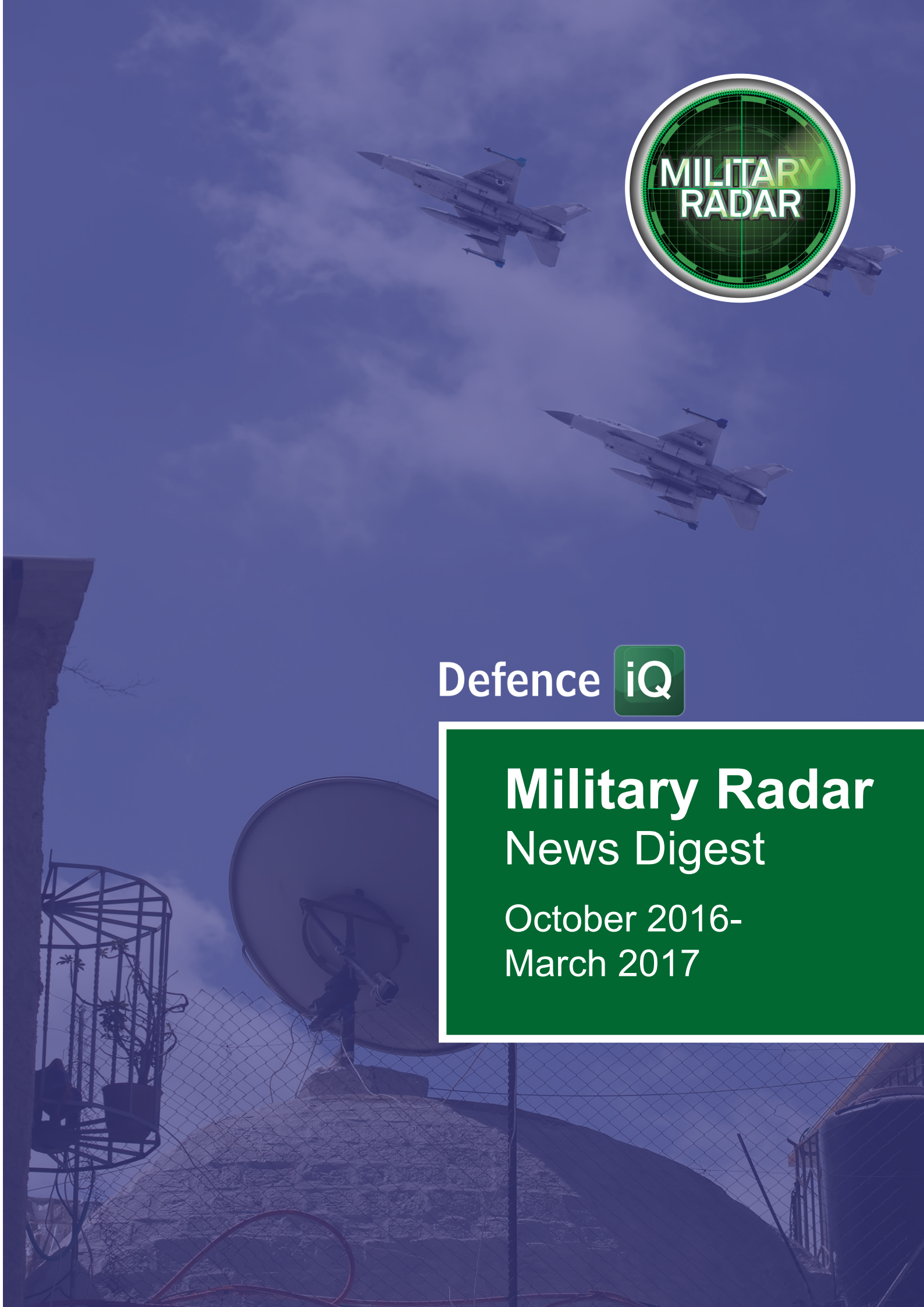

Defence iQ

Military Radar
News Digest

October 2016-
March 2017

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6 March 2017

Raytheon has been given a contract modification to provide radar for **US Special Operations Command**. The modification raises the contract ceiling to $200M, up from the earlierl $45.5M indefinite delivery, indefinite quantity contract. The initial contract obligated Raytheon the deliver a low-rate initial production (LRIP) of the Silent Knight Radar system. This modification now covers LRIP II. Silent Knight is a next-generation TF/TA system for US SOCOM pilots. Work is to be completed by June 2019.

24 February 2017

Northrop Grumman completes initial integration event, started in November 2016 with the **US Marines Corps** for the G/ATOR System of AN/TPS-80 Ground/Air Task-oriented radar. The IIE tested the system's ground weapon locating GWLR mode, which can detect and track multiple rocket, artillery and mortar. In the IIE the GWLR was able to track projectiles from 6-50 km, including volley fire. Adding the GWLR capability would allow G/ATOR to replace 5 legacy USMC radars.

24 February 2017

English company Chemring's US subsidiary, Chemring Sensors and Electronics Systems, has won a contract with the **US Army** to deliver 10 ground penetrating radar trial systems. If this new capability is successful, it could lead to upgrades of the Husky Mounted Detection System (HMDS) inventory. The HMDS enables soldiers to better detect IEDs and anti-tank mines, increasing operational tempo.

