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ASSESSMENT OF IRAQ’S AIR DEFENSE SYSTEM IN THE IRAQI FREEDOM OPERATION

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Abstract: *The paper presents a synthesis of research results that focus on identifying factors that affect the organization and functioning of Iraq's air defense system during the Iraqi Freedom operation and, as a result, contributed to Iraq's defeat. An important part of the considerations presented in the article are the results of research relating to the role and significance of the use by the coalition partners of the state-of-the-art air weapon systems, which facilitated carrying out very precise strikes on the most essential elements of the Iraqi air defense system beyond the reach of the anti-aircraft artillery and missile systems. The authors also indicate that of the vital importance in the lack of adequate protection of the most important objects, the so-called centers of gravity, located mainly in Baghdad, were organizational errors in the distribution of forces and resources, technological problems, and inept command. The paper is concluded with a reflection on the gained knowledge on the influence of the experience gathered from the Iraqi Freedom operation on the processes of technological modernization of the armed forces, and especially air defense that is still based on the technology from the 1960s and 1970s.*

Keywords: *air defense system, centers of gravity, air attack, close air support, active defense.*

Introduction

Analyzing the concepts of conducting air operations at the end of the 20th and the beginning of the 21st century, one can see a change in the Clausewitzian victory paradigm – victory through destruction. This is since more and more advanced technologies allow for precise, even surgical strikes at carefully selected targets, the destruction of which should bring forth the breaking of the will of a given nation, government, or their subordination. As a result, the war and its conduct became more (although not spatially) limited (Świniarski & Wiatr, 1998). Despite a significant change in the paradigm of war and the dynamic development of airpower, the following words were spoken years ago by Sir Winston Churchill: “Air power is the most difficult of all forms of military force to measure, or even to express in precise terms” (MoD, 2015, p. 13) They have lost nothing of their relevance. In contemporary air operations, limiting the damage and losses not only of one's own but also of the opponent, including the civilian population, have grown into the basic canon of modern war (Kuriata, 1998). It also applies to the Iraqi Freedom operation.

In this context, it should be emphasized that after the rapid defeat of Iraq in the 2003 war, there are still many discussions on its main reasons. In this paper, the authors focused on the assessment of the organization and functioning of the air defense system in war conditions, which were recognized as one of the key elements that directly contributed to the final result. In this respect, based on the results of the research conducted at the Polish Air Force University in Dęblin, one can conclude that despite extensive organizational efforts, the Iraqis failed to properly prepare their air defense system to confront the air forces of the two leading countries of the Iraqi Freedom operation, i.e., USA and Great Britain. This resulted, among other things, from the fact that starting from 1991, in accordance with a UN Security Council resolution, an embargo was imposed on Iraq that banned the sale of any weapons by other countries. Among other things, it was for these reasons why Iraq found it very difficult to expand its aviation

potential and develop air defense. The Iraqi army had in its possession only old technologies – from the 1960s and 1970s that needed modernization and replacement for better quality anti-aircraft systems. It was, however, impossible to implement in a short time. Under these conditions, Iraq organized a provisional but relatively strong air defense system, which was based on a large number of various rocket and artillery systems deployed in the regions of Baghdad and Tirkat, as well as at several other important objects.

Preliminary studies carried out on the Iraqi air defense during the Iraqi Freedom operation confirmed the hypotheses that the state of knowledge in this area required more detailed examination and development. Most of the scientific publications describing activities during the Iraqi Freedom focus on their analysis from the point of view of ground forces or air forces, but not air defense, which is a basic determinant in maintaining the viability by the centers of gravity (which are also vital targets for a given state or its armed forces). The information, available in the subject literature, about the organization and operation of the Iraqi air defense in the Iraqi Freedom operation, is usually incomplete and fragmentary. That is why the authors assessed the current state of knowledge as unsatisfactory. In this situation, they decided that this is a sufficiently valid reason to investigate this problem in-depth, and the results of the research are presented in this paper.

From the above-presented problem, the subject of research has emerged, i.e., the Iraqi air defense system in the conditions of confrontation with the air forces of the coalition partners during the Iraqi Freedom operation.

Therefore, it was assumed that the research goal of the paper is to provide a characteristic of the organization and operation of the Iraqi air defense system in the conditions of airstrikes carried out by the coalition aviation during the Iraqi Freedom operation.

The analysis of the manner of achieving such a formulated goal led the authors to order the further research steps by formulating the main scientific problem with the following way: How was the Iraqi air defense system organized and operated during the Iraqi Freedom operation and what were the effects?

The methods used for the research were mainly theoretical; among the methods employed were analysis, synthesis, analogy, generalization, and deduction. The analysis was used because the subject of the study turned out to be too complex to be studied in its entirety.

Searching for answers to the main research problem and the purpose of a detailed understanding of the subject of research, critical literature analysis, and examination of documents were used. The analysis and synthesis were performed to obtain the most reliable information about the subject of the research. The implementation of these methods allowed for describing the strengths and weaknesses of the organization and functioning of the Iraqi air defense system during the Iraqi Freedom operation. Generalization and analogy were used to determine the group of factors that had the greatest impact on the organization and use of the anti-aircraft forces in the situation of mass air raids. The deduction was used in the process of drawing conclusions about the strengths and weaknesses of the Iraqi air defense system in the context of confrontation with modern air forces.

