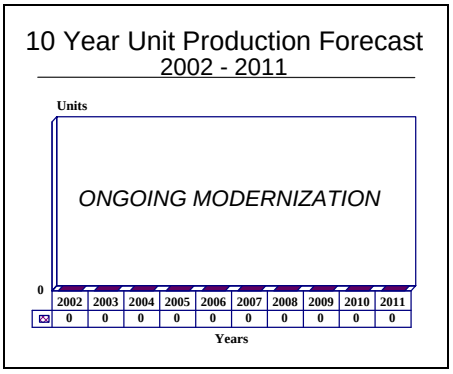
ALQ-178(V)/202(V) - Archived 04/2003

Outlook

- Ongoing logistics support
- Turkish production complete



Orientation

Description. Airborne electronic countermeasures (ECM) system. Called the Integrated Self-Protection System (ISPS), and, in Turkey, the Self-Protection EW System.

Sponsor
Company development.

Contractors
Lockheed Martin Corp
Tactical Systems
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USA
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Web site: http://www.lockheedmartin.com

Licensees
ACEC
Defense and Telecommunications Group
Charleroi, Belgium

Elisra Electronic Systems Ltd
Bene Baraq, Israel

Mikrodalga Elektronik Sistemler (MiKES)
(Lockheed Martin/Kavala joint venture)
MiKES Microwave Electronic Systems Inc
Ankara, Turkey

Status. In service, in production, ongoing logistics support.

Total Produced. Through 2001, an estimated 626 units had been produced.

Application. RAPPORT II: Mirage V; ALQ-178(V): F-16; ALQ-202: F-14, F-16, F/A-18.

Price Range. Estimated unit cost is US$1.5 million.

Price is estimated based on an analysis of contracting data and other available cost information, and a comparison with equivalent items. It represents the best-guess price of a typical system. Individual acquisitions may vary, depending on program factors.

Technical Data

	Metric	**US**
Dimensions		
RAPPORT II		
Weight:	100 kg	200 lb
ALQ-178(V)		
Weight		
Analysis Processor:	15.9 kg	35 lb
Superhet Receiver:	5.5 kg	12 lb
Superhet Controller:	7.3 kg	16 lb
C/D Rx/Power Supply:	6.8 kg	15 lb
Cockpit Display:	1.4 kg	3 lb
System Control:	0.5 kg	1 lb
Power Amplifier:	38.6 kg	85 lb
High Band Switch:	2.0 kg	4.5 lb
ECM Techniques Gen:	40.0 kg	110 lb
Aft Repeater:	15.9 kg	35 lb
Total Volume:	0.15 m^3	5.2 ft^3
ALQ-202(V)		
Total Volume:	0.084 cm^3	3 ft^3
Total Weight:	90.8 kg	200 lb
Characteristics		
ALQ-178(V)		
Frequency Range:	0.5 to 2.0 GHz, 2 to 20 GHz	
Transmitters:	Fore and aft, independently operated	
Receivers:	Superheterodyne-based	
Cooling:	Ram air	
Units (RAPPORT II):	Techniques Generator Power Amplifier (2) Receiver/Processor Dual DF Receiver (2) Display Control Unit	
Units (ALQ-178(V)):	Analysis Processor Superheterodyne Receiver Superheterodyne Controller C/D Band Receiver/Power Supply Cockpit Display System Control Power Amplifier (2) High Band Switch ECM Techniques Generator Aft Repeater	
Antennas:	13	
ALQ-202(V)		
Frequency Range:	2 to 2.0 GHz	
Units:	LRU/WRA-1 ECM Generator LRU/WRA-2 Multi-transmitter LRU/WRA-3 Digital Memory Unit	

Characteristics

	System Control Unit
Antennas:	Forward transmit - 2 left (HB/LB) Aft transmit - 2 (HB/LB) Forward receive - 2 Aft receive - 1
Interfaces with:	ALR-56M ALR-67(V)2 ALR-67(V)3/4 ALR-69(V)

Design Features. The ALQ-178(V) internal ECM suite warns pilots of possible attack and automatically initiates countermeasures tailored for a particular threat. The system consists of separate, integrated radar warning receiver (RWR) and jamming components. It uses a wideband superheterodyne receiver-based RWR subsystem for precision frequency measurement and sensitivity, and has a programmable digital microprocessor for power management, as well as independently operated forward and aft transmitters which provide improved spatial coverage.

The system scans the threat radar RF environment. Detected signals are de-interleaved, identified by type, and displayed in the cockpit on a daylight viewable CRT (cathode ray tube). A Dispense Interface Microprocessor (DIM) controls associated chaff and flare dispensers, responding to the threat according to internalized, programmed response patterns.

The system has a memory capacity of 32K bytes and growth flexibility using the MIL-STD-1553 databus. A programmable digital processor performs signal analysis and provides the pilot with an unambiguous warning display. The system can respond to rapidly changing threats, and its transmitter and receiver characteristics are tailored to a modern threat array. The ALQ-178(V) is programmable via the Preflight Message Generator (PFMG). A record mode allows data to be collected for post-flight examination and can be used for analysis of threat parameter changes.

