CIRCM & DAIRCM & SHiELD & Future Fast Jet DIRCM

Status: New Development
System Type: Airborne Directed IR Countermeasures (DIRCM) & Missile Warning System (MWS)
January 2023

Program Briefing

TADIRCM (Tactical Aircraft Directed IR Counter Measures) was a US Navy development program for an IR missile countermeasures system for tactical aircraft (fast jets), originally planned for the F/A-18E/F, to be carried in a wing-mounted pod. Raytheon, Northrop Grumman, and BAE Systems all participated in TADIRCM development, but following an initial suitability assessment completed in 2006, the program was split (into Assault DIRCM and Strike DIRCM) and postponed.

In mid-2007, the Navy instead planned to fully fund a four-year development program for ***JATAS (Joint Allied Threat Awareness System)***, a next-generation IR-sensor missile warning system, beginning in 4QFY08. Although only JATAS MWS development was funded, the Navy still referred to the overall program as Assault DIRCM (the Navy planned to request funding for the DIRCM portion beginning in FY10). In September 2008, the Navy issued a draft RFP for JATAS, with technology development (TD) contracts awarded to ATK/BAE Systems and Lockheed Martin in September 2009, to be followed by a down-select to a single company for SDD in FY11. In July 2011, NAVAIR awarded Alliant Techsystems (ATK) and BAE a $109.2 million contract for JATAS EMD.

But by March 2014, the Navy planned to end the JATAS program in FY14 in accordance with an Acquisition Decision Memorandum (ADM). Remaining funds in FY15 would be realigned to the Army-led CIRCM instead. All JATAS tasks after FY14 were removed from the budget.

The Navy eventually wanted a full ***Assault DIRCM*** suite for almost 1,000 small and large helicopters and the MV-22. IOC for the full DIRCM system was originally planned for FY15, but then the Army took over as lead developer (for both the Army and Navy) of a redesignated ***Common IRCM (CIRCM)*** program. CIRCM became essentially a next generation, smaller and lighter ATIRCM, since BAE Systems' Army ATIRCM never reached series production after two decades of continuing development problems (see report). CIRCM was to utilize the platforms' existing MWS (the Army's AN/AAR-57(V) CMWS and the Navy's AN/AAR-47, both with older UV-sensors). In January 2012, the Army awarded 21-month CIRCM TD contracts to Northrop Grumman and BAE Systems. Milestone B was planned for 1QFY15, with an EMD award to be announced in 2QFY15.

In August 2015, Northrop Grumman finally won the CIRCM engineering and manufacturing development (EMD) and low-rate initial production (LRIP) contract, beating BAE Systems for this potentially huge program. BAE Systems had finally been shut out of the DIRCM market that they had essentially created when they (as Lockheed Sanders) won the Army development contract for ATIRCM in 1991.

In February 2016, the FY17 OCO budget funded initial production of 76 CIRCM B-kits for Army and Special Operations Forces, to be delivered beginning in November 2017, at a rate of 10 per month. At the time, the overall Army Procurement Objective (APO) for CIRCM was 1,076 (B-Kits only), potentially worth more than $3 billion, and the Navy still also wanted nearly 1,000 DIRCM systems for helicopters and light aircraft.

Finally, in April 2021 the US Army awarded Northrop Grumman a five-year, $959.1 million, indefinite delivery/indefinite quantity (IDIQ) contract for full-rate production of CIRCM.

In February 2023, CIRCM achieved Initial Operational Capability (IOC). By February 2023, Northrop had delivered more than 250 CIRCM systems to the Army with more than 100 aircraft equipped. CIRCM reportedly had accumulated more than 11,000 flight hours since its first field installation in December 2021.

Surprisingly, despite public dedication to the joint CIRCM program, the Navy continued to develop ***Assault DIRCM*** somewhat on the sly – or as the Navy budget reported, "PMA 272 has funded this Future Naval Capability (FNC) since 2006 as a risk mitigator for both JATAS and the CIRCM system." By February 2016, an early production system was ready and funded in the FY17 OCO procurement budget with $27.5 million for 12 systems to be installed in 2017-18 on three different helicopter types – the USMC's AH-1Z and UH-1Y, and the Navy's MH-60S. The new system, initially referred to as ***ADIRCM***, was to be produced by DRS Technologies and Daylight Solutions (who also produce the lasers for CIRCM).

In May 2017, in the FY18 budget, the Navy designated the ADIRCM of DRS & Daylight Solutions (now both owned by Leonardo) as the ***AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures)***, and added both a separate, substantial RDT&E funding line and several new platform funding breakouts in separate helicopter platform budgets.

In August 2019, the Navy completed the first phase of DAIRCM missile warning testing using MH-60S and AH-1Z helicopters at Hot Springs, VA, to support the Navy's

DAIRCM Quick Reaction Assessment (QRA).

Then in March 2020, NAVAIR awarded Leonardo DRS a $16.4 million contract option to procure 114 DAIRCM sensors and 29 DAIRCM processors, specifically 64 sensors and 16 processors for the Air Force, 30 sensors and eight processors for the Navy, and 20 sensors and five processors for the Army.

But development – not production – continued. In June 2020, NAVAIR awarded Leonardo DRS a $120 million contract to provide DAIRCM engineering models, and by April 2022 the US Navy still planned *FY23* RDT&E funding for acceptance and testing of four Engineering Development Models (EDMs).

And in April 2022, a separate production contract was planned to be awarded for Milestone C – planned for 3Q *2024* – for the USAF and Army.

When TADIRCM was split by the Navy more than a decade ago, it envisioned both Assault DIRCM for helicopters and ***Strike DIRCM***, which would eventually use TADIRCM technology to develop a podded family of systems for fast jets. Strike DIRCM was seemingly unfunded for years, but plans were for Strike DIRCM to debut with a third generation MWS with four to six two-color staring sensors providing a full sphere of coverage. There would be one or two lasers and a compact pointer/tracker for the DIRCM itself.

To some degree coming full circle (for fighters), in August 2016 the US Air Force awarded Northrop Grumman a $39.3 million, five-year contract for development efforts as part of the ***STRAFE (SHiELD [Self-protect High Energy Laser Demonstrator] Turret Research in Aero-Effects)*** Advanced Technology Demonstration (ATD) program, for a laser-based self-defense DIRCM system for pod-mounting on fast jets, initially planned as the F-15 and F-16. Northrop was to develop and deliver an ***advanced beam control system*** for integration. The USAF expected to begin flight testing the integrated system by 2019.

In November 2017, the Air Force Research Lab (AFRL) awarded Lockheed Martin $26.3 million for the design, development, and production of a ***high-power fiber laser*** for the Laser Advancements for Next-generation Compact Environments (LANCE) program, as part of SHiELD, with plans to test the laser on a tactical fighter jet by 2021.

With STRAFE beginning a five-year ATD program in 2016, and relatively early development continuing in 2020, a major ***Future Fast Jet DIRCM*** production program is probably still at least a decade away, but we include speculative forecasts.

Total funding forecast in this report is $4.6 billion for Northrop Grumman and Leonardo as primes, with $900 million in Future prime funding still uncontracted and available.

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Manufacturers

Primes

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(CIRCM prime)
(STRAFE [SHiELD])

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Galaxy Scientific Corp.
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Lockheed Martin Corp.
(LANCE [SHiELD])

Leonardo DRS Sysco
100 North Babcock Street
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Tel: (321) 622-1500
(DAIRCM prime)

Subcontractors

- BAE Systems, Information & EW Systems (IEWS), Nashua, NH: TADIRCM EOA laser jammer
- Daylight Solutions, Inc., San Diego, CA: Lasers for CIRCM and ADIRCM (11/16)
- DRS Technologies, Dallas, TX: TADIRCM EOA 2-color IR MWS
- Johns Hopkins University, Columbia, MD: Studies & analysis ($0.6M, 4/05)
- Macauley Brown, Inc., Dayton, OH: Studies & analysis ($0.3M, 4/05)
- Selex ES, Edinburgh, Scotland: Teamed with Northrop Grumman for CIRCM (8/15)
- Tekla: Systems engineering ($2.6M, 9/05; $0.4M, 3/06)

Other Contractors

- BAE Systems, Pomona, CA: Fast Jet DIRCM (Program Manager is Bob Delaney, Ron Gidseg is Principal Systems Engineer, Phong Ha is Principle Software Engineer, Norm Wilcox is Section Manager)
- BAE Systems, Information & EW Systems (IEWS), Nashua, NH: Participant in TADIRCM development, with Agile Eye system
- Northrop Grumman Corp., Electronic Systems, Rolling Meadows, IL: Participant in TADIRCM development, with WANDA system

Functional Description

CIRCM Configuration (February 2020)

The ***Common Infrared Countermeasure (CIRCM)*** is the next generation lightweight, laser-based Infrared Countermeasure (IRCM) component that will interface with both the Army's Common Missile Warning System (CMWS) and future missile warning systems (MWS) to defeat current and emerging missile threats that use multispectral technology for rotary-wing, tilt-rotor, and small fixed-wing aircraft across the DoD. CIRCM receives an angular bearing hand-off from the MWS, employs a pointing and tracking system which acquires the handed-over threat and tracks the incoming missile during and after motor burnout. CIRCM then jams the missile by using modulated laser energy in the missile seeker band, thus degrading the tracking capability of the missile, and causing it to miss the aircraft. CIRCM is utilizing Open Systems Architecture which allows flexibility with software and hardware refreshes to keep pace with future threats.

The CIRCM A-Kit includes mounting hardware, wiring harnesses, and other components necessary to install and interface the mission kit on host aircraft. The A-Kit ensures the mission kit is functionally and physically operational with a specific host aircraft type. The CIRCM B-Kit is the mission kit (laser, pointer tracker, and controller) required to achieve near spherical coverage for an aircraft.

By February 2020, the Army Procurement Objective (APO) had increased to 1,781 (B-Kits only).

DAIRCM Configuration (April 2022)

In April 2022, the US Navy's PE# 0604272N discussed the ***AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures)*** program. DAIRCM consists of three major components: missile warning sensors, processor, and inexhaustible laser countermeasures. DAIRCM interfaces with the platform aircraft and provides signals to onboard Aircraft Survival Equipment (ASE).

Within the Department of the Navy, the UH-1Y helicopter is the lead platform for the DAIRCM Program. The DAIRCM program advances lessons learned from the Joint Urgent Operational Needs Statement (JUONS) to incorporate the system under glass in the H-1; improves laser power; increases processor power

to allow for additional sensors to meet platform/mission needs; improves sensor countermeasure features; improves effectiveness for flare deployment; and further develops cyber security.

The DAIRCM design is scalable to expedite expansion to other platforms and improve crew threat situational awareness. The program also advances modeling and simulation for new countermeasures and develops necessary test equipment for program success.

In April 2022, the US Navy planned FY23 RDT&E funding to provide for acceptance and testing of four (4) Engineering Development Models (EDMs). The program will continue development of Government tracking software and test under glass solutions. DAIRCM will continue studies and evaluations of current and future aircraft threats, modeling and simulation for improved countermeasure capabilities, development, testing, and test equipment to address new and emerging threats.

The program will complete platform (UH-1Y) DAIRCM integration for A-Kit and prepare for B-Kit installation as well as JUONS fielded software product improvements to multiple platforms. The program will also add other Service platforms to the DRS Sysco product development contract in FY23.

The DAIRCM ACAT II Program is a scalable acquisition approach that provides the architecture for an integrated aircraft survivability system with preplanned product improvements (P3I) to outpace the threats into the future. DAIRCM will replace the existing AN/AAR-47 UV Threat Warning System – providing an inexhaustible countermeasure with improved 2-color IR Threat Warning system and growth capability to meet future design improvements and combat advanced threats. DAIRCM leverages JUONS capabilities (cooperation between Government laboratories and industry partners to grow into an integrated capability that meets key performance parameters).

