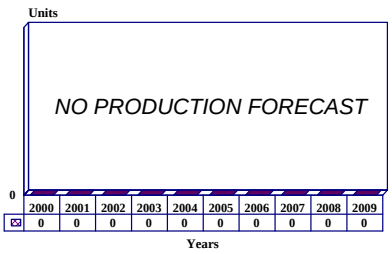
ALE-40(V) -Archive 02/2001

Outlook

- In service, with ongoing logistics support
- Widely used countermeasure dispenser systems
- Common in older aircraft

10 Year Unit Production Forecast
2000-2009



Orientation

Description. Airborne chaff and flare dispenser system.

Sponsor

US Air Force
AF Systems Command
Aeronautical Systems Center
ASC/PAM
Wright Patterson AFB, Ohio (OH) 45433-6503
USA
Tel: +1 513 255 3767

Contractors

BAe Systems – North America
BAe Systems Aerospace
6500 Tracor Lane
Austin, Texas (TX) 78752-2070
USA
Tel: +1 512 929 2884
Fax: +1 512 929 2320
(Prime)
[FormerlyMarconi North America Inc, Marconi Aerospace]

Raytheon Systems Company
Sensors & Electronic Systems
P.O. Box 660248
Dallas, Texas (TX) 75266-0248
USA
Tel: +1 214 661 1000
Fax: +1 214 661 8508
(Sequencer switches)

Per Udsen Co Aircraft Industry AS
Fabrikvej 1
8500 Grenaa, Denmark
Tel: +45 86 32 19 88
Fax: +45 86 32 14 48
(PIDS & C-130 suites)

TERMA Elektronik AS
Hovmarken 4
DK-8520 Lystrup, Denmark
Tel: +45 86 22 20 00
Fax: +45 86 22 27 99
(Sequencer switch upgrades & PIDS)

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

Total Produced. Through 1999, an estimated 7,101 units had been produced.

Application. AlphaJet, A-7, A-10, AC-130, Buccaneer S-2, C-130, C-141, F/RF-4, F-5E/F/N, F-16, F-104, F/FB-111, B-1B, HC-130, MB-339, Harrier GR3/GR5/GR7, Hunter, Mirage F-1, Mirage 3.

Price Range. The cost is approximately US$35,000 per unit.

Technical Data

	Metric	US
Dimensions		
Weight		
ALE-40(V)1,2,3:	58 kg	128 lb
ALE-40(V)4,5,6:	28 kg	62 lb
ALE-40(V)10:	177 kg	90 lb
ALE-40(V)11:	49 kg	108 lb
ALE-40(N):	32 kg	71 lb
TADS		
Pylon mount:	58 kg	128 lb
Internal mount:	28 kg	62 lb
M-130:	28 kg	62 lb

Characteristics	
Typical configuration:	Four dispensers Chaff/flare Programmer Cockpit Control Unit
Payload capability:	RR-170/AL chaff RR-180/AL chaff MJU-7B flares MJU-10B flares M-206 flares
F-4 Pylon Mount - ALE-40(V)1, 2, 3:	120 chaff bundles, 30 flares
F-16 Internal Mount - ALE-40(V)4, 5, 6:	60 chaff bundles, 30 flares
A-10 Internal Mount - ALE-40(V)10:	480 chaff bundles, 240 flares
F-5E/F Skin Mount - ALE-40(V):	60 chaff bundles, 30 flares
F-5N Skin Mount (Netherlands) - ALE-40(N):	60 chaff bundles, 60 flares
F-104 Skin Mount - ALE-40(N):	30 chaff bundles, 30 flares
A-7D Internal Mount - ALE-40(V)11:	120 chaff bundles, 120 flares
GR Mk 5 Harrier - ALE-40(V):	60 chaff bundles, 30 flares
Army Rotary Wing - M-130:	30 chaff bundles, 30 flares

Design Features. The ALE-40(V) dispenses chaff cartridges and infrared decoy flares, and is deployed onboard a variety of tactical aircraft. It can be configured into various combinations and mounted on pylons, on the skin of the aircraft, or internally. The ALE-40(V) usually has four dispensers, a chaff/flare programmer, and a cockpit control unit (CCU).

