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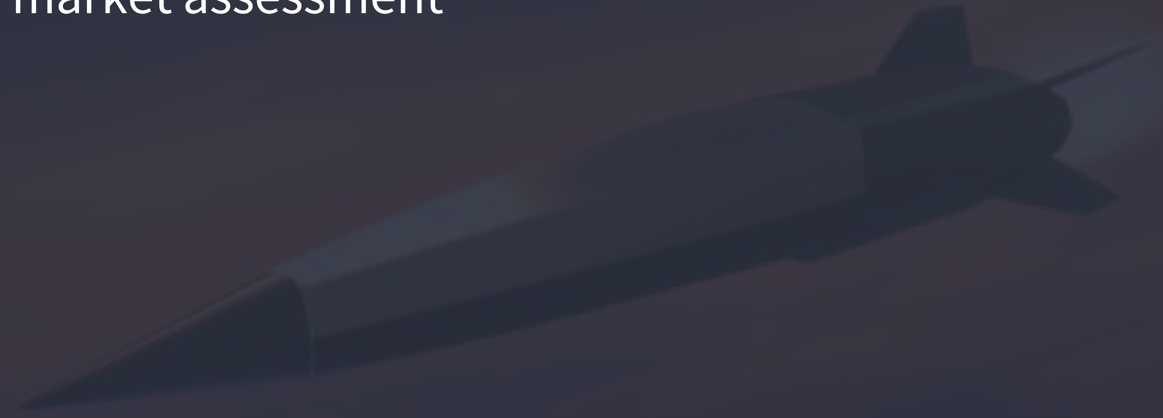
Global guided missile market assessment



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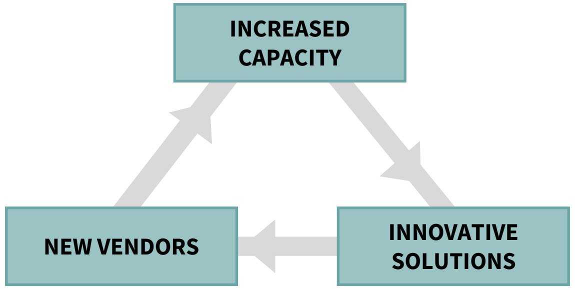
Global guided missile market evolution

The global market for tactical guided missiles is rapidly changing with new vendors threatening to displace established market leaders. Industry participants must ensure their strategies shape the market and influence future dynamics

MARKET EVOLUTION

Increased threats	Russian invasion & Chinese posturing elevating the threat environment
Lessons learned	Ukraine demonstrating new ways to address threats & expand capabilities
Novel technologies	Development of new technologies shaping strategies, CONOPS, & tactics of the future
Growing demand	DOD & MOD customers are increasing spending on guided missiles

MARKET IMPACT



INCREASED CAPACITY	• Customer demand requires increased capacity • Industry challenged to overcome supply constraints & meet demand
INNOVATIVE SOLUTIONS	• Industry developing novel technologies to counter advanced threats • Increased range, speed, & survivability; Loitering munitions
NEW VENDORS	• New vendors emerging to threaten legacy market leaders • M&A, JVs, & partnerships increasing as vendors invest to win share

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Research focus

BCE has analyzed the global market for tactical guided missiles within the U.S. and allied nations. Our analysis excluded ICBMs, nuclear weapons, and weapons produced by or sold to trade restricted states (e.g., Russia, China, Iran)

MARKET DEFINITION:

DOD Definition of Guided Missiles: *Unmanned vehicles moving above the surface of the Earth whose trajectory or flight path is capable of being altered by an external or internal mechanism*

MUNITION TYPE	TARGETS	CAPABILITIES	CUSTOMERS
FIELD ARTILLERY	SURFACE	NETWORKED	US
SHORT RANGE GUIDED	AIR	ANTI-ARMOR	US ALLIES
MEDIUM RANGE GUIDED	MOBILE	ANTI-EW/CYBER	US TRADE-RESTRICTED
LONG RANGE GUIDED	MISSILE	ANTI-A2/AD	
HYPERSONIC GUIDED			
BALLISTIC MISSILE DEFENSE			
ICBM / NUCLEAR			

INCLUDED

EXCLUDED

KEY DOD PROGRAMS:

- *AARGM-ER*
- *Air Launch Cruise Missile (ALCM)*
- *AMRAAM*
- *AVENGER*
- *Conventional Prompt Strike*
- *Evolved Sea Sparrow Missile (ESSM)*
- *Javelin*
- *Joint Air-Surface Standoff Missile (JASSM)*
- *Joint Air-to-Ground (JAGM)*
- *Joint Strike Missile (JSM)*
- *Long Range Stand-Off Weapon*
- *LRHW*
- *LRASM*
- *Mid-range Capability (MRC)*
- *MLRS / GMLRS*
- *Naval Strike Missile (NSM)*
- *Patriot / PAC-3*
- *Precision Strike Missile (PRSM)*
- *Hellfire Missile*
- *Sidewinder (AIM-9X)*
- *SM-3*
- *SM-6*
- *Small diameter Bomb*
- *Stinger*
- *Tomahawk*
- *TOW*

Example list of key programs – Not exhaustive

Macro trends

Active conflict in Ukraine and Indo-Pacific threats are driving global militaries to review defense strategies and update guided weapon priorities to align to the modern battlefield

ENHANCED CAPABILITIES:
Increased precision, range, speed (time to target), lethality, & survivability

LOITERING WEAPONS:
Development & deployment of loitering weapons for missions previously dedicated to missiles; Improved ISR capabilities

INCREASED AFFORDABILITY:
Reduced production & lifecycle costs

EXPANDED PRODUCTION BASE:
Greater quantities of guided missiles

ADDITIONAL PROPULSION SUPPLIERS:
Incumbents & new entrants via M&A look to increase rocket propulsion availability

