AVIATION WEEK Fleet&MRO FORECASTS

2024 MARKET SUMMARY REPORT

MILITARY

AVIATION WEEK NETWORK

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The Northrop Grumman B-21 which made its first flight in November 2023 is representative of a wave of next generation platforms set to enter service during the 2024-2033 period, including the Bell V-280, and the U.S. Air Force's Next Generation Air Dominance (NGAD) program.

(Photo credit: Northrop Grumman)

Foreword

Welcome to Aviation Week's 2024 Military Fleet and MRO Forecast. This market summary report and the accompanying database aims to provide customers with actionable, forward-looking intelligence on the key trends and drivers within the military aircraft market for the period between 2024 and 2033.

The Military Fleet and MRO Forecast builds upon Aviation Week's best in class global military aircraft fleet tracking data to provide projections for the value of the market over the next decade including contracted deliveries, open opportunities and aftermarket revenues. The database enables customers to rapidly identify and assess all existing military aircraft acquisition projects and emerging requirements in order to provide a comprehensive picture of the market landscape over the next 10 years.

We continue to expand the scope and functionality of the forecast, this year by introducing a 10-year historic view of aircraft deliveries, retirements and in service fleets. The addition of historic data provides a major enhancement to the Military Fleet and MRO Forecast by enabling customers to compare projections to historic trends, providing a greater degree of transparency and integrity to the 10-year forecast.

The Military Fleet & MRO Forecast also includes a quarterly report that will be added to the documentation tab at three-month intervals to highlight emerging trends and key developments throughout the year. The documentation tab also features an expanded user guide in order to make database terminology and methodology easily understandable.

Thank you for subscribing to Aviation Week's 2024 Military Fleet and MRO Forecast.

Aviation Network's 2024 Military Fleet and MRO Forecast projects that 20,418 military aircraft worth $1.01 trillion will be delivered to operators worldwide between 2024 and 2033. The number of uncrewed aircraft is projected to increase by 49% over the period, pushing into new mission areas including combat and air-to-air refuelling.
(Photo credit: Boeing)

Defense Market Conditions

Defense Market Conditions

Conditions within the global defense market remain buoyant as a result of heightened levels of strategic tension and competition around the world. The conflict in Ukraine remains a key focus for defense departments in Europe and North America with no end in sight, tensions continue to rise in Asia in response to concerns over Chinese and North Korean intent, and the renewed conflict between Israel and Hamas in Gaza is at risk of widening.

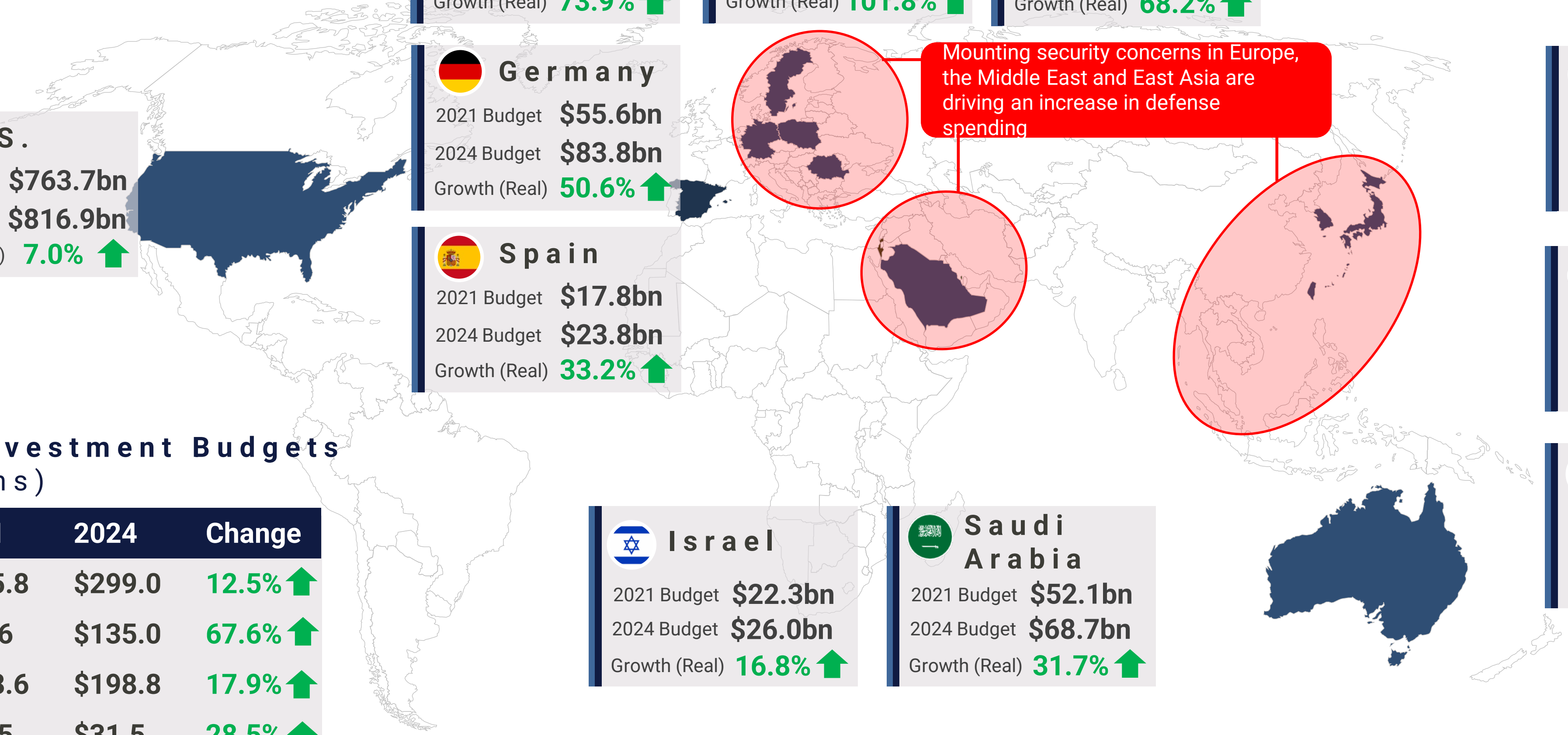
Geo-political and strategic considerations have become the main driver of the defense market, supplanting the economic, fiscal and political factors which have dominated trends since the early 2010s. While the global economy continues to face headwinds, rising global instability has seen defense and security policy become an area of focus both for the world's governments and their populations. Defense spending is rising both in relation to GDP and as a share of overall government spending in many countries, particularly in Asia and Europe – a clear indicator of increased prioritisation of the sector.

The war in Ukraine in particular has exposed gaps in capability, readiness, spares and munitions inventories, and industrial capacity which governments are now trying to urgently address. With demand for defense goods and services rising, focus is increasingly shifting to supply side constraints and the ability of the defense sector to meet demand in a timely manner. As a result, delivery schedules have become an increasingly important selection criteria for defense acquisition programs with operators looking to modernise and expand capabilities quickly.

Supply chain constraints that emerged during the disruption of the COVID-19 pandemic have yet to abate while shortages of key materials and components have begun to impact production rates in some defense programs. In the short term these constraints will likely remain in place while manufacturers re-organise and expand their supply chains and assess options for increases in production capacity in key areas.

Russia's invasion of Ukraine in February 2022 has fundamentally shifted the outlook for the global defense market over the next five years, boosting demand for military aircraft. The ability of manufacturers to deliver equipment on expedited schedules has become a key advantage as militaries around the world look to boost capability in the short term. In July 2023 Korea Aerospace Industries were able to deliver the first FA-50 to Poland just 10 months after contract signature. (Photo credit: Korea Aerospace Industries)

Key Defense Budget Changes



U.S.
2021 Budget $763.7bn
2024 Budget $816.9bn
Growth (Real) 7.0%

Romania
2021 Budget $5.7bn
2024 Budget $9.9bn
Growth (Real) 73.9%

Germany
2021 Budget $55.6bn
2024 Budget $83.8bn
Growth (Real) 50.6%

Spain
2021 Budget $17.8bn
2024 Budget $23.8bn
Growth (Real) 33.2%

Poland
2021 Budget $13.9bn
2024 Budget $28.1bn
Growth (Real) 101.8%

Sweden
2021 Budget $7.7bn
2024 Budget $13.0bn
Growth (Real) 68.2%

Japan
2021 Budget $52.5bn
2024 Budget $67.2bn
Growth (Real) 28.1%

Taiwan
2021 Budget $18.7bn
2024 Budget $23.4bn
Growth (Real) 25.3%

Australia
2021 Budget $34.6bn
2024 Budget $40.5bn
Growth (Real) 17.0%

Israel
2021 Budget $22.3bn
2024 Budget $26.0bn
Growth (Real) 16.8%

Saudi Arabia
2021 Budget $52.1bn
2024 Budget $68.7bn
Growth (Real) 31.7%

Regional Investment Budgets (US$ Billions)

Region	2021	2024	Change
U.S.	$265.8	$299.0	12.5%
Europe	$80.6	$135.0	67.6%
APAC	$168.6	$198.8	17.9%
MENA	$24.5	$31.5	28.5%

Global Defense Spending Trends

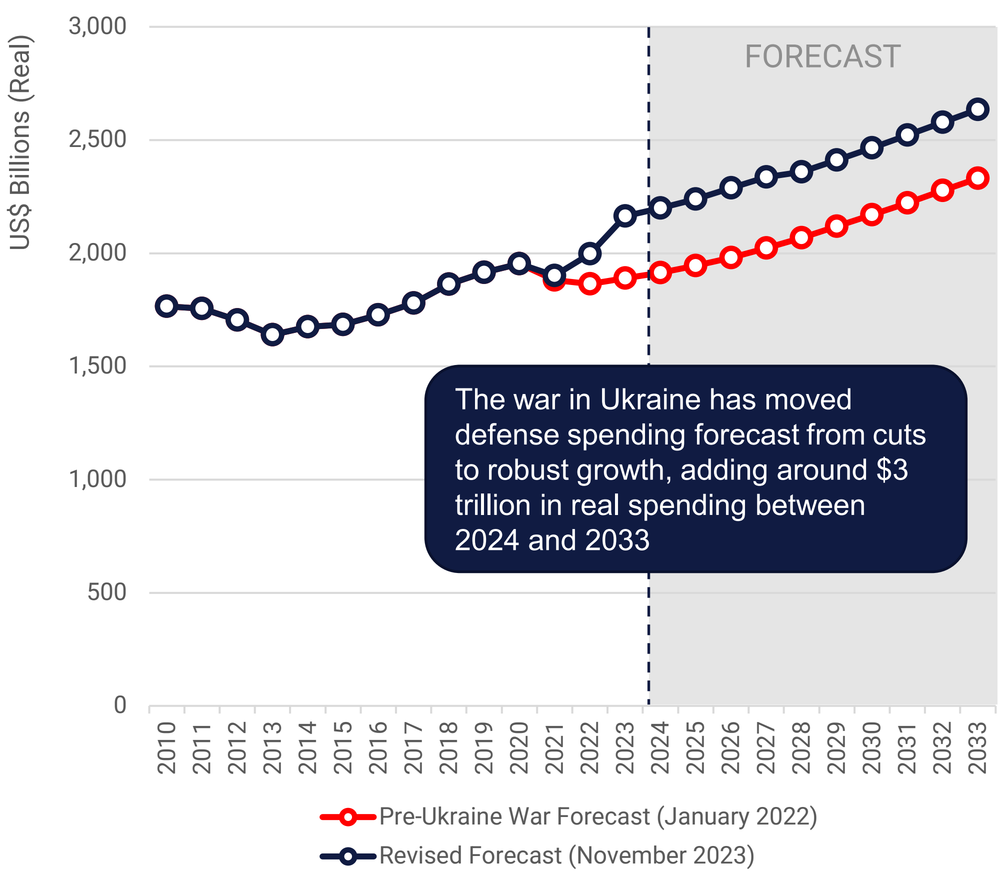
Global defense spending continued to expand rapidly in 2023 as budgetary plans announced following Russia's invasion of Ukraine in 2022 came into effect. Total global defense spending has increased from $1.90 trillion in 2021 to $2.16 trillion in 2023, a rise of 13.8% in real terms over the two-year period. The pace of growth is the fastest seen since the U.S. surge in Afghanistan and Iraq between 2007 and 2009 and represents the third fastest period of expansion for defense spending since the end of the Cold War in the early 1990s.

While the shift in conditions has been most visible in the North Atlantic region and in Europe, significant growth also continues in Asia, prompting large scale increases in defence budgets in key markets such as Australia, Japan, South Korea and Taiwan. Meanwhile higher oil prices through 2022 and 2023 have seen growth return among the states of the Gulf Cooperation Council (GCC) boosting prospects in the world's most crucial defence export market.

Unlike other recent expansionary periods for defense spending growth is not being driven primarily by the U.S. While North America continues to represent the largest of the regional markets, the region's share of global defense spending is projected to fall from 41.2% in 2021 to 37.3% in 2025. By comparison Europe's share will expand from 16.7% to 19.4%, Asia's from 29.9% to 30.8%, and MENA's from 8.3% to 8.7% over the same period. In the longer-term growth will be driven by Asian economic expansion, with the region set to command the largest regional share of defense spending by 2031, surpassing North America.

Crucially for suppliers into the sector the majority of the new funding being allocated by countries around the world is accessible to the defense sector. In the three-year period between 2021 and 2024 investment spending (funding for procurement, RDT&E and infrastructure) will have increased by 24.6% and operating costs (primarily maintenance and support spending) by 13.4%, compared to 10.7% for personnel budgets.

Total Global Defense Spending



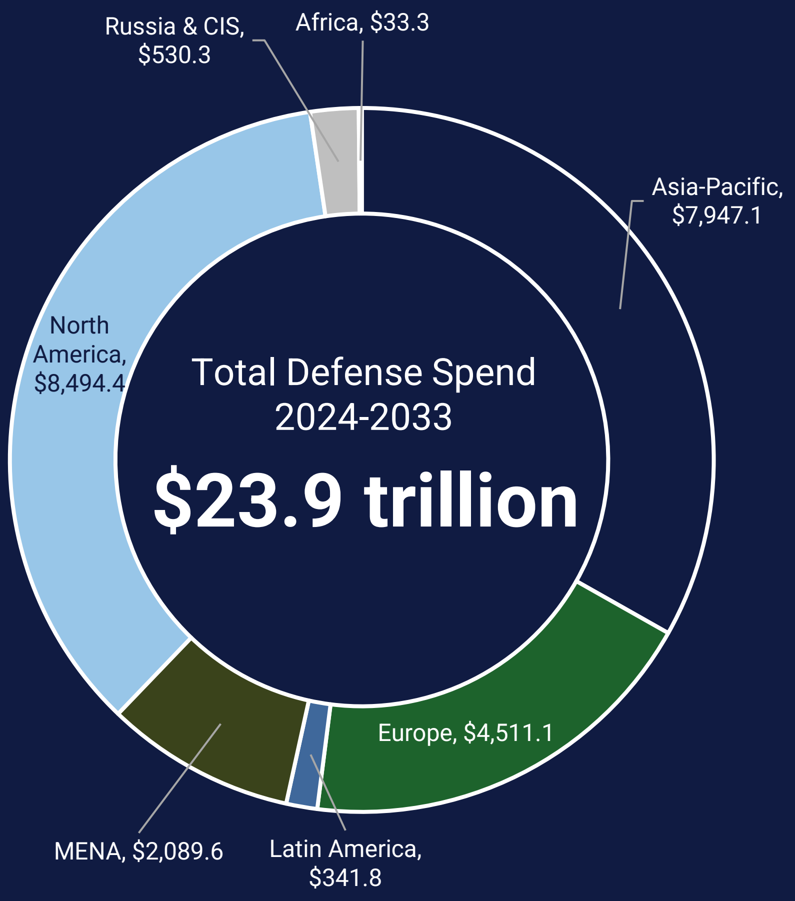
Global Defense Spending – 2024-2033 Market Projections

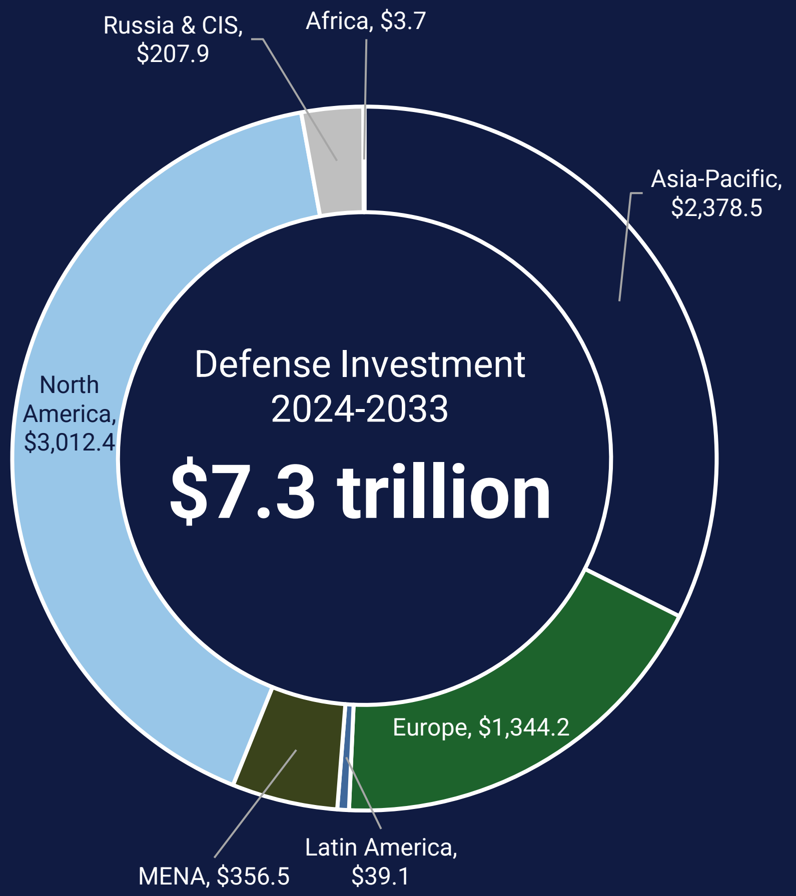
Defense Spend 2024
$2.19 trillion

Defense Spend 2033
$2.62 trillion

Defense Investment Spend 2024
$0.70 trillion

Defense Investment Spend 2033
$0.77 trillion





Challenges in the Aerospace & Defense Market

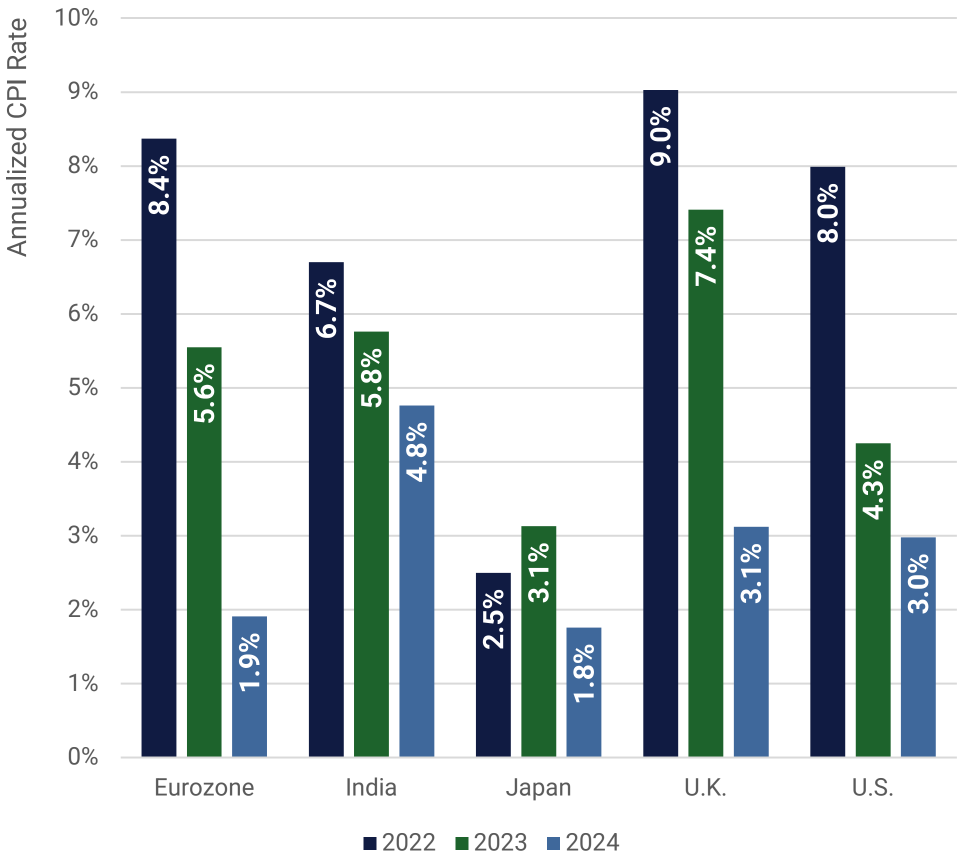
With the threat of a post-pandemic downturn for the defense sector having seemingly abated the challenge has quickly shifted to whether industry can meet the surge in demand now at hand. The war in Ukraine is driving expedited requirements for equipment, munitions, and spare parts which industry is struggling to satisfy given long production lead times and limits to industrial capacity.

A key concern for industry is how long this period of heightened demand will last, with suppliers seeking assurances before investing in capacity expansion. Governments are working with industry on contract structure and long term guarantees in order to mitigate this risk with manufacturers focusing on increasing agility and scalability of production. Concerns over the health of the supply chain are also seeing greater monitoring and – where required – government lead investment in shoring up critical strategic elements within the defense industrial base.

Geo-political and strategic factors continue to exacerbate wider constraints on global supply chains and contribute to production bottlenecks. Security of supply for raw materials, parts, and manufacturing processes have become more pressing due to sanctions placed on Russia and concerns that similar restraints could be imposed on China over the long term. Defense companies are working to simultaneously restructure and de-risk their supply chains, and to expand capacity to meet heightened demand and mitigate the production delays currently experienced around the world.

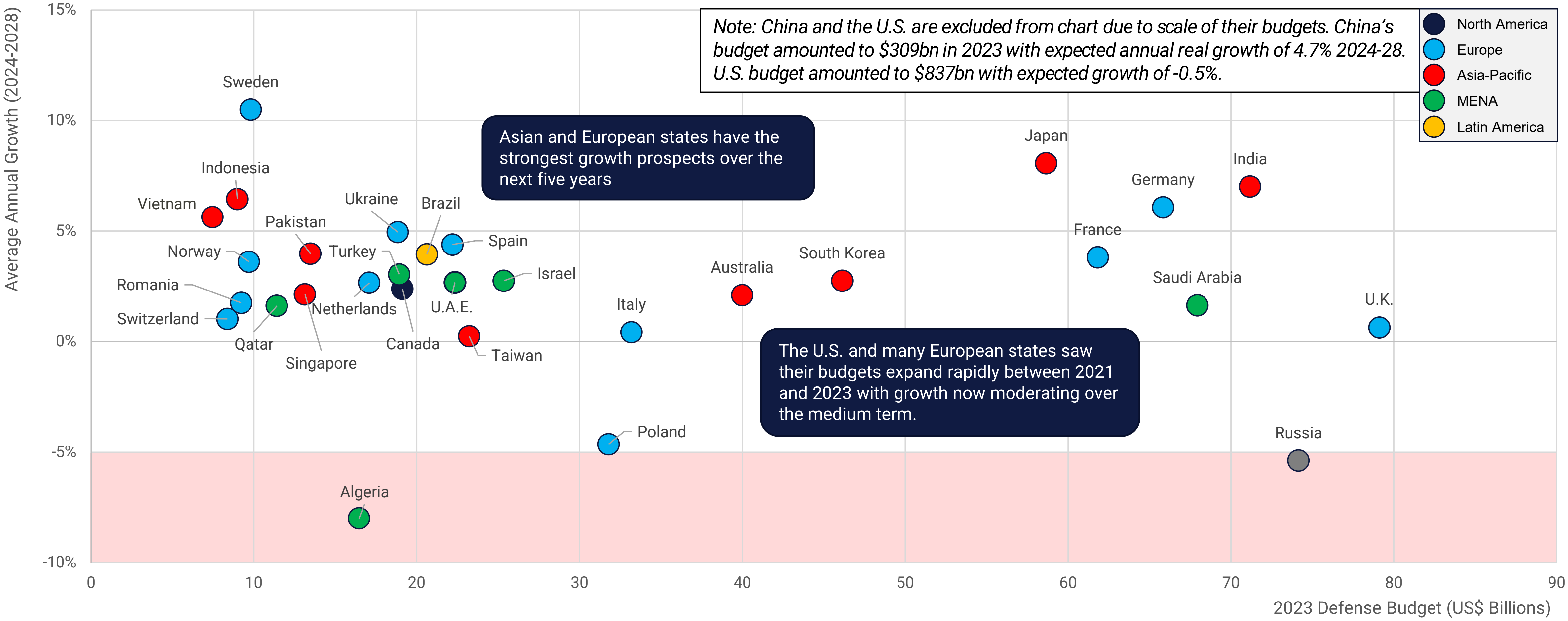
Shortages of skilled labor, the post-pandemic global economic recovery, elevated energy and raw material prices, and increased demand have caused soaring inflation since 2022. This has spilled over into the defense market, where finished goods are labor-intensive and supply chains have become leaner since the end of the Cold War. This has created significant challenges in terms of the financial viability of existing contracts, uncertainty around pricing, and erosion of purchasing power. Pressures eased through Q3 and Q4 of 2023 and will moderate further in 2024, but short term risks remain, particularly further into the supply chain where contract margins are tight.

Consumer Price Inflation in Key Markets



Source: Oxford Economics

Growth Prospects in Key Defense Markets



Forecast Summary

Military Aircraft Market Trends

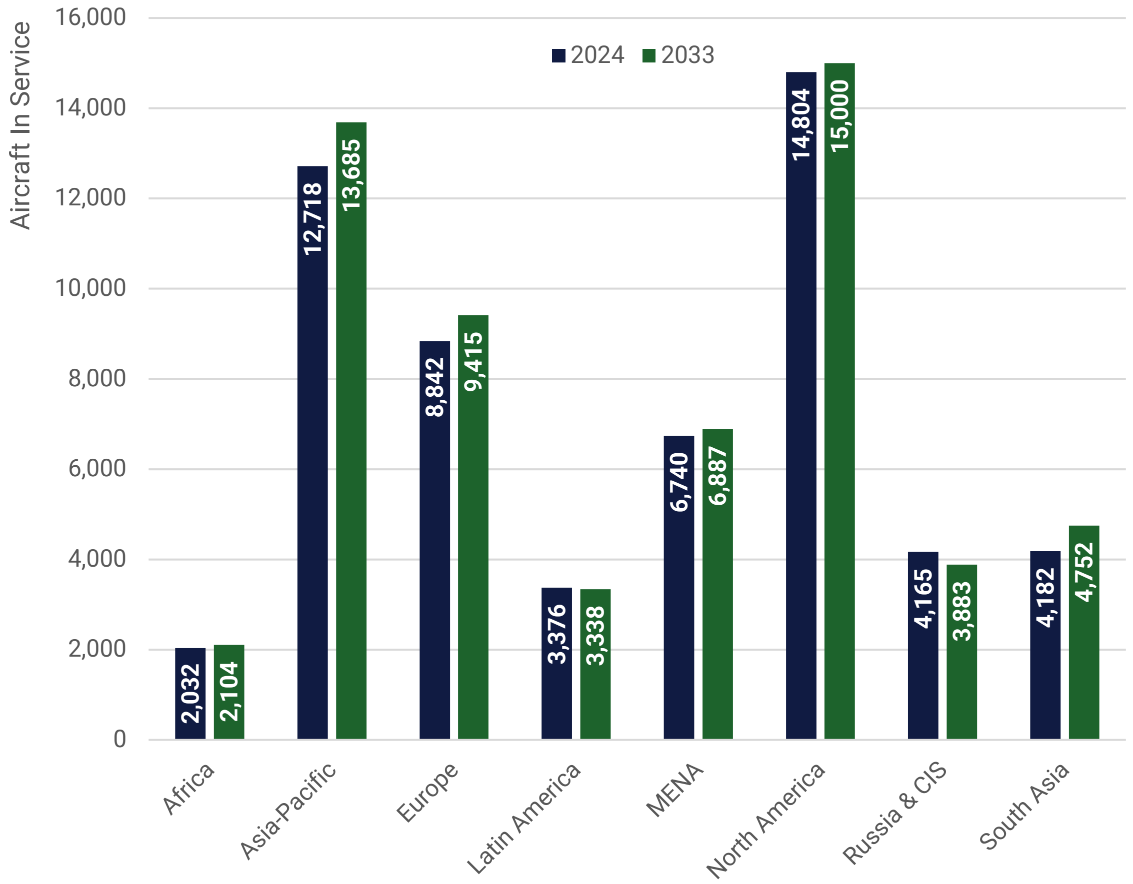
The surge in defense spending being experienced around the world has reinforced an already booming market for military aircraft. As a result, for the first time the value of the military aircraft that are expected to be delivered over the next 10 years has passed the $1 trillion level as air forces around the world look to bolster capabilities.

In the short-term new funding will mostly accelerate existing aircraft acquisition programs with militaries able to move faster on open requirements that would otherwise execute at the back end of the decade. Some operators of Russian-made aircraft have also moved to find replacements as their aircraft are rendered unsupportable due either to the raft of trade embargoes placed on Moscow, or to Russia delaying export of spare parts to make them available for operational requirements in Ukraine.

Countries in Europe are building or revitalizing aviation force structure to meet the Russian threat. After steadily shrinking for 30 years, the number of combat aircraft in service on the continent is expected to grow by 5.2% over the next five years. As new defense strategies are backed by newly bolstered defense budgets and implemented over the coming years there is significant scope for further fleet expansion.

The aftermarket is also set to be boosted by new strategic realities. Air forces around the world are now focussed on increasing readiness, improving aircraft availability rates, and ensuring spares stocks are able to support sustained high tempo operations. As a result, MRO demand generated by the global military aircraft fleet is projected to reach $1.4 trillion over the 10-year forecast.

In Service Fleet by Region (2024 and 2033)



Regional Military Aircraft Market Statistics

Europe	
In Service Fleet 2024	8,842
Fleet CAGR 24-33	0.7%
Value of Deliveries	$191.7bn
MRO Demand	$186.0bn

MENA	
In Service Fleet 2024	6,740
Fleet CAGR 24-33	0.2%
Value of Deliveries	$93.5bn
MRO Demand	$109.4bn

Russia & CIS	
In Service Fleet 2024	4,165
Fleet CAGR 24-33	-0.8%
Value of Deliveries	$42.3bn
MRO Demand	$82.1bn

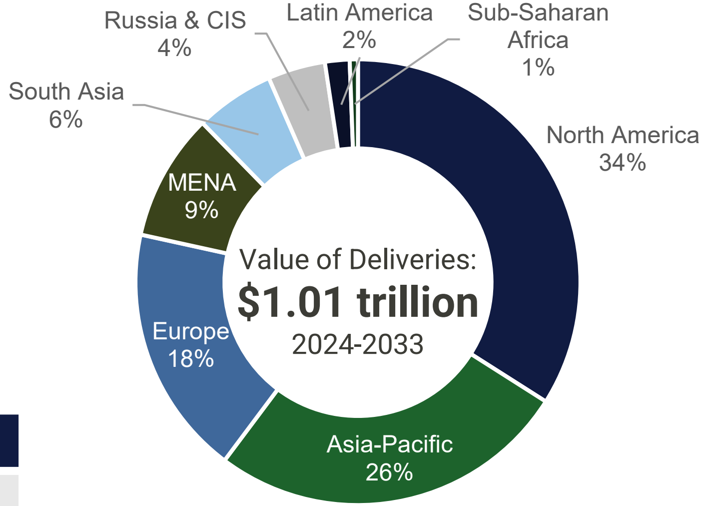
North America	
In Service Fleet 2024	14,804
Fleet CAGR 24-33	0.1%
Value of Deliveries	$342.5bn
MRO Demand	$586.5bn

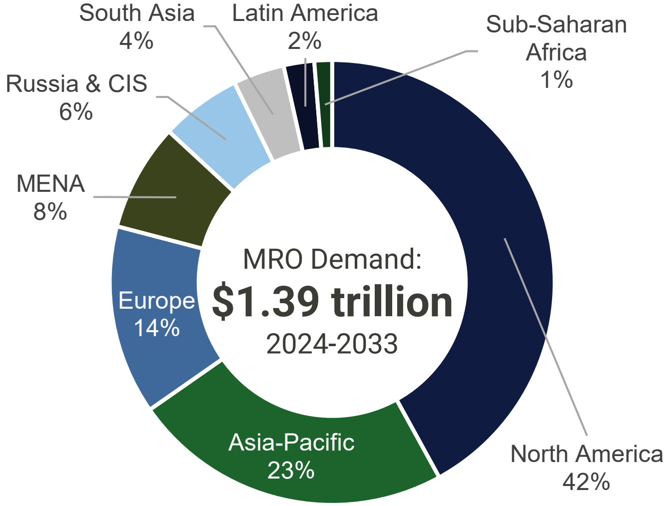
Asia-Pacific	
In Service Fleet 2024	12,718
Fleet CAGR 24-33	0.8%
Value of Deliveries	$264.1bn
MRO Demand	$325.4bn

Latin America	
In Service Fleet 2024	3,376
Fleet CAGR 24-33	-0.1%
Value of Deliveries	$18.4bn
MRO Demand	$30.6bn

Sub-Saharan Africa	
In Service Fleet 2024	2,032
Fleet CAGR 24-33	0.4%
Value of Deliveries	$5.6bn
MRO Demand	$17.6bn

South Asia	
In Service Fleet 2024	4,182
Fleet CAGR 24-33	1.4%
Value of Deliveries	$58.0bn
MRO Demand	$51.7bn





Military Aircraft Fleet Trends

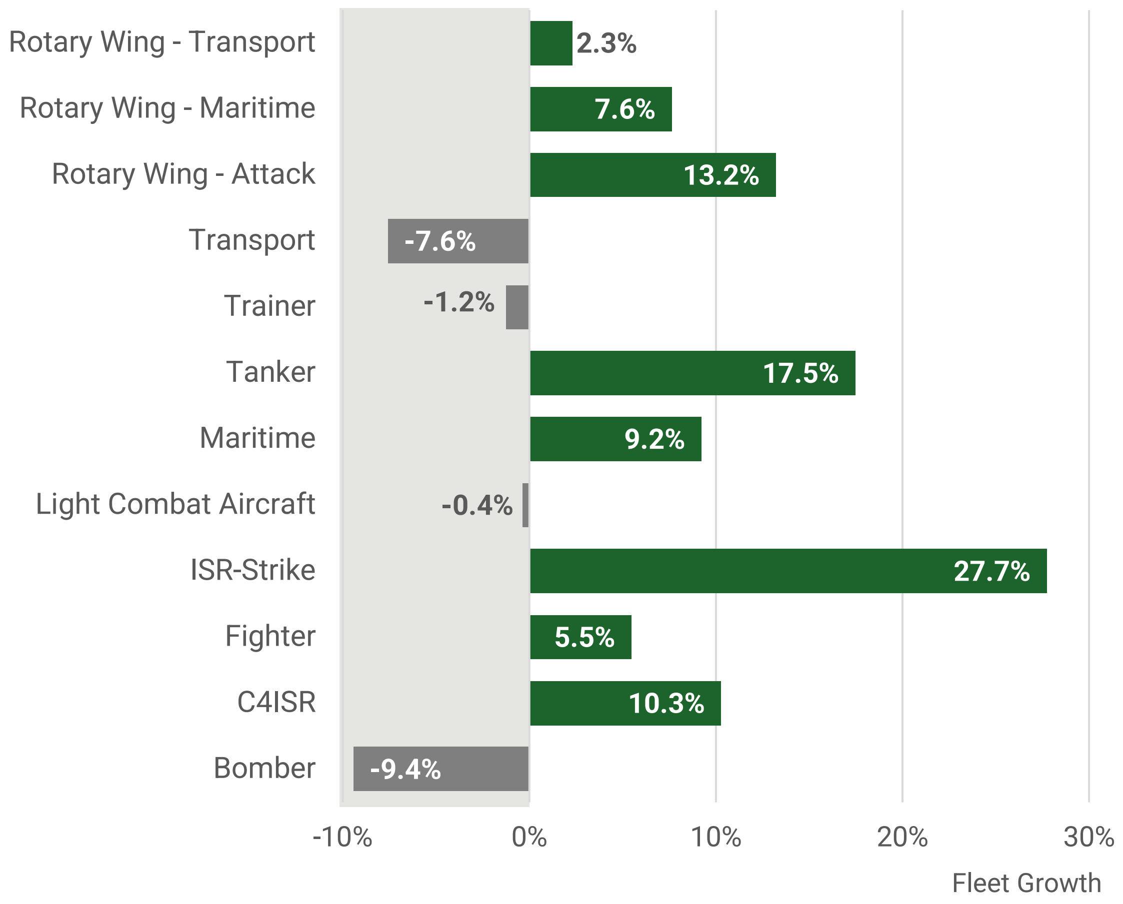
The global fleet of military aircraft is projected to grow by 3.9% over the next 10 years, rising from 56,859 aircraft in 2024 to 59,064 by the end of 2033. Growth will be driven by the expansion of the uncrewed aircraft fleet which is expected to increase from 2,187 platforms to 3,263 over the decade, a rise of 49.2%. By comparison the global fleet of crewed assets is expected to grow by just 2.1% from 54,670 aircraft to 55,799.

Geographically, fleet growth is expected to be concentrated in Asia where the region's expanding economies are able to support expansion of air power capabilities. In South Asia, India is seeking to address a sustained decline in its fighter strength, while further East, countries are looking to expand persistent surveillance and acquire other force multiplying capabilities. The fleet in North America is projected to remain largely flat with the number of manned assets set to decline from 14,221 aircraft 14,061.

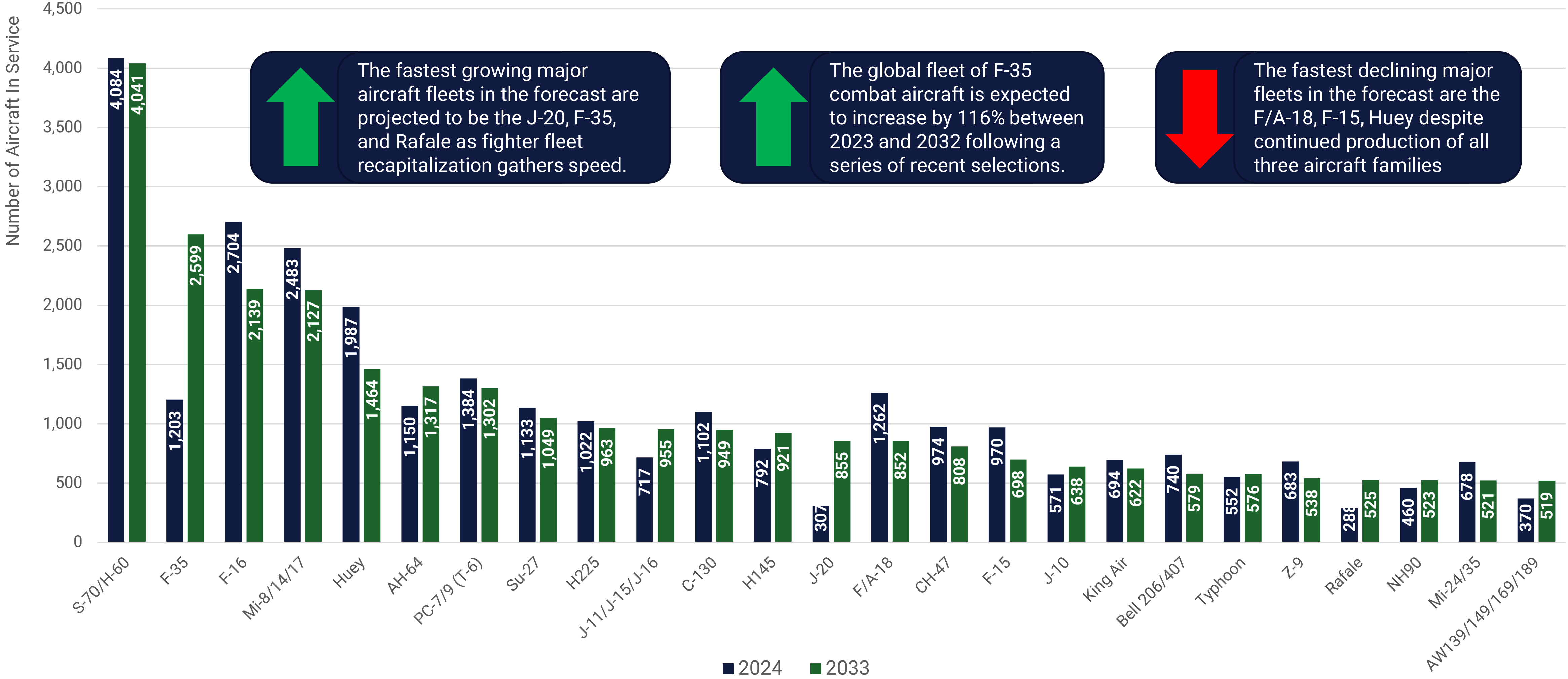
Accelerated by lessons being learned from the war in Ukraine the fastest growing mission segment over the decade will be the uncrewed ISR-Strike role. Sales of Turkish made uncrewed air systems (UAS) in particular surged in the months following Russia's invasion with more than 100 Baykraktar TB2s projected to be delivered over the 10-year period. A 17.5% increase in tanker aircraft in service around the world is primarily being driven by China's expansion of its power projection capabilities.