Land-Based Radar Systems
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7 February 2017

The **US Army** is nearing completion of an acquisition strategy for a 360-degree threat detection capability for future Air-and-Missile Defense Systems. In July 2016, the US Army placed an RFI. The army has yet to decide if they would procure new radar or upgrade the current Patriot Radar, which was in-service from 1982 and was developed by Raytheon. Lockheed Martin and Raytheon have sent responses. The RFI was a call to industry to inform the army of the feasibility of reaching initial operational capability for the radar by 2028. It is hoped that the army can deliver an acquisition strategy by summer 2017.

3 February 2017

The **US Army** plans to extend Patriot Missile capability in a $13.4M modification contract with Lockheed Martin for Raytheon's prototype upgrade. The upgrade will increase the range of threats that Patriot can combat, to include: high-speed aircraft, wider range of drones, cruise missiles, rotary winged aircraft, and extended-range tactical ballistic missiles. The prototype will use the new ASEA GaN (active electronically scanned array, gallium nitride) amplifying the radar's high-power radar frequencies. ASEA GaN reportedly enables 360 degree view. The estimated completion date is 30 January 2018. Boeing is also linked to Patriot Missile development, technology and production.

1 February 2017

The **US Defense Advanced Projects Research Agency (DARPA)** has selected 30 teams to move forward to Phase I of its Spectrum Collaboration Challenge (SCC). The SCC is a three-phase competition to seek solutions to greatly expand the amount of radio traffic that the electromagnetic spectrum can accumulate. The goal was to re-imagine spectrum access and create a new wireless paradigm for autonomous collaboration among radio networks while avoiding interference and increasing effici ency of the available spectrum. Several requirements will now have to be met to prepare for Preliminary Event #1 in December 2017. The finale of the Spectrum Collaboration Challenge will be held at the end of 2019, with prizes of up to $2M to go to the winners.

Land-Based Radar Systems
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6 December 2016

Northrop Grumman has sub-contracted Saab Defense and Security USA to deliver additional components and systems for the **US Marines Corps** AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) system. G/ATOR is the first ground-based multi-mission active electronically scanned array (AESA) radar developed by the US Department of Defense. Saab's contract is valued at $18.6M. Northrop Grumman is the prime contractor for the G/ATOR project and it covers the assembly, software and major systems for the next nine Low Rate Initial Production (LRIP) units. Saab's assemblies will be built into the Lot 3-5 G/ATOR systems and is expected delivery to the US Marines Corps starting in 2018.

South America

8 March 2017

Bolivian MoD announces that three radar units for SINDACTA -- Integrated Air Defence & Traffic Control System, has been completed. Two of the units are civilian and are suspected to be similar to the RSM970 and TRAC2000 approach radars, which can operate in the existing infrastructure. The third is a military-type radar and is understood to be a Ground Master GM400 3D long-range unit.

Asia

3 April 2017

Israel Aerospace Industries (IAI) is the lowest bidder for the **Indian Army**'s procurement programme for 66 new-generation 3-D surveillance and tracking radar. IAI will discharge 30% of contract value to offsets for Indian countries. The bid is for the replacement of India's Flycatcher radar systems. Thales, and L&T (with Cassidian, which is now Airbus, and Elta Systems of Israel) have also submitted a bid. It is expected a signing of contract will still take time as India's Ministry of Defense pursues cheaper options.

10 April 2017

Philippines Department of National Defense Secretary, Delfin Lorenzana, plans to include the acquisition of modern radar systems in the Armed Forces of the Philippines Modernisation Programmes' Second Horizon, lasting from 2018-2022. Under Flight Plan 2038 at least 3 more

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10 April 2017 (cont.)

Air Defense Surveillance Radar Systems (ADSR) will be acquired during Second Horizon. The Second Horizon will be devoted to acquiring equipment for external defence missions with $199B in funding. Delivery of Israeli Elta System's is due in November 2017 according to its Letter of Credit (LOC dated 19 January 2016) under First Horizon.

10 April 2017

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02 March 2017

India's state-owned Defence Research and Development Organization (DRDO) hands-over their Swathi Long-Range Weapon-locating radar (WLR) to the **Indian army.** The Swathi WLR was a joint development between DRDO's Electronics & Radar Development Division and Bharat Electronics Limited.

19 January 2017

RADA Electronic Industries will be supplying an **un-disclosed Far-East country** with a multi-mission hemispheric radar (MHR) RPS-42 radar system. The MHR platform is an S-band, software defined, pulse doppler AESA radar. The MHR is currently integrated with the USN & USMC GBAD HEL program and Lockheed Martin's Athena HEL program as well as Boeing's HEL-MD and Silent Strike programmes.

Europe

20 February 2017

Safran's PicoSAR AESA e-scan radar will be used by **French Forces** in France's Patroller UAVs under the SDT (tactical drone system) Programme. Leonardo was selected by Safran Electronics & Defense to help deliver the system. Leanardo is to provide radars and spares to be used for long-range over-land surveillance missions. The contract is a multi-million euro contract and first deliveries are expected in 2017.

