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LESSONS FROM ISRAELI BATTLEFIELD AIR INTERDICTION DURING THE BATTLE FOR GOLAN, OCTOBER 1973

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

THOMAS D. ENTWISTLE, MAJ, USAF
B.S., East Texas State University, 1975

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This study establishes lessons, and draws conclusions from Israeli Air Force air-to-surface operations during the battle for Golan in October, 1973. The Israeli air mission and principal operational factors are identified and described. A historical analysis then considers how the principal factors influenced Israeli fighter operations, and determines what results were achieved.

The study shows that Israeli air-to-surface operations during the battle were equivalent to current US Air Force doctrine for Battlefield Air Interdiction. Enemy ground forces and their objectives, Israeli assets, threats to fighter operations, and environmental conditions are described and analyzed to establish how they influenced operations. The results of operations are then measured against the doctrinal goals of Battlefield Air Interdiction to determine Israeli success.

The study concludes that Israeli air operations effectively contributed to the defeat of enemy ground forces, but the delayed nature of the effects produced important risks to the outcome of the battle. Further, the principal f.ctors had a significant and mixed influence on the results of air operations.

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ABSTRACT

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CHAPTER 1

INTRODUCTION

Problem Statement

The purpose of this study is to identify lessons and draw conclusions from Israeli Air Force (IAF) air interdiction operations during the battle for Golan Heights in October, 1973. The study attempts to demonstrate how IAF operations fit the current United States Air Force (USAF) model of Battlefield Air Interdiction (BAI). Conclusions are applied broadly to future BAI operations.

Background

At 1400 hours on 6 October 1973, the Syrian army initiated an attack on Israeli positions on the Golan Heights. The Israeli Defense Force (IDF) was greatly outnumbered and IDF mobilization of reserve ground forces had only begun.[1] Syrian forces, using Soviet tactics and equipment, attempted a rapid penetration of Israeli positions to occupy the Golan Heights.[2]

Tactical fighters of the IAF were employed to help stop the Syrian divisions.[3] The Syrian air defense system, however, employed a wide variety of surface-to-air missiles (SAMs), anti-aircraft artillery (AAA), and fighter aircraft to protect ground forces from the IAF.[4]

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This battle is an important event for students of tactical fighter employment because of its intense action and the use of advanced technologies.[5]

Many analysts sought to correlate events of that conflict with a litany of air power issues. Monroe and Farrar-Hockley (1974) said, "...the advent of the missile suggests that the day of the main battle tank and the warplane may be ending."[6] Herzog (1975) concluded that, "To a degree air power will obviously not be as influential as it has been and will affect the battlefield less than it did."[7]

These statements reflect a significant episode in the application of modern air power. Therefore it is important to draw accurate conclusions from the lessons of this intense and technologically sophisticated battle.

Research Question

What are the lessons from the IAF Air Interdiction mission during the October, 1973 battle for Golan?

Sub-questions for the study are:

1. What was the mission for the IAF?

2. What IAF fighters and assets were employed?

3. What factors influenced mission accomplishment?

4. How is mission success measured?

5. How effective were IAF operations?

Methodology

This paper presents a description of information and a historical analysis of data found in the research literature. The descriptions and analysis produce lessons from the Golan battle, that in turn, support conclusions about IAF operations and prompt recommendations.

The research literature consists of primary and secondary sources represented mostly in published books and periodicals. US Government publications are also used. All sources used are unclassified.

The search for information centered on documents available through the Combined Arms Research Library (CARL) located at Fort Leavenworth, Kansas. A computer search was made for BAI, Close Air Support (CAS), and air support documents. The data base for this computer search was the Defense Technical Information Center (DTIC). The CARL card catalog was investigated for works on the subjects of Arab-Israeli War, Yom Kippur War, Golan Battle, Mideast War, and the IAF.

Abstracts published by the United States Air Force (USAF) Air University were reviewed. These abstracts reflect papers written for the Air War College and the Air Command and Staff College.

Texts used by the US Army Command and General Staff College were reviewed for applicable data. Also, texts and student study guides used for the USAF Fighter Weapons

Instructor Course were reviewed for information. Theses written for the Master of Military Art and Science program at Fort Leavenworth, Kansas were researched as well.

The CARL special bibliography number 42, "1973 Middle East War", was also used. This document was revised in January, 1982 and lists books, reports and periodicals.

The validity of sources was determined in two ways. Official United States Air Force (USAF) doctrine, as published in government documents, was taken at face value and assumed accurate. For all other sources the preponderance of evidence was used to balance the information and exclude extreme deviations.

This paper describes and analyzes the research information by developing three chapters for studying IAF operations in the interdiction mission. Together, these chapters answer the research sub-questions.

Chapter 2 discusses the USAF concept of BAI and relates it to the primary IAF air-to-surface mission during the battle for the Golan. It then identifies the principal factors that contribute to defining the specific IAF mission and influenced the outcome. Finally, the criteria for measuring IAF success is described.

Chapter 3 describes the principal factors focusing on their relationship to the BAI mission. Chapter 4 analyzes the influence of the factors and measures IAF effectiveness in terms of the four goals of BAI. Each

factor is considered individually and as a component of the whole.

IAF effectiveness is measured by analyzing contributions made by IAF fighter resources and their supporting assets. This measurement is based on the degree and quality of degradation inflicted on major Arab units. In total, the discussion in chapter 4 provides the lessons from the operation.

Assumptions

1. Combat performance by major enemy ground units is a reliable indicator of BAI mission success.

2. The criteria accurately reflect success and failure.

Definitions

1. BAI - Battlefield air interdiction is that portion of an air interdiction campaign designed to affect the ground battle with near term results. The goals of air interdiction are to destroy, disrupt, delay and divert enemy combat power before it can affect friendly operations. It is a characteristic of BAI that operations are conducted at such a distance from friendly ground forces that close coordination with the ground commander is not required in the execution phase of the mission.

2. Destroy - To break up or completely ruin elements of combat forces, Command, Control and Communications (c^3) networks, transportation networks, and military supplies.

3. **Disrupt** - To disturb or interfere with the enemy's scheme of operation and control of forces.

4. **Delay** - To retard the build-up or arrival of enemy forces and supplies.

5. **Divert** - To force a new direction or subordinate application of important military assets.

Limitations

Many IAF operations during this battle remain classified.

Syrian, Iraqi, and Jordanian accounts of IAF operations are generally unavailable in unclassified works.

Delimitations

Only IAF fighter operations in the BAI role are considered.

Only the Golan battle will be considered.

No attempt will be made to apply the lessons to any particular aircraft or specific theater of operations.

Significance of the Study

Effective employment of tactical fighters in the BAI mission requires full understanding of air power capabilities and limitations. Past episodes of fighter operations provide valuable insights for this understanding only when they correctly reflect the issues and events.

The IAF participation in the 1973 battle for Golan provided an important opportunity to study fighter employment. If the correct lessons from that experience are

identified and applied, effective fighter employment is facilitated.

USAF planners and practitioners will understand the IAF role in the Golan battle. With greater appreciation for the objectives, challenges, and results of these air operations, they will make better application of the lessons to their areas of responsibility.

US Army personnel also will gain insight to the advantages and disadvantages of BAI operations and how their own activities may be affected.

Organization

Chapter 2 describes and validates application of BAI to IAF operations, and identifies factors that influenced operations and results. This chapter also describes the criteria for measuring IAF success. Chapter 3 describes the factors to support analysis. Chapter 4 analyzes how the factors influenced operations and measures IAF results. Chapter 5 establishes conclusions from analysis and presents recommendations for further study and development.

CHAPTER 1

END NOTES

[1] Kenneth S. Brower, "The Yom Kippur War", _Military Review_, (March 1974), pp. 25, 26

[2] Trevor N. Dupuy, _Elusive Victory: The Arab-Israeli Wars, 1947-1974_, (1978), pp. 441, 443

[3] A.J. Barker, _Arab-Israeli Wars_, (1981), p. 127

[4] Dupuy, _Elusive Victory_, p. 441

[5] Herbert J. Coleman, "Israeli Air Force Decisive in War", _Aviation Week & Space Technology_, (3 December 1973), p. 18

[6] Elizabeth Monroe and A. H. Farrar-Hockley. _The Arab-Israel War, October 1973. Background and Events._ Adelphi Papers #111. (London, 1974/5), p. 34.

[7] Chaim Herzog. _The War of Atonement. October 1973._ (1975), p. 261.

CHAPTER 2

MISSION AND FACTORS

Mission

In 1973 the term Battlefield Air Interdiction (BAI) did not exist for either the United States Air Force (USAF) or the Israeli Air Force (IAF). Air Interdiction (AI) and Close Air Support (CAS) were the operative terms and the missions were readily distinguishable. Mission objectives and the nature of coordination with friendly ground forces, during planning and execution, defined the two missions.[1]

Current USAF doctrine incorporates the term BAI as a component of the AI mission. To understand the BAI concept, air interdiction doctrine must first be presented.

> "Air interdiction objectives are to delay, disrupt, divert or destroy an enemy's military potential before it can be brought to bear effectively against friendly forces. These combat operations are performed at such distances from friendly surface forces that detailed integration of specific actions with the fire and movement of friendly forces is normally not required. Air interdiction attacks are usually executed against enemy surface forces, movement networks (including lines of communication), command, control and communications networks, and combat supplies."[2]

Two components of AI doctrine make this mission distinctive. These are the timing of the effect, and the degree of coordination required with the ground force commander. The effect of interdiction is not immediately

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felt on the front lines because AI targets are enemy forces, not yet engaged. The coordination requirements in AI are fewers because the risk of fratricide and waste by redundant targeting are avoided through horizontal target separation.

