Techniques of gaining Israeli air superiority in the 1973 war, better known as “The Yom Kippur war”

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The present study aims at a brief analysis of the various techniques applied by the Israeli Air Force during the Arab–Israeli war of 1973. The author compares various methods and various weapons systems used on various types of aircraft – both fix-wing and rotary wing – in a wide range of missions flown by the Israeli Air Force. These sorties include air defence, air superiority, and ground attack missions although due to the limitations in space the author focuses on the most significant of these issues on gaining air superiority.

Introduction

Yom Kippur is not a geographical name. It is the name of a Jewish holiday and on its first day, on 6th October 1973, the next Arab–Israeli war broke out. Therefore it was named “The Yom Kippur war”.

In this war a wide range of combat techniques was used by the Israelis in order to gain air superiority. Lessons learned from the war in 1967 were processed, evaluated and integrated, and the primary course of further development was also identified. For example, reinforced hardened aircraft shelters were built, which were able to withstand hits by 1,000-kilogram fragmentation bombs. The air defence of airfields included both short- and medium-range surface-to-air missiles and anti air artillery.

This fact required an entirely new tactical method for destroying enemy aircraft on the ground. However, during the 1973 war, the Israeli military leadership kept adhering to tactics successfully used in the previous war. They did not take into consideration the fact that the Arab States had built up a modern system of air defence and hugely underestimated its combat capabilities. The Israeli Air Force intended to launch massive raids against the airfields of Arab States but it failed to break through the Arab air defence system and suffered heavy losses.
General tactics

The Israeli Air Force planned to prevent Arab warplanes from taking off by destroying the runways of their airbases. Later this technique was named “mine laying” as not only impact detonating but also delayed-action concrete piercing bombs were used. However, success for Israel was still way ahead. With the use of advanced technology and synthetic materials, the damage on runways was eliminated within 9–10 hours which resulted in a very disadvantageous situation for Israel – large strike formations had to be set up suffering heavy losses from Arab air defence, while enemy airfields remained serviceable and the air force units stationed there continued operating without major troubles.

No Air Force can forget the idea of destroying enemy airfields. Therefore the views spread that due to efficient defence measures, destruction of airfields cannot be as efficient in modern local wars as it used to be with the use of previous techniques. To this end the elaboration of new strike means and tactical procedures, the previous level of achievement of strikes could be restored.

Accordingly, an agreement was concluded between the Unites States of America and the Unites Kingdom on the manufacture of JP-233 submunition delivery system designed to attack runways. This system was used on warplanes Tornado IDS, F-15 and F-111. Later on, the West German MW-1 submunition delivery system was developed also for the use on Tornado ID3 and F-4 Phantom aircraft. In the Unites States of America, GBU modular bomb systems were developed and commissioned for use on F-4 Phantom, F-111, F-15, F-16 and F/A-18 aircraft.

A significant disadvantage with the use of the above weapon systems was that for the (unguided) delivery of conventional weapons the attacking aircraft had to fly over the target area, taking a huge risk, due to the increasing activity of the ground based air defence of airfields. This problem brought forward the necessity of delivering weapons for destroying airfields with the use of missiles.

Taking into consideration these developments, it is easy to understand that the destruction of aircraft on the ground and destruction of airfields comprised and still comprise a fundamental technique of gaining air superiority.

Between the 8th and 14th October the Israeli Air Force delivered more than 100 air strikes on Arab airfields. These attacks were supported by the simultaneous suppression of SAM sites and AAA batteries in and around the targets. The attack groups usually consisted of 18-26 F-4 Phantom, Mirage and sometimes Skyhawk aircraft. The groups of repeated attacks comprised 6–8 airplanes.
In attacks against airfields, usually several air groups participated, tasked with suppression of GBAD, attack, support, and diversion.

The diversion group imitated an attack against the SAM sites deployed in the vicinity of the airfields, approaching them at maximum speed, applying counter-missile manoeuvres on the basis of altitude and heading. At low altitudes their speed was some 1,200 kph (670 knots) while at medium altitude, it was around 1,800–2,000 kph (1,000–1,100 knots).

Upon entering the surveillance zone of radars, the air defence suppression group began passive jamming and attacked the battle order of radar stations, surface-to-air missile sites, and anti-air artillery.