In a typical installation, one dispenser is mounted on each side of the inboard weapons hardpoint pylon. The dispenser includes an aerodynamic nose fairing, mounting plate and detachable cartridge magazine. Each dispenser carries up to 30 RR-170 chaff cartridges. Mounted on the outboard pylon, the dispensers can carry 15 MJU-7/B IR flares. This installation does not take up a weapon mounting point.

The Consolidated Cleanup Program (CCUP) backfitted ALE-47(V) Digital Sequencer Switches into the ALE-40(V). The new sequencers make a dispense interval of less than five milliseconds possible. They allow for one in-flight-selectable and two software-programmable, operator-activated dispense programs; one for chaff and one for flares.

Operational Characteristics. The ALE-40(V) is part of a self-protection scheme which can dispense flares, chaff, or select active expendables to decoy surface-to-air missiles away from an aircraft. This is needed to counter the proliferation of missiles among potentially hostile forces around the world.

When a missile attack is detected by the pilot or radar warning system, expendables are dispensed in selected

quantities and sequences to produce a pattern designed to provide the attacking missile a more attractive target than the aircraft. The C-130 installations are tailored to protect low-flying tactical airlift missions from heat-seeking missiles common around the world.

Variants/Upgrades

ALE-40(V)1, 2, 3. This is a pylon mount configuration for F-4 aircraft. It consists of four dispensers, a chaff/flare programmer, and CCU. One dispenser is mounted on each side of the inboard armament pylons.

ALE-40(V)4, 5, 6. This is the *internal, flush-mounted* system installed on F-16s. It has a CCU, chaff/flare programmer, sequencer switch, EMI filter and two dispensers mounted internally in the aft fuselage. An adaptation of this variant is installed on selected C-130 aircraft on the international market. The typical Per Udsen Co installation combines eight ALE-40(V) magazines on either side of the aircraft with an ALE-69(V) Radar Warning receiver.

ALE-40(V)7, 8, 9. This *semi-internal mount* variant is installed on F-5E/F aircraft. It consists of a CCU, chaff/flare dispenser, sequencer switch, EMI filter, and one dispenser with two magazines mounted in the belly of the aircraft near the left wing root.

ALE-40(V)10. This in an *internal mount* installation tailored for the A-10.

ALE-40(V)11. This *internal, flush-mounted* system is installed on the A-7.

ALE-40(N). This is a special variant designed for the Royal Netherlands NF-5 and consists of a CCU, chaff/flare programmer, and two dispensers. It is *skin mounted* on the aft fuselage. A similar installation was used on the F-104.

TADS. In 1984, Tracor introduced the ALE-40(V) Threat Adaptive Dispenser System (TADS) as a form, fit, function replacement for the older ALE-40(V) dispenser models. The TADS variant features automatic, semi-automatic, and manual threat-adaptive characteristics.

In the *automatic mode*, the system initiates the best calculated dispensing programs. The *semi-automatic mode* provides the best dispensing plan, but the chaff or flares are dispensed manually. The *manual mode* allows the pilot to initiate a manually selected program.

M-130. The Aircraft General Purpose Dispenser uses ALE-40(V) technology in a lightweight system for US Army tactical rotary or fixed-wing aircraft. A modular design makes for configuration flexibility with common modules and platform-specific cabling and adapters. The system uses M-1 chaff and M-206 flares in 30- or 60-unit payload configurations. It was specifically designed for the unique flight dynamics of helicopters.

ADDS. Tracor's Israeli subsidiary, ROKOR, manufactures a form, fit and function replacement for the ALE-40(V) known as Advanced Decoy Dispenser System (ADDS), for the Israeli Air Forces. ADDS 1 is used on F-15s and the ADDS 2 on F-16s.

Pylon Integrated Dispenser Station (PIDS). A Danish team of Per Udsen Co and TERMA Elektronik AS produces a modified F-16 pod-mounted system, which combines ALE-40(V) dispensers with an ALR-69(V) radar warning receiver and an ALQ-162(V) radar jammer. It is in production for the Danish Air Force and has been evaluated by the US Air National Guard, although budget shortfalls have delayed a spending decision.

The PIDS can expand the expendable-carrying ability of the F-16 without major aircraft modifications. It increased the chaff/flare cartridge capacity by 150 percent (from two to five magazines on the F-16A/B and from four to seven magazines on the F-16C/D Block 40+).

