naval Market Perspectives

AMI International
UDT 2018– Glasgow, Scotland
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- **Global naval market analysis and advisory firm**
 - Industrial analysts creating strategies from the bottoms-up approach
- **Staff of experienced US and Int'l Navy & Industry:**
 - Continually track 93% of naval procurement funds to be spent next 20 years (Since 1992)
 - By 81 Countries Navies & Coast Guards
 - 586 new build ship programs
 - 1,000+ ship modernization programs
 - All related systems
 - In database with 15,000+ hulls:
 - 13,000 existing
 - 3,200 to be built to 2036

Global Perspective

- Product specific
- Growth focused

Country/Region & Product Strategies

- Where competitors are weak
- Where market potential is high

Market Opportunities

- Near term (next 5 years) and long-term projections (next 10-20 years)
- Identifying where to invest

Excellence in identifying near term opportunities and providing capture advantage to industry.



AMI's Network

- More than 10,900 key navy staff and industry contacts in 70 countries.
- Plus 70+ naval experts in 55 countries providing regular market insight.
- Senior Advisory Group—currently 20+ retired Admirals/Industry Executives from US and other countries—available to support specific engagements.
- Regular insider discussions with MOD and naval staffs, naval industry, think tanks, academia.
- At most major naval exhibitions worldwide, teamed with leading conference producers to deliver insight on global naval markets:
 - IMDEX (Singapore)
 - DIMDEX/IDEX (Qatar/UAE)
 - EURONAVAL (France)
 - MAST (Global)
 - Naval Systems Seminar (Turkey)
 - UDT (Global)

Industry:
Systems Houses &
Shipyards

Acquisition
Organizations

Chiefs of Navy, Naval
Headquarters Staffs

Academia, Media
Trade Shows

Parliaments,
Legislatures and
Congresses

Data driven analysis confirmed by unique sources = unbiased Insight



Asia Pacific

- Fastest growing region for naval expansion – China, South Korea, Australia, Japan, Taiwan
- China – The South China Sea land grab is the foundation of maritime tensions in the Asia Pacific – three islands are being heavily outfitted with sensors, and anti-air and anti-ship missiles.
- North Korea's change in posture could become a bright spot in the region. It will take time to implement the changes that could positively influence the Asia geopolitical landscape.

Europe

- Pressure from US to raise military spending; pol/mil perception gaps between west and east Europe have ended – Romania and Bulgaria looking to significantly expand defensive capabilities.
- Russian naval/hybrid/strategic power growing in numbers and capability.
 - ❑ Continuing real world operations lessons and experience from Syria, Ukraine.
 - ❑ Recent exercises and political statements affirm intentions to be viewed as a world leader.

Middle East

- Production limits not pushing oil prices higher – constraints on military spending.
 - ❑ World energy market has greater supply base, more self-sufficiency in places (U.S.)
- Wars in Yemen, Iraq, Syria, frictions in GCC are political strain, resource sink.

United States

- Budget Control Act and Sequestration will continue to cripple US military developments beyond 2019.

South America

- Political uncertainties, lagging economies slowing defense spending, new naval projects (Peru, Colombia frigate programs).
- Brazil still largest potential market, but political risk growing (new delays with every election).
- Chile defense spending still up and down with changes in copper market; modernization work ongoing.



Current World Naval Market Snapshot: *In-Service Ships*

<i>Existing Naval Market</i> <i>(Ships currently in Navy or Coast Guard service)</i>	Aircraft Carrier	Amphibious	Auxiliary	Corvette	Cruiser	Destroyer	FAC	Frigate	MCMV	OPV	Patrol Craft	Submarine	Totals
Asia & Australia	3	711	320	156	2	91	691	171	192	191	2162	245	4935
Caribbean & Latin America	1	110	133	29		1	31	45	15	57	1071	25	1518
Middle East & North Africa		140	73	50		2	231	24	36	28	904	42	1530
NATO	3	232	370	46		19	98	127	201	87	994	83	2260
Non-NATO Europe		122	58	9			32	5	47	16	196	5	490
Russia	1	55	270	30	4	14	111	20	42	39	234	68	888
Sub Saharan Africa		27	17	1			31	7	7	26	405	3	524
USA	11	202	149	1	22	66		20	11	27	188	70	767
Totals	19	1599	1390	322	28	193	1225	419	551	471	6154	541	12912

- Naval ships in service down 24% over last decade – Cold War legacy platforms reaching end of life.
- With fewer naval vessels available, Navy customers are looking for more flexibility in new ships – reconfigurable, multi-mission, “hybrid” platforms.