A review of USAF doctrine highlights the important features of the CAS mission.

> "Close Air Support objectives are to support surface operations by attacking hostile targets in close proximity to friendly surface forces... All preplanned and immediate close air support missions require detailed coordination and integration with the fire and maneuver plans of friendly surface forces.[3]

BAI results and procedures bridge the gap between AI and CAS.

> "Air interdiction attacks against targets which are in a position to have a near term effect on *friendly land forces are referred to as battlefield* air interdiction. The primary difference between battlefield air interdiction and the remainder of the interdiction effort is the level of interest and emphasis the land commander places on the process of identifying, selecting, and attacking certain targets. Therefore, battlefield air interdiction requires joint coordination at the component level during planning, but once planned, battlefield air interdiction is controlled and executed by the air commander..."[4]

BAI then, is the aerial attack of hostile ground forces with the near term, but not immediate, effect of destroying, disrupting, delaying or diverting their combat power. With BAI the friendly ground commander contributes to target planning but not mission execution. Consequently, BAI influences the ground battle more directly than does AI, but without the restrictions inherent to CAS.

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Current USAF doctrine for AI, BAI and CAS missions, and IAF operations during the Golan battle, are conceptually parallel. While the term BAI wasn't used, the concept was.

At midnight on the opening day of the Golan battle the IAF Chief of Staff, Benyamin Peled, gave clear orders: "...try and block, stifle and stop with everything we had the onslaught of the Syrian armor onto the (Golan) Heights..."[5] This identifies an air mission to attack enemy ground forces to divert, disrupt and delay them.

Major General Peled further directed: "The place to get them (enemy ground forces) is where they are concentrated, where they want to get to engagement with your forces."[6] With this statement Peled is describing two key facets of USAF BAI. The first is, the interdiction of enemy forces which are positioned to have a near term impact on friendly forces, and the second, that concentrated forces present a lucrative target for air power.

General Peled's words are closely aligned with the then Chief of Staff for the Israeli Defense Force (IDF), Lieutenant General David Elazar.

> "I see the Air Force's main role in the support of ground forces in interdiction - to achieve destruction of the enemy's military infrastructure, cause havoc among troop movements and, in one word, to paralyze the enemy forces."[7]

General Elazar thus identifies destruction, disruption and delay as components of the main IAF support role...interdiction.

This brings up another important point in identifying the IAF mission. The CAS mission was not primary. Quoting General Elazar: "Even before 1973, I considered the subject of Close Air Support the last priority task of the Air Force."[8]

In fact strong evidence indicates that CAS was neither planned nor flown during the Golan battle to any significant extent. General Peled said:

> "Close support in our definition is that type of air-to-ground operation where a ground commander assesses his own situation, evaluates that he needs an air weapon to solve his immediate problem, calls for it, and gives the Air Force all the relevant data in order to get his address. The Air Force sends a number of aircraft, and tells the commander of those aircraft to contact the ground commander and become his subordinate for the duration of the operation."[9]

This description of IAF close support is conceptually similar to USAF CAS. The key elements are that the ground commander selects targets of immediate import and ensures the integration of air power into his operation. General Peled further discounted the use of close support.

> "In this respect, I can count on the fingers of my two hands, in all the wars we have fought, the cases where this (close support) was done by this definition. All other operations of the Air Force that were loosely called close support were never really close support; they were a combination of information put through ground forces channels to Air Force planners and decision makers..."[10]

This parallels the USAF doctrinal approach to BAI with Army target nomination and Air Force execution.

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Clearly, the IAF mission in support of friendly ground forces during the Golan battle was equivalent to the USAF mission of BAI. The operational concepts, objectives and procedures support this correlation. The rest of this paper will use the term BAI for IAF operations.

Factors that Influence the Mission

Several factors interact to refine a specific military mission from the general concepts of doctrine. These factors also influence the results of operations. The principal factors contributing to the specific IAF mission were enemy forces and objectives, and friendly ground force dispositions. Factors that influenced mission results included IAF assets, threats to fighter operations and environmental conditions.[11]

IAF assets for BAI included fighter aircraft, aircraft systems, weapons, people, and elements of combat support. Elements of combat support were aircraft maintenance, c^3I, and threat suppression.

Threat factors were fighter aircraft, radar guided Surface-to-Air Missiles (SAMs), Infra-Red (IR) guided SAMs, and Anti-Aircraft Artillery (AAA). Environmental conditions were depicted by factors of geography, terrain, meteorology, and battlefield conditions.[12]

Criteria for Success

The goals of BAI are to destroy, disrupt, delay and divert enemy combat power to effect a near term advantage

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for friendly surface forces.   The enemy combat power
targeted for degradation includes combat forces, LOCs, C^3I
and supplies.

The destruction goal is achieved through attrition
of forces and supplies.   Disruption causes the enemy to
adjust his scheme of maneuver or degrades his ability to
command and control his forces.   A destroyed command post
causes disruption just as an air-deployed mine obstacle may
deny him a favored axis of advance.

Diversion is forcing the enemy to shift valuable
resources from their intended use.   When an ammunition
convoy is destroyed, the parts trucks employed to haul the
ammunition have been diverted.   Another example of diversion
is a combat unit, reserved for counterattack, which has been
committed early to compensate for another unit which has
been delayed.

A delay retards the arrival or build-up of combat
forces or their supplies.   Attacking an enemy unit's
marshaling area may disrupt that unit's organization or
prevent its timely employment.   Delay is also achieved when
a significant number of needed river crossing devices are
destroyed.[13]

A key feature of these four goals is that they
interact to produce a collective effect that is greater than
their individual value.   So the best measure of
effectiveness is not gained by counting destroyed equipment

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and dead soldiers. The most valid measure comes from determining the success of enemy ground units that have been subjected to BAI. When possible, their strength, cohesion, timing and location must be compared to their plan and objectives.

Summary

This chapter has established the IAF mission, its close relationship to USAF BAI doctrine, the factors which influenced mission results, and the criteria by which success can be measured. This foundation allows a detailed description of the factors that influenced the IAF mission.

CHAPTER 2

ENDNOTES

[1]US Air Force, _Doctrine Information Publication #4: Service Issues_, (1980): p 3.

[2]US Air Force, _AFM 1-1, US Air Force Basic Doctrine_, (1984): p 3-3.

[3]AFM 1-1: p 3-4.

[4]AFM 1-1: p 3-4.

[5]International Symposium, Jerusalem, _Military Aspects of the Israeli-Arab Conflict_, (1975): p 241.

[6]Symposium: p 256, 257.

[7]Symposium: p 249.

[8]Symposium: p 249.

[9]Symposium: p 255.

[10]Symposium: p 255.

[11]US Army Command and General Staff College, _Battle Analysis_, (1987): p 7-13.

[12]US Air Force Fighter Weapons School, _Surface Attack Mission Planning, F-16 Mission Planning Factors_, (1983): p 13, 14.

[13]AFM 1-1: p 3-3.

CHAPTER 3

DESCRIPTION

By the outbreak of hostilities on 6 October, 1973 the Syrian army amassed five divisions and two independent brigades. The 5th, 7th and 9th Mechanized Infantry Divisions formed the first echelons, the 1st and 3rd Armor Divisions formed the second echelon forces while the two independent armor brigades formed the reserve.[1]

This Syrian force comprised mostly armor with 28,000 men, over 1200 tanks and 1000 Armored Personnel Carriers (APCs).[2] About 600 field artillery tubes, rocket launchers, and armored bridging vehicles supported this highly mobile force.[3] Syrian armor, supplied by the Soviet Union, included the proven T-54 and T-55 tanks as well as the new T-62 tank with its smooth bore main gun. The APCs were Soviet BTR-60s.[4]

Syrian tactics called for echeloned forces with tanks up front supported by bridging and mine clearing vehicles composed of bulldozers and `flail' tanks. The infantry followed close behind in APCs, many with anti-tank weapons.[5]

To facilitate mobility the Syrians formed long columns along existing roads with three or four vehicles

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line abreast on either side of the road. An Australian major who was an observer for the United Nations cease fire arrangement from the previous war, saw 300 tanks in four columns moving toward the Golan.[6] Second and third waves were made up of tanks and APCs.[7]

Syrian objectives were somewhat adjusted from their original plan to terminate the Israeli state. Close cooperation with Egypt led to operations Spark and Badr wherein the two Arab nations would simultaneously attack on two fronts, Golan and Sinai. Syria would limit her operation to capture territory lost in the 1967 war. This meant gaining all of the Golan plateau, including the western escarpment, and sections of the Jordan river.[8]

The western escarpment of Golan was militarily decisive because of its steep vertical development and commanding view of the Jordan River valley. Any IDF reinforcements would have to cross that valley making use of limited roadways. One critical roadway was the Bridge of The Daughters of Jacob. Being the only significant Line of Communication (LOC) into the central Golan from Israel, controlling this bridge was a specific Syrian objective.[9]

The Syrians planned to break through forward IDF positions with the three mechanized divisions. In the north the 7th Division (Mechanized), supported by elements of the 3rd Division (Armor), constituted the supporting attack. In the south the 5th and 9th Divisions (Mechanized) formed the

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main effort.[10] These units would bypass the defenders in their strongholds and sweep the armored echelons rapidly through to occupy and consolidate on the Golan.[11] Bypassed IDF positions would be taken out by infantry.