The DAIRCM program awarded a development cost contract in FY20. The DAIRCM program will also award contract modifications for new platforms to procure DAIRCM Engineering Development Models (EDMs), Production Representative Models (PRMs), and nonrecurring engineering development and test support as future material solution for their platforms. The addition of other Services platforms is expected to lower the overall acquisition costs for all services.

In April 2022, a separate production contract was planned to be awarded for Milestone C – planned for 3Q 2024 for the services that select DAIRCM as the future material solution for their platforms.

DAIRCM Configuration (June 2020)

The ***AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures)*** is an integrated suite of missile warning, laser warning, hostile fire indicator, and infrared countermeasures systems to protect helicopters from infrared missiles.

The system uses one centrally installed laser that feeds all the beam directors. The threat warning sensor sends raw video and digital data information to the processor, which analyzes the data for an incoming missile, laser, or hostile fire threat.

If the processor detects a threat, it notifies the aircrew through the control interface unit and initiates the laser to direct electro-optical jamming energy at the incoming missile.

The US Navy has tested DAIRCM on the Sikorsky MH-60S utility helicopter and the USMC AH-1Z attack helicopter, and the USAF has demonstrated DAIRCM aboard HH-60G Pave Hawk combat rescue helicopters (in response to a joint urgent operational needs statement). DAIRCM is being designed for helicopters performing medium-lift logistical support, medical evacuation, search and rescue, armed escort, and attack operations.

ADIRCM/DAIRCM Configuration (February 2020)

In February 2020, the US Navy FY21 procurement budget discussed ***ADIRCM (Assault Directed Infrared Countermeasure)***, still apparently the budget name for the AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures) project, which is a lightweight Threat Warning System (TWS) and Infrared Countermeasure (IRCM) developed by the Navy Research Lab under an FY04 Office of Naval Research Future Naval Capability (FN04-03): Integrated E/O IR Self-Protect Suite for Rotary Wing Aircraft.

PMA 272 has funded this Future Naval Capability (FNC) since 2006 as a risk mitigation for both the Joint and Allied Threat Awareness System (JATAS) and the Common Infrared Countermeasures (CIRCM) system.

The new DAIRCM nomenclature is the AN/AAQ-45 system, which offers significant savings in Size, Weight and Power (SWaP) and cost avoidance.

The system consists of a centralized processor and laser with high power fiber optic cables leading to four to six two-color IR sensors. Each sensor incorporates a pointer tracker, which allows laser energy to be focused on incoming threats.

CIRCM Configuration (February 2016)

The ***Common Infrared Countermeasure (CIRCM)*** is an infrared (IR) countermeasure system that interfaces with a Missile Warning System (MWS) to provide near spherical protection of the host platform in order to defeat IR-guided threat missiles. The CIRCM will provide the sole acquisition of future laser-based IR countermeasure systems for all rotary-wing, tilt-rotor, and small fixed-wing aircraft across the Department of Defense.

Currently, plans are for CIRCM to utilize the platforms' existing MWS

– the Army's AN/AAR-57(V) CMWS and the Navy's AN/AAR-47, both with older UV-sensors.

The Army's concept of CIRCM is part of the Suite of Integrated Infrared Countermeasures (SIIRCM). The core components of the SIIRCM concept are: a MWS, IR expendables countermeasures (flares), and a laser-based Infrared Countermeasure (IRCM). The SIIRCM detects, declares and initiates IRCM against IR-guided Surface-to-Air Missiles (SAM) or Air-to-Air Missiles (AAM). The CIRCM is the next generation of the laser-based IRCM component and will interface with both the Army's Common Missile Warning System (CMWS) and future missile warning systems.

The A-Kit for CIRCM includes mounting hardware, wiring harnesses, and other components necessary to install and interface the mission kit on host aircraft. The A-Kit ensures the mission kit is functionally and physically operational with a specific host aircraft type.

The CIRCM B-Kit is the mission kit (laser, pointer tracker, and controller) required to achieve near spherical coverage for an aircraft.

The overall Army Procurement Objective (APO) for CIRCM is 1,076 (B-Kits only), potentially worth more than $3 billion.

ADIRCM Configuration (February 2016)

The ***Assault Direct Infrared Countermeasures (ADIRCM)*** is a lightweight Threat Warning System (TWS) and IRCM developed by the Navy Research Lab under an FY04 Office of Naval Research Future Naval Capability (FN04-03), Integrated E/O IR Self Protect Suite for Rotary Wing Aircraft. PMA272 has funded this Future Naval Capability (FNC) since 2006 as a risk mitigator for both the Joint and Allied Threat Awareness System (JATAS) and the Common Infrared Countermeasures (CIRCM) system.

The ADIRCM system offers significant savings in size, weight and power (SWaP) and cost avoidance. The system consists of a centralized processor and laser with high power fibers leading to two-color IR sensors. Each sensor incorporates a pointer tracker, which allows the laser energy to be focused on incoming threats. ADIRCM provides increased survivability against surface-to-air IR missiles, laser guided threats, small arms, anti-aircraft artillery (AAA), machine guns, and rocket propelled grenades for combat & assault rotary-wing and fixed wing aircraft.

The ADIRCM configuration on these aircraft will include one processor, one laser and four sensors. The US Navy's MH-60S is the lead platform with ADIRCM installation currently planned for 2017-18. The US Marine Corps' UH-1Y and AH-1Z are also scheduled for ADIRCM installation from 2017-18.

TADIRCM/Strike DIRCM Configuration (Legacy)

The following description applies to the original TADIRCM project, which was expected to lead to Strike DIRCM.

The ***TADIRCM (Tactical Aircraft Directed IR Counter Measures)*** will be optimized for fast combat jets. Two primary changes are needed to ATIRCM and DIRCM. Both ATIRCM and DIRCM rely on missile cueing from UV-type MWSs (AN/AAR-57(V) CMWS and AN/AAR-54 PMAWS), which detect UV radiation from a missile's rocket engine. TADIRCM specifies an IR-type staring (non-rotating) sensor, which has a longer range and better clutter rejection, and operates at different wavelengths to minimize false alarms. A disadvantage of IR-type systems is the need for cryogenic cooling, adding weight and expense.

The other change needed is a smaller jammer head, in this case exclusively for a laser jammer. Current designs feature a small gimbaled laser under a faceted dome. For aerodynamic reasons, this dome must be considerably smaller that the human-head-sized DIRCM and ATIRCM jammer heads.

TADIRCM originated as an advanced technology development (ATD) program, with most funding coming from BAE Systems and Northrop Grumman for in-house developments. BAE Systems' TADIRCM has about 60% commonality with ATIRCM, but with a miniaturized "Agile Eye" jam head. Northrop Grumman's TADIRCM is called "WANDA", with the Viper mid-infrared laser in a 5.5" dome.

The UK's Fast Jet Directed Infrared Countermeasures (DIRCM) system will acquire and track IR-guided missile threats and point a high-power laser jammer, to protect UK Tornados and possibly Eurofighters. BAE Systems will further develop its DART (Defensive Avionics Receiver Transmitter) for the program, integrated with a laser warner and the company's AN/AAR-57(V) Missile Warning System. BAE Systems' DART Program Manager, Robert Delaney, has referred to DART as a "next-generation TADIRCM", incorporating simplified optical paths and multiple electro-optical/infrared interfaces. It is also smaller than TADIRCM.

Platforms

TADIRCM was initially planned for tactical aircraft such as the F/A-18E/F but would also offer advantages for fast transports such as the C-17.

Fast Jet DIRCM was intended for Panavia Tornados and perhaps Eurofighter and other platforms.

Initial ADIRCM production in 2017-18 was planned for the US Navy's MH-60S helicopter (the lead platform) as well as the US Marine Corps' UH-1Y and AH-1Z helicopters.

By mid-2020, ADIRCM redesignated as the AN/AAQ-45 DAIRCM had been tested on the US Navy MH-60S utility helicopter, the USMC AH-1Z attack helicopter, and the

USAF HH-60G Pave Hawk combat rescue helicopter.

Variants/Related Systems

AN/AAQ-24(V) NEMESIS—NEMESIS is a Directed Infrared Countermeasures (DIRCM) system being developed by Northrop Grumman. NEMESIS lost to Sanders for the ATIRCM EMD contract but was selected by the British Ministry of Defense. It will go into production before ATIRCM, in part because it uses a less advanced noncoherent source of IR energy rather than a laser countermeasure.

AN/ALQ-212 ATIRCM & AN/AAR-57 CMWS—Lockheed Martin Sanders' Advanced Threat Infrared Countermeasures/Common Missile Warning System lost to the comparable AN/AAQ-24 for the UK/US SOCOM DIRCM requirement but won the much more valuable ATIRCM competition. It uses a laser countermeasure beam and will not enter service for at least two years after the AAQ-24. The CMWS is based on Loral's AN/AAR-47.

FLASH—DASA's Flying Laser Self-defense system against seeker-Head missiles (FLASH) is an IR countermeasures system which will use a high-power laser to burn out a missile's focal plane array, instead of simply misdirecting it. Ground testing is planned for early 2000, with flight testing around 2002.

Specifications

	TADIRCM EOA
Weight:	600 lb
Dimensions:	14" diameter x 142" long
Flight envelope:	limited

Funding History

RDT&E ($ Millions)	FY15	FY16	FY17	FY18	FY19	FY20*	FY21	FY22*	FY23**	FY24**
PE# 0604272N Tactical Air DIRCM (TADIRCM)										
Proj. #3302 JATAS	0.1**	—	—	—	—	—	—	—	—	—
Proj. #3304 CIRCM	5.7	19.0	59.8	5.8	—	—	—	—	—	—
Proj. #3348 DAIRCM Development	—	—	—	45.5	45.9	58.4	47.9	33.2	15.0	16.1
PE# 0605035A Common Infrared Countermeasures (CIRCM) (was Aircraft Survivability Development)										
Proj. #EB4 CIRCM	101.3	98.5	90.7	97.7	32.0	23.2	29.8	16.6	11.5	5.2
Proj. #EE4 CMWS	53.6	—	—	—	—	—	—	—	—	—
PE# 0605051A Aircraft Survivability Development										
Proj. #ER8 CMWS	—	62.9	105.4	144.6	40.5	83.2	68.1	23.4	7.0	8.2
CMWS	—	2.9	4.2	4.5	5.5	5.7	3.4	6.4	n/a	n/a
CIRCM	—	16.7	56.1	30.1	5.1	2.1	—	—	n/a	n/a
LIMWS	—	—	33.7	110.0	29.8	75.1	64.6	13.8	n/a	n/a

Procurement ($ Millions)	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20*	FY21**	FY22**
Navy Aircraft Procurement (BA 5) Modification of Aircraft										
Common ECM Equipment										
JATAS	—	17.6**	—	—	—	—	—	—	—	—
ADIRCM	—	—	—	—	27.5	41.0	9.8	—	—	—

Procurement ($ Millions)	FY15	FY16	FY17	FY18	FY19	FY20*	FY21	FY22*	FY23**	FY24**
Navy Aircraft Procurement (BA 5) Modification of Aircraft										
Common ECM Equipment										
DAIRCM	—	—	—	—	—	—	—	2.0	29.3	8.8
Army Aircraft Procurement (BA 4)										
CIRCM										
CIRCM	—	—	90.7	80.7	60.9	178.1	266.5	234.0	288.2	302.2
(Unit quantity)	n/a	n/a	n/a	[144+]	(33)	(81)	(120)	(110)	(125)	n/a
CMWS										
CMWS++	201.9	104.3	97.7	166.6	60.5	137.3	159.7	148.6	107.1	13.8

**Appropriation*
***Budget Request*
+Prior to FY19
++Includes some funding for other programs, especially CIRCM.

Costs

Earlier, the Navy's ***Assault DIRCM*** unit cost was likely to approximate ATIRCM and DIRCM costs, probably being a bit more expensive, or about $2.2 million, including missile warning sensors, installation, and other costs.