To produce a PIDS, a standard F-16 weapons pylon is stripped and the EW components installed internally. The system uses three standard dispenser magazines and two solid-state Enhanced Sequencer Switch Assemblies. The pylon units are operated by the existing ALE-40(V) programmer and cockpit unit. Chaff and flares are dispensed outward from wing stations 3 and 7 and, according to the manufacturer, have better dispersal blooming characteristics than dispensers mounted on the aft fuselage.

C-130 Self-Protection. The Per Udsen Co also produces an ALE-40(V) and ALR-69(V) combination self-protection suite for Dutch C-130 aircraft. It is being made available on the international market as well. The system installs eight standard ALE-40(V) chaff and eight flare magazines on the aircraft fuselage just forward of the paratroop door. Four sequencers and two EMI filters operate the system. It interfaces with an ALR-69(V) radar warning receiver system carried in wing-tip pods.

Program Review

Background. The original ALE-40(V), a militarized version of the TBC-120 countermeasures dispenser, was designed for internal, semi-internal, external and pylon mounting. The original F-4 version was designed in the early 1970s and used four dispensing units fitted on either side of the inboard weapon pylons. Later versions employed two or four skin-mounted, internal, or semi-internal dispensers located wherever practical on the aircraft.

The ALE-40(V) grew from a Vietnam requirement to counter a growing threat from radar-guided missiles. It was originally developed to dispense chaff and later modified to dispense infrared flares.

By 1977, it had been sold to numerous European, South American, Asian and Middle Eastern countries under the F-16 and F-5 FMS programs. Pains-Wessex, a British Company, manufactures decoy flares for the ALE-40(V)s used by the Royal Air Force and three other NATO countries.

The Air Force, under the A-10 modification line, received US$4.3 million in FY84 to begin a corrosion fix for the ALE-40(V). Corrosion caused significant ALE-40(V) component failures and equipment breakdowns, thus affecting mission capabilities. The Air Force also received US$12.6 million in the FY85 budget to modify 425 ALE-40(V)s on A-l0, A-7, F-4, F-l6 and HH-53 aircraft.

In May 1985, a Danish alternative to a sequencer switch used in the ALE-40(V) and ALE-47(V) was tested against the US-produced component. The switch was one of 19 items to be tested as part of a DoD program to consider NATO products as alternatives to US-made products.

In October 1990, E-Systems announced that it had teamed with the Danish company TERMA Elektronik AS to produce solid-state enhanced sequencer switches for the ALE-40(V). The US Air National Guard procured 400 of the new components in January 1990, following a 220-switch order from the Royal Netherlands Air Force.

In August 1993, the Air Force awarded Tracor a contract for 3,800 ALE-47(V) sequencer switches to upgrade the reliability, maintainability, and effectiveness of the countermeasures dispenser. The new sequencer switches could reduce the ALE-40(V) decoy dispersing interval to under five milliseconds, provide squib misfire detection and correction, and make it possible for the ALE-40(V) to dispense RR-180 dual chaff units. It will also be possible to dispense up to four decoys simultaneously and offer two or more software-programmable, operator-activated dispensing programs. The Air Force plans to procure 10,000 to 14,000 sequencer switches.

Airlift aircraft flying with Air Force Reserve and Air National Guard units historically carried no protection. The Gulf War, the Balkan conflict, and Somalia operations generated plans to install protection in 43 Air Force Reserve C-130s and 14 C-141s. In FY95, this broke some of the funding logjam that has held up these actions in the past.

The ALE-40(V)s would be combined with the AAR-47(V) missile warning system. The goal was to provide self-protection for 109 AF Reserve airlifters.

In mid-1993, the Air Force announced that it intended to procure three sets of Electronic Warfare Management Systems (EWMS) from TERMA for the Ogden Air Logistics Center. The contract included options for three more systems. Delivery was required by late October 1993.

In late 1997, the ALE-40(V) got caught up in an ALE-47(V) bid protest and contracting fight. An additional 3,219 digital sequencers had been added to the contract to support ALE-40(V) upgrades under the Consolidated Clean-Up modification program. But at the last minute, the Air Force, for budgetary reasons, dropped the added sequencers from the requirement.

Several smaller companies generated a series of protests over the award of the overall contract to (then) Tracor Inc; the General Accounting Office upheld the award initially, but eventually settled the protested issues. None of the pending actions involved renewing the digital sequencers requirement.