The attack group reached the airfield and launched its attack against the runways, hangars, and aircraft in the open or in hardened aircraft shelters. The support group was patrolling near the airfield, ready to repel the expected attack of Arab fighters.

After the main strike group accomplished its attack on the airfield, the diversion registered the inflicted damage or launched a secondary attack on the airfield. The activities of the entire group were coordinated by active jamming from a Boeing 737 Stratocruiser patrolling in friendly airspace.

The attacking aircraft approached the target airfields flying in pair – column formations at the lowest possible altitude. Within 3–4 kilometres (2–3 miles) from the airfields, fighter bombers suddenly climbed at a 40–50° angle to gain height and dropped their bombs. In certain cases (when there were no surface-to-air missile sites in the vicinity of an airfield) bombs were released in a 45° dive.

After dropping their bombs, the Israeli pilots switched to afterburner and descending to the lowest possible altitude, left the target area at maximum speed while doing counter-GBAD manoeuvres.

Runways and hardened aircraft shelters (HAS), were attacked with the use of concrete-piercing bombs while aircraft and support vehicles in the open and shelters of personnel were attacked with fragmentation bombs and cluster bombs. It was reported that some direct hits from 340-kilogramm bombs (750 pound) penetrated the 50-centimetre thick concrete cover of HASes and destroyed the aircraft parked inside. A few planes in shelters without doors were heavily damaged by shrapnel from fragmentation and cluster bombs. In order to destroy airport facilities and equipment, F-4 Phantom and Mirage III aircraft were used by the support group. When there were no Arab fighters in the air, these planes attacked ground targets with both guided and unguided missiles. On 8th October, for example, after an attack by a Mirage III against an open and soft-skinned shelter, ammunition stored near a MiG-21 exploded.
Fragmentations from S-5K missiles inflicted damage even to airplanes stored in the neighbouring shelter.

Bomblets from cluster bombs were released at 150-metre altitude. A part of the small softball-shaped and size bomblets exploded at the moment of impact while another part of them spread all over the area, presenting significant danger to personnel in ditches because these bomblets remained active for several days. Movement in open or soft-skin vehicles was so risky that aircrew had to be transported in armoured vehicles.

The timing of Israeli air attacks was coordinated so that most of the airplanes were on the flight line either after landing or before takeoff.

During each attack, on average 1–4 bombs hit the runways, making the airfields unusable for 4–12 hours. Random delay-action bombs denied access to affected areas thus increasing time necessary for the reconstruction of the airfield. However, aircraft could operate from reserve grassy airfields, nearby paved roads, and highways too. At the same time, bombraters and other battle damage on the runways were filled with rapid-setting cement. At the airfields, there were engineer units in order to search for and defuse unexploded and delay-function bombs.

However, the continuous activities of the Israeli Air Force against Arab airfields were not as efficient as it was expected. On the ground, the Egyptian Air Force did not suffer casualties because fewer attacks were launched against it. Moreover, the airfields of the Egyptian Arab Republic had a large number of HASes. On the other hand the Syrian Air Force lost 21 airplanes and helicopters on the ground.

In order to weaken the air defence system of both Syria and Egypt, in order to “blind” their systems, Israel destroyed the radar stations of signals and air defence units and only then launched attacks against surface-to-air missile sites, anti-air artillery batteries, and airfields.

Against signals companies, usually 2–4 Israeli aircraft were deployed. The signals units under attack protected themselves with the use of smoke screens, thus, primarily in the first period of time, some 70% of the Israeli attacks failed.

In order to destroy the ground-based radar stations of surface-to-air missile sites, the Israeli Air Force used AGM-45 Shrike and AGM-78 Standard ARM anti-radar missiles and later, in phase four, TV-guided Maverick air-to-surface missiles were also used in combination with fragmentation bombs and cluster bombs. (AGM-78 Standard ARM has a warhead with particularly big fragmentation impact. The warhead consists of some 22,000 pieces of shrapnel flying out at a high speed in a 40–50° cone-shaped kill zone at the time of the detonation.) The characteristic features of ground based radar stations are loaded into the memory of a special electronic device which can guide the missile to the radar even if it is switched off, or is switched over into “false antenna”
mode. Practically, all launched AGM-78 Standard ARM guided missiles (according to some sources 40 launches) were successful. At the same time out of 210 AGM-45 Shrike missiles launched, merely one SA-2 surface-to-air missile site was completely destroyed and the rest were partially taken out of combat, as, due to the high number of fragmentation hits the radars of surface-to-air sites were eliminated.