In February 2016, the FY17 OCO budget funded 12 ***ADIRCM*** systems for three US Navy/USMC helicopter types, at a unit cost of about $2.0 million, plus another $350,000 per helicopter in support costs.

Earlier, we estimated that if the Army's ***CIRCM*** materialized as a sub-120 lb. system for smaller helicopters, it could cost less, perhaps $1.6-1.8 million per platform, also including missile warning sensors, installation and other costs.

In February 2016, the FY17 OCO budget funded initial production of 76 CIRCM B-kits, at a unit cost of $1.2 million, or $1.5 million when including initial installation and support costs. But note that this is only B-kit cost, which is somewhat misleading – total cost for adding CIRCM to each aircraft will be much higher than $1.5 million. When adding the A-kit – basically everything that needs to be added *to the aircraft* to make the sensors and lasers work – actual unit cost might jump to $2.5 million or more. And this additional $1+ million A-kit unit cost is currently being hidden in platform or other funding lines. It is not broken out in DoD budget documents, meaning the true CIRCM cost is not obvious.

The CIRCM B-Kit is the mission kit (laser, pointer tracker, and controller). The A-Kit includes mounting hardware, wiring harnesses, and other components necessary to install and interface the mission kit on host aircraft. The A-Kit ensures the mission kit is functionally and physically operational with a specific host aircraft type.

Within CIRCM, the JATAS MWS system might compose about $300,000 of CIRCM B-kit unit cost.

Earlier, ***Strike DIRCM*** unit cost in full-rate production would likely have been greater than $3 million (including missile warning sensors), more than ATIRCM and DIRCM, but perhaps less than LAIRCM.

By February 2020, funding in the FY21 Army budget showed a CIRCM unit cost in Full Rate Production (at a rate of 80-125 units per year) of about $2.2 million, including both the A-kit and B-kit and initial support.

Program Overview

History

UK's Fast Jet Program

The UK's MoD has been conducting a similar program for tactical aircraft, the "Fast Jet" program, and has already tested MWSs.

Lockheed Martin Sanders Programs

Sanders's TADIRCM – in development since the mid-1990s – has about 60% commonality with ATIRCM. A major development has been the "Agile Eye" miniaturized jam head, which has already undergone flight tests aboard a P-3. TADIRCM is in the evaluation phase.

Northrop Grumman Programs

Northrop Grumman has been developing the MIMS-2000, a missile warning system with two-color staring IR sensors. It has already been tested for the UK's "Fast Jet" program.

Northrop Grumman's IRCM system is called WANDA, with a "Viper" solid-state laser in a 5.5" dome. WANDA is in the demonstration phase.

Raytheon Programs

Although Raytheon does not have the background of ATIRCM or DIRCM to build upon, they are developing an IR-type missile warning system which could be offered for at least part of TADIRCM. Raytheon's Santa Barbara Research Center has developed a stacked mercury-cadmium telluride sensor which operates simultaneously in the mid- and far-IR bands.

TADIRCM Testing

In November 2001, a US Navy QF-4 drone equipped with BAE Systems' Agile Eye TADIRCM laser jammer successfully defeated a shoulder-fired SAM missile, completing the TADIRCM Advanced Technology Development (ATD) program.

BAE Systems Chosen for UK Fast Jet DIRCM Development

In January 2002, the UK Ministry of Defense (MoD) awarded BAE

Systems, Pomona, CA a £3.9 million ($5.6 million) technology demonstration contract for the Fast Jet Directed Infrared Countermeasures (DIRCM) program. The Fast Jet system will acquire and track IR-guided missile threats and point a high-power laser jammer, to protect UK Tornados and possibly Eurofighters. BAE Systems will further develop its DART (Defensive Avionics Receiver Transmitter) for the program, integrated with a laser warner and the company's AN/AAR-57(V) Missile Warning System. BAE Systems' DART Program Manager, Robert Delaney, has referred to DART as a "next-generation TADIRCM", incorporating simplified optical paths and multiple electro-optical/infrared interfaces. It is also smaller than TADIRCM. Laboratory and field trials over the next two years will demonstrate the system's compatibility with several laser systems. Flight trials could follow. Much work will be conducted at the Pomona, CA facility.

Fast Jet DIRCM DART Delivered

In August 2004, BAE Systems completed hardware delivery for Fast Jet DIRCM, including DART. DART was to begin range and flight demonstrations in the UK and US in early 2005, as the final phase of the Technology Demonstration Program (TDP).

Assault DIRCM RFI

In November 2005, the Advanced Tactical Aircraft Protection (PMA-272) Program Office of NAVAIR, Patuxent River, MD, announced the Navy is seeking information from industrial sources with the capability to develop, test, produce, and support a DIRCM for Navy/Marine Corps helicopters.

This information will be used to determine the viability and makeup of a Navy Assault DIRCM acquisition program. A detailed request for information (RFI) has been posted at the NAVAIR Homepage. The NAVAIR Homepage is located at http://www.navair.navy.mil/. The Assault DIRCM RFI will be found under solicitation number N0001906P1PQ009.

TADIRCM EOA Completion

The management and acquisition strategy for TADIRCM has entailed a competitive phased approach to reduce risk to cost and schedule through viable competition. The Early Operational Assessment (EOA) project awarded two contracts for pointer/tracker/laser development, one contract for pod development, and one contract for missile warning sensors, with the Naval Research Lab serving as technical lead in integration of these systems. The Navy then selected one contractor in FY05 for the pointer/tracker/laser, at the fabrication point, to ensure the project did not exceed budget and can be executed on schedule.

Assault DIRCM Status

The Navy's Assault DIRCM program for helicopters is now anticipated to be a spiral upgrade to the Army's ATIRCM, but the lead contractor has yet to be determined (meaning BAE Systems does not have it locked up yet, especially if ATIRCM problems continue). The Army and Navy will pursue a common solution on a joint set of requirements.

However, in mid-2006 Assault DIRCM was under review by the Navy, meaning further delays and an increased likelihood of a simple buy in to ATIRCM at some point. An Analysis of Alternatives (AoA) was planned for 3QFY06.

In mid-2006, Navy requirements called for 400 systems.

Strike DIRCM Status

The Strike DIRCM program will maximize use of TADIRCM technology developed under the EOA, to develop a podded family of systems for fast jets. The program will redesign/repackage components to survive the tactical aircraft environment and will conduct tests to verify system performance meets the tactical environment.

In mid-2006, Navy requirements called for 100 systems.

CH-53E DIRCM TAP

In 2006, The US Navy/Marine Corps CH-53E DIRCM Technology Assessment Program (TAP) was contracted to Northrop Grumman, funded in PE# 0604272N. It will assist in evaluating the most applicable IRCM system to protect the CH-53E helicopter fleet from the threat of shoulder fired infrared (IR) missiles. The TAP will evaluate the performance of five different variations of currently available IRCM systems/capabilities, with test and evaluation methodology also applicable to other Navy/Marine Corps helicopters, including the MH-60S/R, MV-22, UH-1 and AH-1.

The baseline system will be Northrop's AAQ-24 DIRCM, with two GLTA jamheads. The 5 variations of IRCM systems to be evaluated include: 1) Navy baseline ASE for these helicopter, non-imaging ultraviolet (UV) missile warning sensors (MWS) cueing flares, 2) imaging UV MWS cueing flares (allowing for faster timelines, and angle of arrival specific flare dispensing), 3) imaging IR MWS cueing flares (allowing for even faster timelines, and angle of arrival specific flare dispensing), 4) imaging UV MWS cueing a directional infrared countermeasures (DIRCM), and 5) imaging IR MWS cueing a DIRCM.

Flight tests were conducted in the summer of 2006, with TAP assessment planned for September 2006.

ITT Tests the Water

In July 2007, ITT Electronic Systems (Clifton, NJ) successfully demonstrated a new integrated laser pointer/tracker on a UH-60 helicopter. Clearly ITT hopes to be able to capture at least a part of the huge new DIRCM market, much as Raytheon began DIRCM developments a year ago.

JATAS MWS to Precede Assault DIRCM

In mid-2007, the Navy planned to fully fund a four-year development program for JATAS (Joint Allied Threat Awareness System), a next-generation IR-sensor missile warning system, beginning in 4QFY08. Although only JATAS MWS development is funded, the Navy is still referring to the overall program as Assault DIRCM. The Navy plans to request funding for the DIRCM portion beginning in FY10.

The Navy eventually wants Assault DIRCM for almost 1,000 small and large helicopters, and the MV-22. IOC for the full DIRCM system is tentatively planned for FY15 (many shoot-downs in the future; one wonders why the Navy will keep buying impervious F/A-18E/Fs and bloated and unnecessary DDG-1000s, instead of funding defenses for servicemen who are actually being shot and killed; I hope pork politicians *don't* sleep easy…).

An Assault DIRCM/JATAS SDD contract is expected to be awarded in the summer of 2008. Likely bidders include Northrop Grumman and BAE Systems, and now Raytheon and ITT Electronic Systems.

Strike DIRCM Further Out

Strike DIRCM is also unfunded, with the Analysis of Alternatives study now complete. Though the alternatives will certainly change by the time it is ready, the plans are for Strike DIRCM to debut with a third generation MWS with four to six two-color staring sensors providing a full sphere of coverage. There will be one or two lasers and a compact pointer/tracker for the DIRCM itself.

Earlier in 2007, the Navy tested 11-inch diameter DIRCM pod (presumably the TADIRCM pod) on a Super Hornet wing station with good results.

Hostile Fire Indicator for Assault DIRCM JATAS

In September 2007, NAVAIR announced it was soliciting information from industry concerning a Hostile Fire Indicator (HFI) capability for Marine Corps and Navy rotary wing and tilt rotor aircraft. The purpose of this RFI is to determine the maturity of the technology required to implement a HFI capability. NAVAIR intends to use this data to aid in defining an acquisition strategy and assessing risks involved with implementing a HFI capability on USMC and USN aircraft.

The HFI capability should detect ballistic threats such as small arms, RPGs, and AAA directed at the aircraft. Once hostile fire is detected and declared, the HFI should provide the aircrew with a warning of the presence of hostile fire and provide a bearing to the HF. Specific threats to be detected are identified in a classified specification (please contact Don Harwood (Assault DIRCM Engineer), tel: (301) 757-7909). The HFI technology may be integrated with the Joint and Allied Threat Awareness System (JATAS) for control and display or as an integral part of the JATAS. The HFI technology should have enough growth potential to include new threats as they emerge. Aircraft targeted to have the HFI capability are the MV-22, CH-53K, AH-1Z, UH-1N, MH-60R and MH-60S, and potentially KC-130.

Proposed technology should be capable of being deployed on these USMC and USN aircraft beginning in 2014. Written responses to the RFI shall be no greater than 30 pages in length. Multiple RFI responses may be submitted for different technology solutions to the HFI requirement. SOL is N00019-06-P1-PQ009, due October 11, 2007. POC is Lorraine Rardin, tel: (301) 757-7074, fax: (301) 757-7054, email: lorraine.rardin@navy.mil.

Navy IRCM Solicitation

In October 2007, the Office of Naval Research (ONR), Naval Research Laboratory (NRL), Washington, DC, had a requirement for the research and development of new technologies for IRCM systems that exploit the optical spectrum from infrared through ultraviolet to support military aircraft and ship systems. The areas of technical investigation will be broad, but with emphasis on electro-optical and infrared (EO/IR) systems and techniques for countering infrared guided missile threats to tactical aircraft. NRL anticipates an award of a CPFF type contract. Personnel proposed to work on the resultant contract shall have a Secret clearance or shall be eligible for the clearance prior to contract commencement. The contractor shall have at least a Secret facilities clearance and Secret storage capabilities prior to contract commencement. Period of Performance will be one (1) year with three (3) one-year options. SOL is N00173-08-R-LS01, POC is Lisa Fleming, tel: (202) 767-3739, fax: (202) 767-6197, email: lisa.fleming@nrl.navy.mil. POP is 4555 Overlook Ave., SW Washington, DC 20375.