Counterintuitively, the global bomber fleet will contract by 9.4% despite renewed emphasis on long range strike and great power competition as aging assets with limited operational relevance are withdrawn. Most of this contraction takes place in Russia and China. In a similar vein, the reduction in transport aircraft over the decade is driven by concerns over the survivability and utility of tactical battlefield airlifters in modern warfare. The global trainer fleet will also modestly decline with the reduction focused on the earliest phases of training.

In Service Fleet Change by Mission Segment (2024-2033)



Fleet Dynamics of Key Military Aircraft Families



Military Aircraft Deliveries

A total of 20,418 military aircraft worth $1.01 trillion are expected to be delivered to operators around the world over the next 10 years including 16,695 new build and 3,110 remanufactured aircraft.

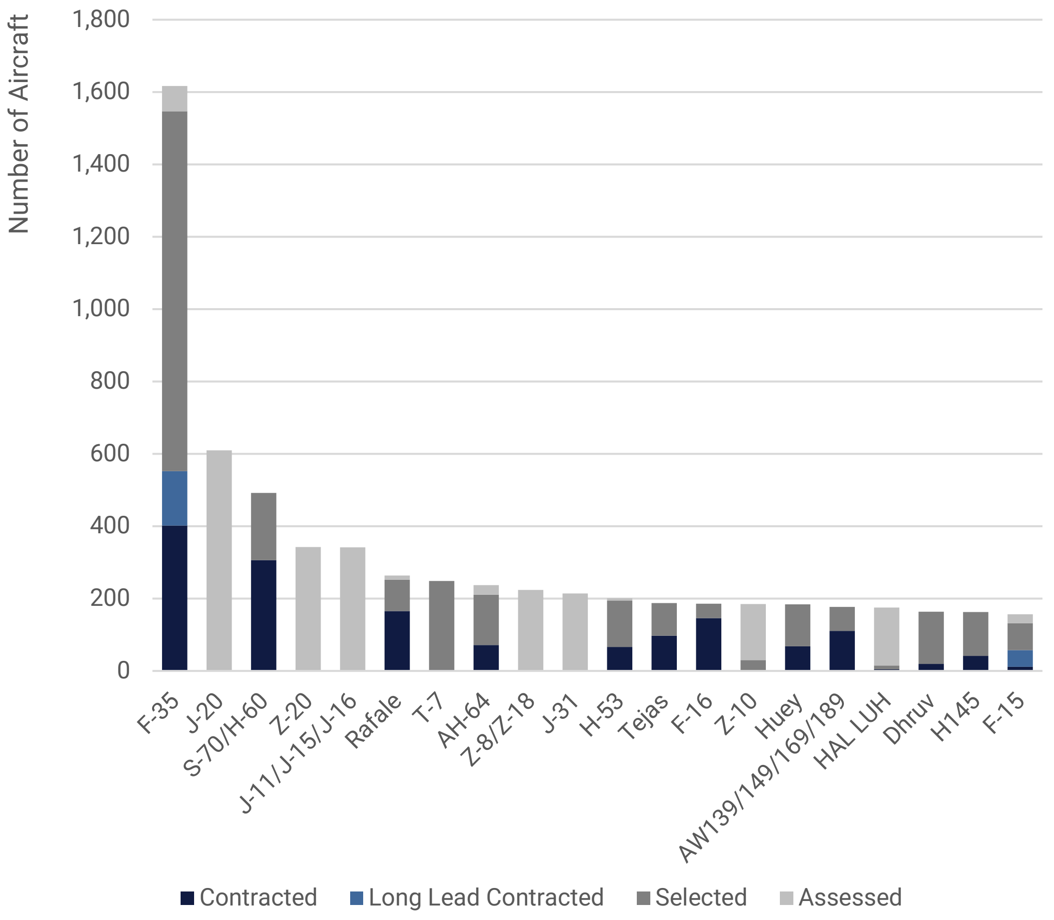
Despite budget growth in Europe and fleet expansion within Asia, U.S. military operators are expected to account for 32.6% of total deliveries by value over the period with 4,993 aircraft due to enter service. The U.S. footprint in export markets is also unmatched with U.S. manufacturers accounting for 51.6% of the $252.3 billion in aircraft deliveries currently under contract worldwide. Excluding Chinese and Russian programs, U.S. aircraft families account for nine of the top ten aircraft programs by value within the forecast.

With a long-term program of record at home and a slew of recent export successes abroad, the F-35 is by far the largest program in the forecast. Over 1,600 F-35s worth $165.4 billion are expected to be delivered to operators between 2024 and 2033, representing around 16.4% of all deliveries by value over the decade.

Despite this U.S. dominance China's position within the market continues to grow. The country's aerospace sector is expected to produce 2,548 military aircraft over the decade, 94.1% of which will be delivered to the People's Liberation Army. Only the U.S. will produce more aircraft over the period. Elsewhere in Asia, India's Tejas light combat aircraft program represents most of India's industrial footprint in the market, driven by domestic demand. Even so, the program may presage India's emergence as a minor supplier in the export market.

Lockheed Martin, Boeing, Chengdu, Northrop Grumman and Sikorsky are the largest manufacturers in the forecast. These five alone account for close to half of the market by value. Airbus and Dassault represent the biggest European OEMs and are the sixth and seventh largest manufacturers by value respectively.

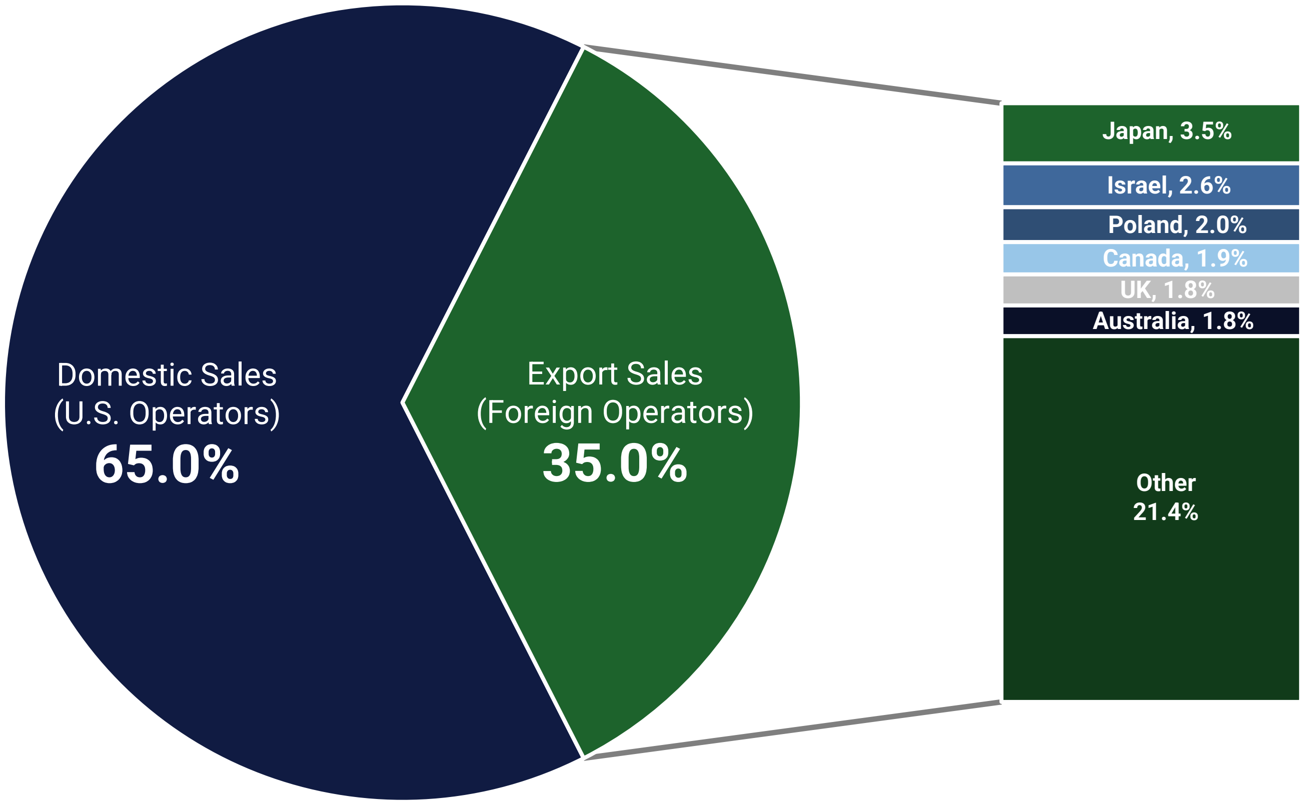
New Build Aircraft Deliveries by Family



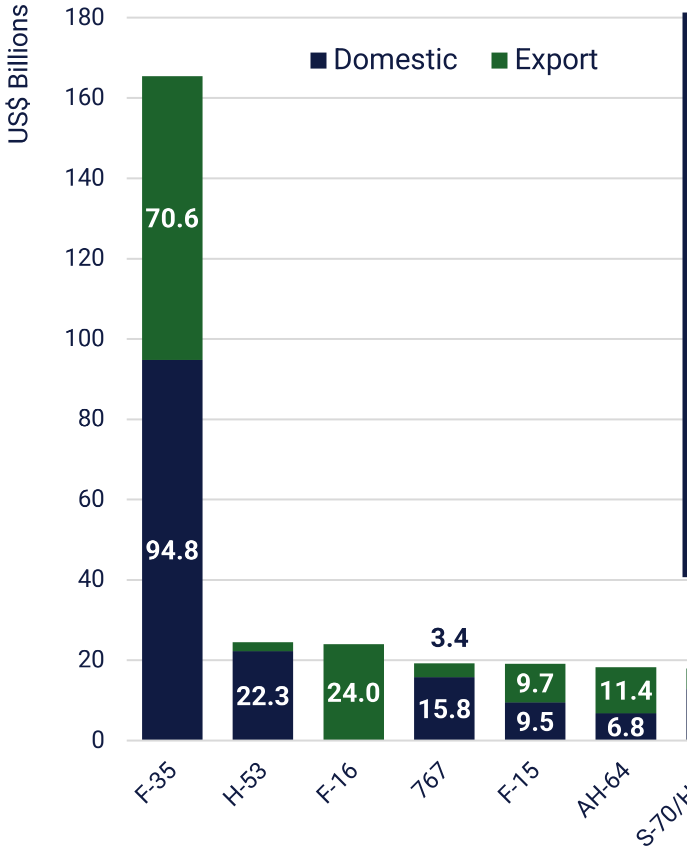
Markets for U.S. Made Military Aircraft

35% of the $433 billion in U.S. made aircraft deliveries projected for the next decade will go to export customers

Destination of U.S. Made Aircraft (By Value)



Export Orientation of Selected U.S. Programs (By Value)



Aircraft	Export %
F-35	42.7%
H-53	8.9%
F-16	100.0%
767/KC-46	17.8%
F-15	50.5%
AH-64	62.8%
S-70/H-60	28.8%
737/P-8/E-7	36.6%
C-130	32.5%
F/A-18	5.3%

Military Aircraft MRO Demand

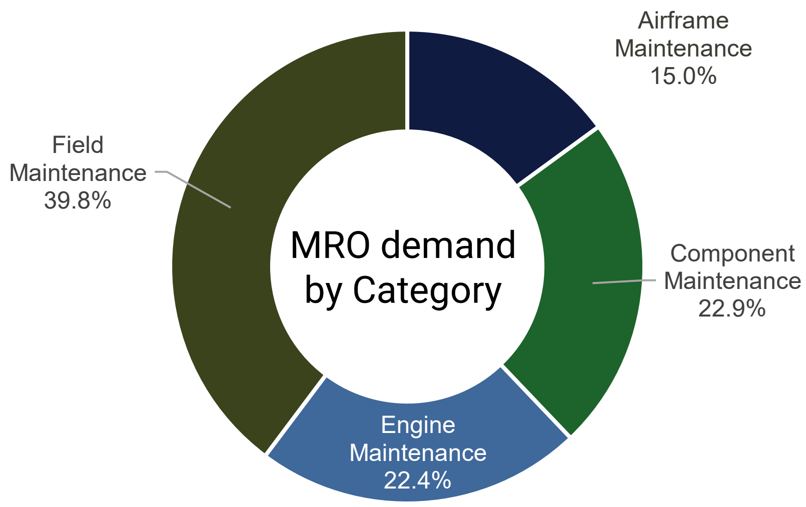
The global fleet of military aircraft is projected to achieve 136 million flight hours over the course of the forecast period generating $1.40 trillion in demand for maintenance, repair and overhaul (MRO). Annual demand is expected to increase at a 1.26% CAGR from $132.8 billion in 2024 to $148.6 billion in 2033, outpacing growth in global military aircraft fleets.

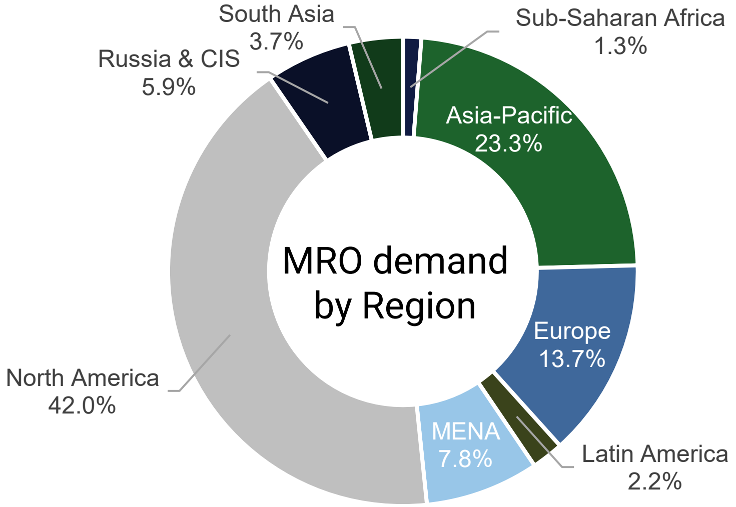
This trend is being driven primarily by the higher MRO costs associated with the technologically advanced aircraft being delivered over the course of the decade, with the gap between MRO and fleet growth projected to widen further in the long term. There is scope for further increases in maintenance demand in the medium term as air forces look to improve readiness and aircraft availability rates.

The vast majority of the demand will be generated by aircraft made by Western OEMs or containing high degrees of Western content. In total this section of the market is projected to account for 77.8% of overall demand worth $1.09 trillion. Driven by the size of its fleet and high readiness requirements the U.S. military alone is expected to spend $554.7 billion on MRO activity over the period accounting for 39.8% of the global total. Demand for spares is adding further strain to an aerospace sector already struggling with capacity constraints and supply chain challenges.

As air power capabilities expand in Asia, the regions with the fastest growing MRO demand are projected to be Asia-Pacific at a 2.39% CAGR, and South Asia at 1.96%. Despite this trend, the drive to modernise and expand capabilities in Europe following Russia's invasion of Ukraine mean that MRO demand will grow rapidly in several European markets. Slovakia, Poland, Finland, and Belgium are among the countries where maintenance spend is expected to expand at a CAGR greater than 4%, driven primarily by the modernisation of each country's combat aircraft fleet through the period.

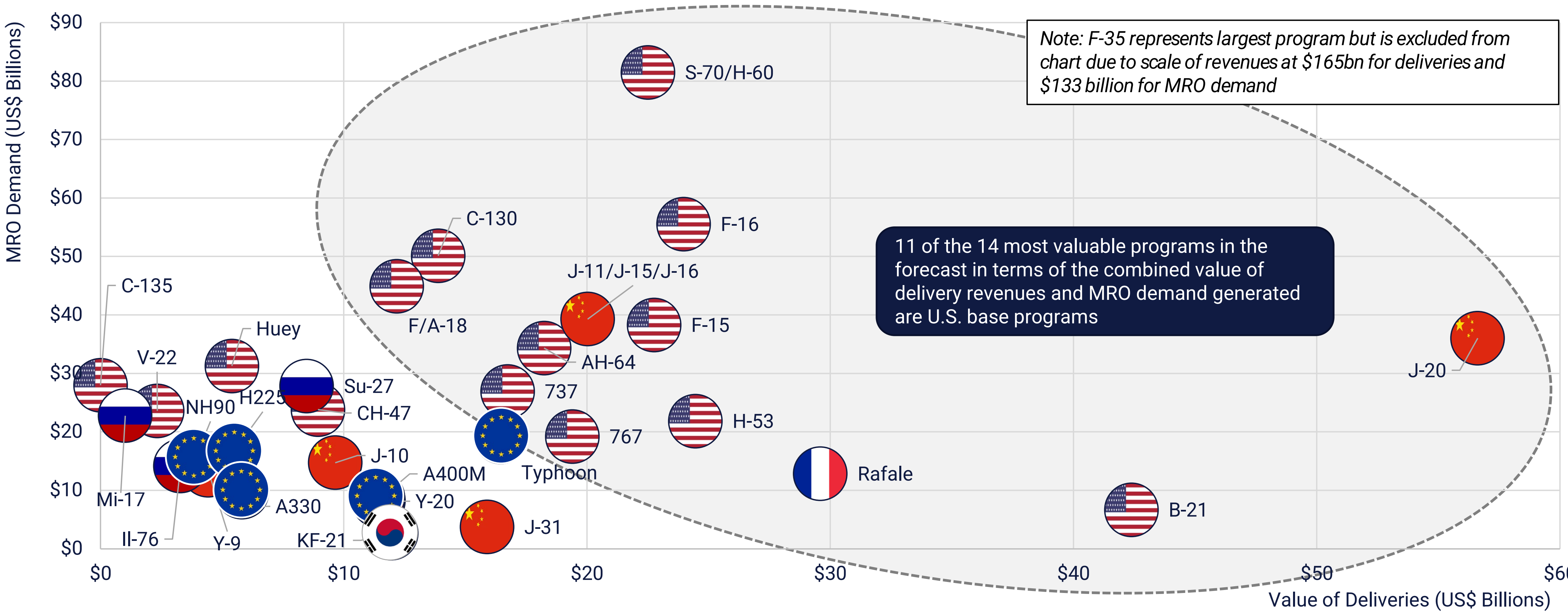
39.8% of all MRO demand is expected to be generated at the unit level as field maintenance, the largest single category worth $554.6 billion. Component based MRO activity is valued at $320.0 billion over the 10-year period, engine maintenance at $311.8 billion, and airframe maintenance at $208.6 billion.





Highest Value Aircraft Programs 2024-2033

Combined value of military aircraft deliveries and MRO demand over the next decade valued at over $2.4 trillion



Opportunities In The Market

Open opportunities for the supply of 4,830 new build military aircraft worth $202.3 billion have been identified over the 10-year scope of the forecast. Around three quarters of this total worth $155.8 billion represent requirements that have been officially announced by governments or operators with a further $46.5 billion identified by Aviation Week analysts based on recapitalisation requirements or capability gaps.

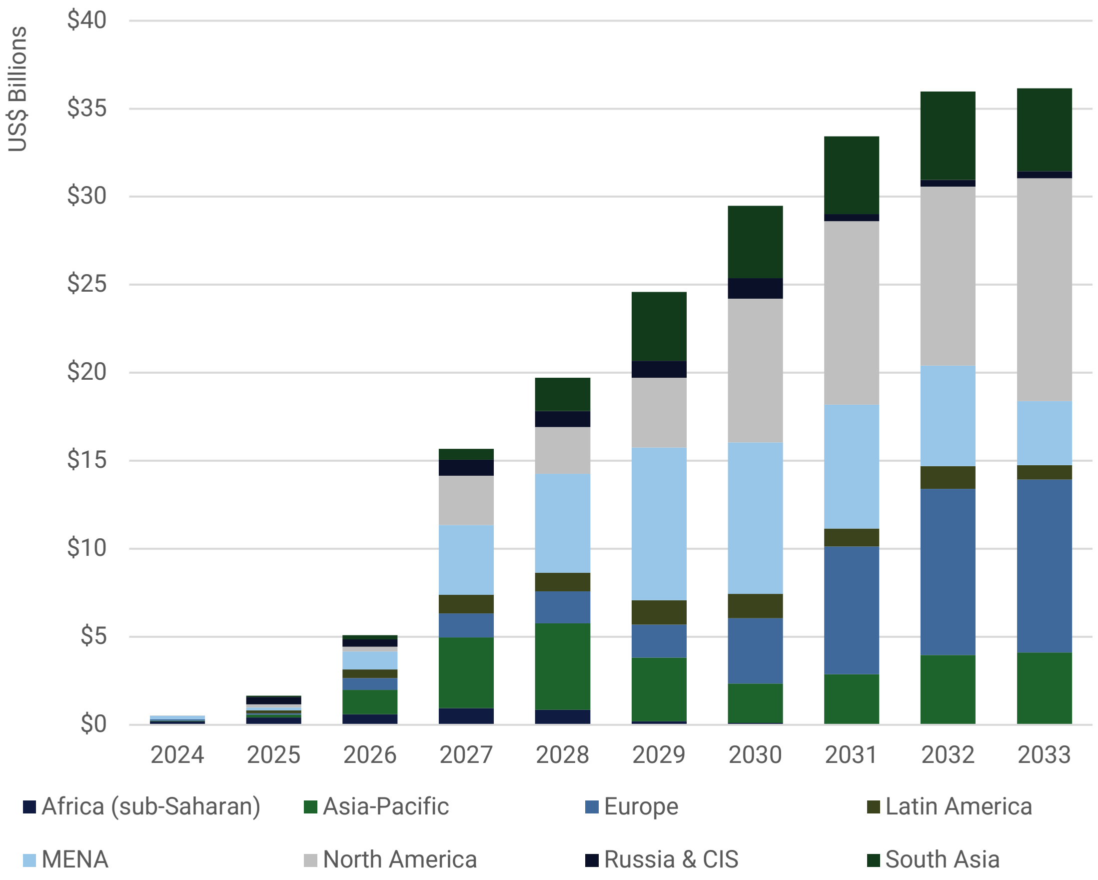
With a plethora of high-profile open competitions due to be decided over the coming years, North America represents the biggest single region in terms of opportunities at 25.4%. Principal U.S. requirements over the forecast period include the U.S. Air Force's Next Generation Air Dominance (NGAD) project, the U.S. Navy's T-45 replacement program, and the U.S. Army's Future Attack Reconnaissance Aircraft (FARA). In total $51.3 billion in aircraft deliveries are expected over the coming decade within the North American market for requirements where a type selection has yet to be made.

Taken together, operators in Asia-Pacific and South Asia are expected to generate a further $52.2 billion in requirements with India alone accounting for $21.8 billion in open opportunities. India's longstanding Multirole Fighter Aircraft (MRFA) project remains the single largest requirement however major naval requirements for multirole helicopters and combat aircraft also exist in the timeframe.

In terms of mission segments the largest opportunities are in the fighter ($67.6 billion), C4ISR aircraft ($27.9 billion), fixed-wing transport aircraft ($21.9 billion) and trainer ($19.5 billion) segments. The fighter mission segment alone accounts one third of all opportunities by value over the decade.

Despite the abundance of opportunities within the market there remains significant scope for more to emerge in the short term as new defense strategies are formulated by operators.

Value of Opportunities by Operator Region



Mission Segments

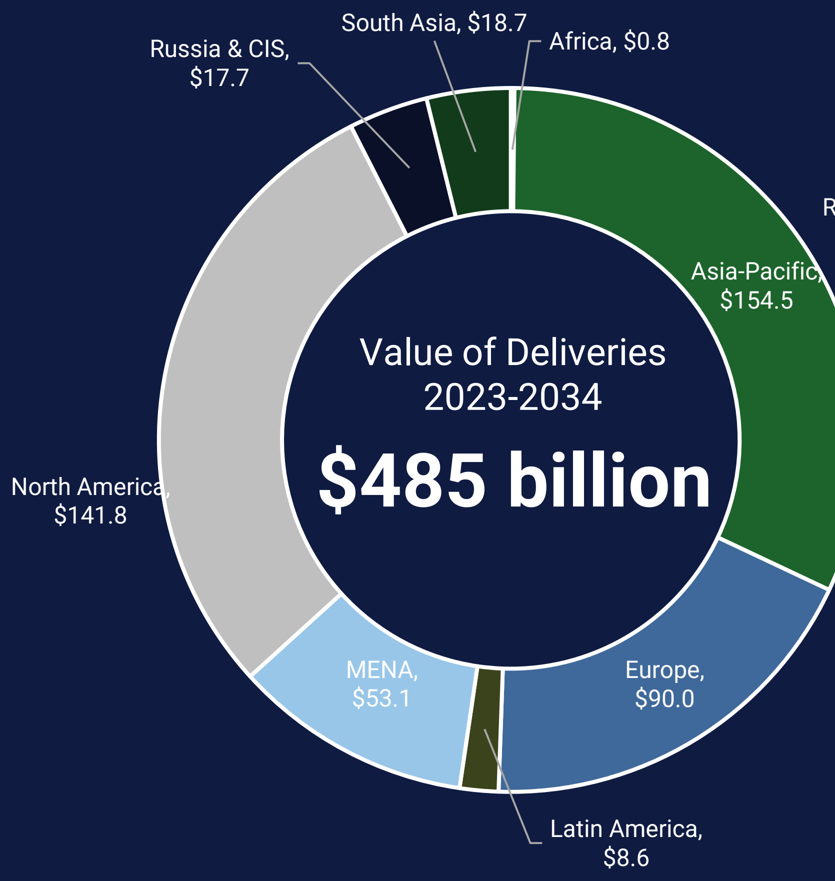
Fighter Aircraft – 2024-2033 Market Projections

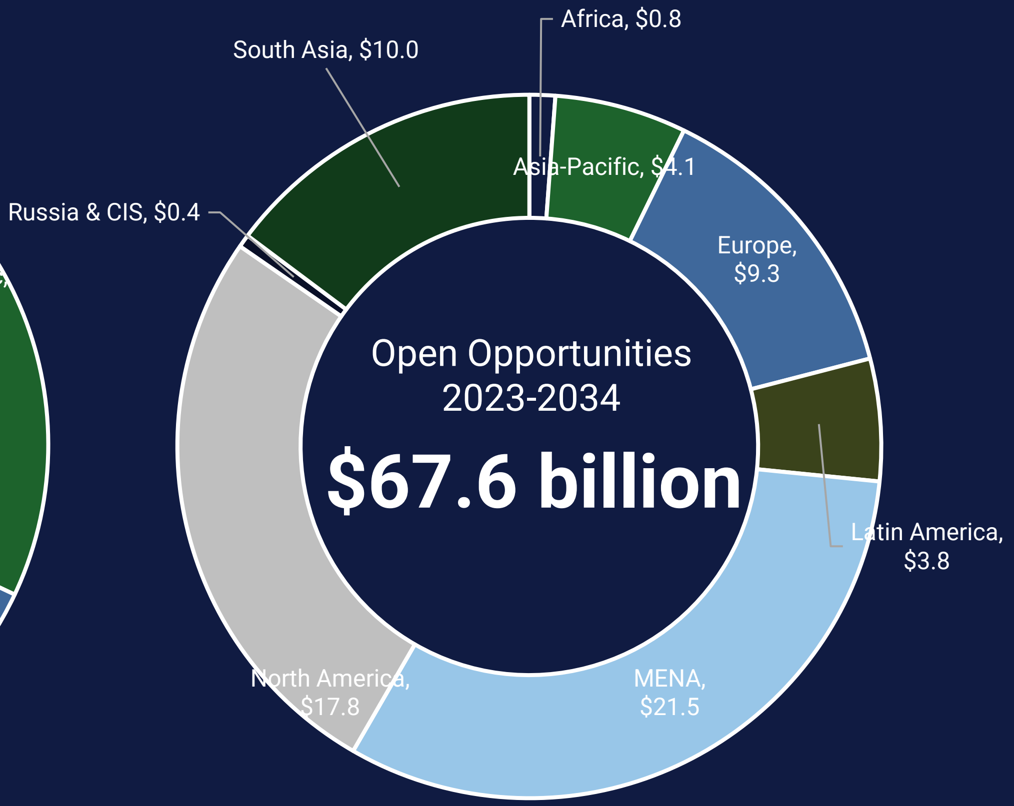
Total New Build Deliveries
5,067 Aircraft

Total Retirements
5,539 Aircraft

In Service Fleet (2024)
14,464 Aircraft

Fleet Growth CAGR (2024-2033)
+0.6%





Fighter Aircraft – Key Market Trends

GCAP concept. (BAE Systems)

"Both GCAP and F/A-XX are expected to enter the market around 2035 and will likely compete against heavily upgraded F-35s paired with CCAs."

While demand for both 4.5 and 5th generation fighters remains robust, Western primes are increasingly focused on developing next generation platforms for the 2030s and 2040s. Key programs include the U.S. Air Force and U.S. Navy Next Generation Air Dominance (NGAD) programs, the Anglo-Japanese-Italian Global Combat Aircraft Program (GCAP) and the Franco-German-Spanish Future Combat Air System (FCAS). Fly-away costs, the relative paces at which these programs mature, their performance and the ability of operators to repair and modify platforms are all expected to shape the fighter market dynamics of the next decade.

In the U.S., the requirements for next generation programs are driven by service led operational analysis (OA) and the resulting domestic orders are robust enough to ensure the U.S. industrial base remains viable. Both NGAD programs are tailored to address the expected high-end threat environment from China in the 2030s by different means – the USAF's NGAD fighter is likely to be an extremely long-range, tailless penetrating Offensive Counter Air (OCA) platform; the Navy's manned component of its NGAD program, F/A-XX, is expected to serve as a fleet air defense interceptor featuring a traditional fighter planform. Both programs will benefit from the U.S. industry's first-mover advantage in LO, sensor fusion, manned-unmanned teaming (MUM-T) and next-generation propulsion technologies. However, exquisite operator requirements are expected to place upward pressure on fly-away costs which could imperil future exports. In 2018, the Congressional Budget Office estimated a unit cost of $189 million for the Navy's F/A-XX and $364 million for the USAF's NGAD (in adjusted FY24 dollars) compared to the F-35A's $92.5 million.

In Europe, the process of service-defined OA is tempered by broader government incentives to ensure exports as domestic orders alone are often insufficient to secure long-term production. French programs have historically preferred lighter designs as weight is strongly correlated with unit cost. French Navy officials expect the New Generation Fighter (NGF) within FCAS to have a gross weight of approximately 30 metric tons – the F-22's is 37.8 tons and Rafale's 22 is tons. Similarly, GCAP nations market the ability of prospective customers to repair and modify their aircraft in contrast to U.S. with its "black box" components. However, European programs are constrained by their multinational structures with differing requirements and competition for industrial workshare. European primes also arguably have more critical capability hurdles to meet prior to launching any next generation program. For example, turbine inlet temperature is often cited as a proxy for engine performance. The Eurojet EJ200 and Safran M88-2 operate at 1,530°C and 1,577°C respectively relative to the P&W F-135's 2,000°C. While both GCAP and FCAS are evaluating 1,800°C+ class powerplants, GE & P&W are developing 2,200°C+ adaptive cycle engines featuring next generation ceramic matrix composites. European primes have yet to mass produce and sustain an LO aircraft fleet.

Both GCAP and F/A-XX are expected to enter the market around 2035 and will likely compete against heavily upgraded F-35s paired with CCAs. The F/A-XX could become the successor to the F-15 as the U.S.' primary twin-engine air superiority fighter export. GCAP may prove attractive for Gulf and Asia-Pacific operators looking for a dedicated air superiority platform or, for operators seeking to diversify from the U.S. geopolitically. Notably, FCAS' delayed 2040 IOC may enable both F/A-XX and GCAP to establish an early market advantage.

Program in Focus – American Air Dominance From ATF to NGAD

In the early 1980s, Air Force planners identified the need for a penetrating offensive counter air (OCA) platform. The Advanced Tactical Fighter (ATF) would take-off from bases in central England and operate within the Soviet integrated air defense system (IADS) over Central Europe, targeting A-50 AWACS and 4th generation fighters. The ATF became the keystone of an emerging portfolio of advanced aircraft tailored to the defense of Europe. The ATF would enable E-3s to provide BMC2, E-8s to provide GMTI against Soviet armored formations for Airland Battle, F-15Es to interdict these second echelon armored forces, EF-111s and F-4Gs to conduct SEAD/DEAD and A-10s to provide CAS. Finally, the F-117A Nighthawk would serve as a “silver bullet force” to target critical C2 centers and other high value targets behind the forward edge of the battle area (FEBA).

The ATF concept foresaw LO, supercruise, high maneuverability, high altitude operation and sensor fusion as mutually supporting elements which would ensure the platform’s survivability by markedly reducing the reaction time and engagement envelopes of threats. The goal was to “to kill without being seen, disengage, and disappear,” according to Col. Albert C. Piccirillo, ATF program manager from 1983 to 1986. The ATF culminated in the single greatest capability leap between fighter generations to date with the IOC of the F-22 in 2005.

Air Force Under Secretary Frank Kendall, the Air Force is fielding a new portfolio of capabilities tailored to confront China including the Long-Range Strike FoS (B-21 and the Penetrating ISR aircraft/“RQ-180”), Next Generation Aerial Refueling System (NGAS), Next Generation Airlift (NGAL), JADC2, space based AMTI & GMTI, F-35A Block 4, AIM-260 Joint Air Tactical Missile (JATM), Stand-in Attack Weapon (SiAW) and Hypersonic Attack Cruise Missile (HACM). The Next Generation Air Dominance (NGAD) FoS will provide the foundational air superiority required to execute all other Air Force missions. The mission of penetrating OCA and the capabilities outlined by the ATF remain relevant, but OCA capabilities must be built upon to address the new threat environment and contemporary technologies.

By the early 2030s, China is expected to field over 1,000 5th-generation fighters as well as over 1,500 4th and advanced 4.5-generation fighters, dozens of Airborne Early Warning and Control (AEW&C) platforms, new surface-to-air missile (SAM) systems and new VHF radars, potentially capable of detecting existing U.S. LO fighters such as the F-22 and F-35 which are optimized against X-band emitters. Together, these assets form a layered IADS supported by naval assets and land-based missile forces designed to deny the U.S. the ability to project power within the first and second island chains.

A 2023 concept for the USAF’s NGAD program. (Lockheed Martin)

The KJ-500 in particular plays an important role in providing the PLAAF with 360° AMTI coverage at extended ranges up to 470 km (254 nmi) – facilitating extended range kill chains and BMC2.

To establish even limited windows of “pulsed” air superiority for joint U.S. operations, the NGAD FoS will have to be able to prosecute high value PLAAF targets behind the FEBA such as the KJ-500, YY-20 tanker and H-20. It will also need to perform sweep missions against PLAAF air superiority fighters such as the J-20.

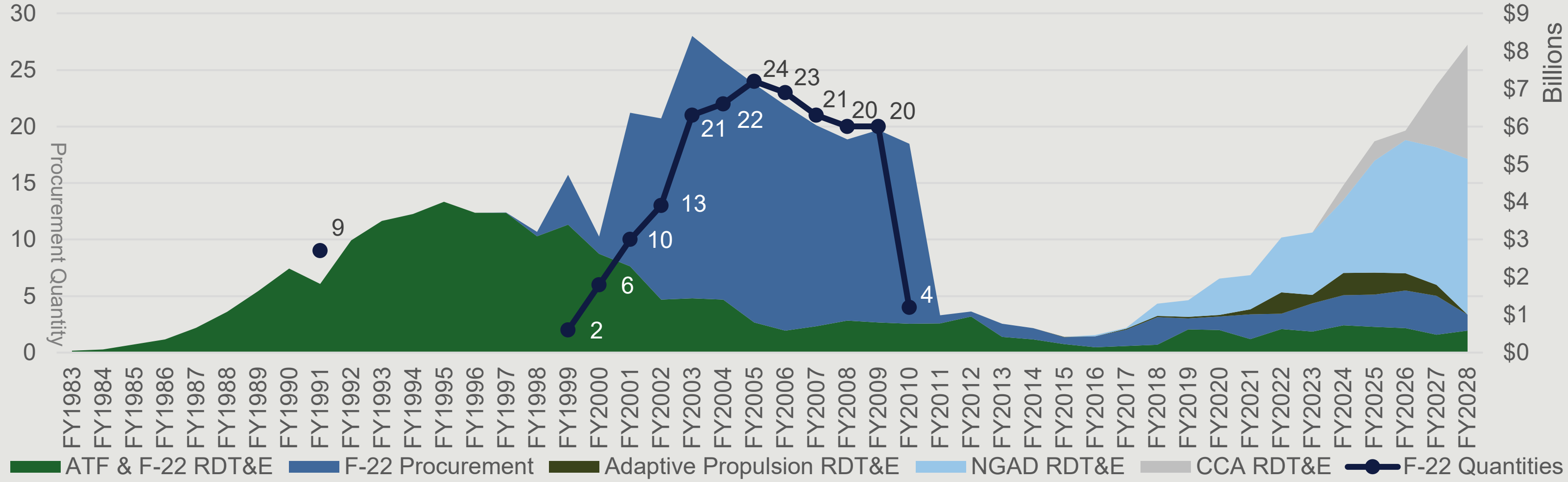
Program in Focus – American Air Dominance From ATF to NGAD

Identification and tracking of LO targets at extended ranges will be a core capability of the NGAD FoS, possibly aided by space based AMTI systems. Collaborative Combat Aircraft (CCA) will also assist in establishing long-range kill chains against LO targets, possibly providing networked multi-static radar and passive AMTI capabilities such as IRST or emerging counter LPI systems. For additional details about CCA, refer to page 85. The NGAD platform will therefore require exquisite computing and signal processing capabilities to glean actionable information from the enormous volumes it generates and receives.

To date, the USAF has spent at least $5.8 billion maturing NGAD, with total spending projected to reach $30 billion through FY28. Secretary Kendall laid the foundations for NGAD with the Aerospace Innovation Initiative (AII) in 2014 in his previous capacity as Undersecretary of Defense for Acquisition, Technology, and Logistics. AII produced flying demonstrators as early as 2019. Following historical trends, these demonstrators likely tested individual pieces of the NGAD FoS. According to then Chief of Staff of the Air Force Gen. David L. Goldfein in 2019, the NGAD FoS consists of five core elements including the NGAD fighter, CCAs, adaptive cycle engines and two classified components.

During the ATF program, the Air Force similarly sought to mature individual pieces of the ATF early on. Initiatives

USAF Air Dominance Investments FY1983-FY2028 (ADJ $B FY24)



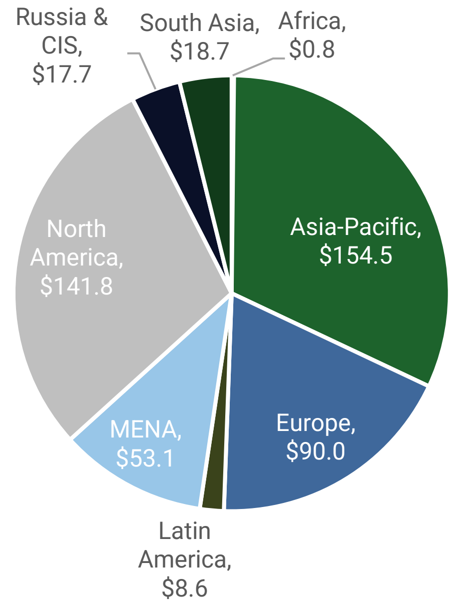
included the Ultra Reliable Radar program, for AESA technologies; Pave Pillar, for the integrated avionics architecture; the Integrated Electronic Warfare System (INEWS); the F-15 STOL/Maneuver Demonstrator, for thrust-reversing and supermaneuvrability; four prototype air vehicles (YF-22 and YF-23) to test both the YF119 and YF120 engines; and finally, a pair of flying avionics laboratories to validate sensor fusion. Kendall has expressed cautious optimism about the course of the LRS-B program, and may emulate it in NGAD by funding both teams through the preliminary design review to reduce risk and insisting early EMD prototypes include the full avionics needed for IOC. Both teams are expected to submit digital designs utilizing model-based simulations (MBS). Boeing is believed to have gained an edge in this field by leveraging its commercial Black Diamond processes used for its T-7A jet trainer. Boeing credits its MBS with a 75% improvement in first-time engineering quality, 50% reduction in software development time and 80% reduction in assembly time. Lockheed has invested heavily in its own StarDrive MBS and digital thread capabilities. NGAD source selection is expected in 2024.

Fighter Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$485 billion

Value of Deliveries by Region



A total of 5,067 new build fighter aircraft will deliver over the forecast worth $458 billion. Deliveries of 5th generation aircraft families (F-35, J-20, J-31 and Su-57) represent 54% of that value at $248 billion. Remanufactured deliveries total $27.1 billion.

The F-35 family alone accounts for 36% of all new build fighter deliveries by value over the period. Cumulatively, the U.S. and international customers will receive 897 and 720 F-35s through 2033 valued at $94.8 billion and $70.6 billion, respectively. Within the past two years, Lockheed has received orders for 332 F-35s from eight countries worth over $30 billion including: Finland (64 in 2021), Switzerland (36 in 2021), South Korea (28 additional in 2022), Germany (35 in 2022), Canada (88 in 2023), Czech Republic (24 in 2022), Israel (25 additional in 2023) and Romania (32 in 2023).