Speed and mass were indispensable for this operation because hurriedly mobilized IDF forces were anticipated to stiffen the resistance. The Syrians enjoyed superior numbers, surprise and a low state of IDF readiness due to Israeli observance of Yom Kippur.[12]

The Syrians intended to hold all of Golan by the 2nd night so that by Sunday, 7 October victory would be achieved.[13] At 1400, 6 October, Syrian jets attacked IDF positions. A massive artillery preparation followed and one hour later the first tank battles started in the north.[14]

The IDF had one division holding the Golan on 6 October. Roughly two armor brigades and one infantry. The 7th Armor Brigade defended the northern sector while the 188th Armor Brigade defended the larger southern sector. These brigades had four armor battalions each and were supported by 11 batteries of artillery. The 7th Brigade had about 105 tanks and the 188th Brigade had 90. Before the battle began, General Eitan, Golan Division Commander, transferred one armor battalion from 7th Brigade to improve the southern brigade's reserve strength.[15]

Additionally, 17 strongholds, including the Mt. Hermon observation complex in the extreme north, were

developed on advantageous hilltops along the breadth of the Golan. Each of these had 10 to 30 soldiers assigned. These strongholds comprised as many as 112 separate pillpoxes or blockhouses from which the infantry operated.[16]

Although this combination of well established strongholds and highly mobile armor represented a respectable force, some aspects of the defense reduced the inherent combat power available.

In the southern sector the 188th Brigade had a relatively large area of responsibility and the hilltops were spaced farther apart than in the north. This caused the fires from the strongholds to overlap only at their extreme range.[17]

Further, the IDF forward units were manned at lower than normal levels. This was attributed to the observance of Yom Kippur, the Jewish day of atonement. Besides soldiers on leave, the logistics system had slowed considerably.[18]

Another limitation to IDF combat power was the relatively small amount of artillery available to the Golan defenders. Since previous episodes of battle showed the IAF to be a decisive and reliable component, the emphasis on artillery deployment was reduced.[19]

Nonetheless, by 1400, 6 October, when the Syrians initiated their offensive, the IDF was alerted to the

impending hostilities and Israel was 6 hours into a 72 hour mobilization process.[20]

Israel started the 1973 War with 522 combat aircraft of all types. Many of these were unsuited for the BAI mission and others were generally dedicated to roles other than air-to-surface operations.

The IAF had 162 A-4 'Skyhawk' attack fighters, 127 F-4 'Phantom' multi-role fighters, 70 'Mirage III' fighters, 20 'Super Mysteres' and, 25 'Barak' fighters.[21] The A-4 and F-4 aircraft were produced in the United States (US), the Mirage and Super Mysteres were of French origin and the Baraks were built in Israel.

Other aircraft included 6 F-5E reconnaissance planes, 32 transport type aircraft, 75 helicopters and a number of US built, Teledyne-Ryan 124 drones.[22] With the exception of the F-5s, these aircraft are discussed as assets later.

The mainstays of the BAI mission were the A-4s and to a lesser degree the F-4s. The Mirages and Baraks were employed exclusively in the air-to-air role which is appropriate for their capabilities. The F-4s were used for both air-to-air and air-to-ground roles while the A-4s did only air-to-ground missions.[23]

The A-4 and F-4 had several important subsystems in common. Electronic Countermeasure (ECM) pods, Radar Warning Receivers (RWR), flare dispensers and some chaff capability.

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The purpose of an ECM pod is to defeat radar threat systems by interfering with the electromagnetic signals used by the threat. RWR equipment serves to give a pilot an indication that he is being illuminated by a radar system. Flares are used to decoy infra-red guidance devices so they will guide to the flare instead of the hot exhaust from an aircraft engine. Chaff is radar reflective material, deployed in strips that can decoy radar guidance devices so they will guide to the chaff reflection instead of the aircraft body. Chaff may also be used to form clutter through which radars cannot see.[24]

The IAF used ECM pods with a capability to defeat SA-2 and SA-3 Surface to Air Missiles (SAMs) but not the SA-6 SAM.[25] The radar frequency of IAF pods was not tuned to the radar used with the SA-6.[26] The SA-7 SAM, also used by Arab ground forces, was not affected by jamming pods because it used IR information, not radar. IAF RWR gear was limited for the same reasons.

Chaff capabilities were different between the F-4 and A-4. While the A-4 employed specifically designed chaff dispensers the F-4 was relegated to packing chaff bundles in the aircraft speed brake well.[27]

The A-4s had some other equipment that was particularly well suited to the surface attack role. Inertial Navigation Systems (INS) were installed in the A-4s along with Head-Up Displays (HUD).[28] These systems are

designed to improve tactical navigation and weapons delivery.

The IAF had a wide variety of air-to-surface weapons for use in the BAI mission. General purpose bombs, napalm, rockets, aircraft cannons and illumination flares. Both the F-4 and A-4 were originally equipped with 20mm cannons but the IAF substituted a 30mm cannon, the 'Aden', for the 20mm in its A-4s. The 30mm gun was more effective against tank and APC targets.[29] The IAF also had a limited number of special purpose weapons available to them.

Perhaps the most significant asset of an air force is its people. Pilots plan and execute the mission. Having enough good pilots is essential to successful operations. The IAF had plenty of pilots, about three for every cockpit.[30] The remaining issue then, is the quality of the pilots.

Historically the IAF has been an underlying strength of the Israeli military.[31] In prior conflicts the IAF pilots consistently outperformed their Arab counterparts and a repeat was expected in 1973 that would make for a short war.[32]

Several reasons have been suggested to explain the consistently high quality of IAF pilots but the main issue seems to be training. The IAF training system was highly developed and high standards were set for performance. IAF fighter pilots received twice as much flying time per month

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as did Arab pilots.[33] IAF training also emphasized the types of missions flown during the Golan battle. Typically, Israeli pilots sought quick, decisive results and were accustomed to getting them.[34] Also, the IAF pilots were intimately familiar with the Golan terrain. Clearly, these men were especially well prepared for the Golan battle.[35]

The final asset for discussion is combat support. Since most IAF aircraft were bought from outside sources at great expense, these resources were hard to come by and good maintenance was required. An example of their efficiency is that they could turn around a combat sortie, from the time they got the plane until it was ready again, in eight minutes.[36]

Like the pilot force, maintenance had high standards. At any time it was possible for 80% of the available aircraft to be in full commission.[37] Indeed, the high in-commission rates, quick turn-arounds and rapid damage repairs are cited as reasons for the IAF actually flying more sorties than all the combined Arab air forces.[38] In quantifiable terms, the IAF maintenance was able to provide 500 sorties a day over Golan alone at the time they were most needed.[39]

IAF c^3I was centralized and responsive to mission needs. High technology made this centralized system work in the swiftly changing environment of air operations.[40] A single command post controlled operations through an

excellent communications network.[41]   Leaders were kept
informed and the air effort was well coordinated.[42]   Target
intelligence information was made available through the use
of drones.[43]   These could be used to help find mobile
targets much as they were during the recently concluded 'War
of Attrition'.

Threat suppression was another element of combat
support available to the IAF. The US built Teledyne Ryan -
124 reconnaissance drones were employed as SAM decoys and
chaff dispensers.[44] Helicopters were loaded with powerful
radar jamming equipment and flew ECM support missions to
augment the on-board capabilities of Phantoms and
Skyhawks.[45]

When the Syrians moved up the roads leading to the
Golan Plateau they brought with them an integrated system of
air defense. This Integrated Air Defense System (IADS) was
unique in the history of warfare.   It incorporated
overlapping, redundant, and mutually supportive components
that when applied in concert, covered the entire battlefield
from the surface to 70,000 feet.[46]

Components of this IADS were designed and
manufactured by the Soviets and the Arab operators received
expert training on their use.[47] The IADS incorporated high
speed and maneuverable fighters, radar guided SAMs, IR
guided SAMs, and a host of Anti-Aircraft Artillery.[48]

The primary aircraft of the IADS consisted of the Soviet built MIG-21 'Fishbed', although other types existed. The Syrians had more than 300 fighter aircraft in their air force; 200 MIG-21s, 80 MIG-17s and 30 SU-7s.[49]

Syrian radar guided SAMs included the SA-2 'Guideline', the SA-3 'Goa' and SA-6 'Gainful'. The number of SAM systems is estimated at 12 SA-2s and SA-3s and 32 SA-6s.[50]

The Syrians also employed an IR SAM, the SA-7 'Grail'. This was deployed in two ways. One, the missile was carried by individual soldiers with one gripstock and four reloads and, two, launch tubes were installed on tracked vehicles with the capability to fire salvos of 4 or 8 missiles.[51]

Syria deployed a variety of conventional AAA using radar and optical fire direction. These systems included the S-60 57mm, the ZSU 23-4, and the ZU 23-2. The hundreds of automatic weapons and thousands of small arms that may be employed against aircraft targets are not described but their presence is hereby noted.[52]

The geographic area for the Golan battle was small yet complex. The immediate area of the Golan Heights is bounded to the north by Lebanon, to the east by Syria, and to the south by Jordan.[53] To the northeast, through Syria, is Iraq. These Arab states were all potential adversaries of Israel and with the exception of Lebanon, eventually

contributed surface forces to the Golan battle on the side
of Syria.[54]

The proximity of these borders represents a very
small area. Damascus was less than 35 miles from the
Golan.[55] The depth of the Golan defensive belt for the IDF
was only 17 miles.[56] Further, the entire breadth of the
Golan front, from Mount Hermon, in the north, to the Yarmuk
River and the Jordanian border, was less than 40 miles.[57]

To gain an appreciation for how close these
distances are in terms of time, an F-4 Phantom traveling
unrestricted at a combat speed of 500 miles per hour, could
cross the Golan's depth in fractionally over two minutes.
Four minutes and 10 seconds later, that Phantom would be
over downtown Damascus.