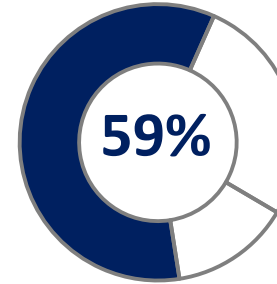
Current Submarine Market Overview

<i>Current Submarine Market</i>	Other	Conventional			Nuclear			Totals
<i>Region</i>	Mini Subs / SDVs	<u>Coastal</u> under 1000 FLD	<u>Small-Med</u> 1,500-2,500 FLD	<u>Large</u> above 2,500 FLD	SSN	SSBN	Other	# of Active Subs
Asia & Australia	53	25	100	55	6	6		245
Caribbean & Latin America		2	23	-				25
Middle East & North Africa	21	1	13	7				42
NATO	2	2	52	6	13	8		83
Non-NATO Europe			5					5
Russia				26	19	13	10	68
Sub Saharan Africa			3					3
USA					52	14	4	70
Totals	76	30	196	94	90	41	14	541

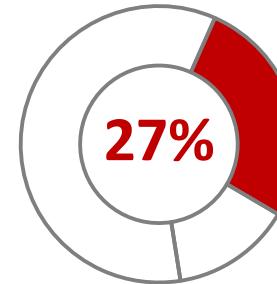


Current Submarine Market Metrics

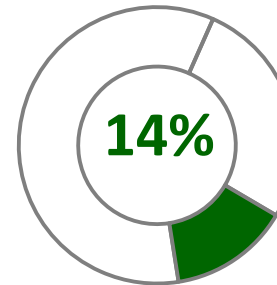
- **World's existing conventional submarine fleet is aged – many hulls nearing or beyond effective service lives.**
 - ✓ 40% of all active conventional subs tracked by AMI have 25 years or more of service (commissioned before on or before 1993).
- **Current “core” existing SSK market made up mostly small-medium sized (1500-2500t) platforms.**
 - ✓ This size segment represents 60% of the conventional sub market, and 36% of the world total sub market (nuclear + conventional).
- **Smaller coastal subs (less than 1300t) make up almost 1/4 of the conventional sub market.**
 - ✓ Small hulls remain attractive to regional navies as simpler/cheaper alternatives to larger mid-sized/larger designs.
 - ✓ ...also “optimized” for operations in confined/defined littoral sea space for coastal defense and “Anti-Access” (Persian Gulf, South China Sea, Korea).
- **Nuclear submarines account for 27% of overall current sub market.**
 - ✓ Players → US, Russia, UK, France, China, India
 - ✓ Brazil, South Korea, Pakistan?