VERBATIMS

*"**Loitering weapons** are useful if you're not quite sure if a target is on the move or what specific element of a larger target you want to hit. You can 'hang around' and figure it out. They can be small and cheap, and **quantity matters**. Loitering weapons cover more ground from an **ISR** standpoint, and they're highly controllable. The tide is shifting towards loitering weapons as **multi-mission force multipliers**."*

– Boeing, Former VP/GM, Autonomous Systems

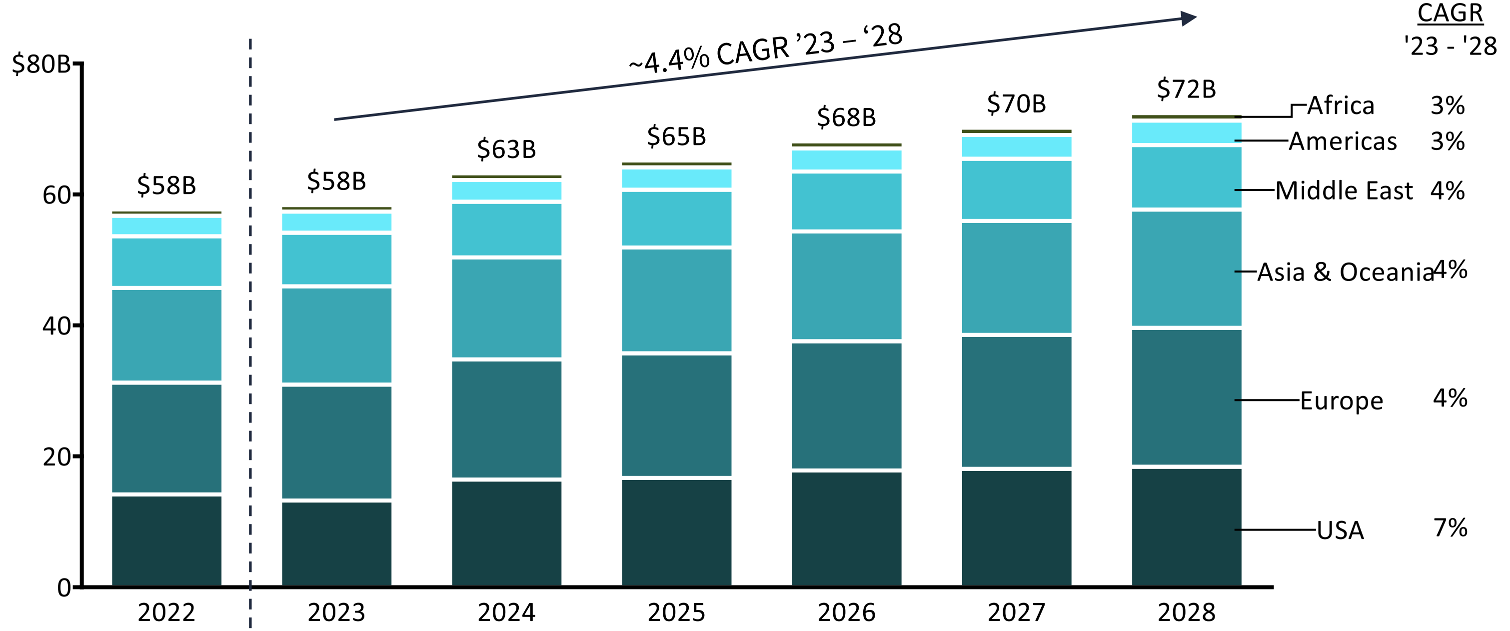
*"What we're seeing in Ukraine isn't just one missile shooting at one target. We're seeing **large scale missile raids** of tens or twenties of missiles going for a number of targets, trying to overwhelm any defensive capability. Now think about China, who has thousands of defensive missiles littering their coast. You might need 500 different missiles to overwhelm a Chinese carrier strike group's defenses."*

– US Army, Former Executive Director, Army Strategy Board

Global market projection

In response to the evolving threat landscape, the global tactical guided missile market projects to grow at a 4.4% CAGR to $72B in 2028. Increased global tensions will drive OCONUS procurement growth with development spend highly concentrated in the U.S.

GLOBAL Guided Missile Market



	2022	2023	2024	2025	2026	2027	2028
USA	$14B	$13B	$16B	$17B	$18B	$18B	$18B
OCONUS	$44B	$45B	$47B	$48B	$50B	$52B	$54B

Market projection reflects initial FYDP analysis and extrapolation across addressable international customers. Additional research needed to refine OCONUS projections.

Global Trends

1. Geopolitics & military modernization driving global spend growth
2. European nations increasing stocks to counter Russian aggression
   a. *Prioritizing established, battle proven weapon systems*
3. INDO-PACOM nations focused on countering CCP aggression
   a. *New capabilities – enhanced range, speeds, & survivability*
4. MENA & Americas spend concentrated in subset of countries:
   a. MENA: *KSA, Israel, UAE, Turkey, Qatar, Kuwait*
   b. Americas: *USA, Canada, Brazil, Mexico, Colombia*

Foreign market initiatives

OCONUS allies and partner nations are responding to the macro geopolitical conditions with increased investment in future-focused guided missile programs, including upgrades to legacy guided missile arsenals and some targeted development initiatives