JATAS Draft RFP

In September 2008, the Navy issued a draft RFP for JATAS, with a two-company technology development period planned for late FY09, to be followed by a down-select to a single company for SDD in FY11, following a Milestone B decision.

In July 2008, Alliant Techsystems (ATK) announced it would partner with BAE Systems (with ATK as prime) to bid for JATAS.

Northrop Wins USAF NexGen MWS

In October 2008, Northrop Grumman's two-color infrared sensor technology won the USAF's NexGen MWS competition, beating Lockheed Martin's one-color seeker (based on the F-22's AN/AAR-56). The Navy awarded Northrop a $5.5 million contract to begin production. Northrop will deliver an initial 18 LRIP units, to be followed by full-rate production after further testing. The C-17 will likely get the first upgrades.

A different version of Northrop's system is also being developed for the Navy's JATAS program, another version (MIMS) is in production for US Marine Corps CH-46 and CH-53D/E helicopters.

ATK/BAE and Lockheed Martin for JATAS

In September 2009, the US Navy awarded contracts worth a combined $65 million to Alliant Techsystems (ATK) (teamed with BAE Systems) and Lockheed Martin to design and develop JATAS prototypes by January 2011. The Navy rejected a competing bid from Northrop Grumman.

CIRCM Ideas

In late 2009, the US Army was developing ideas for CIRCM (Common Infrared Countermeasures) but had not yet established funding or selected contractors. An EMD contractor or contractors could be selected in mid-2010, with a June 2010 Milestone B decision and a 21-month EMD contract. The total installed CIRCM system should weigh less than 120 lbs. The Army's CIRCM point of contact is Darrell Quarles, tel: (256) 955-0304, email: Darrell.quarles@us.army.mil.

Thought to be interested in CIRCM are ITT, Northrop Grumman/Selex, and Raytheon/BAE Systems, all with laser jam-head systems, and possibly Alliant Techsystems/DRS Technologies with a distributed aperture system.

Assault DIRCM Becomes (Army) CIRCM; (Navy) JATAS Goes Ahead; Strike DIRCM Delayed

In the FY11 budget (February 2010), the schedule for Navy TADIRCM programs changed due to new guidance from OPNAV. An earlier Analysis of Alternatives (AoA) was conducted by OPNAV to assess the need for an advanced IRCM capability for assault aircraft (rotary wing/tilt rotor) and strike aircraft (fighters) against surface-to-air threats.

Conclusions from the AoA determined there was an immediate need for an advanced IRCM capability for assault aircraft, however, additional analysis was needed to evaluate strike aircraft IRCM requirements – hence, Strike DIRCM plans have been out on hold.

The AoA conclusion was that advanced missile warning technology was sufficiently mature to proceed into an Engineering and Manufacturing Development (EMD) program – hence continued Joint and Allied Threat Awareness System (JATAS) funding under Navy leadership. In September 2009, competitive Technology Development (TD) phase contracts were awarded to two contractors, to conduct competitive prototyping prior to EMD. The EMD contract award is planned for FY11 with an Initial Operational Capability (IOC) date of FY14 planned.

The AoA determined that Assault DIRCM technology for small to medium USN/USMC rotary wing aircraft required further maturity of several technologies prior to EMD. Hence, the Navy has designated the Army as the lead service for developing a DIRCM capability for assault aircraft. Assault DIRCM, which has now been designated by the Army as the Common Infrared Countermeasures (CIRCM) program, has a planned Milestone B of FY11.

ATK Wins JATAS EMD

In July 2011, NAVAIR awarded Alliant Techsystems (ATK), Clearwater, FL a $109.2 million contract for engineering and manufacturing development of JATAS, after beating off a team of Lockheed Martin Missiles and Fire Control, Orlando, FL; DRS Infrared Technologies, Dallas, TX; and Goodrich ISR Systems, Danbury, CT. ATK is teamed with BAE Systems Electronic Solutions, Nashua, NH, which could perform about 40% of the development work.

CIRCM Delays

By late 2011, CIRCM program delays had grown to at least a year, despite all bidders claiming their systems were at or beyond technology readiness level (TRL) 6, required for development. These delays (and the eventual planned dates by early 2013) raised the continuing specter of ATIRCM – the Army has just not been able to get its crucial requirement for IRCM up and running. In September 2011, the Senate Appropriations Committee (SAC) recommended cutting $67 million from CIRCM in FY12 – zeroing RDT&E. With EW's traditional vulnerability in times of budget cuts, in July 2011 Chris Carlson, director of business development for ITT Electronic Systems, said, "We're going to have to bring a lot more to the table in the long run for [CIRCM] to stay sold."

CIRCM for UAVs?

One spur to CIRCM development might be use on large unmanned aerial vehicles (UAVs), pitched by Raytheon in October 2011. "Raytheon is developing a family of directed infrared countermeasure solutions that can protect cargo aircraft and combat helicopters; unmanned is the next logical step", according to Mike Booen, vice president of Advanced Security and Directed Energy Systems for Raytheon Missile Systems. "Raytheon's DIRCM solutions are lighter [15 lbs. lighter than the Army CIRCM requirement], more reliable and draw significantly less power than other systems on the market today," said Booen.

CIRCM Equipment Offerings

As of late 2011, the five major CIRCM offerings (now down to two for TD) included "incumbent" BAE Systems' Boldstroke, with more than 80% computing and subassembly commonality with ATIRCM. Northrop Grumman is developing its CIRCM from AAQ-24 LAIRCM helicopter variants. ITT and Raytheon Missile Systems had both been developing low cost DIRCM systems for several years, with Raytheon's Scorpion/Quiet Eyes pointer-tracker incorporating the proven IR seeker

from Raytheon's AIM-9X missile. The final bidder was a Lockheed Martin Missiles and Fire Control-led team. ITT, Raytheon, and Lockheed all planned to link their laser generator to multiple jam heads with fiber-optics, to save weight and improve capability, though there have been reliability issues in the harsh rotary-wing environment.

CIRCM Down-Select to Northrop and BAE Systems

In January 2012, the Army awarded 21-month Technology Development (TD) contracts to Northrop Grumman, Rolling Meadows, IL, and BAE Systems, Nashua, NH.

Milestone B is now planned for 1QFY15, with an EMD award to be announced in 2QFY15.

Exelis Protests CIRCM Loss, Unsuccessfully

From February through May 2012, Technology Development (TD-phase) work by Northrop Grumman and BAE Systems on CIRCM was halted as a protest by losing bidder Exelis was resolved, delaying the program by 4 months. Exelis' protest was eventually denied by the GAO.

Preliminary Design Review is now scheduled for July 2013, with delivery of prototype hardware for testing in September 2013.

CIRCM FUE Planned for… 3QFY19

In late 2012, CIRCM plans were for a LRIP decision in 3QFY17 and First Unit Equipped (FUE) in 3QFY19. Hardly the immediate needs program originally intended.

The total procurement objective for the US Army is still 1,076 systems.

HFI for JATAS

JATAS is planned to include hostile fire indication (HFI) threat detection capabilities, to provide accurate and timely warning of small arms, rocket-propelled grenades, and other ground fire in all flight regimes, ambient light conditions, clutter backgrounds, and weather conditions. So far, schedules and plans for HFI incorporation into JATAS are not definite, but it appears ATK – already contracted for an HFI software upgrade for the AAR-47 – may take over HFI development and incorporate it into the baseline JATAS. No word yet whether this will delay JATAS readiness, and ATK has a good record with its on-schedule AAR-47 upgrades, but Teal Group is wary that full baseline HFI incorporation could result in capabilities creep reminiscent of the ATIRCM nightmare.

Army CIRCM EMD Funding: FY15

CIRCM has been undergoing TD-phase development and pre-MS B activities, with MS B approval anticipated in 1QFY15, followed by award of the EMD contract to one vendor in 2QFY15.

In the FY15 budget released in March 2014, planned FY15 RDT&E funding of $128.3 million will support CIRCM EMD, to include platform integration as well as integration with other Aircraft Survivability Equipment (ASE) systems.

The EMD contract will include priced options for Low-Rate Initial Production (LRIP) 1 and 2, Engineering Support, A-Kit development for other aircraft, a Technical Data Package (TDP) (which will enable competition for Full Rate Production [FRP]), and Defense Exportability Features (DEF).

Upon CIRCM MS C approval in the second quarter of FY17, the LRIP and Engineering Support options may be exercised, and the program may immediately enter the Production & Deployment phase. In March 2014, the Product Manager (PdM) Countermeasures intended to pursue competition for the award of a fixed price contract for CIRCM FRP if the option is exercised to procure the TDP.

Army CIRCM Testing Delays

Test schedule delays in March 2014 included A-Kit qualifications for CIRCM H-1 IOT&E changed from 3QFY17-1QFY18 to 3QFY18-1QFY19. B-Kit qualifications for CIRCM H-1 IOT&E changed from 2QFY18-4QFY18 to 2QFY18-4QFY19. All other tasks are on schedule and to be completed by the Army.

Navy CIRCM EMD Plans

CIRCM is a New Start for the Navy. CIRCM development is being led by the Army, but is ultimately intended for Army, Navy, and Marine Corps assault aircraft, and the Navy has RDT&E funding lines in place.

Navy JATAS Folded into CIRCM

In FY13, there was a successful demonstration of CIRCM-JATAS Initial Capabilities Document Interoperability in Lab Environment. FY14 was planned to see Critical Design Reviews and Technical Readiness Reviews. Eight (8) JATAS test articles were developed for various test events in FY13.

In March 2014, Navy plans were to end the JATAS program in FY14 in accordance with the Acquisition Decision Memorandum (ADM). Remaining funds in FY15 will be realigned to CIRCM (PU 3304). All tasks after FY14 were removed from the schedule profile.

CIRCM TD Development Add-Ons

In August 2014, the Army awarded Northrop Grumman and BAE Systems $10 million and $8 million contract add-ons, respectively, for limited-scope services for CIRCM RDT&E, with work to be completed by March 2015. The new contracts are for additional development and testing requirements for the technology demonstrators, including services for continued software development and design, as well as Guided Weapons Evaluation Facility testing, Laser Integration Test and

Evaluation Lab testing, developmental testing, accelerated life test, pallet testing, and reliability characterization testing. The modifications also support engineering support for development of the AH-64E Apache kit and the development of a final Anti-Tamper plan.

Northrop Grumman Wins CIRCM EMD/LRIP

In August 2015, the Army Contracting Command, Redstone Arsenal, AL, awarded Northrop Grumman Systems Corp., Rolling Meadows, IL, a $35.4 million CPFF, fixed-price incentive, FFP hybrid contract with options for engineering and manufacturing development and low-rate initial production of CIRCM. Work will be performed in Rolling Meadows, IL, with an estimated completion date of October 2017. Bids were solicited via the Internet with two received (the other was undoubtedly BAE Systems). The full contract amount was obligated at the time of the award, as FY15 RDT&E funding (W58RGZ-15-C-0067).

CIRCM Recent History

Congressional Adds and OCO CIRCM RDT&E Funding

In February 2016, the FY17 Army budget for PE# 0605051A Aircraft Survivability Development shows FY16 Congressional Add funding of $16.7 million and FY17 OCO RDT&E funding of $61.6 million for integration efforts to support the Advanced Threat Warner and CIRCM Quick Reaction Capability (ATW & CIRCM QRC) solution in support of Joint Urgent Operational Needs Statement (JUONS) SO-0010 for the OIR theater of operations. The intent of the ATW & CIRCM QRC program is to reduce the SWaP that require operational tradeoffs that are associated with the Phase 2a solution.