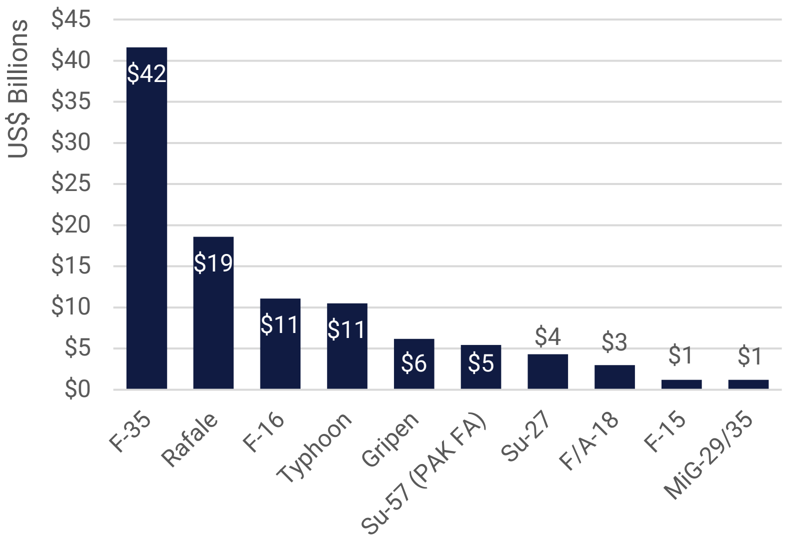
Deliveries of European 4th generation fighter families (Rafale, Typhoon and Gripen) total $54.9 billion through 2033 with the Rafale accounting for 54% of that share. Like the F-35, the Rafale has accumulated a surge of new international orders over the past two years, totaling 164 aircraft including: Greece (6 additional in 2022), Indonesia (42 in 2022), the UAE (80 in 2022) and India (36 in 2023). Additional orders for the Typhoon among Eurofighter consortium members including Spain (45) and Germany (at least 53) will sustain production through the decade.

New build deliveries of the three main U.S. 4th generation families totals $32.6 billion whereas remanufactured deliveries represent $26.2 billion – $7.2 billion for the F-15, $9.8 billion for the F-16 and $9.2 billion for the F/A-18. MLU programs represent a significant future market for Boeing as production of the Super Hornet ends mid-decade and the USAF takes delivery of its 104th and final F-15EX in 2028.

Contracted Order Book (2024-2033)

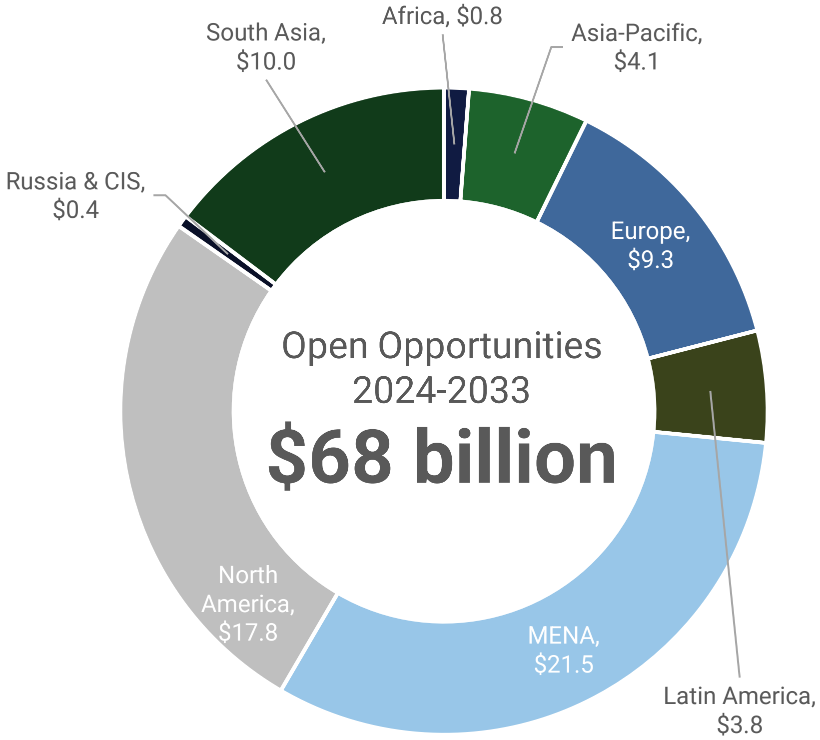
$113 billion

Biggest Programs by Order Book (2024-2033)



Fighter Aircraft – Open Opportunities

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses



Country	Opportunity Size	Notes
United States	54 Aircraft (200) **$17.3 billion**	The USAF is expected to select either Lockheed Martin or Boeing to replace its F-22 fleet as part of its NGAD program in 2024. The NGAP competition between GE & P&W is expected to conclude in either in 2024 or between 2026 and 2027, depending upon contractor performance. The service NGAD IOC target is 2030.
Saudi Arabia	72 Aircraft (72-150) **$8.4 billion**	In 2017, Saudi Arabia signed a LOA to acquire 48-72 Typhoons to replace its Tornado fleet. However, Germany blocked the sale following the 2018 assassination of Jamal Khashoggi. The Kingdom is now examining other options such as the Dassault Rafale F4 and may broaden its requirement by replacing its F-15C/Ds.
India	59 Aircraft (114) **$6.6 billion**	As of late 2023, the IAF had received RFI responses from seven companies for its long-delayed Multi-Role Fighter Aircraft (MRFA) tender. The IAF is now drafting the MRFA RFP which must be approved by the MoD's Defense Acquisition Council. A total of 18 of the 114 fighters will be imported, the rest must be made in India.
Poland	32 Aircraft **$3.0 billion**	Poland originally sought two squadrons of air superiority aircraft (either the Boeing F-15EX or Eurofighter Typhoon) with an aggressive delivery schedule starting in 2026 but is now considering a broader industrial commitment with the KAI KF-21. The PAF already fields 48 F-16s and ordered 48 FA-50PLs and 32 F-35As.
Egypt	24-36 Aircraft **$2.8 billion**	Egypt originally sought to buy at least 20 F-35As, but was denied based on the U.S.' Quantitative Military Edge (QME) policy vis-à-vis Israel. In 2018 Egypt attempted to acquire Su-35s – the U.S. scuttled this with a sanctions threat in 2021. The U.S. has offered the F-15EX instead which is now competing against the Typhoon and Rafale F4.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Fighter Aircraft – Fleet Dynamics

F-35 Fleet Change (2024-2033)

+116%

The global F-35 fleet will more than double from 2024 at 1,203 to 2,599 in 2033. However, production has plateaued at a rate of 156 aircraft per year down from earlier plans to deliver 175 aircraft annually. Turkey's expulsion from the program in 2019 left Northrop Grumman as the sole supplier of center fuselage sections – effectively capping production when combined with the difficulties of inserting TR-3 and Block 4 capabilities into the production line. Prospective customers for the F-35 will likely have to wait seven to eight years (until the early 2030s) to receive their aircraft. In June 2023, Lockheed signed agreements with Patria and Rheinmetall to supply up to 400 forward and centerline fuselage sections, respectively. However, Lockheed CFO Jay Malave explained in a Q2 2023 earnings call that the company would require substantial investment from the U.S. and new customers to expand production. Lockheed maintains it could boost production to over 220 airframes per year, but the requisite investment does not appear to be forthcoming. Aviation Week projects substantial cuts to the USAF's F-35 buys beyond the FYDP as NGAD production accelerates.

The global U.S.-origin 4th generation fighter fleet is projected to decline at a CAGR of -3.18% from 4,936 to 3,689 by the end of the period, driven by both the U.S.' "divest to invest" strategy and legacy Hornet and F-16 replacement tenders abroad. In contrast, European 4th generation fighter families will grow at a CAGR of 3.29% from 1,017 to 1,361. The Gripen, Typhoon and Rafale families are much newer than the F-15, F-16 and F/A-18 with the bulk of deliveries occurring after 2000. Spain and Germany have elected to replace their earliest Tranche 1 Typhoons with new build Tranche 4/5 aircraft. Sweden has decided to upgrade and sustain its JAS 39C/D fleet until 2035 while procuring 60 E-model aircraft. Saab has failed to secure additional export customers since Brazil in 2013 but the Brazilian Air Force has outlined plans to nearly double its fleet from 36 to 70 fighters.

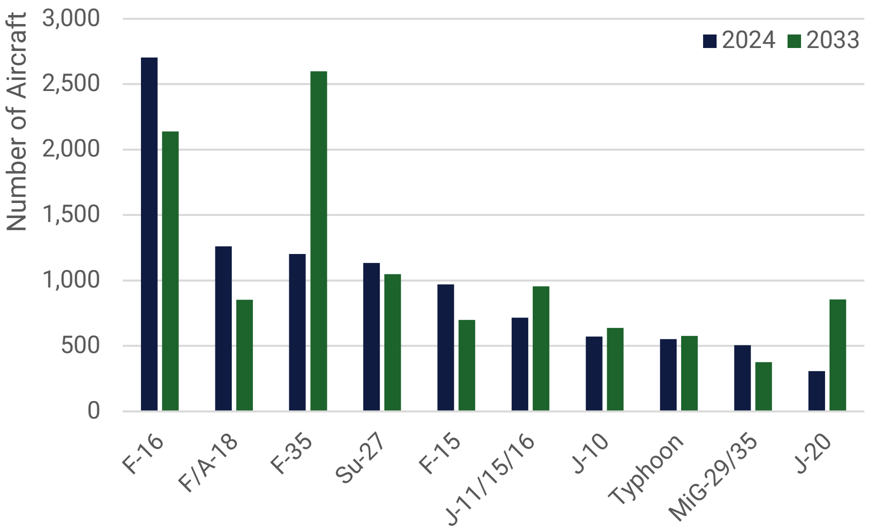
F/A-18 Fleet Change (2024-2033)

-32%

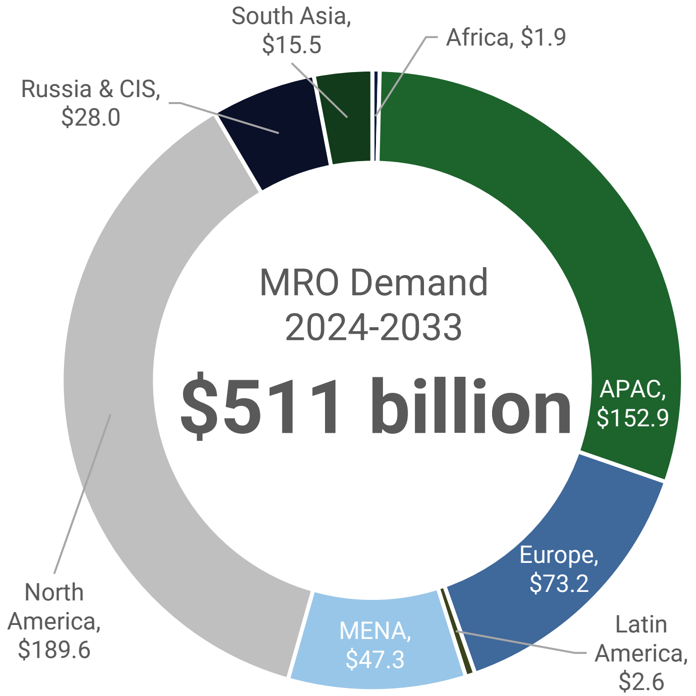
Dassault CEO Eric Trappier confirmed in May 2023 that the Merignac Rafale production line would ramp up from one to three airframes per month (except in August). Trappier lamented the French government's refusal to support a ramp to four airframes per month to fulfill domestic orders, which are now projected to conclude around 2035. Prospective new Rafale customers will likely have to wait until the late 2020s to receive their aircraft.

China's fighter force is projected to grow from 2,153 to 2,668 aircraft over the period, driving renewed investment among other Indo-Pacific operators. More than 40% of China's 2033 fleet is expected to be comprised of 5th generation aircraft: 855 Chengdu J-20s and 217 Shenyang J-31/J-35s.

Key In Service Fleets 2024 and 2033



Fighter Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

+2.4%

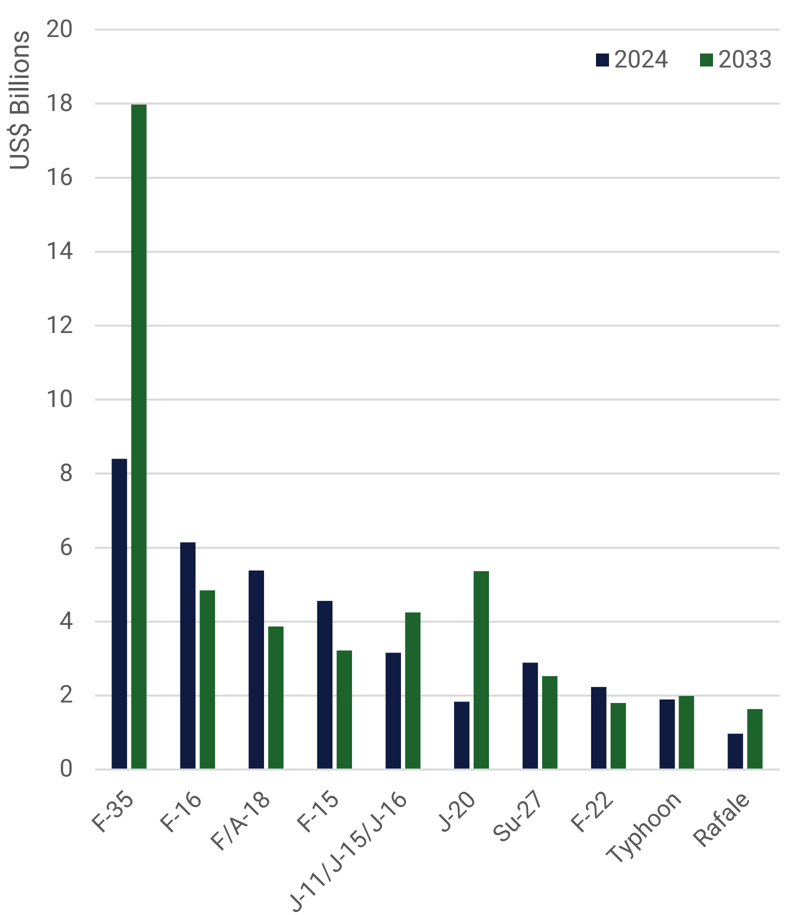
MRO demand generated by fighter aircraft is projected to account for more than one third of all military aircraft maintenance spend over the 10-year forecast. Annual spending is expected to grow at a 2.4% CAGR rising from $46 billion in 2024 to $56 billion by 2023. Rising spending on MRO is being driven by the by the recapitalization of existing fleets with advanced fifth and sixth generation combat aircraft which have higher operating costs due to their combination of advanced technologies and low observable features.

The expansion of the F-35 fleet is the single biggest driver of this trend, but there is scope for the growth in MRO spend to slow if Lockheed Martin is able to generate operating cost savings over the coming years as planned. Regardless, by virtue of the scale of growth within the fleet, the annual MRO demand generated by the F-35 is expected to more than double over the course of the decade.

Maintenance spending on fourth generation aircraft like the F-16, F-15, F/A-18, and Su-27 is generally expected to decline as these fleets are gradually divested. Nevertheless, with new build examples of these aircraft continuing to be produced in large quantities, even by 2033 legacy generation aircraft will still generate the majority of annual fighter MRO demand in 2033.

Longer term there is scope for savings to be generated by the partial replacement of fighter fleets with unmanned collaborative combat aircraft.

Top Programs By MRO Demand



Transport and Tanker Aircraft – 2024-2033 Market Projections

Total New Build Deliveries

1,154 Aircraft

Total Retirements

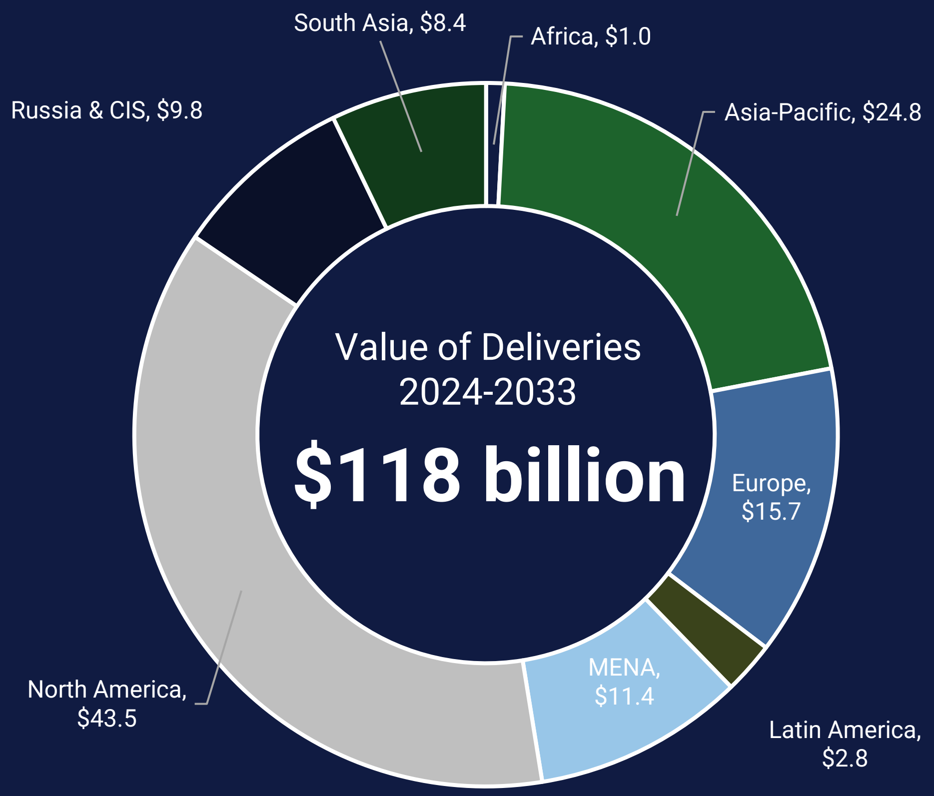
1,424 Aircraft

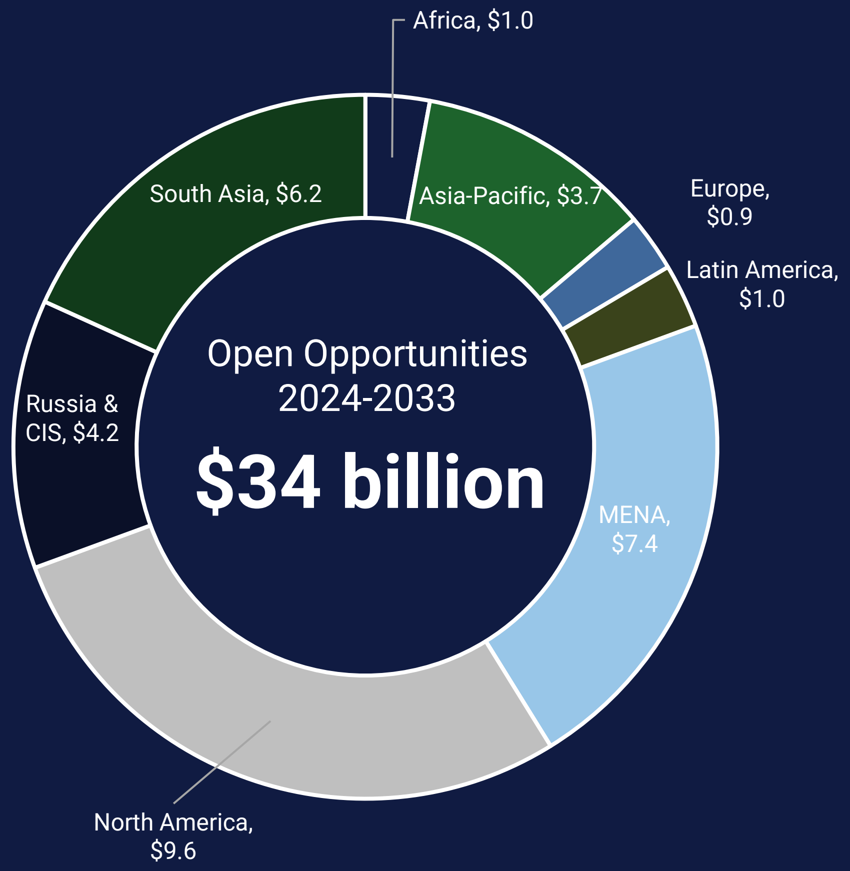
In Service Fleet (2024)

6,113 Aircraft

Fleet Growth CAGR (2024-2033)

-0.5%





Transport and Tanker Aircraft – Key Market Trends

An F-16 viewed from the KC-46A's Remote Vision System 2.0 while taking fuel at night. (Boeing)

"The expanded KC-46A procurement will take the program past the forecast and keep the high end of the western tanker market a duopoly"

Key countries continue to recapitalize their transport and tanker fleets over the forecast period, driving orders for families such as the 767 (KC-46A), A400M, C-130J, C295, C-390, and Y-20. Chief among these are the U.S., Russia, India, and China. The major western European transport operators are also recapitalizing, with Airbus A400M expanding their transport fleets faster than they retire legacy aircraft. Little activity is expected in the heavy segment of the transport market when tankers are excluded, aside from China's Y-20 program and the Il-76 program, neither of which is expected to penetrate the export market over the forecast.

At the light end of the transport market, over 250 Soviet-era An-24 derivatives require replacement, predominately in Russia and India. India is likely to opt for a western solution (possibly more C295s to complement its existing commitment for 56). Russia pins its hopes on the troubled Il-112 program, now powered by the unproven PD-8 engine instead of the TV-117C. The C295 will dominate the light market outside of Russia.

In the tanker segment, most procurement will take place in the U.S. and China. The USAF will complete its KC-46A commitment and will likely opt to procure another 75 aircraft under its truncated Bridge Tanker program (which originally sought 150 aircraft). Bridge Tanker could conceivably result in an Airbus A330 MRTT acquisition, but this is unlikely. The expanded KC-46A procurement will take the program past the forecast and keep the high end of the western tanker market a duopoly, though without more orders Airbus is in trouble past 2028-2029.

Looking beyond the forecast, the remaining half of the USAF KC-135R/T fleet will be replaced by a future tanker dubbed the Next Generation Airlift (NGAL) around 2035. In August 2023, the USAF awarded start-up JetZero a $235 million contract to build a 767 sized demonstrator in partnership with Northrop Grumman by 2027. Compared to existing tankers, the blended wing body design is expected to offer up to 30-40% reduced fuel consumption, greater rates of fuel offload and improved signature performance at the cost of introducing complex aerostructures and weight penalties. The Air Force has also expressed interest in STOL capability and UAS integration for NGAS. A follow-on NGAL heavy transport is expected in the 2040s to replace the service's Boeing C-17 and Lockheed Martin C-5 fleet.

In China, the PLAAF is moving ahead with a tanker derivative of its Y-20 heavy airlifter. The latter is unlikely to have export potential both for policy reasons and for lack of a market. At the lower end, there are many operators desirous of both transport and tanker capability in a smaller package in the form of aircraft like the C-130J-30/KC-130J and KC-390.

Program in Focus – Embraer C-390

Embraer's C-390 program began in April 2009 as a means to replace Brazil's aging fleet of C-130H medium transports and expand the country's aerospace industrial expertise and capacity. The original plan anticipated a large 28-aircraft buy from the Brazilian Air Force that would go well beyond its fleet of 18 K/C-130Hs.

Though this large order – and orders from Latin American industrial partners – have not come to fruition, the C-390 is carving out a niche in the export market. Part of this is down to fortuitous timing. The first production C-390 was delivered to the Brazilian air force (FAB) in 2019, so the production line was ramping up as Russia commenced its full-scale invasion of Ukraine in February 2022. The resultant spike in European defense spending yielded a spate of medium transport replacement requirements the C-390 was well placed to compete for.

When in June 2022 the Netherlands selected the C-390 over the C-130J-30 to replace four C-130Hs, it cited the aircraft's superior availability and lower maintenance burden. It also assessed that a fleet of four C-390s could provide 2,400 flight hours a year, while the C-130J-30 would need five. Austria is now hoping to procure four in cooperation with the Dutch, who will bundle the procurement with their own to control costs.

The biggest peril facing the C-390 is retrenchment from its primary customer, the FAB. The FAB cut its buy from 28 aircraft to 14 aircraft in 2021 before a series of negotiations and controversies brought the acquisition objective back up to 22 aircraft. Procurement of these aircraft has deliberately been spread out to 2034 to keep the C-390 in production and to make the acquisition fiscally sustainable for the Brazilian government.

This bare minimum annual commitment to the program could drive up unit costs and make the C-390 less competitive, or it could force Embraer to make permanent cuts to the production capacity of the line.

In terms of capability, the C-390 sits between a C-130J-30 and an A400M. Its cargo bay measures 60.7 ft x 11.32 ft x 9.68 ft, 1.3 ft. wider and 0.2 ft. higher than the C-130J-30 but 5 ft. shorter, and its 57,320 lb. maximum payload weight compares favorably to the C-130J-30's 42,000 lb. The A400M cargo bay is sized 58 ft. x 13.1 ft. x 13.1 ft., and it can carry 81,600 lb., 42.4% more than the C-390. Because of its higher price point and capacity, the C-390 is generally not in competition with the A400M in the export market.

Another differentiator against the C-130J-30 is the

A KC-390 tanker in flight with hoses extended. Credit: Embraer

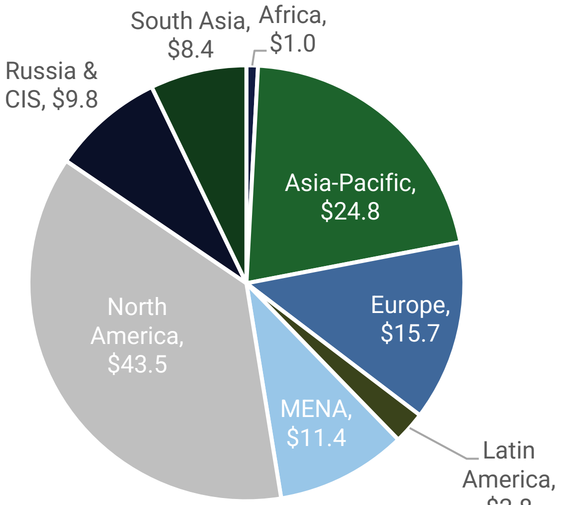
K/C-390's refuelling system. The C-130J-30 is not provisioned for aerial refuelling, so customers desirous both of transport and tanker capability from a small fleet either have to buy a mix of KC-130J and C-130J-30 or make do entirely with a force of short KC-130Js. A C-390, by contrast, can be provisioned as a KC-390 easily. The C-390 also has its own refuelling probe to accept fuel in flight. Special mission C-130J variants can accept fuel, but only via a slipway that accepts a boom.

Transport and Tanker Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$118 billion

Value of Deliveries by Region



Lockheed Martin's C-130 remains in production until 2031, with 107 new-build deliveries, and is well placed for a variety of open transport competitions – it will need to win some to keep the line open to 2033 or beyond.

One of the C-130's chief competitors, the Embraer C-390, has recently secured additional exports to Austria and the Czech Republic. The program is nevertheless constrained by Brazil's 2021 decision to cut its order in half. Embraer is likely to produce aircraft at the slowest sustainable rate to maximize the time the line is open such that it can secure additional exports. At least 24 C-390s will deliver over the forecast period. Should it outlast the C-130 program, the C-390 will be well positioned for medium transport requirements emerging in the early 2030s.

The A400M program remains healthy, owing to a robust orderbook from France, Spain, and Germany. 58 aircraft will be delivered over the forecast. At higher cost and capability than either the C-130 or C-390, the program will have difficulty accessing most open opportunities and depends on its key European customers to remain in production.

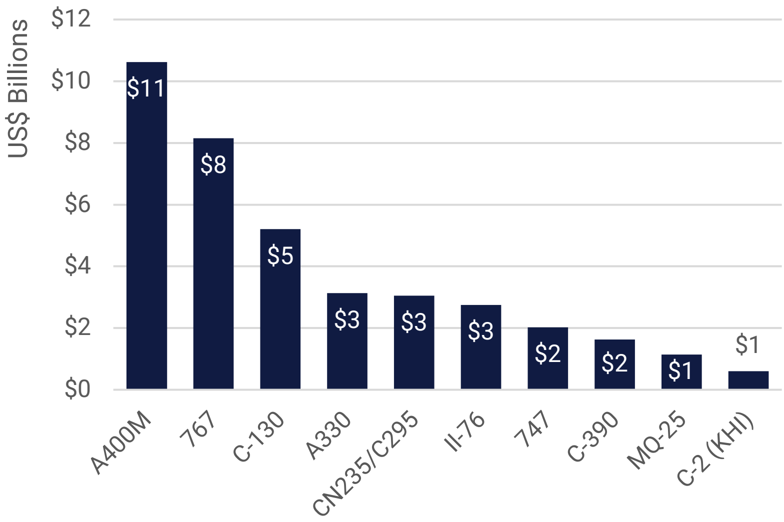
The C295 is now delivering aircraft to India pursuant to a 2021 order for 56 aircraft. The aircraft represents an ideal alternative to higher end medium transports such as the C-130J-30 and A400M and will likely continue to see success among operators of modest means.

In the tanker market, Boeing's KC-46A casts a long shadow. The program has a robust order book due to the U.S. Air Force procurement, and it is likely to grow by 75 aircraft when the fate of the Bridge Tanker competition (which may become a sole-source award to Boeing) is decided.

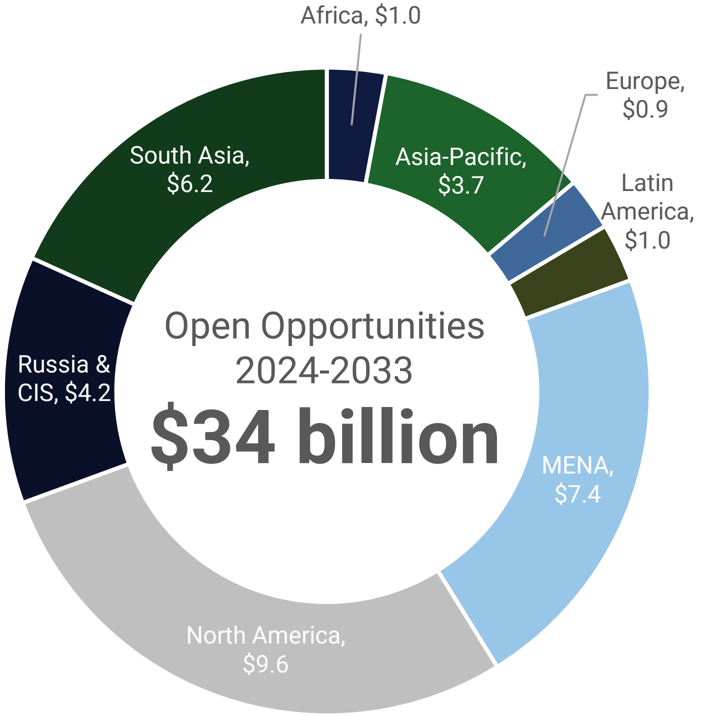
Contracted Order Book (2024-2033)

$39 billion

Biggest Programs by Order Book (2024-2033)



Transport and Tanker Aircraft – Open Opportunities



Country	Opportunity Size	Notes
United States	51 Aircraft (75) **$8.3 billion**	The U.S. is seeking a follow on to its KC-46A procurement as a bridge to its clean-sheet Next Generation Aerial Refuelling System (NGAS) program. This "Bridge Tanker" procurement was previously to cover 150 aircraft, but since NGAS (formerly KC-Z) has been accelerated, the Bridge Tanker program has been cut to 75 planes.
Russia	20 Aircraft **$4.2 billion**	Beginning in 2008, Russia reengined its Antonov An-124 force to the An-124-100 standard at a slow rate. The invasion of Ukraine beginning in 2014 interrupted the program and left much of the An-124 force unflyable. To maintain its very heavy airlift capability, Russia requires a solution independent of Ukrainian industry.
India	17 Aircraft **$3.3 billion**	As India looks to replace its An-32s, the Russian segment of its heavy airlifter force will also age out. The IAF's youngest Il-76s are now over 30 years old. New-build Il-76MD-90As are a possible replacement option. With the C-17 out of production, India's only western option even *close* to this weight class is the Airbus A400M.
India	66 Aircraft (100) **$2.8 billion**	India retains a force of 99 Antonov An-32 and An-32RE light transports that will require replacement during the forecast period. India has 56 C295s on contract to replace its HS748-2s. With local assembly anticipated to 2032, extending the C295 program to cover the An-32 fleet would make a sensible 1:1 replacement.
Morocco	12 Aircraft **$1.3 billion**	Morocco possesses a force of 12 C-130Hs and two KC-130Hs predominately delivered in the 1970s that will age out during the forecast period. Morocco is designated a major non-NATO ally by the U.S. and will have access the C-130J-30/KC-130J should it opt to go that route – alternately C295, C-390, or A400M are options.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Transport and Tanker Aircraft – Fleet Dynamics

C-130 Fleet Change (2024-2033)

-16%

Transport and tanker fleets worldwide will contract modestly over the forecast period, from 6,113 aircraft at year-end 2024 to 5,863 aircraft and year-end 2033. Much of this decline is driven by retirements in key families such as the Antonov An-24, Boeing C-135 and Lockheed Martin C-130. Each will shed hundreds of obsolescent airframes over the forecast as replacements come online.

More broadly, operators across the world are choosing to replace transport and tanker fleets with more efficient platforms in pursuit of cost reduction or in recognizance of decreased operational requirements. By 2033 for instance, the U.S. Air Force's C-130 fleet will have declined by 10.6% since 2013. C-130J variants are nearly one for one replacements for their legacy C-130H counterparts. Though the fleet has shrunk, most non-special mission C-130Js in USAF service are C-130J-30s, while the C-130H fleet is dominated by aircraft sans the 15-ft. fuselage extension. Combined with new engines, the predominance of the stretched variant mitigates the loss of capacity.

230 An-24 variants will retire during the forecast period, predominately in Russia and India. In the latter case, with access to the western market and the Airbus C295 under local assembly a wider C295 procurement is likely. The C295 is in the same weight class as the An-24, and though its engines deliver less power than advanced variants such as the An-32, it can carry a similar payload over a similar range due to its much lower empty weight and superior design.

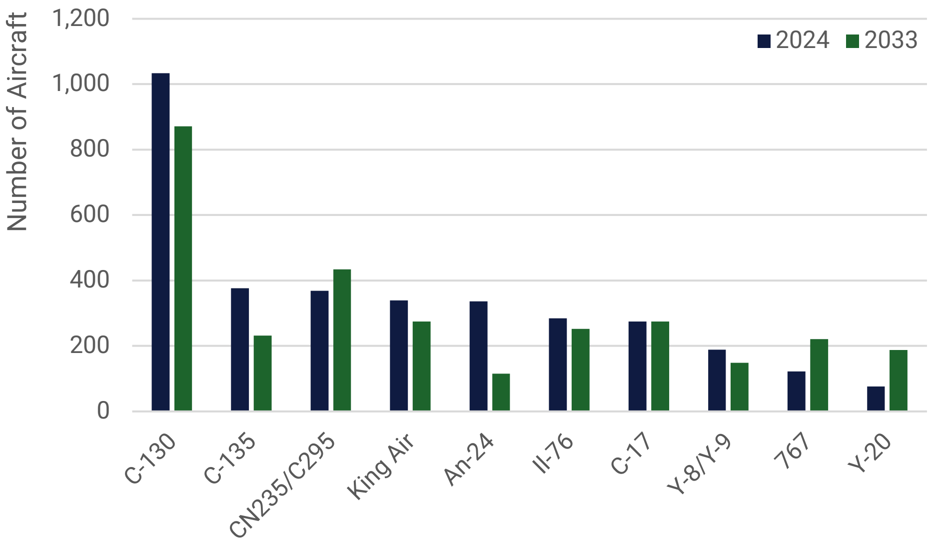
Russia does not have this option and instead counts on its Il-112 program. The Il-112 design has recently been rebaselined to a turbofan configuration using the Aviadvigatel PD-8 in place of the Klimov TV7-117ST turboprop. The Il-112 program is so far notable primarily for an August 2021 crash that destroyed the sole Il-112V flying prototype and killed all three crew aboard following a right engine fire. If the program can be salvaged it could have limited export success among operators who cannot access the C295 for political reasons.

An-24 Fleet Change (2024-2033)

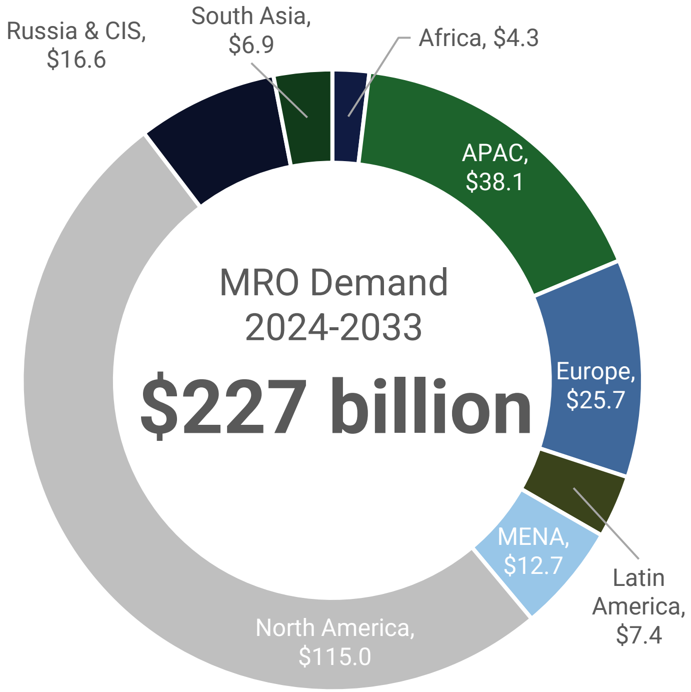
-66%

Finally, the global KC-135 fleet is inexorably in decline as the remaining operators field replacement tankers. Note that special mission C-135s are not captured here and are instead reflected in the C4ISR mission market.

Key In Service Fleets 2024 and 2033



Tanker and Transport Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

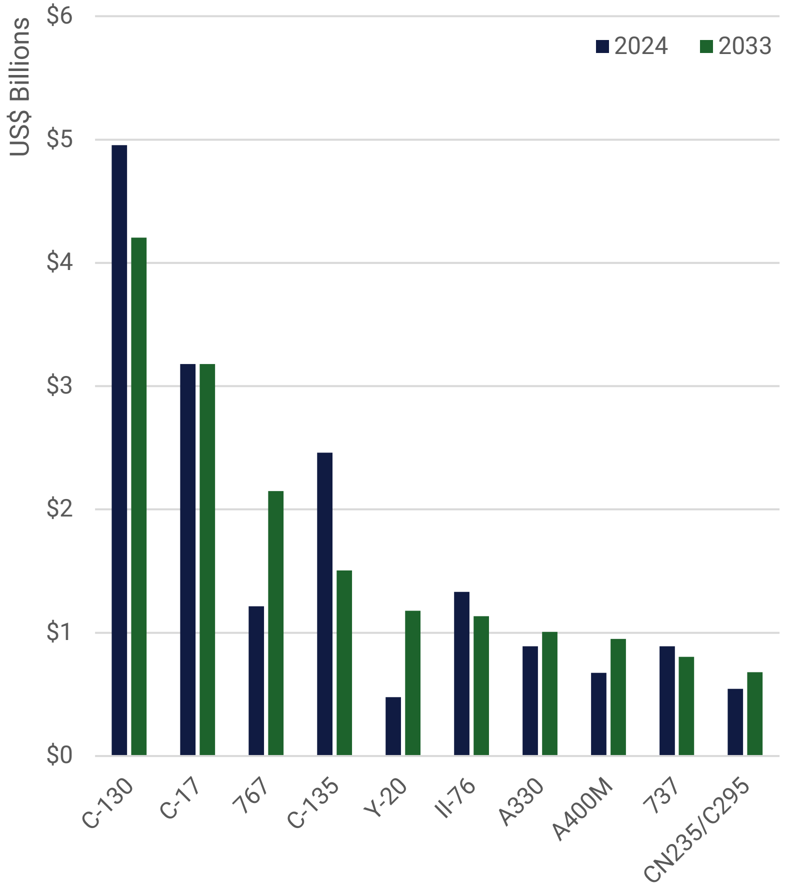
+0.5

MRO demand relating to tanker and transport aircraft is projected to increase at a 0.7% CAGR from $22.2 billion annually in 2024 to $23.2 billion in 2033 despite a decline in the global fleet of transport aircraft. Around one third of these maintenance revenues will be generated by a growing tanker fleet which will expand from 1,026 aircraft to 1,217 over the course of the forecast period.

MRO demand growth is also being driven by a growing fleet of larger strategic tanker and transport aircraft such as the Boeing KC-46A, Airbus A330 MRTT and Xian Y-20. Annual spending on heavy tanker and transport aircraft MRO is projected to rise from $8.0 billion in 2024 to $10.2 billion in 2033 while demand generated by medium and light transports will decline from $14.2 billion to $12.9 billion over the same period. Overall sending on transport aircraft without aerial refuelling capabilities will decline over the period.

The C-130 will continue to generate the highest amount of annual MRO demand throughout the forecast period. However, demand has peaked and is in decline. While the C-130 remains in production, other programs are starting to erode the aircraft's longstanding market dominance. Furthermore, the type's primary user, the U.S. Air Force, is projected to downsize its fleet significantly through the 2020s as it reassesses the delivery of tactical transport capabilities and retires older C-130Hs.

