

# MISSILE DEFENCE UPDATE

## KEEPING EUROPE SAFE

December 2016 Issue

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BY **Raytheon**



Every day, missile defence systems safeguard hundreds of millions of people across Europe, identifying and responding to the unprecedented security challenges coming from multiple sides. These advanced, proven, interoperable systems ensure Europe has capabilities that will keep it safe.

Sustaining this level of protection requires smart, strategic investments by the member states of NATO and the European Union. Many of these countries are users of Raytheon's Patriot Air and Missile Defense system and other defensive systems, which offer the best technology and the best value to taxpayers. This issue of the Missile Defence Update highlights the recent advancements, investments and strategies that allow European countries to rise to the challenge of stopping these threats.

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# SMART INVESTMENTS IN MISSILE DEFENCE

## PROTECTING EUROPE THROUGH COLLABORATION AND INTEROPERABILITY

Europe is facing an increasingly complex web of security threats. The conflict in Syria, the rise of non-state actors across the Middle East and North Africa and Russia's increasing military power together create an environment in which European countries should be prepared for a variety of attacks from a number of different directions.

These types of threats could come from a distance, in the form of short- and long-range missiles, and require advanced systems to detect and block them to keep Europe safe. Just over the past few months, for example, missile attacks have been intercepted in the Middle East, reinforcing that an attack targeting Europe is possible, and that advanced, protective systems are of utmost importance to our safety.

Strong protection depends on having the best technology, with trusted capabilities, and the ability to be deployed immediately. Waiting for systems that currently exist only on paper to become operational is a risk Europe cannot afford.

Raytheon's Patriot Air and Missile Defense System has a proven track record in Europe and its neighbouring countries, meaning it provides user countries the opportunity to implement a ready-to-go missile defence system that is interoperable and layered, offering substantial cost benefits.



As Europe's security threats are multifaceted and increasingly difficult to predict, it is not enough to simply have the best defence technology – countries and defence alliances also must work together. Both NATO and the EU are vital to European security now and in the future, which means that various missile defence systems will have to be connected in order to collaborate across alliances and borders. Collaboration like this