The Israeli cultural centers of Galilee and the
Jordan River are immediately to the west of the Golan
Plateau. The Mediterranean Sea is a short 40 miles to the
west.[58]

The terrain of the Golan was also an important
consideration. The 17 miles from the 1967 cease-fire line
to the western escarpment of the plateau contained no
natural obstacles. While the terrain varied from the open
rising slopes of the south to the hilly approach to Mount
Hermon in the north, the Golan was essentially all open
country. The steep western escarpment gives a commanding

view of the Jordan River Valley, the Israeli settlements, and limited LOCs below.[59]

Though mostly open terrain, the Golan surface was largely rocky and in many sectors the ground was strewn with boulders. Only sparse and sporadic vegetation existed.[60]

The Golan suffered from a very primitive network of roads. Many secondary roads existed on Golan but the only major road ran from central Syria, southwest through Golan, down to the Bridge of the Daughters of Jacob over the Jordan River. This bridge was at the base of the escarpment which overlooks Galilee.[61]

Two other man-made features are notable. The IDF engineers constructed a tank ditch obstacle to thwart an invasion. The ditch was 15 feet deep, had a 12 foot bank on the Israeli side, and was supported by a mine field.[62]

In Syria a rather extensive defensive belt was established. This was constructed under the advice of Soviet engineers and was prepared to withstand artillery and air delivered weapons.[63]

Only one example of cloud cover is considered. The Israelis claim that on 6 October a low cloud over Golan prevented preemptive air operations in the area.[64] No mention is made of precipitation or dust storms and the wind gets no attention in any of the source documents.

The battlefield conditions on the Golan represented a close and vigorously fought battle. Forces were

intermingled. Massive numbers of vehicles scattered across the terrain and a Syrian victory was very nearly won.

The intermingling of forces occurred soon after the first shots were fired. On the first night the Syrians were able to cross the IDF tank ditch whereupon close armored combat was forced. With this penetration, the Syrian armor bypassed IDF positions as planned, and spread generally into three columns.[65]

Prior to meeting IDF resistance the Arabs kept closely to the roads where massive build-ups of armor moved slowly and became confused. After breaking through, however, Syrian armor followed the path of least resistance and joined attack formations of six or seven tanks.[66]

In the south, four of the eight IDF forward strongholds were evacuated but the other half were encircled and isolated. The bypassed units swung their guns and continued to fire at the passing Syrians from behind. Some Israeli tanks added to the confusion by moving east to check on the status of IDF units that had been cut off.[67]

The large number of vehicles on the Golan contributed to the confusion also. The first two days of the conflict constituted the largest tank battle since the Battle of the Bulge in World War II.[68]

From the 1200+ Syrian tanks sent to Golan, almost 900 were left on the battle ground. Some 200 Israeli tanks

added to the refuse, while thousands of other vehicles and and artillery pieces were left behind.[69]

The hard pressed 188th Brigade, in the south, hoped for a lull in the fighting the first night but the Syrians committed 300 more tanks to their penetration, consolidated their forces, and continued the attack.[70] These tanks from the Syrian 5th Armor Division got within three miles of the western escarpment, just north of the Sea of Galilee.[71]

Summary

This descriptive segment gives insight to Syrian objectives and capabilities. It also shows what factors affected IAF operations during the battle. This information provides the basis for analyzing how IAF operations were influenced and what results were achieved.

CHAPTER 3

ENDNOTES

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CHAPTER 4

ANALYSIS

Influence of Principal Factors

The Syrian Air Force (SAF) was not, in itself, a decisive factor in preventing Israeli Air Force (IAF) mission accomplishment. An improved combat entity over time, the SAF was unable to significantly impair IAF fighters or protect the Syrian air space.

SAF fighters aggressively pursued aerial combat with the IAF but fewer than 10% of all IAF losses were air-to-air losses.[1] The Syrians committed all available aircraft to the Golan battle to compensate for somewhat reduced Surface-to-Air-Missile (SAM) and Anti-Aircraft Artillery (AAA) coverage vis-a-vis the Egyptians.[2] This commitment, however, complicated the SAM operator's mission for fear of hitting their own planes.[3]

It is reasonable to assume that concern of fratricide decreased the Syrian pilots performance as well but, when the joint IAF/Israeli Defense Force (IDF) suppression effort terminated SAM operations for several hours, the IAF still was able to perform Battlefield Air Interdiction (BAI) with hardly a loss.[4] Further, in the Syrian rear, where SAM coverage was drastically decreased,

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the IAF was able to inflict significant damage to military and industrial targets.[5] Ultimately Syria called on Egypt to step up operations in the Sinai to relieve some IAF pressure.[6]

There are several reasons why the SAF was ineffective. First the Arab emphasis for control of the skies was on SAMs and AAA and not the air arm.[7] The quality of training would likely decrease under those circumstances. Evidence suggests that the Arab pilots, as a whole, lacked aircraft systems knowledge and suffered from underdeveloped training.[8]

Training wasn't the only problem though. Several operational constraints degraded the SAF performance during the battle. Syrian surveillance radar systems were inadequate for providing fast, accurate target information. Their maintenance was unable to generate the large sortie numbers required to meet a dedicated air offensive. Further, the IAF had apportioned a significant percentage of their assets strictly to the aerial combat role. These issues, when applied to the SAF's generally defensive posture, smaller numbers, and diminished training, almost ensured an ineffectual showing regardless of the pilots' aggressive spirit.[9]

Some students of this battle touted the high technology radar SAMs as the decisive element in modern war. One observer regarded them as the English longbow of the

20th century with the aircraft filling the role of the impaled knight.[10]

This somewhat enlarged view of their effectiveness likely reflects the tactical surprise achieved with the newly introduced SA-6 Gainful. While Electronic Countermeasures (ECM) had proven its worth in dealing with the SA-2 and SA-3 systems, only advanced US equipment offered a working ECM solution to the SA-6. These sophisticated American jamming pods were costly, took time to adjust and were initially unavailable.[11]

In total, the SA-6 afforded some important tactical gains to Sryia. First, it worked. With a total of 80 IAF aircraft lost at Golan, 50% to AAA, 10% to air and one or two by SA-7 engagements, a reasonable estimate would put losses to the Gainful at 40% or about 30 aircraft.[12] This represents about 7% of all IAF fighter resources and is significant even for a battle of 19 days.

The SA-6 was also the only effective high altitude threat to IAF fighters when the other SAMs and SAF interceptors are discounted. Without effective ECM a good visual search and radical defensive maneuvers became more important. This often meant turning down into the low altitude threat. This particular technique, when attempted at night, introduced another serious challenge in avoiding the terrain. Another reward brought by the SA-6 was the

overall reduction of BAI sorties because assets were diverted to suppress the missiles.[13]

The immense volume of guided missiles to which the Gainful contributed, was one of the main advantages of the SA-7, Grail. Often reported to have a warhead too small to bring down a jet fighter, the SA-7 was prolific.[14] Its unique portability made this system omni-present and that denied the low altitudes as a sanctuary.[15]

Further, the greater intensity of air operations amid hundreds of heat seeking missile launches affected the efficiency of BAI sorties because defensive reactions were needed.

The more conventional form of air defense, AAA, was the potent threat to IAF fighters. Over half of all IAF losses were to AAA.[16] These low altitude systems were numerous and effective if only by the volume of fire. A Dutch observer with the United Nations estimated that three of every five aircraft that appeared overhead were hit by missiles or gunfire.

Were these figures universally correct, the damage repair effort alone would be staggering. The presence of the ZSU 23-4, however, brought high technology efficiency to this otherwise humble aspect of air defense. As many as 160 of these highly mobile and accurate AAA systems were employed by the Syrians, increasing the range and lethality of the AAA threat.[17]

The collective effect of the threat factors was that BAI aircraft were lost and damaged, limited resources were diverted, and sortie efficiency was reduced.

The environment also played a significant role in the effectiveness of fighter operations. These factors both strongly supported the BAI effort and dictated a formula for a near disaster.

The local geography had this dual influence by mandating mission requirements for the initial phase of the battle and by providing important offensive and defensive opportunities afterward. In the first decisive days of this battle, geographic factors forced the IAF to directly engage the leading elements of armor units.[18]

Since the observance of Yom Kippur reduced manning on the Golan front and the effective surprise slowed the movement forward of IDF reserves, the preferred first mission of threat suppression was virtually discarded so maximum BAI could be flown. Besides dictating the grim reality of flying into the teeth of an undiminished IADS, the lack of defensive depth forced fighter operations against the well protected and dispersed leading echelons.[19]

The distance and time elements simply didn't allow for adequate reinforcement of IDF ground forces before the overwhelming Syrians could reach the Israeli heartland. Therefore, the IAF was committed to direct confrontation.[20]

There were some advantages to Israel from geography though. The same proximity that brought the Arabs to the strategic heights of Golan with such appalling speed also allowed extraordinary numbers of short-duration sorties from the IAF.[21] An important side benefit from quick sorties is a lower fuel requirement. This provided for faster speeds, heavier weapons loads, diverse routes and deeper penetration.