Top Programs By MRO Demand



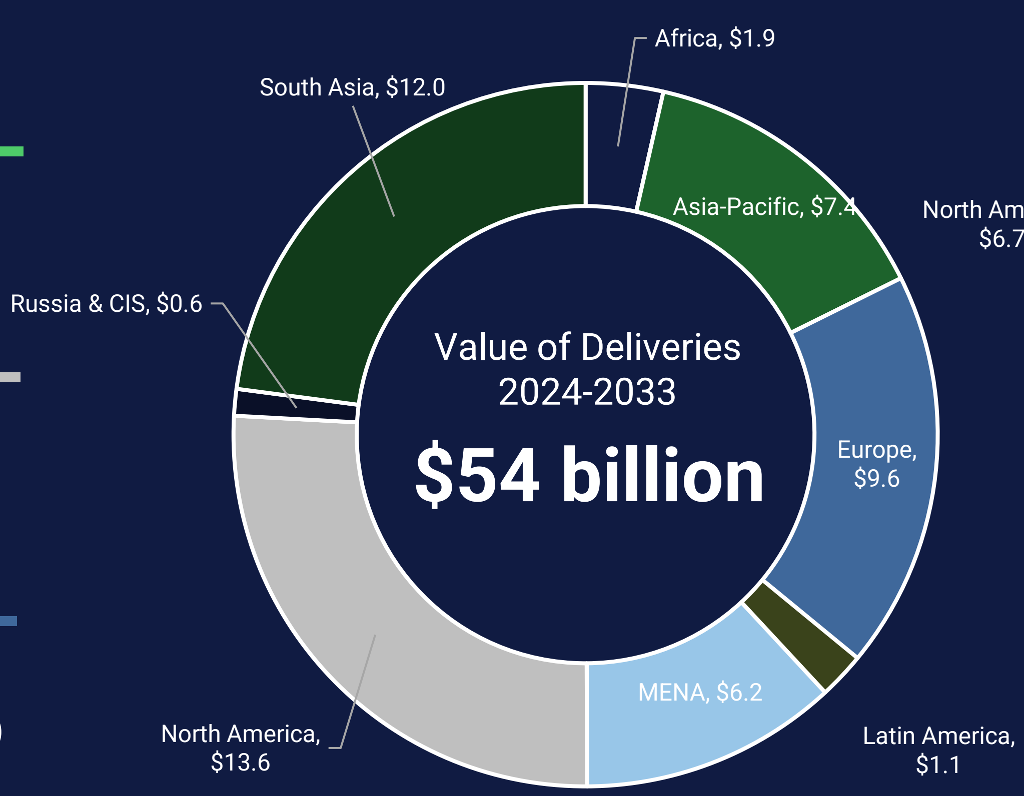
Trainer/LCA Aircraft – 2024-2033 Market Projections

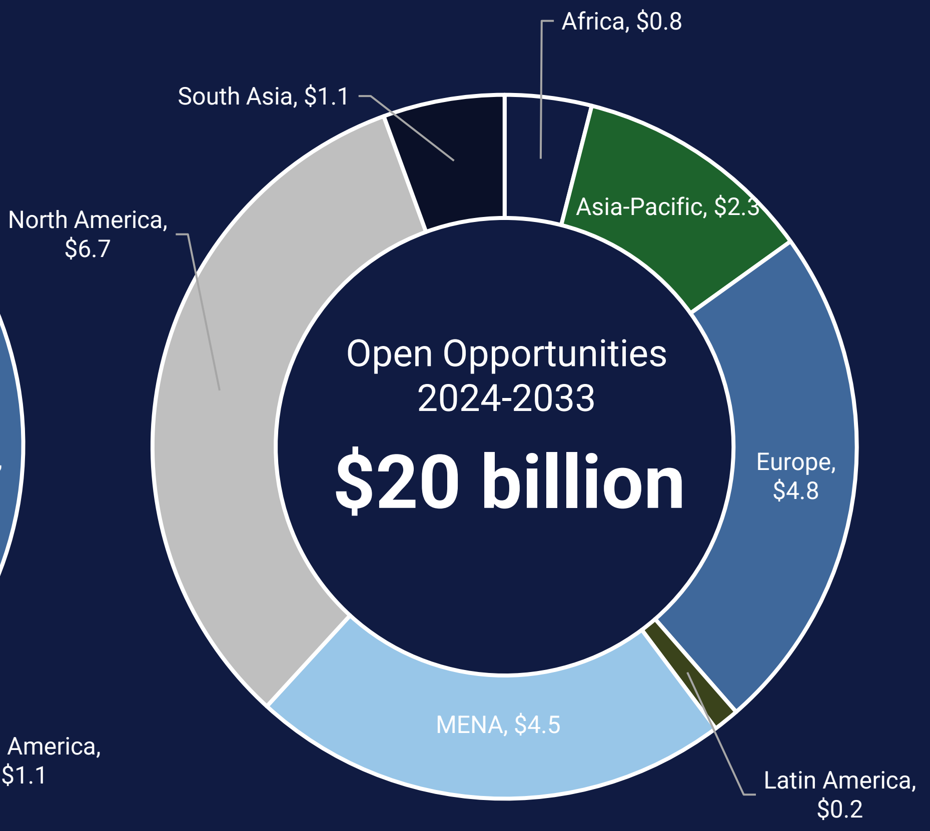
Total New Build Deliveries
3,112 Aircraft

Total Retirements
3,472 Aircraft

In Service Fleet (2024)
10,472 Aircraft

Fleet Growth CAGR (2024-2033)
-0.1%





Trainer / Light Combat Aircraft – Key Market Trends

The ATARS augmented reality visor. (U.S. Air Force)

"LVC solutions like ATARS could enable to the Air Force to scale back its planned procurement of aggressor aircraft [...] and to reduce manning and flight hours of existing units."

The budgetary pressures from global next generation fighter procurements has not dampened the need for new trainers but has compelled industry to focus on low-cost offerings. Breakthroughs in live, virtual, constructive training (LVC) promise to deliver aggressor and large force exercise training at a fraction of the cost of contemporary aggressor squadrons.

At the 2023 Air Force Association's Air Force & Cyber Conference, Boeing highlighted its partnership with the start-up Red 6 to provide in-flight augmented reality training solutions. Last year both companies signed an agreement to integrate Red 6's Advanced Tactical Augment Reality System (ATARS) and Augmented Reality Command and Analytic Data Environment (ARCADE) with a Boeing owned TA-4J. ATARS tracks both the position of the host aircraft and the pilot's head while generating synthetic aircraft over a helmet mounted display using Unreal Engine assets. For example, ATARS could enable pilots to engage simulated J-20s and Su-57s, faithfully replicating their performance characteristics while avoiding the expense of manned aggressor squadrons. ARCADE facilitates mission planning as well as post-mission analysis and debriefing. If successful, Boeing plans to explore adapting ATARS to the T-7A and F-15EX.

The Air Force has long sought to reduce force structure demand for aggressor squadrons as well as the cost of training to approximately $2,000-3,000 per flight hour. The service had previously explored concepts such as ADAIR-X (modified AJTs), ADAIR-UX (developing an unmanned force) and contractor operated aggressor fleets. However, concepts such a modified T-7B for ADAIR-X were expected to cost approximately $20 million each and $7,200 per hour to operate. LVC solutions like ATARS could enable to the Air Force to scale back its planned procurement of aggressor aircraft (such as the Advanced Tactical Trainer or ATT program) and to reduce manning and flight hours of existing units.

Red 6 concluded its Series B round of fundraising in June 2023, raising overall investment to $100 million. Backers included venture firms of Lockheed Martin, Boeing, Disney, the UK's National Security Strategic Investment Fund and the actor Robert Downey Jr.'s Downey Labs. Red 6 has also signed agreements with BAE Systems and Lockheed Martin & KAI to integrate ATARS with the Hawk and T-50 respectively. Despite the pronounced industry interest in Red 6, it remains to be seen if the operational community judges the value of ATARS to be comparable to live force exercise with real world assets as well as the degree in which ATARS can integrate with an aircraft's mission systems to provide representative sensor, electronic warfare and weapons employment opportunities beyond replicating simple basic fighter maneuvering.

Program in Focus – Boeing T-7A

The T-7A "Red Hawk" is an advanced jet trainer (AJT) built by Boeing in partnership with Saab. The aircraft is powered by a single General Electric F404 turbofan engine. The Air Force selected the T-7A as the victor of its T-X competition to replace the T-38 Talon in September 2018. A total of 351 aircraft will be delivered into the 2030s. As of the FY2024 budget, T-7A RDT&E and production costs are estimated at $1.35 and $7.65 billion respectively or $9 billion in total. The Air Force took delivery of its first EMD T-7A on Oct. 14, 2023.

The Air Force is expected to make a Milestone C Low-Rate Initial Production (LRIP) decision by Q1 of 2025, though Boeing says it could accelerate that decision to Q3 of 2024. The service currently plans to declare Initial Operational Capability (IOC) in Q2 of 2027, 2.5-years later than originally planned (October 2024). To date, Boeing has incurred over $1.5 billion in losses under the terms of the firm-fixed-price (FFP) T-7A development contract.

Boeing believes the T-7's embedded simulation capabilities as well as its low fly-away and sustainment costs will make the type an attractive platform in the international AJT and light combat aircraft (LCA) market. Boeing credits its Black Diamond digital design processes with a 75% increase improvement in first-time engineering quality, 50% reduction in software development time and 80% reduction in assembly time. Boeing's confidence in its Black Diamond effort led to an aggressive pricing strategy with a fly-away cost of approximately $18 million ($21.8M in FY24) relative to Lockheed's T-50A bid of at least $25 million ($30.3M in FY24). Air Force criteria heavily favored the lowest-cost technically acceptable solution. Marillyn Hewson, then Lockheed's CEO, later remarked the company would have lost $5 billion ($6 billion) had it met Boeing's aggressive pricing to win the contract. Despite the T-7A's low cost and adoption by the USAF, the aircraft has yet to secure further sales since 2018. Sweden and Australia previously expressed interest in the Red Hawk but have since extended the service lives of their existing trainers until the 2030s.

The USN's Undergraduate Jet Training System (UJTS) program to replace the T-45 represents the largest global AJT opportunity with a minimum of 145 aircraft. Entrants will include the Boeing T-7B, Leonardo-Textron M-346 and KAI-Lockheed Martin TF-50N. The Navy originally prioritized an accelerated delivery schedule and did not include carrier qualification in the 2018 RFI – enabling the acquisition of an off-the shelf system. In August 2023, a Navy RFI indicated the service would now require its new AJT to perform repeated unflared landings to practice the carrier recovery profile, possibly delaying the program

Boeing's T-7A advanced jet trainer aircraft. Credit: Boeing.

with contractors expected to alter their designs to accommodate the additional stress loads now expected over the aircraft's service life.

While Boeing pitched LCA versions of the T-7, the FA-50 has secured its place as the de facto successor to the F-5 as the premier 'Western' light fighter. KAI's Block 20 upgrade package includes the Link 16 data link, BVR missile integration and aerial refueling. KAI is also working to integrate Raytheon's PhantomStrike AESA radar which will deliver with Polish FA-50PLs in 2025 and Malaysian FA-50s in 2026.

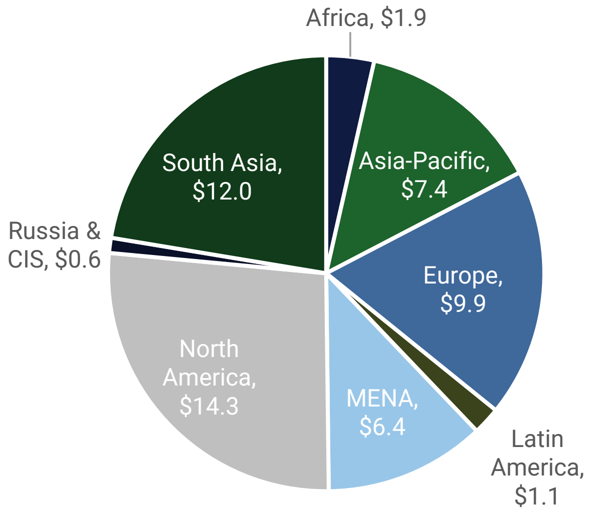
***Refer to the Boeing T-7 program profile on AWIN for additional details**

Trainer / Light Combat Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$54 billion

Value of Deliveries by Region



A total of 3,005 new build light 1-2 seat trainers & LCAs will deliver through 2033 worth $52.1 billion. Jet powered AJTs and LCAs will comprise 87% of that market by value at $45.4 billion relative to $6.2 billion for turbine and piston powered aircraft. 2,734 jet powered aircraft will be delivered to perform AJTs missions over the decade worth $35.5 billion. A total of 633 LCAs will deliver over the period worth $19.1 billion, including jet powered LCAs accounting for $16.6 billion. Heavy body trainers account for a further 112 deliveries over the period worth $1.1 billion.

Of the major jet powered AJTs, the supersonic T-50, T-7 and Tejas (trainer versions) account for $10.3 billion in deliveries relative to the major subsonic families at $6.7 billion including the TAI Hurjet, Hongdu L-15, Leonardo M-345 & M-346, Yakovlev Yak-130, Aero Vodochody L-39 and BAE Hawk.

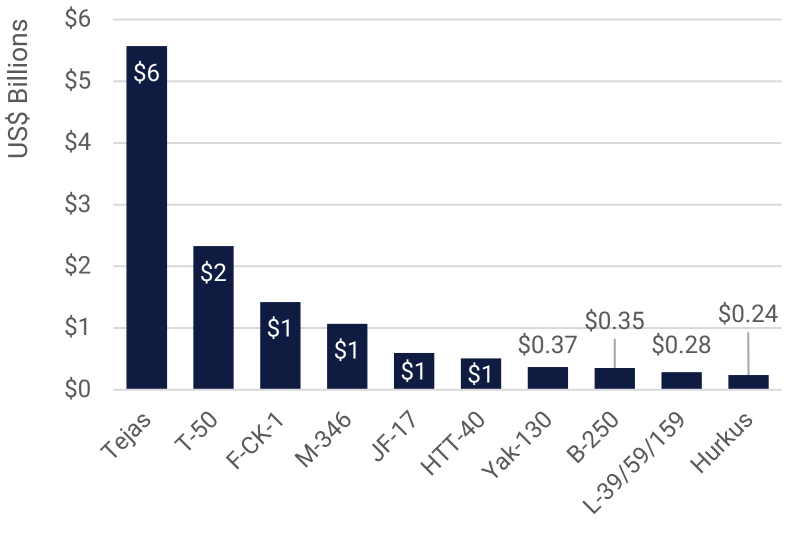
Aviation Week forecasts $15.3 billion in open opportunities for AJTs and $2.1 billion for introductory and BFTs powered by piston, electric or turbine engines.

HAL platforms comprise for 17% of the value of entire light 1-2 seat trainer & LCA market through 2033 at $9.3 billion followed by Boeing at 11% with $5.8 billion, KAI at 7% with $3.8 billion and TAI at 4.5% with $2.4 billion. Platforms manufactured by U.S. primes account for only 15% of the market at $8.1 billion over the period – reflecting the greater competitiveness of international trainer & AJT offerings like the KAI T-50, Pilatus PC-21 and Leonardo M-346. However, the market presence of U.S. primes could grow as the U.S. represents the largest growth opportunity for new trainers worth $6.7 billion through the decade as well as international BFT and AJT competitions among allied countries such as Japan.

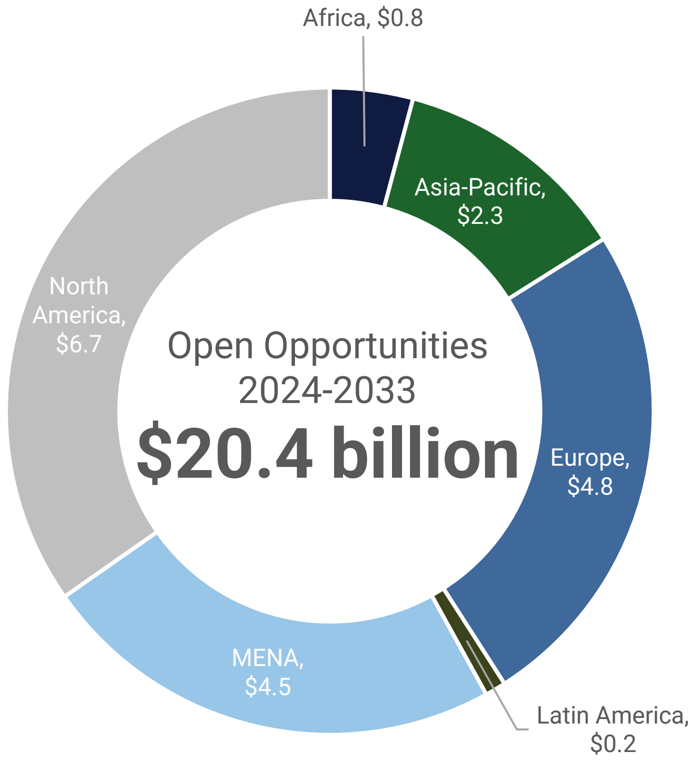
Contracted Order Book (2024-2033)

$20 billion

Biggest Programs by Order Book (2024-2033)



Trainer / Light Combat Aircraft – Open Opportunities



Country	Opportunity Size	Notes
United States	115 Aircraft (145) **$4.7 billion**	The U.S. Navy's Undergraduate Jet Training System (UJTS) seeks a minimum of 145 AJTs (up to 200) to replace its fleet of deteriorating T-45 Goshawk AJTs starting in the mid-2020s. Competitors include the KAI-Lockheed Martin TF-50N, Boeing T-7B and Leonardo-Textron M-346N.
Egypt	100 Aircraft **$2.9 billion**	The Egyptian Air Force is evaluating replacements for its Dassault Dornier Alpha Jet and Hongdu K-8 AJTs. Warming geopolitical ties between Rome and Cairo may grant the M-346 an advantage while KAI has been keen to offer local assembly work for the state-owned Arab Organization for Industrialization.
Spain	50 Aircraft **$1.2 billion**	The Spanish Air and Space Force requires a new advanced jet trainer to replace its F-5 fleet in the 2030 timeframe. Airbus has paused development of its AFJT offering and has instead chosen to partner with Leonardo to offer the M-346 against Boeing's T-7A and KAI's T-50.
India	60 Aircraft (73) **$1.1 billion**	The Indian Air Force had planned to replace its HJT-16 Kiran intermediate jet trainers (IJT) by 2025. The new IJT would transition cadets from the HJT-40 BFTs to the BAE Hawk. HAL's indigenous HJT-36 completed spin testing in 2022 but has yet to receive orders. HAL has also proposed its HLFT-42 supersonic conversion trainer.
United States	32 Aircraft **$945 million**	In October 2021, the USN outlined a requirement for up to 64 Tactical Surrogate Aircraft (TSA) aggressor trainers. Aviation Week forecasts a much more tailored F-5 replacement given the service's budgetary constraints. The TSA requirement may effectively be subsumed or acquired as an option by the larger UJTS tender.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Trainer / Light Combat Aircraft – Fleet Dynamics

T-50 Fleet Change (2024-2033)

+25%

Despite the renewed recapitalization of global fighter fleets, the trainer/LCA fleet will remain largely static with a CAGR of -0.13%. Regionally, trainer & LCA fleets are expected to grow fastest in South Asia with a CAGR of 1.13% and Europe at 1.01%. The larger North American fleet will grow marginally with a CAGR of 0.26% while the fleet is expected to decline throughout MENA at -1.03%, Latin America at -1.34% and the Asia-Pacific at -1.38%. Rather than seeking to grow their fleets, operators are either conducting mirrored replacement programs or, more often, seeking to acquire fewer but more efficient platforms to replace their existing fleets. For example, Australia opted to procure 49 new PC-21 BFTs to replace its 67 PC-9s starting in 2017. Advances in both ground simulators as well as in-flight syntenic training aids has improved the cost effectiveness of both new BFTs and AJTs. Several international operators have also opted to pool resources such as the Elbit Systems managed International Flight Training Center (IFTS) in 2021 which operates M-346s. The IFTS has trained pilots from Italy, Greece, Canada, Saudi Arabia, Austria, Qatar, Japan and Singapore. Contractor operated training schools enable operators to further minimize investment in new trainers.

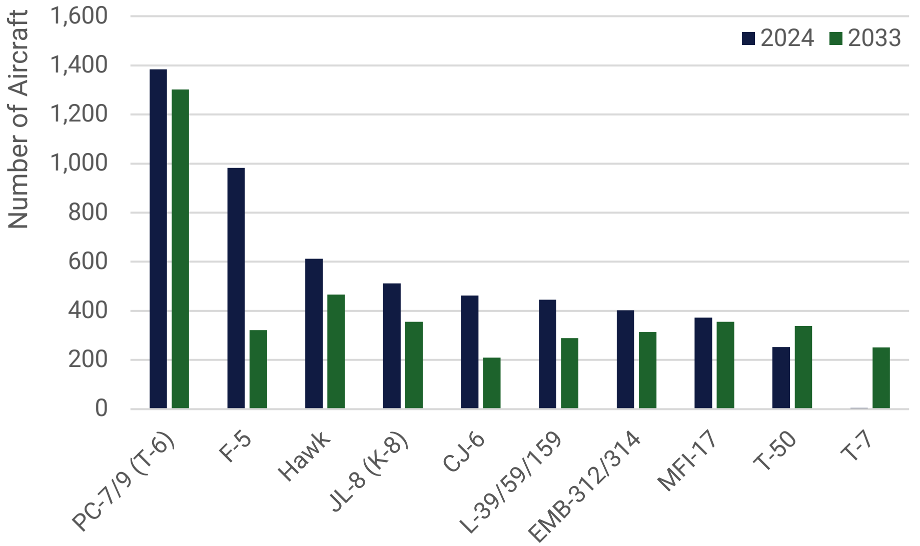
HAL's Tejas is among the few rapidly growing families in this market with a fleet CAGR of 13.77%. Note, the Tejas family consists of both the Mk.1 and Mk.1A which are classified as LCAs as well as the proposed, heavier Mk.2 which is classified as a fighter. In October 2023, Indian Chief Air Marshall Vivek Ram Chaudhari announced plans to acquire an additional 97 Mk. 1As. The IAF had already signed a $6.25 billion contract for 83 Mk.1As in February 2021 which will deliver through 2028. The last of 40 Mk. 1s was delivered to the IAF in 2023. The Tejas has become an increasingly important pillar of the IAF's modernization strategy as several other flagship programs have been sidelined or cancelled since the early 2000s.

F-5 Fleet Change (2024-2033)

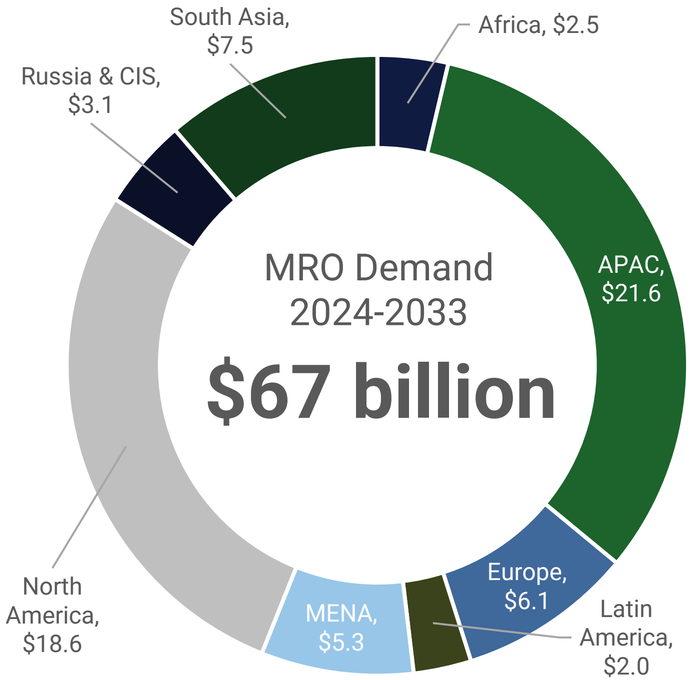
-67%

The global fleet of F-5s is expected to decline by two-thirds from 982 to 322 aircraft with a CAGR of -11.65%. The decline is driven by operators replacing both their T-38 AJTs and F-5 LCAs. Operators such as Brazil and South Korea have opted to replace their F-5s with much more capable multi-role fighters – reflecting the broader market trend of the global LCA fleet shrinking at a CAGR of -1.32%. However, the FA-50 has shown the continued resilience for the light fighter concept in countries like Poland and Malaysia where new build F-16s were either judged to be unavailable in time or unaffordable.

Key In Service Fleets 2024 and 2033



Trainer / Light Combat Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

-0.2%

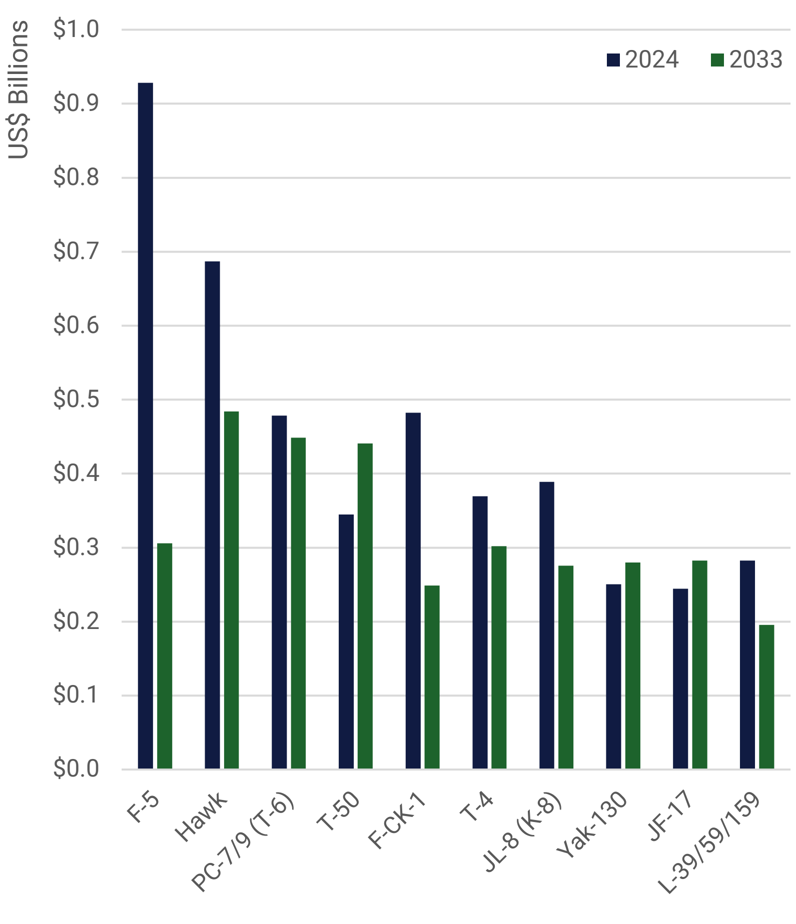
Driven by a gradual decline in the number of both trainer and light combat aircraft in service around the world over the next 10 years, MRO demand in this market segment is expected to fall marginally from $6.7 billion annually in 2024 to $6.6 billion in 2033.

The largest single driver of the trend is the retirement of 288 Northrop F-5 light combat aircraft over the decade, many of which are due to be replaced with heavier multirole fighters such as the Lockheed Martin F-16. Partially countering this trend will be significant growth in the global fleet of KAI FA-50, HAL Tejas, and PAC JF-17 light fighters.

Training aircraft alone are expected to generate $54.8 billion in MRO demand with projections for annual maintenance spend remaining largely static through the decade. Demand relating to advanced jet trainers is set to rise faster than in other sub-mission categories primarily on the expectation that the Boeing T-7 will have higher operating costs than the Northrop T-38 it is set to replace, largely due to higher thrust from the aircraft's General Electric F404 engine.

This trend towards higher MRO demand generated by the final stages of training is also being driven by attempts to 'download' elements of the fighter pilot curriculum from operational conversion units operating advanced combat aircraft down to less expensive lead-in fighter training phases.

Top Programs By MRO Demand



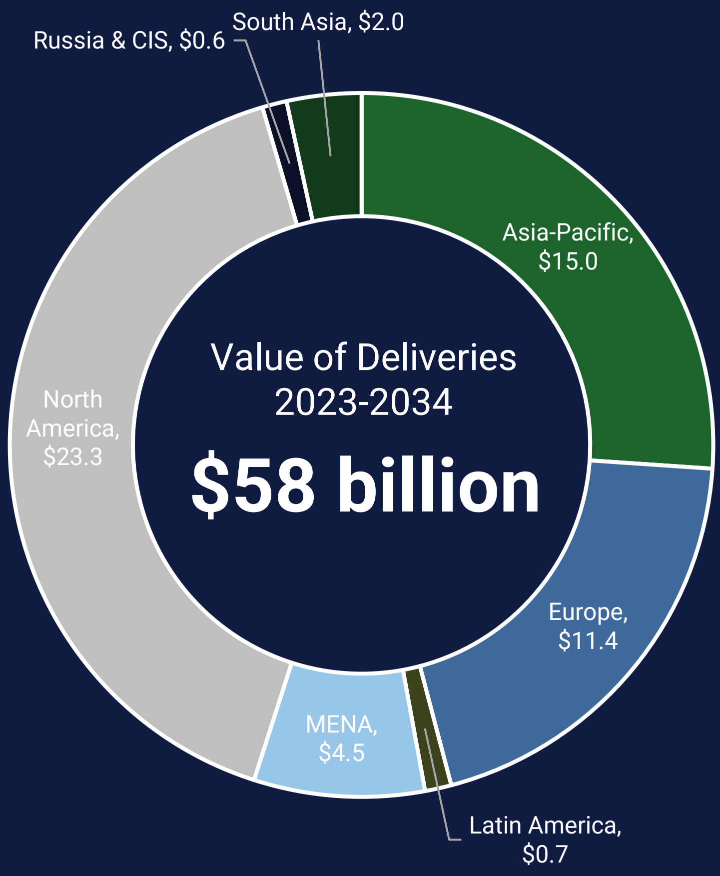
Crewed C4ISR Aircraft – 2024-2033 Market Projections

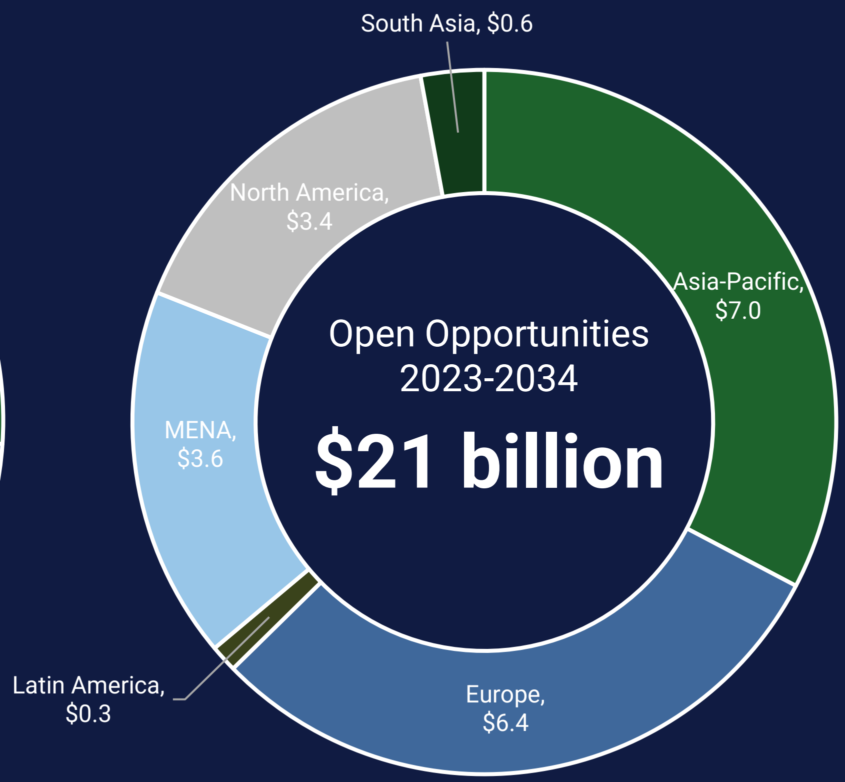
Total New Build Deliveries
348 Aircraft

Total Retirements
342 Aircraft

In Service Fleet (2024)
1,253 Aircraft

Fleet Growth CAGR (2024-2033)
-0.1%





Crewed C4ISR Aircraft – Key Market Trends

Concept illustration for Australia's Joint Air Battle Management System. (Lockheed Martin)

> *"Australia's priorities for AMTI, assured space-based communications and all-domain BMC2 are widely indicative of the broader C4ISR market."*

Over the past decade, Australia has emerged as a leading market for integrated, all-domain C4ISR and BMC2 systems with substantial spillover potential into the larger U.S., Indo-Pacific and European markets. Australia's strategy focuses on forward defense delivered by an expeditionary force seamlessly integrated with the U.S. with exquisite electronic warfare, space and C4ISR capabilities maintained by no other U.S. ally. The evolution of the Australian market has largely been defined by three phases: (1) buying off-the-shelf FMS equipment, (2) undertaking cooperative development programs with the U.S. (such as HACM, MQ-4C, P-8A) and (3) predicting and fielding leading edge systems ahead of the U.S. services (E-7A, MQ-28 and Air 6500) with the aim of exporting them to the U.S. and international markets. Australia's priorities for AMTI, assured space-based communications and all-domain BMC2 are widely indicative of the broader C4ISR market.

Australia's first such system was the Boeing E-7A Wedgetail which was borne out of necessity with the end of E-3 production. The Wedgetail's features such as the Northrop Grumman Multi-role Electronically Scanning Array (MESA) with 360° AMTI, aerial refueling capability, NATO commonality and the use of the 737 as a base platform made the E-7 an export success for not only U.S. primes, but also local. Australia has since sought to repeat the paradigm and develop its own "sovereign" industrial base.

In 2015, the Royal Australian Air Force (RAAF) launched Plan Jericho with the aim of fielding a "5th generation air force" capable of supporting joint operations by networking its assets to provide real time ISR, maritime domain awareness and C2. Plan Jericho and the landmark 2016 Defence White Paper laid the foundation for the acquisition of four L3Harris MC-55A Peregrine EW aircraft worth approximately $1.5 billion, developing the Boeing MQ-28A Ghost Bat, launching the Defence Joint Program 9102 for two geostationary communication satellites (awarded to Lockheed in April 2023) and the Air 6500 Joint Air Battle Management System (JABMS) to support a future Integrated Air and Missile Defense (IAMD) capability. JABMS has evolved to mirror the U.S.' Joint All-Domain Command and Control (JADC2) program.

Air 6500 Phase 1 will deliver the core OMS battle management system to network the country's Aegis equipped Hobart and Hunter-class destroyers and frigates, Super Hornets, F-35s, Wedgetails, JORN VHF radar, NASAMS short-range air defense system and four land-based CEA Technologies AESA radars. Lockheed was awarded the $474 million contract for Air 6500 Phase 1 in August 2023 and aims to make JABMS ITAR free with the aim of "unlocking a A$83 billion [$53 billion USD] export market for Australia's defence industry,". U.S. primes have sought to capitalize on the speed of Australian procurement system to leverage relevant products to the U.S. market yet the strategy is not without risk.
The MQ-28A could become a cautionary example (refer to the UAV analysis section on pg. 85).

Program in Focus – Boeing 737 AEW&C (E-7 Wedgetail)

Based on the Boeing 737-700 fuselage with 737-800 wings, the Boeing E-7A "Wedgetail" is an airborne early warning & control (AEW&C) aircraft powered by twin CFM International CFM56-7 turbofan engines. Each engine supplies 27,300 lbf. (121.4 kN) of thrust to the aircraft, for a total of 54,600 lbf. (242.9 kN). The Wedgetail carries a Northrop Grumman Multi-role Electronically Scanning Array (MESA) L-band monopulse pulse-doppler radar system. The E-7 was originally developed to meet Australian AEW&C requirements drafted in the 1990s with the first aircraft delivering in 2010. The Wedgetail has since been acquired by South Korea, Turkey, the UK and the U.S.

Around 2018, the USAF identified a capability gap in survivable battle management and command-and-control (BMC2) as well as ground and air moving target indication (GMTI & AMTI) systems. Former USAF acquisition chief Will Roper envisioned a disaggregated Airborne Battle Management System (ABMS) family of systems to replace its fleet of 31 E-3 Sentry and 16 E-8 JSTARS aircraft. Roper believed advances in adversary systems made large manned BMC2 platforms vulnerable. However, after years of ABMS demonstrations and Congressional scrutiny, the Air Force failed to develop a ABMS acquisition strategy.

Uniformed service officials such as Pacific Air Forces Chief Gen. Wilsbach and U.S. Air Forces in Europe Chief Gen. Harrigan built momentum for an off-the shelf purchase of E-7s, which was solidified by the appointment of Air Force Secretary Frank Kendall in July 2021. Kendall criticized open-ended experimentation programs which did not lead to programs of record. Kendall justified the acquisition of E-7s as a stopgap solution prior to the fielding of a more survivable space-based AMTI & GMTI solution.

A USAF Justification and Approval (J&A) document from April 2022 notes two other unspecified contractors solicited bids, but the E-7A was judged as the only AEW&C platform on the market with a 360° air moving target indication capability with aerial refueling. The Air Force formally selected the E-7 on April 26, 2022. The J&A document also notes the USAF plans to leverage the UK's Wedgetail configuration to the fullest possible extent to expedite development. Unique U.S. furnished equipment is expected to include U.S. cybersecurity protection, and equipment for satellite communications and M-Code GPS.

Boeing E-7A airborne early warning and control aircraft, Credit: USAF, Staff Sgt. Michael Battles

Boeing currently produces one militarized 737 airframe per month and expects a 51 to 54-month lead time between an E-7A order and deliveries due to the complexity of the conversion process. Approximately two years is required to build a 737NG airframe with the reinforced fuselage Section 46 required to support the MESA. The mission systems conversion process, including installation of the MESA, takes another two years. The first E-7A prototype for the USAF is expected to deliver in 2027. The service plans to declare IOC with the Wedgetail around 2030.

***Refer to the Boeing 737 AEW&C (E-7 Wedgetail) Program Profile on AWIN for additional details**

Crewed C4ISR Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$64 billion

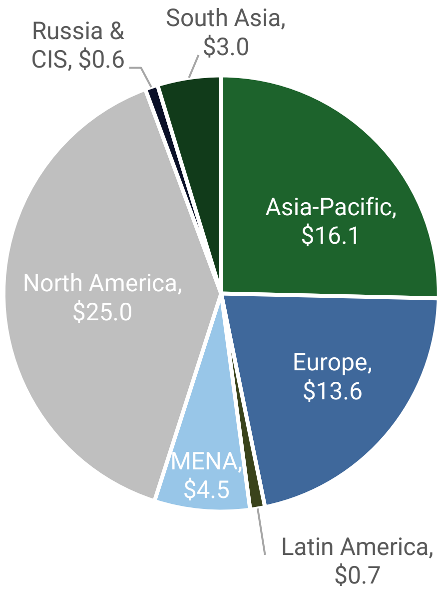
A total of 367 new build crewed aircraft will deliver over the period worth $62.8 billion, including 288 deliveries with types that have already been selected worth $42.1 billion and 82 in open opportunities worth $21.3 billion. Approximately 42% ($26.5 billion) of the total new build market by value stems from modified commercial aircraft, followed by 24% ($15.2 billion) from business jets, 17% ($10.6 billion) from purpose built C4ISR aircraft, 9.7% ($6.1 billion) from military transport aircraft and 5.6% ($3.5 billion) from civil propeller aircraft.

Boeing is expected to maintain its historical advantage in the C4ISR market over the forecast. Deliveries of Boeing aircraft account for $17.5 billion or 28% of the value of all new build manned C4ISR aircraft through 2033 (or 41% of existing source selections by value). USAF orders for E-7A Wedgetail AEW&C aircraft (with 22 projected deliveries over the period) and a pair of VC-25Bs account for 72% of that demand. As of the time of this writing, the USAF plans to sign a full-rate production contract for the E-7A in 2025. The Northrop Grumman E-2 thus remains the aircraft family with the highest valuation in terms of contracted deliveries.

A total of 85 special mission business jets are expected to deliver between 2024 and 2033 worth $15.2 billion. Deliveries (including opportunities) to the Asia-Pacific represent 47% of that demand by value at $7.1 billion or 36 airframes. Major orders include: South Korea (16), Taiwan (6), Japan (5), Singapore (5) and Australia (3). Deliveries to the U.S. account for 27% the market at $4.1 billion with 22 deliveries, largely from the BAE Systems EA-37B Compass Call and U.S. Army MDSS-1000 programs.

The market for manned C4ISR aircraft is among the most saturated by U.S. primes which are anticipated to deliver 71.6% of all deliveries by value among types with existing source selections.