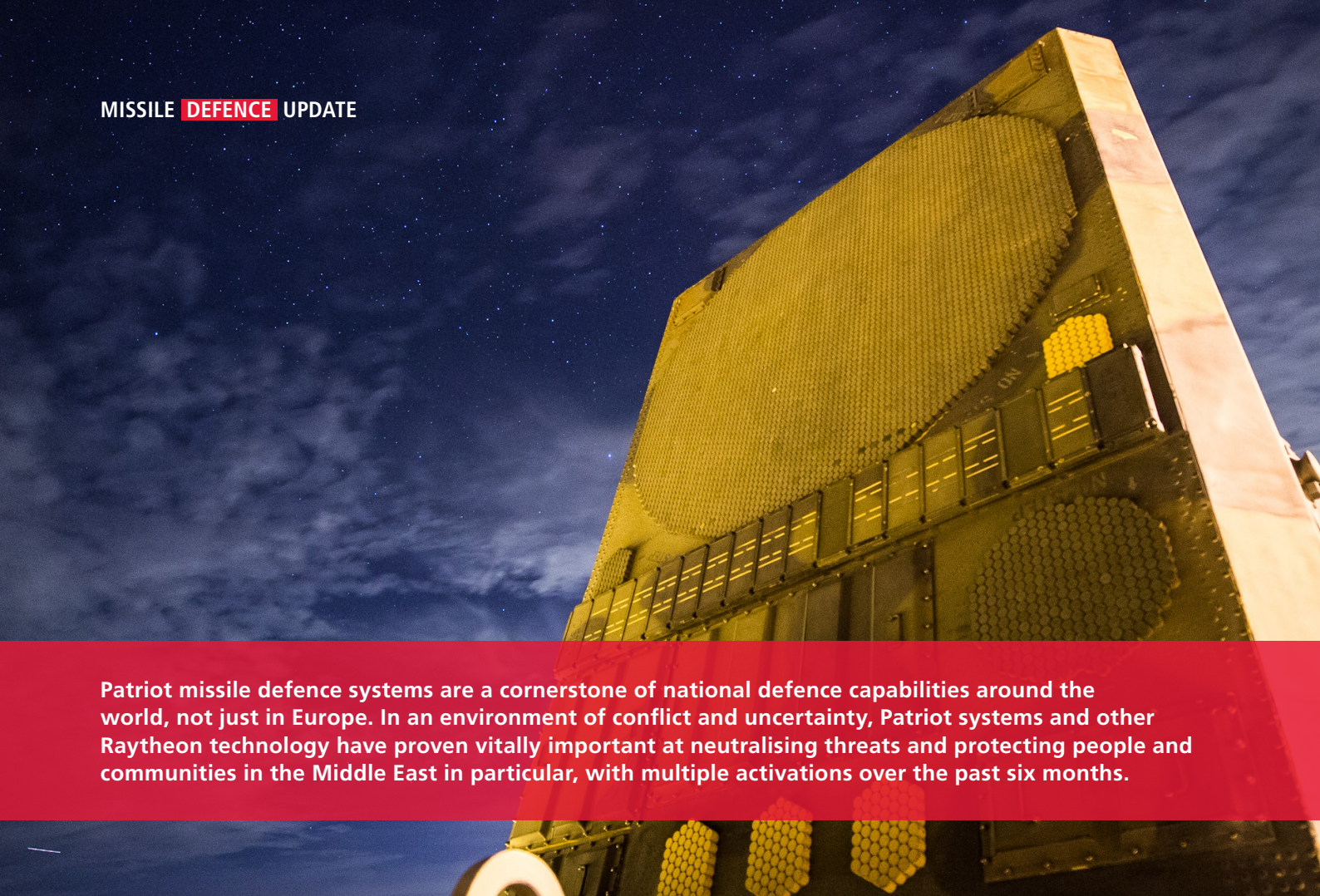
will lead to faster, more effective and more accurate responses. It also increases efficiency and eases budgetary pressures, for example through the pooling of resources for maintenance and coordination of joint testing exercises.

Continued investment in the Patriot also has many economic advantages that contribute to the growth of Europe's defence industry. As part of Poland's WISLA missile defence procurement, for example, Raytheon has offered a 50 percent work share to the Polish government, creating jobs, supporting suppliers and building skills in the workforce.

The same applies for Germany, where the long-established German subsidiary Raytheon Anschutz recently became Germany's new centre for integrated missile defence. Raytheon Anschutz will eventually assume management of a German supplier base that currently generates more than 500 missile defence-related jobs, including more than \$39 million worth of missile defence-related business awarded by Raytheon in 2015 to 22 German suppliers.

By unifying missile defence through close collaboration and strong interoperability between systems, European countries can be confident in their ability to protect their residents. Patriot is the only combat-proven, currently operational air and missile defence system capable of deterring and defending against these rapidly evolving threats, and is therefore ideally placed to support EU and NATO in their defence efforts.





Patriot missile defence systems are a cornerstone of national defence capabilities around the world, not just in Europe. In an environment of conflict and uncertainty, Patriot systems and other Raytheon technology have proven vitally important at neutralising threats and protecting people and communities in the Middle East in particular, with multiple activations over the past six months.

## SUCCESS IN ACTION

### RAYTHEON MISSILE DEFENCE SYSTEMS PROTECT THE MIDDLE EAST

The conflict in Yemen has prompted multiple launches of Patriot surface-to-air missiles to stop incoming attacks upon the people of Yemen and neighbouring Saudi Arabia, according to U.S. military sources. These Patriot batteries fielded by Saudi Arabia have consistently made headlines for their success at intercepting ballistic missiles launched by rebels.

In June 2016, the Command of Legitimacy Support Coalition in Yemen announced that it intercepted a ballistic missile launched from inside Yemen toward Marib City, Yemen. Three months later, in September

2016, the Command announced another Scud missile intercept from Yemen that prevented damage to the city of Khamis Mushayt, Saudi Arabia.

