

# Missiles and Other Means of Delivery in the Middle East

UZI RUBIN\*

## Background paper

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\* Uzi Rubin is the President of Rubicon Defense Consulting Ltd. He was in the Israeli government service until 2002, where his latest positions included in working as Special Assistant for Research and Development Programs in the Office of the Minister of Defence and as Senior Director for Defence Policy. Prior to that he has established and served as head of Israel's Missile Defense Organization, where he oversaw the development of Israel's Arrow anti-missile defence system. He was awarded the Israel Defense Prize in 1996 and 2003.



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## About the Author

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## Abbreviations

CBMs	Confidence Building Measures
GLONASS	Globalnaja Nawigazionnaja Sputnikowaja Sistema
GPS	Global Positioning System
ICBM	Intercontinental Ballistic Missile
PLO	Palestine Liberation Organization
SLBM	Sea Launched Ballistic Missiles
SLV	Space Launch Vehicle
TEL	Transporter Erector Launcher
TERCON	Terrain Navigation System
UAV	Unmanned Aerial Vehicle
WMD	Weapons of Mass Destruction
WWI	First World War
WWII	Second World War

## 1. Introduction

For nearly one hundred years the Middle East has been a region of conflict marked by wars, confrontations and social upheavals driven by religious, ethnic and economic factors. Ever since the outbreak of WWI there have rarely been periods of tranquility. Conflict has been endemic, ranging from civil wars to intrastate wars and foreign invasions. During the Cold War, the region played a key role in the US–USSR confrontation. Today its political evolution is dominated by three great processes: The rise of the Islamic Republic of Iran, internal upheaval in the Arab world (the Arab Spring), and the century-long Israeli–Palestinian conflict. The natural wealth of the region – which contains about one half of the world’s proven oil reserves – is amplifying local confrontation into global crisis and fuels the flood of armaments imported into the region from the outside or manufactured by its more industrially advanced states.

In this somber reality, ‘confidence’ and ‘the Middle East’ may well be regarded as contradictory terms. The major factors that contribute to this almost permanent crisis situation are cultural diversities, clashing national and religious aspirations, and naked fear. In the last category, perhaps the most fearsome factor is the widespread availability of delivery systems that can strike civilian populations from a distance, whether with (highly lethal) non-WMD or with WMD bombs and warheads.

This paper will review the technological history of delivery platforms at large, their spread and use in the Middle East, and their contribution to threat perception. Based on the insights from this review, the paper will strive to point out the most realistic path for confidence-building measures.

For the purpose of this paper, the Middle East is narrowly defined as the region bound to the east by Iran’s eastern borders, to the west by Libya’s western borders and to the south by Egypt’s and Libya’s southern borders. Important players such as Turkey and key regions such as Afghanistan, Sudan and the important Arab states of the Maghreb are thus unfortunately left out, not with complete justification but in favour of clarity and conciseness.

## 2. Historical Background

When the French aviator Louis Bleriot crossed the English Channel with his fragile, wire-braced airplane in 1910, he unwittingly launched a veritable revolution in military affairs. Even in those early times, astute observers could see that cities and countries, hitherto secure from bombardment by virtue of their distance from the battlefield, were destined to be vulnerable to bomb-carrying descendants of the primitive Bleriot Flyer. And indeed, WWI saw the birth of strategic aviation, first

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with lighter-than-air vehicles ('Zeppelins'), then later with rugged, multi-engine and fairly reliable bombers that wreaked havoc on central London and killed hundreds of civilians.

The explosive growth of aeronautic sciences between the world wars brought about the creation of bomber fleets as strategic weapons that heavily influenced the international politics of the era. The warning of Britain's Prime Minister that 'the bomber will always get through' reverberated in the public's awareness and created mass panics such as the partial evacuation of London on the outbreak of WWII. In this way the bomber aircraft foreshadowed today's fear of ballistic missiles.