1. Characteristics of the coalition air forces operations in the Iraqi Freedom operation

It should be emphasized that the political and military situation prior to the commencement of Operation Iraqi Freedom was favorable to the commencement of the air operation, the purpose of which was to simultaneously win an advantage in the air and strike at the centers of gravity of Iraq. This was favored by, among others, by UN Security Council Resolution 688 that called on Iraq to cease ethnic cleansing on the Kurdish and Shiite people. As part of these actions, as early as August 26, 1992, the no-fly zones were introduced in Iraq. They were established to ensure the free carrying out of reconnaissance missions by the coalition air forces, and thus facilitate the constant control over compliance with the provisions of the UN Security Council Resolution. At the same time, they were forbidden zones for Iraqi aircraft of all types. The border of the designated zones was drawn above the 36th parallel in the north of Iraq and below the 33rd parallel in the south.

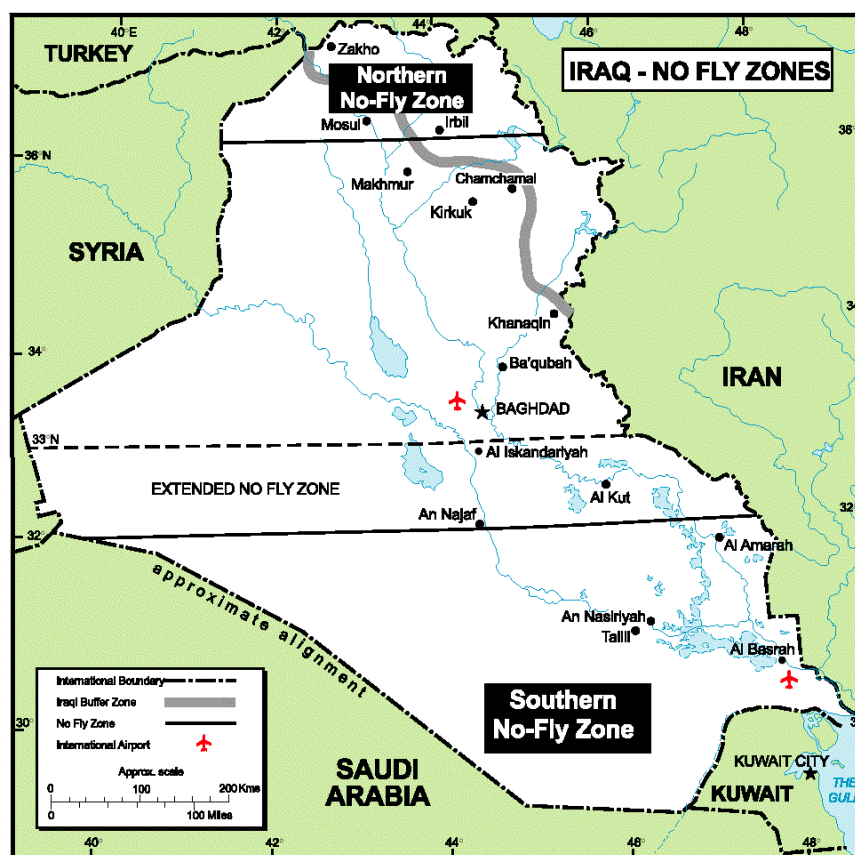


Figure 1: No-fly zones in Iraq

Source: <https://www.globalsecurity.org/wmd/library/news/iraq/2000/45303.htm>

Operations carried out as part of the no-fly zone control were named “Operation Northern Watch” and “Operation Southern Watch.” In order to coordinate the operations, the Americans formed Joint Task Force Southwest Asia, whose operational center was located in Al Udeidi, Qatar, while air bases were located in Turkey, Saudi Arabia, Kuwait, and Bahrain. In total, until the start of the Iraqi Freedom operation, the forces involved in controlling the airspace over Iraq consisted of about 200 combat aircraft and 6,000 personnel (Heliński, 2003, p. 102).

The introduction of no-fly zones met with strong opposition from Iraq. Despite the coalition’s warnings, Iraq did not withdraw its anti-aircraft systems from their positions and started firing at the coalition aircraft. The number of attacks on air targets was steadily increasing, as did the number of retaliation actions undertaken by the Allies. At the end of 1998, there was regular warfare taking place, not a mission aimed at controlling the implementation of the UN Resolution. In the period from December 1998 to January 2001 alone, Iraqi aircraft violated the southern zone more than 470 times, and over 670 accidents of targeting or firing at coalition planes by Iraqi anti-aircraft defense systems were recorded (Radomyski, 2009, p. 148). At that time, the coalition air forces carried out around 22,000 combat flights by opened fire over 350 times (Cordesman & Arleigh, 2003, p. 192). In this regard, one may conclude that even before the start of the Iraqi Freedom operations, both sides had already conducted regular acts of war. As a result of coalition air force strikes on the anti-aircraft systems, air control was obtained even before the start of the joint operation (Mosley, 2003). Airstrikes had intensified even more since the beginning of 2003 – there were around 170 rocket-bomb strikes almost exclusively with the use of precision ammunition. In some cases, these attacks went beyond the zone defined by the UN mandate, and the B-1B bombers were used to attack radar stations just before the outbreak of the conflict (Cordesman & Arleigh, 2003, p. 149).

Thus, the advantage gained by the coalition enabled them to redirect the effort from fighting for the control of the airspace to carrying out strikes at the centers of gravity of Iraq and to support the land

forces. Despite the Southern Watch and Northern Watch operations, it was expected that Iraq would still retain the command structure and control of the anti-aircraft systems that were located in underground shelters and bunkers.

