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DESTROY

Electronic Warfare Forces Study — Iraq ~~(C/NF)~~

Defense Intelligence Reference Series

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SUMMARY

Iraq demonstrated the capability to use its electronic warfare assets effectively during the war with Iran. Iraq was able to identify Iranian ground forces, track deployments, and determine tactical intentions through the use of passive electronic warfare means. The Iraqi Air Force used jamming against Iranian air intercept and ground-based target acquisition radars. Additionally, the Air Force used antiradiation missiles against Iran's target illuminator and ground-controlled-intercept radars.

Iraq's electronic warfare inventory includes Soviet equipment such as the KING PIN, the TUB BRICK, and the SWING BOX. Airborne jamming assets include the SPS-141. Western equipment includes a Japanese communications intercept system and French-made Caiman and Remora airborne jammers. Iraq gained proficiency with its equipment as the 8-year war with Iran progressed, yet never used its assets to their full potential.

Iraqi Army electronic warfare assets are located primarily within the Technical Equipment Directorate of the Logistics and Organizational Branch of the Armed Forces General Headquarters. This directorate operates, maintains, and employs electronic warfare assets within Iraq, although equipped primarily with Soviet radio electronic combat equipment. Placing electronic warfare assets into a separate organization, apart from the control of the combat commander, is similar to the procedure used in the United Kingdom, and consolidates limited equipment and personnel assets.

Employment of airborne electronic warfare assets is the responsibility of the Operations Branch of the Iraqi Air Force (IAF). Although the IAF Technical Equipment Command provides maintenance and logistics support for electronic warfare equipment, unlike the procedure of the Iraqi Army, it is the operational Air Force commander who makes the decision on electronic warfare employment.

Iraq does not have an electronic warfare capability on its few naval assets.

Iraqi ground-based electronic warfare strengths include the interception of Iranian tactical communications. Iraq can locate and identify Iranian ground forces units, track force deployments, and determine unit intentions. Iraq deviates from Soviet use of radio-electronic combat equipment by using its ground-based jamming assets conservatively. Accordingly, despite Iraq's capability to intercept and identify Iranian tactical communications, it used its jamming assets sparingly. Iraq physically attacked Iranian communication nets with artillery toward the end of hostilities.

A major weakness is Iraq's inability to intercept Iranian command-level communications. Iran passes high-level decisions via the Iranian troposcatter and microwave systems. Iraq was incapable of intercepting frequencies in the upper ultra-high (UHF) and super high frequency (SHF) ranges in which the troposcatter and microwave systems operated. Iraq can intercept tactical communications operating in the lower UHF ranges and below. Iraq can identify the immediate threat, but has been unable to determine longer-term Iranian intentions.

The IAF effectively employed electronic warfare in defense of its aircraft. Iraq employed self-protection jamming, or the use of an aircraft's own internal or pod jammer to protect the aircraft, and stand-off jamming, or the use of a dedicated jamming aircraft operating just outside the threat envelope to protect aircraft entering the envelope. The few missions employing the use of Iraqi strategic bombers used noise jammers and chaff. Iranian pilot defectors confirmed Iraqi electronic countermeasures effectiveness against Iranian airborne acquisition and fire control radars. Iraq was able to complete many successful missions within the I-HAWK threat envelope. Iraq employed both spot jamming against the primary I-HAWK frequencies and barrage jamming to degrade any change the Iranians made to secondary operating frequencies. The I-HAWK had severe maintenance and spare parts shortages during the last years of the war, contributing to Iraqi jamming success.

[redacted] The Ministry of Transportation and Communications operates a strategic Japanese-built COMINT system. Original system conception included only the interception of internal clandestine and international communications, and a civilian command and control structure. The immediacy of the war caused Iraq to staff the system with technically experienced military officers and to task the system to support the Iraqi tactical war effort. The end of hostilities will allow Iraq to train more civilians to man and maintain the system and task the system against communications of other countries in the region. Should hostilities resume, Iraq would again task against tactical communications.

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FOREWORD

[redacted] The *Electronic Warfare Forces Study (EWFIS) — Iraq*, provides an overview of Iraq's national doctrine for the conduct of electronic warfare (EW) operations and an assessment of the country's ability to employ and maintain EW equipment and resources. The following documents contain information about the force structure of the Iraqi military: [redacted] *the* [redacted]

[redacted]

(U) Refer questions and comments concerning this publication in writing to the Defense Intelligence Agency [redacted]

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1. INTRODUCTION

[redacted] Iraq's electronic warfare (EW) system is a composite of several diverse doctrine and equipment sources. Iraqi ground-based EW organization, as with the overall Iraqi Army structure, is similar to the command and control structure of the British Army. Despite the presence of Soviet advisors and a large amount of Soviet equipment, Soviet practices have only a minor influence on overall Iraqi EW employment. Iraqi air-based EW employment incorporates methods from both the Soviets and from the West, depending on the airframe. Iraq shapes its EW doctrine not only according to [redacted] 25X1 and 6, E.O.13526 [redacted] Iraq's electronic warfare structure is thus unique to its own priorities and needs.

[redacted] Iraq has enough EW assets to support itself in a hostile action against Iran. However, if Iraq should turn its attention north or west, it would have neither the experience, equipment, nor organization to employ its EW assets effectively against Syria, Israel, or Turkey. Syria receives even more equipment and technical assistance from the USSR than Iraq. [redacted] 25X1 and 6, E.O.13526 [redacted] Although Iraq has enough assets to conduct electronic warfare against most Gulf Cooperation Council states, the balance is shifting as Saudi Arabia gains additional EW assets for its fighter aircraft and ground forces.

[redacted] Iraq has temporarily disrupted [redacted] The disruptions have been unintentional, of short duration, and attributed to the Remora electronic countermeasures (ECM) pod mounted on the F-1. [redacted] Iraq cannot sustain electronic warfare against the United States in the Gulf.

25X1, E.O.13526

[redacted] Iraq has three separate EW systems, with tight command and control procedures within each system. The Army and Air Force each has its own electronic warfare support system which operates independently. Additionally, a civilian SIGINT system overlaps its reporting with that of the Army. The Navy will develop an EW capability within the next 5 years upon delivery of contracted Esmerelda Class corvettes and Lupo Class frigates from Italy.

(U) The glossary located in the appendix provides basic electronic warfare definitions. The term EW often means early warning, but not in this text. Categories of equipment include communications or noncommunications. If it interacts with other equipment, such as radio or TACAN, the equipment is considered to be communications equipment. If it operates independently, such as radar, the equipment is considered to be noncommunications equipment.

2. MISSION

[redacted] The mission of the Iraqi electronic warfare organization is to intercept, analyze, manipulate, suppress, or prevent the enemy's, use of the electromagnetic spectrum while ensuring Iraq's own ability to exploit it to its own advantage.

3. ORGANIZATION

[redacted] The highest military echelon in Iraq is the Armed Forces General Headquarters (GHQ). The GHQ branch responsible for EW employment is the Logistics and Organizational Branch. Within this branch is the Technical Equipment Directorate which oversees the procurement and maintenance of electronic equipment, the employment of units, and unit mission tasking for the Army. The Technical Equipment Directorate oversees nine Technical Equipment headquarters, one located at each corps. The Technical Equipment headquarters are responsible for EW unit deployment, unit logistics and maintenance support, and daily unit tasking. These headquarters are also responsible for coordination with Operations, Military Intelligence, and Communications at the corps level to formulate tasking and unit deployments. Each Technical Equip-

Table 1
Definitions (U)

(U) The following US definitions apply to terms used in this study:

1. Electronic Warfare (EW): Military action involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum. There are three divisions within electronic warfare: electronic support measures (ESM), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM). [redacted]

a. Electronic Support Measures (ESM): "That division of electronic warfare involving actions taken under direct control of an operational commander to search for, intercept, identify and locate sources of radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support measures (ESM) provide a source of information required for immediate decisions involving electronic countermeasures (ECM), electronic counter-countermeasures (ECCM), avoidance, targeting, and other tactical employment of forces."

b. Electronic Countermeasures (ECM): "That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum." ECM includes:

(1) Electronic Jamming: The deliberate radiation, reradiation, or reflection of electromagnetic energy for the purpose of disrupting enemy use of electronic devices, equipment, or systems.

(2) Electronic Deception: The deliberate radiation, reradiation, alteration, suppression, absorption, denial, enhancement, or reflection of electromagnetic energy in a manner intended to convey misleading information and to deny valid information to an enemy or to enemy electronic-dependent weapons. Among the types of electronic deception are:

(a) Manipulative Electronic Deception: Actions taken to eliminate revealing, or convey misleading, telltale indicators that may be used by hostile forces.

(b) Simulative Electronic Deception: Actions to represent friendly notional or actual capabilities to mislead hostile forces.

(c) Imitative Electronic Deception: The introduction of electromagnetic energy into enemy systems that imitates enemy emissions.

c. Electronic Counter-countermeasures (ECCM): That division of electronic warfare involving actions taken to ensure friendly use of the electromagnetic spectrum despite the enemy's use of electronic warfare.

2. Signals Intelligence (SIGINT): A category of intelligence information comprising either individually or in combination all communications intelligence, electronics intelligence, and foreign instrumentation signals intelligence, however transmitted.

3. Electronic Combat (EC): Action taken in support of military operations against the enemy's electromagnetic capabilities. EC includes electronic warfare; command, control, and communications countermeasures (C^3CM); and suppression of enemy air defenses (SEAD).

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ment HQ supervises one or more EW units (units are about battalion size). Units usually consist of about four intercept, one direction finding (DF), one jamming, and one signals security company, although this varies according to perceived battlefield need.

[redacted] This structure provides for rigid, highly centralized command and control that limits control of the assets by operational commanders. Although some Army divisions still maintain EW assets within the signal battalion, most EW assets are under control of the Technical Equipment Directorate. Commanders at division level and below funnel their requests for EW support up to Corps through operations or intelligence channels. The Technical Equipment HQ coordinates and prioritizes requests and tasks the individual EW units it controls.

[redacted] Although the Iraqi electronic war-

[redacted]

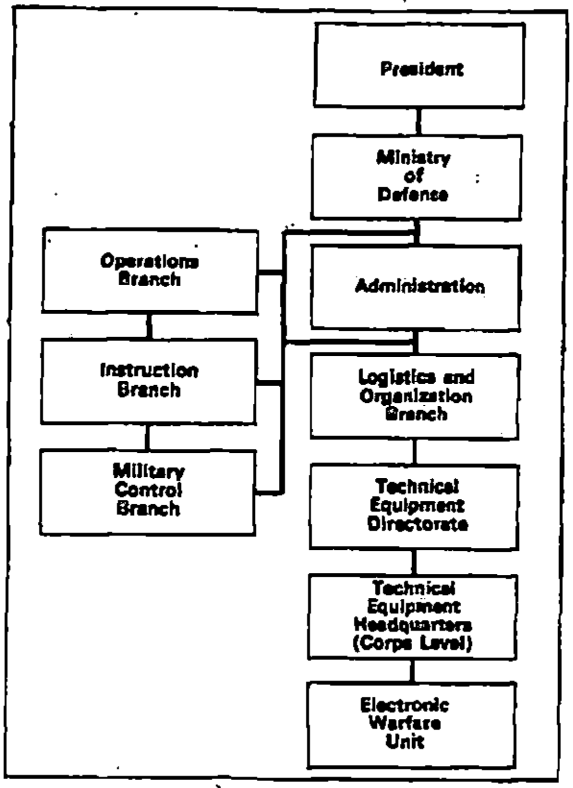

Figure 1. (U) Technical Equipment Directorate Organization.

fare inventory contains many Soviet radio-electronic combat (REC) assets, command and

[redacted] 25X6, E.O.13526

[redacted] On the other hand, the Soviets concentrate REC assets within the Radio-Electronic Warfare Service (REWS) and intercept assets within intelligence or reconnaissance organizations. Soviet Front and each Army-level echelon have subordinate REWS and intercept assets. Each division-level echelon has subordinate intercept assets. Iraqi EW employment differs from that of the Soviets. Iraq concentrates both jamming and intercept assets at the corps-level and subordinates the assets directly under Iraq's Armed Forces General Headquarters. Coordination for operational support to Iraqi unit commanders is through the Technical Equipment HQs and Military Intelligence Bn (MI Bn) at corps-level. This coordination process hampered EW support to combat commanders throughout most of the war with Iran. Noted improvements in EW force employment since 1986 suggest Iraq may have strengthened the coordination process to include coordination between lower Army echelons. However, no known formal lines of communication between divisions and EW units exist.