**59% of Existing
Subs are
Diesel-Electric**



**27% of the
Existing Sub
Market is
Nuclear
Powered**

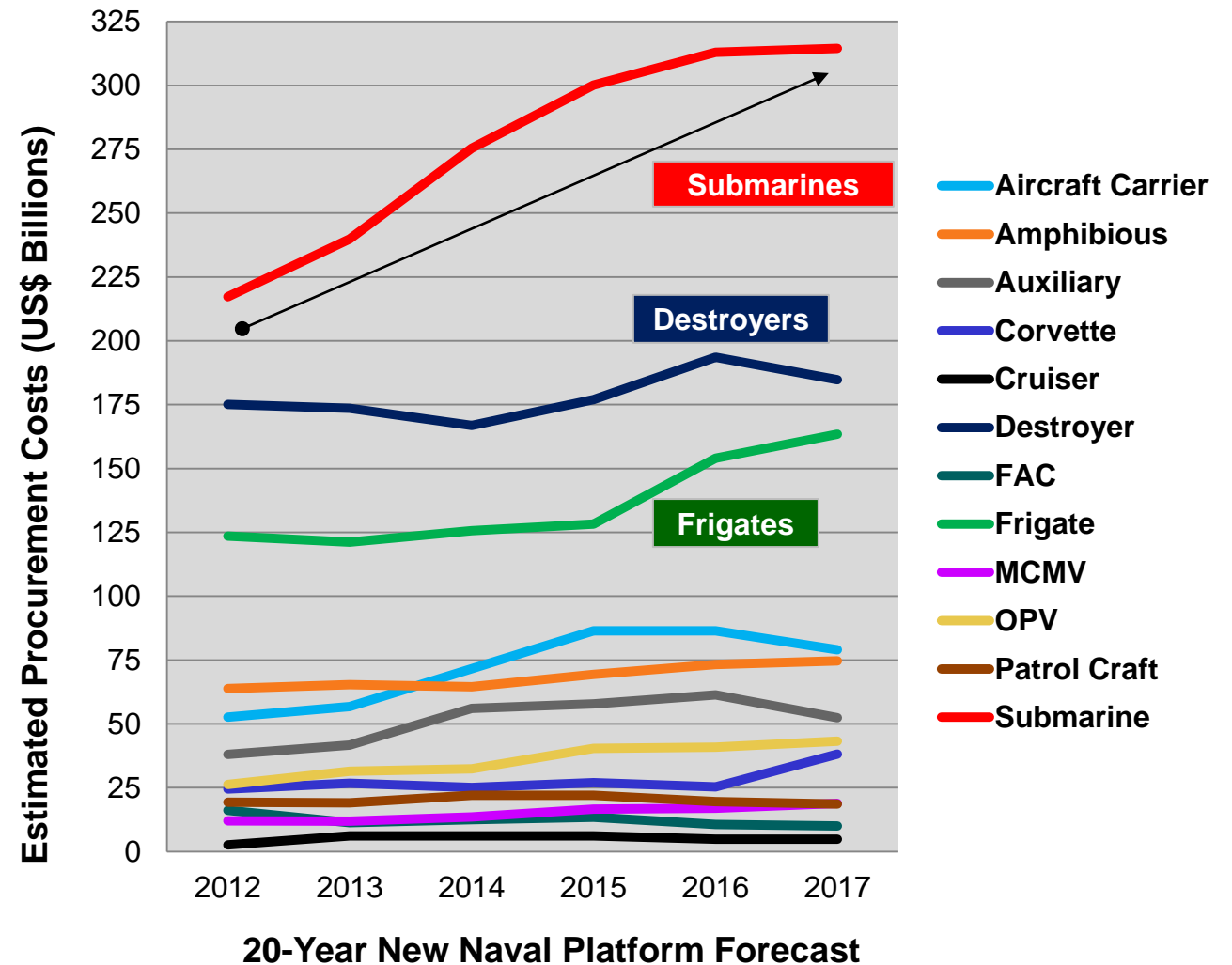


**14% of the
Existing Sub
Market are Mini
Subs & SDVs**



Submarine Threat – Growth Drivers & Trends

- AMI's most recent projections show **new submarine procurements (US\$311B) accounting for almost 1/3 of all forecasted global naval spend thru 2037.**
- **Future spend forecast on sub procurements up 45% (almost US\$100B) since 2010** – most growth in firm “planned” programs...govts allocating budget, formalizing requirements and schedules, starting concept design / development for new hulls.
- **Also seeing new entrants exploring sub acquisitions.**
- Others recapitalizing existing sub capability.