Strategic bombers were the prime delivery platforms during WWII as well as in the later conflicts in Korea and Vietnam. From the fleets of B-17s and Liberators raining bombs on Berlin to the fleets of B-52s raining bombs on Hanoi, the strategic bomber reigned supreme. It devastated London and Coventry, Rotterdam and Berlin, Tokyo and Osaka, killing millions of civilians with non-nuclear weapons. It killed hundreds of thousands in Hiroshima and Nagasaki with nuclear ones.

Yet, as in any other human endeavour, challenges beget responses. Growing German air power compelled Britain to develop the first integrated air defence system, which saved her from defeat in the Battle of Britain. Germany followed suit when British and US bombings achieved an intolerably destructive level. When British airspace became too lethal for continued operation by the German Luftwaffe, the Germans turned to unmanned systems and developed the V1 'flying bomb' – essentially the first cruise missile – and the V2, the precursor of all subsequent ballistic missiles and space launchers. Both types were equipped with powerful high-explosive warheads and used as terror weapons against British and continental cities, killing thousands. While they failed to change the course of WWII, they were harbingers of the future.

Another harbinger of the future emerged at the same time from the Soviet Union, which due to its difficulties in high-volume production of artillery pieces at the onset of WWII, pioneered the use of self-propelled artillery shells – the first modern artillery rockets – to devastating effect. Thus was born the famous 'katyusha' weapon whose descendants still terrorize population centres from Kabul, Afghanistan to Beer Sheba, Israel.

With WWII over, both the US and the Soviet Union were quick to cash in on captured German technology and expertise, racing each other in fielding ever more capable and longer-range ballistic missiles. From a few hundred kilometres immediately after WWII, ranges grew to more than one thousand kilometres in the early 1950s and reached intercontinental ranges of more than 5,000 kilometres by the end of that decade. The ballistic missiles of the era were too inaccurate at such ranges to have any effect even against population centers unless fitted with nuclear warheads. This was quickly achieved by both superpowers, and by 1962 nuclear ballistic missiles were the epicenter of a war-threatening global crisis when the Soviet Union surreptitiously deployed them in Cuba.

With the ascent of nuclear Intercontinental Ballistic Missiles (ICBM) as the mainstay of strategic deterrence, the question of their survivability against a first strike became crucial. This was solved by various methods: By sheltering them in heavily reinforced silos that could withstand nuclear explosion close by, by deploying them on mobile Transporter Erector Launcher (TEL) vehicles, and by adapting them for underwater launch from ocean-going submarines (In their maritime use, they are denoted as Sea Launched Ballistic Missiles (SLBM)).

The high cost and questionable accuracy of ballistic missiles compelled military designers to seek more accurate as well as cheaper nuclear delivery platforms. The German WWII invention of the cruise missile – a small, fast flying unmanned aircraft was thus revived and modernized.<sup>1</sup> Tiny but highly fuel efficient jet engines provided extended ranges, and an ingenious terrain navigation system (TERCOM) provided accuracy that surpassed manned bombers. The first modern cruise missiles were perfected in the US by the early 1970s and quickly emulated by the Soviet Union. In spite of their relatively slow speed (equivalent to that of passenger aircraft), cruise missiles can penetrate modern air defences by virtue of their small size, unpredictable flight path and nap-of-the-earth low altitude flying. Their load-carrying capability is significantly lower than that of ballistic missiles, but nuclear warheads have by now become small and light enough to be fitted on them.

Nuclear ballistic missiles have been and still are the mainstay of strategic deterrence and as such they are central in public awareness and non-proliferation efforts. Yet ballistic and cruise missiles with non-WMD warheads have been playing a growing role in worldwide confrontations. Used against large cities, non-nuclear ballistic missiles were as lethal in the 1980s as they had been in WWII, killing thousands of Tehrani residents in the Iran–Iraq ‘War of the Cities.’ The incessant march of technology recently produced cheap, widely available yet accurate navigation systems, mainly through satellite systems such as GPS and GLONASS but also by the perfection of miniature, solid state sensors<sup>2</sup>. This closed the accuracy gap between aircraft and missiles: modern ballistic missiles can be made as accurate as manned aircraft and cruise missiles. Consequently, non-nuclear ballistic missiles such as the potent Russian SS26 ‘Iskander’ are starting to complement and may replace classic airpower as part of the general trend of robotizing the contemporary battlefield.