[redacted] Although there is a single channel of command and control, there are dual channels for reporting EW information. An EW unit reports data collected through ESM, both to the Technical Equipment HQs and also to the MI Bn at corps. The MI Bn disseminates the information to subordinate units and to lower echelon commanders. (See DIA publication, DDB-1100-343-XX, *Ground Forces Intelligence Study — Iraq.)*

[redacted] The employment of EW within the Iraqi Air Force (IAF) falls directly under the control of the Air Force HQ Operations Com-

[redacted]

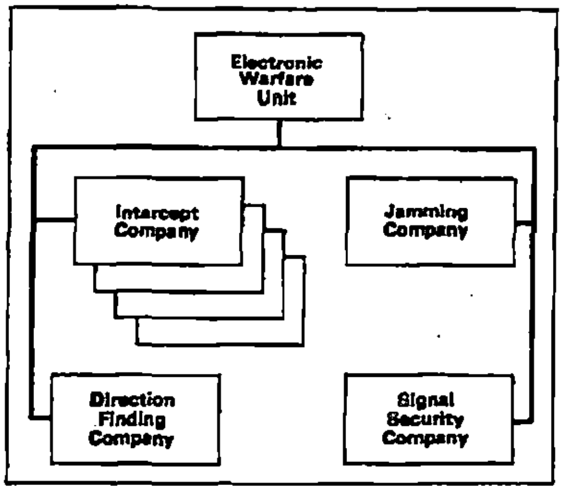

Figure 2. (U) Electronic Warfare Unit Organization.

mand. Command and control procedures fall within the Operations Command, along with other aspects of Air Force mission planning. The Air Force Technical Equipment Command is responsible for procurement, maintenance, and logistic support of equipment, and provides technical personnel to advise operational commanders of EW employment practices. [redacted] EW employment is standard operating procedure during IAF intercept and ground attack missions.

4. CAPABILITIES

a. General

[redacted] Iraq's employment of ground-based electronic warfare assets influenced the outcome of some of the later battles with Iran. Until the last years of the war, Iraq concentrated EW employment on the collection of tactical communications. Lateral dissemination of the information was a problem due to the tight command structure.Battlefield commanders at lower echelons did not always receive needed information of Iranian force employment. Information dissemination improved as the war progressed, and Iraq valued the information it received through its collection assets. Iraq spared jammer usage in order not to disrupt information gathering. As Iraq experienced more battlefield successes, Iraqi EW employment became more aggressive and Iraqi electronic warfare employment of jamming assets began to develop isolated successes.

[redacted] Ground-based SIGINT assets focus on COMINT, although a small ELINT capability exists. Present SIGINT and ESM capabilities allow Iraq to exploit communication signals in the high-frequency (HF), very-high-frequency (VHF), and the lower ultra-high-frequency (UHF) bands. Target emphasis has been on Iran. Also targeted are internal Kurdish groups, and countries neighboring Iraq such as Turkey, USSR, Lebanon, Israel, and Syria. [redacted] 25X8, E.O.13526

b. Employment

(1) Army

[redacted] For most of the war, Iraq fought a defensive war with Iran and used EW conservatively. Therefore, Iraqi ground-based EW employment contains very little of the offensive elements of the Soviet REC doctrine as referenced in *Soviet-Radioelectronic Combat-Capability* (U), DST-1730S—009-XX. The definition of Soviet REC is an operational support measure for systematically detecting and locating enemy control and reconnaissance resources with the aim of disrupting them through a combination of firepower and jamming. REC also includes measures designed to protect Soviet control from similar disruption by the enemy and measures designed to counter enemy reconnaissance. Iraqi EW employment lacks elements of Soviet offensive REC practices. During battle, Iraq did not use massive barrage jamming, rapid frontline EW mobilization units, or extensive radar camouflage.

[redacted] Iraqi EW employment was simpler than Soviet REC doctrine prescribes. An EW unit of battalion size was attached to each corps. Units from the battalion deployed to secure areas before hostilities began. EW units then located, identified, and reported Iranian unit and command post deployments. Iraq has demonstrated an excellent capability to plot Iranian ground movements accurately. Iraq has done a credible job of network analysis of Iranian tactical communications. Target emphasis is on rear-echelon communication nets, frontline artillery nets, and special forces communication nets. Iraqi EW units have been able through COMINT to identify Iranian tactical battlefield intentions, although Iraq did not take full advantage of the information until just before the end of the war. Cumbersome command, control, and reporting procedures caused delays in the dissemination of information to and from the high-level decisionmakers. Since 1986, command and control procedures began to allow for better lateral exchanges of information between division commanders and the EW unit. Perishable information began to reach the division and battalion level in time for immediate decisionmaking.

[redacted] Tactical unit language capabilities include Farsi, Kurdish, Turkish, and Arabic. EW units had the capability to decode tactical Iranian encrypted communications.

[redacted] A secondary role of the EW unit is to monitor Iraqi command and control nets to enforce emission control (EMCON) measures. Due to higher wartime priorities, Iraq had to limit the time spent in monitoring its own communications. Iraq has plans to improve emission control measures by forming an EW unit for this purpose. The status of this unit is unknown.

[redacted] Iraq concentrated its forces on the exploitation of Iranian communications. This allowed Iraq to identify Iranian units and plot their movements. Jamming operations were minimal to ensure continued collection of information. Toward the end of the war, Iraq began to make better use of its ground-based jammers with highly successful results, although collection of Iranian communications remained the top priority. These successes included the jamming of Iranian artillery communication nets, causing ineffective use of Iranian artillery. The jamming of rear-echelon communication nets caused the disruption of high-level command and control. This disruption slowed logistic support to frontline commanders during critical phases of battle.

[redacted] Iraq employed limited ECCM techniques during the war with Iran. Iraq tried to limit radio communications whenever possible. In 1986, Iraq bought the Jaguar frequency hopping radio.

[redacted] Iraq has dedicated ground-based EW units for the jamming of enemy airborne radars and communications. Assets include the KING PIN and TUB BRICK. Iraq placed these assets primarily at military and economic installations. This capability became less important as the war progressed and the capabilities of the Iranian Air Force deteriorated. Additionally, Iraq deployed variants of the R-834 aircraft communications sets with its warning and control regiments.

[redacted] All ground and airborne jammers and intercept equipment have a capability to intercept signals within the equipment's operating parameters. Information can provide early warning information by establishing communication procedures and integrating the information into the air defense network. It is unknown if Iraq employs its assets in this manner; however, Iraq deploys TUB BRICK, KING PIN, and SWING BOX near early warning and surface-to-air missile sites. The use of these assets as passive detectors for early warning information cannot be ruled out.

[redacted] There are reports of Iraqi helicopter use in a jamming role. Iraq could equip some HIP and HIND helicopters with Soviet- or Italian-produced jammers to provide protective jamming support for other helicopter operations near the FEBA.

[redacted]

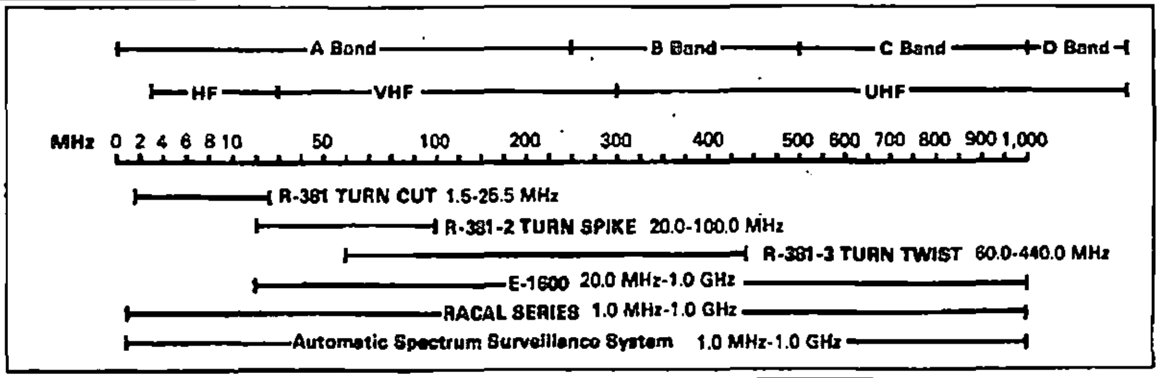

Figure 3. [redacted] *Iraq Electronic Support Measures Frequency Spectrum* [redacted]

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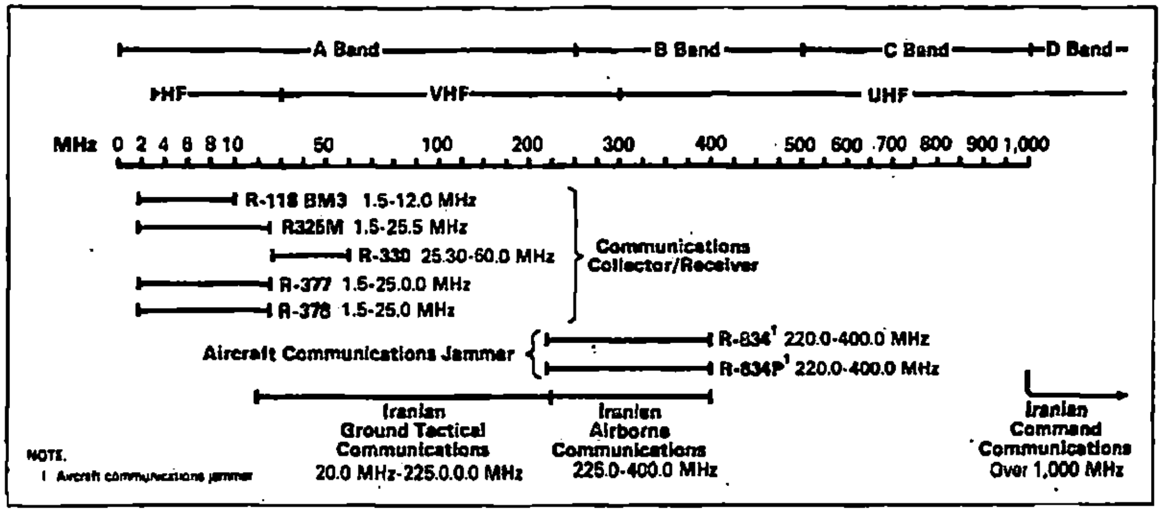

