

Required Sorties and Weapons to Degrade Syrian Air Force Excluding Integrated Air Defense System (IADS)

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Executive Summary: Weapons and Sorties Required to Degrade Syrian Air Force

The Syrian Air Force (SAF) currently conducts three missions on an ongoing basis that result in regime forces having a significant strategic advantage over rebel forces. Those missions are:

- Receiving aerial resupply of weapons, ammunition, and other supplies from Iran and Russia
- Conducting aerial resupply of Syrian Arab Army (SAA) units deployed against rebel forces
- Conducting area bombing of rebel held territory

Although destroying the SAF and its Integrated Air Defense System (IADS) in its entirety would require a major military operation, a series of relatively small strikes, using Precision Guided Munitions (PGMs) launched from outside the Weapon Engagement Zone (WEZ) of the Syrian IADS, would also significantly degrade the SAF and its infrastructure.

Because U.S. PGMs have a greater range than the Syrian IADS, it is not necessary to attack the IADS in order to degrade SAF ability to operate. A limited strike with the intent of degrading the SAF ability to conduct its three primary missions can bypass the Syrian IADS and focus directly on SAF infrastructure and aircraft. Small follow on strikes would ensure that the SAF did not “regenerate” degraded capability.

The following analysis shows that an initial strike would require just three US Navy surface combatant vessels, and 24 total US Navy and US Air Force aircraft. These ships and aircraft can launch the following PGM:

- Tomahawk Land Attack Missile (TLAM)
- Joint Air to Surface Standoff Missile (JASSM)
- Joint Stand Off Weapon (JSOW)

A limited strike resulting in the degradation of SAF infrastructure could be accomplished with no US military personnel entering Syrian airspace or territory, at relatively small cost.

This brief identifies:

- **Primary airfields supporting SAF operations**
- **Secondary airfields capable of but not currently supporting SAF operations**
- **Contested airfields not currently supporting SAF operations**
- **Rebel held airfields**

- **Primary strike requirements to degrade SAF infrastructure at primary airbases**
- **Secondary strike requirements to degrade SAF aircraft at primary airbases**
- **“Maintenance” strike requirements to keep SAF from “regenerating” infrastructure capability at either primary or secondary airbases**

This brief does not identify:

- **Strike requirements to destroy permanently all SAF infrastructure and aircraft**
- **Strike requirements to degrade or destroy Syrian rotary wing (helicopter) inventory**
- **Strike requirements to degrade or destroy Syrian Integrated Air Defense System (IADS)**
- **Patrol requirements to establish a No Fly Zone (NFZ)**
- **Patrol requirements to establish and maintain a humanitarian safe corridor**

This product is a technical study of the requirements to conduct a limited strike. It is not a recommendation for or against such a strike, nor does it evaluate the possible effects of such a strike on the regime, the rebels, or the various states and non-state actors supporting both sides.

Purpose: Identify US weapon types and sortie counts required substantially to degrade the ability of the Syrian Air Force (SAF) to conduct three primary missions:

- **Receive aerial resupply from Iran and Russia**
- **Conduct Intratheater aerial resupply of Syrian Arab Army (SAA)**
- **Conduct area bombing of rebel controlled territory**

Assumptions:

- **Complete destruction of SAF or supporting infrastructure (runways, control towers, fuel depots) is not required as long as SAF ability to conduct its missions is degraded**
- **No intent to establish a full No Fly Zone (NFZ)**
- **No requirement to completely eliminate the Syrian Integrated Air Defense System (IADS)**
- **No requirement to degrade Syrian rotary wing (helicopter) forces**
- **SAF is not capable of conducting Defensive Counter Air (DCA) against US aircraft**
- **Permissive airspace available: Turkey, Jordan, Kuwait, Saudi Arabia, Bahrain, UAE**
- **Permissive hosting available for US aircraft in same countries**

Total airfields in Syria: There are approximately 27 airbases in Syria that are potentially capable of supporting at least one of the SAF's primary missions.