For the purposes of efficient conducting of a military operation against Iraq in the Persian Gulf region, a strong group of air, navy, and land forces was organized that amounted to about 300,000 soldiers with more than 1,000 tactical combat aircraft, 47 B-52N, B-1B, B2A strategic bombers, over 100 warships, of which 35 carried Tomahawk missiles. Military operations in Iraq were also supported by other forces, including satellite reconnaissance and guidance systems. In total, the aviation potential accumulated in the Persian Gulf consisted of 1801 combat and auxiliary aircraft. The US Air Force (USAF) provided 51% of the combat aircraft and all heavy bombers. Most refueling, transport, and reconnaissance aircraft came from the Air National Guard and Air Force Reserve Command (Grant, 2003, p. 10).

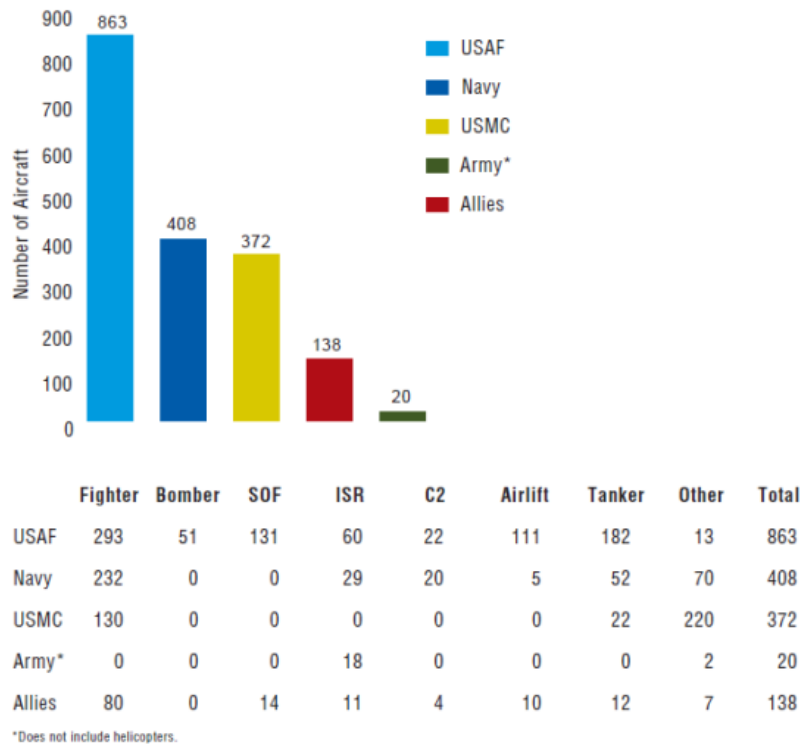


Figure 2: Total number of coalition aircraft
 Source: (Grant, 2003).

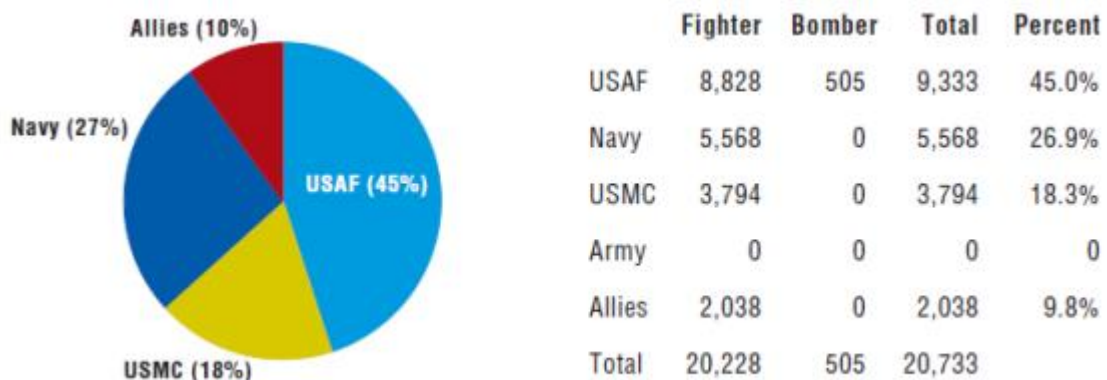


Figure 3: Strike sorties
 Source: (Grant, 2003).

On March 20, 2003, at 3.33, less than an hour after the deadline ultimatum given by President George W. Bush to Saddam Hussein, the first raid on Baghdad started, and this is how the operation Iraqi

Freedom began. The objectives of the operation disclosed by Secretary of Defense Donald Rumsfeld were as follows:

- to end the regime of Saddam Hussein;
- to identify, isolate and eliminate Iraq's weapons of mass destruction;
- to search for, capture or drive out terrorists;
- to collect intelligence related to terrorist networks in Iraq and beyond;
- to collect intelligence on the global network of illicit weapons of mass destruction activity;
- to end sanctions and immediately deliver humanitarian relief to the displaced and the many needy Iraqi citizens;
- to secure oil fields and resources, which belong to Iraqi people;
- to create the conditions for Iraq's rapid transition to a representative government (Garamore, 2003).

In fact, the war against Iraq waged by the US and its allies from March 20 to April 15, 2003, boiled down to de facto control over one of the most important areas of oil production in the world. In this context, the US command in 2003, in a secretive and very detailed way, when planning a military operation including air operations, analyzed the real potential of Iraqi air defense capabilities. On that account, a combined air-ground operation was prepared.

The Iraqi Freedom operation began with the use of several BGM-109 Tomahawks and F-117A and F-16 aircraft that struck a bunker in the suburbs of Baghdad, which was believed to be the location of Saddam Hussein and other important commanders. On the day preceding the air-missile attack, US air forces attacked artillery positions in southern Iraq because they were considered a real threat due to the possibility of using chemical ammunition against the coalition land forces in Kuwait. In the earlier days preceding the war, coalition air forces using B-1B aircraft destroyed the elements of the Iraqi integrated air defense system located in no-fly Zones, including Soviet production radar stations P-15, a radar close to the H3 airbase, and a radar detecting small altitudes air targets in Ruwayshid, near the Saudi and Jordanian border (Kopp, 2003).