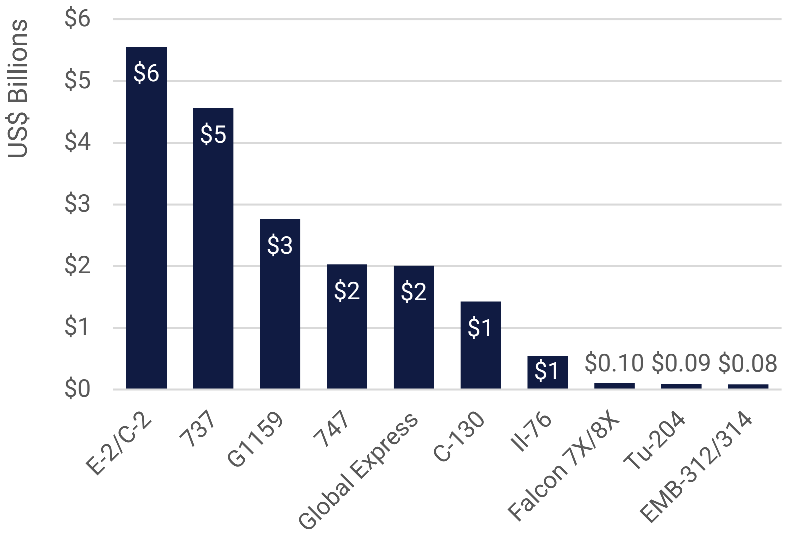
Value of Deliveries by Region



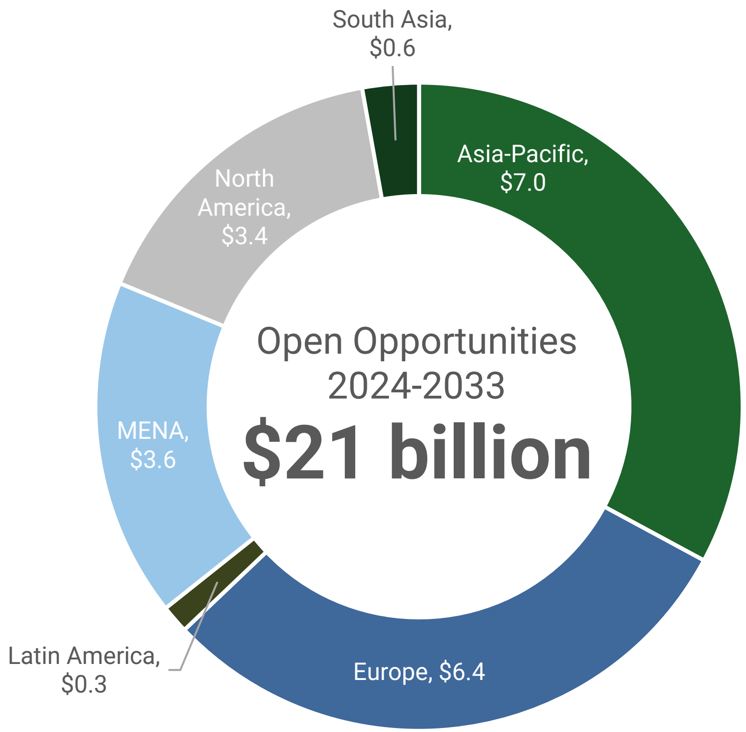
Contracted Order Book (2024-2033)

$19 billion

Biggest Programs by Order Book (2024-2033)



Crewed C4ISR Aircraft – Open Opportunities



Country	Opportunity Size	Notes
NATO	10 Aircraft (14) **$4.3 billion**	NATO's Alliance Future Surveillance and Control (AFSC) program evaluated the Saab GlobalEye, L3Harris Bombardier 6500 CAEW and Boeing E-7A to replace its fleet of E-3 AWACS aircraft between 2031 and 2035. NATO selected the E-7A after the release of the Fleet & MRO Forecast with a truncated "minimum" buy of six aircraft.
United States	10-14 Aircraft **$2.2 billion**	The U.S. Army is looking to acquire a fleet of Global 6500s equipped with the High-Accuracy Detection and Exploitation System (HADES) payload. The Army is expected to select either L3Harris or Raytheon for HADES by the end of 2024. The Army POR is 14 aircraft, but it is unclear if the existing COCO aircraft count toward that goal.
Saudi Arabia	5 Aircraft **$2.1 billion**	In August 2022, Air Force officials confirmed that Saudi Arabia had expressed interest in the E-7A. The Royal Saudi Air Force is amidst a two-phase E-3 MLU program worth $2 billion. However, global E-3 operators such as the U.S. and UK have opted to retire their aircraft even after completing an MLU due to high O&S costs.
France	4 Aircraft **$1.7 billion**	France is projected to begin replacing its E-3s by the 2030s, possibly following the AFSC program. France has historically vacillated between periods of entrenching trans-Atlantic ties as with the original E-3 purchase in 1991 or advocating for greater strategic autonomy with either domestic or European led defense programs.
South Korea	4 Aircraft **$1.7 billion**	The Republic of Korea Air Force is looking for four additional AEW&C aircraft by 2028 to complement its existing four E-7s. The DAPA has reportedly been "struggling" in negotiations with Boeing over higher-than-expected costs. Additional contenders include the Saab GlobalEye and the L3Harris-Korean Air Global 6500 CAEW.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Crewed C4ISR Aircraft – Fleet Dynamics

Global Express Fleet (2024-2033)

+69%

Renewed investment in the fighter market is driving a spillover effect in demand for additional AEW&C capability. Aviation Week projects a total of 199 AEW&C deliveries over the decade at a CAGR of 2.29%. AEW&C deliveries represent over 60% of the value of all manned C4ISR aircraft over the period. Operators like the Italian Air Force (Aeronautica Militare) increasingly view AEW&C aircraft as gateways to coordinate 5th and 4th generation fighters. In recent exercises, the AM used its IAI G550 CAEWs to fuse sensor inputs from its F-35s and relay them to its Typhoons to maintain a common operational picture. The G550s perform BMC2 functions to enable both fighter platforms to realize their own comparative advantages. The key role of AEW&C aircraft in these exercises led the AM to acquire eight G550 airframes for special mission conversion before their production line closed in 2021. The first pair will be modified by L3Harris as SIGINT aircraft while the remaining six will be converted for either AEW&C or electronic attack missions (like the EA-37B). The AM aims to at least double its AEW&C fleet to four G550 CAEWs.

With the closure of the G550 line, the Bombardier Global 6000/6500 has become the choice host platform for future special mission conversions due to the platform's range, 51,000-ft. service ceiling and its high space, power and cooling (SWaP-C) margin. Crucially, the Global 6000 is predominately metal, not composite, and lacks a fly-by-wire flight control system: both are features which can interfere with certain electronic payloads. Firms like L3Harris and Raytheon have pivoted to offer Global 6000/6500 conversions for emerging C4ISR opportunities. Boeing's 737 has similarly emerged as the clear choice at the highest end of the AEW&C market with its superior SWaP-C, endurance and established commercial supply chain. The new demand for E-7s has outpaced Boeing's Renton, WA, production capacity for a dozen 737 military airframes per year, presenting an opportunity for rivals based on business jet conversions.

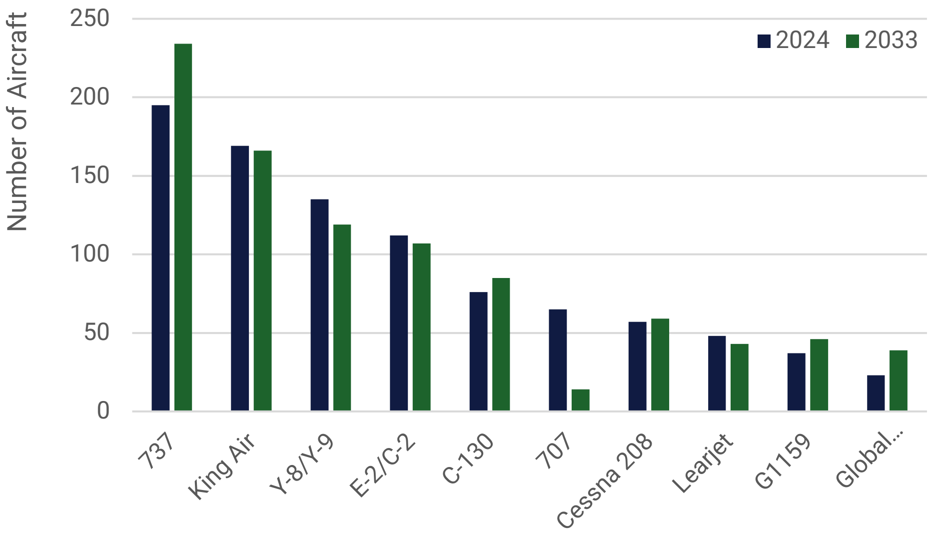
707 Fleet Change (2024-2033)

-78%

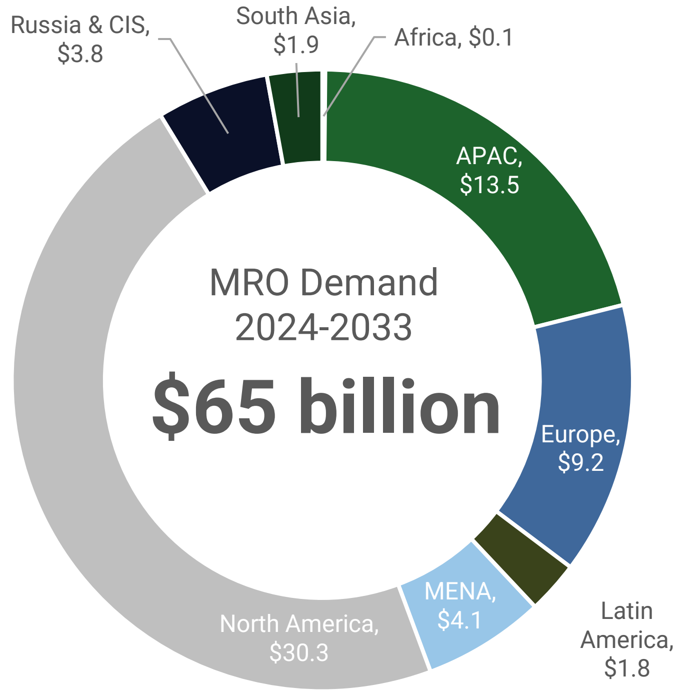
The global fleet of C4ISR Boeing 707s has steadily declined from 93 aircraft in 2013 to 70 in with a further 51 retirements planned through 2033.

Shaanxi and Xian are expected to deliver a third of all AEW&C aircraft over the period, reflecting China's objective to control the airspace within the first and second island chains as well as to stand-up new carrier air wings. China's AEW&C fleet grew by an unprecedented 344% from 18 aircraft in 2013 to 80 in 2023.

Key In Service Fleets 2024 and 2033



Crewed C4ISR Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

-2.4%

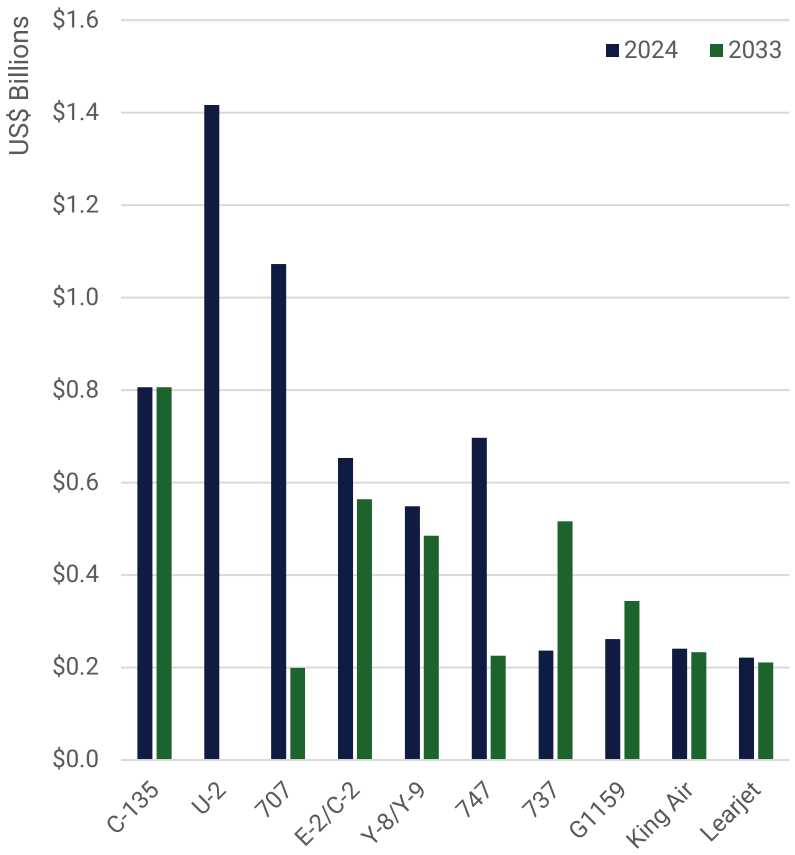
Despite an increase in the numbers of surveillance aircraft in service globally over the next 10 years maintenance spend on crewed C4ISR aircraft is projected to decline through the forecast.

This trend is being driven by the recapitalisation of large, aging C4ISR aircraft like the U-2, E-3, and E-4 with smaller, lower cost aircraft, particularly in the U.S., Middle East, and Europe. Similarly the accelerated adoption of uncrewed aircraft by operators around the world to provide persistent surveillance capabilities is expected to feed into this trend over the course of the forecast.

The global trend does however mask regional difference. While maintenance spending on crewed C4ISR aircraft in Europe and North America is projected to decline over the decade demand will increase throughout Asia as governments seek to improve situational awareness amid rising tensions. MRO demand in Asia-Pacific and South Asia is expected to increase at a 1.8% CAGR over the 10 years as a result.

Longer term the expanded use of the space domain and the adoption of a 'system of systems' approach to generate enhanced situational awareness from a wider range of platforms has the potential to further reduce spending on dedicated crewed C4ISR aircraft, particularly in the U.S.

Top Programs By MRO Demand



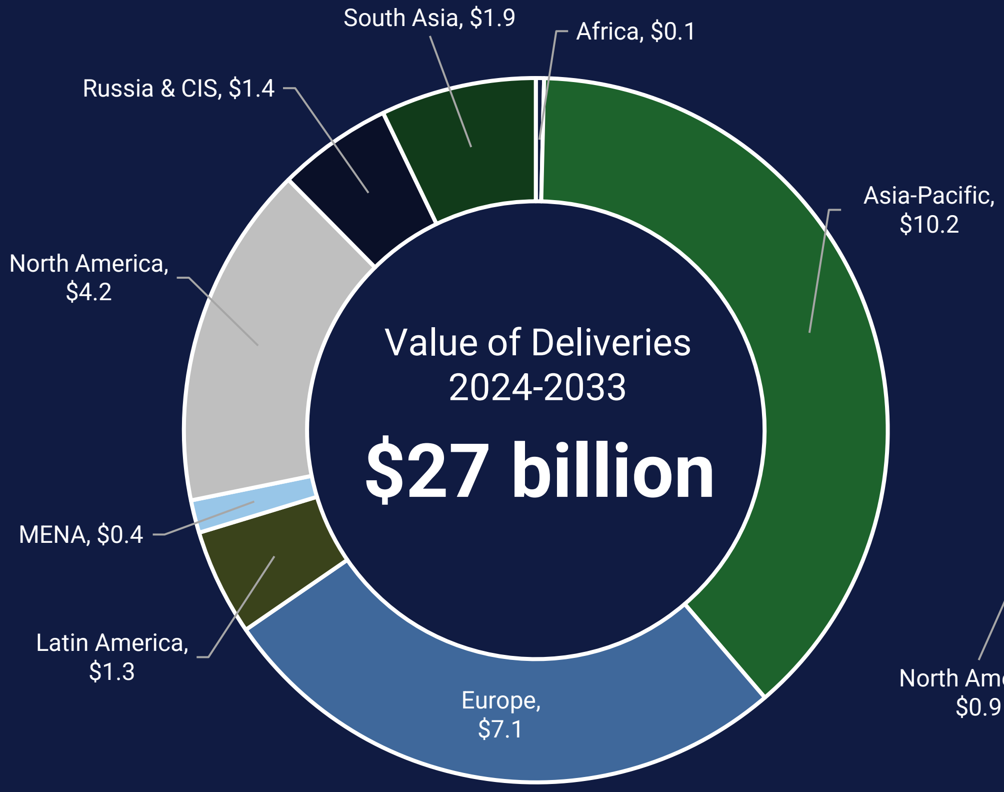
Fixed-Wing Maritime Aircraft – 2024-2033 Market Projections

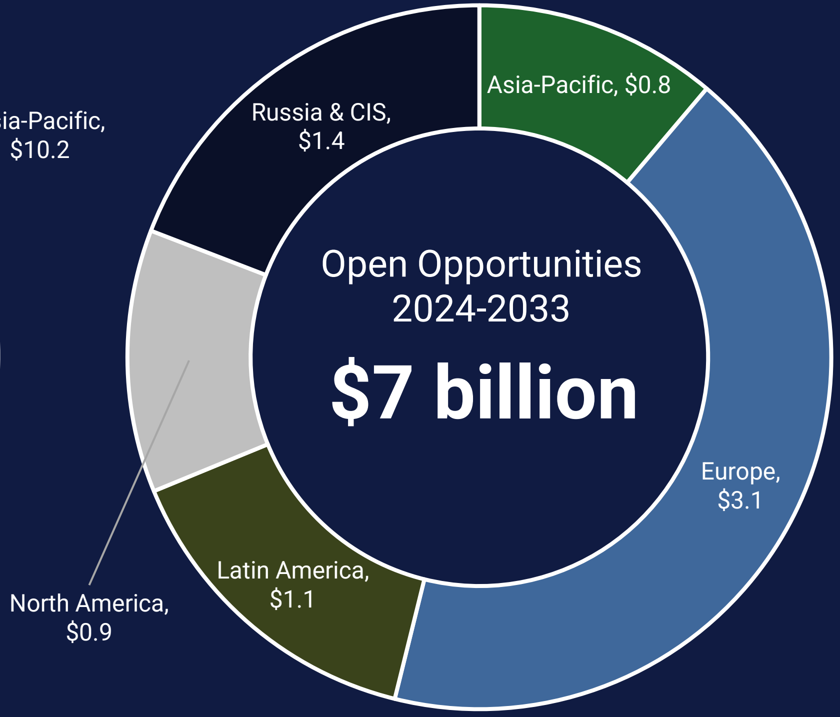
Total New Build Deliveries
316 Aircraft

Total Retirements
222 Aircraft

In Service Fleet (2024)
1,149 Aircraft

Fleet Growth CAGR (2024-2033)
+1.1%





Fixed-Wing Maritime Aircraft – Key Market Trends

A U.S. Navy P-8A Poseidon on the ground at Selfridge Air National Guard Base, MI. (U.S. Air National Guard)

"In the long-term airborne maritime surveillance operations are likely to be increasingly taken over by uncrewed aircraft"

The fixed-wing maritime aircraft market remains bifurcated between a small number of high-end platforms capable of the full spectrum of antisubmarine warfare (ASW) and an array of more modest capability offerings integrating maritime surveillance payloads aboard relatively inexpensive airframes at varying endurance, size and range thresholds. At the apex of the market, the Boeing P-8A Poseidon is the platform of choice for western operators besides Japan and its homegrown Kawasaki P-1. Japan has sought to export the P-1 in the past, but has struggled due to its high unit cost, in part a product of anemic procurement quantities authorized in small batches by Japan's Ministry of Defense. If P-8 production terminates around 2029 the market will become much more diffuse, with many bespoke offerings of missionized aircraft such as the ATR 72, Dassault Falcon or Bombardier Global Express. Of the open opportunities to market maritime aircraft, Canada's P-3 replacement and Italy's effort to acquire ASW capability at the end of the decade are among the last opportunities for which the P-8A is a serious contender – in other cases it is either in excess of operator requirements or political-industrial considerations heavily advantage domestic firms.

CN235 and C295 derivatives offer credible capability across the maritime spectrum, with healthy demand for the C295 in transport, SAR and maritime roles the platform ensuring that the platform will be available well into the 2030s. Indonesian Aerospace's CN235 line, however, will complete deliveries to military customers by the end of 2025.

An important trend of note is the move towards UAS for maritime surveillance taskings. GA-ASI has marketed its MQ-9B Sea Guardian extensively for this role, and has secured commitments from India, Japan and Taiwan. Few purpose-built competitors in the Group 4/5 class exist, but firms such as Baykar and TAI are well placed to offer missionized variants of their flagship platforms.

On the other hand, the U.S. Navy has truncated its acquisition objective for the MQ-4C Triton program from 70 to 27 aircraft. The Triton and Global Hawk from which it is derived have long been temperamental airframes, and the large, exquisite nature of the system makes little sense in the contested operating environment predicted by the Navy. The Navy at present does not plan to compensate for the MQ-4C cut by procuring additional P-8As. Navy aviation modernization is shifting focus to the Carrier Air Wing as the U.S. Navy matures its Next Generation Air Dominance (NGAD) program.

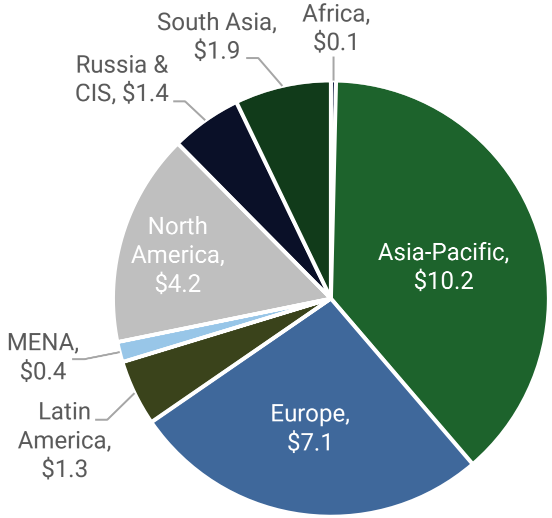
Nevertheless, in the long-term airborne maritime surveillance operations are likely to be increasingly taken over by uncrewed aircraft. Maritime surveillance is an inherently long-endurance and monotonous mission that benefits from remote piloting, especially for operators that do not need to prosecute targets from the air. The complexities of the ASW mission and need to dispense large numbers of sonobuoys, however, may continue to complicate uncrewed solutions and leave a niche for manned aircraft.

Fixed-Wing Maritime Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$27 billion

Value of Deliveries by Region



Boeing's P-8 sees $5.2 billion of deliveries over the forecast, with the line running until 2029 and 30 deliveries anticipated. The U.S. Navy has nearly completed its P-8 acquisition and appears uninterested in buying more to compensate for the diminished MQ-4 procurement. Additional export demand could extend production for a few more years.

Kawasaki's P-1 program will yield 25 deliveries over the forecast, all in Japan. Japan has sought to market the aircraft internationally now that it has relaxed its arms export policy. An overall fleet of 70 aircraft had been envisioned, but Japan has cut the program to 61 to make way for a maritime UAS capability (likely the GA-ASI MQ-9B).

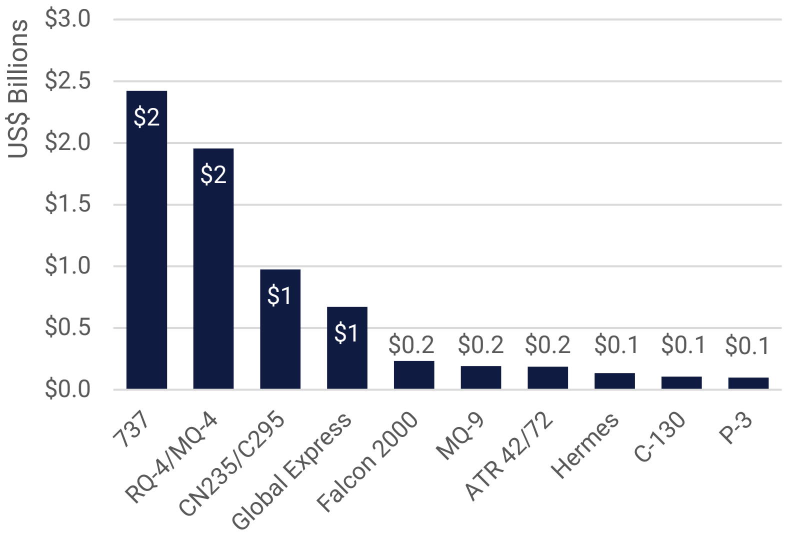
Airbus, Indonesian Aerospace, and Tata Advanced Systems will deliver 37 CN235s and C295s in maritime roles over the forecast. This is dominated by C295 MPA deliveries to the Spanish Air Force as well as India's C295 MMMA and MRMR programs.

Unmanned programs of note in this mission segment include the MQ-9B SeaGuardian, with 47 deliveries; the Baykar Bayraktar TB3, with 30 deliveries; and the Northrop Grumman MQ-4C Triton, with 15 deliveries. The MQ-4C program will conclude by 2029, and additional orders are unlikely since the U.S. Navy has cut its procurement objective. The MQ-9 orderbook will take the program to 2030. The Bayraktar Tactical has a large orderbook but is produced at a high rate, so without more business the program may only go to 2027 – few of these deliveries will take place in the maritime market segment.

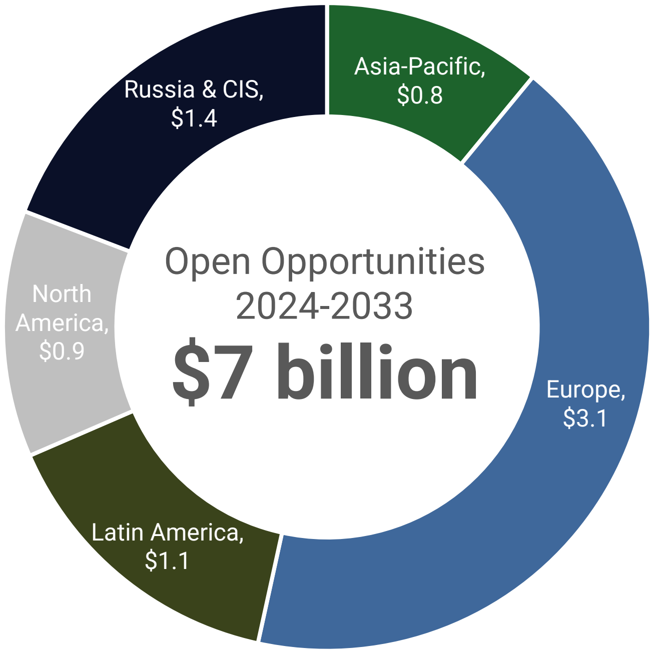
Contracted Order Book (2024-2033)

$7 billion

Biggest Programs by Order Book (2024-2033)



Fixed-Wing Maritime Aircraft – Open Opportunities



Country	Opportunity Size	Notes
France	13 Aircraft (18-20) **$2.3 billion**	By 2030 France's fleet of 22 Breguet Atlantique 2 maritime patrol aircraft will require replacement. For industrial reasons, France will likely seek a derivative of either an Airbus A320neo or a Dassault Falcon 10X. Boeing's P-8 would be the only other serious contender, should it remain in production to 2030.
Brazil	9 Aircraft **$0.9 billion**	The bulk of Brazil's fixed wing maritime surveillance and all its fixed-wing ASW capability is provided by a fleet of 9 P-3AMs refurbished and delivered to Brazil in 2011. The ATR72, C295 MPA, or P-8A are credible options. Embraer has also pitched a derivative of its E190-E2 twin-engine regional jet.
Canada	5 Aircraft (8-16) **$0.9 billion**	Canada's P-3-derived CP-140 Auroras will require replacement by the early 2030s. Boeing is pitching the P-8A, while Canadian firm PAL Aerospace has marketed a converted DHC Dash 8-400 dubbed the P-4. Canada is likely to sole-source the P-8A and received FMS approval from the U.S. Department of State in June 2023.
Vietnam	6 Aircraft **$0.6 billion**	Vietnam has a very limited maritime surveillance capability for a South China Sea claimant, and no fixed-wing antisubmarine warfare capability. It will by the end of the decade seek to extend its modest fleet, possibly with U.S. help – Vietnam has investigated acquiring secondhand U.S. or Japanese P-3s in the past.
Italy	6 Aircraft **$0.3 billion**	Italy's air force is seeking six new maritime patrol aircraft as a belated replacement for Dassault Atlantiques retired in 2017. Bidders include the P-8A, an ATR 72-based MPA and a modified Leonardo C-27J. The four-aircraft P-72A fleet was initially intended as an interim solution.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Fixed-Wing Maritime Aircraft – Fleet Dynamics

Uncrewed Fleet Change (2024-2033)

+62%

Much of the movement in the western fixed-wing maritime market is driven by the continued divestment of the Lockheed P-3 Orion. The P-3 remains in service internationally despite its divestment in its country of origin, the U.S. Japan, the type's largest remaining operator, is expected to replace the remainder of its fleet with its Kawasaki P-1 by the end of 2030. A few C4ISR or research-configured P-3s remain in the U.S. and elsewhere, but are captured in our forecast by those missions, not fixed-wing maritime.

The dominant player in the western fixed-wing maritime market remains the Boeing P-8A Poseidon. The P-8s production run for the U.S. Navy is largely completed, and the global fleet will surpass 200 aircraft during the forecast period. Export deliveries will continue through at least 2025, but few open opportunities are timed well enough and at the high-end of the maritime market to take the P-8 above the 30 deliveries anticipated by our forecast.

The sharpest change in global fixed-wing maritime fleets over our forecast is the roll-out of GA-ASI's MQ-9B. By the end of 2024, 14 will serve in maritime roles. By year-end 2033, this number will jump to 54 aircraft, quickly eclipsing the other dedicated maritime solution in its class, Northrop Grumman's MQ-4C.

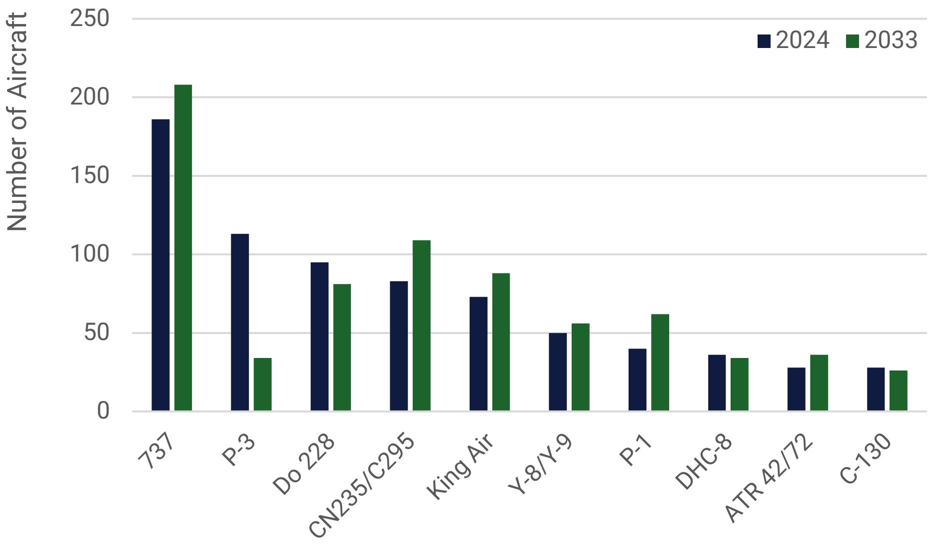
A force of 30 Bayraktar TB3s to be procured by the Turkish Navy are also expected to perform maritime surveillance roles, though as a secondary mission. Taken together this acquisition and the MQ-9B Sea Guardian's growing place in the market presage a steady shift towards uncrewed augmentation of traditionally crewed maritime missions. The proportion of uncrewed aircraft in the global maritime fleet is expected to increase from 8.0% in 2024 to 11.8% in 2033. In absolute terms, the uncrewed fleet will jump from 92 to 149 aircraft, a 62% increase.

P-3 Fleet Change (2024-2033)

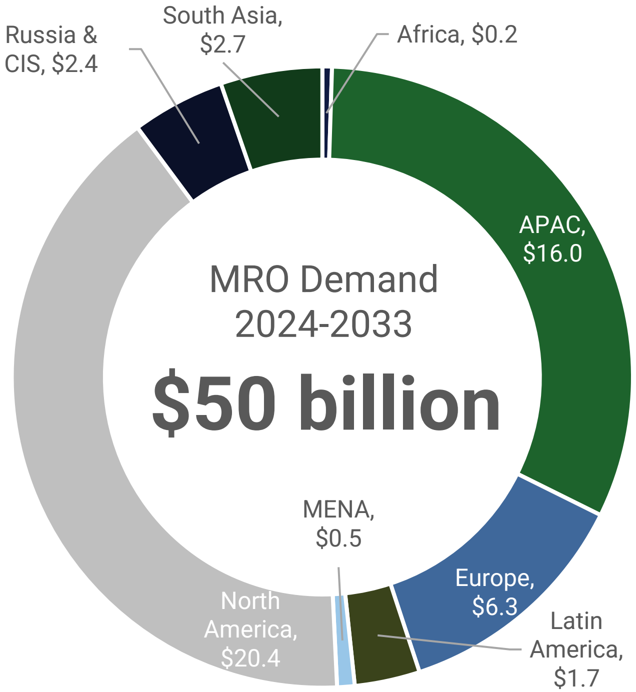
-70%

Finally, outside of the western market China continues a slow but steady expansion of its fixed-wing maritime fleet. A dozen Shaanxi Y-8Q/KQ-200 maritime patrol aircraft will likely be acquired over the forecast period while the remaining two of four 90s-vintage Y-8Xs will be withdrawn.

Key In Service Fleets 2024 and 2033



Fixed Wing Maritime Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

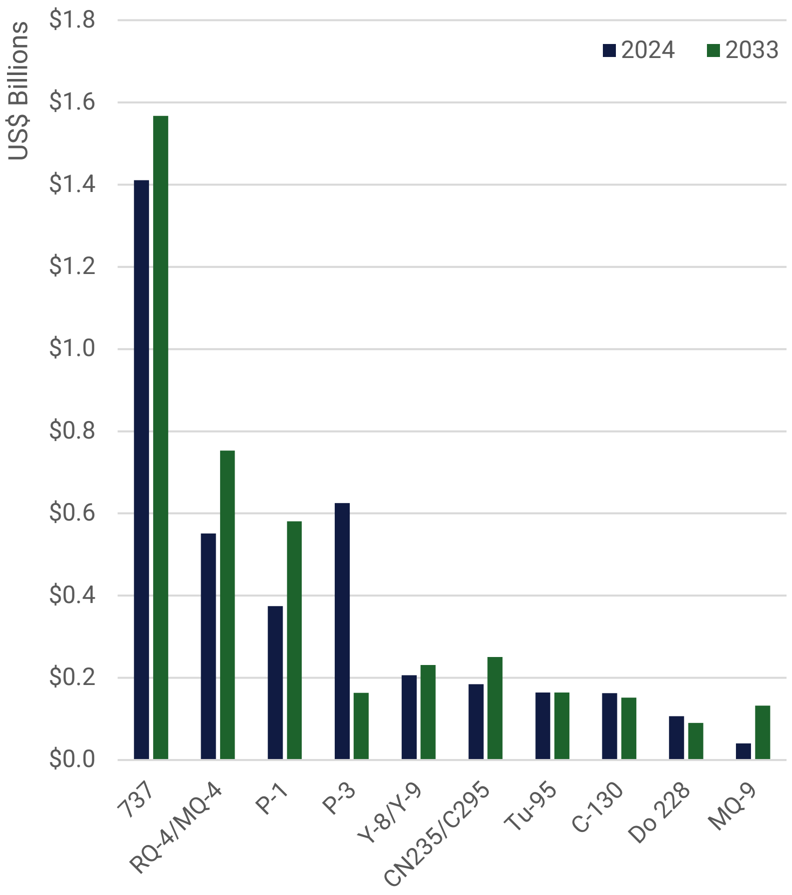
+1.0%

An expanding global fleet of aircraft providing maritime surveillance capabilities is projected to drive an increase in MRO demand in this market segment over the course of the decade. The number of fixed wing maritime aircraft is projected to rise from 1,149 aircraft in 2024 to 1,267 by 2033 driving an increase in maintenance spend from $4.8 billion annually to $5.2 billion over the same period.

The global fleet of the once ubiquitous P-3 Orion is now declining precipitously, falling from almost 300 maritime-configured aircraft in 2013 to a projected 34 by the end of the forecast period. Related MRO demand is expected to fall from $0.6 billion in 2024 to less than $0.2 billion annually by 2033. Simultaneously MRO demand generated by the global fleet of Boeing P-8 Poseidon aircraft will continue to grow through the, forecast period reaching $1.6 billion annually by the end of the period.

In the long term, there is scope for demand to decline as uncrewed assets take on additional responsibility for the provision of maritime domain awareness. The greater endurance of these platforms makes them ideally suited to the provision of broad area maritime surveillance. MRO demand generated by uncrewed platforms in this market segment is projected to expand at a 4.4% CAGR over the forecast, well ahead of the 0.3% seen for crewed aircraft. The introduction of the MQ-4C Triton and MQ-9B Sea Guardian are the principal drivers of this trend over the medium term.

Top Programs By MRO Demand



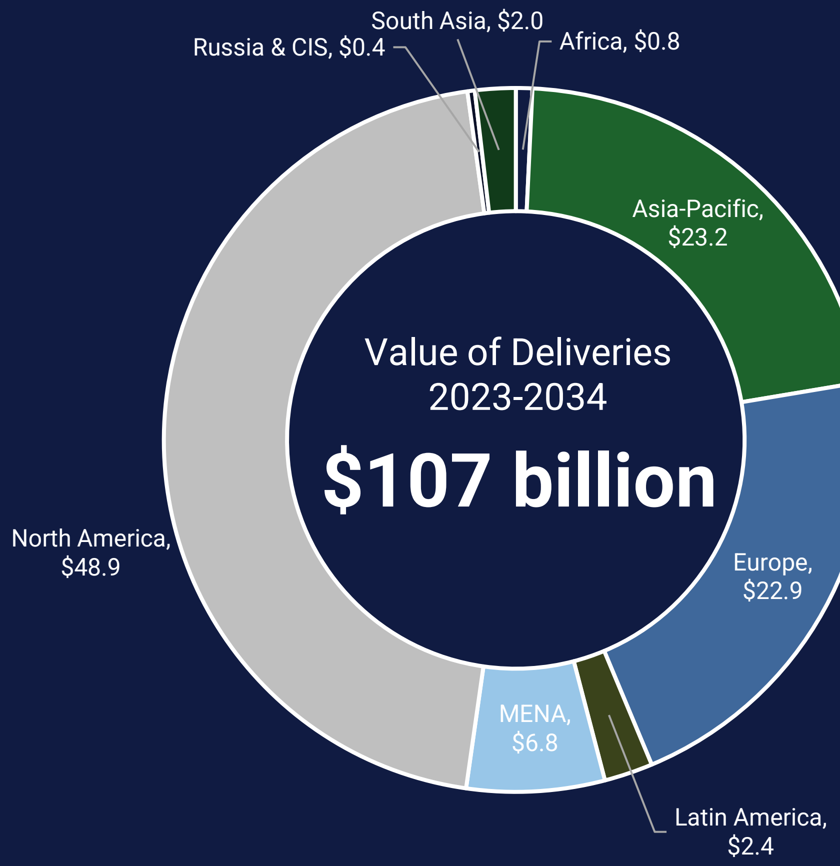
Rotary Wing Transport Aircraft – 2024-2033 Market Projections

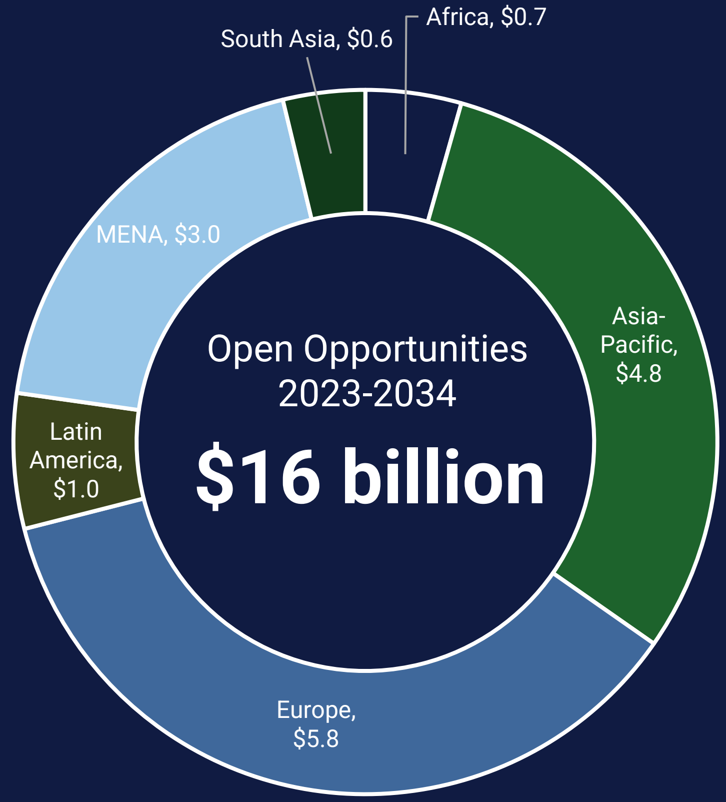
Total New Build Deliveries
3,323 Aircraft

Total Retirements
2,646 Aircraft

In Service Fleet (2024)
14,305 Aircraft

Fleet Growth CAGR (2024-2033)
+0.37%





Rotary Wing Transport Aircraft – Key Market Trends

The V-280 Valor, winner of the FLRAA competition. (Bell Flight)

"The U.S. Army estimates the V-280 program could be worth up to $70 billion including possible FMS orders. However, the international appeal of a large and expensive tilt-rotor remains tenuous."

Bell's source selection in the Future Long Range Assault Aircraft (FLRAA) competition to replace the UH-60 Black Hawk provides the company with much needed lifeline with the end of V-22 Osprey and UH-1 Huey production mid-decade. The U.S. Army estimates the V-280 program could be worth up to $70 billion including possible FMS orders. However, the international appeal of a large and expensive tilt-rotor remains tenuous. The Osprey's sole export customer during more than two decades of production was Japan which acquired 17 aircraft. While the V-280 features substantial speed, cost and reliability improvements over the Osprey, the aircraft is still expected to have a unit cost at least 2.5 times that of a new build UH-60M.

Demand for Boeing and Sikorsky helicopters is expected to remain robust over the decade. The Black Hawk family has four active production lines in the U.S., Poland, Japan and Turkey with production for the U.S military due to extend to 2028. The Black Hawk remains the dominant medium weight RW transport on the market bolstered by continuing reliability and maintainability issues with the NHIndustries NH90, which have led to the type's early retirement in Australia, Norway and Finland. In October 2023, GE delivered its first 3,000 shp T901 engine to support the Future Attack Reconnaissance Aircraft (FARA) program. Deliveries to re-engine the U.S. Army's Black Hawk fleet are expected to commence around FY26.