Current status: The 27 airbases are identified by the following categories:

- **Primary airbases under regime control, currently supporting SAF operations (6)**
- **Secondary airbases under regime control not currently supporting operations (12)***
- **Airbases in contested territory / under siege, not available to the regime for operations (5)**
- **Airbases in rebel controlled territory (4)**
- *** Secondary airbases are in good enough materiel condition to support SAF operations, but are not currently in extensive use. This is primarily a result of low SAF aircraft inventory and manpower. We assess that SAF has at most 100 mission capable fixed wing aircraft. With such a small inventory, SAF does not have enough aircraft to require use of all its airbases. Additionally, SAF is suffering from defections and deterioration of its manpower, and probably does not have adequate support personnel (radar operators, tower / air traffic control, maintenance personnel, fuelers, etc.) to man the secondary airbases.**

Primary airbases currently being used by the SAF to conduct operations include:

- Dumayr
- Mezzeh
- Al-Qusayr/Al-Daba
- Bassel al-Assad Int'l
- Damascus Int'l
- Tiyas/Tayfoor

Secondary airbases available to the Syrian regime but not currently in high use include:

- Shayrat
- Hama
- Khalkhalah
- Marj Ruhayyil
- al-Nasiriyah
- Sayqal
- Tha'lah (Suwayda)
- Qamishli
- Palmyra
- Al-Seen
- Aqraba
- Bali

Airbases located in contested territory or under siege and not available for SAF operations include:

- Kowaires/Rasin el-Aboud
- Mennakh
- al-Nayrab
- Aleppo Int'l
- Deir ez-Zor

List of airbases currently under rebel control and not available for SAF operations include:

- Abu al-Duhur
- Jirah
- Tabqa
- Taftanaz

Degradation and destruction of runways and support structures are fundamentally different:

Destruction requirements:

- Requires heavy “gravity” bombs (2000 lb and 5000 lb) that penetrate and crater runways at a deep subsurface level
- Requires direct overflight of target airbase with manned bombers or strike fighters
- Once heavy bombs crater a runway, rebuilding is a lengthy process that requires specialized equipment, materials, engineering support, and significant manpower

Degradation requirements are significantly easier to achieve:

- Degradation is achieved by damaging the runway enough to preclude flight operations, or by damaging support structures such as:
 - Fuel storage or delivery systems
 - Spare part storage
 - Aircraft maintenance facilities
 - Ground support equipment
 - Control tower and radars
- US long range PGM were not designed to completely destroy runways, but will cause some cratering of runways, enough to preclude flight operations
- US long range PGM will destroy support structures enough to preclude flight operations
- Once PGM crater a runway, repairing is a lengthy process that requires specialized equipment, materials, engineering support, and significant manpower

Analysis: Initial Strike, Primary ABs, Degrade Infrastructure and Support Functions

Target requirement: We assess that 6 primary SAF airbases (AB) are in current operational use, and that a total of 12 PGM targeted at each AB will significantly degrade the ability of SAF to operate from those Abs.

- **Initial strike requirements per SAF AB to degrade the physical infrastructure:**
 - 4 Tomahawk Land Attack Missiles (TLAM)
 - 4 Joint Air to Surface Standoff Missile (JASSM)
 - 4 Joint Stand Off Weapons (JSOW)
- **Initial strike total weapons requirements**
 - 4 TLAM X 6 SAF AB = 24 TLAM
 - 4 JASSM X 6 SAF AB = 24 JASSM
 - 4 JSOW X 6 SAF AB = 24 JSOW
- **Targeting runways: Desired Mean Point of Impact (DMPI)**
 - 8 DMPI per SAF AB runway at roughly 1,000 foot intervals
 - 4 X JSOW and 4 X JASSM targeted on each runway for cratering effect
- **Targeting support functions: Desired Mean Point of Impact (DMPI)**
 - 4 DMPI per SAF AB to degrade support functions: radar, control tower, fuel farm
 - 4 X TLAM targeted on support functions with “bomblet” dispersal
 - Bomblet dispersal results in moderate but widespread / dispersed damage

Sortie requirement: An initial strike against SAF AB runways requires 24 TLAM, 24 JASSM, and 24 JSOW.