Figure 4. Iraq Electronic Warfare Frequency Spectrum

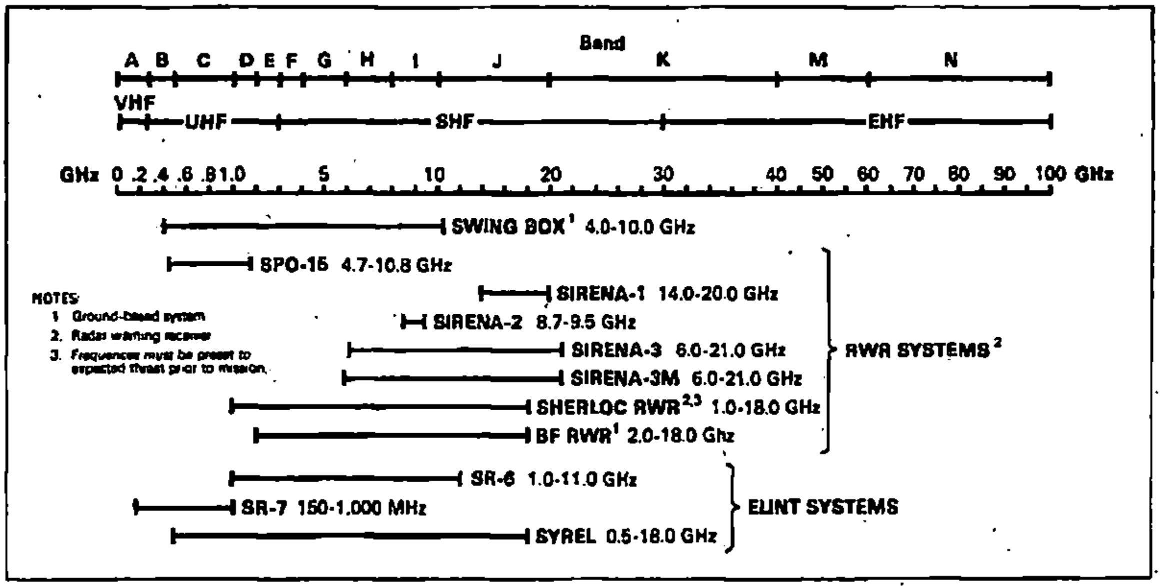

Figure 5. Iraq Electronic Support Measures Frequency Spectrum

[redacted]

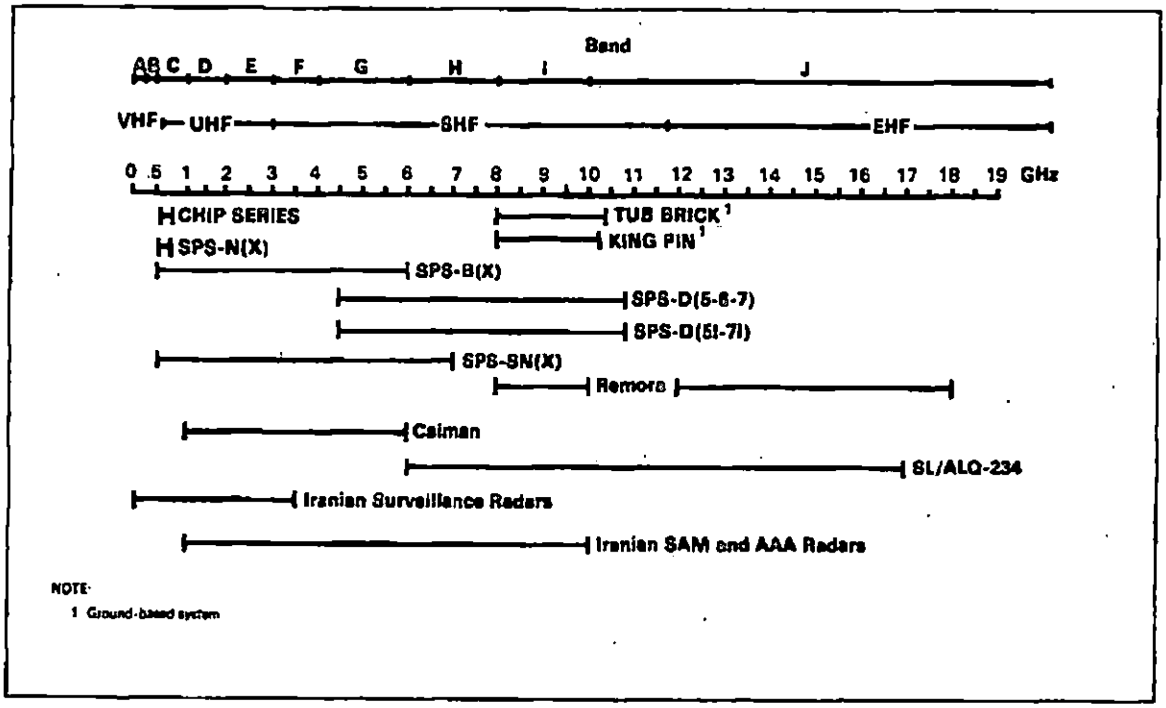

Figure 6. [redacted] *Iraq Electronic Warfare Frequency Spectrum* [redacted]

Table 2
Summary of EW Units (U)

113TH BASRAH EW UNIT
114TH BAGHDAD EW UNIT
115TH AMARAH EW UNIT
116TH EW UNIT
117TH KIRKUK EW UNIT
118TH EW UNIT
120TH EW UNIT
600TH BASRAH EW UNIT
620TH EW UNIT
621ST EW UNIT
622ND AMARAH EW UNIT
623RD EW UNIT
624TH EW UNIT
625TH DOHUK-ARBIL EW UNIT
128TH EW UNIT
The following units may have a communication jamming capability:

4TH Warning and Control Regiment BALAD
22ND Warning and Control Regiment KIRKUK
23RD Warning and Control Regiment Al AMARAH
32ND Warning and Control Regiment MOSUL

[redacted]

(2) Air Force

(a) General

[redacted] The ultimate purpose for air force employment of EW, in any country, is to defend its aircraft in a hostile environment. It became clear early in the war that Iraq was unable to defend its aircraft over Iranian airspace. Iraqi pilots referred to Iran's ground-based air defense mainstay, the I-HAWK surface-to-air missile system, as "death valley." The F-14, armed with Phoenix air-to-air missiles (with a 65-NM maximum range), could launch a missile and begin its return to base before an Iraqi aircraft came within its own intercept range. Reports of the jamming of Iranian threat radars were rare. Iraq adopted a total threat avoidance policy after unacceptable losses of aircraft at the beginning of the war. Threat avoidance included exceptionally high bombing missions, radar avoidance through terrain

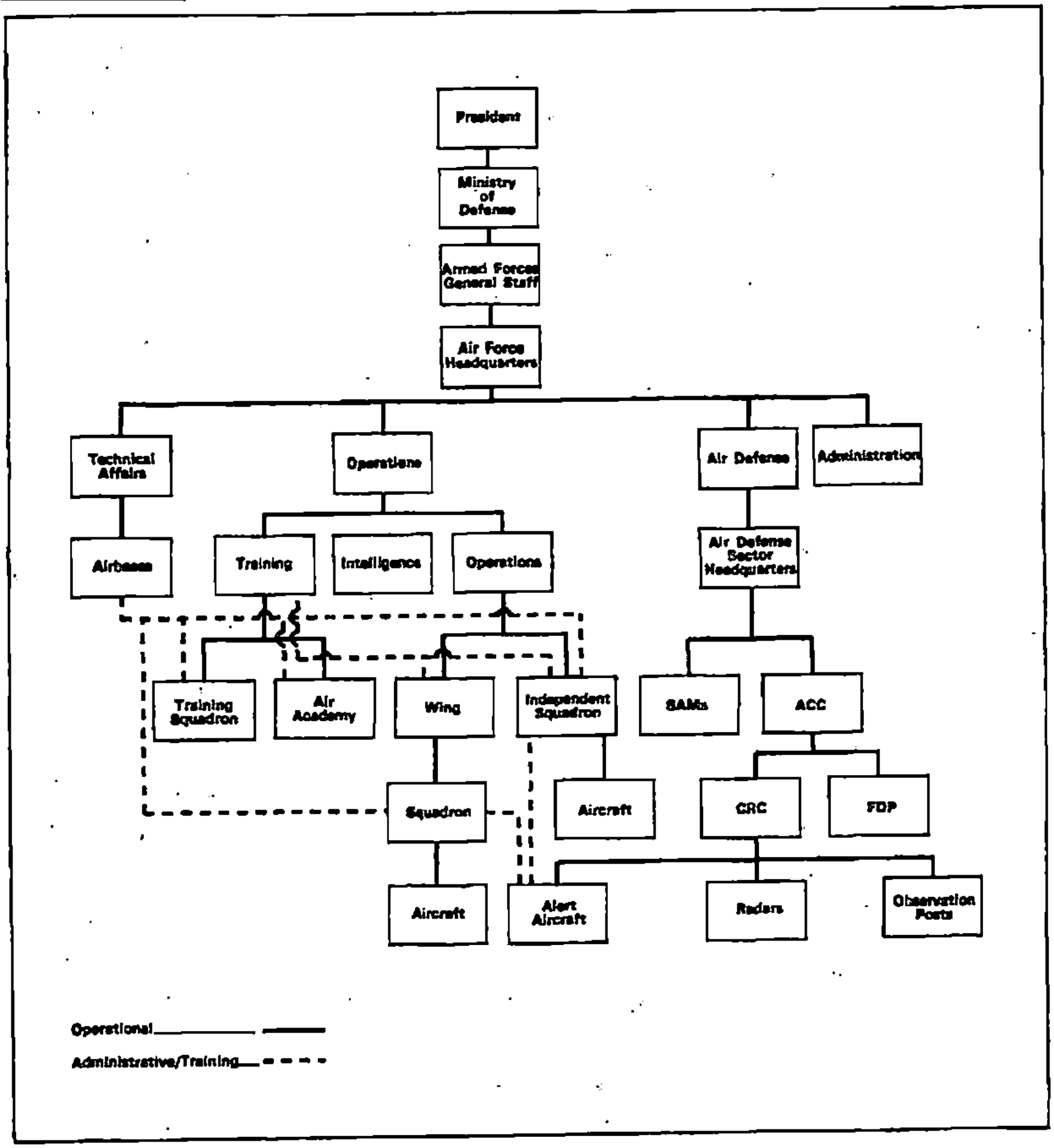

Figure 7. Iraqi Air Force Organization.

masking, and flying outside of effective radar ranges. This threat avoidance policy continued through most of the Iran-Iraq War, despite significant improvements in Iraqi air-based EW assets and the deterioration of the Iranian air defense structure.

[redacted] During the war with Iran, Iraq acquired sophisticated technological equipment that vastly improved its electronic warfare capability. By 1986, Iraq conducted sporadic low-level attacks against Iranian economic facilities, although it never abandoned high-level attacks completely. Iraq suppressed defenses in these low-level attacks through various methods, including destruction of GCI (ground control intercept) and target acquisition radars, the avoidance of GCI radar coverage, the use of radio silence and other emission control procedures, and the use of EW pods and chaff.

(b) Chaff

[redacted] At the onset of the war, Iraq made extensive use of chaff in airstrikes against population centers to include Tehran, Tabriz, and Ahvaz. The success of this tactic is not known. Although the I-HAWK SAM system has ECCM features designed to defeat chaff, an inexperienced radar operator may not realize the effects of jamming and may not follow the proper procedures to overcome it. It is highly probable that the success of chaff jamming varied with the experience level of individual radar operators.