Sikorsky's heavy-lift CH-53K has become the keystone of the USMC's Expeditionary Advanced Base Operations (EABO) concept for its Marine Littoral Regiments, transporting 27,000 lb. payloads across a 110 nm mission radius including NMESIS equipped JLTVs (with a pair of Kongsberg-Raytheon Naval Strike Missiles), M142 HIMARS and LAV-25s. However, like the Osprey, features which make the CH-53K ideal for expeditionary Asia-Pacific operations have arguably proven unattractive in the export market relative to the much more affordable and shorter-range Boeing CH-47F.

Boeing currently maintains two active Chinook production lines. The last Block I aircraft are expect to deliver to South Korea around 2027, and Block II production will likely continue into the 2030s with new FMS orders. However, the U.S. Army has continued to resist Congressional pressure to procure the Block II to free funds for FLRAA and FARA. The Army canceled development of the Block II's Advanced Chinook Rotor Blade (ACRB), which promised to deliver 2,500 lbs. of additional lift capacity required to lift a JLTV, due to vibration issues discovered during testing. The Army has continued to explore re-engining its fleet with either the Honeywell T55-GA-714C or GE T408. Boeing also is interested in the Honeywell HTS7500 which was offered as part of the SB-1 Defiant FLRAA bid. The HTS7500 delivers 42% more power and an 18% reduction in specific fuel consumption relative to the Chinook's existing T55-GA-714As.

Program in Focus – Bell V-280

The Bell V-280 “Valor” is a long-range, medium lift tiltrotor selected as the U.S. Army’s Future Long Range Assault Aircraft (FLRAA) to replace the UH-60 Black Hawk on Dec. 5, 2022. The production configuration of FLRAA will be powered by a pair of Rolls Royce (RR) T406 (AE 1107F) turboshafts supplying 7,000 shp each. Bell's earlier technology demonstrator which took part in the Joint Multi-Role Technology Demonstrator program featured GE T64-419s. FLRAA is projected to enter service starting in 2030.

The U.S. Army’s source selection of Bell was subjected to a Government Accountability Office (GAO) protest filed by Lockheed Martin (which owns Sikorsky). The GAO ultimately upheld the Army’s selection of Bell on March 29, 2023, and provided additional insight into the Army’s FLRAA source selection process. The Army judged Bell’s superior use of a Modular Open Systems Architecture (MOSA), and Sikorsky-Boeing’s MOSA noncompliance, as being more important than cost.

Bells’ total evaluated price for V-280 EMD was $8.087 billion relative to Sikorsky’s $4.445 billion. The GAO reported that the Sikorsky-Boeing team believed that a detailed allocation of subsystem functions could be submitted after the contract was awarded. While the Army justified its FLRAA selection with MOSA requirements, the Valor’s substantially greater speed, range and superior maneuverability when dropping off soldiers and cargo all proved to be decisive factors according to Army Chief of Staff Gen. James McConville. In particular, he noted that the V-280’s cruise speed of more than 280 knots and combat range of more than 500 nm will be important for future operations in the Indo-Pacific. The V-280 is expected to be able to carry 11 to 14 troops.

The U.S. Army has yet to outline a FLRAA program of record with an associated procurement quantity, but the Army has a current acquisition objective for 2,135 Black Hawks (1,375 UH-60Ms and 760 UH-60L to UH-60V conversions). In December 2022, Major Gen. Robert Barrie (Program Executive Officer for Aviation) said FLRAA could be potentially worth $70 billion depending upon the scope of the program. Given the different roles of the UH-60M and FLRAA, the Army’s force structure, budgetary limitations and the clear intention of the service to retain and upgrade its Black Hawks with the T901 under the Improved Turbine Engine Program (ITEP), the FLRAA POR could range from 550 to 1,200 aircraft.

The V-280’s international appeal beyond well-financed militaries which prioritize range, such as Australia and Israel, appears limited. In a 2019 report, the CBO projected FLRAA would have a unit cost of $53 million ($64 million FY24) – more than 2.5 times that of a new production UH-60M. In June 2022, the U.S. Army signed the tenth Multi-Year Procurement (MYP) contract covering U.S. and international orders through 2027. Beyond the latest MYP, demand for the Black Hawk will likely remain robust over the medium term. Sikorsky believes a co-axial pusher prop aircraft sized between its FARA and FLRAA offerings would prove more attractive to international operators than a large tilt-rotor. Sikorsky signed an agreement with Leonardo to evaluate pusher-prop technologies for NATO’s Next Generation RotorCraft Capability program between France, Germany, Greece, Italy, the Netherlands and the UK. NGRC aims for initial deliveries around 2035 at a unit cost of $37 million.

Bell’s V-280 Valor, winner of the FLRAA competition. Credit: Bell Flight

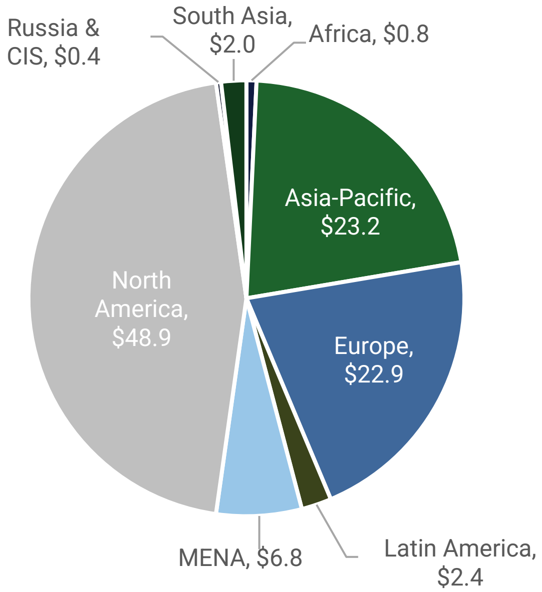
***Refer to the Bell V-280 Program Profile on AWIN for additional details**

Rotary Wing Transport Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$107 billion

Value of Deliveries by Region



A total of 3,323 new build transport helicopters worth $95.2 billion will be delivered over the next decade. Medium and heavy transports comprise the majority of the market by value at $37.4 billion (39.2%) and $32.9 billion (34.6%) respectively. Light transports represent a niche market segment with $1.8 billion in projected deliveries through 2033 with intermediate transports accounting for $13.9 billion. Primes producing intermediate transports (such as Subaru with its UH-2 and Leonardo with its AW139/149/169/189) have sought to market their offerings as a balance between capability and cost compared to the larger and more expensive Black Hawk. Remanufactured deliveries are a key part of this segment, adding $12.1 billion to the new build total (11.2% of the overall market) including $7.8 billion from the Black Hawk and $3.8 billion from the Chinook programs.

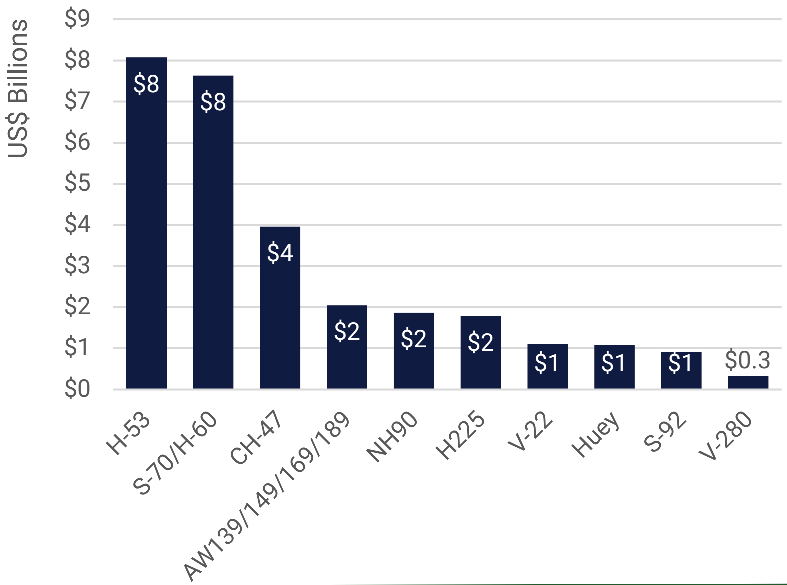
Deliveries to U.S. operators comprise more than 45% of the market by value. Sikorsky alone account for 71.6% of that share between the H-53 ($22.3 billion) and S-70/H-60 ($12.5 billion). Black Hawk family deliveries account for just over 40% of the global medium weight transport market over the period at $18.8 billion. Sikorsky's preeminence in the U.S. market will begin to decline as Bell delivers 107 V-280s to the U.S. Army through 2033 worth more than $6 billion.

European primes are among the least dominant in this market segment with Airbus, Leonardo and NHIndustries combined accounting for less than 15% of deliveries by value at $4.6 billion, $3.7 billion and $3.3 billion, respectively. Among these primes, sales to the European market accounts for 80% of deliveries followed by MENA at 7.5%. Turkey is another secondary player, and hopes to grow its RW industrial base with its T-70 (licenced produced Black Hawk) program worth $2.7 billion as well as the indigenous T-625 Gökbey worth $1.2 billion.

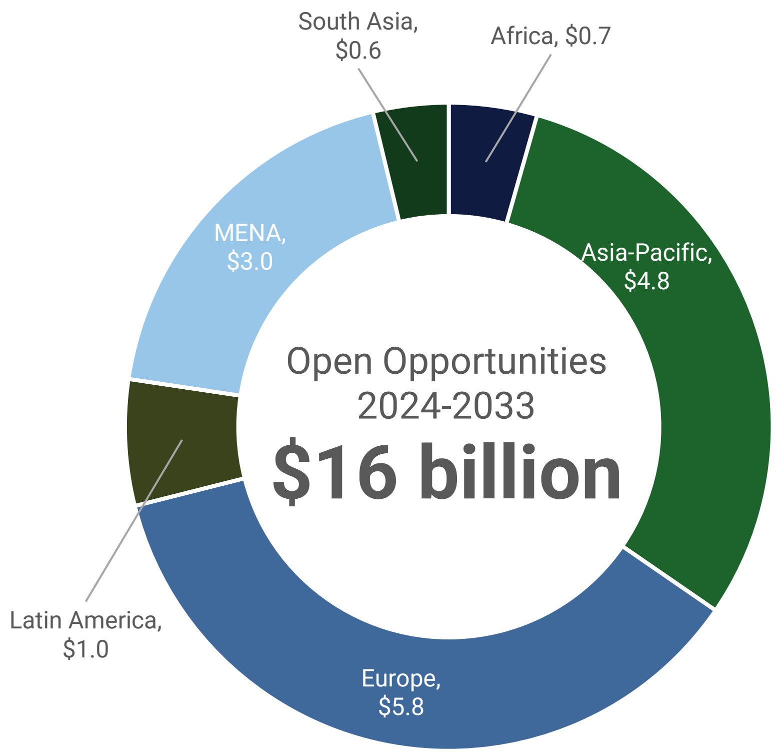
Contracted Order Book (2024-2033)

$33 billion

Biggest Programs by Order Book (2024-2033)



Rotary Wing Transport Aircraft – Open Opportunities



Country	Opportunity Size	Notes
Israel	52 Aircraft **$1.4 billion**	Israel is projected to begin replacing its oldest UH-60A and S-70A Black Hawks by the end of the decade. In February 2022, then-head of the Israeli Air Force Material Directorate, Brig. Gen. Tsentsiper, visited Redstone Arsenal to exchange information regarding U.S. Army FVL programs.
Greece	49 Aircraft **$1.1 billion**	Greece is looking to replace its remaining Huey fleet and submitted an LoR in 2023 for 49 UH-60Ms (35 for the Army, 14 for the Air Force). As of the time of this writing, no formal source selection has been made. The Hellenic Army is also on contract to receive 20 TTH90s from NHIndustries.
United Kingdom	30 Aircraft **$1.0 billion**	The Royal Air Force is looking to replace its Puma fleet with 25-35 New Medium Helicopters (NMHs) by 2028. The Leonardo AW149, Airbus H175M and Sikorsky S-70M are competing for the contract with local assembly offered in Yeovil, North Wales and Gosport respectively.
Greece	28 Aircraft **$1.0 billion**	Greece is forecasted to begin replacing its Chinook fleet by the end of the decade with its oldest airframes having been delivered in 1994. Greece is among the few D-model operators which has yet to announce a recapitalization plan. The Hellenic Army currently operates a mix of 19 CH-47Ds and six longer-range CH-47SDs.
Malaysia	24 Aircraft **$0.8 billion**	The Royal Malaysian Air Force (RMAF) grounded its fleet of S-61A Nuri helicopters in 2020 as a result of deteriorating serviceability but struggled to budget a full replacement program. The RMAF has leased four AW139s in the interim with Leonardo offering the AW149 as a longer-term solution.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parenthesis

Rotary Wing Transport Aircraft – Fleet Dynamics

H145 Fleet Change (2024-2033)

+18%

The largest RW transport families are all expected to remain static or decline slightly through 2033, reflecting mirrored replacement programs throughout much of the market as well as the importance of RW remanufacture and re-engine programs. The longevity and adaptability of airframes like the UH-60L to accommodate new engines and avionics partially obviates the need for new build aircraft. For example, the U.S. Army plans to remanufacture 760 UH-60Ls to the UH-60V standard to equip U.S. Army National Guard units rather than fully replacing the Guard fleet with new build UH-60Ms. Northrop Grumman furnishes the V-model at one-fifth the cost of new build UH-60Ms, adding a digital cockpit analogous to the M-model but without the new rotor blades and machined airframe. Similarly, South Korea opted to conduct a MLU program for its more than 100 Black Hawks which will managed by Korean Air and Collins Aerospace. China, India and Germany are among the few countries with significant growth in their RW transport fleets as operators seek to introduce or expand their air assault or heavy lift capabilities.

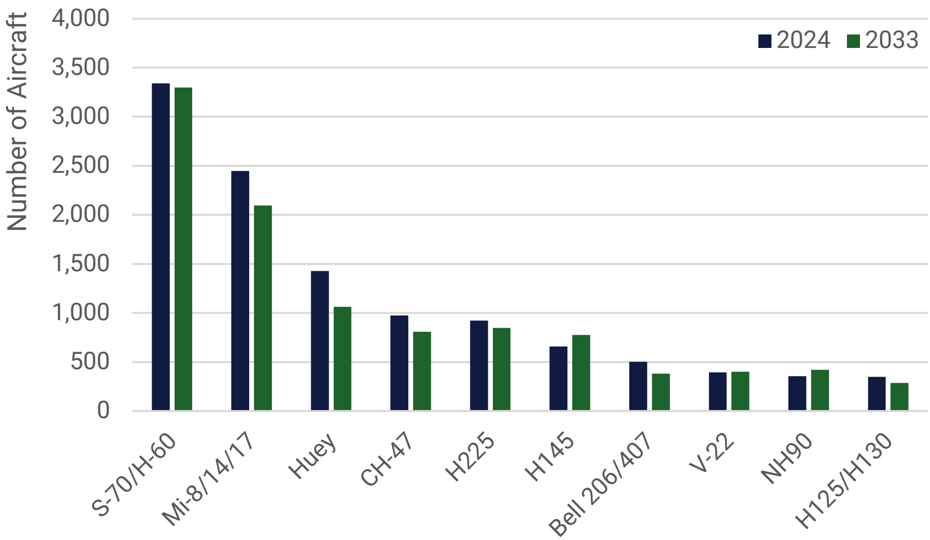
Both India and China also operate large fleets of Russian sourced Mi-8/14/17 helicopters but have increasingly sought to develop domestic alternatives such as the Changhe Z-20 and proposed HAL Indian Multi-Role Helicopter (IMRH). Western primes are expected to have limited access to indigenous Indian programs through various subcomponent and technology transfer agreements. Safran and HAL signed a MoU to develop new turboshaft engines for the IMRH in February 2023. Combined with the threat from CAATSA sanctions and those imposed after Russia's invasion of Ukraine, the global Mi-8/14/17 fleet is also expected to decline across the European, South Asian and Latin American markets. The proportion of Russian sourced helicopters across the global RW transport fleet is expected to decline from 18% in 2013 to 14.1% in 2033.

Mi-8/14/17 Fleet Δ (2024-2033)

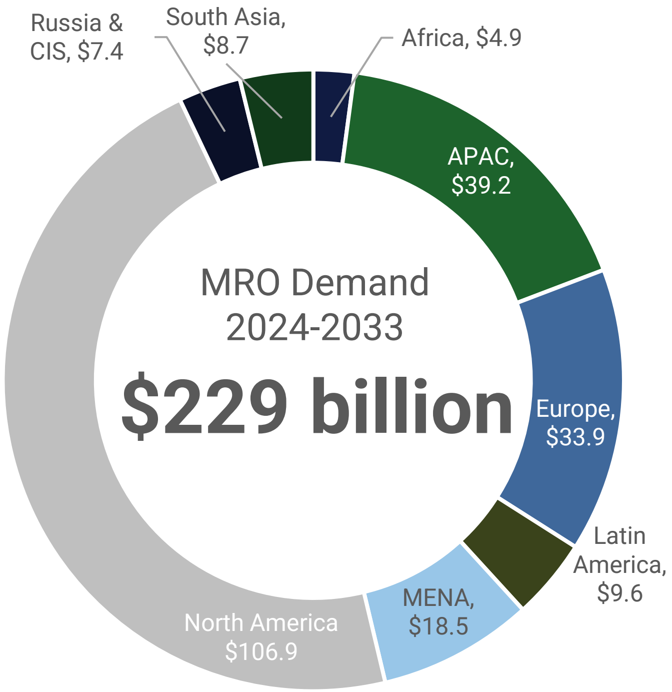
-14%

Over the past two years, Poland has committed to fully replace its Soviet-era RW fleets. This includes 49 Mi-2 light transports, which Poland will replace with 32 Leonardo AW149 scout-transports for $2 billion and 45 Mi-8s, which will be replaced with 22 Leonardo AW101s worth $2.2 billion and 24 locally assembled PZL-Mielec S-70is. Renewed RW investment among Western European operators is expected around 2035, beyond the forecast horizon, under NATO's NRGC program. By 2033, NRGC nations will collectively field 517 medium transports including 307 NH90s, 86 H225s and 45 AW101s as well as 79 helicopters to be acquired through open competitions.

Key In Service Fleets 2024 and 2033



Rotary Wing Transport Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

+0.8%

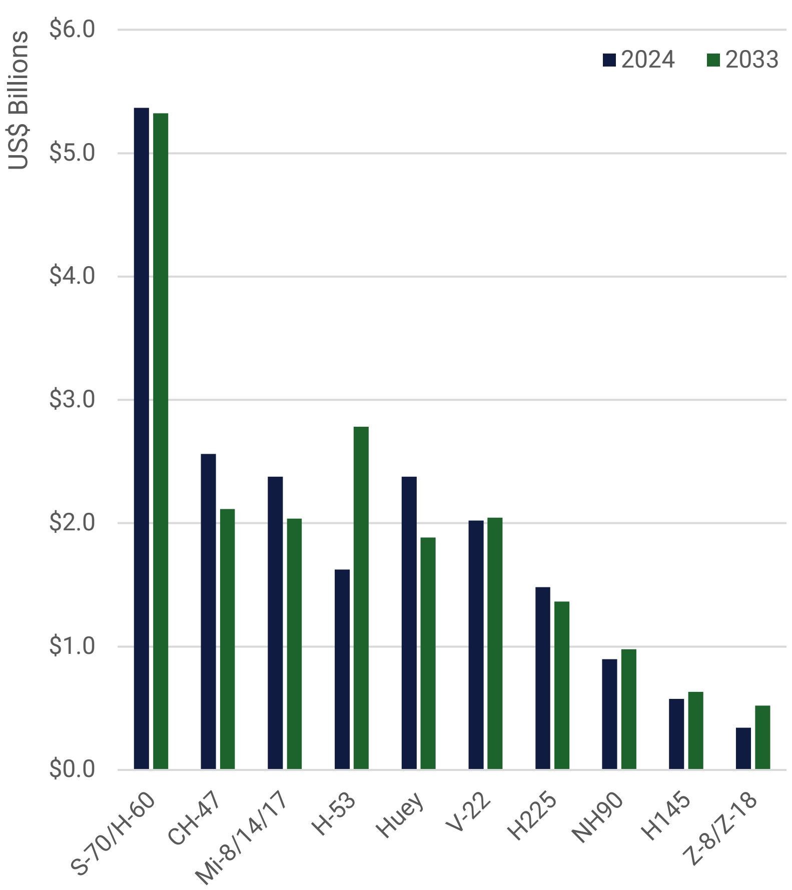
The transport helicopter market segment is expected to generate the second largest amount of MRO demand over the forecast period behind the fighter segment. Annual spending on maintenance of these aircraft is projected to increase from $22.6 billion in 2024 to $24.6 billion in 2033.

A significant driver of demand will be the expansion of rotary wing mobility in China where MRO demand is projected to expand at a 2.8% CAGR as the People's Liberation Army (PLA) grows its fleet of transport helicopters.

Deliveries of the Bell V-280 Valor are also due to accelerate through the forecast period with over 100 aircraft expected to enter service by the end of 2033. This will contribute to further growth in MRO demand due to the expectation of significantly higher costs for the tilt-rotor configured V-280 compared to the UH-60 Black Hawk it will begin to replace. This recapitalization process is driving a 1.3% CAGR for MRO demand in the U.S. within this market segment.

Longer term its remains to be seen whether other operators will also opt for the adoption of higher performance but higher cost platforms within this market segment. European militaries are currently assessing this issue as part of plans to recapitalise their transport helicopter fleets through the 2030s.

Top Programs By MRO Demand



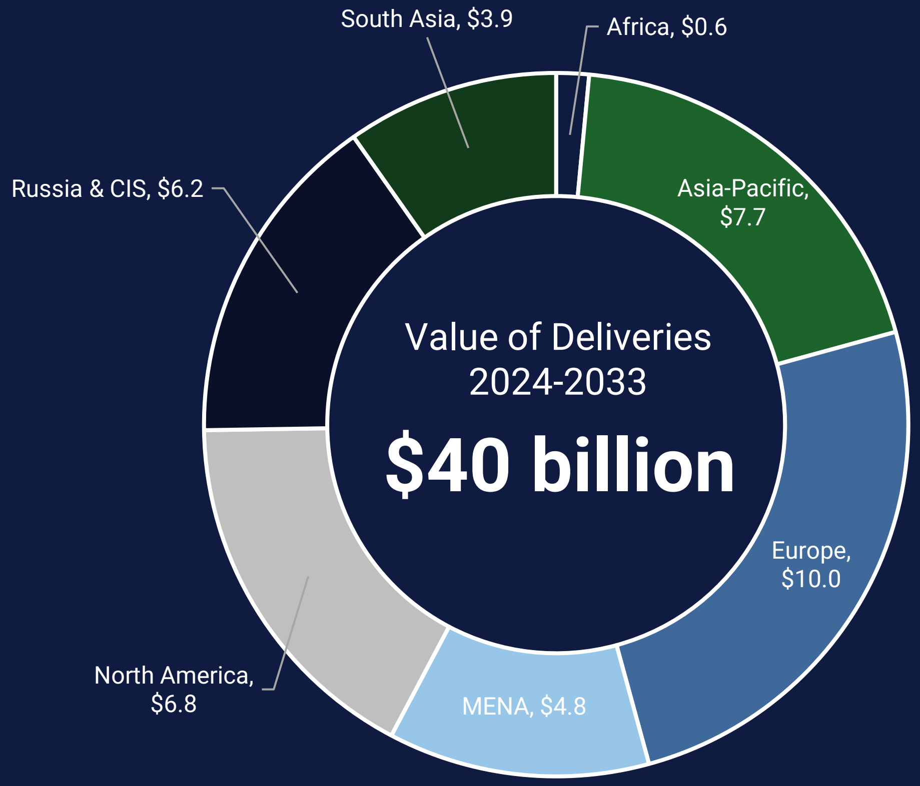
Rotary Wing Attack Aircraft – 2024-2033 Market Projections

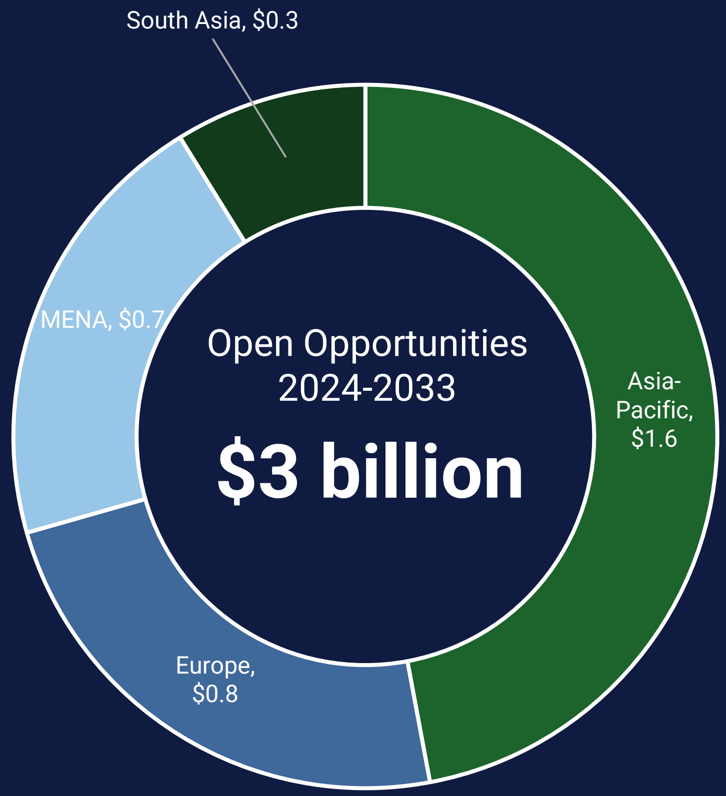
Total New Build Deliveries
1,051 Aircraft

Total Retirements
620 Aircraft

In Service Fleet (2024)
3,278 Aircraft

Fleet Growth CAGR (2024-2033)
+1.4%





Rotary Wing Attack Aircraft – Key Market Trends

An AH-64E on the flight line at Hunter Army Airfield, Georgia. (U.S. Army)

"24.3% of rotary-wing attack deliveries by value are accounted for by Apache remanufacture deliveries"

The rotary-wing attack market is characterized more by continuity than by change. The Boeing AH-64 Apache represents a preeminent platform that has defined the attack helicopter mission since its introduction. Its steady modernization cleanly traces the evolution of that mission – the successful attack helicopter of today requires sophisticated sensing, stand-off weapons and robust survivability. Apache offers all of that in spades and arguably no competitor has ever been able to match its capability.

Western operators opting for an alternative platform typically do so for cost or political/industrial reasons. Italy for example will replace its Leonardo AW129 Mangusta fleet with the larger AW249, and France plans to modernize its Tiger fleet. Meanwhile, India will effectively split the difference due to tension between Indian military requirements and the capabilities of state-owned contractor Hindustan Aeronautics Limited (HAL). The country will dramatically expand its attack helicopter fleet, possibly acquiring up to 33 more Boeing AH-64E Apache Guardians for the Indian Army to complement the six aircraft already on contract. A total of 22 Guardians are already in service with the Indian Air Force. In parallel, it will push forward its Light Combat Helicopter (LCH) program, which will acquire a fleet of the HAL Dhruv-derived Prachand for both its Air Force and Army.

AH-64 remanufacture programs will also drive a large portion of the market – 24.3% of rotary-wing attack deliveries by value are accounted for by Apache remanufacture deliveries. Another 21.3% of the market is accounted for by new-build Apaches. Britain, Greece and the Netherlands are all upgrading their Apache fleets over the forecast period. In the new-build space, Poland has elected to buy up to 96 AH-64Es.

The non-western market sees little activity over the forecast besides in China, where procurement of the Changhe Z-10 will grow China's attack helicopter fleet by over 130 aircraft. The fleet will be 460% larger at year end 2033 than it was in 2024. In Russia, the Kamov Ka-52M and Mi-28NM will be procured at steady rates over the forecast to replace older types and replace losses sustained during the war in Ukraine. These helicopters will be available for export but will struggle to find large markets. Most large attack helicopter customers operate western types, and previous Mi-28 and Ka-52 export customers have had a low opinion of their aircraft (notably Egypt, whose Ka-52s demonstrated poor hot-and-high performance.)

In the long view, advanced armies may deemphasize the attack helicopter mission in favor of UAS capabilities and ground-launched effects. However, the attack helicopter offers a potent combination of proximity, overhead persistence and firepower. And as survivability requires nap-of-the-earth flight over difficult terrain, (and outside line of sight to a ground control system) taking the pilot out of the cockpit may not be so simple.

Program in Focus – Boeing AH-64 Apache

The Apache program began in earnest in December 1976, when Hughes' YAH-64 won the U.S. Army's Advanced Attack Helicopter (AAH) competition. In the years since, the Apache has become the most commercially successful western attack helicopter of all time.

No other helicopter in production or development arguably matches the Apache's capabilities. The latest variant, the AH-64E V6 Apache Guardian, features two 2,000 shp T700-701D engines, 3.5 hr operational endurance and a maximum operating weight of 23,000 lb (10,432 kg). Its four weapons pylons can carry a total of 16 AGM-114-class missiles or four 19-shot Hydra 70 rocket pods.

Other key features of the AH-64E V6 include an open mission system architecture, control of UAS up to 62 mi (100 km) away and an effective range of 16 km for the fire control radar.

Competitors include the Leonardo AW129, TAI T129B, Eurocopter Tiger and Bell AH-1Z. Of these only the AH-1Z is in the same class, and its range and endurance are limited when carrying an AH-64E-like payload. It also lacks manned/unmanned teaming capability and other secondary features that differentiate the Apache.

Leonardo's developmental AW249 will be the closest Apache competitor once it enters production. With two 2,500 shp CT7-8E6 engines, it will have 25% more power than the Apache until the 3,000 shp GE T901 engine is fielded to the Apache under the Improved Turbine Engine Program (ITEP).

Much of the western attack helicopter market outside the U.S. is concentrated in Europe, MENA and the Asia-Pacific. In Europe, industrial considerations limit the reach of the Apache as western European countries continue to rely on the AW129 and Tiger families. Other operators with close ties to the U.S. or proximity to Russia have opted for the Apache, most notably Poland and the United Kingdom.

In the Asia-Pacific, most helicopter operators are U.S. allies or security partners. The range and payload of the Apache are prized in a region where littoral operations are a key competency of any land force.

Finally, in MENA the Apache is again popular among countries with strong defense ties to the U.S. It is also prized for its hot-and-high performance, an area in which the Ka-52 and Mi-28 are lacking. The Tiger and AW129 have not penetrated MENA due partially to their performance limitations.

An AH-64E landing aboard USS Peleliu. RIMPAC 2014. Credit: U.S. Navy

The AH-64 program will continue for the foreseeable future as older models are remanufactured to AH-64E. Later in our forecast, AH-64Es will begin receiving the uprated T901 engine. This will keep assembly operations ongoing past the final new build deliveries, which we anticipate in 2031 unless the AH-64 secures additional customers. Fortunately for Boeing, key opportunities in South Korea, Ukraine and Bangladesh are accessible.

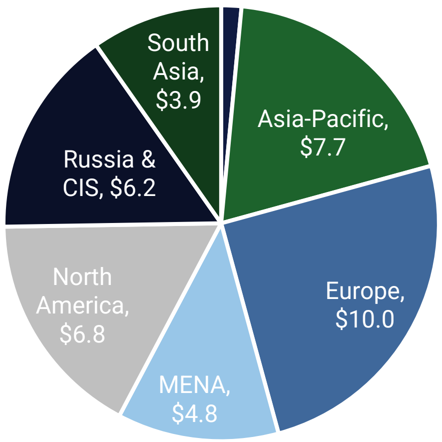
In the U.S., the Army has shelved Apache replacement plans and expects the helicopter to serve into the 2040s.

Rotary Wing Attack Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$40 billion

Value of Deliveries by Region



The western rotary-wing attack market is dominated overwhelmingly by Boeing's AH-64 Apache over our forecast, thanks to a strong export business and to a large U.S. remanufacture program. The U.S. Army is in the final stages of upgrading its AH-64D Block IIs to AH-64E-standard, and once the GE T901 ITEP engine is successfully trialed it will begin reengining the Apache force.

Other key western families include the Eurocopter Tiger and TAI/Leonardo AW129. The Tiger will see a major remanufacture program in Spain and France but divestment in Australia and Germany in favor of the AH-64E and Airbus' H145M, respectively. The AW129 will see at least 15 T129B deliveries, while Leonardo's new AW249 has yet to secure a full rate production contract from the Italian military. Italy has a requirement for 48 of the helicopters.

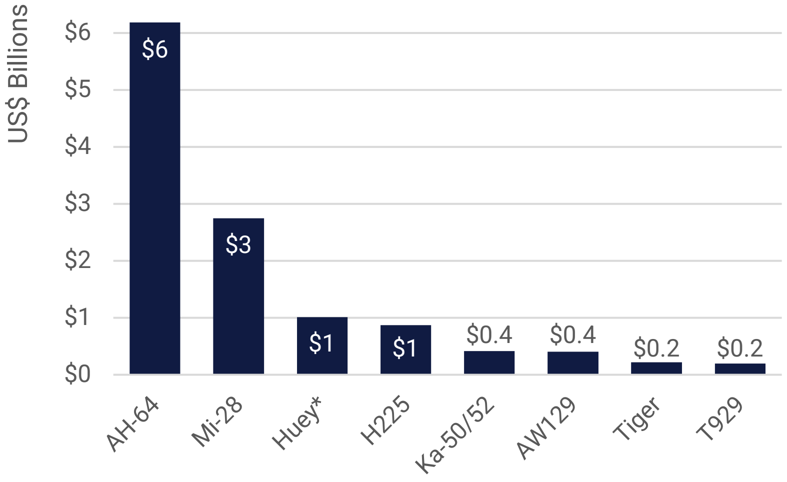
Outside the western market, key players include Changhe's Z-10, the Mil Mi-24 and Mi-28. 185 Z-10s are on order, 155 for China and 30 for Pakistan, which is procuring the Z-10ME export variant.

The Mi-24 family by contrast has no orders anticipated over the forecast. In Russia the family is facing gradual replacement by the Mi-28 and Ka-52. Other countries such as Algeria and Ukraine will draw down their fleets in favor of western alternatives. It is likely however that small numbers of Mi-24s will be remanufactured or brought out of storage as Russian military aid to partner countries such as Bukrina Faso, Chad or Mali, whose military governments rely on Russian mercenaries to fight jihadists and rebels. These transfers are impossible to anticipate with rigor and are not included in our forecast.

Contracted Order Book (2024-2033)

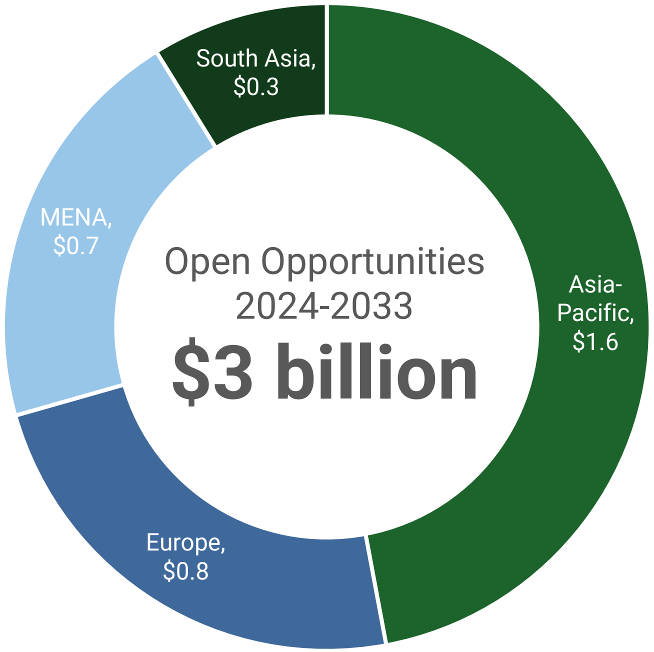
$3 billion

Biggest Programs by Order Book (2024-2033)



*The Huey family contains AH-1 variants in AWIN

Rotary Wing Attack Aircraft – Open Opportunities



Country	Opportunity Size	Notes
South Korea	36 Aircraft **$1.3 billion**	The South Korean army's attack helicopter fleet presently consists of 36 Boeing AH-64Es and 28 Bell AH-1Fs. The AH-1Fs require replacement over the forecast, and there is an official government plan to procure 36 new attack helicopters. The requirement will likely yield 36 more Apaches.
Ukraine	25 Aircraft **$0.8 billion**	Ukraine eventually will need to replace its Mi-24 fleet with a western alternative. AH-64E is an ideal, if expensive candidate. Leonardo may pitch its AW249, and TAI's T929 may also be an option thanks to robust Turkey-Ukraine defense cooperation. In any case, replacement is unlikely until hostilities with Russia conclude.
Algeria	20 Aircraft **$0.5 billion**	Algeria is a longtime operator of Mi-24s upgraded to the Super Hind configuration by ATE (now Paramount Systems). These will require replacement by mid-forecast. From 2016 to 2019, Algeria acquired 42 Mi-28NEs. Additional Mi-28 procurement would be sensible to replace the Mi-24s, and Russia is Algeria's primary security partner.
Myanmar	12 Aircraft **$0.3 billion**	Myanmar has since at least 2021 been interested in augmenting its fleet of 8 Mi-35P attack helicopters. Myanmar's junta is engaged in genocide against its Rohingya minority, and in a war against a broad pro-democracy insurgent movement. Western countries will not permit arms exports, so Russia and China are the only options.
Bangladesh	8+3 Aircraft **$0.2+0.1 billion**	Both Bangladesh's air force and army are seeking eight and three attack helicopters, respectively, under an ambitious modernization plan termed Forces Goal 2030. The country has reportedly considered the Boeing AH-64E, Eurocopter Tiger, Mil Mi-28NE and TAI T-129B.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Rotary Wing Attack Aircraft – Fleet Dynamics

Poland Fleet Change (2024-2033)

+336%

Owing to large expansions of the Chinese, Indian and Polish attack helicopter fleets, the rotary-wing attack fleet will grow at a rapid clip over the forecast. India's HAL LCH program will see 135 deliveries over the forecast, with only 20 Mil Mi-35 retirements in return. Aviation Week categorizes the LCH within the HAL Dhruv family. Additional Boeing AH-64E buys up to 33 aircraft drive fleet growth even higher.

In China, we anticipate the Changhe Z-10 fleet growing from 279 to 414 aircraft, with no accompanying divestments. Another 30 Z-10s will be delivered to Pakistan to replace its Bell AH-1Fs.

In Poland, the legacy force of 22 Mi-24s will give way to up to 96 AH-64Es. Procurement to that number may prove difficult from a fiscal standpoint as Poland modernizes and expands nearly every segment of its armed forces simultaneously. On the other hand, the Apache was designed explicitly for the adversary Poland faces and a Polish fleet will integrate handily with other NATO Apache operators. Even if the buy is truncated, a minimum of 32 is likely.

The global fleet of Mi-24/35s will decline by 678 to 521 aircraft over the forecast as Russia and various European operators replace them. The Hind will soldier on in Sub-Saharan Africa, MENA and the CIS countries.

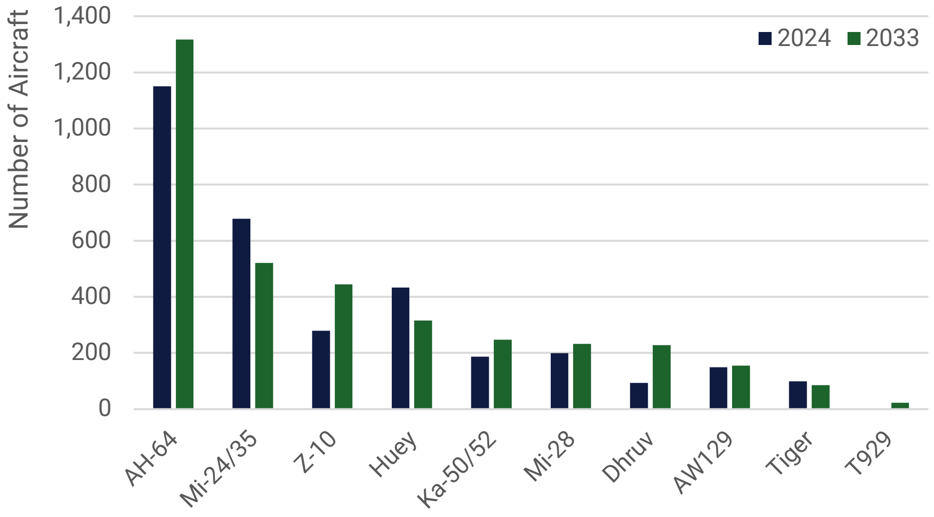
Another family seeing widespread retirement is the Bell AH-1 Cobra (part of the Huey family). The global fleet will decline from 433 aircraft in 2024 to 316 in 2033 with substantial divestments in Japan, Pakistan and Taiwan. Production of the final variant, the AH-1Z Viper, will terminate by the end of 2026 absent further exports. The AH-1Z has struggled to compete on cost with the AH-64E, and with the final delivery to the U.S. Marine Corps in 2022 the line is operating at a fraction of its peak capacity.