- **Sortie requirements**
 - **3 X Navy Surface Combatants to launch TLAM at 8 x per vessel**
 - **12 X F-15E to launch JASSM at 2 X per aircraft**
 - **12 X F-18E to launch JSOW at 2 X per aircraft**
 - **Total requirements for initial strike: Three surface combatants, 24 strike fighters**

Target requirement: We assess that a maximum of 100 SAF fixed wing aircraft are operable. We have identified a total of 109 aircraft bunkers or pads at the six primary SAF ABs.

- **Initial strike will render primary airbases unusable. As a result:**
 - **Operable SAF aircraft will be unable to reposition to secondary airbases**
 - **Reconnaissance assets can easily identify exact locations of operable aircraft**
- **Secondary strike requirements**
 - **109 TLAM, 1 X per operable aircraft or aircraft bunker or pad**
 - **SAF aircraft in the open can be targeted with TLAM bomblet**
 - **SAF aircraft in bunkers can be targeted with TLAM unitary warheads**
- **Secondary strike total weapons requirements**
 - **109 TLAM, 1 X per aircraft, bunker, or pad**
- **Targeting aircraft, bunkers, or pads: Desired Mean Point of Impact (DMPI)**
 - **109 total DMPI, 1 X TLAM per DMPI**
- **Sortie requirements**
 - **3 X Navy Surface Combatants to launch 109 total TLAM**

The mission of “degrading” primary SAF airbases and operable aircraft can be accomplished through primary and secondary strikes. It is highly unlikely that SAF would be able to reposition aircraft from primary airbases to secondary airbases for the following reasons:

- The physical infrastructure of primary airbases (runways) will be degraded in initial strike.
- SAF aircraft in a flyable status cannot reposition from primary ABs until runways are repaired.
- SAF aircraft in a flyable status will be targeted in the secondary strike.
- The majority of flyable SAF aircraft will be damaged in the secondary strike.
- SAF has limited ability to repair infrastructure and aircraft.
 - Repairs to infrastructure are labor intensive and require materiel and equipment
 - Repairs to aircraft require skilled labor and spare parts
 - SAF is suffering from limited manpower due to attrition and defections
- If SAF is able to reposition aircraft to secondary airfields and start operations from secondary airfields, the secondary airfields can be targeted as required.

Analysis: “Maintenance” Strikes Against 6 Primary ABs

Target requirement: If the SAF is able to conduct repair work on damaged SAF ABs, that work will be visible to reconnaissance assets. “Maintenance” strikes may be required to degrade repair work.

- **Planning assumption:** maintenance strikes only require half the sorties that the original strike required
- **“Maintenance” strike total weapons requirements**
 - **2 TLAM X 6 SAF AB = 12 TLAM**
 - **2 JASSM X 6 SAF AB = 12 JASSM**
 - **2 JSOW X 6 SAF AB = 12 JSOW**
- **Periodicity:** The SAF is suffering from significant manpower shortages. Heavy repair work on infrastructure – runways, control towers, radars, fuel depots – is manpower intensive. Repair work on damaged aircraft requires high technical proficiency. Best case scenario, the SAF will be able to start bringing some of its infrastructure and aircraft back on line in one week.
- **Sortie count:** 1 Navy ship can provide the TLAM strike, total of 6 X F-15 E to provide JASSM and 6 X F-18E to provide JSOW.
- **Conclusion:** A maintenance strike conducted every 7 – 10 days will keep the SAF AB infrastructure degraded and the SAF fixed wing capability virtually nonexistent

Initial strike results: The initial strike targeting SAF AB infrastructure will render SAF incapable of conducting its three primary missions for at least a week while repairs are conducted to runways, radars, control towers, and fuel storage. During this time, reconnaissance assets will be able to identify exact locations on SAF fixed wing aircraft, which will not be able to relocate to other airbases due to infrastructure damage.

Secondary strike results: The follow on strike will target SAF fixed wing aircraft located in aircraft bunkers or on pads at the six primary ABs. With 1 TLAM targeted against each functional SAF fixed wing aircraft, and each TLAM containing over 150 bomblets or a 1000 lb unitary warhead, it is highly likely this strike will degrade the majority of the operable aircraft in SAF inventory.