(c) Antiradiation Missiles

[redacted] In mid- to late-1982, Iraqi aircraft began launching French Martel or AR-MAT antiradiation missiles (ARM) against I-HAWK HPIRs (high power illuminator radars) and PARs (pulse acquisition radars). Iraqi attack formations consisted of three to five aircraft; two to four MiG-23 aircraft flew as decoys for a single ARM-carrying Mirage flying in trail. The MiG-23 flew at ranges up to 40 NM from the I-HAWK site. Although Iran developed countermeasures to the ARM for its target acquisition radars, Iraq experienced success with this tactic. Iran had only a limited amount of spare parts for its electronic systems. Despite some acquisition of parts during the US arms embargo, Iran was unable to maintain more than a third of the needed radars. Destruction of I-HAWK radars during the early years of the war played a significant part in limiting the number of systems available to defend economic targets and the battlefield defense. Attacks continued sporadically throughout the war. The Martel also has an optional guidance head for use against frequencies of early warning radars, and Iraq has had success in the destruction of GCI-related radars. The Iraqis have also used the Soviet AS-9 antiradiation missile. Su-22s, armed with the Soviet AS-9, would fly search-and-destroy missions on Iranian threat radars over the battlefield. (For more information see [redacted]

[redacted] Iraqi antiradiation search and destroy missions were sometimes unsuccessful due to the lack of Iranian radar activity. Iraq would then occasionally drop bombs on known occupied battlefield I-HAWK sites.

(d) Airborne Jammers

[redacted] Iraq successfully used the Remora ECM pod, the SPS-141, and chaff systems against Iranian air-to-air missile attacks. A former Iranian F-4 pilot claimed he was unable to maintain lock-on with his cockpit acquisition radar for more than 3 seconds when faced against an F-1 with a Remora pod. The use of the F-1 Sycomor chaff/flare dispenser decoyed Iranian Sidewinder missiles.

[redacted] Since mid- to late-1983, almost every FITTER strike formation included aircraft equipped with an SPS-141. The SPS-141 is a repeater jamming system that breaks angle track in systems employing either pulsed or continuous wave illumination. System employment is against tracking radar systems and either active or semiactive missile seekers. Strike formations are typically composed of a flight of four aircraft, each consisting of two elements of two aircraft. The lead of each element carries the pod for the protection of the section. The pod is activated about 5-10 NM outside the maximum range of the threat weapon system and deactivated when clear of the threat.

Table 3
Airborne Electronic Warfare Assets[1] (U)

BADGER A SIRENA-2 ASO-2B PRL-23	BLINDER A/D SIRENA-2 ASO-2B APP-22
FOXBAT A/B/C/E SIRENA-3M SPS-D(5/6/7) PRL-30 PRLS-5	FOXBAT D SIRENA-3M SPS-D(5/6/7) or SPS-D(5I/7I) PRL-30 ASO-2P PRLS-5
FITTER F/J/K SIRENA-3M SPS-D(5/6/7) ASO-2P PRL-30 PRLS-5	FITTER G SIRENA-3M ASO-2P PRL-30 PRLS-5
FISHBED C/E SIRENA	FISHBED/F/J/L/ SIRENA-2 PRL-23 PRLS-5
FISHBED H SIRENA-3 SRS-6/7 ASO-2P PRL-23 PRLS-5	FLOGGER E/G SIRENA 3M or SPO-15 ASO-2P PRL-23
FLOGGER C SIRENA-3M	FULCRUM SPS-(5/6/7) or SPS-D(5I/7I) ASO-2P PRL-30
FLOGGER F SIRENA-3M ASO-2P PRL-23 PRLS-5	FENCER SPS-D(5/6/7) or SPS-D(5I/7I) AASO-2P
FROGFOOT SPS-D(5/6/7) or SPS-D(5I/7I) ASO-2P	
F-1E/EQ BF Syrel Remora Caiman	

[1] [redacted] Assets shown are for standard Soviet FIT. Iraqi electronic FIT may show some variation.

[redacted]

[redacted] IAF stand-off jamming missions have used one to three FITTER aircraft to operate in a racetrack pattern in an area usually 1-35 NM from the strike area or SAM site. The jamming pattern is usually on a vector 50-60 degrees from the area of strike activity, and flown at altitudes of between 20,000 and 25,000 feet. The aircraft makes two to five passes at intervals between 3 and 7 minutes, coordinated to take place during the period of related Iraqi strike activity.

[redacted] An F-1 jamming tactic against the I-HAWK included 2-4 aircraft with Caiman pods, in column formation, 4 minutes apart. The aircraft flew just above the maximum effective threat envelope at 35,000 feet and at 600 knots. Jamming began 75-80 NM away from the I-HAWK site and continued while the aircraft approached as close as 30 NM (again, just outside the I-HAWK's effective range). The jamming turned the I-HAWK acquisition and illuminator radars away from the strike aircraft.

[redacted] TU-16 missions have included a combination of noise and repeater jammers and chaff. Iranian fighter pilots claim that these measures, along with the ground clutter of low-level TU-16 flights, caused their cockpit acquisition radar screens to turn white.

(e) Threat Avoidance

[redacted] Iraq possibly used threat radar avoidance and terrain masking during attacks on Kharg Island oil facilities and the Bushehr nuclear facility. Iraq conducted these missions at low altitudes. Iraqi aircraft entered the Gulf at 500 feet and circumvented Iranian GCI radars by approaching from the south. Iran places target acquisition radars such as the I-HAWK on the north end of the island, with large hills in the center of the island blocking transmissions to the south. I-HAWK associated radars could not acquire Iraqi targets until the aircraft were almost on top of them. During the attack, Iraq would sometimes place other Iraqi fighters on combat air patrols at higher altitudes, possibly as decoys to distract Iran's GCI operators and air intercept pilots. Missions employing this

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[redacted] Equipped with the Syrel ELINT pod, a Mirage F-1 mission profile consists of 1-2 F-1s along a route which roughly parallels the Iran-Iraq border. The aircraft keep 20-30 NM away from Iranian airspace. Mission altitudes vary from 5,000 to 30,000 feet along 160-260 NM legs.

[redacted] The Iraqi FITTER aircraft conducted ESM missions before the acquisition of the F-1. Mission altitudes varied between 5,000 and 21,000 feet along 60-80 NM legs on routes about parallel and 20-30 NM inside the border.

[redacted] Iraqi FISHBED H carry the SRS-6 and SRS-7 ELINT pods. These systems are automatic self-contained ELINT collectors mounted in a centerline pod. The limited system capability includes the identification of the RF band, emitter location, and radar scan rate. Maximum collection range is 60 km. Photographic film records the data in the air and is manually processed on the ground. The total processing time is about 2 hours.

[redacted] Iraq displayed an IL-76 modified for an airborne early warning role at an April 1989 air show in Baghdad. Iraq calls the modified aircraft "Baghdad One." Iraq replaced the aft cargo doors with a large, drooping radome under the aircraft's tail section. The radome houses an inverted Tiger G early warning radar. The French-made Syrel ELINT pod is center-line-mounted on a forward pylon on the underside of the aircraft. Reports indicate the existence of a COMINT capability; however, equipment and capability are not known at this writing.

[redacted] The Tiger G is a French-designed, Iraqi-manufactured, low-altitude, normally ground-based battlefield early warning radar. The ground-based version is housed in a cabin installed on a two-wheel trailer. The cabin supports a foldable 8-meter mast bearing the 3 X 1.6-meter antenna. Operating in the G band, it is highly ECM- and clutter-resistant. Operating parameters include a frequency of 500 MHz and the capability to track up to 60 targets simultaneously.

[redacted]

Figure 8. [redacted] ***Baghdad One Radome.***

(U) The Syrel ELINT pod is designed for fighter use during tactical penetration missions at medium or low altitude. It is intended to provide reliable information of ground-based threat emitters in the C-J frequency band.

[redacted] The Iraqis claim "Baghdad One" operated during the last months of the war, but there is nothing to confirm this. The Syrel ELINT pod has a data-link capability with a ground station, but it is unknown if the same automatic data-link capability exists for information obtained by the Tiger G. The rear mounting of the radome causes a blanking effect in the forward hemisphere and above the aircraft. For maximum coverage, the Iraqis would need two "Baghdad One" aircraft synchronized in a racetrack orbit so that radar line of site to the FEBA is not lost during the return leg of the orbit. The Iraqis claim they have three aircraft modified for this role.

[redacted] Information received from electronic warfare assets is fused into the Iraqi Air Defense Forces telecommunications system. The dedicated long-haul system consists primarily of French Thomson-CSF TFH troposcatter equipment and some Soviet R-400 series radio relay and French Thomson-CSF TFH 150 line-of-sight equipment. The system experiences significant periods of downtime in which tactical communication equipment is used for backup. Also available is a coaxial cable following a north-south and east-west axis through the country; however, its use for air defense remains unconfirmed.

Iraq was slow to take full advantage of its air forces although its tactics became much bolder toward the end of hostilities. Iraq rarely relied on just one electronic warfare tactic during an incursion into Iranian airspace, combining several types of jamming with other ECM tactics such as chaff, terrain masking, or decoys. Iraqi conservation of aircraft was usually successful, and Iraq lost few aircraft toward the end of the war. However, this may be due in part to the lack of Iranian air defense as well as to improved Iraqi electronic warfare practices.

(3) Navy

Iraq's naval units currently have no EW capability. Iraq has contracted for six Esmerelda Class corvettes and four Lupo Class frigates from Italy. Both platforms will have integrated EW systems and chaff dispensers manufactured by Electronica. Sanctions employed against the sale of arms to Iraq and monetary constraints caused delays in delivery.

(4) Strategic Systems

Although EW does not normally include strategic SIGINT systems, during times of hostilities SIGINT systems can provide tactical warning. In fact, the Iraqis interpreted Iranian tactical maneuvers but were unable to accurately predict Iranian strategic goals due to the high frequency range (2.5-5 GHz) of the Iranian troposcatter system through which strategic information passes.

The Iraqis originally ordered the Japanese-built RM-858 HF/DF system to provide a SIGINT system with an overall capability to monitor foreign communications for strategic information and a local system capability for monitoring domestic clandestine transmissions. The Iraqis shifted the emphasis because of the pressure of the war. Iraq placed its emphasis on monitoring tactical level communications for gathering information on Iranian troop movement and unit activities. The system, staffed with military officers, included a direct communications link with the Technical Equipment Directorate. Although the system was at first designed for the strategic monitoring of communications, the Iraqis expressed displeasure with the local level monitoring capability of the SIGINT system. This is because the system, when first put into operation, could not positively identify the location of short-termed radio bursts of communications, either when monitoring clandestine radio communications within the city of Baghdad or when monitoring Iranian battlefield tactical communications. Japan dispatched a team of experts to Iraq in 1985 to improve the tactical capability of the RM-858. The Japanese made some design changes to improve the system's tactical DF capability.

The Iraqis set up the main central station in Baghdad and three substations in Mosul, Ar Rutbah, Ash Shuaybah, and Baghdad. Iraq planned a substation in Al Basrah which sustained damage during an Iranian artillery attack and was never completed. The main central station detects radio signals in the .1-30 MHz frequency range, and the subcentral stations cover the entire .1-1,000 MHz frequency spectrum. The main central station also controls two Type-I, semi-fixed direction-finder stations. The mobile Type-II DF stations function in a manner similar to the Type-I DF stations, although there are certain restrictions to their employment. Divided among the subcentral stations are a total of 13 Type-II DF

tactic, along with other jamming techniques, caused significant damage to oil export facilities on Kharg Island with minimum loss of Iraqi aircraft. Iran countered this tactic with the temporary deployment of another I-HAWK system to cover the southern approaches to the island and a mobile GCI (AN-TPS-43) radar to Bandar E Taheri.

(f) Airborne ESM

The IAF has an ELINT collections capability. A variety of aircraft in the Iraqi inventory have the capability of tactical ELINT collection. These aircraft include the Mirage, FITTER, FISHBED H, and FOXBAT B/D.

