

# Operation Odyssey Dawn

## - the collapse of Libya's relic air defence system

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Gaddafi's timing in terms of having a civil war in Libya was impeccably bad. Had Odyssey Dawn been initiated in 2 to 3 years time, NATO aircraft would have been seriously challenged, especially by the five-minute 'shoot and scoot' SA-20B batteries with long range jam resistant SAMs.



SA-6 Gainful SAM system.

WHEN public unrest in Libya exploded into civil war Libya was only months away from launching a deep upgrade and rebuild of its relic 1980s Soviet-style air defence system, using the latest Russian technology. When the United Nations declared a no-fly zone and NATO nations and the United States responded in earnest, Libya's extensive Integrated Air Defence System (IADS) collapsed in a matter of mere hours, under a deluge of Tomahawk and Storm Shadow cruise missiles, and JDAM smart bombs.

The public debate surrounding these events, especially in Washington and Europe, has largely been predictable. The Russians have objected loudly over the NATO action, as they have just lost billions of dollars in military hardware sales and tens of billions in long term support business, upgrades and follow-on sales.

In Washington, apologists for Secretary of Defence Robert Gates argued loudly that there is no need for advanced upper tier air power, and that aircraft such as the Joint Strike Fighter and Super Hornet are more than adequate for expeditionary campaigns.

What makes Libya almost unique globally, and the main cause of its susceptibility to advanced weapon systems, is that when Odyssey Dawn was initiated, Libya operated one of the few remaining unadulterated 1980s Soviet air defence systems worldwide.

When combat operations commenced on March 19 the initial attack was the launch of 112 BGM-109 Tomahawk cruise missiles from US Navy ships and the Royal Navy submarine HMS Triumph, targeting Libya's fixed SA-2 Guideline, SA-3 Goa and SA-5 Gammon SAM sites, and supporting acquisition radars and command posts. An undisclosed number of Storm Shadow cruise missiles were also launched by Royal Air Force Tornado GR.4 aircraft of 9 SQN at Marham, supported by Tristar tankers. US DoD media briefings indicated that all radar emissions from Libya ceased at that time. Following bomb damage assessments, an additional 12 cruise missiles were launched against remaining IADS targets.

Libya's most active fighter base, Ghardabiya AB near Surt, was attacked on March 20 by three B-2A Spirit bombers operating with tanker support from Whitman AFB in Missouri. Jamming support was provided by US Navy EA-18G Growlers. Concrete piercing GBU-31/BLU-116/B 2,000 lb JDAMs were delivered against the Hardened Aircraft Shelters destroying these and aircraft in situ.

At this point Libya's IADS was declared inoperative, and NATO aircraft swung to interdiction operations against Gaddafi's loyalist forces, with most attacks against armour, logistics, and naval vessels.

While touted as a great victory the fact remains that the complete obsolescence and poor state of repair in Libya's IADS rendered Libya incapable of producing any useful combat effect. Libya's IADS was demonstrably the least challenging IADS that Western air power has confronted since the defeat of Saddam IADS in 1991. The notion that other IADS will be as ineffective as Libya's is not supportable by the evidence. Libya was an anomaly and should not be treated as the norm in assessing the combat effectiveness of current Western systems.

Odyssey Dawn was quickly followed by a burst of public relations exultation. The achievements of the EA-18G Growler have been lauded in its first operational deployment. The defence industry funded Lexington Institute went as far as to state "the F-35 would be perfect for conducting operations against Libyan targets". The reality that the Libyan IADS was an unchallenging poorly serviced 25 - 30 year old relic lacking any of the modern technologies now being globally exported from Russia and China was conveniently ignored.

Any reasonable mix of advanced Russian or Chinese weapons such as the Su-35S Flanker, T-50 PAK-FA, S-400 / SA-21, S-300PMU2 Favorit / SA-20B Gargoyle, HQ-9/FD/FT-2000, 96K6 Pantsir S1 / SA-22 and 9K335 Tor M2E / SA-15D would present insurmountable challenges for both the F/A-18E/F/G family of aircraft and the F-35, as these threat systems were explicitly designed to fight the much more capable F-22A Raptor.