While speaking at the Space and Missile Defense Symposium, Admiral Cecil Haney, head of U.S. Strategic Command, stated that in July 2016, “the Houthis in Yemen fired missiles into southern Saudi Arabia, which was defended by Saudi Patriot.”

According to the Center for Strategic and International Studies (CSIS), a Washington, D.C.-based think tank, “Houthi rebels within Yemen have launched a significant number of short-range ballistic missiles towards Saudi Arabia and other [Gulf Cooperation Council] military installations. Despite major efforts to

negate Houthi ballistic missile assets, the tempo of ballistic missile activity does not appear to have abated.”

According to CSIS, Patriots have intercepted Scud and Tochka missiles in the conflict.

Separately, the U.S. Navy’s guided-missile destroyer USS Mason sailing in the Gulf of Aden, located between Yemen and Somalia in the Arabian Sea, was targeted by missiles in October 2016. According to USNI News sources, the Mason launched two Standard Missile-2s (SM-2) and one Evolved Seasparrow Missile (ESSM), both of which are protective missiles made by Raytheon and designed to stop incoming attacks.

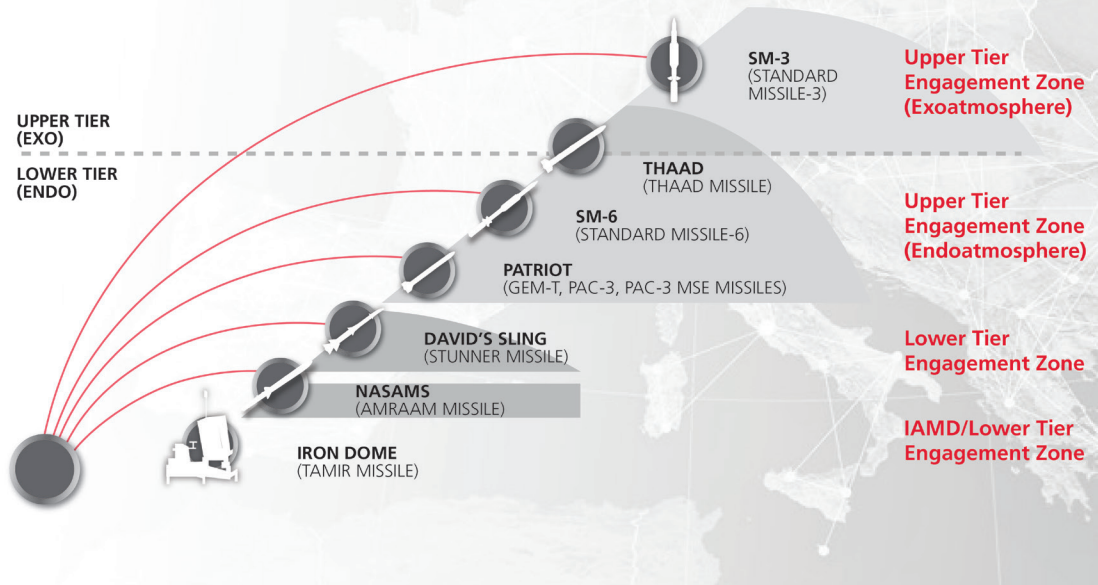


# HOW DOES LAYERED MISSILE DEFENCE WORK?

Regional protections against short-to-intermediate-range ballistic missiles

Defense against short-range ballistic missiles, large-caliber rockets, unmanned systems and cruise missiles

Defense against rockets, artillery, mortars, unmanned systems and cruise missiles



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## INTELLIGENCE REPORTS FROM NATO ALLIES AND EU MEMBER STATES HAVE SHOWN THAT THE THREATS PRESENTED BY BALLISTIC MISSILES HAVE INCREASED IN COMPLEXITY AND INTENSITY IN RECENT YEARS

With more frequent and more diverse security challenges, Europe needs state-of-the-art layered missile defence systems to ensure a consistently high level of security.