The short distances not only brought the Arab capital in range but also major Command, Control, Communications and Intelligence (C^3I) facilities, transportation hubs and military installations.[22] The Israeli centralized command and control system was also aided by the small area of operations. Good communications and coordination gave Israeli leaders the flexibility to orchestrate an effective air effort including BAI.[23]

With Jordan and Lebanon being relatively demilitarized and so near the battlefield, a comparatively low-threat axis of attack was provided to Golan targets.[24] It's likely that this contributed to aircraft survivability by providing unpredictable routes and decreased response times to the Syrian threats.

The terrain also contributed to fighter survival in some respects. The technique of terrain masking involves defeating threat sensors, such as radar, Infra-Red (IR) and optical, by hiding behind terrain or blending in with a

terrain background. This technique is useful for avoiding detection and for restricting sensor discrimination of its target. Since the southern Golan Plateau rose gradually to the west, terrain masking would be possible only at extremely low altitudes. In the north with Mt. Hermon and its foothills, and at the western cliffs, masking terrain was readily available.

Another terrain feature that supported fighter operations was the rough, boulder-strewn ground that was open enough to deny natural cover and concealment but too rugged to traverse quickly. This worked in conjunction with the limited road network and the Syrian goal of rapid movement, to produce predictable, visible, and vulnerable targets. The IDF tank ditch and mine obstacles made these same targets lucrative for air power.[25]

The meteorological factors had a real influence on fighter operations in that almost no adverse conditions existed for the duration of the battle. This includes: clouds, precipitation, obscurations to visibility and winds. The reported low cloud over Golan Heights on the afternoon of the 6th is considered to be a politically inspired justification for not preempting Syria's attack.[26] This is based on the isolation of the cloud report, the fact that many sorties actually were launched to the Golan, and the value of not preempting Syria to secure US support.[27]

With the favorable meteorological conditions, the IAF operated without the added restrictions inherent with bad weather. These restrictions would include, navigation, route of flight, altitude limitations, target acquisition and, ordnance delivery parameters.

Of course, darkness was a present condition for much of the battle and evidence suggests this was a meaningful influence to mission conduct. It was during the first night that Syrian armor effected their breakthrough in the south.[28] The Israelis hoped for a lull in the fighting during darkness but the Syrian advance continued.

Apparently the Syrians emphasized night fighting in their offensive doctrine of continuous operations while the Israelis made only limited advances since the last war.[29]

Syrian convoys on the Golan were targeted by IAF fighters at night with the aid of illumination flares.[30] Most air operations though, when reported with reference to light conditions, show a preference for day combat. A dawn attack in conjunction with artillery is reported.[31] Late in the afternoon of the first day, pairs of fighters attacked Arab armor. This attack was launched hurriedly to take advantage of remaining light after the temporary grounding on the 6th had cost valuable daylight attack opportunities.[32] Also, the IDF counterattack in the north was delayed until morning when air support was available.[33]

It is not surprising that night operations over Golan were limited. The radar threat operates well at night and lacking adequate ECM, sophisticated night systems, or even the protection of terrain masking, the night environment was dangerous.

The final group of environmental factors, battlefield conditions, made air attacks in close proximity to friendly troops less viable than BAI operations which did not require careful integration and close control.

In the first days, battlefield conditions provided no clear distinction between friendly and enemy positions. Opposing forces were intermingled.[34] Encircled IDF troops were firing from the enemy rear.[35] One account even described friendly artillery intentionally firing on an overrun IDF position.[36]

Enemy armor at the front was dispersed and followed no predictable path. With all this, hundreds of defeated tanks and a host of other vehicles from both sides littered the battlefield.[37]

This confusion on the battle ground meant that any CAS effort would be extremely difficult. The likelihood of IAF pilots finding and hitting the correct targets was questionable under the circumstances. The situation on the ground, then, argued against CAS operations in favor of BAI.

The dramatic numerical superiority enjoyed by Syria put enormous pressure on the IAF as well as the Israeli

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ground forces. In numbers, the Syrians posessed a 5 to 1 advantage overall, and a 12 to 1 ratio where Arab armor was massed for penetration in the south.[38] Under the circumstances, immediate results from air attack had a special value.

As might be expected, the two categories of influencing factors, threat and environment, played a significant role in the BAI effort. A complicated relationship existed between supportive and degrading aspects of the factors and their influence on fighter operations.

IAF Effectiveness

Before the Syrian artillery barrage began the Golan battle, the IAF was fully alert and ready to execute its prebattle plan for a preemptive strike against Arab forces. The plan called for a massive suppression effort to neutralize Arab surface-to-air threats so subsequent air operations would achieve more and cost less. This preemption, however, was canceled for political reasons.[39]

When the Syrian and Egyptian attacks began simultaneously, Israeli leadership thought the Sinai front was more threatening and that the Golan was relatively secure.[40] Based on this analysis, the main effort for the first wave of IAF fighters was to the Sinai where suppression, not BAI, was conducted.

When it became evident that the Golan was the
greater risk, the IAF was concentrated there. This new
commitment not only suffered from a change in direction, but
also from a change in mission which forced a reconfiguration
of the aircraft.[41]

After this initial delay, the IAF launched BAI
sorties to the Golan where the volume and efficiency of the
Syrian IADS downed 30 IAF fighters, damaged many more and
prevented any significant success.[42] The shock of this
devastation caused General Elazar to ground the IAF shortly
after 1600 hours, on that first afternoon, so tactics could
be rethought.[43]

The initial response of the IAF to the BAI mission
at Golan was significantly impaired by these events. The
failure of intelligence to accurately present Syrian
intentions and capabilities led to a misdirected first
response to the Sinai. Further, the IAF was not prepared
for the effectiveness of the surface-to-air threat. This
tactical surprise contributed to aircraft losses, and to a
reduced sortie effectiveness in the near term.

Also, the failure of the Israeli command structure
to clearly depict the Golan situation contributed to a
disjointed IAF effort. It was a notable achievement,
however, that when the real danger in the north was
determined, the control and communications assets were able
to redirect the IAF main effort swiftly.

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The period of no flying yielded three changes to IAF operations. These were expressly designed to enhance survival even at the cost of mission effectiveness. First, the previously employed frontal assault was replaced with flanking attacks from Jordanian airspace.[44] Second, the use of direct terrain masking was emphasized to reduce the range and effectiveness of the radar SAMs. Most significantly, a temporary flight restriction kept fighters 15 miles away from the old cease-fire line.[45]

The alternate approach axis of Jordan and the emphasis on terrain masking enhanced survival without detriment to mission success because the four goals of BAI were well served by survivable tactics. The 15 mile restriction, though, directly interfered with BAI mission objectives.

With only 17 miles of battlefield depth, a 15 mile restriction implied operations against the leading elements of the Syrian divisions and left the vulnerable rear virtually undisturbed.[46] This is significant because the leading armor, dispersed, mobile and protected, was less susceptible to aerial attack than were the follow-on forces. The follow-on forces, including sustainment assets, were bunched together, relatively immobile, and vulnerable to the majority of IAF weapons.

Though some data documents the direct destruction of armored combat forces by IAF fighters, the greatest impact

of Israeli BAI on front-line armor was by indirect means.
General Peled assessed the situation in these words;

> "Air power was undoubtedly not going to be
> measured by the number of tanks that we destroyed on
> the battlefield, but by the fact that, after 5:30
> A.M. on Sunday, the Syrian forces turned back from
> two key points on the Golan Heights...From 5:30 that
> morning till about 10:30 A.M. there were no ground
> forces to oppose them on either of those two routes."[47]

Some sources indicate that not a single tank was
actually destroyed by IAF fighter operations. Yet, the
Syrians did stop short of the western cliff and as few as 15
tanks from the 188th Brigade survived the fighting on the
first night.[48] The 5th Division advanced to within three
miles of their objective, the western escarpment, after the
7th Division wore down most of the IDF 188th Brigade.[49]
With the 188th nearly depleted and reinforcements not yet at
the battle, the only effective force to stop the penetration
was the IAF. That they were stopped short is the most
pointed illustration of IAF success and all four BAI goals
played a role.

United Nations observers, trapped in their bunkers,
reported that almost no fuel or ammunition moved forward to
resupply the Syrian front elements. The reason was IAF
interdiction of the supply convoys. During the day of the
attacks the sustainment convoys were either held up by the
overloaded roads or they were intimidated by the threat of
Israeli air power. During the first night, however, the

convoys did attempt to move their vital supplies forward but were destroyed, disrupted and delayed by BAI sorties.[50]

The devastating results of these attacks is indicated by the fact that one fourth of all the Arab tanks left on the battlefield were operational except they were out of fuel.[51] Furthermore, there is no accounting for the number of tanks that ran out of ammunition and subsequently were destroyed by IDF ground forces.

In the north the Israeli lines held against the Syrian 9th Division. Better force ratios, defensive positions and air power coordination are contributing factors.[52] The ground in the north facilitated terrain masking and the density of the IADS was relatively light since only one division attacked there. Both of these considerations would positively influence fighter operations in the immediate battle area. More to the point, though, is the same interdiction effort that contributed to the Syrian collapse in the southern sector would have affected the northern sector as well.