Odyssey Dawn was therefore an anomaly, most unlikely to be repeated in the future, which begs the fundamental question why Western air forces should be investing any scarce funds into aircraft only designed to defeat such obsolete threats, rather than the much more capable threats now being deployed.

Gaddafi's timing in terms of having a civil war in Libya was impeccably bad. Had Odyssey Dawn been initiated in 2 to 3 years time, NATO aircraft would have been seriously challenged, especially by the five-minute 'shoot and scoot' SA-20B batteries with long range jam resistant SAMs.

Twelve months ago the Russian Vedomosti journal reported an intended US\$2 billion sale to Libya of a squadron of advanced Su-35S Flanker E+ fighters, a squadron of MiG-29SMT Fulcrums, four Su-30MK2 Flanker G fighters, two batteries of the potent S-300PMU2 Favorit / SA-20B Gargoyle SAM system, and batteries of the Buk M1E / SA-17 Grizzly medium range battlefield SAM system and Tor M2E / SA-15D Gauntlet Counter-PGM SAM system. At the time the United Nations arms embargo was initiated in late February 2011 the purchase was yet to be finalised.

The intent to procure the even higher mobility SA-15D on wheeled MZKT-69222 chassis indicates that the Russian sales pitch focused on protection for the SA-20B batteries by the deployment of escorting SA-15D Gauntlet Counter-PGM SAM systems. The SA-15D would be employed to engage and destroy any anti-radiation missiles or smart bombs targeting the SA-20B battery. The high mobility of the SA-20B/SA-15D package would preclude targeting by cruise missiles.

NATO forces confronted by the planned future Libyan IADS package would have to then rely wholly on the deployment of US Air Force F-22A Raptors from US bases, likely the 1st FW from Langley AFB, or the 49th FW from Holloman AFB, with the F-22As used to attack key targets and hunt the mobile SAM batteries.

## COMPARING LIBYA'S IADS

The best starting point in sizing up Libya's IADS capability is to explore other IADS with similar origins, operated by other former Soviet clients.

Within the region, Iran's IADS is a patchwork of re-engineered Shah-era United States equipment, hybridised with Chinese and Russian equipment of multiple generations, including advanced hardware such as NNIIRT 1L119 Nebo SVU counter-stealth radars. The partly-paid-for delivery of S-300PMU1 / SA-20A Gargoyle was blocked by a United Nations resolution. The same edict would prohibit China from exporting the FD-2000 export variant of the HQ-9 SAM, similar to the S-300PMU1. Claims have also emerged that Iran is sourcing the 96K6 Pantsir S1E / SA-22 Counter-PGM SAM system via Syria. Iran is a major operator of the potent Soviet era S-200VE Vega / SA-5B Gammon long range SAM. Syria started out with a 1980s Soviet IADS comprising a different mix of the very same systems Libya operated, but since then has progressively added much more advanced hardware such as the MiG-31BM Foxhound interceptor ordered three years ago and yet to be fully validated claims of up to fifty 96K6 Pantsir S1E / SA-22 Counter-PGM SAM systems ordered. Claims have also circulated for many years that Syria procured the S-300PMU / SA-10B Grumble SAM, and there are numerous reports of Syria negotiating for the more lethal Patriot-like S-300PMU2 Favorit / SA-20B Gargoyle. To date no hard evidence of deliveries has emerged. Other claimed improvements to Syria's IADS include upgrades to the S-200VE Vega / SA-5B Gammon long range SAMs, and the S-125 Neva / SA-3 Goa point defence SAMs.