FY16 development will begin ATW & CIRCM QRC development and qualification of the new Army ATW processor and the ATW transfer alignment function. Funding will also begin software integration with the current ATW processor. Efforts will also begin on A-Kit development/Integration. Efforts will also include Army systems engineering and program management efforts.

FY17 development will continue development and qualification of the new Army ATW processor and the ATW transfer alignment function; complete software integration with the current ATW processor and begin the software integration with the new Army ATW processor; and continue QRC A-Kit development/Integration efforts for UH-60M, UH-60L, HH-60M, CH-47F, AH-64E, MH-47G and MH-60M. Funding will also support the modification of the JUONS SO-0010 Phase 2a A-Kit to accommodate the new Army ATW processor and CIRCM on all aircraft.

CIRCM Procurement Begins

In February 2016, the US Army budget provided FY17 OCO funding of $108.7 million to procure CIRCM B-kits for Army and Special Operations Forces.

The overall Army Procurement Objective (APO) for CIRCM is 1,076 (B-Kits only).

The Common Infrared Countermeasure (CIRCM) is an infrared (IR) countermeasure system that interfaces with a Missile Warning System (MWS) to provide near spherical protection of the host platform in order to defeat IR-guided threat missiles. The CIRCM will provide the sole acquisition of future laser-based IR countermeasure systems for all rotary-wing, tilt-rotor, and small fixed-wing aircraft across the Department of Defense.

The Army's concept of CIRCM is part of the Suite of Integrated Infrared Countermeasures (SIIRCM). The core components of the SIIRCM concept are: a MWS, IR expendables countermeasures (flares), and a laser-based Infrared Countermeasure (IRCM). The SIIRCM detects, declares and initiates IRCM against IR-guided Surface-to-Air Missiles (SAM) or Air-to-Air Missiles (AAM). The CIRCM is the next generation of the laser-based IRCM component and will interface with both the Army's Common Missile Warning System (CMWS) and future missile warning systems.

The A-Kit for CIRCM includes mounting hardware, wiring harnesses, and other components necessary to install and interface the mission kit on host aircraft. The A-Kit ensures the mission kit is functionally and physically operational with a specific host aircraft type.

The CIRCM B-Kit is the mission kit (laser, pointer tracker, and controller) required to achieve near spherical coverage for an aircraft.

Initial CIRCM Deliveries Planned for 2017

In February 2016, the FY17 OCO budget funded initial production of 76 CIRCM B-kits, at a unit cost of $1.2 million, or $1.5 million when including initial installation and support costs.

These 76 systems are to be delivered beginning in November 2017, at a rate of 10 per month.

Note that this is only B-kit cost, which is somewhat misleading – total cost for adding CIRCM to each aircraft will be much higher than $1.5 million. When adding the A-kit, basically everything that needs to be added to the aircraft to make the sensors and everything else work, actual unit cost might jump to $2.5 million or more.

CIRCM Reaches Milestone C…

In September 2018, Northrop Grumman's CIRCM achieved Milestone C, following "a rigorous testing process to ensure system readiness

for the demands of combat operations." Milestone C, awarded by the Department of Defense Milestone Decision Authority, marks the end of the development and testing phase and enables the beginning of production and deployment.

$500 Million CIRCM Production Award

In August 2019, the US Army awarded Northrop Grumman a contract award with a potential value of $482 million for CIRCM systems and support services, with an initial task order for $82.8 million. The award expands CIRCM production and strengthens the logistics support infrastructure necessary to support the program as it moves toward full rate production.

CIRCM IOT&E and Testing Continue

Also in August 2019, CIRCM entered Initial Operational Test and Evaluation (IOT&E) for the Army.

In January 2020, according to Northrop Grumman, CIRCM successfully completed free flight missile testing at White Sands Missile Range. As part of the tests, CIRCM engaged both single and multiple shot scenarios while mounted to an aircraft hanging from an aerial cable. "CIRCM has undergone thousands of hours of testing to verify its performance in a range of realistic combat scenarios," said Bob Gough, vice president, land, and avionics C4ISR, Northrop Grumman. "During the recent testing at White Sands Missile Range, our system once again demonstrated superior capability in countering infrared threats. We look forward to providing the U.S. Army with this unparalleled protection."

But… CIRCM Compatibility Problems Should be Resolved Before FRP

In November 2019, according to the Army, the Army concluded IOT&E, including operational flights, free flight live missile tests, a logistics demonstration, laboratory test, flight tests, and cybersecurity tests.

Army Assessment: The Army discovered compatibility problems during developmental testing that may require hardware changes to correct. DOT&E will provide the Army a classified IOT&E report of the CIRCM system to inform the Army Acquisition Program Baseline Objective date for the Full-Rate Production decision in June 2020.

Army Recommendation: The Army should resolve the compatibility problems that occurred during post-Milestone C developmental testing.

ADIRCM/DAIRCM Recent History

US Navy/USMC ADIRCM Procurement

In February 2016, the US Navy FY17 procurement budget outlined the status of the Assault Direct Infrared Countermeasures (ADIRCM) program – previously a program very much under the radar. But by 2016, early production systems were ready and funded in the FY17 OCO procurement budget with $27.5 million for 12 systems to be installed in 2017-18 on three different helicopter types – the AH-1Z, UH-1Y, and MH-60S. The new system, now referred to as ADIRCM, is being produced by DRS Technologies and Daylight Solutions (who also produce the lasers for CIRCM).

ADIRCM is a lightweight Threat Warning System (TWS) and IRCM developed by the Navy Research Lab under an FY04 Office of Naval Research Future Naval Capability (FN04-03), Integrated E/O IR Self Protect Suite for Rotary Wing Aircraft. PMA 272 has funded this Future Naval Capability (FNC) since 2006 as a risk mitigator for both the Joint and Allied Threat Awareness System (JATAS) and the Common Infrared Countermeasures (CIRCM) system. The ADIRCM system offers significant savings in size, weight, and power (SWaP) and cost avoidance. The system consists of a centralized processor and laser with high power fibers leading to two-color IR sensors. Each sensor incorporates a pointer tracker, which allows the laser energy to be focused on incoming threats. ADIRCM provides increased survivability against surface-to-air IR missiles, laser guided threats, small arms, anti-aircraft artillery (AAA), machine guns, and rocket propelled grenades for combat, assault rotary-wing and fixed wing aircraft in theater.

The scope of the Joint Urgent Operational Needs Statement (JUONS) phase includes the non-recurring engineering (NRE) required to develop, integrate, and test all hardware, software, and firmware to field ADIRCM. Efforts will also include the manufacturing of ADIRCM test articles, test bench fixtures, fleet representative hardware, and system training. Two prime contractors, DRS Technologies, and Daylight Solutions, will be awarded sole source contracts for the ADIRCM WRAs. During the JUONS phase, the ADIRCM system will be installed on the following USN/USMC aircraft identified in JUONS SO-0010: AH-1Z, UH-1Y, and MH-60S.

The ADIRCM configuration on these aircraft will include one processor, one laser and four sensors. The US Navy's MH-60S is the lead platform with ADIRCM installation currently planned for 2017-18. The US Marine Corps' UH-1Y and AH-1Z are also scheduled for ADIRCM installation from 2017-18.

Leonardo DRS to Acquire Daylight Solutions

In March 2017, Leonardo DRS agreed to pay $150 million for Daylight Solutions, Inc., a leading developer and supplier of quantum cascade laser products and technology. According to Mauro Moretti, Leonardo CEO and General Manager, "Acquisition of Daylight Solutions… will allow Leonardo DRS to extend the range of advanced solutions to civil and military customers around the world, integrating the Daylight Solutions laser technology in the core business of electro-optical and infrared sensors and systems." Leonardo believes Daylight Solutions will grow significantly in the coming years due to the rollout of new US military aircraft survivability systems. Daylight Solutions will become one of eight Leonardo DRS business lines. Both Daylight Solutions co-founders, Timothy Day and Paul Larson, will remain with Leonardo DRS.

ADIRCM Becomes AAQ-45 DAIRCM Program of Record

In May 2017, in the FY18 budget, the Navy began designating DRS & Daylight Solutions' ADIRCM as the AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures), and added both a separate, substantial RDT&E funding line in the PE# 0604272N TADIRCM program element (Proj. #3348 DAIRCM Development), and several new platform funding breakouts in separate helicopter platform budgets.

More ADIRCM Production Funded by FY18 OCO Budget

In May 2017, the Navy's FY18 OCO budget provided $41.0 million for continuing production of twenty-four (24) initial ADIRCM systems, stating, "FY 2018 OCO funds are required to procure assets in support of fielding the next two Marine Expeditionary Units (MEUs). The FY 2018 OCO ensures that the capability to conduct missions in areas where the JUONS [Joint Urgent Operational Needs Statement] threat exists until the Program of Record (PoR) assets can be fielded."

The FY18 budget also describes, "OCO Other Support: FY 2018 increase [to $9.3 million, from $4.1 million in FY17] as the program transitions from development funding to fielding funding. Other support includes Government Teams supporting procurement of assets, project management, engineering support for initial B-kit fielding as well as product support." However, this funding about doubled, as did the number of ADIRCM systems to be procured, leading Teal Group to continue adding this amount as an "actual" unit procurement cost.

The FY18 Navy budget also adds a new reference to the classified documentation for ADIRCM: "The driving [ADIRCM] requirements can be found in the classified JUONS SO-0010 and the classified Request for Initiation of Rapid Deployment Capability process for an Advanced Threat Warning and Inexhaustible Infrared Countermeasure for Rotary Wing Aircraft (RDC Ser N9/16S139158).

ADIRCM/DAIRCM Follow-On Production Contract

In mid-2017, the US Navy announced plans to award contract modifications to DRS (for sensors and IR processors) and Daylight Solutions (lasers and fiber-optic cable assemblies) to procure as many as 60 AAQ-45 DAIRCM systems.

Funded MH-60R DAIRCM Upgrades

In March 2019, the US Navy's FY20 budget for PE# 0604216N Multi-Mission Helicopter Upgrade Development, Proj. #1707 MH-60R Development, funds various programs for the MH-60R, including development of critical aircraft survivability equipment upgrades, including the platform design for the integration of DAIRCM. DAIRCM substantially improves the survivability of MH-60 aircraft, significantly enhancing the defense of high value units and enabling operations in high threat scenarios.

DAIRCM Flight Testing

In August 2019, the Navy completed the first phase of DAIRCM missile warning testing using MH-60S and AH-1Z helicopters at Hot Springs, VA, to support the Navy's DAIRCM Quick Reaction Assessment (QRA).

From August to September 2019, the Navy completed laser warning and hostile fire testing using a surrogate target at the Naval Air Warfare Center's Weapons Survivability Laboratory located in China Lake, CA, to support the DAIRCM QRA.

In September 2019, the Navy began conducting the second phase of missile warning testing using MH-60S and AH-1Z helicopters at Eglin AFB, FL, to support the DAIRCM QRA.

SHiELD & Future Fast-Jet DIRCM Recent History

Fast Jet Laser DIRCM Returns: USAF STRAFE/SHiELD Contract to Northrop

In August 2016, the USAF Air Force Research Laboratory (AFRL) awarded Northrop Grumman a $39.3 million, five-year CPFF contract for development efforts as part of the STRAFE (SHiELD Turret Research in Aero-Effects) (SHiELD is Self-Protect High Energy Laser Demonstrator) Advanced Technology Demonstration (ATD) program, for a laser-based self-defense IRCM system for pod-mounting on fast jets.