On the second day of the battle, BAI operations continued to weaken the Syrian strength while IDF reinforcements flowed at an ever increasing rate to the front. Syrian forces continued to push to their objectives but heavy pressure from the IAF thwarted them still.[53]

By Sunday night the Syrian army was spent. Their supplies had been destroyed or delayed, and their plans were

disrupted. On Monday, the 8th, the IAF was diverted from the BAI mission to concentrate on suppression of the Arab air defenses. This shift of emphasis preceded the IDF counter-offensive which was supported by the IAF.[54]

In conjunction with this suppression mission, the IAF began strategic and interdiction operations deeper into Syria.[55] It is no stretch of BAI objectives to say that many of these deeper sorties met the goals and timing criteria that define BAI. With these targets so near the battle, any interdiction of combat power would be near term.

On October 9th, 10th and 11th, the deep attacks took the BAI effort farther away from the immediate battlefield. Among the interdiction targets hit on the 9th, electric power generating plants at Damascus and Homs were all but destroyed. The Syrian Ministry of Defense in Damascus and a C^3I site at Barouch Ridge in Lebanon were struck. Fuel supplies and port facilities at Tartous, Adra and Latakia were also damaged.[56]

Hitting these targets caused disruption and delayed the employment of critical war supplies on the Golan. On the 10th and 11th, air interdiction continued to reduce the Arab war fighting potential. In the process, the IAF directly disrupted the Syrian land line communications.[57] Another indirect value to these damaging raids was that Syrian SAMs were diverted from the Golan front to protect the deep resources. Finally, such pressure was put on Syria

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through these deep strikes that Egypt was asked to increase her operations on the Sinai front to divert some of the air operations.[58]

By Wednesday, October 10th, the IDF mobilization was adequate to support a counter-attack on the weakened Syrians. The IAF preceded the ground maneuver and artillery with air strikes on Syrian positions near Khushniye, and by Wednesday night the Israelis had recovered almost all ground they initially lost. Thursday the counterattack continued with IAF support and further gains were made.[59]

As the Syrians retreated into prepared defenses, and as Iraqi and Jordanian forces entered the battle, the Israeli counterattack stalled. The defenses were built to withstand aerial attack so the effects of the IAF efforts were diminished.[60] The battle for Sinai had also intensified and on the 13th General Elazar called for a maximum economy of IAF operations.[61]

Thus, the importance of IAF operations on the Golan front were decreased. Deep operations continued through the 18th, however, with marginal impact.[62]

The effectiveness of the BAI mission during the Golan battle was of great significance to the overall outcome of the battle. The initial response was marred by misdirection and tactical surprise but the results from subsequent operations fulfilled the prescribed objectives of the BAI mission.

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That severe losses were incurred by the fighter force is significant, but the over-riding consideration is that the mission was accomplished. The battlefield was interdicted, and the ground battle was positively influenced as a result.

CHAPTER 4

ENDNOTES

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CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

IAF interdiction operations during the Golan battle were equivalent to the current USAF mission of BAI. The operational concepts, mission objectives and procedures support this correlation.

IAF operations were an effective application of tactical air power. Through BAI operations, the IAF significantly contributed to the defeat of Syrian armored forces in the Golan battle. During air operations the IAF suffered significant losses and while the issue of combat losses was related to mission success, it did not supersede the importance of mission accomplishment. The situation on the ground convinced Israeli leaders that initially high IAF losses were preferable to the consequences of not performing a maximum BAI effort.

The total effect of BAI may not be immediate. The goals and direct targets of IAF operations did not result in the instant cessation of the enemy's combat effort. Through BAI, engaged combat forces were allowed to continue operations largely unhindered by air power. However, their sustainment, c^3I, and reserves were interdicted. In this

application, individual tanks and Armored Personnel Carriers (APCs) were not directly stopped by air in significant numbers, but major armored units were. The chief disadvantage to this concept of employment was that friendly ground forces had to deal with leading enemy forces without the benefit of concentrated Close Air Support (CAS).

When immediate results from air power are required, BAI may be inadequate. In the Golan battle, Syrian forces very nearly achieved their objectives. The Syrian advantages of surprise, numerical superiority, momentum, and short range objectives combined to reduce their dependency on the very object of BAI operations. The relatively small size of Israeli Defense Forces (IDF) and the lack of sufficient, organic fire support exacerbated the defenders' difficult situation. That the IDF held the leading Syrian units until BAI results could influence the battle was remarkable and, perhaps, not repeatable. The Golan battle demonstrated that a strategy of forward defense, combined with a reliance on BAI, has considerable risk.

Aircraft durability was crucial to mission success. IAF fighter resources were subjected to rather extreme conditions during the Golan battle when numerous effective sorties were needed to bring success. The first issue is aircraft readiness rates. For each 10% not available, a fleet of 400 aircraft is reduced by 40. Consequently, the 80% rate seen by the IAF during the time of the battle meant

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that more aircraft were down for maintenance than were lost in combat. Also, since analysis indicates that many aircraft were hit by surface-to-air threats but were able to land safely, the importance of durability is clear.

This battle demonstrated how complex the electronic battlefield had become. Caught short in some important areas of Electronic Combat (EC), the IAF immediately put great emphasis on increasing its EC capabilities. Jamming pods, Radar Warning Receivers (RWR), and chaff systems were of particular importance.

The Arabs demonstrated the capability to move aggressively during the hours of darkness. This tactic was consistent with their objective of rapid, continuous combat and they had some success with it. Syrian sustainment and reserve forces used the cover of darkness to move forward and join the fight. IAF fighter systems, for the most part, were reliant on visual target acquisition and weapons delivery. For night BAI employment the IAF depended on illumination flares for locating and hitting their targets. This technique restricted attacks to the timing and spatial limitations of the illuminating flares.

Highly trained and dedicated pilots and maintenance personnel were crucial to mission success under extreme circumstances. The capabilities of these people were clearly equal to the challenges of this intense operation. While no basis for comparison exists between the Syrian and

Israeli pilots in the surface attack role, the air-to-air role showed that IAF pilots achieved successes greater than equipment advantages alone could account for.

The quick response of the IAF was largely attributable to an all regular force structure. The small IAF force, by numbers alone was more responsive to mobilization than the much larger land component. With far less transition required to establish a wartime status, the regular IAF was able to commit maximum combat power almost immediately.

Although planning called for a decisive suppression campaign at the onset of hostilities, the IAF was forced to dedicate maximum assets to the BAI mission. This left the Syrian Integrated Air Defense System (IADS) undisturbed during the initial fighting. A successful suppression effort would have provided a degree of protection for the first strikes, and likely reduced the requirement to divert BAI assets to the suppression mission in later operations.

Centralized Command, Control, Communications, and Intelligence (C^3I) gave flexibility and responsiveness to complex IAF operations. Late breaking information about the danger at the Golan front caused Israeli leaders to change the IAF mission in three significant ways. The area, the mission and the totality of effort were all hurriedly adjusted to reflect the Golan situation. It is unlikely

that the main effort of the IAF could have been shifted so quickly with a decentralized c^3I system.

The existent IAF c^3I system was slow to target massed Syrian columns at the onset of the battle. As a result, lucrative BAI target opportunities were missed and *more Arab combat power was* allowed to become engaged as planned. This shortcoming was reflected by the initially under valued estimate of the Syrian threat approaching the Golan, and by the 15 mile operating restriction from the 1967 cease-fire line. These errors demonstrated missed opportunities which diminished the effectiveness of BAI.

The location, numbers and types of surface-to-air threats were not accurately depicted. The IAF was not only surprised by the effectiveness of the SA-6 Gainful and ZSU 23-4 Shilka, they were also stunned by the large numbers of threat systems employed. Additionally, the Israeli targeting system was ill prepared to deal with the rapid mobility of so many threats. The Israeli c^3I system was also late to realize that the Syrian rear was so lightly defended. IAF exploitation of this weakness in air defense was delayed long enough for critical Syrian assets to move forward unhindered.

A dense and sophisticated Integrated Air Defense System (IADS) had multiple effects on BAI operations. BAI operations called for penetration of enemy airspace, and to the degree that airspace was controlled by enemy threats,

BAI results suffered. This decrement was in the form of lost fighter resources, ineffective sorties, lower sortie rates, and ultimately, greater enemy combat power for the ground battle.

The Israeli air defense system effectively controlled the airspace over Israeli territory and negated any real opposition from the Syrian Air Force. These conditions allowed efficient IAF ground operations, isolated the threat geographically, and reduced the overall threat volume. The value of these conditions cannot be quantified but an increased Arab air threat would certainly have presented a negative influence to BAI operations.

Anti-Aircraft Artillery (AAA) continued to be a primary threat to fighter operations. With over half of all Golan losses attributed to AAA, this battle reinforced the preeminence of this conventional threat.

The limited geographic size of the combat zone had a profound effect on IAF operations. The lack of operational depth for the Israeli defenders dictated the immediate IAF mission of BAI and forced air operations in highly threatening airspace. Also, the short distances concentrated the threat and compressed the time available to recover from a disadvantaged position. On the positive side, the geography supported high sortie rates and unrestricted tactical techniques. The geography allowed for deep penetration to the enemy's source of military strength

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and it permitted the circumnavigation of an isolated threat structure.

The meteorological conditions did not restrict BAI operations. IAF fighter resources and weapons relied heavily on visual techniques for offensive employment. Further, with the deficiency in ECM capabilities, fighter pilots were forced to use visual methods of threat acquisition and defense. Successful night combat was particularly dependent on clear air conditions. The favorable weather strongly supported visual operations for both offensive and defensive requirements.

Recommendations

The real value of lessons is in their careful application to current and future situations. This paper provides an accurate representation of events and underlying influences. The lessons established herein should be applied to appropriate United States Air Force (USAF) operations.