OCONUS FUTURE-FACING MISSILE DEVELOPMENT SNAPSHOT

COUNTRY	PROGRAM/MISSILE	VENDOR(S)	MISSION	DETAIL
Germany, Israel	EuroSpike / MELLS	Diehl Defence, Rafael Advanced Defense Systems Ltd., Rheinmetall	Anti-tank	• First used by Germany, currently used by several EU and NATO nations with a recent $236M order from Finland
Germany, Hungary, Italy, Spain, Sweden	FSRM	TBA, Diehl likely involved	Air to Air	• Concept & requirement development by 2030 for missiles to counter 5th & future 6th generation combat aircraft
France, India	70MM LGR	Thales, Bharat Dynamics Limited	Multi-mission	• Key armament for Indian Light Combat Helicopters • Lightest, shortest 70mm LGR (Laser Guided Rocket)
South Korea	New supersonic cruise missiles	LIG Nex1	Surface to ground Ground to surface Surface to Surface	• Test phase of key anti-ship capability enabler • Designed to give ROK an offensive advantage over China & North Korea
France	ASN4G	ArianeGroup, MBDA Missile Systems	Air-launched ground attack	• Expected to replace French ASMPs by 2035
France	V-MAX, V-MAX2	ArianeGroup, MBDA Missile Systems	Surface to surface Ground to surface	• Hypersonic glider development
Italy, UK, France	FC/ASW	Safran, MBDA Missile Systems, Rolls Royce	Deep strike & Anti-ship	• Two variants: 1) Subsonic, low observable; 2) Supersonic, highly maneuverable • Will replace Harpoon & Exocet anti-ship missiles, and air-launched SCALP missiles starting in 2028
Turkey	Atmaca	roketsan	Anti-ship	• Will replace US-made Harpoon missile as Turkey's standard anti-ship missile
Japan	'New SSM'	Kawasaki	Anti-ship	• Designed for island defense against China, Russia, North Korea • Includes modular warheads
Japan	Type 12 upgrades, sub-launched missiles	Mitsubishi Heavy Industries	Ground/air/ship to ship, submarine to ship	• Extended-range Type 12 and submarine-launched guided missiles highlight Japan's pivot to preemptive strike capability development

OCONUS Trends

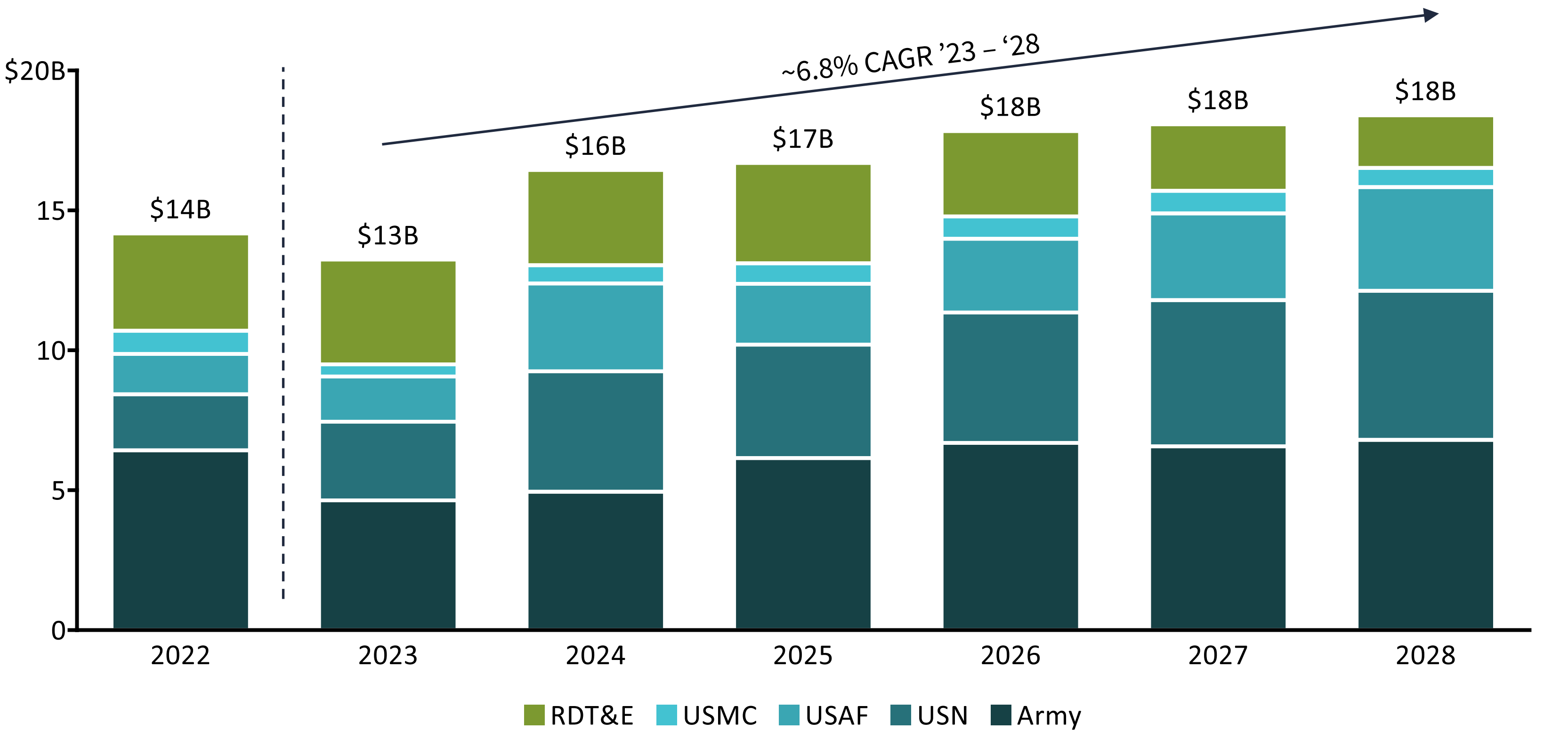
1. OCONUS initiatives aligned to region-specific threats
2. Russian (EUCOM) & CCP aggression (INDOPACOM) are pacing threats
3. Legacy systems → EUCOM
4. Innovative solutions → INDOPACOM
5. European countries relaxing local production requirements to counter urgent Russian threats

NOTE: Highlighted initiatives are representative & not meant to be exhaustive

DOD market projection

The DoD tactical guided missile market projects to outpace global market growth with an 6.8% CAGR from $13B in 2023 to $18B in 2028. Procurement of legacy systems and RDT&E investment in hypersonic development and weapons hardening will drive spend.