The main phase of warfare began with aircraft missiles strikes delivered by combat aircraft on selected targets in Iraq. Later on, these strikes were carried out in series; in total there were over 300 of them. Attacks took place both, during the day, and at night and targeted industrial, economic, and military facilities of the state control system, on the positions of the Iraqi troops, including the ground-based air defense systems and airports, which were systematically destroyed.

At that time, a wide range of precise weapon systems was used. For example, during the operation Desert Storm 282 Tomahawk missiles were used, while in the Iraqi Freedom, in only 15 days, over 1000 precision missiles and many thousands of self-guided bombs were fired.

Table 1: The number of precision combat weapon systems used during the Iraqi Freedom operation in 2003

Type of the air destruction agent									
TLAM *		Maverick		WCMD **		LGB ***		JDAM ****	
%	number	%	number	%	number	%	number	%	number
4	802	4.6	918	4.5	908	43.7	8.716	32.8	6.542

* Tomahawk Land Attack Missile;

** WCMD – Wind-Corrected Munitions Dispenser e.g., CBU-103/105,SFW/107;

*** LGB – Laser Guided Bomb, e.g., CBU-12/16/24/27/28 and EGBU-27;

**** JDAM – Joint Direct Attack Munition, e.g., GBU-31/32/35/37.

Source: Own elaboration

In total, coalition planes dropped 29,199 bombs, rockets, and missiles of all kinds on Iraq. The Second Gulf War was characterized by the intensive use of weapons guided by laser beams, satellites,

and other types of missiles guided by signal or TV image. Two-thirds, i.e., 19,948 of the used airborne weapons were precision-guided munition.

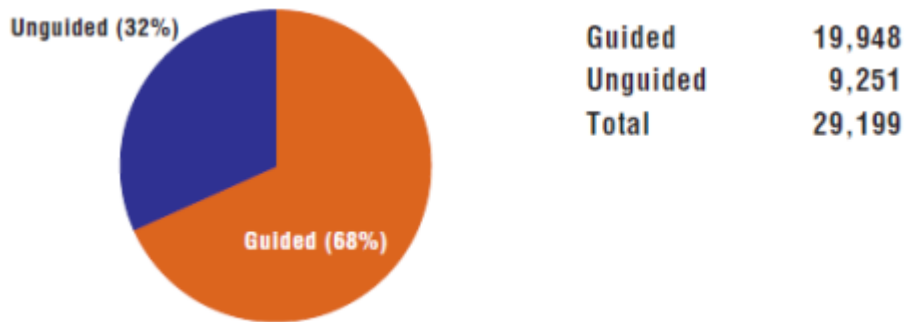


Figure 4: Munitions expended
 Source: (Grant, 2003).

In attacks against Iraq, one of the most frequently used weapons were laser-guided bombs, joint direct attack munition, and Mk 82 bombs. These three types of means accounted for 71% of all types of munition used during the Iraqi Freedom campaign. The rest of the aviation weapon systems contained 16 other types.

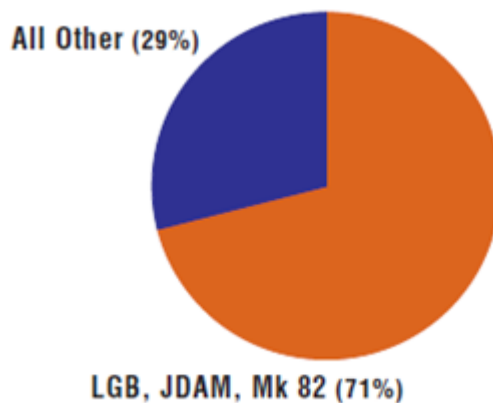


Figure 5: Most popular munitions
 Source: (Grant, 2003).

The most effective was the rockets and bombs guided to the target with signals from the outer space radio navigation system NAVSTAR.

During the Iraqi Freedom operation, the precision-attack missiles HARM and MAVERICK also played a significant role in the disorganization of Iraq's air defense system. The latter is an American air-to-ground tactical missile manufactured by Huges Aircraft Corporation and Raytheon Corporation, and it is designed to fight tanks, combat transporters, surface ships, to destroy launch stations, and other tasks. The anti-radiation missiles AGM-88 HARM (high-speed anti-radiation missile) from Raytheon Corporation were introduced to the armament of American air forces in 1982. The HARMs significantly contributed to the destruction of many radar stations in combat operations in Iraq.

During the war against Iraq in 2003, American aircraft used the modernized variant of the "air-ground class MAVERICK AGM-56G2 missile. New software, including the targeting system with a thermal warhead (heat guided) allowed to detect the target and remember its location. The same type of missiles had already been used in operations in former Yugoslavia, where airstrikes were carried out not only on military equipment and facilities but also on military warehouses and bridges. The impact efficiency of this type of missiles was very high – it amounted to 97%. Most guided missiles were fired 6

kilometers or less from the target. During the entire Iraqi Freedom operation, more than 900 missiles of this type were used. They were carried by A-10 aircraft fighters; each of them could carry up to six such missiles. American air forces had 60 aircraft of that type in the Gulf region.

The appeared anti-radiation missiles HARM turned out to be the right choice for the campaign. Their 68 kg warhead caused great havoc among the Iraqi radar stations. The main carriers for these missiles were F-14, F-15, F-16 CJ, F/A-18, and TORNADO.