The DPRK (North Korea) also entered the post Cold War period equipped with a 1980s Soviet

IADS, and also enhanced it with various items of post Cold War Russian hardware. Key items of 1980s hardware include 45 MiG-23MF Floggers, 15 MiG-29 Fulcrums, and claimed but never confirmed multiple batteries of the S-300PMU / SA-10B Grumble SAM. Like Syria, Libya and Iran, the DPRK operates the S-200VE Vega / SA-5B Gammon long range SAM. Unlike Syria, Libya and Iran – who largely deploy their SAMs from unhardened and often rudimentary open fixed SAM sites – the DPRK's sites are amongst the best hardened globally, with reports of engagement radars mounted on elevating platforms, to permit the radars to be hidden in underground shafts to defeat air attacks.

Other operators of 1980s Soviet IADS technology have also performed various upgrades, including Vietnam and Kazakhstan who acquired advanced Flankers to replace older MiG fighters such as the Fishbed, while both have procured the advanced S-300PMU2 Favorit / SA-20B Gargoyle. Until the 1990s China operated a massive inventory of reverse engineered early Soviet equipment, but has since then deployed the largest inventory of new Flanker fighters globally, as well as the largest inventory of late S-300PMU series SAM batteries, supplemented by domestically built HQ-9 SAMs. Libya was therefore in many respects the 'odd man out' in the many former Soviet client nations operating original Soviet 1980s IADS.

## LIBYA'S RELIC 1980s IADS

The Libyan IADS was commissioned during in the 1980s when the Gaddafi regime was actively sponsoring terrorism across the Middle East and Europe, and involved in repeated aerial and maritime confrontations with US Navy task forces operating in the Mediterranean. The Libyans suffered repeated losses in these engagements, and Russian publications from that period repeatedly point out the sheer incompetence of the Libyans, who more than often launched SAMs well outside of their engagement envelopes, and in violation of the very disciplined operational procedures the Russians developed for these complex high performance weapons.

The Libyan IADS comprised a mix of interceptor aircraft units and fixed strategic SAM batteries, both supported by a robust network of Soviet supplied long range search radars, more recently supplemented by some Italian supplied radars.

Soviet supplied radars included the P-12/P-18 Spoon Rest VHF band radar used to support S-75 / SA-2 Guideline and S-125 / SA-3 Goa SAM batteries, and the 5N84 / P-14 Tall King long



SA-2 Guideline SAM, Fan Song and Spoon rest radars.



SA-5 Gammon Square Pair.



SA-3 Goa Low Blow.



*The SA-5 Gammon has a range of 130 to 160 nautical miles, and was built to destroy EW and ISR platforms.*

range VHF band radar used to support S-200VE Vega / SA-5B Gammon long range SAM batteries and interceptors. These acquisition radars were supplemented by Ground Control Intercept (GCI) radars, including the very common S-band Soviet LEMZ P-35 and P-37 Bar Lock radars, and the L-band 5N87 / 64Zh6 / P-80 Back Net radar. There are also reports that three not so common L-band Soviet 5N69 Big Back radars were procured, possibly to support the SA-5 Gammon batteries. During the early 1980s five X-band Contraves-Italiana LPD-20 AAA acquisition radars were also procured. Other than the latter two types, all others have been identified from satellite imagery (O'Connor @ <http://geimint.blogspot.com/2010/05/libyan-sam-network.html>).

Most of these radars were sited in clusters surrounding Tripoli and Benghazi, with two gapfillers in the Gulf of Sidra, and four sites in central Libya.

By far the most capable SAM system deployed by Libya was the S-200VE Vega / SA-5B Gammon, developed to destroy E-3 AWACS, tankers, strategic bombers and SR-71 reconnaissance aircraft at ranges of up to 140 – 160 nautical miles. The massive 7 metric tonne 5V21 or 5V21 SAMs employ a variable thrust liquid rocket engine using a hypergolic AK-20/27 and TG-02 propellant mix. The missile is equipped with a jam resistant dual plane monopulse continuous-wave semi-active radar homing seeker, and a large high explosive warhead jacketed with ball bearings. Modes

include conventional “Lock On Before Launch” and a less conventional “Lock On After Launch” mode against distant or low flying targets, where the missile is launched blind and it automatically acquires the target during the flyout. Home-On Jam (HOJ) modes are built into the seeker – one of the designers’ intentions was to kill the EA-6B Prowler and EF-111A Raven.