Secondary airbase strike: Given the limited ability of SAF to reposition aircraft or support operations at secondary airbases, no strikes are planned at secondary airbases. If SAF demonstrates the ability to reposition aircraft or conduct operations, strikes can be conducted against secondary SAF airbases.

Maintenance Strikes: If the SAF has adequate manpower and supplies to repair infrastructure and aircraft at primary ABs, smaller “maintenance” strikes can be conducted as required.

Expected losses: The entire strike scenario can be conducted without any US aircraft entering Syrian air space. All weapons launches can take place from international airspace over the Mediterranean, or over Turkish, Israeli, Jordanian, or Saudi airspace.

Tomahawk Land Attack Missile (TLAM)

- Highly reliable, accurate, effective
- Circular Error Probable (CEP) less than 5 meters
- 1,000 nautical mile range
- 1,000 lb. warhead
- Reprogrammable in flight
- Option of unitary warhead or “bomblet” warhead
- Current inventory 3,700 (est.)
- Cost per missile \$650,000
- Capable of varying speed in flight to enable Multiple Round Simultaneous Impact (MRSI) strike
- Does not require foreign basing rights / overflight
- Can be used immediately – no repositioning required

TLAM can be fired from several hundred miles off Syrian coastline. It can be used without any requirement to obtain foreign basing or overflight permissions. TLAM is in place now on US Navy surface combatant vessels in the Mediterranean. If required, it can be launched from Persian Gulf. It is highly reliable, highly accurate, and inventory is big enough to support a significant expenditure.



Weaponearing Review: Joint Air to Surface Standoff Missile (JASSM)

Joint Air to Surface Standoff Missile (JASSM)

- Circular Error Probable (CEP) less than 5 meters
- 200 nautical mile range
- 1,000 lb. warhead
- Option of single warhead or multiple “bomblets”
- Current inventory: 1,000 + (est.)
- Cost per JASSM: \$700,000

JASSM is less capable than TLAM – it is shorter range, and requires a manned aircraft to launch it. JASSM has adequate range to be launched from outside of Syrian air space and IADS.



Joint Stand Off Weapon (JSOW)

- Highly reliable, accurate, effective
- Circular Error Probable (CEP) less than 5 meters
- 70 nautical mile range
- 500 lb. warhead
- Option of single warhead or multiple “bomblets”
- Current inventory: 2000 (est.)
- Cost per JSOW \$500,000

JSOW is less capable than JASSM – it is shorter range and has a smaller warhead. JSOW has adequate range to be launched from outside Syrian air space against nearly half of the SAF ABs.



US Navy Surface Combatants

- Ticonderoga Class Cruisers have 122 Vertical Launch System (VLS) cells to carry TLAM and defensive missiles.
- Arleigh Burke Class Destroyers have 90 VLS cells to carry TLAM and defensive missiles.
- Assume a 50% offensive / defensive mix of missiles.
- Cruisers = 60 TLAM
- Destroyers = 45 TLAM

One cruiser and two destroyers can deliver a total of 150 TLAM in initial, follow on, and maintenance strikes. These can be replenished in theatre. No “surge” of Navy ships required to service this tasking.



US Navy Carrier / Super Hornet

- **USS Nimitz is in North Arabian Sea now**
- **Can transit to Mediterranean in less than a week**
- **Nimitz has 48 F-18's onboard**
- **All maintenance / logistics self contained on ship**
- **Direct access to Syria from the Mediterranean**
- **No overflight / host nation requirements**

USS Nimitz and embarked Carrier Air Wing does not require any external support – short range flight from Eastern Mediterranean to launch point for JSOW.



USAF F-15E Strike Eagle

- F-15E's can easily base out of numerous bases in the Mideast / Mediterranean
- Turkey, Kuwait, Saudi Arabia, Bahrain, Qatar, Greece, Italy are all candidates
- For this strike, assume 2 X JASSM per F-15E
- Prepositioned maintenance / logistics packages in several locations
- Overflight / host nation requirements have been exercised before

Incirlik AB, Turkey can host F-15E.