Northrop will develop and deliver an ***advanced beam control system*** for integration as part of a larger program for a complete laser weapons system for USAF fighter aircraft – primarily the F-15 and F-16 (the pod would negate the stealth characteristics of the F-22 and F-35 JSF). The system will be tested on a tactical aircraft flying at speeds up to supersonic. The AFRL expects to begin flight testing the integrated system by 2019.

According to W. Mark Skinner, vice president, directed energy, Northrop Grumman Aerospace Systems, "Our Northrop Grumman-led team is integrating an innovative beam director with proven beam control technologies to help the Air Force define and successfully demonstrate a laser weapon capability for current and next generation aircraft. The beam control system characterizes the flight environment for atmospheric disturbances that could distort the laser beam, acquires, and tracks incoming targets, determines an aim point for the laser, then 'shapes' and focuses the outgoing beam on the target."

Northrop Grumman is developing the SHiELD beam control system under the segment of the ATD program known as STRAFE. The AFRL will integrate the STRAFE beam control system with a laser source, and power and cooling systems developed for the SHiELD ATD. Work will be performed at Redondo Beach, CA and Kirtland Air Force Base, NM, and is expected to be complete by August 2021. This award is the result of a competitive acquisition with three offers received (FA9451-16-C-0007).

According to some sources, the SHiELD laser would "destroy" incoming missiles, as opposed to diverting IR-guided missiles with flares – today's fighter defense. Northrop Grumman's website even shows an artist's illustration of just this happening (but it also shows a stealthy future UCAV carrying the laser, and pods are unstealthy). However, as with Northrop's very successful LAIRCM countermeasures system for large and slow aircraft, airborne laser countermeasures systems typically do not have enough power to destroy missiles (certainly not enough to "blow them up" in picturesque fireballs), but instead lasers distract or disable the missile guidance systems. The Air Force does claim future pods will increase laser power output for greater effect/range, but again, missile destruction is unnecessary if the guidance system is disabled or destroyed, and missile diversion at long ranges will always be preferable to blowing up missiles at close ranges (this will also save on flight suit laundry needs).

According to the Department of Defense (DoD), the STRAFE project will also increase knowledge and understanding of aero-optic disturbances in a supersonic environment by collecting data during engagement scenarios.

Lockheed Wins SHiELD Laser Development (LANCE) Contract

In November 2017, the Air Force Research Lab (AFRL) awarded Lockheed Martin $26.3 million for the design, development, and production of a ***high-power fiber laser*** as part of the AFRL's Self-protect High Energy Laser Demonstrator (SHiELD) program, with plans to test the laser on a tactical fighter jet by 2021.

According to Lockheed Martin, the SHiELD program includes three subsystems:

STRAFE (SHiELD Turret Research in Aero Effects), the beam control system, which will direct the laser onto the target (Northrop Grumman).

Laser Pod Research & Development (LPRD), the pod mounted on the tactical fighter jet, which will power and cool the laser (not yet awarded).

Laser Advancements for Next-generation Compact Environments (LANCE), the high energy laser itself, which can be trained on adversary targets to disable them (Lockheed Martin).

LANCE is designed to operate in a compact airborne pod, with a high efficiency laser needed, with "challenging size, weight, and power constraints," according to Lockheed. Lockheed Martin has more than 40 years of experience developing laser weapon systems, including the ATHENA system and ALADIN laser, as the US Army's Robust Electric Laser Initiative (RELI) program.

Also, according to Lockheed, "Earlier this year, we delivered a 60 kW-class laser to be installed on a US Army ground vehicle. It's a completely new and different challenge to get a laser system into a smaller, airborne test platform. It's exciting to see this technology mature enough to embed in an aircraft…. The development of high-power laser systems like SHiELD show laser weapon system technologies are becoming real. The technologies are ready to be produced, tested, and deployed on aircraft, ground vehicles, and ships."

Alternative Directed Energy Weapons to SHiELD also Sought

In October 2018, having already cut Lockheed Martin into Northrop Grumman's STRAFE ATD, the US Air Force Research Laboratory (AFRL) also announced it was seeking proposals for additional systems separate from the SHiELD program – either a high-energy laser or high-powered microwave directed energy weapon – for precision airborne offensive strike missions, as well as defensive roles.

The Air Force Special Operations Command (AFSOC) has also been considering adding an offensive laser capability to its AC-130J Ghostrider gunships by 2022, though by 2019 that effort appeared to have been pushed back.

SHiELD (STRAFE) Laser Ground Testing Begins

In April 2019, the US Air Force Research Laboratory (AFRL) conducted a test with Lockheed Martin's Laser Advancements for Next-generation Compact Environments (LANCE) laser system and the Demonstrator Laser Weapon System (DLWS) at the US Army White Sands Missile Range, NM, successfully shooting down multiple air-launched missiles with a ground-based laser weapon test system as part of the SHiELD (Self-protect High Energy Laser Demonstrator) development program. The Air Force hopes to have a podded airborne prototype system ready for flight tests by 2021, with an operational capability by the end of the 2020s.

The SHiELD development contract awarded in 2016/2017 reportedly has a test plan in three phases, with Phase I to include low-power ground testing and low-power flight testing, both with a surrogate laser – with what was conducted in 2019 probably the beginnings of this testing. Also, part of Phase I is successful demonstration of "beam control, power, cooling, and system control in flight qualified pod." The surrogate laser used in 2019 testing is a large, ground-based system, however, and miniaturizing it for an airborne pod will be a major task.

And, despite the whiz-bang sci-fi aspect of SHiELD and other directed "energy beam" weapons that are intended to kill rather than distract (as ATIRCM, LAIRCM, CIRCM, DAIRCM etc.), laser range and power are greatly affected by atmospheric conditions such clouds and smoke – much more so than radio frequency (RF) jamming and physical weapons. Also, the overarching STRAFE (SHiELD Turret Research in Aero-Effects) Advanced Technology Demonstration (ATD) is developing a podded single-laser turret system, only be able to engage one target at a time.

CIRCM Current Developments

CIRCM Planned & Previous Production

In February 2020, the FY21 US Army procurement budget discussed CIRCM. CIRCM MS C was approved in September 2018, and the Low-Rate Initial Production (LRIP) and Engineering Support options were exercised, and the program entered the Production & Deployment phase with First Unit Equipped (FUE) planned for 3QFY20, and a Full Rate Production Decision Review (FRPDR) planned for 3QFY20.

During the MS C approval process, the CSA directed funding be increased beginning in FY20 to accelerate CIRCM production and Initial Operational Test (IOT), and to field one Combat Aviation Brigade (CAB) per year.

The Army Procurement Objective (APO) has increased to 1,781 (B-Kits only)

Previous and planned production includes:

FY17: QRC 2, Quantity=77; FY18: QRC 3, Qty=30; FY19: LIMWS QRC, Qty=9.

FY18: LRIP 3 (DO 01), Quantity=24; FY19: LRIP 2, Qty=24; FY20: LRIP 3 (DO 02), Qty=81; FY21: FRP, Qty=120.

CIRCM & DoN LAIRCM & LIMWS Procurement Plans

In February 2020, the CIRCM budget line in the FY21 US Army procurement budget included, 1). ***CIRCM*** (AZ3537), 2). funding to counter emerging technology as identified in Joint Urgent Operational Needs Statement (JUONS) SO-0010 Phase 2a (***DoN LAIRCM***) and the Headquarters Department of the Army (HQDA) Directed Requirement for the Common Infrared Countermeasures Quick Reaction Capability (CIRCM QRC), and 3). funding to support HQDA Directed Requirement for the ***Limited Interim Missile Warning System (LIMWS) Quick Reaction Capability (QRC)***.

JUONS SO-0010 and CIRCM QRC: As a part of Phase 2a of the JUONS (SO-0010) program, the Army integrated the *Department of the Navy (DoN) Large Aircraft Infrared Countermeasure (DoN LAIRCM)* system onto Army and Special Operations Aircraft (SOA) platforms. Due to several challenges, circumstances, and variables, the Army updated the Advanced Threat Warning (ATW)/ CIRCM QRC and Limited Interim Missile Warning System (LIMWS) Directed Requirements (dated November 2018).

The updated requirements *extend the utilization of ATW DoN LAIRCM on conventional Army aircraft and cancel the need for the ATW/CIRCM QRC system for the conventional Army* (though it should be noted that the updated requirement maintains the need for ATW/CIRCM on Army Special Operations aircraft).

As a result, the Army did not acquire the ATW sensors for use in Phase 3 of the JUONS effort. Instead, *the Army accelerated the procurement of the CIRCM QRC systems for use with the currently fielded CMWS in preparation for transition to the LIMWS system when available*.

The Army's Joint Urgent Operational Needs Statement (JUONS)/ Common Infrared Countermeasure Quick Reaction Capability (CIRCM QRC) APO = 42 (B-Kits).

ATW/CIRCM Acquisition Plans

In mid-2020, the CIRCM LRIP and Engineering Support options were exercised, and the program entered the Production & Deployment phase with First Unit Equipped (FUE) achieved in 2QFY20.

During the Milestone C approval process, the Chief of Staff of the Army directed funding be increased beginning in FY20 to accelerate

CIRCM production and Initial Operational Test (IOT) and to field one Combat Aviation Brigade (CAB) per year.

In April 2021, the Full Rate Production (FRP) decision was approved, and a five-year Indefinite Delivery/Indefinite Quantity contract was awarded to Northrop Grumman Systems Corporation (NGSC) for up to 596 B-Kits with options for Engineering Services, Repairs, and Contractor Logistics Support services.

In April 2022, the program planned to meet the Initial Operational Capability (IOC) threshold date of September 2022.

As mentioned above, due to the urgency of addressing the Size, Weight, Power, and Cooling (SWaP-C) issues related to the Phase 2a JUONS SO-0010 DoN LAIRCM initial materiel solution, the Army approved a Directed Requirement for the Phase 3 ATW/CIRCM QRC (requirement updated in November 2018). The updated requirements extend the utilization of ATW DoN LAIRCM on conventional Army aircraft and *cancel the need for the ATW/CIRCM QRC system for the conventional Army*.

It should be noted that the updated requirement maintains the need for ATW/CIRCM on the Special Operations Aircraft. Sustainment of ATW on Special Operations Aircraft will transfer to the Special Operations Aircraft budget line in FY23.

As a result, the Army will no longer acquire the ATW sensors for use in Phase 3 of the JUONS effort. Instead, the Army accelerated the procurement of the CIRCM QRC systems for use with the currently fielded CMWS in preparation for transition to the LIMWS system.

$1 Billion, Five-Year CIRCM FRP Contract to Northrop

In April 2021, the US Army awarded Northrop Grumman a five-year, $959.1 million, indefinite delivery/indefinite quantity (ID/IQ) contract for full-rate production of CIRCM.