In Iraq, the main carriers of the HARM missiles were F-16 CJ, whose task under SEAD (Suppression of Enemy Air Defense) was to destroy the enemy's ground-based air defense systems. There were about 70 aircraft of this type in the American air forces, and they were based at the airports in Kuwait, Saudi Arabia, Qatar, and Turkey. The upgraded software and security equipment in the HARM missiles allowed to increase the accuracy in targeting the attacked objects.

In total, during the war, the coalition air forces used about 400 HARM anti-radiation missiles. They were also carried by F-117 attack aircraft, EA-6B electronic warfare aircraft, and F/A-18 combat jets. The greatest concern of Americans was the anti-aircraft shield of Baghdad, whose main core were medium-range anti-aircraft missile systems and high saturation of short-range anti-aircraft missile systems and anti-aircraft artillery, whose launch and fire positions were not accurately located. The Iraqi radars were turned on and off in very short time sequences, which made it difficult for the HARM missiles to reach the target. It showed the weaknesses of the HARM system – with the adopted tactics of Iraqi radar stations it had a problem with the proper location of the attacked object.

In the first part of the operation, the air and naval forces of the coalition struck the previously selected targets, including all Iraqi airports, which led to the elimination of many aircraft and airport infrastructure.

Based on the data, it can be stated that the air component focused the vast majority of its efforts, i.e., 78%, on air support for land forces, which was implemented under the Kill-box Interdiction/Close Air Support” (KI/CAS) strategy.

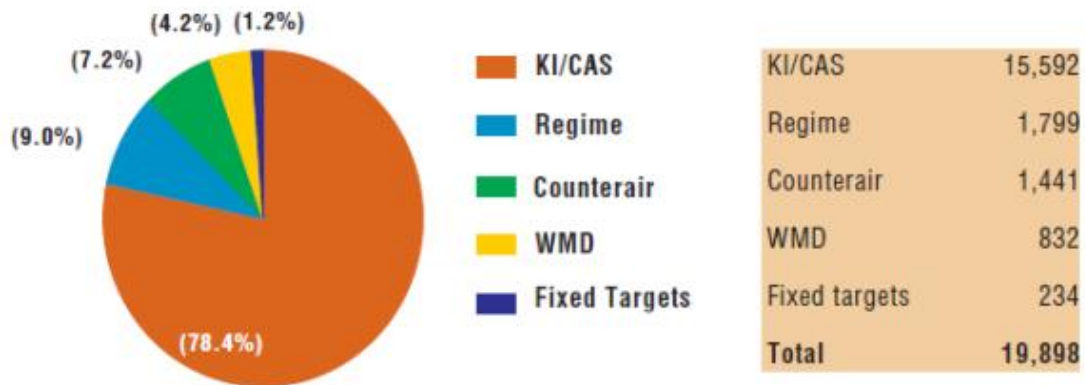


Figure 6: Strikes by category
 Source: (Grant, 2003).

The effort of air forces to support land forces coincided with the ongoing strategic bombing that began with two-day “shock and awe” raids carried out with the use of B-2As, F-117As, and F-15E Beagles aircraft and several hundred of Tomahawk missiles that were fired from warships. As a result of these raids, Ba'ath Party facilities, Saddam's palaces, anti-aircraft stations, republican guard posts, and other targets in Baghdad were destroyed. The impact did not affect basic infrastructures, such as power plants and water intakes. Having analyzed air impacts, one can describe them as quite precise. The purpose of the raids in the initial period of the operation was to affect the civilian population and the Iraqi authorities psychologically and to disrupt the functioning of the state. After the initial phase of air raids, there were long and intense day and night attacks on the remaining government facilities in the city. These raids were part of the preparation for ground forces that were to engage in combat in the Baghdad region. Their goals were satellite links, buildings of the Ministry of Information, various Baath and mili-

tia and air defense facilities as well as republican guard positions and fire departments in Baghdad. As a result, airstrikes led to the disorganization of the defense system prepared by Iraq in the capital. The weapons used included laser-guided bombs Paveways and JDAMs. The uniqueness of this air force operation should be emphasized, because civilians, water and power supply systems, bridges, and government buildings that were not an integral part of the regime were not attacked during it.

The successes already achieved on the first day of the air operation and the lack of counteraction by Iraqi aviation enabled the early start of land operations. On the night of March 21/22, during the Shock and Awe operation, the coalition land forces began the strike. The lack of possibility to initiate the land attack from Turkey was definitely a disadvantage. It was also the reason why the main land component was deployed in Kuwait. The move forward of ground forces was accompanied by increased activity of air forces. The latter, closely supporting land forces (CAS), also successfully performed deep air support tasks (AI). Therefore, no classical, sequential course of operations was used, where land and air operations followed special and aerial operations, but individual phases of operations were carried out in parallel. At the same time, to ensure the offensive-raiding nature of land forces operations, special forces conducted intensive activities aimed at capturing important objects: airports, bridges, oil wells. It is estimated that air forces conducted as many as 4,278 strikes (Mosley, 2003, p. 5) to support special forces, and thereby opened them the way to take control over various strategically important places. From March 30 to the end of the operation, the difference between CAS and AI aerial operations blurred completely. In order to eliminate the resistance points at the entire depth of the task closer to the tactical relations with land forces, all air forces capabilities were used, and the depth of strikes of helicopters and close air support aircraft often went beyond the depth of strikes of strategic aircraft. It was also the first time when B-1B strategic bombers were used to carry out CAS tasks. These aircraft equipped with four powerful 2-ton BLU-113 bombs each performed frequent duty in the waiting zone over Iraq and were engaged when called from the battlefield. The use of unmanned aerial vehicles for reconnaissance purposes was also significant. The images transmitted in real-time were sent to the command of land forces, including the level of the company commander.