In September 1998, the Air Force of Denmark completed the integration and flight testing of Northrop Grumman Corporation's AAR-54(V) imaging ultraviolet passive missile approach warning system (PMAWS) on its F-16 midlife update (MLU) aircraft. The Belgian Air Force participated in an observer role.

The test program completed many performance measurement activities during the one-year project to validate the feasibility of passive missile warning for fighter aircraft. With these activities successfully accomplished, Denmark, the Netherlands and Norway are confident they can move forward with their respective missile-warning acquisition plans.

A total of 20 flights of the AAR-54(V) were conducted in a pylon-mounted self-protection suite installed on a Royal Netherlands Air Force F-16 MLU aircraft. The system was controlled by an ALQ-213(V) Terma

Elektronik Electronic Warfare Management System and installed into a Per Udsen pylon-integrated dispenser system. Missile threat data were displayed on the ALR-69(V) radar warning receiver. PMAWS alert information was routed to the onboard ALE-40(V) countermeasures dispensers.

Full system operation flight testing for both aircraft certification and missile warning false alarm and clutter rejection performance was completed under European operating conditions in airspace over several countries.

Electronic Warfare Cockpit Control. In an April 11, 1996 issue of *Commerce Business Daily*, the Air Force announced that it was conducting a market survey to identify potential sources for delivery of a fully developed, fully tested, non-developmental item (NDI) or commercial off-the-shelf (COTS) Electronic Warfare Cockpit Control (EWCC) system for the F-16C/D, A-10A and 0-10A aircraft.

The purpose of the EWCC System is to provide displays, controls, and cues to manage the Electronic Warfare Avionics of the various aircraft. The system would control existing and future EW avionics through a reduced number of cockpit units. The EWCC's major role is managing the flow of control signals and data into and out of the EW avionics suites comprised of the following systems: ALE-40(V), ALE-47(V), AAR-47(V), ALR-69(V), ALR-56M, ALQ-131(V), ALQ-184(V) Pylon Integrated Dispenser System (PIDS), and Modular Reconnaissance Pod (MRP). Future avionics for additional suites will include the ALQ-157(V), ALQ-162(V), and ALQ-172(V).

TERMA Elektronik AS of Denmark was awarded a 1996 contract for up to 800 ALQ-213(V) EMWS units for the USAF. The system was already in use with six NATO countries in F-16s, C-130s, C-160s, and Fokker patrol/surveillance aircraft.

Besides integrating, managing, and controlling the EW suite, a single, miniaturized Control Panel and EW Prime Indicator replace the ALE-40(V) Cockpit Control Unit and ALE-40(V) Programmer and four other EW cockpit units. The ALQ-123(V) provides a constant indication of the number of useable decoys remaining as well as low-level cues and indications of dispense system activity.

DoD completes BAe-GEC Marconi review. The Department of Defense reviewed the proposed acquisition of GEC-Marconi Electronic Systems by British Aerospace plc, and announced on November 22, 1999 that it would not block the European aerospace company's takeover of the parent to a major US defense company. The agreement would have to ensure competition and innovation, according to defense officials. Among the requirements for approval was that Marconi's shipyards and avionics businesses remain separate subsidiaries available to all potential contractors on identical terms to BAe. Some security issues had to be ironed out as well.

"The cooperative spirit demonstrated by US and UK authorities is an important example of the role allied governments can play in facilitating beneficial trans-Atlantic collaboration and integration," the Pentagon said in a release.

This created an interesting situation. The Administration had been encouraging greater trans-Atlantic cooperation and better access to Europe for the US defense industry. This was supported by people like Dr. James R. Schlesinger, former Secretary of Defense, Director of Central Intelligence (DCI), Energy Secretary, and Presidential advisor. Speaking at a Washington luncheon sponsored by the British-American Business Association, Schlesinger said that increased trans-Atlantic cooperation is a must. Congress, on the other hand, had been leery of cooperation and relaxing export control limits on systems and technology, fearing giving non-US companies an advantage in the market. There has also been a growing reluctance in Washington to allow defense companies to merge into singular giants, evidenced by the refusal to approve a merger between Lockheed Martin and Northrop Grumman.

The merger was completed November 30, 1999. The new company was named BAe Systems. Marconi North American became BAe Systems-North America (BAe Systems-NA).