Defending Europe requires a robust system of integrated land, sea and space ballistic missile defence assets.

Raytheon’s proven interoperable ballistic missile defence systems provide effective and overlapping capabilities that are as diverse as the threats they neutralise, from advanced sensors and 360-degree radar systems to interceptors that respond immediately.

Layered defence capabilities provide protection against threats travelling at a variety of altitudes, both in and out of the atmosphere, and over distances long and short.

In May 2016, the Aegis Ashore land-based missile defence system was opened in Romania, with ground broken on a second installation in Poland shortly after. Both sites will

deploy Raytheon’s SM-3 interceptor, ideal for defending against short- to intermediate-range ballistic missiles.

NATO partners across the continent are building additional layers and adding capabilities. Joining the Patriot user community is one way to accelerate efforts to modernise integrated air and missile defences to defeat ‘lower-tier’ threats closer to cities, military bases, and critical infrastructure. Benefits of joining the Patriot user community include significant cost savings through shared maintenance, joint testing and equipment swaps.





# NEXT GENERATION MISSILE DEFENCE TECHNOLOGY

## Raytheon to Provide Patriot System with 360-degree Capability

The world's newest, lower-tier air and missile defence radar recently completed a critical milestone, moving it one step closer to testing in an operational environment.

Raytheon engineers successfully integrated a new digital radar exciter and waveform generator for the company's proposed Gallium Nitride-powered (GaN) Active Electronically Scanned Array (AESA) upgrade to the Patriot Air and Missile Defense radar. Beyond the GaN-based AESA radar, Raytheon has also installed and tested the digital exciter and waveform generator in the currently fielded Patriot radar.

When implemented, this technology will enable Patriot's radar to function with a full 360-degree capability, a game-changing step in protecting Europe from incoming threats. In

addition, Raytheon's proposed new digital exciter and waveform generator replace more than 15 individual components in the current Patriot radar, which significantly reduces lifecycle costs and increases Patriot's already-high reliability. It also uses a slotted-card design, which will enable soldiers in the field to replace circuit cards in a matter of minutes.

"The threats militaries will face in 10 or 20 years will be very different than the ones they are facing today," said Ralph Acaba, vice president of Integrated Air and Missile Defense at Raytheon's Integrated Defense Systems business. "The new technology will enable engineers to rapidly upgrade and adapt the GaN-based AESA radar as well as the current Patriot radar to defeat new and emerging threats such as ballistic and cruise missiles, aircraft and drones."

Raytheon's proposed GaN-based AESA Patriot radar will work with the Integrated Air and Missile Defense Battle Command System and other open architecture. It will retain backwards compatibility with the current Patriot Engagement Control Station and will provide European countries with a ready-to-go, fully interoperable missile defence system.

A number of current and expected future Patriot Air and Missile Defense System partner nations in Europe and Asia have already expressed interest in acquiring GaN-based AESA. The GaN-based AESA technology also meets Germany's requirements for the German Taktisches Luftverteidigungssystem, or TLVS, tactical air and missile defence system.



# POLAND'S COMMITMENT TO PATRIOT

Poland's government announced it will formally request the Raytheon Company combat-proven Patriot Integrated Air and Missile Defense System from the United States government.

"Poland's formal request is an important milestone toward becoming the 6th NATO Patriot country and the 14th Patriot partner nation," said Wes Kremer, president of Raytheon Integrated Defense Systems.

"Raytheon will continue supporting the U.S. and Polish governments through the Foreign Military Sales process. Poland's Patriot solution provides a proven capability against the evolving threat of ballistic and cruise missiles, and advanced aircraft and drones."

During the FMS process, Raytheon will also partner with Poland's government and industry to finalise offset and industrial participation plans. Raytheon has already signed eight contracts and more than 30 letters of intent with Polish industry.



## READY NOW FOR GERMANY

Raytheon Anschütz, a wholly owned German subsidiary of Raytheon Company, has taken key steps to lead for Raytheon the modernisation of Germany's air defences. Efforts began with the announcement at the Berlin-ILA airshow that Raytheon Anschütz would assume the lead role for German air and missile defence.