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14 December 2016

The **Czech Republic** has decided to complete a $114M radar purchase from Israel-made radars. The purchase is of eight ELM 2084 multi-mission radars produced by Israel state-run IAI Elta Company and will their replace soviet-era radar. Delivery is scheduled for 2019-2021. The ELM 2084 MMR is a vehicle-mounted S-band radar with a 470km range for air surveillance and a 100km range for enemy weapon location detection. It is also the primary radar used in Israel's Iron Dome missile defence system. The radars will help the Czech Republic guard its airspace from 100-3,000 meters.

9 December 2016

The **Czech Ministry of Defence** sought to acquire new radar systems as part of the Czech Republic's drive to intensify its defence spending. The expected 2017 radar procurement is expected to be worth $67M. Military expenditure in the country was at 1.08% of its GDP, and it wishes to increase it to 1.4% by 2020 and 2% by 2025. The Czech Republic's 2017 budget is to increase by $2.1B, a 10% increase from 2016.

Middle East & North Africa

2 April 2017

Israel's David's Sling Weapons System (DSWS) has been marked operational in a ceremony opened by Israeli Prime Minister Benjamin Netanyahu, Defense Minister Avigdor Liberman, representatives of the US military attaché to the IDF and other Defense Officials. The ceremony was held at Hazor Air Force Base in Israel. David's Sling was developed jointly by Israel's state-owned Rafael and the US's Raytheon. DSWS uses the same EL/M-2084 AESA multimission S-Band radar used in the Iron Dome and produced by Elta Systems. DSWS's radar is to serve as a bridge between the lower-tier Iron Dome and the higher intercepting layers served by Israel's Arrow 2 and Arrow 3 systems.

4 March 2017

Iran tests its advanced radar system, the Russian-made S-300 and has declared it operational. While the S-300 is able to detect 4th generation aircraft, it is incapable of detecting stealth aircraft. Full battlefield operational tests for their domestic Bavar 373 system are set for May 23 2017. The Bavar 373 is allegedly a more advanced clone of the Russian S-300 radar system.

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25 January 2017

The Israel Missile Defense Organization (IMDO) and the US Missile Defense Agency (MDA) reported the completion of intercept testing of the David's Sling weapons system, a missile-defence system part of a multi-layer anti-missile array. The testing included Multi-Mission Radar (MMR), which relayed information to the Battle Management Centre. The main contractor for the David's Sling System is Rafael Advanced Defense Systems and is also subcontracted to Raytheon Missile Systems. The Multi-Mission Radar was developed by Elta, a subsidiary of Israel Aerospace Industries.

3 January 2017

Iran deploys the Nazir Radar System, a domestic-made long-range system. Nazir is a high-range and high-precision radar designed for objects with small radar cross-sections such as MQ1, RQ4 and U2 aircraft. Nazir reportedly is capable of detecting targets up to 800km at 100,000 feet altitudes and is resistant to radar evading and anti-radar missiles.

18 October 2016

The US State Department has approved a request by **Kuwait** for a Foreign Military Sale for radar field systems, including their equipment, training and support. The estimated cost of the possible sale is $194M. For radars, Kuwait has specifically requested: 6 Short Range radars, 1 Long Range radar with Primary Surveillance Radar and Secondary Surveillance Radar Arrays, and upgrades to upgrades to existing
AN/FPS 117 (V) 3 Long Range Radar. Kuwait officials have also requested limited-competition between three US vendors – Lockheed Martin, Northrop Grumman and Raytheon - to procure the systems. Only one of the radars under consideration, the AN/MPQ-4, would be considered as major defence equipment.

Oceana

2 March 2017

Australia is presently deciding between Lockheed Martin and BAE Systems to upgrade the Jindalee over-the-horizon radar, developed by Australia's defence department. The prospective contract would be for

2 March 2017 (cont.)	performance improvements for the Royal Australian Airforce and is to begin in 2018 and completion is scheduled for 2020. The contract would be worth at least hundreds of millions of US dollars. The Jindalee detects objects by dopplar shift, and are thus suited for aircraft detection.

Misc.

13 March 2017	VSTAR has tested its MA-C/Lite single-intelligence drone sensor onboard a Martin V-Bat UAV. The test was completed in 35min at an altitude of 400 feet above ground level. The MA-C/Lite collected signals at a distance of 20km.

Aerial Radar Systems

North America

27March 2017

General Atomics has been awarded a $12.2M contract for extending the range of the **US Airforce**'s MQ-9 Reaper. General Atomics is to install 10 each of: MQ-9 Block 5 extended range installation kits, MQ-9 Block 5 Barrett Asymmetric Digital Datalink Computer installation kits, MQ-9 Block 5 Beyond-Line-of-Sight installation kits and MQ-9 Block 5 VORTEX installation kits. The contract is to be completed by March 2019. The award was a sole-source acquisition by the US Air Force Life Cycle Management Centre, contracting activity FA8620-17-F-2351.

10 March 2017

Qinitiq North America has been awarded a $3M contract by the **US Air Force** to supply its Wind Profiling Portable Radar Technology (WPPRT). Qinitiq is to design and build a prototype airborne WPPRT system based on its ground WPPRT. The WPPRT is compatible with PADS/JPADS and will be able to increase the C-130 and C-17 aircrew's airdrop accuracy to provide critical supplies to US ground forces. The system provides wind profile updates up to one-per-minute

28 February 2017

Raytheon and the **US Air Force** validated the performance of the upgraded GAINS II radar system, as part of the Miniature Air-Launched Decoy Jammer (MALD-J). The MALD-J and GAINS II successfully operated in six test-flights from B-52 and F-16 aircraft in New Mexico. GAINS (GPS Aided Inertial Navigational System) improves MALD-J navigational performances in jamming environments with a multi-element GPS antennae.