An analysis of the combat operations of the coalition air forces indicates the versatility and multi-dimensionality of the aviation usage that often had to take over the tasks of land forces. This situation was the result of a substantial, previously unforeseen pace of attack of the coalition forces, and thus the impossibility of introducing more and more troops.

In addition, air forces did not carry out a several-week "preparatory" air operation for the land attack, as was the case in 1991, but operated in parallel with the ground and special forces.

Close air support played (CAS) a significant role by clearly going beyond the area of tactical operations and covering the tasks of air interdiction (AI) and strategic strikes.

Over 50% of the overall effort was given to CAS. It was five times greater than in the Desert Storm operation. On the other hand, the Iraqi Freedom allocated more than twice as little effort, just 14%, to win and maintain the control in the air. Of course, the main reason here was the 12-year fight for control in the air, conducted almost continuously since the end of the war in 1991 and covering 70% of Iraq's airspace.

2. Organization and operation of the air defense system of Iraq during the Iraqi Freedom operation and the main reasons for the defeat

The Iraqi strategy of waging war in 2003 focused from the very beginning on the idea of defense based on the "city bastions," where the Republican Guard, Fedayeen, and other loyal units were deployed in urban areas, or the areas around them. The adopted defense model based on the cities was also supposed to provide better protection for soldiers against the consequences of air attacks and a certain limitation for the attacking air forces due to the possibility of large losses among civilians. Iraqis have deployed soldiers in schools, mosques, hospitals, historic sites, and in densely populated suburbs, which are excluded from bombing under the international law. In line with the adopted strategy, the Iraqis or-

ganized a layered defense around Baghdad based on Republican Guard troops, and to a large extent, it resembled the Soviet siege doctrine of 1941–43.

In the run-up to the Iraqi Freedom operation, out of the 220 combat aircraft at Iraq's disposal, only about 100 machines were fit for combat. That is why all Iraqi aviation was centered at eight airports (air bases). Before the start of warfare, Iraqis moved most of their combat aircraft: Mig-23, Mig-25, and Mig-29 (in sum around 50 units) near the Tammuz airbase (El-Habbania, 70 km west of Baghdad). On the basis of the directive of the commander-in-chief of Iraqi armed forces issued during the war, combat aircraft and helicopters were taken out of the command of the respective armed forces – their use, during the war, was governed by separate orders from Saddam Hussein himself.

Initially, it was assumed that aircraft stationed at the Tammuz airbase were important in the Iraqi concept of warfare. Moreover, the command of the Iraqi air force intended to use their aircraft to support their land forces from the al-Bark airport (about 80 km north of Baghdad) and the al-Hurrya airport (about 240 km north of Baghdad), where approximately 20 combat aircraft were located. However, this plan was not implemented. It should be noted that these forces, as Iraqi command declared, were best prepared for action and, at the same time, most strongly protected by ground anti-aircraft systems. Prior to the commencement of operations at the airport of the al-Bakr base, there were aircraft and their crews. That changed on April 6, when the base commander General M. Faruk ordered the officers to leave for homes and wait until they would receive a special order; an order that was never issued.

Such a decision resulted, among others, from the fact that the command of the Iraqi armed forces was aware of the fact that the coalition air forces would gain control in the air. Under these conditions, it was considered useless to use their own aircraft. However, it was predicted that they would be deployed during the defense of Baghdad, mainly when the enemy forces would approach the suburbs of the Iraqi capital. Again, for unknown reasons, it never happened. As a result, Iraqi air forces carried out only one reconnaissance flight from the Al-Bakr air base throughout the entire operation.

The main assumptions of Iraqi air defense tactics boiled down to a very short stay of anti-aircraft weapon systems at fire stations. Total control in the air of the US and UK air forces, which carried out missile-bomb attacks on objects located in Iraq, caused a significant weakening and the need to decentralize the command of Iraqi troops – subunits of anti-aircraft systems, which hindered, and in many cases even prevented the use of radar information from the stations that were located in the prohibited zones. The Soviet production anti-aircraft missile systems (S-75 and S-125) that were in possession of the Iraqi armed forces were not technologically modernized before the operations.

Before 2002, the Iraqi armed forces partly modified other air defense systems, which largely came from the Soviet era, with newer equipment that was obtained from various sources. As a result, before the outbreak of another war in the Persian Gulf, Iraq's air defense systems were a mixture of western and older Eastern European and Far East technologies. An important element of the qualitative improvement of Iraq's air defense system was technical assistance provided by China. It concerned the laying of fiber optic cables between various air defense nodes, especially in southern Iraq. As a result, it was supposed to limit electronic emissions of the air defense devices, which normally could be easily detected and located on the basis of standard reconnaissance activities carried out from the air. Despite these difficulties in detecting elements of the air defense system, American pilots were in a comfortable situation because they had the support of specialized aircraft specially designed to detect radar positions and anti-aircraft missile systems and disrupt their work. Moreover, American pilots could carry out attacks on radar stations from a distance of several dozen kilometers. In some parts of the country, Iraq was found to have attempted to block the global positioning system (GPS) that NATO forces used to target missiles at targets accurately. It was not entirely known whether those so-called GPS jammers were of domestic production or had been illegally purchased.