<sup>1</sup> This should not be confused with modern anti-ship missiles which are almost invariably designed as small self-piloted aircraft, and are often called ‘cruise missiles’. Anti-ship missiles are designed to home in on and hit moving ships, and are usually incapable of navigating by terrain features and hitting a pre-selected impact point unless significantly modified. For the purpose of this paper, a ‘cruise missile’ refers to an unmanned self-navigation ground attack aircraft.

<sup>2</sup> Modern handheld smart phones and tablet computers have built-in miniaturized sensors and satellite navigation device like these, albeit with intentionally low accuracy.

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In a parallel chain of events, the simple, unguided ‘katyusha’ of WWII evolved into modern artillery rockets (or in short, ‘rockets’) that combine low cost and high firepower with simplicity of operation and maintenance. As such, it became prevalent worldwide, with most armed forces operating one or another type of this class of weapon. For the same reasons of availability, low cost and simplicity they became the weapons of choice for terrorist organizations and non government militias. Rockets have been steadily growing in range and now have a range of hundreds of kilometres. Since, at such ranges, unguided rockets are extremely inaccurate, military designers have recently combined them with newly available precise, ultramodern navigation and control systems. The result is the ‘guided rocket’ – a relatively cheap but potent guided weapon that can be even more accurate than a true ballistic missile. This is further accelerating the trend towards replacing traditional airpower with tactical strikes.

The growing potency of ground-based air defences has compelled the development of another class of weapon – the Unmanned Air Vehicle (UAV) – mainly to penetrate defended air spaces, initially for reconnaissance and later on for strike missions. While UAVs are essentially remotely piloted or self-piloted multi-mission aircraft, designed to be used over and over again, there is no obstacle (except cost considerations) to equipping them with warheads and sending them on one-way ‘suicide’ missions – as improvised, not entirely cost effective but viable ‘ersatz’ cruise missiles.

Finally, manned combat aircraft can be transformed into unmanned, remotely-piloted UAVs by installing remote controls. Such modified combat aircraft are usually used as targets for target practice by air and ground defences; nevertheless, they can be easily used for ground attack on one-way missions.

Today delivery platforms can be categorized as follows:

- For nuclear delivery: Manned aircraft, ballistic missiles of all ranges and cruise missiles
- For non-nuclear delivery: Manned aircraft, modified combat aircraft, ballistic missiles of short and medium ranges, cruise missiles, UAVs, unguided and guided rockets.

### 3. Delivery platforms in the Middle East

Upon achieving independence or semi-independence after WWI, most Middle Eastern countries established national armies and air forces. By 1948, Egypt’s air force already included a small contingent of improvised bombers that participated in the Israeli–Arab war of that year to some effect. On its side, Israel quickly developed a potent air force that initially included bomber aircraft but that later on grounded them in favour of multi-role combat aircraft. Other countries such as Egypt and Iraq maintained manned bomber fleets which – equipped with Soviet-supplied (TU 16) jet bombers up until the early 2000s –played an insignificant role in the Israeli–Arab wars of 1967 and 1973. Soviet

supersonic TU 22 manned bombers were acquired by Libya and Iraq, playing a small part in Sahara region fighting by the former, and a major role – including devastating raids on Tehran –during the Iran–Iraq war by the latter. No air force in the region today operates manned bombers; instead, multi-role strike fighters are prevalent: Iran and Syria operate the Soviet-era Sukhoi 24 while Israel deploys the F15I systems. Interestingly, there was one recorded case of the fielding of an unmanned version of combat aircraft for attack missions, and that was by Saddam’s Iraq.