Surface-to-air missile units were deployed in 8–15 kms, which allowed a 3–4-times overlap of surveillance from any directions. Therefore, the attempts of the Israeli Air Force to frontally break through failed, making the Israelis change tactics.

As a new technique to outmanoeuvre air defence, Israeli fighter-bombers tried to utilize the screening features of terrain, flying at very low altitudes and approaching the target area without being seen or detected by radars. Their task was to spend the shortest possible time in the target area and over the target itself, delivering their strike on the first raid. Thus on 8th October the Israeli warplanes flew at 10–20 meters to attack a crossing point, and troops in an assembly area near El-Kantara, thus remaining under the Arab radars and undetected. The aircraft were organised in three groups. First two F-4 Phantoms entered the target area attacking radar stations near the crossing point, SAM sites, and anti-air artillery batteries. Then, 5–6 minutes later the bulk of the strike force – 4 F-4s – arrived climbing to 600–800 metres in 2–3 kilometres before the target (“jump”) attacking the crossing point. During their second run, they attacked troop formations and military technology. The activities of the support group and the attack group were covered by a Mirage III pair patrolling in the vicinity of the crossing point.

Especially the ridges near the Golan Heights and near the Lebanon-Syria border provided very efficient natural protection for approaching Israeli aircraft, almost entirely preventing their radar detection.

On the Egyptian front, the Israeli warplanes usually attacked from the direction of the Mediterranean Sea and in the south they exploited the Suhni Valley.

The features of low level flight determined the structure of the Israeli formations too. Regardless of their number in the formation, the planes flew in pair-columns with a 1–2 km distance between them.

Arab visual observation posts deployed along the forward edge of battle area played an important role in detecting Israeli aircraft flying at low-level. On the basis of the information received from the observation posts and entered into the roster of the central headquarters, all means of air defence could be put on high readiness in the sector. Apart from observing air targets, the observation posts also collected and sent information on downed aircraft, on the location of their crash sites, on launching surface-to-air missiles, and on the insertion of air mobile units too.
In countering Israeli aircraft flying at low levels, SA-3 and other surface-to-air missiles had the most efficient homing techniques: TV-guided homing systems (combined with Carat-2 adapters) and triangulation-based homing methods. On 11th October, for example, with the use of TV-guided missiles – upon the primary information from visual observation posts – an SA-3 surface-to-air missile battery downed 6 Israeli F-4 Phantoms. That event had a very strong psychological impact on the Israeli air crews flying low-level missions.

During the 1973 Arab-Israeli war the biggest results were achieved by the combination of low-level sorties, and continuous, intensive radar jamming by the Israeli Air Force.

For attacks against crossing points, AGM-62 Walleye guided bombs were used with significant efficiency. The Israeli Air Force attacked ground targets from level flight, climbing, turns and dives after sudden climbs (from the angle of approach to the target).

After involving American pilots in combat activities, techniques elaborated in the Vietnam war were also used: raids with the involvement of diversion groups against surface-to-air missile sites (either from one of several directions), circular attack from various directions with the involvement of every plane of the formation against the elements of the SAM-sites, outmanoeuvring surface-to-air missiles at the highest possible overload, or launching chaff – metal-coated plastic passive jamming devices – upon the detection of the launch of a SAM.

When Israeli F-4 Phantom aircraft attacked airfields defended with only anti-air artillery, the Israeli Air Force applied new tactics that had never been used before. The attacking airplane entered the airspace of the airfield at 20–30 metre altitude then it suddenly climbed to 450–500 metres and flew level towards the targets. Then, some 2–3 seconds later the pilot did several banking manoeuvres (at 100–110°) to the right and to the left. This banking did not change the heading significantly – this was less than 10°. Then the pilot stabilised the position of his plane and in a turn increased altitude and then dropped the bombs. It should be noted that the precision of bombing was fairly satisfactory. The advantage of the manoeuvre was that it combined the counter-GBAD manoeuvres with the direct attack against a target.