"Raytheon Anschütz has identified a number of German companies as potential Patriot suppliers, and as we modernize the German Patriot assets, they will receive requests for proposals with a total anticipated value exceeding €100 million over the next three years," said Lueder Hogrefe, CEO of Raytheon Anschütz. "We established a German-based

Raytheon Integrated Air and Missile Defence center because the German government asked Raytheon to serve as the TLVS alternative provider. We will meet the German MoD's essential TLVS requirements on time, within budget and at substantially lower risk than anyone else."

TLVS, short for Taktisches Luftverteidigungssystem, is Germany's medium-range air and missile defence modernisation program.

Raytheon Anschütz employs more than 600 people across Germany. As it transitions to the role of Raytheon IAMD lead for Germany, it will eventually assume management of a German supplier base that currently

generates more than 500 missile defence-related jobs. In 2015, Raytheon awarded more than \$39 million worth of missile defence-related business to 22 German suppliers.

Raytheon Anschütz extends Raytheon's record of more than five decades of collaboration with German industry.

"Raytheon recognizes that German sovereign capability is as important for TLVS as is technological maturity, cost and proven performance," said Ralph Acaba, Raytheon vice president of Integrated Air and Missile Defense. "With Raytheon Anschütz working closely with German industry, we can ensure that Patriot meets all of the needs of the German government."



# THE NETHERLANDS ENHANCES PATRIOT INVESTMENT

The Royal Netherlands Defence Materiel Organisation awarded Raytheon a contract to upgrade its Patriot Integrated Air and Missile Defense system with the Modern Man Station user interface, a move to significantly boost the nation's missile defence capability.

The combat-proven Patriot is the most advanced air and missile defence system in the world. It saves lives and protects critical infrastructure by defending against advanced threats such as aircraft, tactical ballistic missiles, cruise missiles and drones. Thirteen nations, including the U.S., The Netherlands and three other NATO members, depend on Patriot as the foundation for their defence.

"The Netherlands will continuously modernize Patriot as they intend to keep it in their inventory until at least 2040," said Ralph Acaba, Raytheon vice president of Integrated Air and Missile Defense. "The Modern Man Station is an important step in the Royal Netherlands Army's plan to upgrade their entire Patriot inventory to the most advanced capability currently available."

"Patriot remains a pillar of NATO missile defense because it is the only fielded, combat-proven air and missile defense system capable of outpacing the evolving threat," said Joe DeAntona, Raytheon vice president of business development for Integrated Air and Missile Defense.

"This upgrade will make it easier for The Netherlands to operate Patriot, and will provide them enhanced situational awareness."

The Modern Man Station, or MMS, is the latest operator-machine interface upgrade to Patriot command and control shelters. It provides state-of-the-art, full-colour graphical user interface with LCD displays. It also has touch screens and soft keys for enhanced situational awareness, with best-in-class command and control decision support tools. MMS is used to identify and display airborne objects; track potential threats; and engage hostile targets, including aircraft, unmanned air vehicles, cruise missiles and tactical ballistic missiles.

# AMRAAM-ER COMPLETES SUCCESSFUL TEST FLIGHT

At the world's northernmost military testing base, in Norway, Raytheon and Kongsberg oversaw the first flight test of the AMRAAM®-Extended Range (Advanced Medium Range Air-to-Air Missile) missile from a NASAMS™ (Norwegian Advanced Surface to Air Missile System) launcher. With a dramatic increase in both range and altitude, the missile protects a larger area against multiple threats simultaneously.

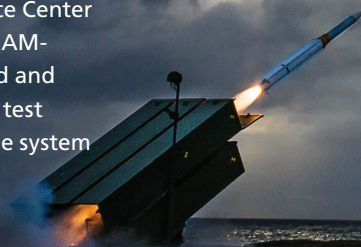
It proved this capability in a test conducted at the Andoya Space Center on August 31, when an AMRAAM-ER missile successfully engaged and destroyed a target drone. The test verified that all the parts of the system

– the missile, NASAMS system, Sentinel radar and Kongsberg's Fire Distribution Center – work seamlessly together.