Indigenous cruise missiles started to appear in the region only recently. In 2010, Iran unveiled the ‘Karar’ system which is essentially a modified drone (i.e. a small unmanned aircraft used for target practice by ground-based air defence), with an advertised range of 1,000 km. More recently, in September 2012, Iran announced (but did not unveil) a 2,000 km cruise missile called ‘Meshkat,’ most probably based on the Soviet-era air-launched KH55 3500 km cruise missile, examples of which were smuggled by unknown persons (probably acting for Iran) from Ukraine in the 1990s. No combat use of those or any other locally made cruise missiles has been recorded to date. At the same time, non-nuclear cruise missiles were copiously used to devastating effect against military targets by the US in the 1991 Gulf War as well as in the opening phase of the 2003 Iraqi war. While causing some collateral casualties among civilian populations, their inherent accuracy apparently prevented substantial civilian losses.

Israel was the first country to introduce reconnaissance UAVs into the region, using them effectively in the 1982 (First) Lebanon War. As far as is known, its very advanced UAV fleet is not used as ‘ersatz’ one-way cruise missiles. Iran followed suite after the Iran–Iraq War showed the need for this type of system. Today it manufactures and deploys a large variety of indigenously designed UAVs, mostly for reconnaissance but also, according to some reports, for ground attack. Iranian UAVs were supplied to Syria and Hezbollah, the latter making the only recorded use to date of UAVs as one way ‘ersatz’ cruise missiles during the 2006 (Second) Lebanon War.

Ballistic missiles were introduced into the region when Egypt embarked on the development of an indigenous family of short- and medium-range ballistic missiles in the early 1960s. When this effort failed, it purchased Scud-Bs from the Soviet Union and used them (on a very small scale) during the 1973 Israeli–Arab War. Subsequently, all the Soviet clients in the region acquired ballistic missiles, overwhelmingly of the Scud-B type but in one case (Syria) also of the battlefield type (SS 21). Following the defeat of its air force in the 1982 (First) Lebanon War, Syria purchased a large number of Scud-Bs from the Soviet Union and later the longer range versions, Scud-C and Scud-D from North Korea, equipping some of them with chemical warheads. It also built its own self-capability in the design and manufacturing of ballistic missiles and guided rockets. Today it operates at least three types of the former and one type of the latter, with an arsenal estimated at several hundred units.

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According to some reports, Syria transferred some Scud variant ballistic missiles to the Lebanese Hezbollah, and has definitely transferred its own developed 'Tishrin' 300 km guided rocket to that organization.

Iran first acquired ballistic missiles from Libya and Syria during the Iran–Iraq War in the 1980s, subsequently establishing its own design and manufacturing capabilities with North Korean and probably also with (probably unofficial) Russian and Chinese help. Today Iran is the foremost missile country in the Middle East, with its missile force playing the declared role of one of the country's prime strategic strike forces. It is also the second Middle Eastern country – after Israel – to orbit its own satellites by its own developed and manufactured SLVs. It fields at least four types of ballistic missiles (with a fifth one and a suspected sixth one in development) as well as at least two types of guided rockets. Its arsenal of ballistic missiles and guided rockets of all ranges is estimated to number more than 1,000 weapons.

A total of six countries in the Middle East operate ballistic missiles and/or Space Launch Vehicles (two more – Iraq and Libya – were disarmed of their ballistic missiles in differing circumstances). Ballistic missiles have been used on several occasions against civilian populations. The most notorious case was the War of the Cities in 1988 when hundreds of missiles were fired by Iran and Iraq against each other's major cities, causing significant loss of life. No less notorious was the use of ballistic missiles by Saddam Hussein in 1991 against Saudi Arabia and Israel, fortunately causing relatively few casualties. A more obscure case of ballistic missiles in action was in the 1995 Civil War between North and South Yemen, in the course of which both sides fired missiles at each other's major cities, causing dozens of fatalities in the capital city of Sana'a. Another almost forgotten case was the extensive use by Iran of its Scud missiles against Iranian opposition camps in Iraq during the 1990s. The recent Libyan civil war saw the firing of a few Scud-Bs, with no known effect.