Aerial Radar Systems
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27 February 2017

Raytheon systems received a Foreign Military Sales Contract worth around $1B from the **US Air Force**. The contract is to provide Qatar with an early warning radar system. The system can be integrated into a variety of platforms, such as the USN E-2D Hawkeye aircraft. Work on the radar is to be completed by June 30, 2021. The award is listed as contracting activity FA8730-17-C-0010 of the Air Force Life Cycle Management Centre in Woburn, Massachusetts.

23 February 2017

Raytheon has been awarded a $45.5M contract modification from **US Special Operations Command** on the delivery of the Silent Knight Radar System. The modification refers to the 2006 agreement. The modification supports low-rate initial production in addition to full-rate production for the radar systems. The Silent Knight Radar System is a next generation TF/TA system and type APQ-174/186 Multi-Mode Radar that supports low-level day and knight flying. Silent Knight Radar is onboard the MH-47 Chinook, MH-46 Seahawk, MC-130 Combat Talon and a number of fixed wing aircraft.

8 February 2017

Northrop Grumman has started testing the third of a series of sensor payloads from the RQ-4B Block 30 Global Hawk. This test included, for the first time, the MS-177 sensor fitted to the **US Air Force**'s E-8C Joint Surveillance Target Attack Radar Systems (JSTARS) platform. In September 2016, UTC announced that it was developing an improved MS-177A capable of 10 optical bands under a US Air Force contract for a 2019 delivery. The RQ-4B Block 30 Global Hawk also includes all-weather synthetic aperture radar/moving target indicator SAR/MTI and a 3rd generation infrared sensor. The Global Hawk is set to replace the U-2 Dragon Lady. The U-2 is set to be decommissioned in 2019.

1 February 2017

The US Defense Advanced Projects Research Agency (DARPA) has selected 30 teams to move forward to Phase I of its Spectrum Collaboration Challenge (SCC). The SCC is a three-phase competition to seek solutions to greatly expand the amount of radio traffic that the electromagnetic spectrum can accumulate. The goal was to re-imagine spectrum access and create a new wireless paradigm for autonomous collaboration among

1 February 2017 (cont.)	radio networks while avoiding interference and increasing efficiency of the available spectrum. Several requirements will now have to be met to prepare for Preliminary Event #1 in December 2017. The finale of the Spectrum Collaboration Challenge will be held at the end of 2019, with prizes of up to $2M to go to the winners.
8 November 2016	The **US's Defense Advanced Research Project's Agency (DARPA)** has awarded BAE Systems with a modification contract worth $13.3M. The contract brings BAE Systems' Adaptive Radar Countermeasures (ARC) project to Phase 3, the completion of algorithm development. The contract modification brings the overall contract total for the ARC project to $35.5M. Early versions of jamming technology could be available to US fighters by 2018. The ARC programme uses advanced signal-processing machine-learning techniques via BAE's cognitive electronic warfare technology to identify dynamic, virus-like radars to form a countermeasure. DARPA has refined the concept since 2013 and included transitional paths for ARC to be integrated into other electronic warfare systems. BAE Systems will be working with several platform partners on a transition plan from 2018 once DARPA funding ends. By 2019, ARC is expected to level 6 in technology readiness. Level 6's benchmark is when the adaptive system is able to overcome a broad range of advanced radar threats in real time.

Asia

15 February 2017	Saab enters competition to equip **India**'s Tejas LCA Mk1a fighter aircraft, by offering an electronic sensor suite. Saab's solution is directed towards bringing the AESA fighter radar and electronic warfare capability to the Indian Air Force.
21 November 2016	The Republic of Korea Air Force (ROKAF) has awarded Lockheed Martin a $1.2B contract to upgrade the avionics and radar for 134 of their F-16s. The ROKAF upgrade is part of a foreign military sales contract issued by the US Air Force. The upgrade will be based on the F-16V variation and notably includes Active Electronically Scanned Array (AESA), commercial off-the-shelf (COTS) based avionics system and high-speed data bus.

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03 October 2016 China Electronics Technology Group Corporation (CETC) develops **China**'s first, "single photon quantum radar system". The technology uses quantum entanglement and is allegedly untraceable by anti-missile countermeasures. The new radar system is reported to have a range of 100km.

Europe

30 March 2017 RADA has signed a strategic value-added distribution agreement with a **Western European air defence systems provide**r. The systems provider markets its products to NATO countries, among others. RADA tactical radars will be integrated with the company's Very Short-ranged Air Defence Systems (VSHORAD), with a focus on counter-UAVs and drones. RADA's Multi-Mission Hemispheric Radar (MHR) and Compact Hemispheric Radar (CHR) are S-band, software-defined, pulse-Doppler, active electronically scanned array radars.