US DOD Guided Missile Market – *Procurement by service + RDTE*



Market projection reflects initial FYDP analysis. Additional research needed to refine outer year projections.

Market Trends

1. Procurement of legacy systems to replenish stocks
2. Procurement spend growing at 11% CAGR ’23-’28
3. RDTE targeting hypersonics, BMD, & system hardening
4. Largest spend categories include:
   - **a. Tactical Missiles:** Standard Missile, JASSM, AMRAAM, LRASM, SIAW, JSM
   - **b. Surface-to-Air Missiles:** Patriot, IFPC, PrSM
   - **c. Anti-Tank/Assault Missiles:** Javelin, TOW, MLRS
   - **d. Mods:** Tomahawk, Sea Sparrow, Patriot, AARGM, Stinger

DoD future multi-year initiatives

The DoD's FYDP includes key multi-year initiatives that will require long-term investment to realize service priorities

GMRLS

- Surface to surface rockets fired from MLRS and HIMARS launchers providing ability to engage critical deep threats with lethality and precision
- Quantity: 18,000
- Expected Savings: $67.7M (2.5%)

PAC-3 Missile Segment Enhancement (MSE)

- Surface to air missile counters tactical ballistic missiles and airborne threats with enhanced lethality/range/accuracy, a key enabler of Army Modernization Priorities for missile defense
- Quantity: Minimum of 692, up to 1,000
- Expected Savings: $79.9M (>3%)

ARMY PRIORITIES:

- Long range air and missile defense & strike

Large-Lot Procurement (LLP) for three MYPs:

- AMRAAM, JASSM, & LRASM group enhancement and procurement will improve efficiencies and yield to enable 'substantial' progress against DoD inventory objectives

AMRAAM

- Extended range, networked air to air missile

JASSM

- Networked air to ground missile

LRASM

- Networked air launched anti-ship missile

AIR FORCE PRIORITIES:

- Stand off weapons

NSM

- Over the Horizon NSM one of the core DON missile programs for LCS, Frigates, and Destroyers
- Quantity: Up to 516
- Expected Savings: $153.6M (13.6%)

SM-6

- SM-6 Block 1AU will upgrade electronics units and guidance packages over Block 1A
- Quantity: Up to 825
- Expected Savings: $508.2M (13.6%)

NAVY PRIORITIES:

- Stand off weapons
- Long range anti-ship weapons

DoD hypersonic initiatives

DOD’s committed investment in hypersonic initiatives across the services is highly concentrated in three vendors: Lockheed Martin, Northrop Grumman, and Raytheon. Increased survivability is needed to support hypersonic proliferation

FUTURE-FACING MISSILE DEVELOPMENT SNAPSHOT

CUSTOMER	PROGRAM	VENDOR(S)	MISSION	DETAIL
Missile Defense Agency	THAAD	Lockheed Martin	Counter missile (defensive)	• Global use, BMD targeting missiles in terminal phase • Could become effective against hypersonics in next several years
	PAC-3 MSE	Lockheed Martin	Counter missile (defensive)	• Key enabler of Army Modernization Priorities • MYP FY2024-2026 with expected 3% savings
Department of the Army	LRHW	Lockheed Martin, Northrop Grumman	Surface to surface	• Anti-A2/AD, suppression of enemy long-range fires • Primary hypersonic program for the Army
Department of the Navy	CPS	Lockheed Martin	Surface to surface	• Navy developing for use across services • Expected to pair glide body with booster to create All-Up Round (AUR) for Navy/Army
	HALO	Lockheed Martin, Raytheon	Air to surface	• New start program in FY2023 • Will be compatible with Navy’s F/A-18
DARPA	TBG	Raytheon	Air to ground	• Will enable air-launched, tactical-range hypersonic boost glide to penetrate air defenses • Development to be compatible with standard VLS
	MOHAWC	Raytheon	Air to ground	• ‘Effective and affordable’ air-launched hypersonic cruise missile • Seeker integration will be easier than on glide vehicles
Department of the Air Force	HACM	Raytheon, Northrop Grumman	Air to ground	• Comparatively small body profile, launched from bombers and fighters (B-52 will reportedly hold 20+)
	ARRW	Lockheed Martin	Air to ground	• Unsuccessful ARRW demonstrations led USAF to prioritize HACM