In order to have Arab air defence units and devices concentrated in diversion directions, the Israeli Air Force often used a variety of phoney activities. Sometimes the diversion and raiding groups attacked from the same direction. Sometimes F-4 Phantoms imitating an air raid and providing support for the attackers, having accomplished the diversion manoeuvres and covered the first raid, also attacked the targets after the main formation as a secondary strike force.
These groups usually had various approach routes. On 10th October, for example, a group of F-4 Phantoms imitated the breaching of Syrian air defence towards Damascus. At the same time another group consisting of 12 planes flying at the lowest possible level along the southern air corridor, approached a Syrian airfield and accomplished a surprise attack.

Israeli Unmanned Aerial Vehicles (UAVs) were also efficiently used against Arab air defence. These UAVs were deployed mainly as false targets in order to divert the GBAD from piloted aircraft. Later, UAVs were used for target acquisition and also for electronic intelligence gathering in Lebanon and Syria. In the 1982 war Israeli UAVs kept enemy airfields under constant surveillance allowing the elaboration of alternative attack plans on the basis of collected information.

Characteristics and new air combat tactics of the Israeli Air Force

The activities of the Israeli Air Force were rather hasty. It was primarily deployed for gaining air superiority and providing close air support to the activities of ground troops.

In combat F-4 Phantom and Mirage III tactical fighter-bombers, A-4H Skyhawk attack aircraft, Bell-205 (UH-1D), Alouette II and III, and Super Frelon helicopters were widely used by Israel.

In dogfights, only F-4 Phantom and Mirage III were deployed by the Israeli Air Force. In air combat it had to be quickly realised that in high-G climb at a high attack of angle, F-4 Phantom aircraft tended to lose velocity and go into a tail-spin.

According to downed Israeli pilots, at medium and high altitudes it was difficult to manoeuvre F-4 Phantoms in level flight, especially at speeds lower than 400–450 kph. Therefore, in order to increase low-speed stability and manoeuvrability features of F-4 Phantoms some 80 planes of this type were additionally equipped with special, automatic additional wings. After such improvements the manoeuvrability of the modernised F-4 Phantoms significantly increased which made them capable of entering into dogfights with MiG-21s even at low speed and in level flight with turns.

At low altitude, the manoeuvrability of F-4 Phantoms and Mirage IIIIs was better then that of MiG-21s.

When attacking airfields defended with surface-to-air missile sites, the optimum payload of F-4 Phantom fighter-bombers was 8–10 340-kg bombs and either 2 cluster bombs – 456 kgs each – or 2 air-to-surface guided missiles.

When used as fighter planes, F-4 Phantoms were armed with 6 air-to-air guided missiles (2 AIM-7 Sparrows and 4 AIM-9 Sidewinders) while Mirage III Cs had 2 AIM-9 Sidewinders on their hardpoints.
During the Middle-East military operations it was Israel that deployed helicopters in a fire support role against main battle tanks and other armoured targets. These helicopters were – Bell-205 (UH-1D), Alouette II and III. Apart from these types French-made AS-11 guided missiles and American TOW (Tube-launched, Optically-tracked, Wire-guided) type missiles were also in use.

The most typical example for the use of new air combat techniques was the deployment of attack helicopters armed with guided anti-tank missiles against Egyptian tank units tasked with taking a side road on 14th October 1973. When the brigades of the 21st tank division reached the side road, a group of some 15–18 Israeli helicopters appeared in front of their battle order. Exploiting the rough terrain features, the helicopters managed to reach the front line flying at extremely low altitude (3–10 metres) and having climbed to engagement height, launched their guided anti-tank missiles. As a result, several dozens of tanks were destroyed within 5–6 minutes, which clearly proved the high level of efficiency of helicopter-based guided anti-tank missile systems. The pattern was as described above: flying at 3–10 metres, attack helicopters approached the area of the missile launch. In some 3 kilometres from this line or near the targets, helicopters climbed to 20–100 metres and after a brief targeting, their missiles were launched immediately. Climbing, target acquisition (main battle tanks, armoured personnel carriers, etc.), launching and guiding anti-tank missiles took all in all merely 25–40 minutes. After the strike the helicopters suddenly descended to the lowest possible altitude and returned to friendly territories in order to prepare for the next sortie.