Funding

ALE-40(V) units are procured under operations and maintenance funding as spare and replacement units for the aircraft fleet. They are not carried as separate line items, and no significant research and development activities are currently funded.

Recent Contracts

No recent DoD contracts over US$5 million recorded.

Timetable

Month	Year	Major Development
	1974	Design commenced on chaff systems for USAF F-4 aircraft
	1977	MJU-7B infrared flares integrated into system
	1979	Tracor begins supplying ALE-40(V)s for USAF A-10 and F-16 aircraft
	1984	ALE-40(V) TADS production begins
	1987	SATIN kits unveiled for Lockheed C-130
Feb	1993	ALE-47(V) production begins
Dec	1996	ALQ-213(V) contracts for USAF

Worldwide Distribution

The ALE-40(V) is in service with the following air forces/aircraft types:

Bahrain - F-16
Belgium - F-16
Denmark - F-16
Egypt - F-16
Germany - AlphaJet, F-4
Greece - A-7, F-4, F-16
Indonesia - F-16
Israel - F-16
Japan - F-4
Morocco - F-5, Mirage I
Netherlands - F-16
Norway - F-5F, F-16
Oman - Jaguar
Pakistan - F-16
Portugal - A-7
Republic of China - F-5E/F
Singapore - F-16
South Korea - F-16
Spain - Mirage I, Mirage III
Switzerland - Mirage III, F-5
Turkey - F-16
Thailand - F-5
United Kingdom - Buccaneer, C-130, CH-47, GR Mk3/5/7 Harriers, Sea Harrier
United States - A-10A, C-130, C-141, F-4, F-5, F/FB-111, F-16, MC-130H, RF-4C
Venezuela - F-16

Forecast Rationale

The ALE-40(V) is standard on most older USAF aircraft and popular on the foreign market. The system is simple yet adaptable, and upgrades have focused on maintenance and reliability in the dispensing components to overcome the problems of corrosion from the cartridges. It is important that switches and sensors transmit the correct cartridge status to the Controller. A new solid-state sequencer switch takes a new-technology approach to overcoming deficiencies in the system.

Countermeasures are crucial to aircraft survival. If an aircraft countermeasures dispenser is deemed inoperative, the aircraft is pulled from the mission. In post-mission interviews during Operation Desert Storm and Balkan operations, many pilots said that using chaff and flares prevented Iraqi surface-to-air missiles and radar-controlled guns from inflicting damage to US and coalition aircraft.

Changes in the international threat climate have increased the need for protection of tactical aircraft from the shoulder-fired heat-seeking missiles that are commonplace in the areas where conflict is likely to break out.

This is a much-needed protection and a large market exists for the ALE-40(V)'s capabilities. It is especially important for the airlift platforms which cannot outmaneuver missiles. Special Operations C-130 Aircraft are being configured with a missile warning system and countermeasures dispenser. The pod-mounted expansion plans are also popular with many international F-16 users since it is a relatively inexpensive and quick way to increase the capacity for chaff and flares on existing aircraft.

New European equipment and the ALE-47(V) advanced countermeasures system are the ALE-40(V)'s major competitors in the marketplace. Future applications for the ALE-40(V) are limited because of its older technology. The system is capable and flexible, but newer equipment has capabilities more appropriate for the next-generation aircraft. The ALE-40 is not compatible with the "smart" or active expandable jammers whose numbers are steadily increasing in the inventory; these jammers will be an important part of future electronic combat suites.

The ALE-47(V) was designed specifically to interface with the microprocessor-based warning equipment and the automated aspects which will be characteristic of the new platforms. It will not be retrofitted into many older platforms which carry the ALE-40(V) because the modifications required are extensive and expensive. The ALE-47(V) is being installed on new-production F-16s and retrofitted to Block 40 aircraft during depot overhaul. The ALE-47(V) is not planned for any F-16s older than the Block 40s.

The large number of dispensers fielded need ongoing support, and additional units are required for repairs and spares, and to support the Dutch PIDS and C-130 units. C-130 requirements will support some production; but not all of the pending installations will require new-production ALE-40(V)s because of an available stock of hardware.

The spare and repair parts market will continue through the remainder of the reporting period and well into the next decade. The Air Force continues to release notices for ongoing component procurement.

Ten-Year Outlook

No further production is expected.

* * *