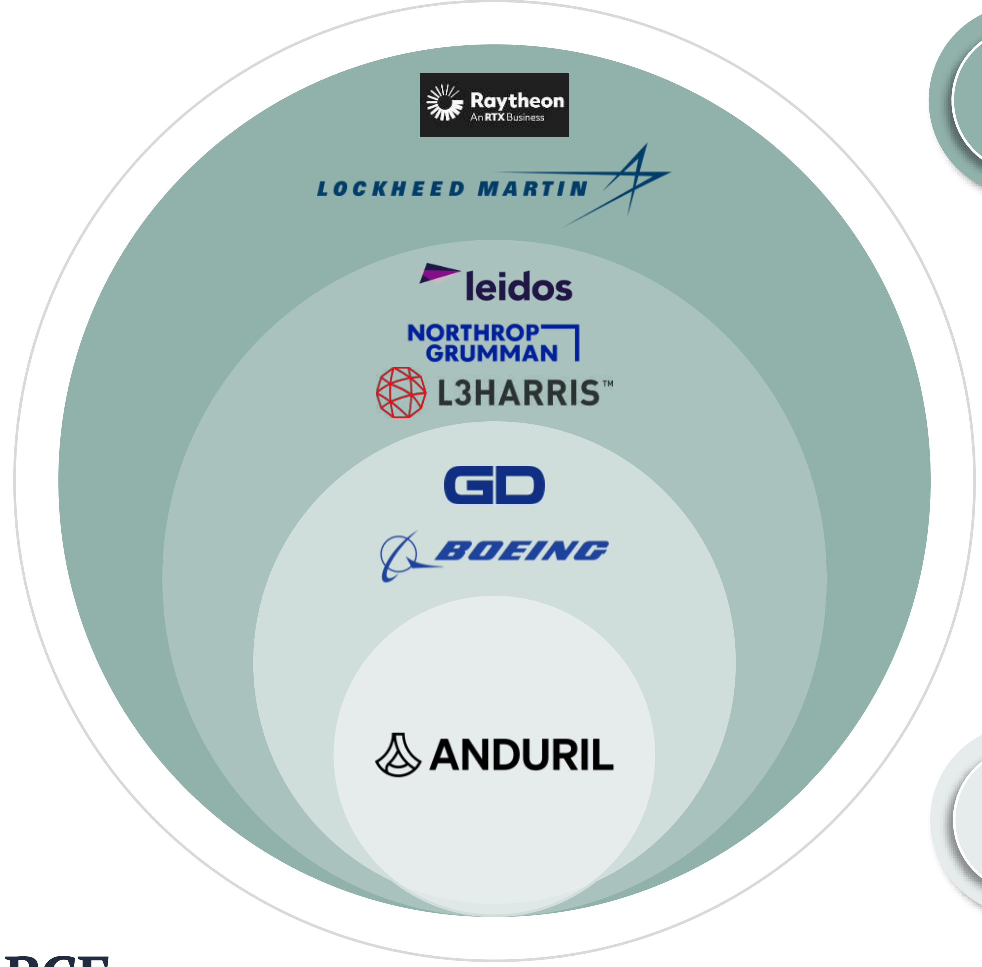
Branch Priorities

1. Hypersonic efforts focused on increased speed and faster time to target
2. Army spearheading hypersonic development with LRHW
3. Navy hypersonic development centered around anti-ship
4. USAF prioritizing R&D of small profile weapons that meet key performance requirements (HACM over ARRW)
5. MDA improving hypersonic defense
6. DARPA developing technologies to be applied across services (especially USAF & USN)

Hypersonic development timelines remain uncertain; Close monitoring required

US competitive landscape analysis

Market leaders Raytheon and Lockheed Martin are facing increased competition from vertically integrating aspiring primes, established sub-system vendors, and an emerging disruptor in Anduril



Traditional Primes

- Legacy market leading primes with long-standing DOD and OCONUS franchise programs
- Facing increased competitive pressure on new contract awards from emerging vendors
- Increased investment and defensive strategies required to retain leadership positions

Emerging Vertical Integrators

- Proven sub-system providers who have invested to vertically integrate
- Top competitive threats to traditional primes
- Targeting emerging market segments including hypersonics & space-based effects

Proven Sub-System Vendors

- Established providers of sub-systems with some prime contracts
- Common partners with Lockheed Martin and Raytheon technologies
- Capability gaps limit ability to compete directly with larger missile houses

Aspiring Disruptor

- Recent acquisition of Adranos highlights commitment to missile market
- Potential to establish Anduril + Adranos as additional missile propulsion provider
- Success largely dependent upon viability of proprietary aluminum-lithium alloy fuel

Propulsion M&A

Recent industry acquisitions of propulsion businesses highlight the vertical integration strategies of traditional sub-system providers to capitalize on customer investment guided missiles

PROPULSION ACQUISITIONS

ACQUIRER	ACQUIREE	STRATEGIC RATIONALE
ANDURIL	ADRANOS	• Granted Anduril access to Adranos's rocket motor production capabilities • Anduril is investing to expand rocket motor production facilities
L3HARRIS™	AEROJET ROCKETDYNE	• Combined L3Harris missile expertise with AJRD's propulsion capabilities • Potential for L3Harris to establish itself as an additional missile prime
NORTHROP GRUMMAN	Orbital ATK	• Bolstered Northrop's vertically integrated missile strategy • Provided additional benefits to Space Systems unit
leidos	Dynetics	• Enhanced Leidos's position in defense & intelligence markets • Targeting "technologically advanced missions"

1. Propulsion market highly concentrated in Aeroject Rocketdyne (L3Harris) & Orbital ATK (Northrop)
2. Vendors acquiring propulsion providers to vertically integrate and capture market share
3. L3Harris acquisition of Aerojet Rocketdyne received heavy FTC scrutiny given vendor concentration
4. Anduril + Adranos or potentially Leidos + Dynetics could provide a pathway to establishing a true third propulsion supplier

Industry partnerships

Industry participants have established partnerships and branded joint ventures to capture global business, satisfy localization requirements, and turn competitors into partners. We expect this trend will continue as customer needs evolve.

NOTABLE JOINT VENTURES & PARTNERSHIPS

COLLABORATORS	INITIATIVE	PROGRAM/MISSILE	CUSTOMERS
Lockheed Martin; Raytheon (An RTX Business)	Javelin JV	Javelin missile	• US Army & Marine Corps, Allied Armies
Kongsberg; Raytheon (An RTX Business)	N/A	Naval strike missile	• US Navy, Allied Navies
Diehl Defence; Rafael Advanced Defense Systems Ltd.; Rheinmetall	EuroSpike	Spike anti-tank missile	• Finland, Germany, and others
Raytheon (An RTX Business); MBDA Missile Systems; Diehl Defence	RAM	Rolling airframe missile	• US, Germany, South Korea, Egypt, Turkey, and others
Raytheon (An RTX Business); BAE Systems	Excalibur	M982 Excalibur guided artillery	• US, Australia, Canada, Jordan, India, Netherlands, Spain, Sweden, Ukraine
Raytheon (An RTX Business); Rafael Advanced Defense Systems Ltd.	Iron Dome	SHORAD, C-RAM, & cruise missile defense	• US, Israel, and others

1. Industry leveraging JVs to partner with “compete-mates” rather than compete directly

2. Some JV’s used to enter new geographies and satisfy increasingly stringent localization requirements

3. JV’s also provide branding & marketing opportunities
   - E.g., Eurospike targets European customer through branding, marketing, & tailored solutions