Sometimes 1–2 attack helicopters were used from ambush. Such helicopters took off and launched their missiles when tanks approached. Their primary targets were mobile command posts and lead tanks.

New infrared traps – flares – were also used by Israeli aircraft in order to neutralise infrared guided, or in other words, heat seeking missiles.

A flare is a sphere-shaped metal container with 4-mm thick walls and 250 mms in diameter, filled with a special fuel mix. These flares are launched from aircraft every 2–4 seconds and descend with a small parachute, burning at a very high temperature. One airplane can take 10 of these flares on average in two containers with 5 flares in each. The fuel mix leaks from the container through an opening in its bottom and burns for about 30 seconds creating a false target for infrared guided surface-to-air missiles.

That is why all of the 66 SA-7 surface-to-air missiles of the Syrians failed to hit their targets.

Among air-to-ground guided missiles, television guided AGM-65 Mavericks and TOW antitank missiles proved to be the most efficient.
AGM-65 Mavericks were used against tanks, missiles, and artillery pieces in the final stage of the war. F-4 Phantoms launched some 50 AGM-65s and 40 of them were direct hits while the rest detonated within 3 metres of their targets. After launching their missiles, the aircraft made counter-air defence manoeuvres and began to execute other tasks.

During the military operations, the Israeli Air Force used a whole range of guided and unguided ammunition, inter-alia unguided aerial bombs, cluster bombs, unguided rockets, and machine guns. TV-guided AGM-62 Walleye and GBU-15 guided aerial bombs were used against small and very important ground targets like command posts, signals headquarters, etc.

Among unguided aerial bombs and cluster bombs, 225 kg and 337 kg MK-82 Snake Eye and MK-117 demolition bombs, 337 kg BLU-1/B incendiary bombs, BLU-26/B and BLU-59/B fragmentation bombs, CBU-24/B and CBU-49/B cluster bombs, and MK-20 Rockeye cluster bombs with MK-118 antitank bomblets were used most frequently. 112, 450, 900 and 1350 kg demolition bombs and 45–90-kg fragmentation bombs were in use much more rarely.

MK-82 and MK-117 demolition bombs were dropped primarily on targets in the hinterland (for example airfields, stores, depots, industrial facilities, civil buildings, troops concentrations, etc.). Such targets were attacked in various air raids with different types of ammunition. For example, petrol, oil, and lubricant (POL) stores were hit with demolition and incendiary bombs, while airfields were destroyed with demolition and concrete-piercing bombs, and CBU-24/B, CBU-49/B cluster bombs; and the troops concentrations were attacked with demolition bombs and CBU-24/B and MK-20 Rockeye bombs.

Airfields raided by the Israeli Air Force became unserviceable for 4–6 hours on average. In order to hamper and complicate repair work some bombs had delaying fuses with 4-, 6-, 7-, or 9-hour delay fuses. There were also dispensers with BLU-59/B bombs dropped with random delay action fuses. In order to destroy aircraft and other pieces of military technology out of shelters, dispensers with impact detonated BLU-24/B bombs were used.

In close air support to troops, soft-skinned vehicles and personnel were destroyed with napalm bombs and CBU-24/B dispensers while with armoured vehicles (primarily main battle tanks) MK 20 dispensers and AT defence structures (mainly demolition bombs) were dropped.

Unguided missiles were used primarily against ground targets. The most frequently used types included American-made 70-millimetre fragmentation-demotion, antitank, and special warhead (for example, filled with arrow-shaped shrapnel) rockets. The latter ones were primarily fired at personnel and transport vehicles.
On-board aircraft armaments were primarily used for close air support to ground forces units, against ground targets, and against enemy aircraft in dogfights. The outcomes of air combat clearly proved that on-board aircraft weapons were still efficient tools in dogfight.

**The importance of electronic jamming devices**

Electronic jamming aimed at Arab surface-to-air missile sites and signals units was conducted by the Israeli Air Force with the use of specially equipped Boeing 737 Stratocruiser jamming aircraft, unmanned aerial vehicles, and ground based jamming stations. In order to cover the activities of strike forces jamming aircraft were ordered into the zone of combat air patrol as early as 1–2 hours before the sorties were flown. The radio countermeasures began when the Israeli airplanes entered the surveillance zone of enemy radars. The time of jamming depended on the duration of stay of fighter-bombers in the target airspace and also on the timeframe necessary for leaving the surveillance zone of enemy radars.