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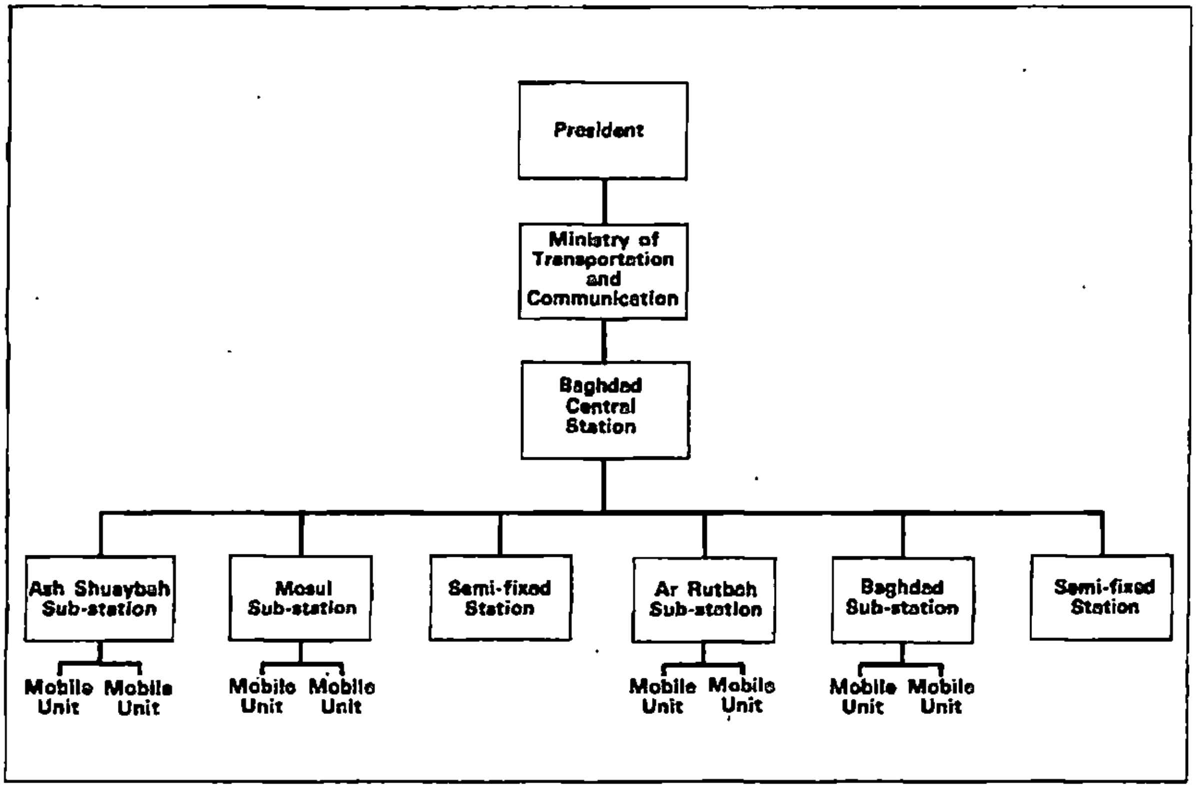

Figure 9. (U) Ministry of Transportation and Communication Organization.

stations. To gain the best possible coverage of incoming radio signals, these vehicle-mounted direction finders move to the most favorable collection location. A microwave and coaxial carrier network referred to as the Postal, Telephone, and Telegraph (PTT) Network links all stations together while in DF operations. The DF stations in the network simultaneously measure direction-arrival of a radiowave from a long-distance emitter to triangulate its location. Upon identification of a signal of interest (SOI), the main central station automatically sends out a message to all DF stations. This action directly activates the receivers in each DF PTT for reception of the SOI. Each station sends the bearing information back to the main central station for a computerized calculation of the emitter location. Translating capability includes Arabic, Persian, Hebrew, English, Turkish, and Russian.

[redacted] Although staffed with military personnel, the system does not fall under military command and control. The Ministry of Transportation and Communication manages the system. During the war with Iran, there were dual channels of reporting; the first through the civilian organization, and also through the military via the Technical Equipment Directorate of GHQ.

5. PERSONNEL

[redacted] Iraq experienced a severe service-wide shortage of personnel during its war with Iran. Personnel talented in technical fields such as electronics are in high demand as Iraq carries on modernization programs. The diversity of equipment increases training time and hinders job skills.

[redacted] Despite unit undermanning, Iraqi personnel maintain a significant standard of proficiency. Foreign advisors include the Soviets, French, and Japanese. Iraq appreciates the value of self-sufficiency and strives to train its own personnel on the foreign systems. Although Iraq sends personnel out of the country for training, particularly to the Soviet Union, most training is in-country. As Iraq masters a particular system, Iraqis replace foreign personnel in schools and maintenance facilities. However, the continual acquisition of technically advanced equipment keeps Iraq reliant on foreign support.

[redacted] Iraq has been slow to disband military units following the cease-fire with Iran. In fact, within the IAF demand for technicians increases with the continued acquisition of advanced fighters. Iraq may disband some ground force EW units; however, personnel may transfer to other undermanned EW units rather than be released from service. Personnel numbers within the Army will remain constant despite the wind-down of hostilities. Personnel numbers will increase within the IAF due to equipment gains.

[redacted] Technical Equipment Directorate personnel number 7,000 to 10,000. Iraqi ground EW units are about the size of battalions and employ between 500-700 people. The diversity of equipment hampers personnel training. Despite these problems, Iraq can operate and maintain most of its equipment. Iraq initially leans heavily on foreign support until it can train and replace advisors with its own personnel.

6. TRAINING

[redacted] The diversity of equipment hampers training in Iraq. Several schools exist. Each school trains personnel on equipment received from a particular country. Some personnel attend specialized courses outside the country, such as in the Soviet Union.

[redacted] Al Taji is the primary ground-based EW training school. Courses include a Commanders of Electronic Warfare Companies course for officers, an Electronic Warfare course for NCOs, and ground and airborne equipment maintenance courses. Personnel train on Soviet equipment, often under Soviet advisors.

[redacted] Iraq initially trained on the Japanese RM-858 in Japan. Training includes courses in receivers and transmitters, computers and software, DF equipment, supervisory training, antennae array, and mechanical engineering. Training time varies according to the technical level of the course. More than half the initial 50 trainees were college graduates and nearly all had some technical experience. Trainees were usually active military personnel filling civilian positions. The RMS training center in Baghdad now provides training for the required 150-240 Iraqi operators. Training is in English, causing problems with trainees not well versed in the language.

[redacted] Air Force EW training is the responsibility of the Training Directorate of IAF HQ, subordinate to the Deputy Commander for Operations. Pilot training of aircraft-based EW systems most likely begins in aircraft conversion training conducted at H3, Al Jarrah, and Rasheed Air Bases. It is likely that training continues in the flight leader course at Rasheed Air Base. Jordan reportedly provides Iraqi pilots with live ECM training against Jordanian HAWK sites.

[redacted] EW equipment maintenance is taught at the Ground and Airborne Radar Equipment School, at Al Taji, and at the Aircraft and Support Equipment Maintenance School at Habbaniyah Air Base. Curriculum is unknown.

7. LOGISTICS SUPPORT

[redacted] Iraq remains dependent on foreign sources for most military equipment and technical advisors, with the Soviet Union the chief source of military equipment. During the past few years, Iraq has turned increasingly to the

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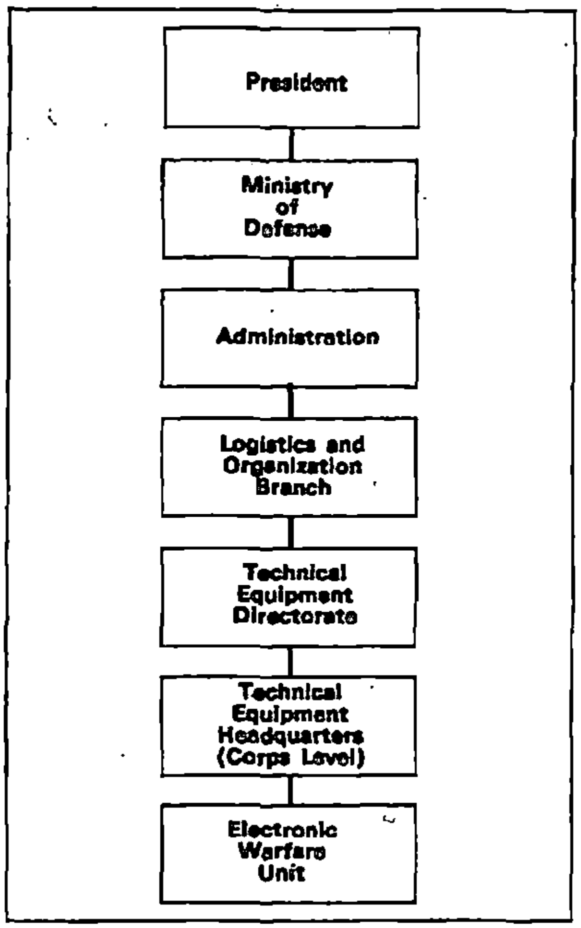

Figure 10. (U) Logistics Organization Chart.

West and the Warsaw Pact countries for additional equipment. Foreign sources of equipment include France, Italy, Japan, and the Warsaw Pact countries.

The Deputy Chief of the General Staff, Administration, has overall responsibility for logistics support of all the Armed Forces. The Logistics and Operations Directorate provides logistics support for Army operations and reports directly to the Deputy Chief of the General Staff, Administration. The Technical Equipment Directorate falls directly under the Logistics and Operations Directorate.

The supply principle used by the Iraqi Army is generally in line with British doctrine in that, at the GHQ level, supplies are "pushed" from rear depots to forward GHQ depots by GHQ transportation assets. The corps-level units draw supplies from the GHQ depots, and each subordinate level then draws supplies from the superior level. Superior-level units also provide transportation movement of supplies to the next lower-level unit.

Several supply sources have given Iraq a versatility it would not have if it depended on one country for all its weapon systems. Iraq has had some difficulty in stocking needed spare parts due to the diversity of equipment and source countries. Standardization of supply practices and procedures is difficult to develop and maintain. Iraq has adopted the Soviet tactic of centralizing maintenance and supply facilities and makes extensive use of cannibalization. There is little repair work at the battlefield, and Iraq has set up rear area depots to which equipment is transported from the battlefield. Iraq has a Signal Equipment Depot, possibly located at Baghdad Taji.

The IAF Technical Affairs Branch performs all maintenance and repair of aircraft-based electronic warfare systems. The overall logistics responsibility within the IAF centralizes in the office of the Deputy Commander for Technical Affairs. The Operations Branch, on the other hand, decentralizes support necessary to sustain air operations. Operational Air Force commanders decide matters of EW employment, and the Technical Affairs Command is responsible for EW equipment maintenance.

The IAF can support most of the routine maintenance work in-country, although Iraq must send some parts and equipment to the Soviet Union for major repairs. Iraq adopts Western maintenance methods for its French-made aircraft. This method emphasizes routine maintenance at the base level.

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8. [redacted]

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Figure 11. (U) TURN TWIST Communications Intelligence Collection.

[redacted]

9. EQUIPMENT

a. Electronic Warfare Support Measures

[redacted]

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Figure 12. (U) SPIKE SQUARE Communications Intelligence Collection.

[redacted] The Japanese Automatic Spectrum Surveillance System, a combination of automatic spectrum surveillance equipment and DF equipment, measures the direction and frequency of waves automatically and semiautomatically. It also measures field strength and bandwidth. Although manufactured by Koden, Iraq received an expanded variation to include Anritsu Electric Company receivers and a Nippon Electric central processing unit.

(U) The AEG of the Federal Republic of Germany produces E-1600 VU VHF/UHF series receivers and ancillary equipment. Designated as E-Series, the equipment has monitoring and surveillance applications. The E-1600 VU monitors communications from 20- to 1,000-MHz range and is used in both fixed and mobile ESM stations.