The heart of the SA-5 Gammon system is the large 5N62 Square Pair engagement radar, operating in the C-band (low X-band). It is also highly jam resistant, using a high powered dual plane monopulse continuous-wave design. Declassified technical manuals the author has been translating indicate the use of pseudo-pulse Doppler techniques of a kind not patented in the US until a decade after the Soviets deployed this system. While the system was trialled as an Anti Ballistic Missile (ABM) system, the absence of a suitable acquisition radar meant it was never used as such. A typical SA-5 battery has six relocatable rail launchers, each with a pair a ready reload rounds on rail or semi-trailer transloaders, all in revetments. One and often two Square Pair radars support the site, with paired radars used to permit two concurrent engagements.

Western analysts often dismiss the SA-5 due to its poor showing during the 1986 skirmishes with Libya. The SA-5 is technically complex and unusually demanding in operator training, technical skills, and teamwork, and must be competently operated to produce effect. The Libyan crews in 1986 clearly were not, repeating a pattern observed across the Middle East since 1985.

The SA-5 had the potential to do some genuine damage to NATO forces, as it had the performance and reach to kill E-2 Hawkeyes, E-3 AWACS, EA-18G Growlers and NATO tankers orbiting of the Libyan coast.

One SA-5 site was located near Tripoli, one near Misratah, one near Surt in the Gulf of Sidra, and one near Benghazi, to support eleven procured batteries. While the most likely variant was the standard export S-200VE Vega / SA-5B, there have been reports that the later S-200D Angara / SA-5C was also supplied.

The second tier in the Libyan system was the widely used late production S-75M Volkhov / SA-2D/E Guideline of Vietnam era fame, with eleven batteries deployed. Four batteries were sited around Tripoli, one at Misratah, two at Benghazi, and three near Tobruk, with a final site at Sabha in central Libya.

A third tier in the Libyan system was the late model S-125M Neva M / SA-3B Goa point defence

SAM system, with sixteen active batteries, mostly co-sited with SA-2 Guideline batteries to protect the latter.

The three fixed SAM system types were supplemented by mobile Army batteries of the 2K12 Kvadrat / SA-6 Gainful area defence SAMs, 9K33 Romb / SA-8 Gecko and 9K35 / SA-13 Gopher point defence SAMs. The capable French Crotale point defence SAM has also been reported. While the SAM systems provided fixed and mobile defences for surface assets, long range air defence was provided by a robust force of interceptors, mostly of Soviet origin, based across a network of 13 airbases.

The best known of Libya’s airbases is Umm Aitiqah / Mitiga / Okba Ben Nafi AB, formerly Wheelus AFB, near Tripoli. Other major bases include Misrata AB, Benina AB near Benghazi, Ghardabiya AB near Surt, and Sabha AB in central Libya. These are supplemented by several forward operating bases, often dual use.

The best of Libya’s combat aircraft were a large batch of up to 60 MiG-25 Foxbat variants, claimed to include the MiG-25PD Foxbat E interceptor, MiG-25RBK Foxbat D recce subtype, and MiG-25PU/RU trainers. Up to three squadrons were claimed to be operational, including 1025 and 1055. Remaining aircraft have been photographed as recently as 2009 at Okba Ben Nafi AB, mostly appeared unserviceable.

The next most useful type was a fleet of more than 100 MiG-23 Floggers, claimed to include the MiG-23ML Flogger G and MiG-23MS Flogger E interceptor, MiG-23B/BN Flogger F/H interdictor, and MiG-23UB Flogger B trainer. The Floggers were widely deployed across Libyan airbases when the civil war broke out.

Other remaining interceptors were two dozen residual MiG-21 bis Fishbeds and MiG-21U Mongols, and a small number of recently overhauled Mirage F.1s, remaining from a delivery of 32 F.1AD/ED/BD/DD delivered during the 1970s.