Active noise jamming was rather frequently used against the radar stations of surface-to-air missile sites while impulse jamming – radiated as jamming signals in distance and at a certain angle – were used rarely.

Camouflaging passive jamming – primarily in order to imitate a phoney air combat situation – involved the dispensing of metal coated glass-fibre dipole reflectors – chaff. For this purpose metal-coated cardboard reflectors and specific counter-radar passive jamming charges were used dispensed with small parachutes.

Passive jamming charges made of metal coated fibre-glass bundles were used for preventing surface-to-air and air-to-air missiles from tracking their targets, for diverting them from their targets, and also for camouflaging strike force air formations. As a result of the periodical discharging of chaff, 6–8 imitated group targets appeared on the radar scopes besides the real targets, with 1–2 kilometres of separation, making the selection and identification of the real target difficult. In such cases the automatic tracking system of a surface-to-air missile switched to a new target and guided the missile to the metal coated fibre-glass bundles which had a much bigger radar signature than the attacking aircraft.

On 9th October, for example, during an air raid against Damascus, one of the attacking F-4 Phantoms, having identified two incoming surface-to-air missiles launched at it, fired a few passive jamming charges creating two chaff clouds of metal coated fibre-glass bundles diverting the missiles. The airplane was downed only by a third surface-to-air missile.
MQM-74A unmanned aerial vehicles were also widely used as decoys, or phoney target aircraft, and for increasing the complexity of air combat situations. The jamming of radar stations was the strongest along the route of the main attack of the Israeli Air Force, while other radars located on the flanks, managed to track their targets successfully.

The analysis of combat activities clearly showed that Israel failed to exploit the whole range of opportunities of jamming from warplanes. During air strikes, trying to achieve total surprise, F-4 Phantom pilots often switched on their on-board jamming devices only after dropping their bombs leaving the airspace of targets.

Cooperation between the Israeli Air Force and Ground Forces

Precise synchronisation of the cooperation between the Air Force and Ground Forces in close air support and also in every phase of combat activities was successful.

Such cooperation was supported by the Liaison Officer of the Air Force and the Forward Air Controller. Both Liaison Officers and Forward Air Controllers were usually Air Force pilots banned from flying for some reasons, or observers in reserve, or Ground Forces officers after special retraining.

Forward Air Controllers always belonged to the battle order of Ground Forces and were provided with information on the positions of friendly and enemy troops, on the forward edge of the battle area from the commanders of cooperating units and sub-units. They also gave requests of sorties planned for close air support too. After entering the current situation on their maps, the “line of secure bombing” could be seen. Before takeoff, the pilots of fighter-bomber squadrons were provided with a copy of such maps. Anything located beyond the “line of secure bombing” could be bombed or raided without risking the destruction of friendly troops.

In cases when the target was between the “line of secure bombing” and friendly troops, the Israeli pilots requested clearance to deliver an air strike from the Forward Air Controller. Directing fighter-bombers onto their targets was the task of helicopters hovering at low altitudes and provided them with visual intelligence, choosing the most advantageous position in relation to the target.

When strikes were aimed at targets in areas very close to friendly troops, the following safety regulations were to be observed: bombing targets closer than 1,000 metres to friendly troops was forbidden; launching unguided missiles and dropping napalm bombs at targets closer than 500 metres to friendly troops was forbidden; firing on-board machine guns at targets closer than 200 metres to friendly troops was forbidden. At the same time Israeli artillery units were forbidden to shoot indirect fire.
without the permission of the Forward Air Controller for the sake of the security of friendly aircraft.

Close air support was usually provided with small formations consisting of 4–10 aircraft. Cluster bombs, napalm canisters, or antitank charges were used to destroy the battle order of enemy troops in trenches, foxholes, artillery positions, armoured vehicles, trucks and lorries, command posts, and communications infrastructure. The covering group was divided into two teams – one of them operated in front of the strike force while the other one operated behind it.