(U) RACAL is a British-produced series of radio-monitoring and direction-finding equipment. The series covers the HF/VHF/UHF bands up to 1 GHz on mobile or transportable platforms. The systems use electronically commutated Adcock four-element antenna arrays to generate a signal which is amplitude-modulated with azimuth information. After conversion to digital form, this signal feeds into a microprocessor-based bearing evaluation and display unit (MA1110). The MA1110 derives bearing information and presents it directly in numerical form. Several antennas cover the frequency band segments up to 1 GHz. The MA1110 processing and display unit also presents bearing evaluation for all systems. This has a numeric LED readout which updates data five times per second, giving a direct indication of bearing. Three or more DF stations can link to form a locating net, which can be manually or automatically controlled.

(S) Noncommunications Intercept

[redacted] The SWING BOX targets airborne radars to include IFF and has two variants. The earlier variant is the POST-2MK and the later version is the POST-3M. Associated equipment with both systems includes the ZIL-157 receiver van and a generator truck. Both versions have a wide frequency coverage. The POST-2MK covers bands centered at 1.23, 3, and 10 GHz. The POST-3M system has continuous frequency coverage from 3 to 37.5 GHz. The SWING BOX employs both horn and parabolic

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Figure 13. (U) SWING BOX Electronic Intelligence Collection.

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cut antennas. Intercept range extends out to 500 km. The system has some capability to follow a close-in target with a rapidly changing azimuth. The system is highly mobile with setup, operation time, and transfer ready time under an hour. The Iraqis collocate this equipment with the TUB BRICK, using the two systems to identify, DF, and jam hostile signals.

The SRS-6 and the SRS-7 are two FISHBED H ELINT pods normally flown as a single unit. The SRS-6 is an automatic self-contained ELINT collector mounted in a centerline pod. The system collects electronic order of battle information and can only determine RF band, emitter location, and radar scan rate. Maximum collection range is 60 km. The SRS-6 uses a filtered crystal video receiver covering the RF spectrum of 800 to 10,300 MHz, with a system sensitivity about -25 to -40 dBl. The DF accuracy is about 2.5 degrees at maximum range. Photographic film records the collected data, which require manual processing on the ground at the end of each mission. The total processing time, including film development, is about 2 hours. The SRS-7 is similar and is normally flown with the SRS-6. Antennas located on each side of the collection platform manually feed both the SRS-6 and the SRS-7. A common photographic film-recording device processes information from each pod. The significant difference between the SRS-6 and the SRS-7 is the RF coverage. Coverage for the SRS-7 ranges from 150 to 1,000 MHz.

The Syrel is a fully automatic electronic reconnaissance system pod which is pylon-mounted under the fuselage of the Mirage aircraft or Puma helicopter. Primary use is penetration missions at low to medium altitudes to acquire and record data automatically. Recorded data include the identification and location of ground-based electronic search, acquisition, GCI, and fire control radars associated with antiaircraft missiles or artillery. The two-part system consists of a pod housing a C to J band receiver, antennas, a processor, and a data recorder. The second part of the system consists of a data link to a ground station processing center which offers a real time capability.

(3) Radar Warning and Receiving (RWR)

The SIRENA-2 radar warning system is a passive tail-warning system that the Soviets install on the BADGER and BLINDER. SIRENA detects approaching RF signals in the frequency range of 8.7-9.5 GHz within approximately a 60-degree cone aft of the aircraft. Detected RF signals are crystal-rectified, changed into a video signal, and amplified at the antenna. The aircrew receives an audio signal that varies in intensity, depending upon the range to the radiating source.

The Sherloc radar warning system mounts on most NATO fighters and helicopters. It instantaneously detects and identifies radar emitters in complex signal environments. The basic system covers the frequency range between 1-18 GHz. A high-speed analogue and digital processor incorporates a threat library of 100 modes which readily reprograms on the flight line. The library extends to 200 modes. Although unconfirmed in the Iraqi inventory, the system has a very high sensitivity, is of small size, and weighs only 10 kg.

The SPO-15 may be the radar warning receiver installed on the FULCRUM A aircraft. The SPO-15 has multiple receiver sectors, the capability to recognize radar types, and an enhanced pilot warning display. This display possibility incorporates threat-type symbology that warns the pilot to specific fire-control radar types in his environment.

SIRENA-3 is a 360-degree radar warning system designed to alert the pilot of illumination of a hostile radar through audio and visual signals. It also provides some directional information on the potential attack. The SIRENA-3 is standard to the FITTER and some variants of the FOXBAT aircraft. The frequency range for the system is from 6.0-21.0 GHz, with gaps in the spectrum between 8.3-8.7 and 10.9-11.9 GHz.

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Figure 14. (U) SIRENA-3 Radar Warning System.

[redacted] The type BF radar warning receiver mounts on the Mirage F-1. This system provides the pilot with an alarm, shows the general direction of the threat, and gives threat identification when a tracking radar illuminates the aircraft. This system covers all known threat potential frequency bands. Like the SIRENA-3, it affords 360-degree protection through four fixed antennas, each covering a 90-degree sector.

b. Electronic Countermeasures

(1) Communications

[redacted] R-118 BM-3 is a medium-power HF jammer organic to the Iraqi EW battalions. Frequency range limits are only 1.5 to 12 MHz; however, an R-377, R-378, or R-325M control receiver can increase the radio station's capacity frequency range up to 25.5 MHz. The R-325M is a high-power jammer used for jamming strategic communications up to a depth of 30 km beyond the FEBA. The R-325M employs AM-by-

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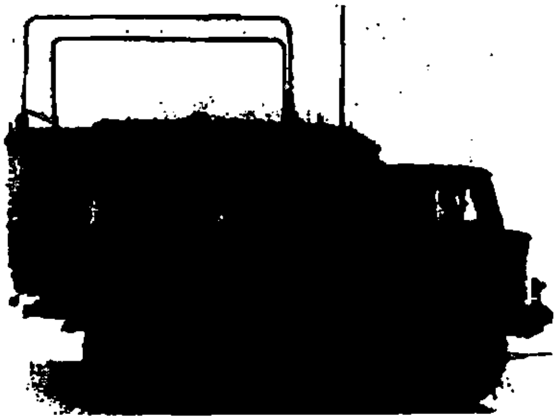

Figure 15. (U) R-118 BM-3 HF Jammer.

tone modulation, commonly called rotary buzz jamming. Physically, the system is difficult to identify because it is housed in three nondescript box-bodied vehicles. A GAZ-66 truck usually houses the R-118 BM-3, and the R-378 mounts on a ZIL-157/131 truck.

[redacted] The R-834 is the Soviets' first try at introducing a communications jammer in the UHF band. As a communications set, the R-834 transmits voice communications to aircraft, transmitting or receiving on 3,400 separate 50-kHz channels between 220 and 399.95 MHz. Including a noise modulator in the R-834 communications system gives the set a simple communications jamming capability. The set does not have an automatic search capability and a requires a separate receiver for targeting. Five variants of this system range from a communications station to a sophisticated dedicated jamming station. It is not known which variants are in the Iraqi inventory. The basic communications stations employ two transceivers, a power amplifier, two discone antennas, one whip and one omnidirectional antenna, a central control console, and a remote control unit. Iraq deploys the system with its warning and control regiments.

[redacted] The R-834b (exploited following the 1973 Middle East war), was an attempt to build a dedicated jammer with more appropriate features. This variant has a jamming control unit which provides an automatic sweep-lock-and-jam feature. Thus, the jammer operates across the frequency band to locate and lock on to an enemy signal. This automatic jamming feature increases the system's responsiveness and provides omnidirectional coverage. A second antenna (five-section discone on a telescopic mast or nine-element end-fire array) may also be present.

[redacted] The R-834P is the same as the R-834B, except that its noise source is solid-state rather than from tube manufacture and additional antennas.

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Figure 16. (U) R-834P Land-Based, Airborne Communications Jammer.

(2) Noncommunications

[redacted] Iraq has two types of ground-based noncommunications jammers, the SPB-7 TUB BRICK and the SPO-8 KING PIN. The primary roles of both are those of air defense radar jammers targeting various airborne bombing, navigation, and reconnaissance radars. Most of these fixed sites defend Baghdad, and the remainder defend major airfields and key Iraqi cities.

[redacted] The SPB-7/TUB BRICK is an I-band noise barrage jammer primarily targeting airborne bombing radars and other navigation radars that operate between 8-10 GHz. The system complements air defense sites; for example, the Iraqis collocate the system with the SA-2 site at Al Shaibah. The TUB BRICK normally receives tracking data from early warning radars or from an ELINT system, but can determine azimuth and frequency when operating in an independent mode. It is possible for the Iraqis to reverse the process and use the system to cue the air defense system. There is no evidence to suggest this is occurring. However, Soviet doctrine uses the system in this passive defense role. Changes in target radar frequency require the operator to retune the system manually. It deploys in a two-trailer set and is towed by MAZ-502 or URAL-375 trucks. While outwardly similar, the trailers perform different functions. One trailer houses the jammer and the other contains the associated intercept receiver and direction-finding equipment. The TUB BRICK has a radome-housed antenna and employs AM noise and sine wave modulation techniques.

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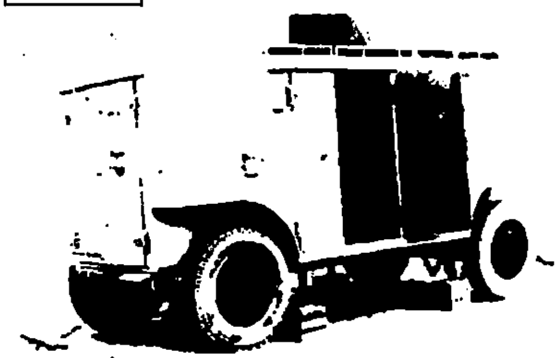

Figure 17. (U) TUB BRICK Noise Barrage Jammer.

[redacted] The SPO-8/KING PIN is an I-band deception jammer targeting airborne bombing and navigation radars operating in the 8-10 GHz range. It denies airborne radars a true radar presentation of natural and man-made features in areas of bombing targets or navigational checkpoints. The KING PIN operates by transponding false target returns to the victim radar scope. The system can vary pulse

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Figure 18. (U) KING PIN Deception Jammer.

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Figure 19. (U) Remora F-1 Self-Protection Jammer.

length and width to match the actual protected target. This obscures the real target with multiple false targets. The system operates automatically, responding with a programmed series of noise modulation pulses of any signal in a specified 60-degree sector. This system can simultaneously confuse multiple airborne radars as long as there is no actual pulse overlap. The KING PIN has directional receiver horns and cut paraboloid antennas under a radome. A URAL-375 truck tows the system.

Caiman CT-51 is an airborne noise and deception jamming pod which succeeds the earlier ALLIGATOR system. The system is a stand-off jammer for use on dedicated EW aircraft to protect groups of similar aircraft in ground attack roles and target surveillance and tracking radars. Within the pod are two jammers, each with its own receiver, and fore-and-aft receiver antennas. Power output from each jammer is 250 watts in I-band (18-10 GHz) or 1 kW in L-band (50 GHz). Three modes of operation are available. The manual mode allows the pilot to select any one of three predetermined frequencies at will. Semiautomatic mode alerts the pilot of an incoming transmission so he can take the appropriate action. Fully automatic mode automatically activates the jammers when such a signal is received. The jamming signal has a bandwidth of about 1 GHz, and the mode of transmission is selected before the mission.