To conserve jamming power as well as to maximize the effective radiated pulse, the jamming transmitters are set to the exact frequency of the threat emitter. Threat radars can be jammed at "sufficient" range. The ALQ-178(V) features a wide spectrum of smart noise and deception (pulse and CW) jamming techniques to counter a variety of known threats, including pulse-Doppler systems.

The system uses a central programmable computer and independent microprocessors to direct the radar warning receiver, display and jammer functions. Separate forward and aft jammers provide for maximum coverage, and the system is power-managed to match transmitted power to the threat engaged. System traveling wave tubes (TWTs) operate at a 100 percent duty cycle.

The ALQ-202(V) autonomous jammer is considered a fourth-generation internal self-protection system. It was specifically designed to protect F-16 fighter aircraft in a multimission environment by automatically detecting threats and initiating countermeasures, freeing the pilot to concentrate on other aspects of the mission. It can be internally mounted.

The system features an expanded frequency range using high- and low-band transmitters and receivers, as well as an upgraded central processor. It combines ALQ-56M front-end technology with jamming components from the ALQ-178(V), repackaged to conform to Advanced Self-Protection Jammer (ASPJ) spaces reserved in the F-14 and F/A-18 airframes. It can interface with existing radar warning receivers, the Navy ALE-50(V) towed decoy and other decoy and expendable dispensing systems. The system has a Digital Radio Frequency Memory (DRFM) and is capable of autonomous signal intercepts.

It uses advanced superheterodyne-based receivers that provide the needed frequency selectivity, sensitivity and intrapulse processing capability. It also is capable of rapid threat identification and coordinated RF and dispensed countermeasures. Although the jammer can interface with any RWR, the system incorporates an internal Jammer Support Receiver (JSR) which scans a preprogrammed frequency range and initiates jamming to counter threats.

The ALQ-202(V) can determine the direction of arrival of threat radars and select its response from a prioritized multi-level list of ECM techniques. The jamming can be optimized and transmitted in a set direction, further improving the effectiveness and efficiency of the system. The system was designed to be lightweight, reliable and attractively priced for the market.

Operational Characteristics. The aircraft's radar warning receiver constantly scans the electronic environment to provide situational awareness for the pilot and inputs for the ALQ-178(V)/202(V). When a signal is detected, it is separated from other signals and analyzed to identify the type radar that transmitted it. A power management algorithm selects the appropriate power for the threat, enhancing jammer effectiveness and efficiency as the jammers respond with a tailored signal.

The pilot display is a daylight-viewable CRT. The ALQ-178(V)/202(V) interfaces with countermeasures dispensers for chaff and flare management and is fully compatible with the ALE-47(V).

The ALQ-202(V) can operate independently or interface with any radar warning receiver. It continually searches for new threats and updates system information on previously detected signals. Transponder or repeater jamming can be used based on a library of complex deception and denial jamming techniques.

A built-in test system constantly monitors operation and will display faults to aircrews even during heavy operation. Sophisticated fallback modes are available in case of system failure.

Variants/Upgrades

ALQ-178(V)3. A license-built version for Turkish F-16s, it does not have the direction-finding receiver subsystem of the ALQ-178(V)1. It is assembled from components provided by Lockheed Martin.

ALQ-178(V)5. This version was manufactured for the Turkish Air Force F-16 Block 50 aircraft being produced in-country by MiKES.

ALQ-202(V) Autonomous Jammer. This is a significantly changed version of the ALQ-178(V) developed as an alternative to the ALQ-165(V) ASPJ Electronic Warfare suite for the F-16, F-14 and F/A-18. It was to be a competitive offering for the Navy's Integrated ECM needs, and specifically targeted at the US market.

The system was also made available internationally via FMS or direct commercial sale.

Program Review

Background. The Rapid Alert Programmed Power management of Radar Targets (RAPPORT) electronic countermeasures system was the only internal integrated system of its type developed and produced by one manufacturer. Development began in the early 1970s for a competition sponsored by the Belgian Air Force. The installation targeted 85 Mirage 5BA and BR aircraft.

In June 1975, (then) Loral was selected as the contractor and production began in 1978. In 1979, the Belgian Air Force tentatively decided to install a more advanced model, RAPPORT III, in all Belgian F-16s from the 53rd production aircraft, with the previous aircraft to be retrofitted. Because of budget problems, the program was postponed, and funding of RAPPORT III stopped by the Belgian Air Force.

ALQ-178(V) RAPPORT II production was completed in 1985 at 100 systems, with most installed on Belgian F-5BA/R aircraft.

Experience with RAPPORT II was instrumental in deciding to adapt RAPPORT III in lieu of the standard US Air Force countermeasures suite for the Belgian F-16s, which would have used the ALR-69(V) and ALQ-119(V). The ALE-40(V) chaff/flare dispenser was retained.

The first production contract for RAPPORT III was awarded in December 1983. The US$88 million contract was awarded by Israel. The Israeli Air Force installed the system in its F-16s and used it with remarkable success against the Syrian Air Force during the Lebanon campaign. Under a special agreement, the Belgian Air Force was kept informed of the RAPPORT III's performance and subsequently decided to install the system on its own F-16s.