Large size targets – e.g. a tank battalion – were attacked by 6–8 aircraft in formation where each fighter-bomber had its own designated target. During the raid the lead aircraft maintained permanent communication with the Forward Air Controller, which allowed confirmed kills and made decisions on repeated runs. At certain targets, primarily ones only weakly defended by anti-air artillery or SAMs (such as columns), took 2–4 bombing runs from 1,800–2,000 metres from a high dive. In such cases aircraft spent 4–8 minutes in the airspace of the target. At heavily defended targets only one run was initiated with a minimum duration of time – 1–2 minutes – spent over the target area.

Apart from airplanes, helicopters armed with both guided and unguided antitank missiles were also widely used for providing ground troops with close air support.

In the last stage of military operations, the Israeli Air Force also used new American AGM-65 Maverick and AGM-62 Rockeye antitank bombs. Fighter-bombers dropped these bombs in MX-20 dispensers with 247 bomblets in each of them.

Bombing raids were usually at 1,500–2,000 metres and the dispensers opened at 400–500 metres above ground level. The focused, cumulative antitank charges of the bomblets burned a hole of some 12 mm in diameter on the top of the turret of main battle tanks, inter alia, those of T-62s.

On the Egyptian front, one northern, two central, and one southern “air corridors” were used by the Israeli Air Force. On the Syrian front the Northern “air corridor” went over the hilly terrain of Lebanon, the Western one was over the Golan Heights, while the Southern “air corridor” followed the border line between Syria and Jordan then turning to the airspace over the desert south of Syria.

In these directions the Israeli Air Force first opened so called “air corridors” in the enemy air defence systems then these routes could be used by Israeli aircraft without taking the risk of ground based air defence. However, adhering to such routes also helped with organising enemy countermeasures to a certain extent, including the deployment of active air defence tools and visual observation posts.
Air interception techniques elaborated before the war, were widely used by the Israeli Air Force during military operations. On the Egyptian front, air targets were intercepted 10–20 kilometres west of the Suez Channel and on the Syrian front 10–15 kilometres east of the forward edge of the battle area. Fighter interceptors were directed to their targets either from the state of "immediate readiness" or from air patrolling by airborne or ground-based command posts. If the fighters were on patrol they were able to engage their targets in 2–6 minutes and had 20–30 minutes to intercept them.

Fighter interceptors were usually directed to the back of the target airspace within 15–30 kilometres. In most cases the interceptor crews located their targets at medium altitude from 15–20 kilometres with the use of on-board radars and had visual contact in 3–6 kilometres, which they immediately reported to the Ground Control Interceptor.

Surprise attacks from below, which also proved very efficient during the war of 1973, were elaborated in the tactics of the Israeli Air Force in the basis of lessons learned in air combat of 1969-1970. One of the most important preconditions of such tactics is the camouflage of the attack formation from enemy radars. Therefore the bulk of aircraft flew in close formation and at low altitude. When engaging enemy, they quickly fanned out into pairs (in accordance with the actual air combat situation) and launched an attack from below. In-board radar-operated aiming systems of F-4 Phantoms allowed target acquisition and the launch of guided missiles even with a several kilometre difference between the altitude of target and that of attacker.

For Israeli aircraft, launching surprise attacks from below was relatively easy because they were continuously informed on the changes of air combat situations, and were provided with direction from airborne or ground-based command posts.

In dogfights during military operations of 1969–1970, a pre-coordinated fanning-out of the fighter group involved the split of large fighter formations into pairs. In accordance with the lessons learned in October 1973, air formations fanned out into individual airplanes. When the risk of an attack from the rear emerged, the lead pair of the group made a sudden turn to the right/left and the wingmen turned in the opposite direction. If the Arab fighters followed suit, the Israeli planes continued to split and flew their sorties individually. Further manoeuvres were conducted in reciprocal directions as if providing Arab pilots with options – continued pursuit of one of the split groups outnumbering them and losing the rest from sight or to split and enter dogfights with individual planes.

Following individual planes often created disadvantageous situations for Arab pilots – while increasing their forces, the air groups hidden from observers were involved in combat. Arab pilots were forced to learn that disintegration of their battle order would result in friendly losses.
The Israeli Air Force used ambush tactics against fighter-bombers providing close air support to enemy ground forces. Such ambushes were initiated from airspaces near the front line, where usually either Mirage IIIs or F-4 Phantoms did patrolling with external fuel tanks allowing an extended patrolling time.