Remora DB-3163 provides self-protection for individual tactical aircraft against both air and ground radar threats. The power management system incorporated in the pod automatically counters threat radars. The pod detects, identifies, and counters both pulse and continuous wave radars. The Remora is integrated with the aircraft's navigation and weapons control system. The system has a superheterodyne receiver that carries out a frequency search function simultaneously from forward- and aft-facing antennas. The pilot adjusts the receiver to receive three of six pre-set frequencies in flight. Digitally stored threat data can jam up to three frequencies at once by means of electronic switching and power management of the traveling wave tube (TWT) transmitter system. The Iraqis employ the Remora on the F-1 in a ship attack role, and probably with other systems in a land attack role. Additionally, Iranian pilot defectors credit the Remora-equipped F-1 with the interruption of Iranian airborne acquisition radars.

CHIP THORN is a swept noise jammer associated with early Soviet bomber aircraft. Although CHIP THORN is outdated, the BADGER, BLINDER or Mi-8 HIP may still employ the system.

The Click jammers are a family of

wide-band jammer systems. Signal activity correlates to BADGER, CUB, and CANDID aircraft in the Soviet Union. Other deployment options include the SPS-N(X), SPS-B(X), and the SPS-SN(X). The SPS-N(X) is a narrow-band noise jammer employing fixed-tuned and slow-sweep operational modes. The SPS-B(X) is the wide-band variant, and the SPS-SN(X) identifies a smart-noise model. These automated systems have greater RF agility. The smart-noise jammers can operate with a wide variety of jamming modulations and programs. Iraqi BADGERs may carry an upgraded variant or merely the manual, older SPS-N(X). Iraqi transports are not believed to carry any electronic countermeasures.

The SPS-D(5, 6, 7) is a first-generation family of repeater jammers. The system mounts internally in the FOXBAT B/D and FLOGGER D/H/J variants and externally as a pod on the FITTER C/D and H. It provides self-protection in the forward hemisphere. The system operates in three interchangeable subbands, within an overall RF range of 4.7 to 10.8 GHz. RF bands require selection before each mission. These systems are capable of range and velocity gate pull-off and cooperative blinking jamming against monopulse angle-tracking radars. The SPS-141 is an example of the SPS-D(7). The improved second-generation equipment (SPS-D(5I, 7I)) has new jamming techniques for operation against monopulse angle-tracking radars.

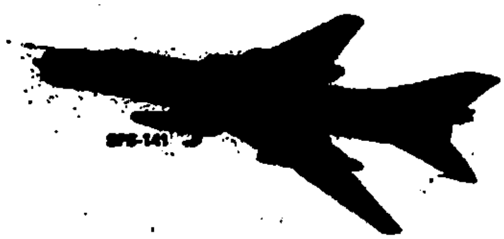

Figure 20. (U) SPS-141 Self-Protection Jammer.

Figure 21. (U) SLQ-234 Aircraft Radar Warning and Aircraft Protection Jammer.

The newer systems operate in the same RF range. There is no confirmation of this system on Iraqi FOXBATs.

The SLQ-234, by SELENIA, is a noise/deception jammer providing aircraft protection against ground-based aircraft threat radars operating in the H through J frequency bands. It is a self-contained pod that incorporates its own broad-band electronic warfare support measures section, using a wide open receiver operating in the H, I, and J frequency bands. Intercepted data feed into the pod's on-board digital computer for use in threat list compilation and comparison against an existing threat library. Intercepted threats automatically arrange in order of priority. The computer also performs jamming power management against several threats simultaneously in order of priority. The TWT's transmitter jams a frequency band of 6-GHz width in the fire control region of the radar spectrum. Each pod contains three jammers, a receiver/processor, and antennas at each end. A jammer at the front of the pod counters Doppler and continuous wave threats. Two centrally located jammers are "smart-noise" transmitters. The rear section houses the superheterodyne radio warning receiver and an instantaneous frequency measurement system.

(S) Chaff

[redacted] The ASO-2B is an electromechanical chaff dispenser. Nearly all Soviet-produced medium and heavy military aircraft use the system including the BADGER A/D and BLINDERs within the Iraqi inventory. All BADGERs may employ the system on the aft fuselage for self-protection. The system design is elementary but reliable. Ruggedness and serviceability are salient characteristics of this dispenser. The dispenser uses two magazines which have 25 wells containing 16 chaff packets each. The chaff releases either manually or automatically from the command of a radar warning receiver such as the SIRENA.

[redacted] The ASO-2I chaff dispenser activates pyrotechnically. The FISHBED H and other small Soviet-produced fighters employ the dispenser. The system mounts internally or is carried within the airframe's reconnaissance pods. The ASO-2I can house and dispense 64 cartridges. The dispenser on the FISHBED H consists of two cassettes of 32 cartridges each, installed side by side. The cassettes are separately removable and reloadable. There are five known chaff lengths associated with this system. The dipole lengths include 3-mm (48 GHz), 9-mm (16 GHz), 15-mm (9.6 GHz), 50-mm (2.9 GHz), and 63-mm (2.3 GHz).

[redacted] The ASO-2P self-protection chaff dispenser operates pyrotechnically. The dispenser is Soviet third-generation technology, modular in design. Each module has 12 chaff cartridges. These 12-cartridge modules bank to provide a larger chaff loading to suit the radar cross section requirements of the aircraft. Frequency coverage estimates for the dispenser are 2.3-48 GHz.

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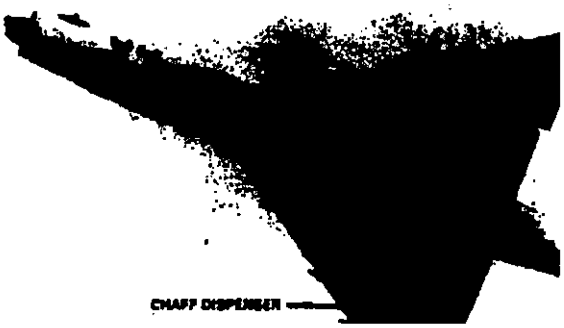

Figure 22. (U) ASO-2I Chaff Dispenser.

[redacted] The role of the ASO-16 is either group- or self-protection. ASO-16 employment impedes GCI operations, disrupts radar intercepts by hostile fighters, and confuses terminal threat control radar systems. The ASO-16 is housed in the weapons bay of the TU-16. Chaff dispensing operates like the ASO-2B. Upon activation, a fabric tape surrounding the chaff packet winds onto a rotor. This action pulls the packets into the chaff chute and opens them simultaneously. Once opened, they fall through the chute, exiting via an external port. The system consists of a permanently installed ejector and a single removable and reloadable magazine. The system may also load a variety of dipole cuts with separate controls for each unit. This allows for more flexibility in responding to threats and gains RF versatility. The operator begins chaff release manually and may select the desired packet dispensing rate. The ASO-16 has a minimum dispense rate of 6 packets per minute and a maximum dispense rate of 120 packets per minute. The unit could contain up to about 1,320 packets.

[redacted] Protivo Radio Lokatsionnyj (PRL) literally translates into "antiradar" systems. The Soviets developed these forward-fired chaff munitions in the mid-1960s as an effective ECM against surface and airborne fire control radars. The chaff-filled ammunition within the Iraqi inventory includes three calibers: 23-mm, 30-mm, and the 57-mm rocket. Iraqi use of 37-mm caliber chaff munition is not confirmed.

[redacted] The PRL-23 chaff dispenser deploys on the FLOGGER E/F/G and FISHBED H. It loads in a centerline gun and provides self-protection against threat radars. The standard D-15 marked projectile deploys 15-mm chaff resonant at 9.6 Ghz. The dipoles are standard tinecoated soda-lime glass fibers. The PRL-23 can carry chaff dipoles up to 5.4 cm in length for a resonant range of 2.67 to 48 GHz.

The PRL-30 commonly deploys on the FITTER A/C/D/H models and the FULCRUM for self-protection. The 30-mm chaff round fires forward and carries the same dipole cuts as the PRL-23. However, it has a wider frequency coverage (1.98 to 48 GHz) resulting from longer dipole cuts, that is up to 7.3 cm in length vice the 5.4-cm limit on the PRL-23. As a point of comparison between varying the size of the munition round, the PRL-30, when loaded with DOS-15, provides a radar cross section (RCS) of 20 square meters 10 seconds after dispensing, close to three times the RCS area covered by the PRL-23. If loaded with DOS-54 (dipole length of 54 mm), the PRL-30 provides a mature cloud RCS of 90 square meters.

There is also a chaff rocket designated the PRLS-5, a variant of the S-5 rocket. The S-5 rocket role is normally air-to-air and air-to-ground, but also makes a respectable chaff dispenser. Tactical aircraft carriers include the FITTER, FLOGGER, and FULCRUM fighters. The 57-mm PRLS-5 rocket carries a wide selection of chaff, providing a frequency coverage of 1.2 GHz to 48 GHz. The rocket yields an effective RCS of 350 square meters at 9.6 GHz (DOS-15). The Iraqis primarily employ the PRLS-5 for self-screening or for blanketing radar scopes. It can also break a ground or air threat radar lock-on. The system is most effective when countering ground-based radars.

The PHIMAT chaff dispenser contains 210 packets (14 KG) employed for aircraft self-protection against surface-to-air missiles, fire control radars, and air-to-air intercept radars. Chaff wavelengths are variable within the E-J band to match frequencies with the target radar. The system offers continuous diffusion at adjustable rates or intermittent diffusion at rates and intervals. It can also create chaff cloud in puffs through intermittent ejection at very high density. Ejection can be manual or automatic.

The Sycomor system's development is the result of MATRA's concern over the increase of passive countermeasures equipment. MATRA bases the system on its experience with PHIMAT. The system jams threat radars and infrared guided missiles by ejecting clusters of chaff and cartridges. The equipment is available in the form of containers and pods fixed under the F-1 wing.

(4) Lethal

Optimum launch of the AS-9 radiation-homing TASM is at altitudes between 300 and 39,000 feet and ranges up to 53 NM. The missile flies a programmed "up-and-over" profile before homing on the target's radar emissions at dive angles ranging from 30 to 50 degrees.

The AS-37 Martel is an antiradiation missile carried by the Mirage F-1E. Target acquisition is by either of two modes: azimuth search mode of a known target frequency or frequency search mode for estimated target frequency. The latter mode operates with three separate frequency homing heads. Homing heads operate in the D, E, F, G, or H bands; the band is chosen before the beginning of a mission. Upon acquiring the target, lock-on is automatic. A cockpit display of frequency and angular displacement of the homing head allows pilot verification of proper targeting.

The ARMAT (short for antiradiation MATRA) is a follow-on to the AS-37 Martel. It uses the same airframe and is the same externally, but it incorporates an improved seeker. The seeker can cope with frequency agility,

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Figure 23. (U) ARMAT Antiradiation Missile.

blinking, and other ECM/ECCM techniques.

10. FUTURE TRENDS

Iraq will continue to improve its employment of electronic warfare. The most significant growth will be within Iraq's Navy. Upon delivery of Italian Esmerelda Class corvettes and Lupo Class frigates, Iraq will have a naval EW capability. Iraq negotiated for the installation of Elettronica-manufactured ELT-series equipment aboard these vessels.

The IAF will receive technically advanced equipment as it becomes available. The Soviets will dominate aircraft sales to Iraq with Soviet RWR gear and jammers. Pleased with Western equipment performance during the war with Iran, Iraq will seek to buy Western equipment as well. Soviet-style depot maintenance requires a greater reliance on foreign support than Western style maintenance, which encourages procedures that the Iraqis can perform for themselves.

Iraqi ground force targeting will continue to emphasize the Iranian border area. The Iraqis will continue a rigid command and control structure, but Soviet influence may allow for more control by the Operations Branch of GHQ. The wind-down of hostilities will allow Iraq to move ground assets from the Iranian border to western borders. EW employment in the west will serve not only a collection mission, but jamming assets may target Syria and Israel for civil and military communications harassment.