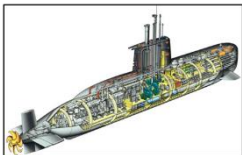









First-Time* Submarine Operators	Submarine Operators with Expanding Fleets	Conventional Submarine Operators with plans to add Nuclear
Azerbaijan	Australia	Brazil
Bangladesh	Algeria	India**
Malaysia	China	Pakistan
Singapore	Egypt	South Korea
Thailand	India	
Vietnam	Indonesia	
Canada	Pakistan	
	Russia	
	South Korea	
	Turkey	
*Over the last decade		**One SSBN already built – <i>Arihant Advanced Technology Demonstrator</i>



Leading Submarine Exporters (SSKs)

France 	Russia 	Germany 	Sweden 	China 
Naval Group (formerly DCNS)	Rubin / Admiralty	ThyssenKrupp / HDW	Saab / Kockums	Wuchang Shipbuilding Industry Corporation
Scorpene 	Kilo 	Type 209 / 1400 	AS26 SSK 	S26T (Thailand) 
Shortfin Barracuda 	Amur 	Type 212 		
		Type 214 		
		Type 216 		



World Naval Market Forecast: *New Build Hulls (2018-2037)*

<i>Forecasted New Builds</i> <i>Estimated Ships to be Procured by Navy or Coast Guard service thru 2037</i>	Aircraft Carrier	Amphibious	Auxiliary	Corvette	Cruiser	Destroyer	FAC	Frigate	MCMV	OPV	Patrol Craft	Submarine	Totals
Asia & Australia	8	74	51	45	6	37	110	141	76	125	240	112	1025
Caribbean & Latin America		10	13	4		3		20	6	32	144	13	245
Middle East & North Africa		12	15	15			28	23	21	13	174	23	324
NATO	1	20	72	23		40	12	46	49	69	113	63	508
Non-NATO Europe		3	3				7	10	9	4	17	6	59
Russia		8	7	6			27	30	29	15	13	42	177
Sub Saharan Africa		4	1				7			5	39		56
USA	3	158	41	38				41		30	128	45	484
Totals	12	289	203	131	6	80	191	311	190	293	868	304	2878

- Global defense engagements driving amphibious builds.
- Navies seeking cost savings by shifting missions to lower cost auxiliaries and OPVs.
- Fast Attack Craft (FACs) - new (lower cost) weapons systems providing greater maritime coverage.
- Submarines – undersea environment will become a congested maritime area.



Future Submarine Market Overview *New Build Hulls (2018-2037)*

<i>Future New Build Sub Market</i>	Other	Conventional			Nuclear			Totals
<i>Region</i>	Mini Subs / SDVs	<u>Coastal</u> under 1000 FLD	<u>Small-Med</u> 1,500-2,500 FLD	<u>Large</u> above 2,500 FLD	SSN	SSBN	Other	# of New Subs
Asia & Australia	15		40	36	13	8		112
Caribbean & Latin America			12		1			13
Middle East & North Africa		4	19					23
NATO	8		27	12	10	6		63
Non-NATO Europe			6					6
Russia				18	14	10		42
Sub Saharan Africa								0
USA	6				32	7		45
Totals	29	4	104	66	70	31	0	304
Forecasted Acquisition Spend	US\$981M	US\$99B			US\$211B			\$311B

- Asia-Pacific nations projected to procure more subs than any other region in the world over the next two decades.
- Almost US\$100B forecasted to be spent on conventional submarines, with 60% estimated to fall in the small-medium sized category (1500-2500 FLD).



Increases in Submarine Investment Worldwide

Region	2012 20-Year Forecasted Sub Investment (US\$B)	2018 20-Year Forecasted Sub Investment (US\$B)	6-Year Change
Asia & Australia	63.2	80.9	28%
Caribbean & Latin America	7.8	6.7	-14%
Middle East & North Africa	8.2	10.3	26%
NATO	50.0	62.8	26%
Non-NATO Europe	1.8	2.4	33%
Russia	10.4	29.4	183%
Sub Saharan Africa			
USA	74.6	118.6	59%
Totals	216.1	311.1	44%

- **Asia-Pacific:** Spend is over 25% of global 20-year forecasted sub investment. Regional/emerging navies want subs (mostly conventional) to enhance strategic deterrence – China.
- **Latin America:** Brazil leading the way with Scorpene SSKs (w/ DCNS assistance). SSN – still planned – but has been slow to start. Chile, Colombia, Ecuador, Peru all have SSK requirements.
- **MENA:** Iran's large investment in small subs, build up of swarm boats and mini-SDVs continue to drive GCC to look at subs. Increasing demand for both coastal/conventional and special purpose subs.
- **Russia:** Economic growth & stabilization since 2009 global crisis due to oil revenues. Resurgence of investment in sub design & development leading to large growth in new advanced submarines.