The new weapon's maximum range is 50 percent longer than the standard version, and its maximum altitude is 70 percent higher, thanks to enhancements including an enlarged rocket motor.

The standard AMRAAM missile can launch from airborne platforms including the F-15, F-16, F/A-18, F-22, Typhoon, Gripen, Tornado, Harrier, F-4 and the Joint Strike Fighter aircraft. It is also the baseline missile for the NASAMS launcher. The ability to launch from air and from the surface offers a benefit that military commanders call "operational flexibility."

The NASAMS system, manufactured by Raytheon and Norwegian partner Kongsberg, is the most widely-used short- and medium-range air defence system in NATO. Raytheon and Kongsberg have delivered more than 70 fire units of the highly adaptable launcher to seven countries.







SM-3 Block IIA is the centrepiece of the European missile defence system. The programme is on track for 2018 deployment at sea and on land in Poland.

## AEGIS ASHORE TRANSFORMS EUROPEAN MISSILE DEFENCE

In May 2016, a new land-based missile defence system was launched in Romania. Dubbed Aegis Ashore, the site is operated under NATO control, providing regional ballistic missile defence protection. Construction has begun on a second installation in Poland that is scheduled to become operational in 2018. Both sites field the Raytheon-made SM-3® interceptor, the only weapon that can defend against short- to intermediate-range ballistic missiles from both sea and shore.

“Countering the threat of ballistic missile attacks...is a collective security challenge that requires collective defence,” U.S. Deputy Secretary of Defence Robert Work said in a news release regarding the partnerships with Poland and Romania.

The two land-based SM-3 missile sites join four U.S. Naval destroyers deployed out of Rota, Spain, as the backbone of the U.S. contribution to Europe’s regional missile defence.

“The U.S. and Europe are demonstrating their ability to integrate and collaborate on solutions,” said Dr. Mitch Stevison, vice president of Raytheon Air and Missile Defence Systems, during a missile defence briefing at the Royal United Services Institute in London. “But the threat is escalating, and Europe needs continued investment to deepen its defence.”

NATO partners across the continent are building other layers of the region’s missile defence, accelerating efforts to modernise their integrated air and missile defence systems to defeat “lower-tier” threats closer to cities, military bases and critical infrastructure.

These threats are best countered by the combat-proven Patriot Air and Missile Defence System, which has been tested more than 2,500 times in real-world conditions.

“Our partners must strike the right balance between making their own investments and working together through NATO and the EU on shared capabilities that enhance regional stability,” said Tim Glaeser, vice president of business development for Raytheon’s Integrated Air and Missile Defence Systems business, while attending GLOBSEC, a leading European security conference in April. “Funds are limited, which is why interoperability is critical.”

During a POLITICO Playbook Live forum in Brussels in June 2016, NATO Secretary General Jens Stoltenberg reinforced the importance of interoperability to Europe’s collective defence. “We’re facing some new security threats and challenges,” said Stoltenberg. “None of us has all the tools in the toolkit; we have to work together to meet these challenges.”



# SKYCEPTOR INTEGRATION IN POLAND'S MISSILE DEFENCE SYSTEM

The U.S. government has authorised Raytheon to integrate SkyCeptor, a variant of the jointly developed Israel/U.S. Stunner interceptor into the Polish Patriot Integrated Air and Missile Defense system.

## THE SKYCEPTOR INTERCEPTOR IS A NEW, HIGHLY ADVANCED, HIT-TO-KILL MISSILE, DEVELOPED TO DEFEAT SHORT-TO-MEDIUM-RANGE BALLISTIC MISSILES, CRUISE MISSILES AND ADVANCED AIR DEFENCE THREATS.

“Raytheon anticipates SkyCeptor will cost significantly less than current hit-to-kill interceptors used by Patriot,” said Ralph Acaba, Raytheon vice president of Integrated Air and Missile Defense.