23 March 2017 Northrop Gruman was awarded a contract by the **Royal Danish Airforce** to equip their F-16s with LITENING advanced targeting pods. Denmark is the first international partner to take delivery of the 4th gen. LITENING pod. LITENING has been approved for export to NATO countries. The pod is equipped with 1-K forward-looking infrared, charge-covered device sensors, laser imaging sensors and advanced data links. The pod's integration history includes the A-10, AV-8B, B-52, C-130, F-15, F-16 and F/A-18.

23 January 2017 Armasuisse, **Switzerland**'s procurement organisation for armaments awarded Thales a $79.5M contract to upgrade the Swiss Air Force's radar systems. The work will take place under the Swiss Airforce's FLORAKO air-defense radar programme. The contract is to extend the lifetime programme of the current radar system until 2030. Under the contract, Thales is to upgrade the antenna system and develop new radar signal and data-processing routines. FLORAKO is a modified version of the Swiss Master -M & Master-A S-band radars, also produced by Thales. The company states that the upgrade will take around 60 months, with a 24 month development phase leveraging existing radar technologies

05 December 2016

The Royal Netherlands Air Force has awarded Northrop Grumman a contract to upgrade the AN/ALQ-131 electronic countermeasures pods in their F-16 fleets. As part of the upgrade, Northrop Grumman's Digital Receiver/Exciter adds fifth-generation aircraft electronic warfare technology with new jamming and threat detection capabilities to the AN/ALQ-131.

Middle East & North Africa

11 January 2017

The Royal Moroccan Air Force has given the Harris Corporation a contract worth $191M. The contract is an indefinite delivery/indefinite quantity (ID/IQ) contract to deliver its AN/ALQ-211 Advanced Integrated Defensive Electronic Warfare Suite (AIDEWS) systems to the Moroccan Air Force's fleet of F-16 fighter jets. The AN/ALQ-211 is a modular electronic warfare system that includes radar warning and radio-frequency countermeasures.

Sea-Based Radar Systems

Africa

13 March 2017

Denel has signed a Memoriam of Understanding (MoU) with Germany's ThyssenKrupp Marine Systems (TKMS) in support of the **South African Navy**'s 3 submarines and 4 frigates. It is speculated that the MoU is in anticipation of Project Syne, devoted to the mid-life upgrades of South Africa's frigates. It is expected that the ships' radar system will be upgraded over the next decade, along with the combat management systems and guns. Work is due to start between 2017 and 2018 and aims to extend vessel service life into 2035.

North America

31 March 2017

The **US Navy** has announced initial operational capability with AN/AES-1 Airborne Laser Mine Detection System (ALMDS). The system is currently mounted on MH-60 helicopters. ALMDS delivers rapid wide-area threat assessments of mines in sea lanes, littoral zones, confined straits, and choke points.

31 March 2017

Raytheon has, for the first time, completed a tracking test on a ballistic-missile target for its Air and Missile Defence Radar system. The **US Navy** has declared the test a success and follows recent exercises in tracking satellites and aircraft. The AMDR aka. the AN/SPY-6(Y) is a next generation missile-defense system being developed for the US Navy's DDF-51 Flight III Destroyer. It is 30 times more sensitive than the Flight III's current AN/SPY-1D(V) system.

Sea-based Radar Systems
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16 March 2017	Northrop Grumman has secured a $3.6M contract with the **US Naval Air Systems Command** to work on an autonomous-helicopter radar system.
8 March 2017	FLIR was awarded a five-year $50M contract with the **US Coast Guard**. FLIR is to provide navigation and sensor systems for the Coast Guard's Scalable Integrated Navigation Systems II programme. The systems will be placed in more than 2,000 coast guard vessels and will include radar, sonar and a variety of displays. Delivery is scheduled for May 2017.
28 February 2017	Lockheed Martin has been awarded a $150M by the **US Marines Corps** for follow-on contracts to helicopter AH-1Z attack helicopter sensors. Presently, Lockheed Martin is obligated to provide Lots 13 & 14 of the AH-1Z's target site system. There are also options for Lots 15 & 16 offered, and if exercised, would bring the total value of the contract to $284.6M.
27 February 2017	Raytheon wins $128M **US** "mobile sensors" contract. The contract is an indefinite-delivery/indefinite-quantity (IDIQ) tasks for the Cobra King Radar. The Radar is forward-deployed aboard the US naval ship Howard A Lorenzen (TAGM-25). Raytheon also holds a contract for the Grey Stars Radar for the USNS Invincible (TAGM-24). The two vessels act as support for US Centcom and US Pacific Command.
27 February 2017	Raytheon wins $128M **US** "mobile sensors" contract. The contract is an indefinite-delivery/indefinite-quantity (IDIQ) tasks for the Cobra King Radar. The Radar is forward-deployed aboard the US naval ship Howard A Lorenzen (TAGM-25). Raytheon also holds a contract for the Grey Stars Radar for the USNS Invincible (TAGM-24). The two vessels act as support for US Centcom and US Pacific Command.
15 February 2017	**US Navy**'s First-Class Destroyer, the USS Zumwait DDG-1000 begins testing its combat system components. Included in this test is the SPY-3 Multi-Function Radar.