Center for Countermeasures (CCM) FY21 Testing

In January 2022, the US DoD's Director for Operational Test & Evaluation reported on the FY21 activities of the Center for Countermeasures (CCM). The CCM used unique capabilities, generating more than 17,000 missile plume signatures, to execute 19 tests of Infrared Countermeasures (IRCM) systems to support the expedited development and fielding of eight Quick Reaction Capability, Urgent Operational Needs Statement, and Joint Urgent Operational Needs Statement CM programs as well as 11 tests that supported hardware and software upgrades of fielded systems against single and multiple IR-guided threats. Testing included:

• ***Advanced Threat Warner (ATW)*** and ***Common Infrared Countermeasures (CIRCM)*** installed on US Army rotary wing aircraft, demonstrating readiness for fielding

- Large Aircraft IR Countermeasures (LAIRCM) Next Generation System Processor Replacement (LSPR), in direct support of ongoing US Navy efforts to improve aircraft survivability of fixed-wing aircraft
- Department of the Navy LAIRCM ATW Processor Upgrade Flight Test, as an initial evaluation of the software performance capabilities
- Common Missile Warning System (CMWS) and ***Common Infrared Countermeasures (CIRCM)*** as integrated on the AH-64E and UH-60M, to evaluate their effects on aircraft survivability
- Limited Interim Missile Warning System (LIMWS), to determine its effectiveness in support of a fielding decision intended to increase the survivability of the UH-60M, CH-47F, and AH-64E
- Distributed Aperture Infrared Countermeasure (DAIRCM), in direct support of ongoing Air Force efforts to improve the survivability of tactical HH-60G rotorcraft
- LAIRCM system upgrade performance, in direct support of ongoing Air Force Life Cycle Management Center efforts to improve survivability of C-5M and C-130J strategic transport platforms

CIRCM Reaches IOC

In February 2023, CIRCM finally achieved Initial Operational Capability (IOC), which according to Northrop Grumman will advance the accelerated fielding of CIRCM systems on more than 1,500 Army aircraft. Northrop reports CIRCM has met the IOC requirements for UH-60M, HH-60M, CH-47F, and AH-64E helicopters, which will now inform future attack reconnaissance aircraft (FARA) and future long-range assault aircraft (FLRAA) requirements, making CIRCM a key enabler for Multi-Domain Operations (MDO) and advancements in Army modernization.

Northrop Grumman reports it will continue to develop and improve CIRCM to overmatch current and future threats, with an enhanced laser Line Replaceable Unit currently being tested to increase capability against near-peer threats.

CIRCM Deliveries

Also in February 2023, Northrop Grumman reported it had delivered more than 250 CIRCM systems to the Army with more than 100 aircraft equipped. CIRCM had accumulated more than 11,000 flight hours since its first field installation in December 2021.

ADIRCM/DAIRCM Current Developments

DAIRCM Development Efforts

In February 2020, the US Navy FY21 procurement budget discussed AAQ-45 development: FY17 through FY19 Overseas Contingency Operations (OCO) funds for AAQ-45 provided increased survivability against Man-Portable Air Defense Systems (MANPADS), Rocket Propelled Grenades (RPG), hostile gunfire, Anti-Aircraft Artillery (AAA), and laser-directed weapons for combat, assault rotary wing, and fixed wing aircraft in theater. FY17 OCO funds completed the original Joint Urgent Operational Need Statement (JUONS) fielding requirements. FY18 OCO funds were required to procure assets in support of fielding two additional Marine Expeditionary Units (MEUs). The FY18 OCO ensured the capability to conduct missions in areas where the JUONS threat exists until the Program of Record (PoR) assets can be fielded. FY19 OCO funds were required to support fielding.

DAIRCM Development Plans

In February 2020, the US Navy FY21 procurement budget discussed additional developmental efforts in the JUONS phase, including the Non-Recurring Engineering (NRE) required to develop, integrate, and test all hardware, software, and firmware to field the AAQ-45. Efforts will also include the manufacturing of AAQ-45 test articles, test bench fixtures, fleet representative hardware and system training. The driving requirements can be found in the ***classified*** JUONS SO-0010 and the ***classified*** Request for Initiation of Rapid Deployment Capability (RDC) process for an Advanced Threat Warning (ATW) and Inexhaustible Infrared Countermeasure for Rotary Wing Aircraft (RDC Ser N9/ 16S139158).

Two prime contractors, DRS and Daylight Solutions (now both owned by Leonardo), were awarded sole source contracts for the AAQ-45 Weapons Replaceable Assemblies (WRA).

DAIRCM Procurement Plans

During the JUONS phase, the AAQ-45 system will be installed on the following United States Navy (USN)/United States Marine Corps (USMC) aircraft identified in JUONS SO-0010: AH-1Z, UH-1Y, and MH-60S. The AAQ-45 configuration on these aircraft will include one processor, one laser and four sensors. The USN's MH-60S is the lead platform for AAQ-45 JUONS configuration.

The US Navy plans to procure and install 253 A-kits and B-kits for H-1 helicopters and 500 A-kits and B-kits for MH-60R/S helicopters. Procurement accounts for B-kits that align with the A-kits for H-1 ADIRCM are to be fully integrated with the APR-39(DV)2, H-1 Mission Computer OFP SW XX in the 2025 timeframe. PMA 272 is to procure FOCA for H-1 to support H-1 unique system platform integration through APR-39D(V)2 to the H-1 mission computer.

But DAIRCM First Deployed on USAF HH-60G!

In March 2020, Leonardo DRS announced that the first DAIRCM systems have been deployed on US Air Force HH-60G helicopters in support of a Joint Urgent Operational Needs Statement. Under an Air Force Materiel Command (AFMC) contract, Leonardo DRS will integrate DAIRCM kits on the HH-60G platforms.

DAIRCM Contract: For USAF (56%), Navy (27%), Army (17%)

Also in March 2020, the Naval Air Systems Command (NAVAIR), Patuxent River, MD, awarded Leonardo DRS Network and Imaging Systems LLC, Melbourne, FL, $16.4 million for modification P00013 to a previously awarded firm-fixed-price, cost-plus-fixed-fee contract (N000 19-16-C-0015). This modification exercises an option to procure 114 DAIRCM sensors and 29 DAIRCM processors, specifically 64 sensors and 16 processors for the Air Force; 30 sensors and eight processors for the Navy; and 20 sensors and five processors for the Army.

Work will be performed in Dallas, TX, and is expected to be completed in August 2021. FY18 aircraft procurement (Air Force and Navy), FY18 procurement (defense-wide funds), FY19 aircraft procurement (Air Force and Navy), FY19 procurement (defense-wide funds) in the amount of $16.4 million will be obligated at time of award, none of which will expire at the end of the current fiscal year. This modification combines purchases for the Air Force ($9.2 million; 56%), Navy ($4.4 million; 27%, and Army ($2.9 million; 17%).

$120 Million DAIRCM EDM Models Contract

In June 2020, the US Navy awarded Leonardo DRS, Melbourne, FL, a $120 million contract to provide engineering models of the AAQ-45 DAIRCM system. The Naval Air Systems Command (NAVAIR), Patuxent River NAS, MD, will provide non-recurring engineering to design, develop, integrate, and test engineering development models and production-representative models of weapons replaceable assemblies for the AAQ-45. Leonardo DRS will conduct work in Dallas, TX; San Diego, CA; Fort Walton Beach, FL; and Melbourne, FL; work is to be complete by June 2024.

Center for Countermeasures (CCM) FY21 Testing

In January 2022, the US DoD's Director for Operational Test & Evaluation reported on the FY21 activities of the Center for Countermeasures (CCM). The CCM used unique capabilities, generating more than 17,000 missile plume signatures, to execute 19 tests of Infrared Countermeasures (IRCM) systems to

support the expedited development and fielding of eight Quick Reaction Capability, Urgent Operational Needs Statement, and Joint Urgent Operational Needs Statement CM programs as well as 11 tests that supported hardware and software upgrades of fielded systems against single and multiple IR-guided threats. Testing included:

- Advanced Threat Warner (ATW) and Common Infrared Countermeasures (CIRCM) installed on US Army rotary wing aircraft, demonstrating readiness for fielding
- Large Aircraft IR Countermeasures (LAIRCM) Next Generation System Processor Replacement (LSPR), in direct support of ongoing US Navy efforts to improve aircraft survivability of fixed-wing aircraft
- Department of the Navy LAIRCM ATW Processor Upgrade Flight Test, as an initial evaluation of the software performance capabilities
- Common Missile Warning System (CMWS) and Common Infrared Countermeasures (CIRCM) as integrated on the AH-64E and UH-60M, to evaluate their effects on aircraft survivability
- Limited Interim Missile Warning System (LIMWS), to determine its effectiveness in support of a fielding decision intended to increase the survivability of the UH-60M, CH-47F, and AH-64E
- ***Distributed Aperture Infrared Countermeasure (DAIRCM)***, in direct support of ongoing Air Force efforts to improve the survivability of tactical HH-60G rotorcraft

LAIRCM system upgrade performance, in direct support of ongoing Air Force Life Cycle Management Center efforts to improve survivability of C-5M and C-130J strategic transport platforms

DAIRCM Development Plans

In April 2022, the US Navy's PE# 0604272N discussed the DAIRCM program. DAIRCM consists of three major components: missile warning sensors, processor, and inexhaustible laser countermeasures. DAIRCM interfaces with the platform aircraft and provides signals to onboard Aircraft Survival Equipment (ASE).

Within the Department of the Navy, the UH-1Y helicopter is the lead platform for the DAIRCM Program. The DAIRCM program advances lessons learned from the Joint Urgent Operational Needs Statement (JUONS) to incorporate the system under glass in the H-1; improves laser power; increases processor power to allow for additional sensors to meet platform/mission needs; improves sensor countermeasure features; improves effectiveness for flare deployment; and further develops cyber security.

The DAIRCM design is scalable to expedite expansion to other platforms and improve crew threat situational awareness. The program also advances modeling and simulation for new countermeasures and develops necessary test equipment for program success.

DAIRCM EDMs Funded

In April 2022, the US Navy planned FY23 RDT&E funding to provide for acceptance and testing of four (4) Engineering Development Models (EDMs). The program will continue development of Government tracking software and test under glass solutions. DAIRCM will continue studies and evaluations of current and future aircraft threats, modeling and simulation for improved countermeasure capabilities, development, testing, and test equipment to address new and emerging threats.

The program will complete platform (UH-1Y) DAIRCM integration for A-Kit and prepare for B-Kit installation as well as JUONS fielded software product improvements to multiple platforms. The program will also add other Service platforms to the DRS Sysco product development contract in FY23.

DAIRCM Acquisition Strategy

The DAIRCM ACAT II Program is a scalable acquisition approach that provides the architecture for an integrated aircraft survivability system with preplanned product improvements (P3I) to outpace the threats into the future. DAIRCM will replace the existing AN/AAR-47 UV Threat Warning System – providing an inexhaustible countermeasure with improved 2-color IR Threat Warning system and growth capability to meet future design improvements and combat advanced threats. DAIRCM leverages JUONS capabilities (cooperation between Government laboratories and industry partners to grow into an integrated capability that meets key performance parameters).

The DAIRCM program awarded a development cost contract in FY20. The DAIRCM program will also award contract modifications for new platforms to procure DAIRCM Engineering Development Models (EDMs), Production Representative Models (PRMs), and nonrecurring engineering development and test support as future material solution for their platforms. The addition of other Services platforms is expected to lower the overall acquisition costs for all services.

In April 2022, a separate production contract was planned to be awarded for Milestone C – planned for 3Q 2024 for the services that select DAIRCM as the future material solution for their platforms.

Teal Group Evaluation

CIRCM Development: The New ATIRCM, Delays and All?

In mid-2010, following a draft RFP in May, the US Army was expected to award at least two 21-month ***Common IRCM (CIRCM)*** technology development (TD) contracts in early 2011, with flight tests beginning in 2012. Plans called for CIRCM First Unit Equipped in 2017 and set a procurement objective of 1,076 systems for Army Apache, Black Hawk, upgraded Kiowa Warrior, and other helicopters, potentially worth more than $3 billion.

By February 2011, delays had slipped the planned TD contract award to the third quarter of 2011, with a two-year sole-source EMD contract planned for late 2013.

In January 2012, the Army finally awarded 21-month TD contracts to Northrop Grumman, Rolling Meadows, IL, and BAE Systems, Nashua, NH, with Milestone B planned for a not-right-around-the-corner 1QFY15 and an EMD award to be announced in 2QFY15. In late 2012, CIRCM plans were for a LRIP decision in 3QFY17 and First Unit Equipped (FUE) in 3QFY19. CIRCM was thus hardly the immediate needs program originally intended.