USAF tactical fighter units with BAI capability should emphasize realistic BAI training. The Golan battle validates the existent doctrine and supports the continued emphasis on BAI as an effective application of air power. Specific training for BAI enhances its value through improved pilot performance, better cooperation with supporting assets and deeper understanding of its effects. CAS capabilities, however, must not be discarded because the

unique effects of CAS operations may be required in a future conflict.

The Air Staff should commission a study to evaluate and quantify the delayed effects aspect of BAI operations and incorporate the results into joint planning. If the BAI mission is flown at the expense of CAS operations, ground forces must be prepared to deal with the delayed results.

The USAF should continue to emphasize durability and maintainability in aircraft design. With large numbers of aircraft, even a small decrease in availability represents a significant loss in combat power. Starting a conflict at full strength and maintaining strength are both important.

Tactical Air Command must ensure that fighter systems incorporate highly capable Electronic Countermeasures (ECM) systems to protect aircraft from a variety of surface-to-air threats. These systems must be immediately available and quickly programmable to deal with changing, or newly discovered threat characteristics. This ensures a degree of protection to fighter assets from surface-to-air threats when the tactical situation precludes an early suppression effort. An organic ECM capability will also be advantageous when a committed suppression effort is only partially successful.

Tactical Air Command must strive to develop a broad-based night attack capability. Effective and survivable operations during hours of darkness must be used

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to deny the enemy a primary sanctuary. This is particularly important when BAI is used in conjunction with a forward defense strategy on the ground.

The USAF should accelerate the development and deployment of a real-time target acquisition and direction system to support BAI operations. This system should be reliable, survivable, and dedicated to the BAI mission. It must be able to acquire moving and stationary targets at great range and under adverse meteorological conditions.

Tactical Air Command must ensure that the AAA threat is recognized and trained for by fighter pilots preparing to conduct BAI. This threat to fighter operations deserves careful consideration in the development and employment of tactical options.

APPENDIX 1

REVIEW OF RESEARCH LITERATURE

This appendix reviews literature that applies to the study. The references discussed here are organized in sequence by books, periodicals, and US Government publications. The relevance to the methodology is described for each item listed.

Books

Arab-Israeli Wars, by A. J. Barker (Hippocrene Books, Inc., 1980) provides a broad overview of Israeli Air Force (IAF) missions, objectives and results. It provides a useful but brief description of IAF fighter aircraft characteristics.

Duel for the Golan, by Jerry Asher and Eric Hammel, (William Morrow and Co. Inc., 1987) is most valuable for the description of the Syrian armor attack. This is important for understanding the missions and environmental factors facing the IAF. Some space is given to discussing results of IAF fighter employment.

Elusive Victory, by Trevor N. Dupuy, (Harper & Row, 1978.) is an outstanding work. The author's in-depth analysis of the ground battle helps identify and describe

missions and factors that affected the results. A section dedicated to the air war helps measure the results.

Heights of Courage, by Avigdor Kahalani, (Greenwood Press, 1984), shows some specific examples of BAI results.

Israel, the Embattled Ally, by Nadav Safran, (Belknap Press, 1978), supports the description of missions and factors. Further, it helps analyze the effect of some environmental conditions.

Israel, The Superpowers, and the War in the Middle East, by Yaacov Bar-Siman-Tov, (Praeger Publishers, 1987), contributes to the analysis of threat influences on IAF operations.

Military Aspects of the Israeli-Arab Conflict, International Symposium, Jerusalem, Editor: Louis Williams, (University Publishing Projects, (Tel Aviv, 1975), is the single best source for identifying IAF missions and objectives. Specific successes and failures are also described. This book quotes the IDF Chief of Staff and the IAF Chief of Staff for the Golan battle.

No Victor, No Vanquished, by Edgar O'Ballance, (Presidio Press, 1978) is one of the outstanding references for the Golan battle. Background information helps put the opening events into perspective, particularly with respect to Syrian intentions and operations. The author elaborates on the composition and use of Syrian armor forces. Clear estimates of Syrian air defense strengths and dispositions

are given along with IAF fighter assets. The descriptions of the IAF weapons and tactics used to defend against the Syrian IADS are particularly good.

October 1973: The Arab-Israeli War, by Frank Aker, (Archon Books, 1985) is another outstanding reference for students of this conflict. The author's descriptions of the Syrian attack help describe IAF missions and environmental factors. This work is replete with examples of IAF objectives, missions, tactics, and results. Some expressions of IAF successes are a little inflated, however.

D. K. Palit's Return to Sinai, (Palit & Palit Publishers, 1974) was primarily helpful in understanding the complexities of the IADS and how they affected BAI operations.

Take Now Thy Son, (Howard Timmins, 1974) by Desmond Blow, helps identify IAF missions and environmental factors. Further, it provides valuable, though general, insights into the Syrians' use of surface-to-air missiles.

The Arab-Israeli War, October 1973, by Elizabeth Monroe and A. H. Farrar-Hockley, (the International Institute for Strategic Studies, 1975) is an excellent source for determining operational factors such as the threat, geography and terrain. BAI results are also identified.

The Arab-Israeli Wars, by Chaim Herzog (Random House, 1982) describes IAF readiness, deep operations and threat factors. Usable mission results are identified.

The October War: documents, personalities, analyses, and maps, by Editors of An-Nahar Research Staff, (An-Nahar Press Services, 1973), covers most of the IAF missions and weapons. One notable contribution is the impact of the IAF effort during the Golan counter-offensive.

The War of Atonement by Chaim Herzog, (Little, Brown, 1975) is very useful for understanding the initial response of the IAF. It shows how some preparations for war were undermined by the surprise Syria orchestrated.

The Yom Kippur War, by The Insight Team of the London Sunday Times, (Doubleday & Company, Inc., 1974), describes missions, assets and factors for BAI operations. It also aids the analysis process with information on how factors influenced the events.

When God Judged and Men Died, by Arnold Sherman, (Bantam Books, Inc., 1973), describes IAF BAI contributions to the battle and how threat factors affected those operations.

Periodicals

Aviation Week and Space Technology has been a remarkable source of technical information and informed perspectives. Fourteen articles directly contributed to several aspects of this study.

An Israeli Aerospace Industries engineer, interviewed for the article, "Israeli Aerospace Activities Near Normal", provides interesting insights on the technological significance of the Yom Kippur War.

In "Israelis Outmanned" the immensity of Israel's strategic dilemma is presented. The combined Arab force strength is explained in the context of Israel's small standing army and requirement for mobilization.

"The Lessons of October" gives a particularly succinct overview of several operational and tactical lessons resulting from the 1973 Mideast War. Most of these have relevance to the Golan battle.

"Israeli Aircraft, Arab SAMs in Key Battle" presents an outstanding review of Arab IADS effectiveness, IAF losses and self protection measures used to defeat Arab defenses.

"Israeli Air Force Decisive in War" is an extraordinary article for its presentation of the IAF surface attack role during the war and especially the Syrian front.

"Soviet Aid Sparks Arab Gains" provides some information on air defense systems sent to Syria by The Soviet Union. A short, but important discussion of the IAF effort to suppress Arab air defenses systems is given.

Two articles describe equipment sent to Israel before and during the war. These help establish the weapons used by the IAF in their suppression and anti-armor

missions. These are, "Mideast War Spurs Renewed Interest in Standoff Weapons" and "U.S. Equips Israel with 'Smart' Guided Weapons".

A number of articles are instructive for their description and analysis of Arab air defense weapons. These are, "Israeli Losses May Spur ECM Restudy", "SA-7 Avoids Homing on Flares", "SA-6 Shows Soviet Technology Gains", "Soviet SA-6 Used Effectively in Mideast", and "Soviet Anti-Aircraft Gun Takes Toll".

Two good articles support this study by describing Electronic Countermeasures (ECM) for fighter aircraft, including those used by the IAF in the battle of Golan. These are, "U.S. Spurs Countermeasures to Israel" and "Pentagon Spurs SA-6 Countermeasures".

Military Review published a useful article. "The Yom Kippur War" is of some benefit in understanding the conditions of the Golan front from an operational level. This article also describes the intensity of IAF operations. The chief value of this work is its succinct overview of the war.

Newsweek Published three articles applicable to this study. The most informative one, "Tactics: How the Arabs Scored Their Surprise," describes the Israeli limitation of depth on the Golan front. It also rates the IAF capability to contribute to an Israeli victory and discusses tactics to defeat SAMs.

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"The Toll: What Each Side Lost" contributes U. S. Government estimates of Syrian and Israeli losses in the battle. This is an ending tally that includes aircraft, tanks and personnel.

"The Two-Front War" lends perspective on the significance of the war and describes tactical problems in defeating Syrian SAMs from the low altitude environment.

Time magazine published seven articles that are applicable to this study of IAF participation in the Golan battle. "Black October: Old Enemies at War Again" supplies valuable insight to the initial response of the Israeli military to information of Arab build-ups. It shows the force balance between Syria and Israel forces and describes the Syrian army at the Golan.

"A Tale of Two Battle Fronts" includes a quote from the Israeli commander on the Golan, Major General Hofi. This quote describes a view of what the Syrian intentions were.

"The War of the Day of Judgement" is good for its explanation of IAF support for the Israeli counterattack across the Golan. It also reports the U.S. Department of Defense casualty estimates for the first 7 days of the war.

"The Deadly New Weapons" describes the Arab use of SAMs and the IAF's use of air to surface missiles in the anti-armor role.

"The Desert As a Proving Ground" is a very good article for describing the high technology weapons of this conflict. The discussion includes SAMs, air defense guns, air to surface missiles, and 'smart bombs'.