In order to support their combat activities from an ambush airspace, the Israelis deployed diversion air squadrons engaging the cover groups of Arab fighter bombers or prevented enemy aircraft from executing their mission when they had no cover groups.

The Israeli air formation in the ambush airspace waited until the Arab airplanes used the bulk of their fuel and then launched their surprise attack. During air combat, the Israelis continuously increased their deployed forces trying to slow the activities of Arab aircraft as long as possible counting on drying out of their fuel tanks. When launching their surprise attacks from an ambush airspace, a so called “claw” technique was applied by the Israelis, which was based on precise directions from a Ground Control Interceptor. Having received them, Mirage IIIs took up a loose formation. If MiG-17s, exploiting their better manoeuvrability, turned towards one of the Mirage III pairs, the other Mirage III pair launched an attack against them.

In the last stage of the war, Israeli diversion manoeuvres were also applied in order to lure in Arab aircraft and create advantageous preconditions for entering into combat with the immediate involvement of augmentation groups. Since the Israelis did not have any significant success with destroying Syrian aircraft on the ground they tried to achieve their objective in air combat. The Israeli Air Force sent planes over Lebanon and entered into Syrian airspace in order to make Syrian fighter groups take off and engage. With the involvement of reserves from low-altitude camouflaged ambush airspaces, the Israeli aircraft had a tactical superiority over their adversaries making Syrian pilots fight in unfavourable situations.

If surprise was not achieved or if Arab warplanes outnumbered them, Israeli pilots often made evasive manoeuvres. It should be noted here that in such cases Israeli F-4 Phantoms were involved carrying aerial bombs designed for attacking ground targets and not those Mirage IIIs and F-4 Phantoms which were deployed in fighter roles and were armed with air-to-air missiles. The first usually avoided encounters with MiG-21 fighters.

**Conclusion**

On both front lines, guided and unguided air-to-air and air-to-ground missiles were used several times in reciprocal headings from altitudes below that of the target. However,
the analysis of missile launches clearly shows that the preparedness of the Israelis was weak in firing at air targets with a reciprocal heading.

The fourth Arab-Israeli war underpinned the previous lessons learned that Israel, which has a relatively very small territory, must set quality against the overwhelming quantitative superiority of Arab States.

Literature


References

E. J. Kis: Techniques of gaining Israeli air superiority

22. GORDON, S. L., Dimensions of Quality, A New Approach to Net Assessment of Airpower, Tel Aviv University, Memorandum, Tel Aviv, 2003.
23. GUNSTON, B., Das grosse Buch der Luftkampfe, Andreas Verlag, Belgium, 1976.
38. KELLER, B. A., Avoiding Surprise: The Role of Intelligence Collection and Analysis at the Operational Level of War, School of Advanced Military Studies – United States Army Command and General Staff College, Monográfia, Fort Leavenworth, 1992.
42. A légyvédelmi erők harcvezérlékenységének tapasztalatai a második világháború utáni helyi háborúkban, Jegyzet, Légvédelmi rakéta- és tüzérszékház, Zrínyi Miklós Katonai Akadémia, 1985.
45. LUKÓ, D., A légierő alkalmazásának alapjai, Tansegéödet, Zrínyi Miklós Nemzetvédelmi Egyetem, Budapest, 1998
E. J. Kis: Techniques of gaining Israeli air superiority

60. SAVROV, I. J., Helyi háborúk, Zrínyi Katonai Kiadó, Budapest, 1982.
63. SPEIER, W.A., Operational Art Considerations For Army Air And Missile Defense: Lessons From The October War, Szakdolgozat, School of Advanced Military Studies – United States Army Command and General Staff College: Fort Leavenworth, 2003.
64. STILLION, J., Blunting the Talons: The Impact of Peace Operations Deployments on Egyesült ÁllamokF Fighter Crew Combat Skills, RAND Graduate School, Santa Monica, 1999.
70. YOO, J. H., The Countermeasures to an Initial Surprise Attack through the Analysis of Historical Examples, School of Advanced Military Studies – United States Army Command and General Staff College: Fort Leavenworth, Kansas, 1980.