4. Increased partnerships expected as new vendors seek to win share from more established, legacy vendors

Ukraine lessons learned

The ongoing conflict in Ukraine has highlighted the efficacy of older, legacy weapons to counter Russian aggression and defense vendors have responded with increased investment in hypersonic development, networked effects, and increased production volume

LESSONS LEARNED – UKRAINE CONFLICT

NEED FOR PRODUCTION & SUPPLY

- Conflict highlights increased quantity requirements to successfully strike/defend

EFFICACY OF LEGACY WEAPONS

- Ukraine has demonstrated the continued efficacy of legacy weapons against Russian forces

HYPERSONICS

- Strengths and weaknesses of Russian hypersonics shape US/Ally hypersonic defense efforts

MANPADS FOR SHORAD AND COUNTER-UAS

- Successful defense against tanks, trucks, helicopters using shoulder-launched Javelin missiles

NETWORKED WEAPONS

- Networked weapons accelerate the kill chain

VERBATIMS

*"Right now, we're seeing the critical importance of **missile quantity and stockpiles**, even with 3:1 offense to defense ratios required for Ukraine to defend."*
– US Navy, Former Director of Naval Intelligence

*"Within the EUCOM area of operation, MODs are increasingly interested in procuring **legacy systems** that can meet their **urgent needs** with little delay. In response, vendors are deploying strategies that focus on selling **more of what they already have sold**. There is less emphasis on development of innovative new solutions, and more focus on delivery volumes of legacy weapons."*
– BCE Consulting, Aerospace & Defense Principal

*"Ukraine is **netting their ISR to their fire units**, which enhances the effects that come from shortening the kill chain. That's how they're beating Russia- **speed to kill matters.**"*
– Raytheon Missile Systems, Former Director of Strategy

INDOPACOM implications

Threat of naval conflict with China will lead to prioritization of technical improvements, agile logistics, hypersonic development, full-domain effects, and multi-domain ASuW capabilities

DEMAND IMPLICATION	NEED
Technical improvements	• Stealth, Distributed Maritime Operations, and cross domain effects
Agile logistics	• Rapid, agile, & adaptable resupply
Hypersonics	• Standoff weapons • Increased speed to target/kill
Full-domain effects	• Range, guidance, EW/Cyber, netted effects • Capability to shoot with electrons and kinetic solutions with a cyber component for network-centric warfare
ASuW capabilities	• Improved ASuW capabilities via land, sea, & air-based missiles to engage ships from all domains

VERBATIMS

*"Taiwan needs about 2,000 more Tomahawk missiles because they need to threaten the Chinese. Having that many Tomahawks will allow them to reach deep into mainland China. Taiwan builds cruise missiles and anti-ship missiles, but **they aren't building a large enough quantity**. Getting Tomahawks into Taiwan really highlights how important the logistics element of the market is. Hopefully the US has done planning with Taiwan to figure out how to support our ally with enough missiles in terms of **quantity and logistics** alike, because they're going to need a lot of them if China strikes."*

- Raytheon Missile Systems, Former VP of BD

*"If it happens, **China will be a high-end fight**. It'll need to include space, undersea, autonomous vehicles, and a lot of sneaking. **Traditional CONOPS are not going to work**. If you look at the threat laydown of getting into China, the coast is littered with missile defense, offensive missile launchers, countless naval ships, and more. NATO forces will need full-domain effects, including space and cyber, just to get a missile into China's sphere. Missiles need **stealthy designs** and sensor packages with **low probabilities of interception** that are **hardened against the cyber and EW** elements of China's IAMD."*

- Boeing, Former VP/GM, Autonomous Systems

Key takeaways

The guided missile competitive landscape will continue to evolve as industry adapts to changing market dynamics, increased customer demand, and elevated geopolitical tensions

1. The Russian invasion and increased Chinese aggression are driving demand growth for guided missiles across the globe
2. Despite global threats and increased international demand, the DOD and US industrial base will continue to drive innovation and the development of next-gen solutions
3. Market leaders Raytheon and Lockheed Martin are facing increased competition from vertically integrating aspiring primes, established sub-system vendors, and and emerging disruptor in Anduril
4. Recent industry acquisitions of propulsion businesses highlight the vertical integration strategies of traditional sub-system providers to capitalize on customer investment guided missiles
5. Non-US vendors are positioning to play larger roles in the guided missile market to capitalize on demand growth and meet localization requirements

Key questions

As the guided missile market evolves, close monitoring of key customer priorities and vendor responses will be needed for market participants to shape the future state of the market and align to changing dynamics

CUSTOMER PRIORITIES

1. Will European nations continue to procure mission proven systems to counter Russia or will the emphasis switch to increased development of innovative new solutions?
2. How will customers continue to incorporate loitering munitions into CONOPS? What missions traditionally served by guided missiles will instead be served with loitering munitions?
3. How will customers continue to incorporate non-kinetic effects into CONOPS? What missions traditionally served by guided missiles will instead be served with non-kinetic effects?
4. How will the guided missile market evolve to incorporate increased utilization of space-based assets?
5. How will DOD and OCONUS requirements evolve to align to C-JADC2 initiatives?

VENDOR LANDSCAPE

1. Which vendors will emerge as the leaders in the hypersonic market?
2. What strategies will Lockheed Martin and RTX deploy to defend their positions as leading missile houses?
3. How will Northrop Grumman leverage Orbital ATK?
   - Will Northrop Grumman position as a missile prime?
     - What market segments will Northrop Grumman prioritize going forward?
4. How will L3Harris leverage its recent acquisition of Aerojet Rocketdyne?
   - Will L3Harris position as a missile prime?
   - Will L3Harris leverage its space heritage to target space-based weapons opportunities?

Contact BCE

BCE's global A&D sector leaders are prepared to support clients with strategy development and refinement, market assessment, competitive intelligence, customer insights, and build/buy/partner decisions

BCE's global A&D team is closely monitoring the evolution of the guided missile market and global defense initiatives.