However, by March 2014, more than $100 million in annual CIRCM RDT&E funding was scheduled beginning in FY14, and the dates for Milestone B and EMD contract award had not slipped at all – still planned for 1Q and 2QFY15. Procurement funding was also in the FY15 budget, planned to begin in FY17.

In August 2015, the Army awarded Northrop Grumman the CIRCM engineering and manufacturing development (EMD) contract, with options for low-rate initial production (LRIP).

In February 2016, the FY17 OCO budget funded initial production of 76 CIRCM B-kits, to be delivered beginning in November 2017, at a rate of 10 per month.

Finally, in April 2021 the US Army awarded Northrop Grumman a five-year, $959.1 million, indefinite delivery/indefinite quantity (IDIQ) contract for full-rate production of CIRCM.

In February 2023, CIRCM achieved Initial Operational Capability (IOC). By February 2023, Northrop had delivered more than 250 CIRCM systems to the Army with more than 100 aircraft equipped. CIRCM reportedly had accumulated more than 11,000 flight hours since its first field installation in December 2021.

ATIRCM & Navy JATAS Disappear: It's All CIRCM Now…

By late 2014, ATIRCM – the original planned "common" IRCM – was finally definitely dead, at least in the non-classified budgets. And, as of early 2014, the US Navy's ***JATAS (Joint Allied Threat Awareness System)*** missile warning system (MWS) had been folded into CIRCM, transferring future JATAS funding to CIRCM. CIRCM would initially utilize the platforms' existing MWS – the Army's AN/AAR-57(V) CMWS and the Navy's AN/AAR-47, both with older UV-sensors.

Northrop's CH-53E LAIRCM with two laser jam heads weighs 193 lbs. and BAE's Chinook ATIRCM weighs 160 lbs., with all-up weights of around 350 lbs. including cabling and A-kit aircraft mods. CIRCM's planned weight was just 85 lbs. with two jammer turrets, with a maximum weight including A-kit of only 120 lbs. for smaller helicopters such as Apaches and Black Hawks, and 155 lbs. for the Chinook and V-22.

CIRCM will utilize a modular open system approach (MOSA) to integrate jammers, MWSs, and missile trackers. Today's LAIRCM and ATIRCM are federated systems, with single-purpose sensors and countermeasures linked through proprietary interfaces.

Thus, overall, the US seemed to be serious about the need for CIRCM and content with its capabilities, just perhaps not in as big a rush as previously claimed (the initial CIRCM B-kits to be delivered in 2017 couldn't have been final configuration versions, in part because procurement funding was to shrink to only $6.3 million in FY18). On the other hand, this "serious but not immediate" need was also the case throughout 20+ years of ATIRCM development, so Teal Group forecast that CIRCM funding would stay strong, but actual production might continue to be delayed.

In terms of CIRCM production numbers, it was also the same ATIRCM promise all over again. In July 2010 the Defense Acquisition Executive (DAE) directed that CIRCM provide the *sole acquisition* of future laser based infrared countermeasure systems for all rotary-wing, tilt-rotor, and small fixed wing aircraft across the Department of Defense. But by late 2016 we had still not seen any production systems, and ATIRCM itself was only procured for fewer than 100 US Army CH-47 helicopters.

…Except the Navy was Cheating (Wisely): ADIRCM & DAIRCM Enter Production

Thus, perhaps it should not have been totally surprising (but it was) that despite public dedication to the joint CIRCM program, the Navy continued to develop ***Assault DIRCM*** somewhat on the sly – or as the Navy budget reported, "PMA 272 has funded this Future Naval Capability (FNC) since 2006 as a risk mitigator for both JATAS and the CIRCM system." By February 2016, an early production system was ready and funded in the FY17 OCO procurement budget with $27.5 million for 12 systems to be installed in 2017-18 on three different helicopter types – the USMC's AH-1Z and UH-1Y, and the Navy's MH-60S (the unit cost,

installed, seemed to be about $2.3-2.4 million). The new system, then still referred to as ***ADIRCM*** but now designated the ***AN/AAQ-45 DAIRCM (Distributed Aperture Infrared Counter Measures)***, is being produced by [Leonardo-owned] DRS Technologies and [Leonardo-owned] Daylight Solutions (who also produces the lasers for CIRCM).

In August 2019, the Navy completed the first phase of DAIRCM missile warning testing using MH-60S and AH-1Z helicopters at Hot Springs, VA, to support the Navy's DAIRCM Quick Reaction Assessment (QRA).

Then in March 2020, NAVAIR awarded Leonardo DRS a $16.4 million contract option to procure 114 DAIRCM sensors and 29 DAIRCM processors, specifically 64 sensors and 16 processors for the Air Force, 30 sensors and eight processors for the Navy, and 20 sensors and five processors for the Army.

But development – not production – continued. In June 2020, NAVAIR awarded Leonardo DRS a $120 million contract to provide DAIRCM engineering models, and by April 2022 the US Navy still planned *FY23* RDT&E funding for acceptance and testing of four Engineering Development Models (EDMs).

And in April 2022, a separate production contract was planned to be awarded for Milestone C – planned for 3Q *2024* – for the USAF and Army.

So, What Happens to CIRCM? What Production Numbers?

In April 2021, the US Army finally awarded Northrop Grumman a five-year, $959.1 million, indefinite delivery/indefinite quantity (IDIQ) contract for full-rate production of CIRCM.

The Navy and Air Force collaborated with the Army in determining requirements, but according to Army Lt. Col. Raymond Pickering, product manager for infrared countermeasures at the Program Executive Office-Intelligence, Electronic Warfare and Sensors (PEO IEWS), "[CIRCM] is not a joint program, but it is kind of a multi-service-interest program." The Navy urgently needed a system lighter than LAIRCM for the AH-1Z SuperCobra, MH-60S, and hundreds of other helicopters. But apparently, it did not need CIRCM.

Though the sudden success of DAIRCM may have surprised the world, and even in 2020 CIRCM was struggling a bit in testing, Northrop Grumman has had incredible success with LAIRCM, and it is unlikely that Leonardo's DAIRCM will replace CIRCM, at least for the US Army. Beyond the Army, DAIRCM may be produced in the hundreds, or more, but future CIRCM production should still be huge. It should also be remembered that Leonardo's DAIRCM is somewhat of a "foreign" system. Although the US Navy has already procured several "international" electronics systems (NULKA, BOL dispensers, Litening targeting pods…), the chance of an all-encompassing, multi-service solution being bought from Leonardo rather than Northrop Grumman or BAE Systems… well, it just seems unlikely.

Eventually, thousands of next-generation DIRCMs will be acquired, and as Teal Group suggested in 2017, these could be of several types, of more than one design and from more than one manufacturer. A good quantitative market comparison is with the current US IRCM for small and mid-sized helicopters – more than 6,000 of BAE Systems' AN/ALQ-144 have been produced.

For the moment, Teal Group will forecast CIRCM staying on track for Army production and growing to substantial unit and funding numbers, and DAIRCM going ahead in the near-term for the Navy and for limited procurements for urgent needs by other services (including internationally).

But, for the long-term, as we discuss in our speculative ***Future Low-Cost DIRCM & MWS Systems*** forecast (see report), the future market is still wide open. Northrop's LAIRCM was bought, at great expense, for nearly every large aircraft near a war zone – but that was because there *was* a war on and there were no alternatives. Today, perhaps, we are finally seeing more than one capable system, and competition could possibly return to improve capabilities and/or lower prices.

If a competitor *does* come up with a $1-2 million DIRCM system – as long sought – CIRCM could see production numbers shrink. But currently the Army and Navy both seem willing to buy a $2-2.5 million "low-cost" system, and both CIRCM and DAIRCM likely have this unit cost on track. In February 2020, the Army budgeted about $2.2 million per CIRCM in FRP, through FY25.

Our CIRCM forecasts follow planned Army schedules fairly closely for now, as Northrop Grumman has been producing LAIRCM at high rates for a decade and the Army no longer seems to expect a $1-2 million CIRCM even for utility helicopters.

But we speculatively forecast production tapering off after a few years for the "international" and non-"Big Three+BAE" DAIRCM/ADIRCM system – to be replaced either by later CIRCM systems, perhaps a new system developed by BAE Systems (which recently scored a huge comeback with its LIMWS (Limited Interim Missile Warning System) QRC system [see ATIRCM/CMWS report]), or something else. For this speculative future forecast see Teal Group's Future Low-Cost DIRCM & MWS Systems report.

Fast Jet DIRCM: The LAIRCM of Next Decade?

When TADIRCM was split by the Navy more than a decade ago, it envisioned both Assault DIRCM for helicopters and ***Strike DIRCM***, which would eventually use TADIRCM technology to develop a podded family of systems for fast jets. Strike DIRCM was seemingly

unfunded for years, but plans were for Strike DIRCM to debut with a third generation MWS with four to six two-color staring sensors providing a full sphere of coverage. There would be one or two lasers and a compact pointer/tracker for the DIRCM itself.

To some degree coming full circle (for fighters), in August 2016 the US Air Force awarded Northrop Grumman a $39.3 million, five-year contract for development efforts as part of the ***STRAFE (SHiELD [Self-protect High Energy Laser Demonstrator] Turret Research in Aero-Effects)*** Advanced Technology Demonstration (ATD) program, for a laser-based self-defense DIRCM system for pod-mounting on fast jets, initially planned as the F-15 and F-16. Northrop will develop and deliver an ***advanced beam control system*** for integration. The USAF expected to begin flight testing the integrated system by 2019.

In November 2017, the Air Force Research Lab (AFRL) awarded Lockheed Martin $26.3 million for the design, development, and production of a ***high-power fiber laser*** for the Laser Advancements for Next-generation Compact Environments (LANCE) program, as part of SHiELD, with plans to test the laser on a tactical fighter jet by 2021.

With STRAFE beginning a five-year ATD program in 2016, and relatively early development continuing in 2020, a major ***Future Fast Jet DIRCM*** production program is probably still at least a decade away, but we include highly speculative forecasts.

Perhaps – it's a long shot and not yet in our forecast, but maybe – beginning later this decade, a major Fast Jet DIRCM procurement for US and international 4th generation fighters (F-15s, F-16s, F/A-18s) could become a multi-billion ongoing program the way Northrop Grumman's LAIRCM was for large aircraft for the past decade.

Funding Forecast

RDT&E (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All RDT&E										
CIRCM [Northrop Grumman]	32.0	28.0	26.0	22.0	24.0	32.0	42.0	46.0	26.0	18.0
DAIRCM [Leonardo]	38.0	28.0	20.0	12.0	14.0	18.0	16.0	10.0	8.0	6.0
Total RDT&E	***70.0***	***56.0***	***46.0***	***34.0***	***38.0***	***50.0***	***58.0***	***56.0***	***34.0***	***24.0***

Procurement (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All Production and Upgrade & Support										
CIRCM (US Army) [Northrop Grumman]	232.0	270.0	300.0	280.0	260.0	260.0	260.0	260.0	240.0	240.0
CIRCM (Undetermined) [Northrop Grumman]	18.0	26.0	66.0	80.0	102.0	124.0	120.0	140.0	140.0	140.0
DAIRCM (US Navy) [Leonardo]	2.0	30.0	24.0	38.0	48.0	52.0	38.0	26.0	12.0	14.0
DAIRCM (Undetermined) [Leonardo]	34.0	36.0	34.0	32.0	30.0	26.0	24.0	22.0	20.0	18.0
Total Procurement	***286.0***	***362.0***	***424.0***	***430.0***	***440.0***	***462.0***	***442.0***	***448.0***	***412.0***	***412.0***

RDT&E+Proc (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All RDT&E and Production and Upgrade & Support										
Future Fast Jet DIRCM [Available]	38.0	42.0	68.0	76.0	84.0	92.0	104.0	120.0	130.0	140.0