"A Battlefield Post-Mortem" describes the significance of missile technology on the modern battlefield. It also discusses the role Israeli intelligence played in the aspect of surprise.

"Arabs v. Israelis in a Suez Showdown" reports the U.S. Department of Defense estimates of losses in the first 14 days of this war. The combatants listed are Israel, Syria, Iraq and, Jordan. These were the participants on the Syrian front.

U.S. GOVERNMENT PUBLICATIONS

U.S. Army Field Manual (FM) 100-2-3, The Soviet Army (Headquarters Department of the Army, 1984) is the best unclassified, single-source document, for the description of Soviet weapon systems. This study used it to discuss Syrian air defense weapons and their capabilities.

U.S. Air Force Manual (AFM) 1-1, US Air Force Basic Doctrine, (Air University, 1984) was the primary document for converting IAF roles and missions into the USAF context. This doctrine is clear and concise.

U.S. Army Command and General Staff College book of readings, Battle Analysis, (CGSC, Combat Studies Institute,

1987) provides the best framework for battle analysis. A modification of this format used information from two other sources. These are Tactical Air Command (TAC) Manual 3-3, Mission Employment Tactics, Fighter Fundamentals, F-16, Vol. 5 (Department of the Air Force, 1986) and USAF Fighter Weapons School student study guide Surface Attack Mission Planning, F-16 Mission Planning Factors, (USAF Fighter Weapons School, 1983). These Air Force publications helped convert the generic battle analysis model into air power terms and issues.

APPENDIX 2

LIST OF TERMS

AAA - Anti-Aircraft Artillery: air defense system which fires ballistic projectiles with characteristics designed to hit and destroy enemy aircraft.

AI - Air Interdiction: An air power application to destroy, disrupt, delay and divert enemy surface forces before they can be brought to bear on friendly ground forces. In AI the operations are carried out at such a distance from friendly forces that close coordination is not required.

APC - Armored Personnel Carrier (includes infantry fighting vehicles): a lightly armored vehicle designed to carry and protect personnel engaged in ground combat.

BAI - Battlefield Air Interdiction: a component of the USAF interdiction mission designed to destroy, disrupt, delay, and divert enemy ground targets that would have a near term effect on the close battle. In BAI the ground commander plays a role in mission planning but not execution.

CAS - Close Air Support: a USAF mission conducted in close proximity of friendly ground troops when close coordination and controlled integration into the ground commander's scheme of battle is required.

CBU - Cluster Bomb Unit: an air -delivered canister weapon that opens, when dropped, to release a quantity of submunitions.

C^3I - Command, Control, Communications, and Intelligence.

EC - Electronic Combat: Use of the electromagnetic spectrum to achieve combat objectives.

ECM - Electronic CounterMeasures: active or passive measures taken to deny the effects of an electronic warfare system.

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EO - Electro-Optical: electronically enhanced visual system.

GBU - Guided Bomb Unit: a conventional, general purpose, air-delivered bomb, with a terminal guidance system attached.

HUD - Head-Up Display: A device that shows flight, navigation, and weapons information to an aircraft pilot so he can see it without having to look inside the cockpit.

IADS - Integrated Air Defense System: a combination of air defense systems working in coordination.

IAF - Israeli Air Force

IFF - Identification, Friend or Foe: a system of coded electronic signals to establish an aircraft's identity.

INS - Inertial Navigation System: A mechanical device that generates navigation information.

IR - Infra-Red: A segment of the electromagnetic spectrum.

KM - KiloMeter

LOC - Line Of Communication

MACH - The reference for the speed of sound.

MM - MilliMeter

RWR - Radar Warning Receiver

SAF - Syrian Air Force

SAM - Surface-to-Air Missile: a guided rocket fired from the Earth's surface to engage and destroy aircraft.

TEL - Transporter/Erector/Launcher: A single vehicle that provides for these three functions for surface-to-air missiles.

TTR - Target Tracking Radar: A radar component used to track aircraft targets for a radar directed or guided weapon system.

US - United States (of America)

USAF - United States Air Force

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APPENDIX 3

WEAPON SYSTEMS DESCRIPTION

IAF BAI Aircraft

The F-4 Phantom is a two-seat, two-engine, multi-role fighter capable of delivering a variety of air-to-surface weapons. For self defense it employs chaff, flares and Electronic Countermeasures (ECM) in the form of jamming pods and Radar Warning Receivers (RWR). Its maximum combat radius is 200-300 miles unrefueled and it is capable of speeds in excess of MACH 2.

The A-4 *Skyhawk* is a single-seat, single-engine, surface attack fighter capable of delivering a variety of air-to-surface weapons. For self defense it employs chaff, flares and ECM in the form of jamming pods and RWR. Its maximum combat radius is 150-250 miles unrefueled, and it is capable of speeds in excess of MACH 1.

IAF Weapons

The WALLEYE is an Electo-Optical (EO) Guided Bomb Unit (GBU) with wings attached that enable the delivering aircraft to stand off as far as 25 miles from a high value target and precisely deliver this 1000 pound bomb.

SHRIKE is another special weapon that allows a stand off delivery to its target, however in this case the

target is an emitting radar and the guidance is provided by radar energy.

ROCKEYE is an anti-armor Cluster Bomb Unit (CBU) consisting of an air delivered canister containing hundreds of anti-armor bomblets. Each bomblet uses a shaped charge warhead to destroy armor. By penetrating the thinner armor plate located on the tops of tanks, ROCKEYE is capable of destroying several targets with one delivery if the tanks are grouped together.

MAVERICK is another special weapon used by the IAF. The variant they had is an EO missile that guided to a visible target via a miniature television image. An advantage to MAVERICK is its limited standoff capability, but more importantly, it allows the delivery aircraft to leave the area immediately after launch.

Syrian Fighter Aircraft

The MIG-21 Fishbed is a single-seat, single-engine, fighter/interceptor capable of delivering a variety of air-to-air and air-to-surface munitions. Its maximum combat radius is over 200 miles and its maximum speed at sea level is around 682 miles per hour.

The MIG-17 Fresco is a single-seat, single-engine, fighter/attack aircraft capable of delivering a variety of air-to-air and air-to-surface munitions. Its maximum combat radius is over 200 miles and its maximum speed at sea level is over 450 miles per hour.

The SU-7 Fitter is a single-seat, single engine, surface attack fighter capable of delivering a variety of air-to-surface munitions. Its maximum combat radius is over 200 miles and its maximum speed at sea level is around 500 miles per hour.

Syrian Surface-to-Air Missiles

The SA-2 Guideline is a transportable radar SAM with a 21 mile range and a maximum altitude of more than 70,000 feet. It is normally deployed 25 to 30 miles to the rear of leading ground forces in fixed sites and its role is point defense. This MACH 4+ missile is associated with the Spoon Rest acquisition radar and uses command guidance from the Fan Song Target Tracking Radar (TTR). Reload time for the launcher is about 10 minutes. It has poor mobility, a minimum effective altitude of 300 feet, and is susceptible to ECM.

The SA-3 Goa is a transportable radar SAM with a 15 mile range and a maximum altitude of over 70,000 feet. It is normally deployed in the rear of ground forces in fixed sites and its role is point defense. This MACH 3+ missile is associated with the Flat Face acquisition radar and uses command guidance from the Low Blow TTR. Reload time for the launcher is about 50 minutes. It has poor mobility, a minimum altitude of about 300 feet, and is susceptible to ECM.

The SA-6 Gainful is a mobile radar SAM with a 15 mile range and a maximum altitude of over 35,000 feet. It is normally deployed at division level, 3 to 6 miles to the rear of the leading elements. The five batteries of four Transporter, Erector, Launchers (TELs) are normally deployed with three up and two back in the close air defense role. This MACH 2.5+ missile is associated with the Long Track acquisition radar and uses command guidance from the Straight Flush TTR. The Gainful has semi-active terminal guidance with continuous wave illumination. Reload time for the TEL is about 10 minutes. It has good mobility, a minimum effective altitude of about 150 feet, and, like all radars and thin skinned missiles in the open, is vulnerable to physical destruction.

The SA-7 Grail is a man-portable IR guided SAM with a 2 1/4 mile range and a maximum altitude of over 10,000 feet. It is normally deployed with leading elements of the ground forces in APCs for the close air defense role. This MACH 1.4 missile identifies, locks on and guides to IR energy emanating from aircraft engine exhaust. It has a minimum effective altitude of about 50 feet, and is susceptible to decoy flares, battlefield obscurations, and suppressive fires.

Syrian Anti Aircraft Artillery

The S-60 57mm AAA is a road transportable, divisional, point defense system that employs both optical

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sighting and radar direction to achieve a fire solution. It
can fire up to 120 rounds per minute from each of the six
guns assigned to a battery. Its maximum effective range is
more than 18,000 feet.

The ZSU 23-4 Shilka is a self-contained, self-
propelled, close air defense, AAA system with four 23mm
barrels. Its Gundish fire control radar sits on top of the
lightly armored chassis. Normally employed in pairs, these
tracked vehicles are positioned with the leading armor
battalions. The system's four liquid cooled barrels can
fire at 4000 rounds per minute with a maximum effective
range of over 7500 feet. The Gundish is susceptible to ECM
and the thin skinned armor is vulnerable to physical damage.

The ZU 23 is a transportable 23mm AAA system that
uses optical fire direction for its twin barrels. It is
capable of 2000 rounds per minute with a maximum effective
range of nearly 8000 feet.

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