The RM-858 will target internal and strategic international communications. It will lose its military mission to enhance President Saddam Hussein's national and international political goals.

Although more of Iraq's attention will turn to the west, Iran remains its greatest potential threat. Currently Iran's limited warmaking potential allows Iraq to target electronic warfare assets against other countries. However, should Iran begin to rebuild its military, Iraq would again devote most of its assets against Iran.

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Appendix A
GLOSSARY

(U) The following US definitions apply to terms used in this study:[1]

Angle Deception — Deception technique that causes a radar to develop incorrect target bearing and elevation data.

Angle Jamming — Transmission of a jamming pulse similar to the target radar pulse but with modulation information out of phase with the returning target angle modulation information. This technique jams azimuth and elevation information from a scanning fire-control radar.

Angle Noise — Tracking error introduced into a radar by variations in the apparent angle of arrival of the echo from target.

Antiradiation Missile (ARM) — A missile that homes passively on radiating sources in a particular frequency band.

Barrage Jamming — Jamming of a frequency band much wider than the radar receiver bandwidth of the specific victim radar. It normally covers the operating frequencies of more than one radar within a given frequency band.

Birdnesting — The clumping together of dispensed chaff.

Blind Speed — In radar systems using a moving target indicator, blind speed is the radial velocity of a target with respect to the radar for which the response is approximately zero. Blind speed is the radial velocity at which the moving target changes distance by one-half wavelength (or a multiple thereof) during each pulse period.

Blinking — A form of angle deception in which one or more aircraft turn jamming on and off. Alternate jamming from two aircraft will cause the radar tracking circuits to oscillate, making proper fire control operations very difficult.

Break Lock — The moment at which an automatic tracking system is no longer tracking a target.

Burn Through — Detection of the target return above the transmitted jamming coming from the target or a nearby jamming source.

Chaff — Reflective jamming device made up of thin, lightweight metallic strips, cut to one-half length of the victim's radar wavelength.

Chaff Bursts — Dispensing chaff in short corridors with clear areas between them.

Chaff Corridors — Long, continuous clouds of chaff formed by dispensed chaff bundles so their returns overlap on the radar displays. Chaff corridors mask aircraft from detection by enemy radars.

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[1] (U) All quoted material is from JCS MOP 95.

Clutter — Unwanted radar returns from rain, clouds, land, sea, or other objects.

Command, Control, and Communications Countermeasures (C^3CM) — The integrated use of operations security (OPSEC), military deception, jamming and physical destruction, supported by intelligence, to deny information to, influence, degrade, or destroy adversary C^3 capabilities and to protect friendly C^3 against such actions.

Communications Security (COMSEC) — The protection resulting from all measures designed to deny unauthorized persons information of value derived from the possession and study of telecommunications. To mislead unauthorized persons in their interpretation of the results of such possession and study. Communications security includes cryptographic security, transmission security, emission security, and physical security of communications security materials and information.

Continuous Wave (CW) — Successive oscillations of waves, identical under steady-state conditions. Generally, electromagnetic waves are of constant amplitude and frequency.

Decibel — A unit for expressing the ratio of two amounts of electric or acoustic signal power equal to 10 times the common logarithm of this ratio.

Decoy — False target or reflector used to simulate the cross-section of a real target.

Early Warning Radar — A long-range radar, normally fixed or semi-mobile, and positioned in the outlying region of a defined area. Its role is to provide warning as early as possible of unfriendly aircraft approaching the defended area.

Electromagnetic Spectrum — The frequencies (or wavelengths) present in a given electromagnetic radiation. A particular spectrum could include a single frequency or a wide range of frequencies.

Electronic Combat (EC) — Action taken in support of military operations against the enemy's electromagnetic capabilities. EC includes electronic warfare; command, control, and communications countermeasures (C^3CM); and suppression of enemy air defenses (SEAD).

Electronic Counter-countermeasures (ECCM): "That part of electronic warfare involving actions taken to retain effective friendly use of the electromagnetic spectrum."

Electronic Countermeasures (ECM): "That part of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum." ECM includes:

- Electronic Jamming: The deliberate radiation, reradiation, or reflection of electromagnetic energy with the object of impairing the use of electronic devices, equipment, or systems being used by the enemy.
- Electronic Deception: The deliberate radiation, reradiation, alteration, absorption, or reflection of electromagnetic energy in a manner intended to mislead an enemy in the interpretation or use of information received by the enemy's electronic systems. There are two categories of electronic deception:

    — Manipulative: "The alteration or simulation of friendly electromagnetic radiations to accomplish deception."

    — Imitative: "The introduction of radiations into enemy systems which imitate the enemy's emissions."

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Electronic Deception — The radiation, reradiation, alteration, absorption, enhancement, or reflection of electromagnetic energy intended to mislead an enemy in the interpretation or use of information received by his electronic system.

Electronic Support Measures (ESM): — "That part of electronic warfare involving actions taken under direct control of an operational commander to search for, intercept, identify and locate sources of radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic support measures provide a source of information required for immediate decisions involving electronic countermeasures, avoidance targeting, and other tactical employment of forces."

Electronic Warfare (EW) — "Military action involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum and action which retains friendly use of the electromagnetic spectrum." EW is divided into three areas: electronic support measures (ESM), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM).

Electro-Optic (EO) — The interaction between optics and electronics leading to the change of electrical energy into light, or vice versa with the use of an optical device.

Emission Control (EMCON) — Orders, referred to as EMCON orders, used to authorize, control, or prohibit the use of electronic emission equipment.

Flare — As a countermeasure, it is a pyrotechnic device released from an aircraft causing an infrared homing missile or target tracker to follow it rather than the aircraft.

Frequency Agility — The ability of a radar to change frequency within its operating band. This ECCM technique affords rapid radar frequency changes to avoid a spot jammer or force a jammer to spread its power over a wide frequency band.

Frequency Diversity — Simultaneous operation of radars having different operating frequencies to lessen the effects of jamming or fading. May be two or more radars in a ship or force, or one radar transmitting on two or more frequencies.

Ground Control Intercept (GCI) Radar/Site — A radar or combination of radars that can monitor the height, speed, and heading of an incoming hostile aircraft.

Imitative Electronic Deception — The introduction of radiations into enemy systems which imitate its emissions.

Jitter — Random variations of pulse recurrence interval.

Lock-On — Signifies that a tracking or target seeking system is continuously and automatically tracking a target.

Manipulative Electronic Deception — The alteration of friendly electromagnetic mission characteristics, patterns, or procedures to eliminate revealing or convey misleading indicators to hostile forces.

Meaconing — The receipt of radio beacon signals and their rebroadcast on the same frequency to confuse navigation. Aircraft receive inaccurate bearings from ground stations. UNCLASSIFIED

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Noise — An unwanted receiver response other than another signal (interference).

Noise Jamming — Noise jamming is noise modulation on a carrier frequency to increase a radar receiver's noise level. It sweeps through a frequency spectrum at various rates or spot speeds. Video interference at all ranges in a sector of a scope is noise jamming. The size of the sector depends on the power and range of the jammer.

Optically Directed Threat System — A threat system relying on visual or imaging electro-optical sensors for acquisition and tracking.

Pulse Recurrence Frequency (PRF) — The number of pulses that occur each second.

Pulse Recurrence Interval (PRI) — The time between successive pulses. Also called pulse recurrence period.

Radar Warning Receiver (RWR) — System designed to alert aircrews to the presence of enemy radars. It lets the aircrew know the type of radar, its relative strength and bearing, and identifies which one is the priority threat to the aircraft.

Rope — Chaff cut to respond to radar pulses radiating at frequencies below 1,000 MHz. At these frequencies the chaff must be of long length, hence the term rope.

Self-Protect Jamming — The mounting vehicle receives the jammer's protection, as opposed to support or mutual jamming.

Self-Protection Suite — Normally composed of a radar warning receiver, jammer for radar target trackers, and expendables in the form of chaff and flares.

Side Lobe — Beams of energy transmitted from a radar which are not part of the main beam or lobe. Usually, side lobes contain much less power than the main beam, and for the most part they are undesirable radiations.

Side Lobe Blanking — The use of an auxiliary omnidirectional antenna which compares relative signal strength between the auxiliary and the radar antenna. The omni channel (plus receiver) has slightly more gain than the side lobes of the normal channel, but less gain than the main beam. Therefore, any signal that is greater in the omni channel must have been received from a side lobe and therefore is blanked to remove spoofer signals. This technique is effective in removing spoofer signals with a duty cycle up to about 50 percent.

Side Lobe Cancellation — This ECCM technique employs the same antenna and receiver configuration as the side lobe blanking except that a gain matching a cancelling process takes place. Extraneous signals entering the side lobes of the main antenna cancel while the targets remain. This type of system exhibits cancellation on the order of 20 dB against a single noise jammer. With multiple jammers at various azimuths, the performance of this device rapidly deteriorates.

Signals Intelligence (SIGINT) — Intelligence information derived from communications, electronics, and telemetry signals. The most common elements of SIGINT are communications intelligence (COMINT) and electronic intelligence (ELINT). ELINT also refers to noncommunication information. SIGINT is similar to ESM but lacks direct involvement with immediate tactical decisions.

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Signal Security — A generic term which includes both communications security and electronic security.

Simulative Electronic Deception — The creation of electromagnetic emissions to represent friendly emissions to mislead hostile forces.

Stand-Off Jammer — A landbased system, ship, or aircraft equipped with powerful jamming equipment. Its mission is to stand off at a safe range (beyond the enemy's missile weapon system envelope) and provide jamming coverage for the attacking element.

Suppression of Enemy Air Defense (SEAD) — That activity which neutralizes, destroys, or temporarily degrades enemy air defense systems in a specific area to enable air operations to be conducted successfully.

Terrain Masking — The effect of terrain features in preventing the detection of targets by radar.

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Appendix B
Electronic Warfare Installations (U)

Al Taqaddum DF Site	33-20-30N 043-34-30E
Ar Rutbah SIGINT Substation	33-04-58N 040-18-21E
Ar Rutbah DF FAC South	33-02-23N 040-16-19E
Ash Shuaybah SIGINT	30-26-02N 047-33-22E
Ash Shuaybah SAM Site	30-19-40N 047-44-30E
Baghdad/Ad Dawrah	33-16-40N 044-26-20E
Baghdad East	33-18-20N 044-34-10E
Baghdad Main Central	33-29-50N 044-24-10E
Karbala	32-42-40N 043-50-55E
Mosul DF FAC West	36-21-45N 043-03-50E
Mosul SIGINT Substation	36-25-45N 043-07-50E
Rasheed ELC WAR Site	33-15-28N 044-32-40E
Shaikh Mazhar Barracks Area	32-51-24N 044-44-32E

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Appendix B (continued)

Al Taqaddum DF Site

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Appendix B (continued)

Ar Rutbah SIGINT Substation

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Appendix B (continued)

Ar Rutbah DF FAC South

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1.4 (c)

Appendix B (continued)

Ash Shuaybah SIGINT Substation

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Appendix B (continued)

Ash Shuaybah SAM Site

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Appendix B (continued)

Baghdad/Ad Dawrah

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Appendix B (continued)

Baghdad East

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Appendix B (continued)

Baghdad Main Central

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Appendix B (continued)

Karbala

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Appendix B (continued)

Mosul DF FAC West

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Appendix B (continued)

Mosul SIGINT Substation

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Appendix B (continued)

Rasheed ELC WAR Site

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Appendix B (continued)

Shaikh Mazhar Barracks Area

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