Sea-based Radar Systems
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1 February 2017

The **US Defense Advanced Projects Research Agency** has selected 30 teams to move forward to Phase I of its Spectrum Collaboration Challenge (SCC). The SCC is a three-phase competition to seek solutions to greatly expand the amount of radio traffic that the electromagnetic spectrum can accumulate. The goal was to re-imagine spectrum access and create a new wireless paradigm for autonomous collaboration among radio networks while avoiding interference and increasing efficiency of the available spectrum. Several requirements will now have to be met to prepare for Preliminary Event #1 in December 2017. The finale of the Spectrum Collaboration Challenge will be held at the end of 2019, with prizes of up to $2M to go to the winners.

13 January 2017

The **US Navy** has selected Lockheed Martin for a development contract to provide MH-60 helicopters with new electronic warfare pods. If all options in the contract are exercised, Lockheed Martin could deliver 18 Advanced Off-board Electronic Warfare (AOEW) Active Mission Payload (AMP) AN/ALQ-248 pods which can be integrated into MH-60R or MH-60S helicopters. The AOEW AMP AN/ALQ-248 system can work independently or with the ship's onboard electronic surveillance sensor, SEWIP Block 2 AN/SLQ-32(V)6 for missile detection. AOEW can then use radio frequency countermeasure techniques to deter anti-ship missiles (ASMs).

9 January 2017

The **US Coast Guard** has selected Airbus's Multi-Mode Radar AN/SPS-75 TRS-3D Baseline-D for its 9th National Security Cutter (NSC). The TRS-3D Baseline uses gallium nitride technology (GaN) and is a multi-mode 3-D naval radar. The TRS-3D can be used for surface and air surveillance, target acquisition, self-defense, gunfire support and aircraft control. Lockheed Martin holds the contract for providing the AN/SPS-75 and has contracted Airbus DS electronics to deliver the radar system.

4 January 2017

L-3 Communications Integrated Systems has been selected under a $14.6M contract option to missionise the **US Coast Guard**'s 11th HC-130J Super Hercules aircraft with the Minotaur Mission System. The Minotaur system is comprised of software, integrated radar, sensor and communications systems. The Minotaur is replacing the legacy systems in six

4 January 2017 (cont.)	of the US Coast Guard's HC-130J aircraft. The 11th aircraft is currently in production and is scheduled to receive the baseline configuration in early 2017, after which it will undergo Minotaur missionisation. The HC-130J aircraft features a belly-mounted 360-degree multi-mode surface search radar.
14 December 2016	Raytheon's RTN unit has received a $110.2M modification contract for the **US Navy**'s Air and Missile Defense Radar Program's S-Band Radar (AMDR-S) and the Radar Suite Controller. The full designation is the AMDR AN/SPY-6(V). It is a next-generation radar and has improved detection ranges, discrimination accuracy, lower total ownership cost and better reliability and sustainability than current radar systems. This S-Band radar will be incorporated with an X-band horizon search radar. The contract was awarded by the US's Naval Sea Systems Command and will use the 2017 fiscal year shipbuilding and conversion navy funds.
10 November 2016	Airbus Defense and Space, under contract with affiliate Airbus DS Electronics and Border Security GmbH, will deliver TRS-4D radar to the **US Navy**'s Freedom-variant littoral combat ship (LCS). The TRS-4D radar is a rotating version of the Active Electronically Scanned Array (AESA) fixed panel TRS-4D radar that will be installed onto the German F-125 class frigates. TRS-4D combines mechanical and electronic azimuth scanning to achieve fast generation of target tracks. It is a 3 dimensional multi-mode naval radar used for target acquisition, surveillance, gunfire support and aircraft control.
20 October 2016	The **US Navy** has selected Leanordo Finmeccanica's Osprey AESA radar to be onboard their unmanned MQ-8C Fire Scout helicopters. Leonardo will deliver an initial batch of 5 radars to the the Naval Air Systems Command (NAVAIR), for testing and evaluation work. The navy has chosen the two-panel variant of the Osprey, which allows for a 240-degree instantaneous field of view and a range of digital modes such as weather detection, air-to-air targeting and a ground moving target indicator (GMTI). The prime objective of the contract is integration into the MQ-8C Fire Scout for first production deliveries. Osprey radar provides an

20 October 2016 (cont.)

open architecture that allows for insertion of new software independently. The Fire Scout will, in the future, be fully integrated with both variants of the US Navy's littoral combat ship.

Asia

23 February 2017

India's Ministry of Defence has awarded Nova Intgrated Systems Limited (NISL) a contract to provide the Indian Navy with new surface surveillance radar (SSR). NISL is working with Terma, a Danish electronics and sensors group, on the SSR technical solution while using Terma's Scanta 6000 solid-state radar. NISL is to manufacture the radars in-country as part of the 'Buy and Make (India)' policy initiative. NISL is a subsidiary of Tata Advanced Systems.

2` February 2017

Turkish defence company, STM, has contracted Kelvin Hughes to deliver its SharpEye I-band dopplar radar submarine system to the **Pakistan Navy.** The radar system will be placed on the Agosta 9-B class submarines aka. the Khalid class. This is part of mid-life upgrade programme under a June 2016 contract with STM.

3 February 2017

Japan, the US Missile Defense Agency and the US Navy have completed a flight test that resulted in the first intercept with the Standard Missile-3 Block II-A on a ballistic missile target. The test was conducted onboard the USS John Paul Jones DDG-53 and used the AN/SPY-1D(V) radar using the Aegis Baseline 9.C2 Weapon System. The SM-3 Block IIA was cooperatively developed by the US and Japan to defend against medium and intermediate-range ballistic missiles. The Standard Missile-3 Block IIA Cooperative Development Flight Test Maritime – 1 (SFTM-1) is a development test to support BMD 5.1 certification expected in 2018. It is the first intercept engagement using the Aegis Baseline 9.C2 system.