Unguided rockets reached the arsenals of most Middle Eastern armies in the course of the 1950s arms races. Their first recorded use as terror weapons was in 1979 when the Palestinian Liberation Organization (PLO) started firing them from Jordanian territory at Israeli population centers. After the PLO moved its centre of operation to Lebanon, it continued and intensified its rocket attacks on Israel's northern cities and villages. After being ousted from Lebanon, the PLO was replaced by Hezbollah who launched its own protracted rocket campaign against Northern Israel, reaching its destructive zenith (to date) in the 2006 (Second) Lebanon War, when 43 Israeli civilians lost their lives during a month-long rocket assault.

Rockets have been and still are extensively used in Middle Eastern conflicts. Iraqi insurgents used rockets against British and US installations, causing collateral losses in civilian populations. Rockets are being used in the Yemen by the Al-Qaeda factions there against government forces and local



populations. By far the most innovative use of rockets was made by Hamas in Gaza, adapting amateur rocket technologies to build their own homemade (but nonetheless deadly) rockets for bombarding villages and towns in southern Israel. This is still going on at the time of writing, albeit sporadically.

#### 4. The Role of Delivery Platforms in Shaping National Security Policies

In the course of the huge military build-ups in the region between the 1950s and the 1980s, almost every player invested heavily in air power as its main strategic arm. This pattern changed to some extent on the establishment of the Islamic Republic in Iran. In contrast to the previous imperial regime, today's Iran regards its missiles – rather than its manned combat aircraft – as its foremost strategic arm. Syria seems to be following suit and has adopted a missile-centric defense policy after the defeat of its air force in the 1980 (First) Lebanon War. Both countries now possess large and growing arsenals of indigenous ballistic missiles and rockets.

All the same, Western-equipped Middle Eastern nations including Saudi Arabia, Egypt, Jordan and Israel continue to regard their manned combat aircraft fleets as their major strategic arms and frequently modernize them at great cost.

Non-governmental armed factions such as Hezbollah, Hamas, Islamic Jihad and other radical organizations rely on rockets as their primary strike forces, since they have no capacity to employ any other delivery platforms except suicide bombers.

While global concern is firmly fixed on nuclear-capable delivery platforms, within the Middle East itself concerns still overwhelmingly revolve around non-nuclear delivery platforms. The losses and damage from non-nuclear missile attacks in the various conflicts surveyed above are still fresh in the minds of constituents and leaders alike. The terror of simple rockets in the south of Israel is threatening to unleash major military operations with their inevitable civilian casualties. Israel's public is highly concerned about non-nuclear missile strikes from Iran and Syria. Any concern about nuclear delivery platforms is still vague and not (yet) a major factor in shaping policy. This divergence between exogenic and endogenic perceptions is a source of not inconsiderable errors by outside analysts.

#### 5. Prospects for Confidence-building Measures

Recommendations for arms controls and confidence-building measures are frequently based on a conscious or unconscious distinction between nuclear and non-nuclear delivery platforms as well as between aircraft and missiles. Consequently, they tend to focus exclusively on one dimension of the

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issue: that of nuclear-capable missiles. As we have seen above, such distinctions hardly apply in the Middle East, where threat perceptions encompass manned and unmanned platforms capable of delivering both non-nuclear and nuclear payloads. Comprehensive approaches that deal with all types of platforms might seem more logical but would actually be less realistic. Since most of the delivery platforms in the region are dual purpose, chances that countries would agree to put any limitation on their utilization are close to nil. And since threat perceptions in the region are mainly about non-nuclear threats, it is hard to see how nuclear-related CBMs could change them.

Perhaps the only fruitful prospects for CBMs would be in the declarative and behavioural areas. It is not merely the existence of the weapons that creates a permanent sense of crisis – this atmosphere is aggravated by the way they are continually brandished in disclosures, demonstrations and widely advertised testing. It may well be that the most useful and at the same time not too unrealistic CBMs could be in the public domain: To curb excessive public glorification of delivery platforms and make them less alarmist and thus less disturbing to constituents and leaders alike.