Mi-24/35 Fleet Change (2024-2033)

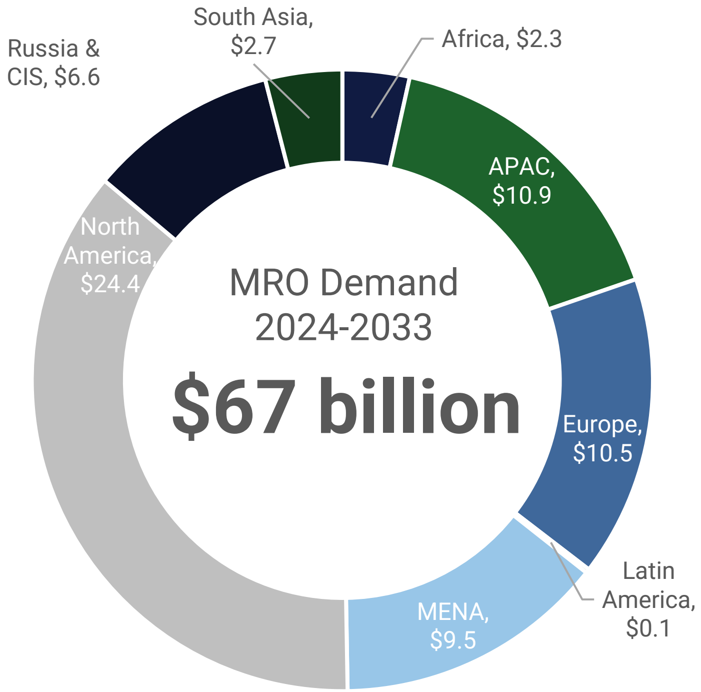
-23%

Though the Leonardo AW129 and Eurocopter Tiger fleets are nearly static over the forecast by fleet count, the composition of these fleets will change. France and Spain will modernize their Tigers to a Mk III standard, while Italy and Turkey will replace their AW129s and T129As with AW249s and T129Bs.

Key In Service Fleets 2024 and 2033



Rotary Wing Attack Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

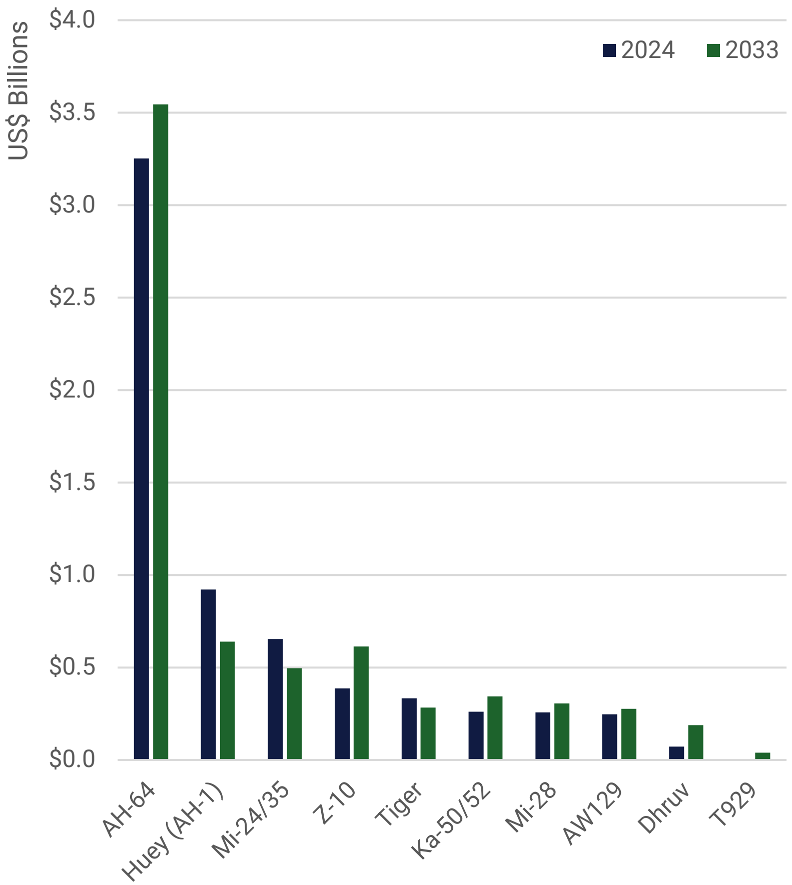
+1.0%

Over the 10-year period between 2024 and 2033 more than half of all MRO demand generated in the attack helicopter market segment will be generated by a single platform family – the Boeing AH-64 Apache. In total $34.4 billion of the $67.0 billion in maintenance spend over the decade will be generated by the AH-64 with spending gradually increasing over the period. The U.S. Army alone is projected to spend around $21.3 billion on Apache maintenance over the course of the forecast.

More broadly the 1.0% CAGR for MRO demand is being driven by an increase in the number of attack helicopters in service globally between 2024 and 2033. As European militaries look to enhance anti-armour capabilities, the region's fleet is projected to increase from 437 aircraft in 2024 to 531 by the end of 2033. Despite this trend in Europe, maintenance demand generated by the Airbus Helicopters Tiger is projected to decline with uncertainty surrounding the future of the type.

Attack helicopter fleets are also projected to expand significantly in Asia. India in particular will likely more than double its inventory as more AH-64Es and HAL Light Combat Helicopters (LCH) enter service. Similar moves in China focused on the expansion of the Z-10 fleet will see the Asian market increase its share of attack helicopter MRO demand from 19.2% in 2024 to 20.9% by the end of the 10-year period.

Top Programs By MRO Demand



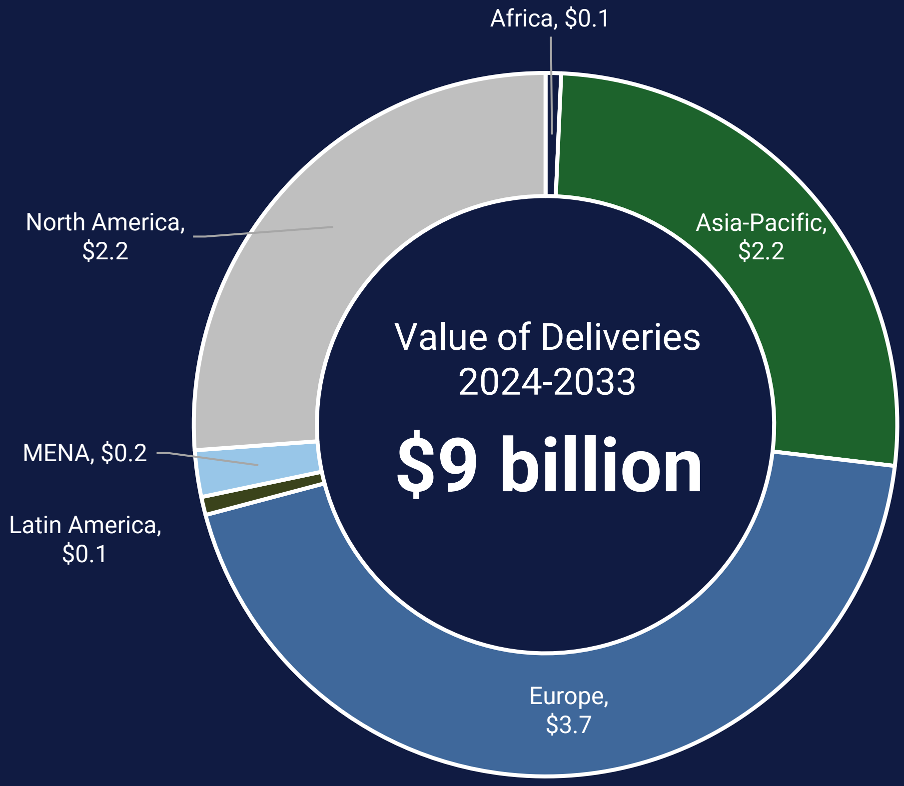
Rotary Wing Scout Aircraft – 2024-2033 Market Projections

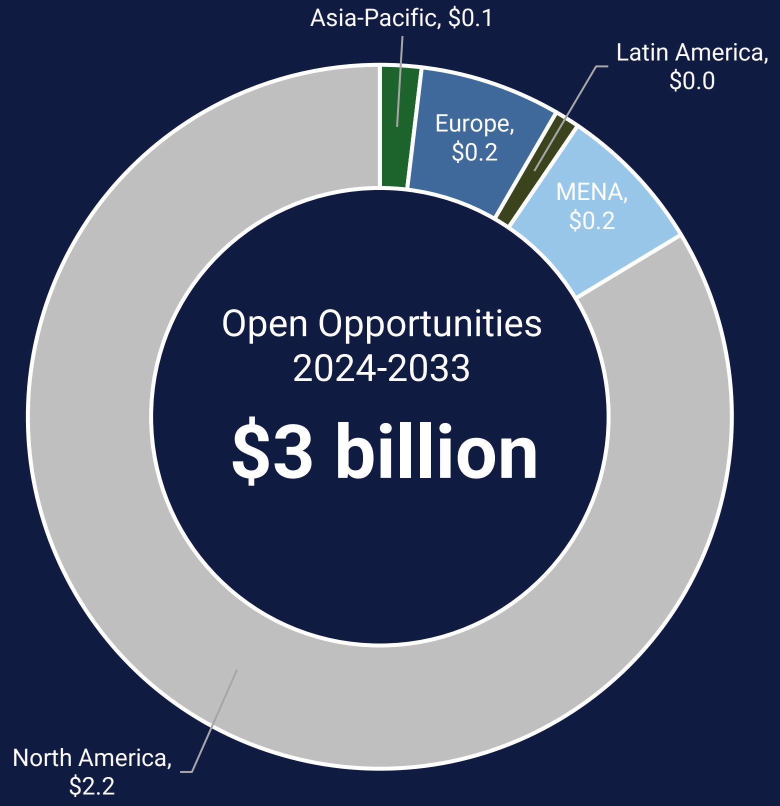
Total New Build Deliveries
547 Aircraft

Total Retirements
696 Aircraft

In Service Fleet (2024)
2,339 Aircraft

Fleet Growth CAGR (2024-2033)
-0.5%





Rotary Wing Scout Aircraft – Key Market Trends

Sikorsky's FARA entrant, Raider X. (Sikorsky)

"FARA will likely dominate the high-end portion of the western scout market from the early 2030s well into the 2040s"

The rotary-wing scout market is the smallest mission segment in the military aircraft market both by value and number of deliveries anticipated over the forecast period. The global scout fleet has declined steadily since 2012, driven mostly by the U.S. Army's retirement of the Bell OH-58 Kiowa without a direct replacement. Since divestment the Army has filled the aerial reconnaissance niche within its combat aviation brigades with an additional squadron of Boeing AH-64E Apache attack helicopters teamed with the AAI RQ-7 Shadow Group 3 UAS.

The Army has never been content with this – recent history is littered with ill-timed or ill-conceived Kiowa replacement initiatives such as the RAH-66 Comanche, the Bell ARH-70 Arapaho and the Armed Aerial Scout (AAS) program. The technically ambitious and expensive Comanche suffered a unit cost death spiral as procurement quantities were cut from 1,292 to 650 aircraft. The more technically conservative ARH-70 was essentially a reengined OH-58D with a composite rotor and a new tail assembly however, cost overruns and delays doomed the procurement. The subsequent AAS program was terminated under massive budget cuts imposed in March 2013 under the Budget Control Act of 2011.

In the background of these initiatives, the Army forged ahead with its ambitious Future Vertical Lift (FVL) effort. FVL yielded the Future Attack Reconnaissance Aircraft (FARA) requirement in 2018. The winning FARA platform will likely dominate the high-end portion of the western scout market from the early 2030s well into the 2040s. However, the clean-sheet design of both bids, lack of civil applications, and the relatively small fleet size anticipated by FARA may adversely impact the unit cost of the aircraft and constrain its export prospects. Annual production rates may also be constrained by concurrent aviation modernization initiatives pursued by the Army such as FLRAA and the Improved Turbine Engine Program (ITEP) backfit onto the UH-60M and AH-64E.

The lower-end of the market will be served by a variety of converted civil helicopters such as the Airbus H155, Leonardo AW139, Airbus H145 and MD Helicopters MD 500. These solutions offer a modest mix of capability at cost, typically integrating an off-the-shelf EO/IR solution and light pylon-mounted weapons such as 12.7 mm gun pods or 70 mm rocket pods (if armed at all).

Another critical program over the forecast period is the Airbus H160M. France is procuring 80 in an armed reconnaissance configuration for its army – 65 of these fall within the forecast period.

Program in Focus – Future Attack Reconnaissance Aircraft (FARA)

Initiated in October 2018, the U.S. Army's FARA program hopes to yield a new scout helicopter to provide a light, agile and long ranged complement to the Boeing AH-64E Apache Guardian in the Army's combat aviation brigades. Bidders initially included AVX Aircraft, Bell, Boeing, Karem Aircraft and Sikorsky.

The program has reached a competitive fly-off between the Sikorsky Raider X and Bell 360 Invictus. The Raider X is compound helicopter with two coaxial main rotors based on the S-97 Raider, a technology demonstrator Sikorsky pitched for the abortive Armed Aerial Scout program. The 360 Invictus is a conventional helicopter with a four-blade rotor system based on the Bell 525 relentless.

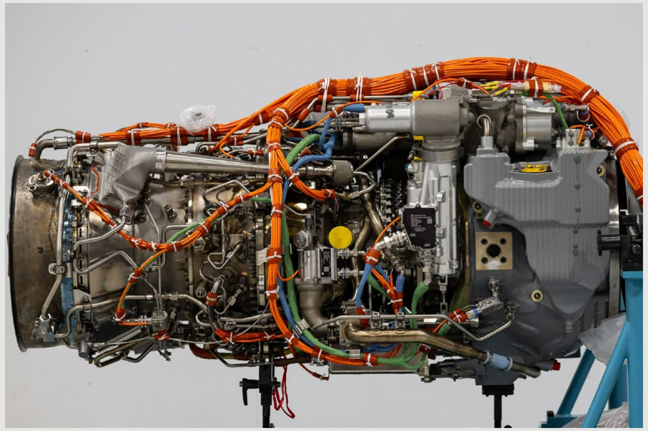
Both helicopters will be powered by a single GE T901 ITEP engine per the government's requirements, though Bell says the Bell 360 will also carry a P&W Canada PW207D1 as an auxiliary power unit. The PW207D1 will be geared to provide additional power to the main transmission. The T901 will deliver 3,000 shp and is slated to eventually power most of the Army's legacy rotary-wing portfolio when it is installed aboard the AH-64E and UH-60M.

The core requirements for FARA are simple yet ambitious – the Army desires a helicopter with a main rotor diameter no greater than 40 ft, a maximum speed of at least 180 knots and a maximum takeoff weight of 14,000 lb. The platform is also expected to provide 90 min of loiter at 135 nmi, and hover out-of-ground-effect performance of 4,000 ft at 95 F.

The cruise speed and rotor diameter requirements are serious engineering constraints that have shaped Bell and Sikorsky's proposals. This modest rotor diameter is intended to allow FARA to operate gracefully in urban areas. The AH-64E's rotor diameter is 48 ft.

In Bell's case, the 360 Invictus is designed to minimize drag and to augment lift from the rotor at high speeds with large stub wings. These wings will carry a weight penalty. In turn, the conventional arrangement means a lighter transmission than Raider X. Sikorsky's entrant is in some ways more technically ambitious but is based on a demonstrator flying since 2015, the S-97 Raider. The S-97 has achieved speeds of up to 200 kt in flight testing.

The Army has yet to publicly disclose an acquisition objective for FARA. Based on the Army's force structure, wherein 12 combat aviation brigades in the active component will replace a reconnaissance battalion composed of Apaches with FARA, a procurement of around 300 aircraft is likely.



The first GE T901 test engine upon acceptance by the government. Credit: U.S. Army

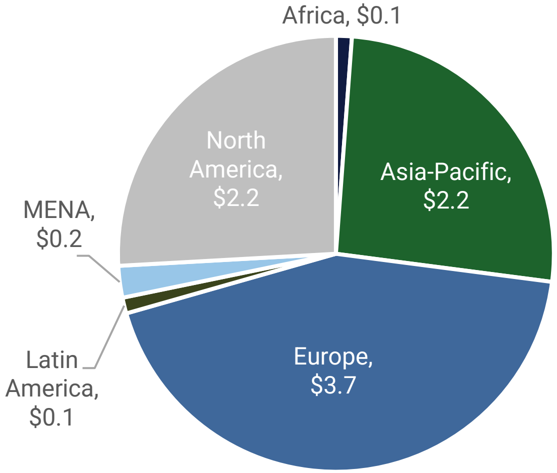
In October 2023, the Army delivered the first ITEP engines to Bell and Sikorsky. Ground runs are expected in early 2024, with first flights near the end of Fiscal 2024. Source selection is expected in Fiscal 2025 with the EMD contract slated for signature a year later. The Army hopes to achieve the first unit equipped milestone in Fiscal 2031.

Rotary Wing Scout Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$9 billion

Value of Deliveries by Region



Because scout helicopter procurements are typically small and are often converted civil helicopters with short production times, few programs have deep orderbooks in the rotary-wing scout market. The exception is Leonardo's AW139/149/169/189 family. This is driven by three key European procurements in Austria, Poland and Italy.

Austria is in the process of acquiring 36 AW169Ms, 30 of which are armed. Three have already been delivered but will serve primarily as trainers for the fleet.

Poland is buying 32 AW149s to replace its Mil Mi-2 and most of its PZL-Swidnik W-3 helicopters. The AW149s will be armed with the Lockheed Martin AGM-114 Hellfire ATGM and are therefore considered armed reconnaissance helicopters.

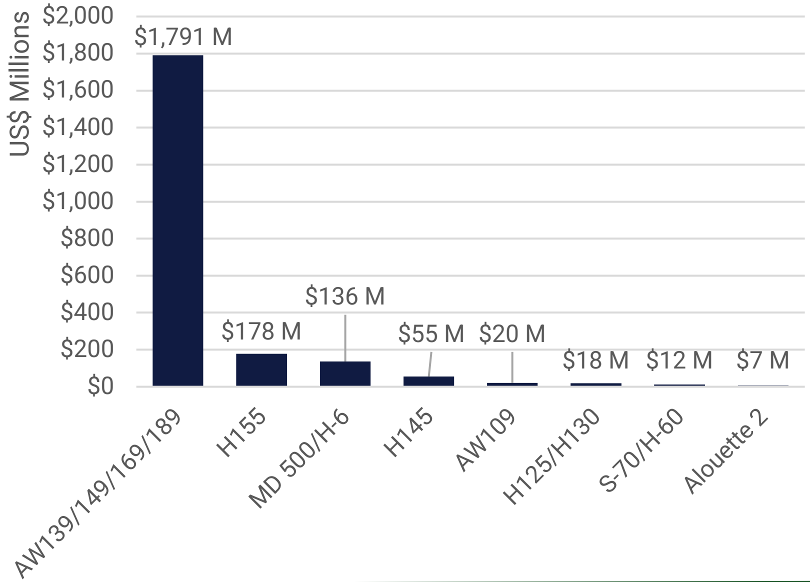
Italy, where Leonardo is headquartered, is acquiring 27 AW169Ms during the forecast period for its army and finance guard. The finance guard's acquisition of 24 helicopters is taking place first, with 15 already delivered (and one operational loss) by the end of 2023. For the Army, a total of 18 will be delivered.

Outside of the AW139 family, we expect a modest number of deliveries in the H155, MD 500 and H145 families. When a full-rate production contract is awarded for South Korea's LAH program, the value of the H115 program in the scout market will increase by more than an order of magnitude. The H145 will likewise see a large jump in contracted valuation once contracts are signed for large Belgian and German procurements in the next few years. The MD 500 will remain mostly at the margins, periodically picking up small U.S. foreign military sales opportunities for U.S. counterterrorism partners.

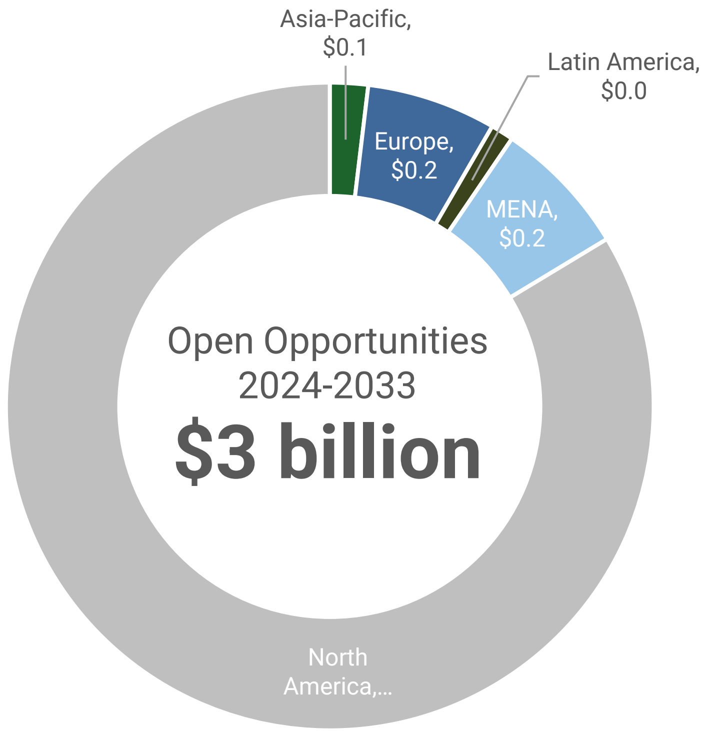
Contracted Order Book (2024-2033)

$2 billion

Biggest Programs by Order Book (2024-2033)



Rotary Wing Scout Aircraft – Open Opportunities



Country	Opportunity Size	Notes
United States	48 (~300) Aircraft **$2.2 billion**	The U.S. Army is seeking a new armed reconnaissance helicopter in its eleven active component combat aviation brigades. Each brigade will receive a battalion of these Future Attack Reconnaissance Aircraft to replace a comparable number of AH-64E Apache Guardian attack helicopters.
Kuwait	15 Aircraft **$270 million**	Kuwait possesses a fleet of 13 Airbus Gazelles that are now nearly 50 years old. These will require replacement with an equivalent capability by the end of the forecast period. Kuwait is both upgrading its fleet of 16 Apaches and acquiring 8 more, so it may opt to divest the Gazelles and replace them with a UAS instead.
Denmark	12 Aircraft **$80 million**	Denmark has a force of 11 Airbus AS.550C2s performing a scout role. These are over thirty years old, and replacement will become a priority once the Danish F-16A/B MLU fleet is retired in favor of the F-35 and the country's aging Saab MFI-17 introductory flight trainers are replaced.
Austria	8 Aircraft **$73 million**	Austria's Bell OH-58Bs will require replacement by the early 2030s. The fleet is armed, so a weapons-capable derivative of a modern European equivalent such as the Airbus H145 or Leonardo AW109 are likely options. Offerings from Bell or MD Helicopters are plausible also.
Lebanon	9 Aircraft **$38 million**	Lebanon is another country requiring a Gazelle replacement. The Lebanese military is a longstanding recipient of western military assistance, including U.S. foreign military financing. It has also taken delivery of armed MD530F scout helicopters as recently as 2021 – acquiring more is plausible.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Rotary Wing Scout Aircraft – Fleet Dynamics

H155 Fleet Change (2024-2033)

+378%

The global rotary wing scout fleet will modestly decline over the forecast period, driven by divestments in South Asia, Latin America, the Asia-Pacific and MENA. This will be partially offset by growth in other regions, most notably in North America as the first third of FARA deliveries take place. These deliveries will not be accompanied by divestments.

Elsewhere, South Korea's rotary wing scout fleet will undergo a major transition with the replacement of the MD500D/E with the Airbus/KAI LAH, an H155 derivative. While their scout fleet modestly contracts over the forecast period, the complete LAH procurement is expected to yield 214 aircraft, a fleet approximately 50% larger than the legacy force of MD500s. This accompanies a broad expansion of South Korean military aviation over the forecast period.

The South Korean MD 500 retirements offset new deliveries in the family and generate a net contraction in the fleet of over 25%. Another family declining over the forecast is the Airbus Gazelle, which declines from 186 aircraft at year-end 2024 to 48 aircraft in 2033. Only a fourth of the fleet will remain by that time due to the type's retirement in France, Kuwait, Lebanon, Morocco and Serbia. The preceding Alouette 2 and Alouette 3 families soldier on due largely to the slow pace of retirements anticipated within the HAL Chetak and HAL Lama fleets in India.

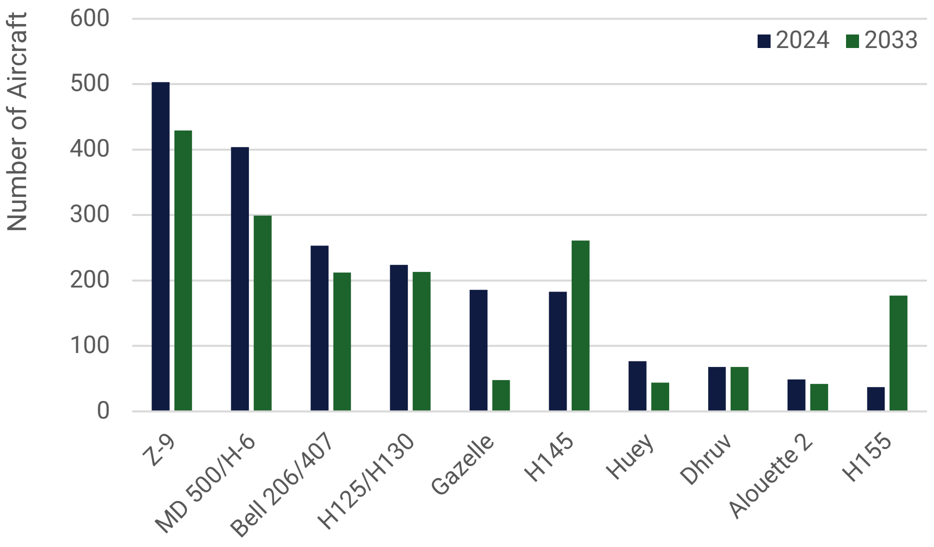
Finally, the Huey and Bell 206/407 families lose share in this mission segment as older types are retired. Colombia will divest its UH-1H IIs over the forecast, possibly in favor of the H145. Bolivia also has a force of 11 UH-1Hs that will likely be retired. Bell 206s and 407s will be divested in Austria, Iraq and Pakistan.

Gazelle Fleet Change (2024-2033)

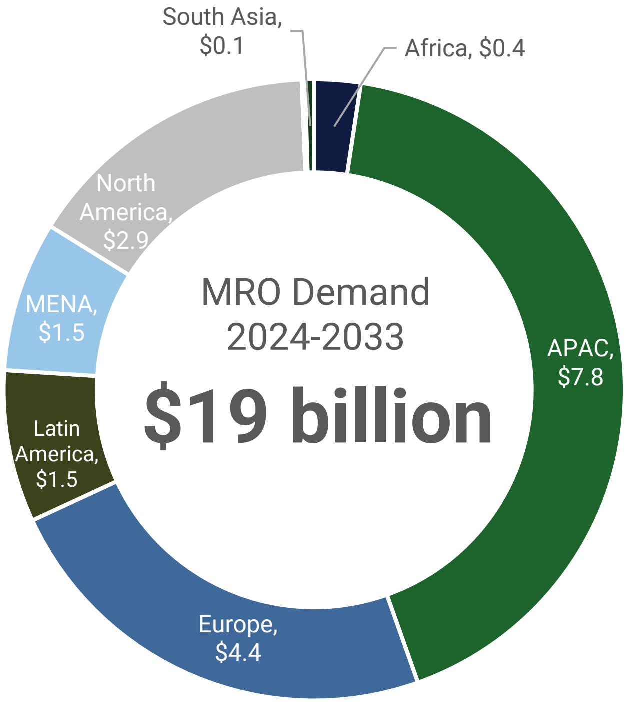
-74%

Outside the western market, China continues to procure the Harbin Z-19 in large numbers to replace less sophisticated scout helicopters such as the Z-9W, Z-9WA and Z-9WZ. The Z-19 itself is derived from the Z-9 but features a streamlined airframe, tandem seating and additional weapons pylons.

Key In Service Fleets 2024 and 2033



Rotary Wing Scout Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

+0.03%

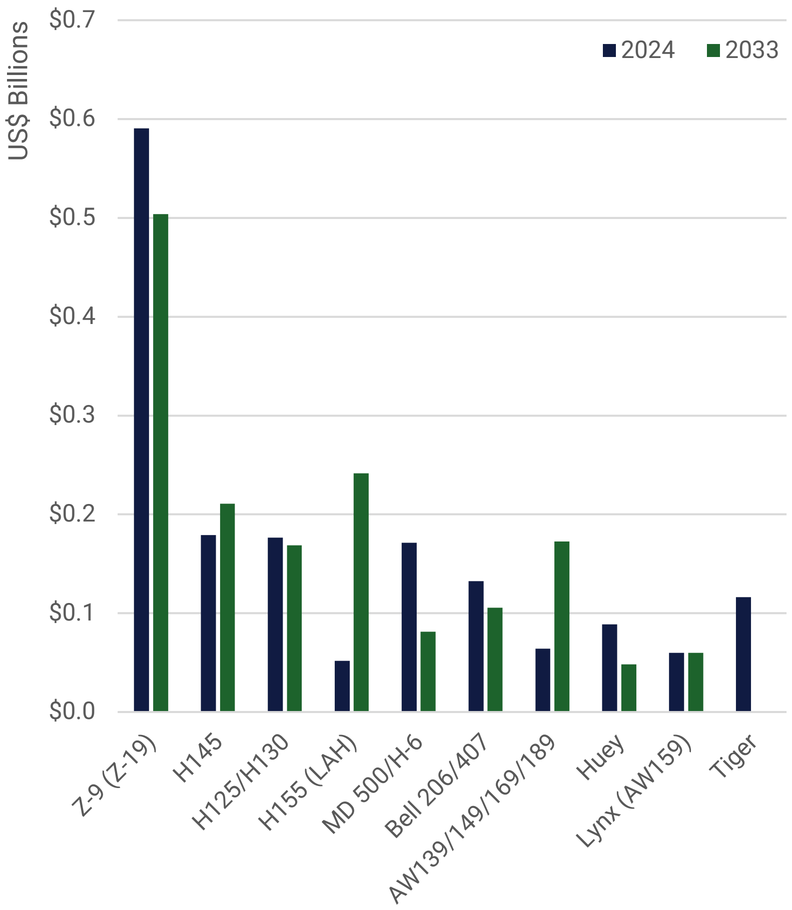
Unlike the majority of mission segments the scout helicopter market is currently dominated by non-U.S. made platforms, primarily originating from Asia and Europe. Growth in the market is however projected to be limited through the forecast period.

The proliferation of armed uncrewed aircraft is acting as a partial brake on fleet and related maintenance spend growth with a number of operators shifting lightly armed surveillance capabilities to these versatile platforms. The range, endurance and survivability limitations of armed reconnaissance helicopters are of increasing concern within the context of contemporary and future threat environments.

The introduction of the U.S. Army's FARA platform in the latter part of the forecast may reinvigorate the market and point to a continued relevance for the mission. The yet to be selected platform looks set to drive higher MRO demand in the longer term given the sophistication of the competing platforms. U.S. Army scout helicopter maintenance spending is expected to grow at a 9.1% CAGR as a result.

The Korean Light Attack Helicopter (LAH) based on the Airbus H155 and the Airbus H145 will also see market share expand over the forecast period with only the Chinese Z-19 expected to generate more MRO demand over the period.

Top Programs By MRO Demand



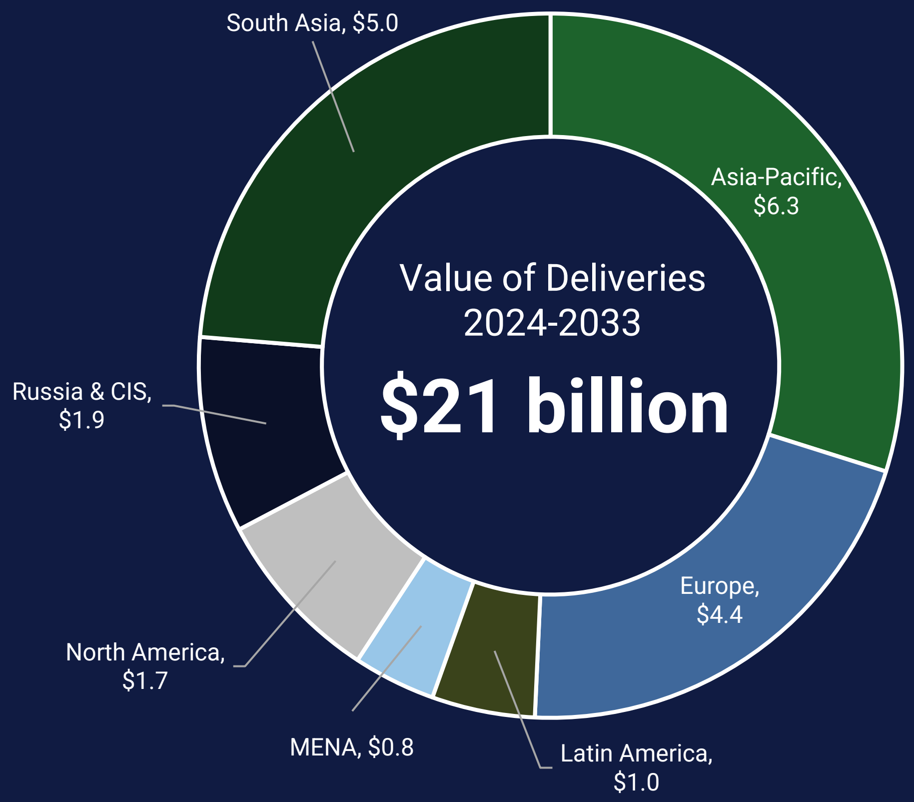
Rotary Wing Maritime Aircraft – 2024-2033 Market Projections

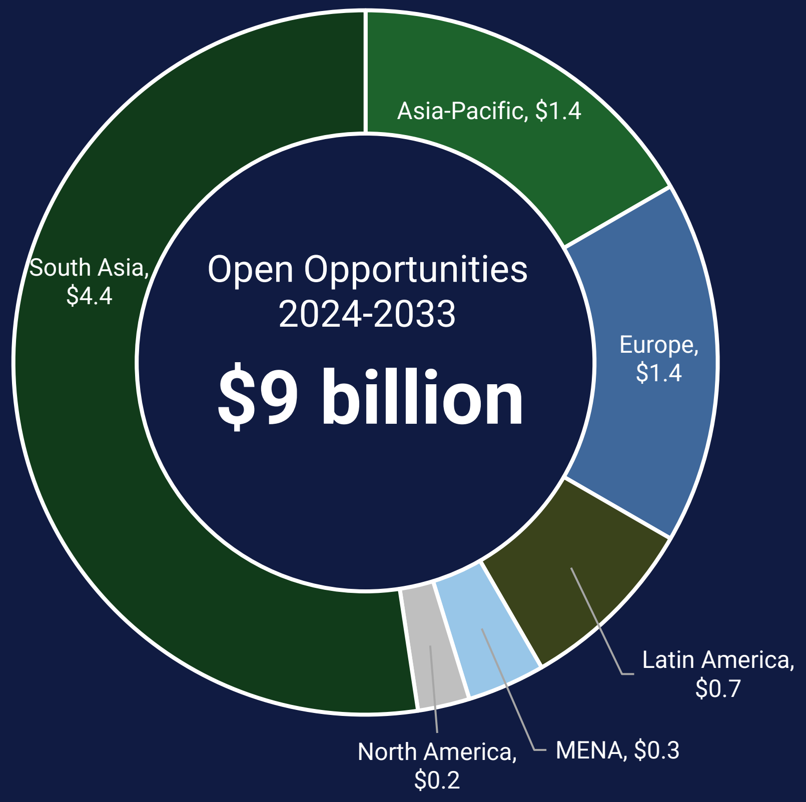
Total New Build Deliveries
731 Aircraft

Total Retirements
486 Aircraft

In Service Fleet (2024)
2,422 Aircraft

Fleet Growth CAGR (2024-2033)
+0.8%





Rotary Wing Maritime Aircraft – Key Market Trends

An MH-60R pictured in-flight, with USS *San Jacinto* (CG-56) steaming in the background. (U.S. Navy)

"The decade-defining opportunities are in India"

Over the 2024-2033 forecast period, Sikorsky's MH-60R production run will come to an end after nearly 25 years. A variety of small requirements exist that the program could bid for, but the decade-defining opportunities are in India. India has imposed rigid indigenous content and technological transfer requirements for these procurements. They are in effect sole-source awards to Hindustan Aeronautics Limited (HAL), the state-owned firm that dominates the Indian aerospace sector.

The MH-60R and its general-purpose cousin, the MH-60S, can serve well into the 2030s. In U.S. Navy service both have been lightly used owing to slower than anticipated surface combatant procurement over the past decade, and to the truncated procurements of both the Littoral Combat Ship (LCS) and DDG-1000. The Navy is exploring a Seahawk replacement that would likely enter service in the mid-2030s. Though this falls outside the ten-year forecast window, we expect engineering and manufacturing development examples to enter test and evaluation by 2030.

On the non-western side of the market, sustained low-rate production of maritime derivatives of China's Z-20 and Z-18 helicopters is expected. China will commission multiple aircraft carriers during the forecast period and a plethora of new Type 052DL and Type 055-class guided missile destroyers. This will drive demand in China for a significant expansion to fleets of ASW, AEW and general-configuration maritime helicopters.

Russia has signaled its intent to develop a new coaxial-rotor maritime helicopter to replace its Kamov Ka-27s. This new helicopter, the Ka-65, will enter service in the late 2020s if the program is adequately resourced. The design hews closely to the Ka-27 and should be regarded as evolutionary. Unfortunately for Russia, there are very few Ka-27s serving internationally and many are in countries such as South Korea that will not consider Russian platforms for the foreseeable future.

One critical open question for the future of the rotary-wing maritime mission is to what extent it will be performed by uncrewed platforms. The U.S. explored a UAS capability in this mission area with the Northrop Grumman MQ-8B and MQ-8C Fire Scout during the 2010s but has opted to retire the MQ-8B and operate only a limited number of MQ-8Cs aboard the Independence-class LCS. Both platforms are markedly smaller than the MH-60R. For general maritime service, crewed or at least optionally manned capabilities will persist indefinitely as militaries are unlikely to entrust personnel transport or the even more demanding visit, board, search, and seizure (VBSS) mission to remote pilots.

Rotary Wing Maritime Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$21 billion

Sikorsky's S-70/H-60 family continues to lead the rotary-wing maritime segment over the forecast period. This is thanks primarily to Mitsubishi's SH-60L, produced under license in Japan to replace its SH-60J and SH-60K fleets.

On the U.S. side, the Navy's part of MH-60R program has concluded, but up to 50 deliveries to export customers are expected. 41 MH-60Ts will also be remanufactured for the U.S. Coast Guard using components from existing MH-60Ts and a combination of new-build and ex-USN SH-60 hull components.

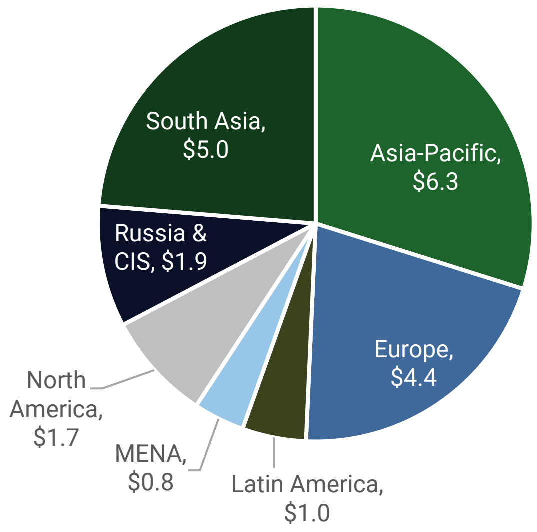
NHIndustries' troubles with its NH90 has also benefited the MH-60R program. Norway and Australia have both elected to summarily retire their NFH90s and have contracted for 6 and 13 MH-60Rs, respectively.

Despite the small number of airframes on order, Bell/Boeing's V-22 program makes a strong second showing in this market segment by value of contracted deliveries. The Navy's CMV-22B program will finish in 2025, with a total of 12 deliveries in 2024-2025. These aircraft replace the fixed-wing Northrop Grumman C-2.

Airbus' H225 and H160 families will also see many deliveries over the forecast, driven by the French navy's procurement of 49 H160Ms and a Dutch requirement for 14 H225Ms.

Another longstanding player in the rotary-wing maritime market, Italy's Leonardo, will complete AW169M deliveries to the Italian finance guard in 2024. The AW139 and derivatives such as the AW169 have been enormously successful in the civil market, and the helicopter is likely to remain available indefinitely.