28 December 2016

The US government has approved the sale of AN/SPS-77 Sea Giraffe 3D air search radars to the **Philippines**. The sale is valued at $25M. The Philippines requested two of the Sea Giraffe radars along with

28 December 2016 (cont.)

equipment, support and training for its two Hamilton-class cutters acquired through the Excess Defense Articles (EDA) program.

Europe

16 March 2017

The UK's National Audit Office has released a report on the risk of cost over-runs and further delays on a number of projects in the next three years, related to the £6.2B Carrier Program. This includes an assessment on possible delays to the integration of Crowsnest Radar System onboard Merlin Helicopters.

21 February 2017

Kelvin Hughes wins a contract with the **UK Royal Navy** to deliver two additional SharpEye radar systems. The systems are to be mounted on the Batch-2 River class Offshore Patrol Vessels, the Tamar and the HMS Spey. The ships will be equipped with SharpEye I-band radar for helicopter control and navigation, as well as E/F band radar for collision avoidance. In addition to integration with the ships' combat management systems, the systems can also be integrated with third-party applicatinos such as the WECDIS and WAIS. SharpEye radar systems are a solid-state technology, delivering pulse-compressed doppler navigation and situational awareness for use in early warning systems.

17 February 2017

Thales secures contract from Danish Defence Acquisition & Logistics Organisation (DALO) to supply the **Danish Navy** with GaN CWI radar transmitters. In addition to the Gallium Nitride technology (GaN), the transmitters will also be utilizing a proven waveform generator (MWFG) The 14 transmitters are to be integrated into the evolved sea sparrow missile fire-control systems (ESSM). They will be hosted onboard the Absalon and Iver Huidfelt-class vessels. The first delivery is scheduled for mid-2019 with contract completion by 2021. Sustainment support was filled by an addition contract up to 2049.

Sea-based Radar Systems
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16 January 2017

The **UK Ministry of Defence** has signed a deal worth over $335M to start construction of the Crowsnest radar and surveillance system for protection of Queen Elizabeth – class ships. Crowsnest's new capabilities include 306 degree coverage. The radars are to be mounted on Merlin Mk2 helicopters. Lockheed Martin is the primary contractor while the UK's branch of Thales will be building the equipment. Leonardo will be working on the modification of the Merlin helicopters to accommodate the new system. The Crowsnest radar is a modified version of the Search-Water 2000 radar and Cerberus control systems currently fitted on the UK's ageing fleet of Westland Sea King-7 Helicopters. The current Thales SearchWater 2000 an Airbone Surveillance and Control Sensor (ASaC) with a high-power Pulse Doppler radar integrated with Mk XII IFF, ESM and an INS/GPS navigation system.

11 January 2017

BAE Systems' Artisan 3-D radar system has completed three years of sea-based trials for the **UK's Royal Navy**. The Artisan 3-D radar system is based on a $128M contract whereby BAE Systems are to develop, manufacture and provide 19 of the radars by the middle of 2017 and to continue supporting the radars until 2020. Artisan 3-D is a medium-range air-to-surface surveillance 3D radar designated to operate on E or F band frequency with a maximum detection range of 200km. The radar system has so far been fitted onto 11 frigates as well as the aircraft carrier HMS Queen Elizabeth, a landing dock platform helicopter assault ship, and an MoD land-based test-site at Portsmouth.

8 December 2017

German military is to buy new air radar systems for three F-124 frigates. Experts say that the supplier will likely be France's Thales. Thales has not commented. The German defence ministry's procurement agency is to review potential radar suppliers for installation by the mid-2020s.

Sea-based Radar Systems
News from October 2016 - March 2017
By Region

Middle East & North Africa

9 March 2017

Iran's Islamic Revolution Guards Corps (IRGC) have successfully tested the domestically-made Hormuz-2 missile. The Hormuz-2 is a radar-guided naval ballistic missile reportedly capable of hitting floating targets up to 300km. The test has confirmed the Hormuz-2's ability to hit a floating target at 250km.

2 March 2017

Thales has been selected by the **United Arab Emirates** to develop the capabilities of the UAE's navy in the fields of electronic warfare, ant-submarine warfare, security and surveillance. As part of its latest suite, Thales has installed the SMART-S Mk2, its latest 3D multibeam radar for medium-to-long range surveillance in littoral environments. Thales has also installed its combat system TACTICOS and STIR, a medium-to-long range illumination radar tracking system. Thales systems are notably on-board the UAE's Offshore Patrol Vessel, the Arialah.

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Oceana

2 February 2017

Australia's HMAS Arunta, an ANZAC class frigate, is deployed to the Middle East to join a multi-national Combined Maritime Force as part of Operation MANITOU. The HMAS Arunta has received upgrades on enhanced sensor and weapons systems through the Anti-Ship Missile Upgrade Programme. The frigate's upgrades include new Phased Array Radar technology supplied by CEA Technologies in Canberra, upgrades to combat systems by Saab Systems – South Australia and weapons up-grades by BAE Systems – Victoria. It can counter simultaneous threats from aircraft, submarines and survey vessels.