The analysis of Iraq's potential for air defense confirmed that in 1990 Iraq had 16,000 radar-guided surface-to-air missiles (SAM), mainly of Soviet production: SA-2, SA-3, SA-7, SA-8, SA-13, SA-14, and SA-16 and Roland produced by France and Germany. Iraq also had a wide range of Soviet mobile SAM systems, including SA-6 Gainful and SA-9 Gaskin. Of these, the most famous was Gainful, which inflicted heavy losses on Israeli air force during the Yom Kippur war in October 1973.

Table 2: Air defense command

SYSTEMS		1990 *	1995 *	2000	2002
AD GUNS		~ 4.000	~ 5.500	~ 6.000	~ 6.000
130mm		+	+	+	+
100mm		+	+	+	+
100mm	KS-19	+	+	+	+
85mm		+	+	+	+
57mm	S-60	+	+	+	+
57mm	ZSU-57-2 SP	+	+	+	+
37mm	M-1939	+	+	+	+
23mm	ZSU-23-4 SP	+	+	+	+
SAM				~ 2.300	~ 2.000
	SA-2	160	+	150	125
	SA-3	140	+	110	100
	SA-6	~ 300	+	150	125
	SA-8		0		
	SA-9 / -13		+	2.000	125
	SA-7 / -14	+	+		1.500
	SA-16	?	?	?	?
	Roland	100	+	+	+
	Crotale	5	5	5	+
	Aspide	-	-	+	+

Source: Own elaboration on the basis of <https://www.globalsecurity.org/military/world/iraq/air-defence-equipment.htm>

The most modern mobile SAM in the Iraqi army was the SA-8 Gecko short-range system. Its normal range of destruction of air targets was 1.1-5 nautical miles for targets flying between 100 and 16,500 feet. The most common tactic used against SA-8 was the use of anti-radar missiles or flying above its effective range. The self-propelled AAA ZSU-23/4 and MANPADS (Man-portable air-defense) systems supplemented the air defense. The portable anti-aircraft missiles sets MANPADS were equipped with missiles with thermal warheads that were designed to destroy targets at low altitudes and did not need accurate information from radar indicators. Iraq had an older type of MANPADS (SA-7, SA-14).

In addition, Iraqi air defense possessed more than 7,500 AAA units, which protected all the important military and civilian facilities. Some of these systems were located on the roofs of government facilities in Baghdad. 57mm and 37mm anti-aircraft guns, self-propelled AAA ZSU-23/4 and ZSU-57/2 systems, and hundreds of light anti-aircraft 14.5mm and 23mm machine guns constituted the backbone of the integrated air defense system. Based on the UN report, it can be stated that Iraq did not return a large amount of military equipment to Kuwait after the Gulf War in 1991, including one Hawk battery and 675 Russian surface-to-air missiles.

For major defense areas such as Baghdad, airports, chemical production complexes and nuclear facilities, air defense systems were particularly dangerous for aircraft operating below 10,000 feet.

To sum up, it can be said that the Iraqi air defense system was relatively well organized and combined the features of several systems. Multilayer air defense around Baghdad was more extensive than that surrounding most of the Eastern European cities during the Cold War and several times stronger than the one that defended Hanoi in the later stages of the Vietnam War. In the opinion of military ex-

perts, if it were assured that it would function as intended, that air defense system was able to protect key facilities in Iraq effectively.

Moreover, the quantitative and qualitative analysis of Iraqi air defense shows that it was one-third stronger in 2000 than during the first Gulf War in 1991. In 2002, Iraq already had an integrated air defense system (IADS) in which SAM systems of the various range covered all the area and created a protective umbrella. In particular, it was so in the Baghdad and Tikrit regions. In addition, air defense in the no-fly zones was mainly based on AAA, MANPADS, and a small number of SAMs. These were the means that could move quickly and organize ad hoc anti-aircraft ambushes. Command of the anti-aircraft resources in no-fly zones was decentralized. The information about air targets was received by radars deployed outside no-fly zones or from reconnaissance. Obtaining information from the radar indicators that were located at a fairly large distance from the anti-aircraft weapon systems resulted in its insufficient accuracy and timeliness for precise determination of the azimuth, distance, and altitude of the target.

In no-fly zones, apart from anti-aircraft artillery (AAA), MANPADS SA-7 and SA-14 were also used to fire at low-altitude aircraft. In this regard, it should be noted that Iraq did not have more modern MANPADS types like SA-16 and SA-18.

Although in the no-fly zones Iraqi air defense forces were much smaller than around Baghdad and Tikrit, where the main air defense forces were deployed, pilots of allied forces had to be very vigilant and careful. This was mainly due to the tactics of using the anti-aircraft weapon systems, which could unexpectedly appear in the no-fly zones, then open fire on the aircraft and quickly retreat to new positions. According to intelligence data, anti-aircraft systems arrived from the Baghdad region that was 80-100 km away from their operating areas and remained there for no more than two days, after which they returned to the areas of their permanent locations. Only in 2001, the coalition lost nine unmanned aircraft Predator over the territory of Iraq. The last such event took place in the northern part of Iraq in the no-fly zone on December 23, 2002, where the UAV was shot down by an Iraqi fighter.

According to the coalition's assessments, the air defense system in central Iraq was in a similar state of the organization as during the operation Desert Storm. The air defense operations center in Baghdad as well as the zone centers in Tai (central zone), Kirkit (northern zone) and Talili (southern zone) continued to operate. There was also the H-3 western center. These centers had the authority to command dozens of anti-aircraft weapons, SA-2, SA-3, SA-6 missile systems, and artillery systems organized in batteries or battalions. These centers commanded about 60 SAM (SA-2, SA-3, and SA-6) batteries and divisions. For comparison, there were 90 such subunits at the beginning of the Desert Storm. According to some estimates, there were 7,000-7,500 AAA 23mm or larger guns in these subunits (IISS estimates that there were about 6,000 such guns).