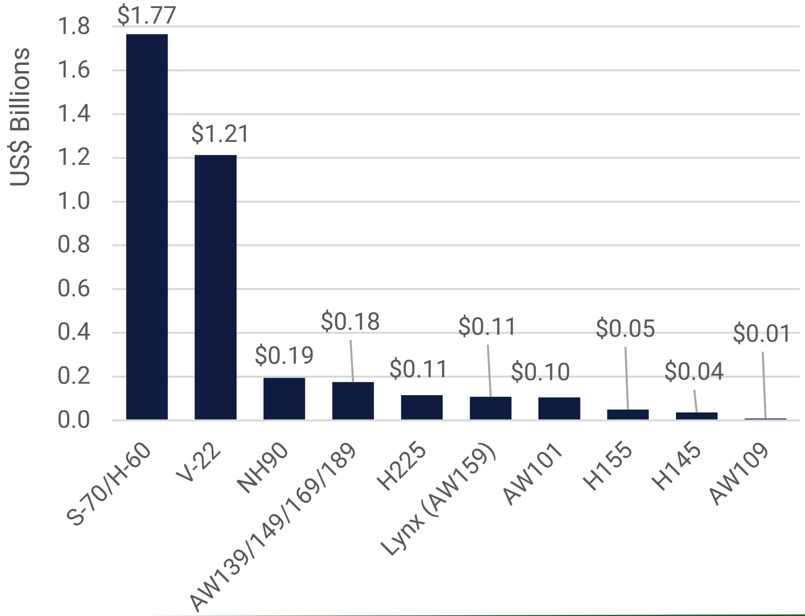
Value of Deliveries by Region



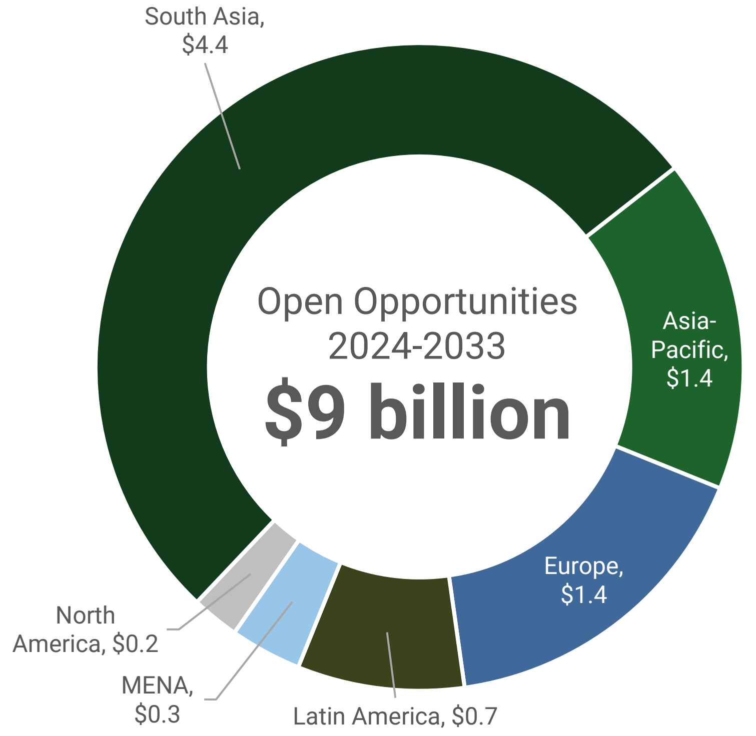
Contracted Order Book (2024-2033)

$3.8 billion

Biggest Programs by Order Book (2024-2033)



Rotary Wing Maritime Aircraft – Open Opportunities



Country	Opportunity Size	Notes
India	54+54 (123+111) Aircraft **$1.9 + 1.5 billion**	The Indian Navy is seeking a massive expansion of its maritime helicopter force as it anticipates China projecting more naval power into the Indian Ocean over the coming decade. It seeks 234 helicopters, 123 provisioned for ASW. India will most likely buy variants of the HAL LUH or IMRH when these platforms mature.
United Kingdom	10 Aircraft **$0.6 billion**	The Royal Navy (RN) employs a fleet of 10 missionized Merlin HM2s to provide AEW capability aboard its two *Queen Elizabeth*-class aircraft carriers. The "Crowsnest" AEW system aboard the Merlins has proved problematic and is slated for replacement with a new system by 2029. This system will likely be unmanned.
Pakistan	12 Aircraft **$0.4 billion**	Pakistan requires 12 ASW-capable maritime helicopters for its *Babur*-class guided missile frigates. The lead ship commissioned in September 2023 and three more are on order. Each ship has an enclosed hangar accommodating one helicopter.
India	14 Aircraft **$0.4 billion**	In parallel to the Navy program, the Indian Coast Guard (ICG) is seeking 14 medium maritime helicopters. ICG is in talks with HAL to develop a marinized IMRH derivative. The ICG fleet consists primarily of the HAL Dhruv, a smaller helicopter. IMRH would give the ICG more reach for maritime surveillance and SAR operations.
South Korea	12 Aircraft **$0.4 billion**	South Korea has a longstanding requirement for a squadron of mine-countermeasures helicopters. KAI is offering a derivative of its Surion helicopter equipped with Northrop Grumman's Airborne Laser Mine Detection System (ALMDS) and the BAE Archerfish mine neutralization system.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Rotary Wing Maritime Aircraft – Fleet Dynamics

MH-60R Fleet Change (2024-2033)

+11%

While the size of the global fleet of maritime helicopters is projected to remain relatively stable over the forecast regional differences exist with fleets in South Asia and Asia-Pacific expected to expand at a 5.7% and 1.2% CAGR respectively. Numbers of naval helicopters in service in Europe and North America will remain largely static over the period.

The S-70/H-60, will continue to dominate the global fleet following the introduction of large number of MH-60Rs over the past two decade. Older S-70/H-60 derivatives such as S-70B and SH-60L will however begin to be replaced, many replaced by newer aircraft in the same family. Absent further sales the H-60 fleet may peak in size during the current forecast however a number of opportunities – principally in India – offer a means by which to further extend production of the type.

The most significant change in the composition of the global fleet is the phasing out of the Kamov Ka-27 family. This fleet is projected to decline from 149 aircraft at the end of 2024 to just 41 at the end of 2033, a 72% decrease. This is driven primarily by retirement of the type in China, where the Ka-27 is being replaced by the Z-20; and in Russia, where it will be replaced with the Ka-65.

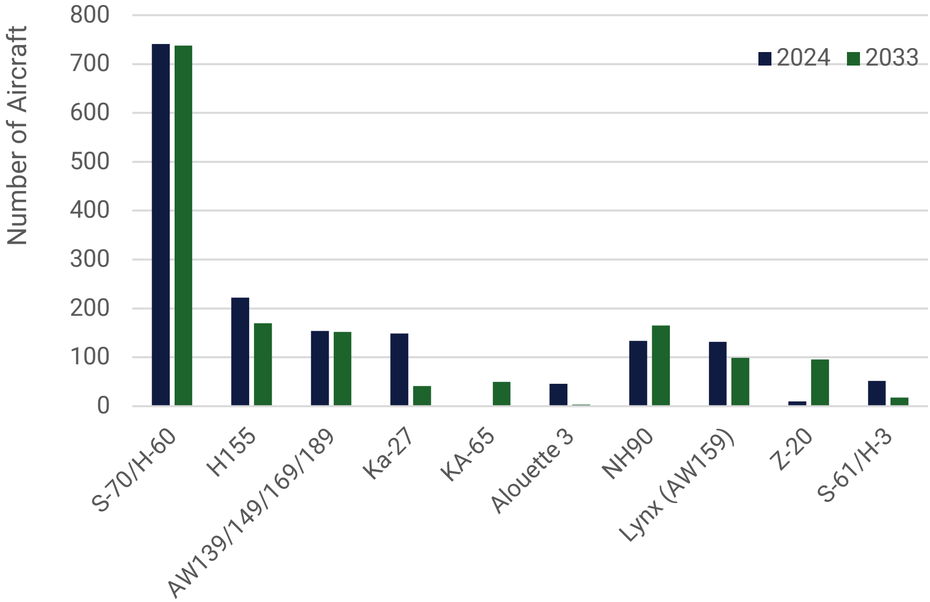
In Europe the Airbus H155 family will also see a modest decline as France replaces its AS.365s with the H160M. Germany will retire 22 ASW configured Super Lynx 100s, most likely with an extended acquisition of the NH Industries NFH90. Despite recent challenges the NH90's presence within the market segment is projected to expand over the decade with the global fleet increasing from 122 helicopters in 2024 to 145 by the end of 2033 driven principally by continued acquisition by the German Navy.

Ka-27 Fleet Change (2024-2033)

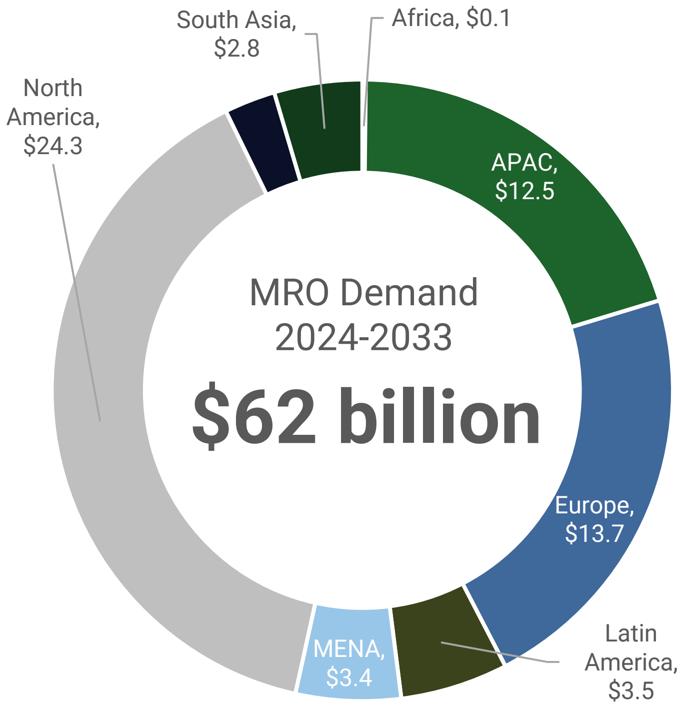
-72%

Other families facing divestments include the venerable Sikorsky S-61/H-3 and the Airbus Alouette 3. Of the remaining 52 S-61s or H-3s serving in maritime roles, only 18 are expected to remain in service by the end of the forecast. Key retirements will be in Argentina, retiring 10 aircraft; and India, retiring 18. The retirement of the Indian Sea King fleet will take place in the context of a broader recapitalization and expansion of its maritime helicopter fleet, for both its Navy and Coast Guard. When these opportunities reach source selection, they will give a major boost to HAL's Dhruv and IMRH programs.

Key In Service Fleets 2024 and 2033



Rotary Wing Maritime Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

+0.6%

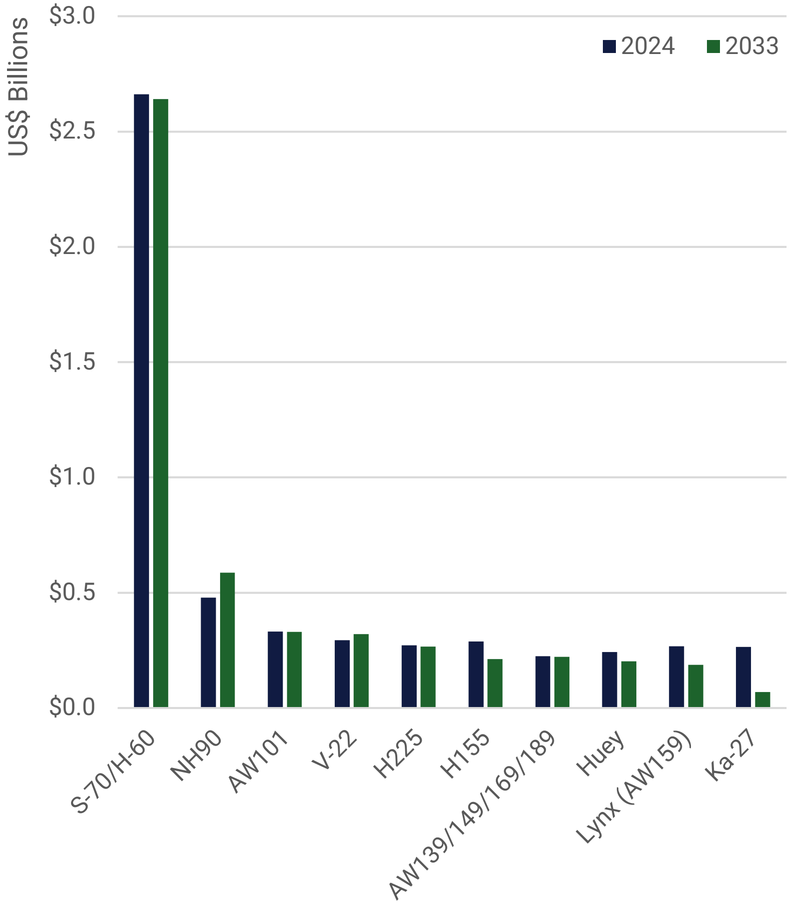
As a result of its market dominance 42.4% of all maintenance demand generated by maritime helicopters will relate to the Sikorsky S-70/H-60 family. In total operators are expected to spend $26.8 billion maintaining their fleets globally over the next decade with demand remaining steady above $2.5 billion annually throughout the forecast.

With the NH90 having struggled to live up to expectations and next generation U.S. and European platforms some years away there is scope for the H-60 to expand its dominant market position over the next 10 years if it can secure further export orders, as seems increasingly likely.

The global fleet of anti-submarine warfare capable helicopters represents the largest sub-mission component of the rotary-wing maritime market in terms of MRO demand generated, with $30.5 billion due to be spent on maintaining these platforms over the decade.

MRO demand growth is expected to be greatest in India which has several maritime helicopter requirements outstanding for both its Navy and Coast Guard. With 172 maritime helicopters due to enter service over the next decade and the fleet set to grow at a 6.2% CAGR, MRO demand is projected to increase from $0.2 billion annually in 2024 to $0.4 billion in 2033.

Top Programs By MRO Demand



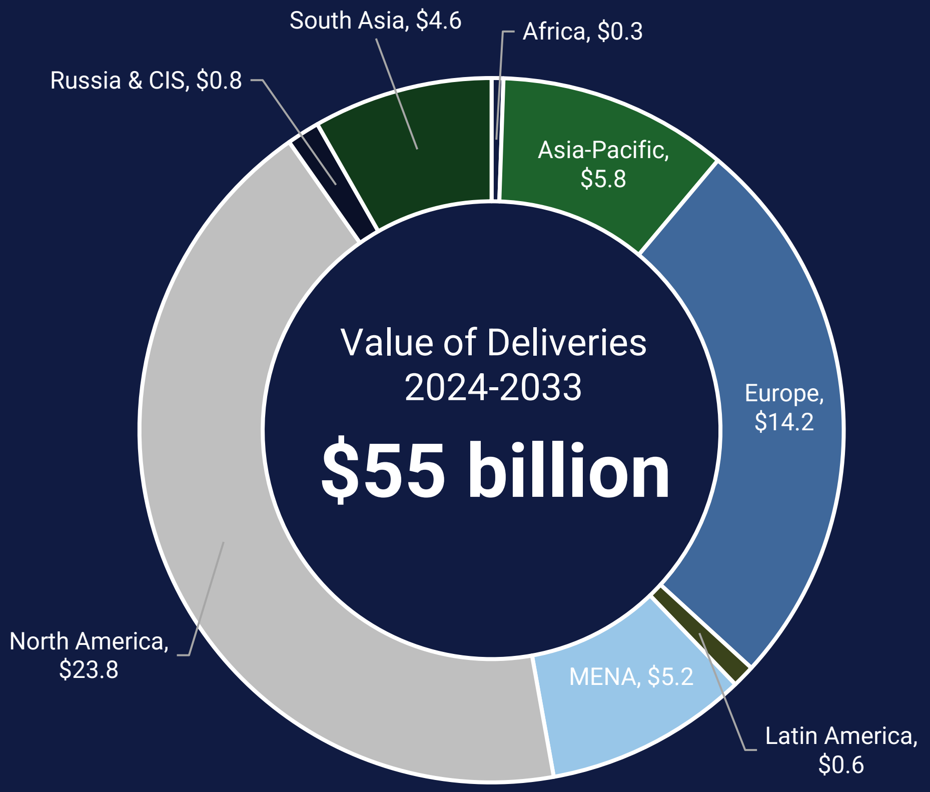
Uncrewed Aircraft – 2024-2033 Market Projections

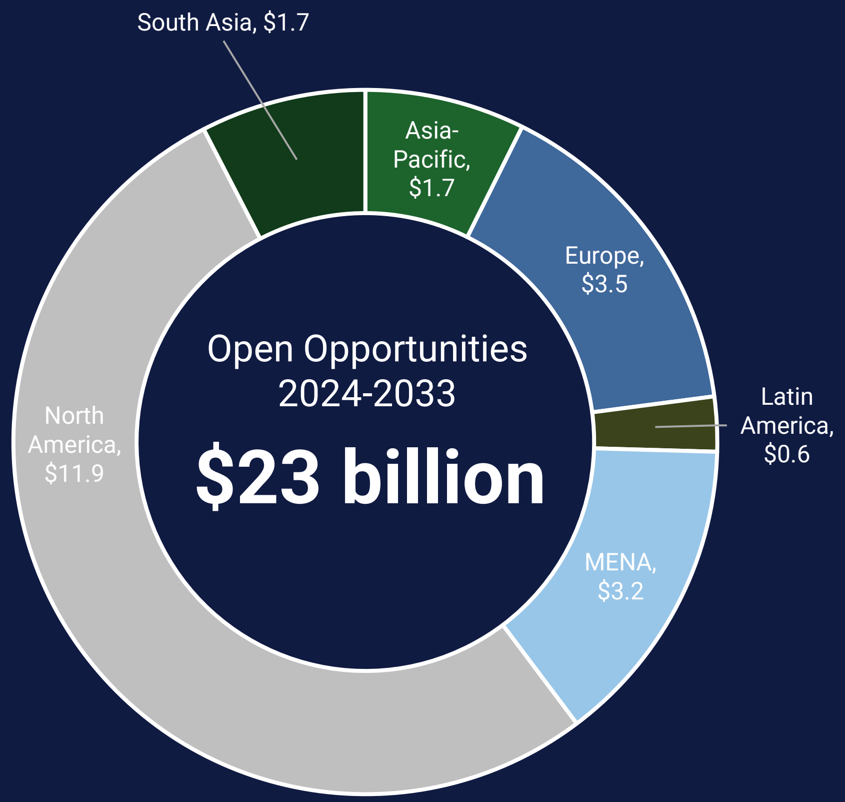
Total New Build Deliveries
1,409 Aircraft

Total Retirements
193 Aircraft

In Service Fleet (2024)
2,187 Aircraft

Fleet Growth CAGR (2024-2033)
+4.6%





Uncrewed Aircraft – Key Market Trends

Boeing's Phantom Ray demonstrator. Credit: Tony Landis, NASA

"Attritable systems arguably occupy an undesirable position; not expendable enough to justify high losses, but not exquisite enough to carry operationally relevant payloads at range."

Since 2017, interest in autonomous combat aircraft (ACA) has surged despite failing to generate programs of record. However, Aviation Week forecasts substantial growth in this market in the late 2020s in the U.S., Turkey and Asia-Pacific. According to the USAF, ACAs can be categorized into three groups: expendable ($100k-$2M), attritable ($2-20M) and exquisite ($20M+). Despite the rapid maturation of the Kratos XQ-58 Valkyrie and Boeing MQ-28A, attritable systems have received tepid support from the operator community which favors more exquisite systems.

Subsequent analysis identified two viable solutions for enabling manned fighters to operate in the highest-end threat environments. The first masses low-cost expendable systems like the Raytheon ADM-160 MALD to saturate defenses. The second relies on exquisite ACAs tailored to operate within the IADS threat with robust LO, range and mission systems. Exquisite ACAs could provide next generation fighters with long-range AMTI, networked mid-course missile guidance, penetrating electronic attack and extra magazine capacity.

Frank Kendall became Secretary of the Air Force in July 2021 and has shifted emphasis to exquisite ACAs launching the USAF's Collaborative Combat Aircraft (CCA) program with the FY24 budget. The USAF plans to field at least 1,000 CCAs with two aircraft each to accompany 200 NGAD platforms and 300 F-35A Block 4s. Kendall believes prior investments such as the Skyborg AI control agent, LCAAT and X-62A VISTA programs obviate the need for a lengthy EMD phase. Kendall has said the CCA will have a flyaway cost between ¼ to ⅓ of an F-35A or approximately $23-$31 million. Initial deliveries are targeted for 2028.

Much of the more recent industry discussions have focused on reducing the cost per lb. of ACAs to $1,000 per lb. from the typical $4,000 per lb. of traditional fighter aircraft. However, it remains to be seen if such a figure is achievable. Kratos claims new build XQ-58As cost approximately $6.5 million with a dry weight of 2,500 lbs. ($2,600 per lb.) at current production volumes and excluding mission sustems. Kratos claims flyaway costs could decline to just $4 million per tail ($1,600 per lb.) with annual production volumes of 50 aircraft and $2 million ($800 per lb.) with 100+ airframes per year.

CCA increment 1 will have a range "relatively the same as the current fighter fleet [500-760 nm], potentially a little bit longer" with an October 2023 RFI specifying a thrust range between 3,000-8,000 lbf. Such a figure suggests an aircraft larger than the MQ-28 (with ~2,000 lbf. of thrust), but far smaller than the Northrop Grumman X-47B (with 15,000 lbf.). A platform sized closer to the Boeing X-45C with its 1,300 nm combat radius, 4,500 lb. payload and 9,000 lbf. GE F404 engine could prove attractive, but the type's empty weight of 18,000 lb. suggests serious affordability challenges absent breakthroughs in manufacturing.

Program in Focus – Boeing MQ-25A “Stingray”

The Boeing MQ-25A “Stingray” is a jet-powered, Group 5 uncrewed aerial vehicle (UAV) which will perform aerial refueling missions for the U.S. Navy (USN) with a secondary role as an ISR platform. The Stingray is powered by a single Rolls Royce AE3007N turbofan engine that produces 10,200 lbf. of thrust. The MQ-25A is expected to enter operational service in 2026 and have a projected flyaway cost of approximately $150 million. 76 aircraft are on order delivering through the 2030s.

The U.S. POR including three System Demonstration Test Articles (STDAs), four Engineering Development Models (EDM) and 69 production aircraft. Boeing’s existing T1 prototype is not counted toward the POR. The Primary Authorized Aircraft fleet will consist of 47 aircraft which will support eight CVWs with five aircraft each as well as one Forward Deployed Naval Force (FDNF) CVW with seven aircraft.

The FY24 budget includes $845 million in MQ-25A RDT&E and $3.8 billion in procurement over the FYDP (FY24-28). A total of seven test and 46 production aircraft are funded through FY28. All three STDAs and one EDM aircraft are scheduled to be delivered in FY24 with the remaining pair of EDMs delivering in FY25. Four production airframes are procured each year from FY25-27 before increasing to seven airframes in FY28, matching the latest available Selected Acquisition Report (SAR)’s full rate production projection though the end of the program. The SAR estimates the MQ-25A’s total program cost is $13.7 billion including $2.37 billion for RDT&E, $10.6 billion for procurement and $778 million for MILCON. The FY24 budget raises the MQ-25’s estimated total procurement cost to $11.6 billion. At the time of writing, Boeing has incurred $718 million in losses under the terms of its firm-fixed-price EMD contract.

The Navy had initially hoped for a 2023 initial operational capability (IOC) at the time of contract award. The FY23 budget projected a 2025 IOC, since delayed another 10 months under the FY24 request. The Navy now plans to declare IOC for the Stingray in July 2026 with an initial deployment with the USS *Theodore Roosevelt* (CVN-71).

The MQ-25A was designed to be able to deliver more than 16,000 lbs. (7,258 kg) of fuel to carrier aircraft operating 500 nautical miles (926 km) from the strike group. The Stingray’s overall planform is optimized for internal fuel load and endurance with a very high aspect ratio wing and a narrow-curved fuselage. Unfolded, the MQ-25A’s wingspan of 75 ft. will be the largest of any carrier aircraft expected to operate in the 2020s.

The MQ-25A incorporates some LO features but represents a more modest approach to LO compared to

Boeing’s MQ-25 prototype. Credit: Boeing

Lockheed’s Sea Ghost flying wing concept. The addition of external stores is expected to degrade its LO performance. The Stingray features two inboard pylons on each wing capable of carrying a single Cobham 330-gallon external fuel tank. The MQ-25A will initially feature an unspecified Raytheon EO/IR system (possibly the DAS-4 Multi-Spectral Targeting System) but additional sensors will be added over time. In December 2021, OPNAV N98’s Rear Adm. Loiselle said the Navy is also exploring eventually adding electronic attack and strike capabilities to the MQ-25A, “…it's got significant additional capabilities with a mission bay and weapons phase that, you know, we plan to take use of in the future."

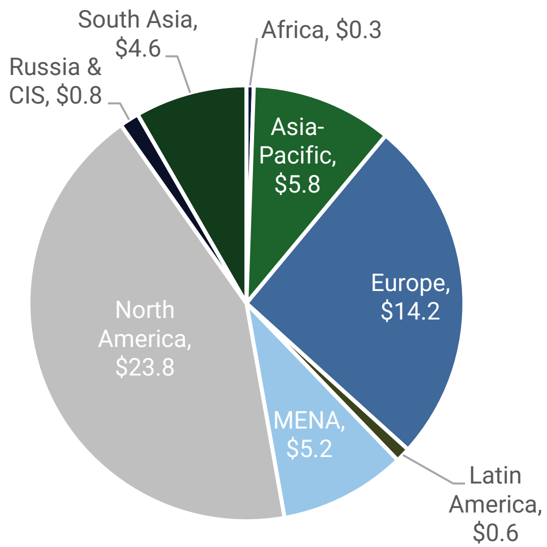
***Refer to the Boeing MQ-25A Program Profile on AWIN for additional details**

Uncrewed Aircraft – Orderbook and Deliveries

Total Value of Deliveries (2024-2033)

$55 billion

Value of Deliveries by Region



A total of 1,409 new build Group 4 and 5 UAVs will deliver over the period worth $55.1 billion. Group 5 systems comprise 57% of new build deliveries over the decade but proportionally represent a substantially higher valuation relative to Group 4 systems at $42.7 billion or 77% of the total market by value. Among deliveries with existing type selections, U.S. primes account for 47.9% of the market followed by the Eurodrone partner nations at 25.3% and Turkey at 10.7%.

The U.S. is the dominant market, accounting for $23.3 billion or 42% of deliveries by value. However, contracted deliveries for U.S. Group 5 UAVs represent a much smaller proportion of projected spending compared to other mission areas. As part of its FY24 budget, the USN announced it had truncated its Northrop Grumman MQ-4C POR by 64% from 72 to 26 aircraft. The Navy justified the decision by stating its commitment to buy 76 Boeing MQ-25s would partially offset the loss in ISR capability.

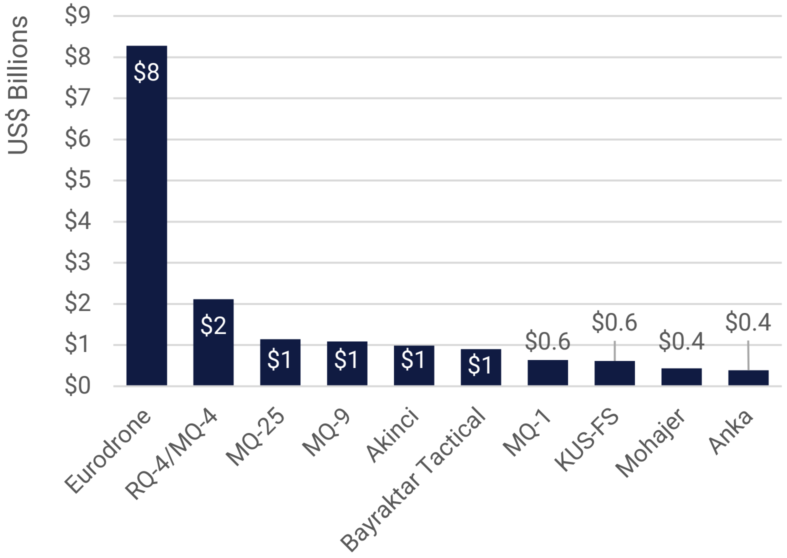
General Atomics Aeronautical Systems (GA-ASI) has become increasingly reliant on international sales to sustain MQ-9 production with deliveries to U.S. operators concluding mid-decade. 116 MQ-9s ae expected to be delivered over the decade worth $3.3 billion with 88% by value destined for international customers such as India, Japan, the UK and Poland.

The €7.1 billion ($8 billion) contract for 60 Airbus Eurodrone UAVs on behalf of Germany, Spain, France and Italy with 21, 12, 12 and 15 aircraft on order, respectively signed in February 2022 makes Eurodrone the largest non-U.S. uncrewed program over the forecast. Despite their historical pre-eminence this segment, Israeli primes IAI and Elbit have a backlog of only 19 outstanding Heron and Hermes deliveries worth less than $400 million and will rely on orders from India, Latin America and the Indo-Pacific to continue production into the late 2020s.

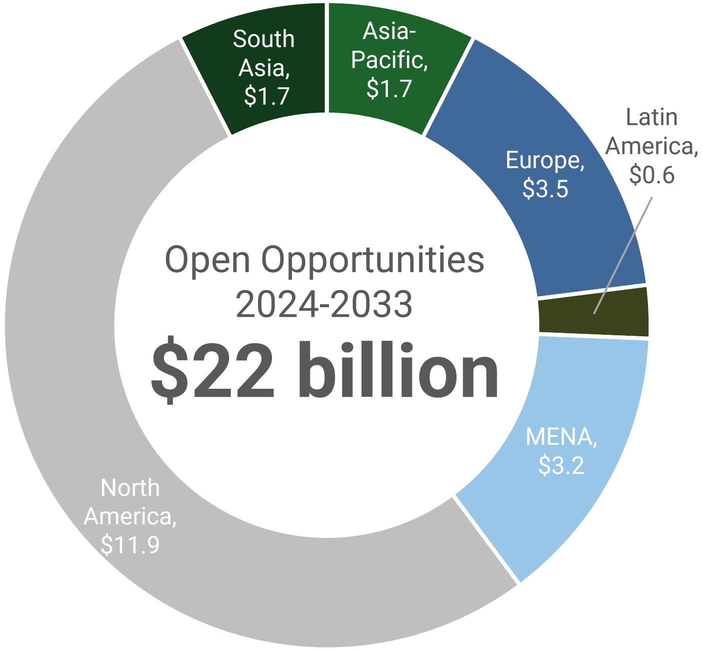
Contracted Order Book (2024-2033)

$18 billion

Biggest Programs by Order Book (2024-2033)



Uncrewed Aircraft – Open Opportunities



Country	Opportunity Size	Notes
United States	212 Aircraft (1,000-1,500) **$5.6 billion**	The USAF is looking to acquire at least 1,000 Collaborative Combat Aircraft (CCA) to complement 300 F-35 Block 4s and 200 NGAD platforms. The service plans to launch the CCA acquisition process in FY25 with the first increment delivered in FY28 and new increments following every two years after that per an October RFI.
United States	~25 Aircraft **$4.3 billion**	The USAF is expected to replace its 20-30 Lockheed Martin RQ-170s this decade. The Sentinel was developed in secret during the 1990s and fielded in the 2000s. In 2023, Lockheed disclosed $270 million in losses for a classified FFP aeronautics program which may relate to the start of a new classified LRIP program at Palmdale.
India	50 Aircraft **$1.6 billion**	India is projected to begin replacing its fleet of 50 IAI Herons Is which were acquired in the early to mid-2000s by the end of the forecast period. India has acquired a limited number of Heron IIs and is also examining an Elbit-Adani Defence offer to locally produce either Hermes 450 or Hermes 900 UAVs.
United States	14 Aircraft (300-500) **$1.1 billion**	The USN has released few details on its own CCA program. Range, carrier suitability and fixed recovery and launch infrastructure favor an exquisite design, possibly optimized for the long-range strike mission while the F/A-XX could be optimized for fleet air defense mirroring the A-12/NATF combo planned in the 1980s.
Israel	18 Aircraft **$945 million**	Israel is forecasted to launch a major unmanned recapitalization program by the end of the period with much of its fleet having being inducted during the 2000s and subsequently extensively utilized in local conflicts.

*All values and quantities reflect those within forecast (2024-2033) unless otherwise noted in parentheses

Uncrewed Aircraft – Fleet Dynamics

MQ-9 Fleet Change (2024-2033)

+21%

Unmanned systems represent the fastest growing market segment in the forecast with a fleet CAGR of 4.6% and overall growth of 49.2% over the decade from 2,187 to 3,263 aircraft. Great power competition is driving three principal areas of investment in uncrewed systems: MALE and maritime patrol systems in the Indo-Pacific and Mediterranean, strategic reconnaissance HALE systems in the U.S. and China, and autonomous combat aircraft (classified in the forecast as the "wingman" mission) in the U.S. and Asia-Pacific. While demand for peacetime maritime domain awareness in countries like Japan, India and Greece is expected to sustain the MQ-9 production line into the late 2020s the U.S. continues to pivot toward UAVs capable of operating in contested environments as demonstrated by the USAF's decision to retire 148 MQ-1s between 2016 and 2018 and more than 100 MQ-9s and 24 RQ-4s (Block 10, 20 and 30) in the early 2020s.

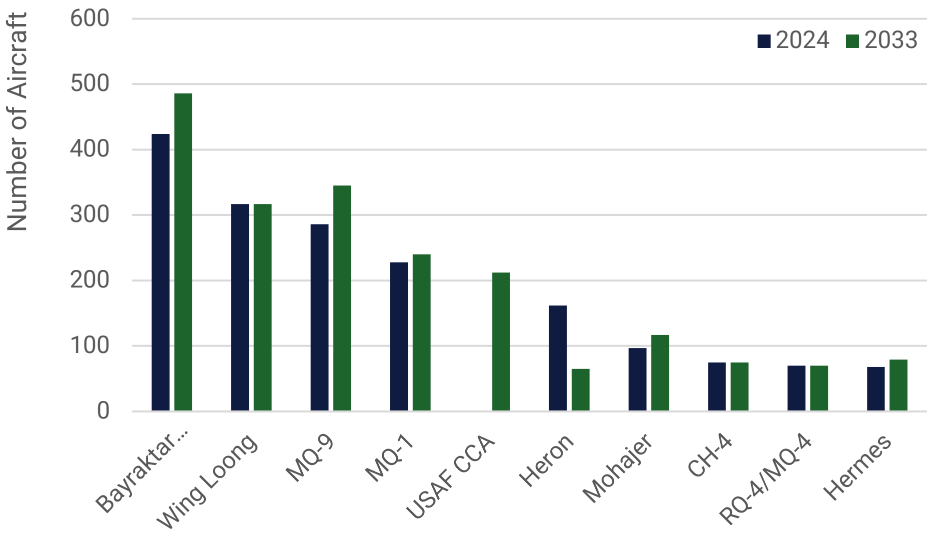
Strategic reconnaissance is experiencing a renaissance not seen since the late Cold War. The advent of increasingly advanced reconnaissance satellites has not diminished demand for airborne penetrating ISR given the latter's greater flexibility for dynamic tasking, new payloads and dwell time. The primary challenge remains survivability. The LO, subsonic and short-range RQ-170 was an interim solution procured in the early 2000s after the collapse of the highly ambitious Lockheed-Boeing AARS/"Quartz" and subsequent scaled-down RQ-3A DarkStar. The USAF is now believed to have two concurrent P-ISR programs: (1) the RQ-180, which was awarded in 2007 to replace 34 RQ-4 Global Hawks and (2) a new classified Lockheed Martin UAV program which began to deliver in 2023 to possibly replace the 20-30 estimated RQ-170s and or the 27 U-2S.

Heron Fleet Change (2024-2033)

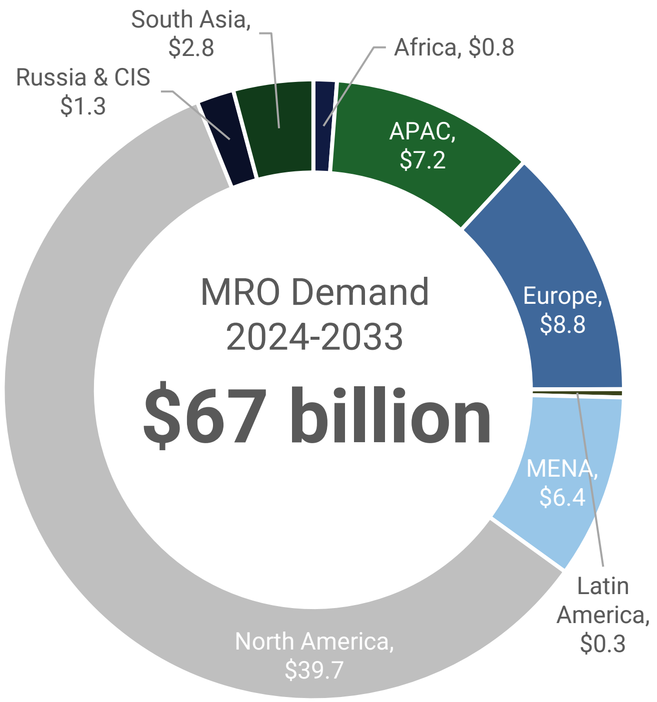
-60%

A total of 352 wingman UAVs will deliver through 2033 worth $10.2 billion with the U.S. accounting for approximately 70% of that share at $7.1 billion. The U.S. has four concurrent CCA programs for the USAF, AFRL, USN and USMC. In Asia, Australia and Japan have expressed interest in a trilateral CCA program with the U.S., while South Korea is positioning itself the Korean Air Aerospace Division (KAL-ASD) KUS-FC and KUS-LW programs. Turkey is likewise looking to leverage its market position with the TB2 with the future Baykar Kızılelma supersonic wingman and possibly the LO, subsonic TAI Anka 3.

Key In Service Fleets 2024 and 2033



Uncrewed Aircraft – MRO Demand



MRO Demand CAGR (2024-2033)

+5.4%

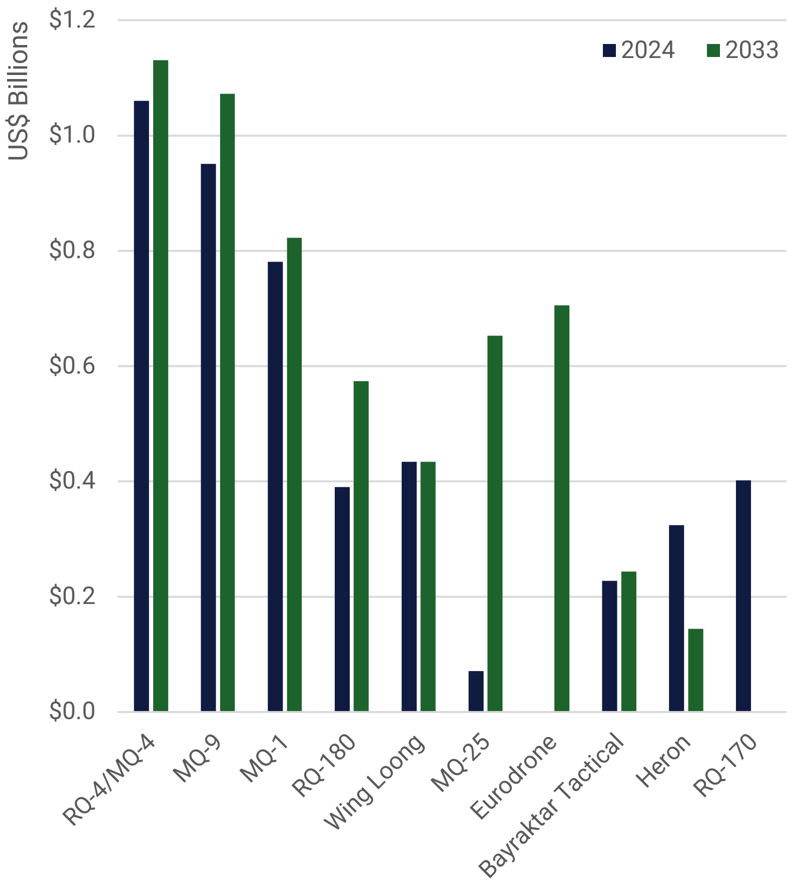
With the global uncrewed aircraft fleet expanding at a significantly faster rate than their crewed counterparts, maintenance spend for uncrewed assets is expected to grow much faster than rate than overall demand. Annual spending on maintenance of uncrewed air systems (UAS) is projected to expand at a 5.4% CAGR from $5.4 billion in 2024 to $8.6 billion by 2033.

The trend is being driven by the increased use of uncrewed aircraft by traditional users, the expansion of these platforms into new roles, and the proliferation of uncrewed assets globally. Despite this broader adoption of UAS North America will continue to account for two thirds of overall demand.

MRO demand for large Group 5 UAS is expected to outpace the trend for the wider uncrewed aircraft as a number of new platforms like the MQ-4C Triton and MQ-25 Stingray enter service. By the end of the forecast period collaborative combat aircraft (CCA) or 'loyal wingmen' will begin to enter the fleet in significant numbers further driving increases in maintenance spending.

Despite the rapid growth in MRO demand driven by these assets uncrewed systems have the potential to lower maintenance spending in other market segments by offering lower cost solutions to technologically advanced, non-expendable crewed assets. The acquisition of CCAs in particular is likely to be partially driven by the need to keep maintenance spend in check as increasingly exquisite, high cost crewed assets enter the fleet from the late 2020s.

Top Programs By MRO Demand



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Report Authors:

Craig Caffrey
Head, Defense Data
craig.caffrey@aviationweek.com

Matthew Jouppi
Senior Analyst, Programs
matthew.jouppi@aviationweek.com

Sterling Richmond
Senior Analyst, North America
sterling.richmond@aviationweek.com

Intelligence & Data Services | Aviation Week Intelligence Network
Washington, D.C.

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Contact:
Melissa Crum
+1 913 284 2951

Report Authors:

Craig Caffrey
Head, Defense Data
craig.caffrey@aviationweek.com

Matthew Jouppi
Senior Analyst, Programs
matthew.jouppi@aviationweek.com

Sterling Richmond
Senior Analyst, North America
sterling.richmond@aviationweek.com

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