“SkyCeptor gives the Polish military a fourth Patriot interceptor to engage airborne threats, offering Polish commanders increased operational flexibility and a cost-effective way to engage a wide variety of threats.”

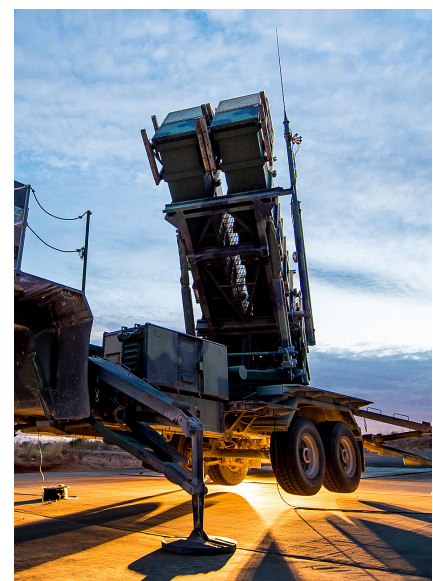
SkyCeptor will address Poland's air and missile defence threat requirements, and offers significant work content for Polish industries.

The combat-proven Patriot currently uses PAC-3, PAC-3 MSE and GEM-T missiles. The PAC-3 and PAC-3 MSE are hit-to-kill kinetic interceptors which destroy threats by the force of the collision, while the combat-proven GEM-T interceptor uses a blast fragmentation warhead to destroy tactical and ballistic missiles or manned and unmanned aircraft.

The Stunner missile is affordable and features a superior aerodynamic design, multi-pulse rocket motor, and an innovative seeker design. Furthermore, it has successfully completed four intercept test series, validating fielding readiness as the effector for Israel's David Sling Weapon System and is in full-rate production; fielding for the Israeli Defense Forces commenced in 2016.

“The SkyCeptor low-cost interceptor brings an affordable missile to Poland's Patriot,” said Mitch Stevison, Raytheon vice president for Air and Missile Defense Systems. “Using this rigorously tested effector with the

Polish Patriot will help to meet current and future threat requirements.” The current Stunner low-cost interceptor is co-developed by Raytheon and Rafael Advanced Defense Systems, and is co-funded by the U.S. and Israeli governments. Raytheon and Rafael have already started preliminary integration work and are in the process of conducting testing, modelling and simulation. They are also developing plans and identifying potential co-development and co-production partners.





# RAYTHEON IN EUROPE


Committed to Europe's Protection for More Than a Century


## EUROPEAN PRESENCE



## BY THE NUMBERS

  
**100+**  
YEARS IN EUROPE

  
**2,500+**  
EMPLOYEES

  
**24**  
RAYTHEON LOCATIONS

  
**66%**  
OF RAYTHEON'S INTERNATIONAL SUPPLY BASE IS IN EUROPE

  
**4**  
MANUFACTURING CENTRES

  
**15+**  
PARTNERSHIPS

  
**500+**  
SUPPLIERS

## PARTNERING FOR PROTECTION

  
RAYTHEON OFFERING  
**50%**  
WORKSHARE

  
INDUSTRY PART OF PATRIOT GLOBAL BASE  
**1,000** JOBS

  
PURSUING INDIGENOUS MISSILE CAPABILITY

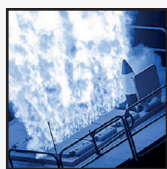
## RAYTHEON MISSILE DEFENCE IN EUROPE



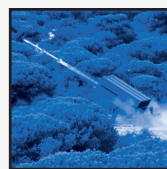
AN/TPY-2



EARLY WARNING RADARS



LAND-BASED SM-3



NASAMS



PATRIOT



RAYTHEON SOLUTIONS PROVIDE LAYERED DEFENCE CAPABILITIES ACROSS EUROPE



RAYTHEON'S EUROPEAN PARTNERSHIPS AND VENTURES HAVE GROWN LOCAL CAPABILITIES AND INNOVATION





Standard Missile-3, shown here in this illustration, is the world's only ballistic missile killer deployable on land or at sea.

**Impressum**

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