It should be noted here that despite the modernization of the command system, it did not have sufficient information capacity. It had just a few means, like KARI, which was produced by THOMSON-CSF (now TALENS), before the Desert Storm operation. Despite the fact that 10-12 years ago, this system was difficult to disrupt, it could be effectively disorganized during the Iraqi Freedom.

As a result of extensive post-war control in 1991, as part of sanctions imposed on Iraq, the command decided that all the best anti-aircraft systems would be regrouped into an open zone for flights between 33 and 35 degrees latitude, where they would not be attacked by aviation.

The information that Iraq was in possession of SA-10 or SA-20 air defense systems was not confirmed. Moreover, the Pentagon has not released any information confirming the presence of these systems in Iraq.

It was also recognized that older SAMs: SA-2, SA-3, and SA-6 did not undergo any significant modernization. The reports that Iraq supposedly had a passive detection system, such as the Ukrainian Kolchuga, the Czech Tamara, or Trash Drum / Ramona were not confirmed either.

Conclusion

Air operations in the Persian Gulf during the Operation Iraqi Freedom in 2003 were of different nature to those that took place in 1991 war. They were strategic airstrikes of a sequential nature, which by destroying the highest value targets, consequently weakened the Iraqi defense system. A series of sequential attacks, the so-called “series warfare – sequential attack” on elements of the early warning system, airports, and anti-aircraft systems (missiles launchers and artillery) became the primary objectives. Each of these destroyed targets has opened a way to strike the next one.

Moreover, the Iraqi Freedom operation was carried out by relatively small land forces, with strong air support and significant involvement of the infantry and special forces. It is estimated that it was the first conflict of the 21st century in which the use of all components allowed to achieve a synergy effect.

Once again, the thesis has been confirmed that the best for air strikes (strategic and tactical) are air forces because they allow to achieve political and military goals the fastest, both, by themselves, and in cooperation with other types of armed forces (Zdrodowski & Marciniak, 1998). When assessing the predisposition of the air force to perform strategic attacks during Iraqi Freedom, one should turn attention to the need to have different air platforms with high combat capabilities (Szpyra, 1998).

Operation Iraqi Freedom has broken the standard that only obtaining control in the air is a prerequisite for starting a land or sea operation. In this case, the fight over control in the air was carried out simultaneously to strategic strikes and CAS. Offensive air operations and strategic strikes conducted at the same time as part of the air operations created particularly difficult and complex conditions for the Iraqi air defense system to undertake effective countermeasures. Difficulties in the efficient functioning of the anti-aircraft system stemmed, among other things, from a large number of objects (centers of gravity) in need of a strong shield. The complexity of operations of anti-aircraft forces in case of combined air operation also results from the diverse nature and variety of defended objects (of linear, point, or surface nature), as well as their location. Such a diverse nature, structure and location of centers of gravity requires air defense to have modern reconnaissance, fire, and command systems adequate to the predicted air threat. There are no doubts that only if Iraq had had state-of-the-art anti-aircraft systems, it would have been able to provide an effective defense to the center of gravity. What we mean here is also having the possibility of choosing the optimal method defending the given object, i.e., zone defense, object (direct) defense, or zone-object defense.

According to military experts, other factors also largely contributed to the successes of the coalition forces. One of them was that the defense was carried out in a situation of a disrupted and disorganized command system of the Iraqi armed forces. Moreover, desertations and escapes from the anti-aircraft positions were a big problem.

There are no doubts that the Iraqi air defense system in the first and second war in the Persian Gulf had to face the most modern air weapon systems that had been invented so far. An additional difficulty in its functioning was that it had to act alone without the support of an ally. The outcome of the first and second clash of the Iraqi air defense with the state-of-the-art air technology of the United States and other coalition countries proved to be catastrophic. It confirmed, at the same time, that the Iraqi system was largely an arsenal of outdated means of reconnaissance, command, and combat, which only seemed dangerous and threatening. In fact, it turned out that it was not able to resist modern airpower.

When assessing the course and results of the Second Gulf War, it can be concluded that many other, more technologically and organizationally advanced air defense systems would have survived. However, in all probability, with a better command organization, the Iraqi air defense could have been more efficient.

Despite the specificity of the environment in which the warfare was conducted, one can certainly draw conclusions of a universal nature that should be taken into account in the process of enhancing national air defense systems. It is pertinent especially to the armed forces of countries that have similar anti-aircraft potential. From the Polish perspective, this is important, because especially the armament of the Iraqi anti-aircraft system was, in many respects, analogous to the one we currently have in the Polish armed forces. Analyzing the weaknesses of Iraqi air defense, we have the opportunity to learn about our own shortcomings. In our opinion, both the First and Second Gulf War as well as subsequent military

operations in Libya, Ukraine, and Syria should provide a platform for serious reflection, mainly on choosing a rational development path for the national air defense.

In spite of a lot of sentiment for the S-125, KRUG, KUB or OSA sets, we believe that the currently undertaken "cosmetic" resuscitation attempts to modernize some parts of the anti-aircraft defense system cannot bring the desired results, because often over 30-year-old missiles sets in case of confrontation with modern air forces would never provide an effective defense of the endangered objects, regardless of their nature, type or location. Therefore, in many armed forces, it is necessary to replace outdated anti-aircraft defense weaponry, and it should not be put off in time. In our opinion, we should focus on mobile, multi-channel systems, resistant to interference, and capable of conducting independent (autonomous) operations in any battlefield environment.

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