Sea-based Radar Systems
News from October 2016 - March 2017
By Region

Misc.

6 December 2016

Blighter Surveillance Systems unveiled a new coast-based radar called the Blighter C400 series. The Blighter C400 is a modular, solid-state non-rotating e-scan advanced Doppler Radar. It can be used for the protection of harbours, ports and also land-based assets near coastlines.

1 November 2016

Lockheed Martin has placed an order with Cobham Integrated Electronics Solutions for approximately $10M. The contract is for Cobham to supply waveguide components and assemblies to support production for Lockheed Martin's AN/SPY-1 radar. The AN/SPY-1 is an S-band fixed phased array radar, and is part of the continuous-surveillance Aegis Combat System. Lockheed Martin produces the Aegis and it is used in the US Navy, Japan Maritime Self-Defense Force, Spanish Navy, Royal Norwegian Navy, Republic of Korea Navy and the Royal Australian Navy.

Space Radar Systems

North America

13 March 2017 — Leolabs announces that their Midland Space Radar (MSR) located in Texas, **USA**; is now operational. The radar is at a low-earth orbit (LEO) and will be collecting information for its data sets on LEO-based satellites and debris. The MSR is the product of a September 2016 agreement with Midland City Council.

13 March 2017 — **20th Space Control Squadron of the US Air Force** has succeeded in tracking India's Polar Satellite Launch Vehicle, using the AN/FPS-85 phased array radar. The AN/FPS-85 is the only phased array radar that is capable of tracking objects 10,000 km away. The AN/FPS-85 radar sweeps for space debris within its field of view. Regarding the 104 PSLV objects that were launched, the radar detected the objects for less than 10 minutes due to the earth's rotation. Crews at the 20th SPCS work 24/7 tracking known and unknown objects orbiting the earth. Data is transmitted to the 18th Space Control Squadron in Vandenberg AFB, California, for regular monitoring.

1 February 2017 — **The US Defense Advanced Projects Research Agency (DARPA)** has selected 30 teams to move forward to Phase I of its Spectrum Collaboration Challenge (SCC). The SCC is a three-phase competition to seek solutions to greatly expand the amount of radio traffic that the electromagnetic

1 February 2017 (cont.)

spectrum can accumulate. The goal was to re-imagine spectrum access and create a new wireless paradigm for autonomous collaboration among radio networks while avoiding interference and increasing efficiency of the available spectrum. Several requirements will now have to be met to prepare for Preliminary Event #1 in December 2017. The finale of the Spectrum Collaboration Challenge will be held at the end of 2019, with prizes of up to $2M to go to the winners.

Asia

20 March 2017

Japan's JAXA space agency has successfully deployed an IGS Radar Reconnaissance Satellite built by Mitsubishi Electric. An H-2A launcher carried the IGS- Radar 5 observation Satellite for the Japanese Cabinet Satellite Intelligence Centre. It is the 6th radar satellite of the IGS (Information Gathering Satellite) series of optical and radar observation platforms and the first 4th-gen platform. It is estimated to have a resolution of 50cm. The IGS series was first launched in 2003 to observe the military activities of neighboring countries.

24 January 2017

Japan successfully launched a military communications satellite, carrying an X-band defence communication satellite 2 (DSN-2), with an H2A launcher. The DSN-2 is the second in a series of three X-band relay satellites used by the Japanese Self-Defence Forces. The DSN programme was created to develop X-band communication satellites for the Japanese Ministry of Defense. It is developed by Japanese company the DSN Corporation, a subsidiary of SKY Perfect JSAT Corporation.

Oceana

17 March 2017

The C-Band Space Surveillance Radar System has attained operational status in Australia. It is an Air Force Space Command Radar that was previously located at Antigua Space Station, Antigua before being deactivated in July 7, 2015. It has now been moved to Naval Communications Station Harold E. Holt in Western Australia. It will operate as a dedicated sensor node for the Space Surveillance Network.

17 March 2017 (cont.)

The new location allows for radar coverage in the southern and eastern hemispheres. The C-Band identifies space debris along with being a node in the SSN.

MILITARY RADAR

22-24 AUGUST 2017

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Military Radar 2017 will identify the critical improvements to radar functionality. Key to the programme will be an update on progress towards cognitive radar, together with the risks and benefits of adopting multi-system technologies. Managing SWaP challenges is another focus for capability development, reflective of the need to mount radar on ever-smaller airborne platforms.

Join a panel of experts at the 15th annual Military Radar summit, as they establish a critical path for applying advanced radar technology to deliver improved threat detection. Take part in the only summit commited not just to realising the latest research, but to understanding the growing threat of Electronic Warfare.

Top Reasons to Attend

*Hear directly from HQ NORAD about the operational requirements of a multi-system radar

*Develop adaptive and autonomous systems that are rigorous enough to meet the minimal fail rates required by military operators, and continue to work towards the application of a truly cognitive radar system

* Discover the critical advances in ELINT and Electronic Warfare, and analyse how advances in MIMO radar can be used to safeguard your capabilities against jamming and stealth technologies

* Establish an effective procurement strategy by exploring the latest innovations in radar technology and reasearch.....and more!

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