In mid-1985, the Belgian Air Force announced plans to restart the RAPPORT III program. The production plan granted the Teamco Co exclusive production rights, and the company set up manufacturing facilities in Belgium. From 1988 on, the Belgian Air Force provided the bulk of RAPPORT III funding.

The total Belgian program for the RAPPORT III was valued at US$180 million for 108 systems. In late 1988, after expending US$33 million in development funds, Belgium dropped the RAPPORT III program because of escalating program costs, selecting

Carapace, a combination RWR/jammer from France as a follow-on to RAPPORT II.

In 1989, Loral announced that the government of Turkey had placed a US$325 million order for the self-protection electronic countermeasures system for its new F-16s. The name RAPPORT III was replaced by the nomenclature ALQ-178(V). Turkey selected it to equip a major production run of F-16s. First deliveries were made in 1992.

Loral and Kavala (a Turkish holding company) formed a joint venture to produce ALQ-178(V) Self-Protection EW Suites (SPEWS) in Turkey. The joint venture was known as Mikrodalga Elektronik Sistemler (MiKES), and a production facility was operational by 1993. In 1998, MiKES announced that it would manufacture the ALQ-178(V)5 EW protection system for the Turkish Air Force's Block 50 F-16s, rather than simply assemble the systems from components provided by Lockheed Martin (as it did with the ALQ-178(V)3).

In 1993, Loral offered a significantly enhanced ALQ-178(V) (the ALQ-202(V), Loral Autonomous Jammer - LAJ) as an alternative to the terminated ALQ-165(V) ASPJ. The enhanced and repackaged system was offered to both the US Navy and international F-16 and F/A-18 customers. The company offered to pay the cost of a competitive fly-off between the LAJ and ASPJ. Test flights of the ALQ-178(V)3 began at Eglin AFB, Florida, in February 1993. The tests were completed in August.

The ALQ-178/202(V) was offered to South Korea and Egypt for their F-16s, and to Finland and Switzerland for their F/A-18s. In 1994, Finland and Switzerland decided to procure the ALQ-165(V) ASPJ instead in a combined FMS/commercial program. South Korea followed suit in early 1997. The US Navy awarded a contract for the Integrated Defensive Electronic Countermeasure (IDECM) electronic warfare system for the F/A-18E/F in November 1995, eliminating any chance that the ALQ-202(V) would be procured for US F-18s.

Funding

Funding is from platform and O&M funds.

Recent Contracts

No recent contracts over US$5 million have been recorded.

Timetable

Month	Year	Major Development
	1972	RAPPORT II development begins
	1978	RAPPORT II production begins
		ALQ-178(V) RAPPORT III development begins
	1979	RAPPORT II operational evaluations,
		ALQ-178(V) full-scale development begins
Jan	1984	ALQ-178(V) ordered into production
	1985	RAPPORT II production complete
	1986	ALQ-178(V) fully operational
	1989	Turkey selects ALQ-178 for F-16s
	1993	ALQ-202(V) introduced
	1994	Finland and Switzerland select ASPJ
	1995	US Navy initiates IDECM program
Jan	1997	South Korea selects ASPJ for its F-16s
	1998	Production of the ALQ-178(V)5 begins in Turkey
	2001	Estimated end of production

Worldwide Distribution

Belgium uses the RAPPORT II system on its Mirage V.
Israel has installed the ALQ-178(V) system on some of its F-16s.
Turkey selected the ALQ-178(V)3 for its F-16s. The ALQ-178(V)5 version is being produced in Turkey for Block 50 F-16s being produced by TUSAS.

Forecast Rationale

Turkey and Israel were the major supporters of the RAPPORT program. The US Navy's termination of the ALQ-165(V) ASPJ temporarily changed the market attractiveness of the ALQ-178(V)/202(V) on the international scene, and it was hoped that this would open new US market opportunities. Many F-16 users who were to install ASPJ found themselves able to consider a replacement. The ALQ-178(V) was aggressively marketed as an ASPJ alternative to international customers, and the ALQ-202(V) variant was developed for the US market.

The Finnish decision to procure the ALQ-165(V) ASPJ prompted the Swiss to do the same, followed a year later by South Korea. The US Navy decided to purchase the IDECM for its F/A-18E/F, effectively eliminating the major market targeted by the ALQ-202(V).

The ALQ-178/202 is a capable system, but could not compete with the original choice (ASPJ) or totally new IDECM Towed Decoy for new markets. A GAO report praising towed decoys in favor of standard onboard jamming systems prompted many users to consider switching to the new technology, further eroding the overall internal jammer market.

Turkish orders supported production of the ALQ-178(V)3. Developers marketed the system to other international F-16 users in an attempt to capitalize on their need to find a replacement for the ALQ-165(V) ASPJ, but key users decided on the ALQ-165(V), negating the impact of this effort.

The opportunities for any significant new ALQ-178/202(V) procurement are limited. Support will continue for systems in the field.

Ten-Year Outlook

No further production expected.

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