To learn more about BCE's global A&D team or how we support clients in strategy development and refinement, market assessment, competitive intelligence, customer insights, and build/buy/partner decisions please email jgiandomenico@bceconsulting.com or globaldefense@bceconsulting.com.

BCE Consulting

BCE’s global A&D team

BCE's global A&D team

BCE's defense sector leaders are integral to our project delivery process – we drive engagement scoping, research and work plan development, synthesis and analysis, and strategy development

CRAIG BELANGER, SENIOR PARTNER

Craig Belanger is a senior partner at BCE Consulting. For over 20 years he has provided support to Global 500, middle market, private equity, and venture clients as a strategic advisor. He has experience in core and adjacent market strategy development, market analysis, customer and competitor assessment, M&A support, business capture, and organizational design/change management.

Currently, Craig has global responsibility for the firm's A&D and private equity relationships. He is co-managing director of BCE's Technology & Industrials division's defense sector and is BCE UK executive chairman. Additionally, he leads growth and operational strategy and organizational design/change management engagements for clients across Technology & Industrials commercial and defense sectors, which in addition to supporting A&D clients allows him to work with automotive, manufacturing, network & compute, telecommunications, materials, energy, building systems, and industrial technologies clients. He is a member of the firm's management committee.

MARK KIPPHUT, PRINCIPAL (Ret.)

Colonel Mark E. Kipphut, USAF Retired is a principal in BCE Consulting's Technology & Industrials division. He leads BCE's relationship with an American multinational aerospace and defense technology company, which is one of the firm's three largest clients. His work has focused on enterprise strategy development, future state market analysis across mission areas, platforms, domains, customers, and geographies, and defense industry competitive assessments. He has led BCE's thought leadership around the emerging C5ISRT mission area, dynamic kill webs, and unmanned systems. Much of his focus has been on the U.S. national security response to peer threats from China and Russia, and how U.S. industry can best support joint, allied, and coalition force projection in EUCOM and INDO-PACOM.

JOE GIANDOMENICO, PRINCIPAL

Joe Giandomenico is a principal in BCE Consulting's Technology & Industrials division. He is responsible for leading many of the firm's relationships across the defense sector. Joe joined BCE in January 2018 after working at Audax Group, a capital market company.

Joe has led concept development through engagement delivery across mission areas, domains, customers, and geographies.

His recent work has focused on JADC2, C5ISRT, the space and undersea domains, unmanned systems, and integrated air and missile defense. Joe earned his BA in Economics Magna Cum Laude from Middlebury College.

ANIRUDH SUNEEL, PRINCIPAL

Anirudh is a Principal at BCE Consulting based in London UK. Anirudh's experience spans Strategy through to Transformation, covering Corporate and Business Unit Strategy, M&A advisory, Operating Model design, Change management and complex Programme and Project management. Anirudh's industry specialism is across the A&D supply-chain where he has worked on various Strategy and Transformation engagements for the likes of Airbus, Babcock, Leonardo and the various arms of the UK Ministry of Defence.

Anirudh holds an MBA from Warwick Business School.

DENNIS J. CARROLL, SENIOR ADVISOR

Dennis's first career as a Naval Aviator included 20 years of service including 960+ carrier landings, 168 combat sorties in Vietnam, a Master of Sciences in Computer Systems, Command at Sea, CNO Strategic Studies Group V, and supporting CNO Executive Board on strategic investment decisions.

Upon retirement, he joined GDMS for 23 years through various acquisitions from Hughes and Raytheon. He moved on as BD lead of the Hughes Naval missiles business and then to Director of the strategy of the Tucson Missile Business unit. He took over as program director of the failing Phalanx business, gaining over a billion in new revenue. He was assigned to the international Excalibur business completing the development to production and deployment.

He became VP of Business Development for RTN Missiles Systems and was responsible for the development and execution of the growth strategy including US and international. Over his tenure, they increased domestic and international revenue growth by more than 30%.

REAR ADMIRAL TONY COTHRON, SENIOR ADVISOR (Ret.)

Rear Admiral Tony Cothron retired from the U.S. Navy in January 2009. Adm Cothron's career included duty as an Intelligence Officer at every level, from ship/squadron to Fleet and the Pentagon. His experience includes ocean surveillance and tactical analysis of the Soviet Fleet during the Cold War, combat operations against Iraq during Desert Storm and at Sixth Fleet as the N2, Assistant Chief of Staff for Intelligence.

Upon retiring, he joined General Dynamics Information Technology as the VP for Customer Requirements where he led opportunity development for a multi-billion-dollar IT services business supporting the Intelligence Community. Adm Cothron currently serves as the Chairman of the Board for the Naval Intelligence Professionals. In August 2021, he joined the faculty at Liberty University Associate from Northern Illinois University.

BCE's global A&D team

Our senior leaders help to drive our research process and thought leadership, and the team's combined experience allows the project to be led by SMEs

COLONEL SCOTT GERBER, SENIOR ADVISOR (Ret.)

Prior to joining BCE, Scott was an Intelligence Community Senior Officer and executive director for the Army Strategy Board. He is also a retired Army colonel. His experiences included leading combat formations in Iraq, C5ISR employment, advanced warfighting, and leading strategic transformation. He pioneered processes to integrate the nation's most sensitive analyses into over $110 billion in DoD investments, R&D, and strategies to counter Russian and Chinese threats.

Scott has served as a thought leader on addressing national security and has facilitated over 50 executive strategy seminars for the Deputy Secretary of Defense, Principal Deputy Director of National Intelligence, the Joint Chiefs and numerous three- and four-star flag officers.

COMMANDER RICHARD MASCOLO, SENIOR ADVISOR (Ret.)