- Increasing concerns in export economies about threats to global sea trade routes. Submarines are perceived as a serious and growing threat to those routes. Provides strong justification for ASW as a naval investment priority.



“Top 10” Sub Spenders

Country/Region	2012 20-Year Sub Investment (US\$B)	2018 20-Year Forecasted Investment (US\$B)	% of Region (2018)	6-Year Change
United States (US)	74.6	118.6	100%	59%
India (Asia-Pacific)	18.4	31.0	38%	68%
United Kingdom (NATO)	27.3	29.6	47%	8%
Russia (Russia)	10.4	29.4	100%	183%
S. Korea (Asia-Pacific)	7.0	12.3	15%	76%
France (NATO)	7.8	12.2	19%	56%
Taiwan (Asia-Pacific)	8.0	8.7	11%	9%
Turkey (NATO)	2.7	7.1	11%	163%
Japan (Asia-Pacific)	7.5	6.2	8%	-17%
China (Asia-Pacific)	6.0	5.8	7%	-3%
Australia (Asia-Pacific)	9.0	4.8	6%	-47%**
“Top 11” Totals	178.7	265.7		49%

- **US** – Virginia class attack subs, SSBN(X)
- **India** – SSBN, Project 75, Future SSNs
- **UK** – Astute SSNs, Dreadnought SSBNs
- **Russia** – 4 sub programs in-progress, plans for 5th Generation SS and SSBN
- **South Korea** – Son Won II (KSS-2) and Jangbogo III (KSS-3) Class subs, plans for Future SSN
- **France** – Barracuda SSNs, 3G SSBN planned
- **Taiwan** – Future Indigenous Defensive SSK
- **Turkey** –Type 214 SSKs, Planned Indigenous MILDEN
- **Japan** –Modified Soryu underway, Planned 3000-ton SS
- **China** – Truncated Yuan Class (Type 041) at 12 due to continuing problems. SSNs and SSBNs also in-progress.
- **Australia** – Shortfin Barracuda Class SSKs (SEA -1000).
**Only 4 of the 12 hulls fall into AMI’s 20-year forecast.



- **Significant MPA investment**
 - MPA as multi-role asset – easier to justify, more affordable for tight budgets
- **ASW Helicopters – down last 8 years**
 - General purpose airframes preferred (AW, MH-60)
 - Unmanned VTUAV not a full replacement
- **Surface Ship ASW**
 - Majority of primary ASW surface ships built over last 20 years
 - Most prior to 2008-15 economic recession
 - Significant modernization opportunities from this “pause” in ASW platform and system spend
- **Unmanned Vehicles (Surface, Air, Underwater)**
 - Navies seeking lower cost, higher endurance solutions
 - Getting humans out of high risk environments
- **Underwater Networks**
 - Seeing growth in this segment
 - Solutions are country and even local/littoral specific
 - Some new deep water projects

ASW Related Spend – Next 10 years



Maritime Patrol Aircraft – US\$50B



Shipborne Helos – US\$25B



Surface Ship ASW – US\$123B



Supporting ASW Assets US\$2.3B



Unmanned Vehicle Solutions – US\$3B



Underwater Netted Sensors – US\$10B

Forecasted ASW spend is greater than new-build sub investment over the next 10 years.



Impact from Submarine Proliferation – Shipboard Self-Defense

- Changes in the environment over the next decade will be significant with expanded submarine operations and threat from submarine launched ASMs.
- Requires advances in Sensors/EW/ECM/ISR and defense solution robustness from detection to engagement.
 - Supersonic sea-skimming long-range ASMs are the most difficult threat.
 - Pop-ups will demand rapid/robust reactions.
 - Unmanned Air/Surface drones – unique solutions demanded



USS Stark hit by an Exocet ASM



**Russian KALIBER
(boosted KLUB
missile)**



**Russian ZIRCON
Hypersonic**



PLAN YJ-82



India Brahmos



Fr SCALP



Fr Exocet