The Gaddafi regime also procured a large number of strike aircraft, the best known of these being the large supersonic Tupolev Tu-22 Blinders, used during the 1980s war against Chad. The surviving but unserviceable Blinders were claimed destroyed by French aircraft on the 24th March, 2011, thus denying many museums rare exhibits.

The most numerous strike fighter in Libyan service were single and dual seat variants of the Su-22M3 Fitter, a swing wing derivative of the Su-7BM Fitter series, of which around 40 were claimed remaining in service. While there is no direct Western analogue to the Fitter, it is a supersonic



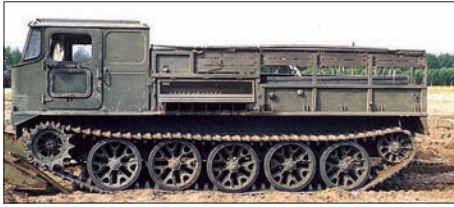
*76N6E Clam Shell acquisition radar.*



*92N2 Grave Stone radar.*



*5P85TE2 common TEL used with the SA-20B and SA-21 SAMs.*



Tracked vehicles were often used as substitutes for Russian wheeled tractors when deploying SAMs in the Middle East.



5P85TE TEL used with SA-20A and some SA-20B systems.



A Middle Eastern SA-3 Goa SAM site with quad missile launchers.

equivalent in role to the LTV A-7D Corsair II and larger F-105D Thunderchief. The Libyan fighters were best known for the pair shot down by US Navy F-14A Tomcats in 1981.

The most potent strike fighter in Libyan service were a small number (5 claimed) of Su-24MK Fencer D aircraft, the Fencer being a smaller Soviet analogue to the F-111. Open sources claim a squadron of 8 were procured before the end of the Cold War as replacements for Blinders lost in Chad. Libya's combat aircraft were supplemented by a mix of trainers, some of which had weapons capabilities. These included the Czech L.39 Albatros, the Yugoslav Soko G-2 Galeb and single seat J-21 Jastreb, and Italian supplied SIAI Marchetti SF.260W Warrior armed piston trainers. The serviceability status of Libya's IADS prior to the start of hostilities is not well documented, and may never be known now, given the damage to the Libyan military infrastructure. A large fraction of Libya's military aircraft were unserviceable or being overhauled by foreign contractors.

There are public claims that a good proportion of Libya's aircrew and ground support personnel were

foreign contractors, many from former Warsaw Pact nations. The same may also have been true of Libya's SAM and IADS systems. Whereas the serviceability of aircraft can be readily assessed by observation of condition and flight activity, SAM system conditions can only be assessed by observing missile battery firings, and radar system activity, typically during live fire exercises, none of which have been reported in recent months.

Another factor is that given the state of civil war in Libya it is entirely conceivable that many Libyan missileers deserted their posts once it became clear that Libya would come under NATO/UN attack. Even limited personnel losses would severely impair the operation of SAM systems like the SA-2 Guideline and SA-5 Gammon, which require large engineering crews for missile servicing, missile assembly and checkout, missile liquid fuelling and loading. The crew involved in operating the weapon system is typically much smaller than the support personnel required to prepare the missiles and maintain the equipment. Solid fuelled weapons such as the SA-3 Goa, SA-6 Gainful and SA-8 Gecko are still maintenance intensive due to sheer

complexity, and the challenging environmental conditions, with high ambient temperatures during the day, larger thermal cycles through 24 hours, and the ever present dust which can cause all manner of difficulties once inside the electronics.

All of these Soviet era weapons demand without compromise extremely well trained and educated crews. Indeed, in the Warsaw Pact system crews were typically conscripted university students, usually picked from engineering and science schools. During the Cold War, Libya was the recipient of generous Soviet aid and an abundance of experienced Soviet and other Warsaw Pact 'advisors' often substituting for Libyan personnel. The aid dissipated as the Soviet Union collapsed. If the poor state of Libya's air force at the onset of combat was any indicator, then it is likely that most of Libya's SAM systems were in a similar state of disrepair and thus not available for combat operations.

The observed results of the Odyssey Dawn effort inevitably reflected these realities.

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