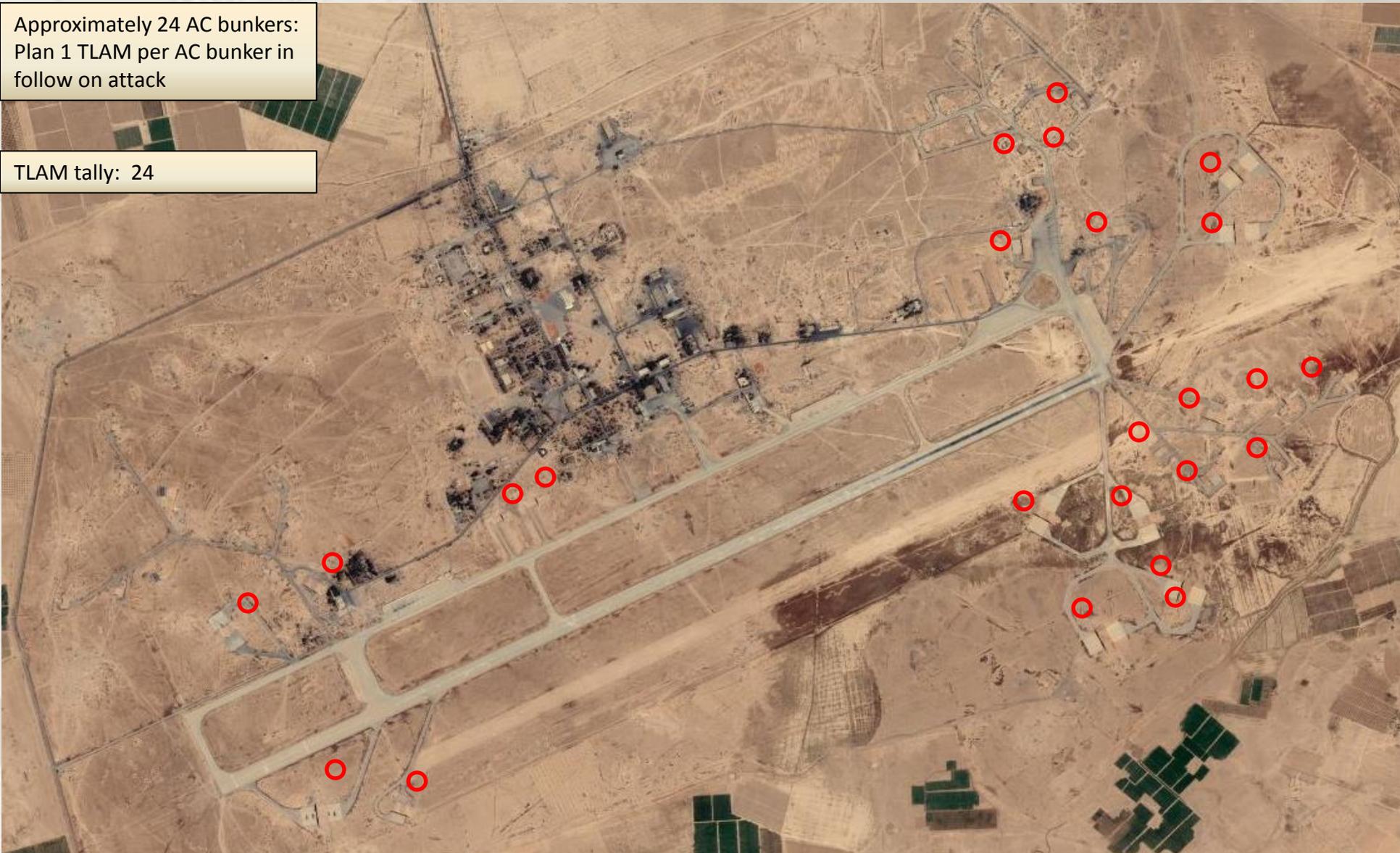


Map of 6 Primary Airbases



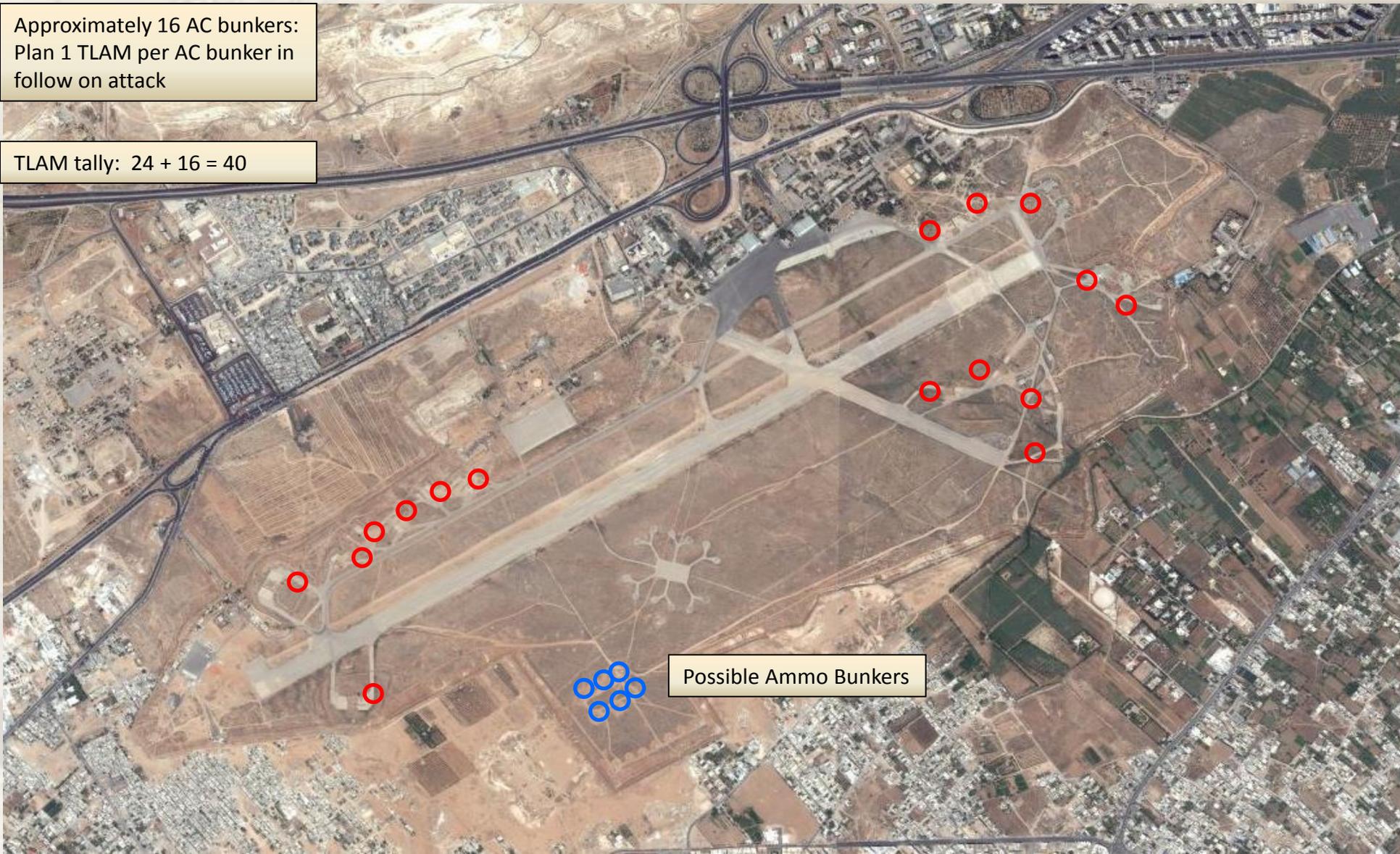
Approximately 24 AC bunkers:
Plan 1 TLAM per AC bunker in
follow on attack