After a thirty-one-year career as a senior Information Warfare Officer, Commander Mascolo recently retired from the Navy, leaving a lasting mark on the field. Throughout his journey, he assumed various roles, supporting the Navy, Special Operations Command, and NATO in areas encompassing command, control, communications, computers, cyber-defense, combat systems (C6), intelligence, surveillance, and reconnaissance (ISR). A holder of an M.S. in Network Operations and Technology, a B.A. in International Relations, and Certificates from the Tuck School of Business and Naval Postgraduate School, Richard's credentials are matched only by his commitment to values deeply rooted in faith, honesty, and service. His tenacity for driving change and his ability to foster meaningful connections position him as a poised and invaluable asset.

GENERAL AARON PRUPAS, SENIOR ADVISOR (Ret.)

Prior to joining BCE, Aaron served in the Air Force for 32+ years, retiring as a Major General. Aaron served in a variety of Air Force, Joint, and OSD positions and commanded at the squadron, group, and wing levels. He served as the Deputy Director of Intelligence for NATO operations in Afghanistan, as the Director of Intelligence for the Air Force's ACC, and as the Director of Intelligence for NORAD and USNORTHCOM. Aaron was the Director for Defense Intelligence (Warfighter Support) within the OUSD for Intelligence and Security. He was also the director of the OSD cross-functional team developing AI/ML (Project Maven).

DR. DOUGLAS H. REEP, SENIOR ADVISOR

Dr. Reep serves BCE as a senior advisor specializing in technology and business growth strategies. Dr.Reep previously led Research for Qorvo's Infrastructure and Defense Products. Previously, Dr. Reep served as program executive for the airborne early warning radar business unit at Lockheed Martin. During a career that spanned almost 30 years at Lockheed Martin and its predecessor companies (Martin Marietta and GE Aerospace), he held various technical and executive positions, gaining experience in airborne, ground-based, missile and naval radar, EW, RF and AESA technology, and achieving the rank of Vice President of Technical Operations.

KRISTIN ROBERTSON, SENIOR ADVISOR

Kristin A. Robertson is a highly-experienced, recognized senior industry executive with experience leading complex business portfolios and extensive knowledge of disruptive technology, digital practices, and methods across the lifecycle in the defense, space, and intelligence sectors.

Most recently she served as President, Space & C2, a division of Raytheon Technologies where she helped increase book to bill significantly with new JADC2 franchises and multiple awards instantiating new hybrid architectures such as proliferated space awards from SDA, Missile Track Custody in MEO, and NextGen GEO (NGG). Before joining RTX, Robertson served on the Boeing Defense Space & Security (BDS) leadership team as VP & GM of Autonomous Systems, a seabed to space portfolio that included key franchise programs such as MQ-25 Stingray, Orca eXtra Large Unmanned Undersea Vehicle (XLUUV), and Boeing's Airpower Teaming System (ATS) as well as five wholly owned subsidiaries. While at Boeing was the Vice President and Program Manager for Bell-Boeing V-22 as well as Vice President and Chief Engineer for Boeing Military Aircraft Programs.

JEFF SNYDER, SENIOR ADVISOR

Jeff Snyder has been involved in cyber strategy, business development, and M&A for Fortune 500 companies over the last 20 years. As Cyber Vice President at Raytheon, Snyder led the cyber growth strategy involving the deployment of $4B in cash to acquire 20 companies to establish a balanced portfolio and 25,000+ cyber customers.
Snyder serves on the Advisory Board of Sertainty Corporation and Tortora Brayda Institute (Global Think Tank) and is a Cyber Senior Advisor at CEA Worldwide. He has served on a variety of federal and commercial non-profit boards that have significant interests in cyber.

BCE's global A&D team

The breadth and depth of our A&D team ensures each engagement is staffed with SMEs who have the proper domain, mission area, geographic, and functional expertise to deliver highest-value outputs

JERRY L. SPRUILL, SENIOR ADVISOR

Most recently, Jerry was the Senior Director, Counter-UAS within the Defense Systems Sector - Northrop Grumman. Jerry had global responsibility for defining mission solutions for this emerging threat. Previously he served as Strategy & Business Development leader for the Combat Systems and Mission Readiness Division, focused on IAMD, JADC2 and training networks within the Defense Systems Sector and earlier served in a similar role within Mission Systems focused on IR Counter Measures (IRCM), targeting pods, navigation systems, TPS-80 G/ATOR ground radars, and UH-60V Black Hawk cockpit. Before moving to the Mission Systems, served as Sector Director of Global Expansion responsible for Aerospace Systems Sector-wide International Pursuits for the E-2D Hawkeye, the MQ-4C Triton, RQ-4 Global Hawk and MQ-8C Fire Scout.

DR. JIM WALKER, SENIOR ADVISOR

Dr. James Walker is a senior advisor to BCE Consulting's aerospace and defense clients. Prior to joining BCE, Jim worked for Raytheon, first serving as the Competitive Intelligence (CI) lead for Raytheon Network Centric Systems and then as the CI lead for the Raytheon Capture Management Excellence team. Prior to joining Raytheon, Jim was the Director of Strategy and Policy for the U.S. Army Space and Missile Defense Command.

Jim is a U.S. Navy veteran and served in Vietnam

BENJAMIN OSTERHOLTZ, MANAGER

Ben Osterholtz is a Manager at BCE Consulting responsible for managing all engagements with one of BCE's largest aerospace and defense clients. He has worked across BCE's aerospace and defense, industrials, consumer, and healthcare verticals on projects ranging from market analysis to competitive analysis and strategy development.

Prior to BCE, Ben worked for Technology Business Research, producing quarterly and ad-hoc market research on Federal technology and professional service firms.

Ben earned a BA in Mathematics and Economics from Bowdoin College.

ROBYN PIRIE, MANAGER

Robyn Pirie is a manager assigned to BCE's global defense sector team. In this role, she supports business development, engagement management, insights generation, and thought leadership. Robyn has led strategy development work for Fortune 100 defense contractors.

Additionally, her work at BCE has included the creation of a strategy development and value creation framework called CRO, which has been deployed in support of client goals across industries.