TLAM tally: 24

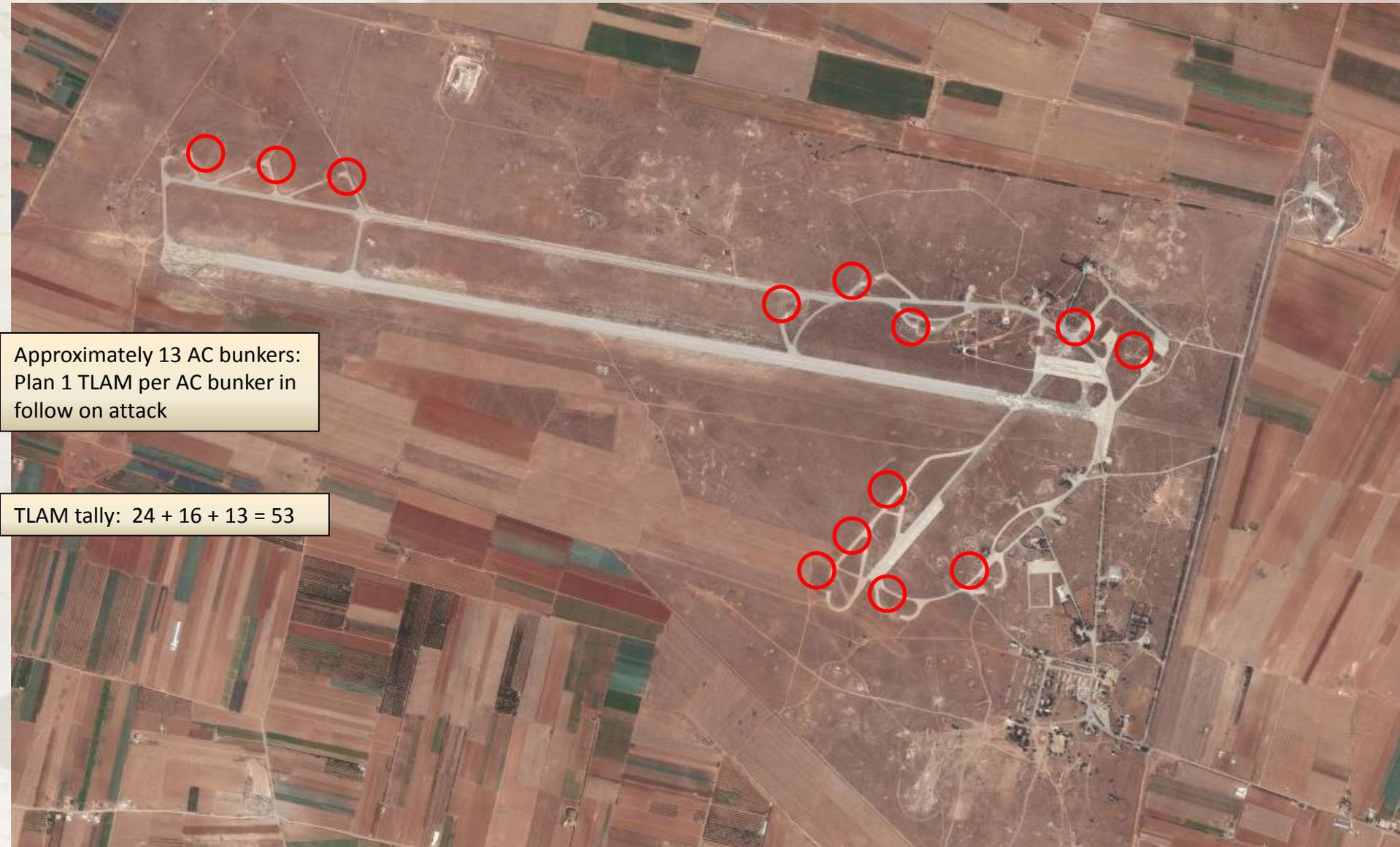


Approximately 16 AC bunkers:
Plan 1 TLAM per AC bunker in
follow on attack

TLAM tally: $24 + 16 = 40$



Possible Ammo Bunkers



Approximately 13 AC bunkers:
Plan 1 TLAM per AC bunker in
follow on attack

TLAM tally: $24 + 16 + 13 = 53$



6 X AC pads, no bunkers

7 X AC pads, no bunkers

Approximately 13 AC pads:
Plan 1 TLAM per AC pad
in follow on attack

TLAM tally: 24 + 16 + 13 + 13 = 66

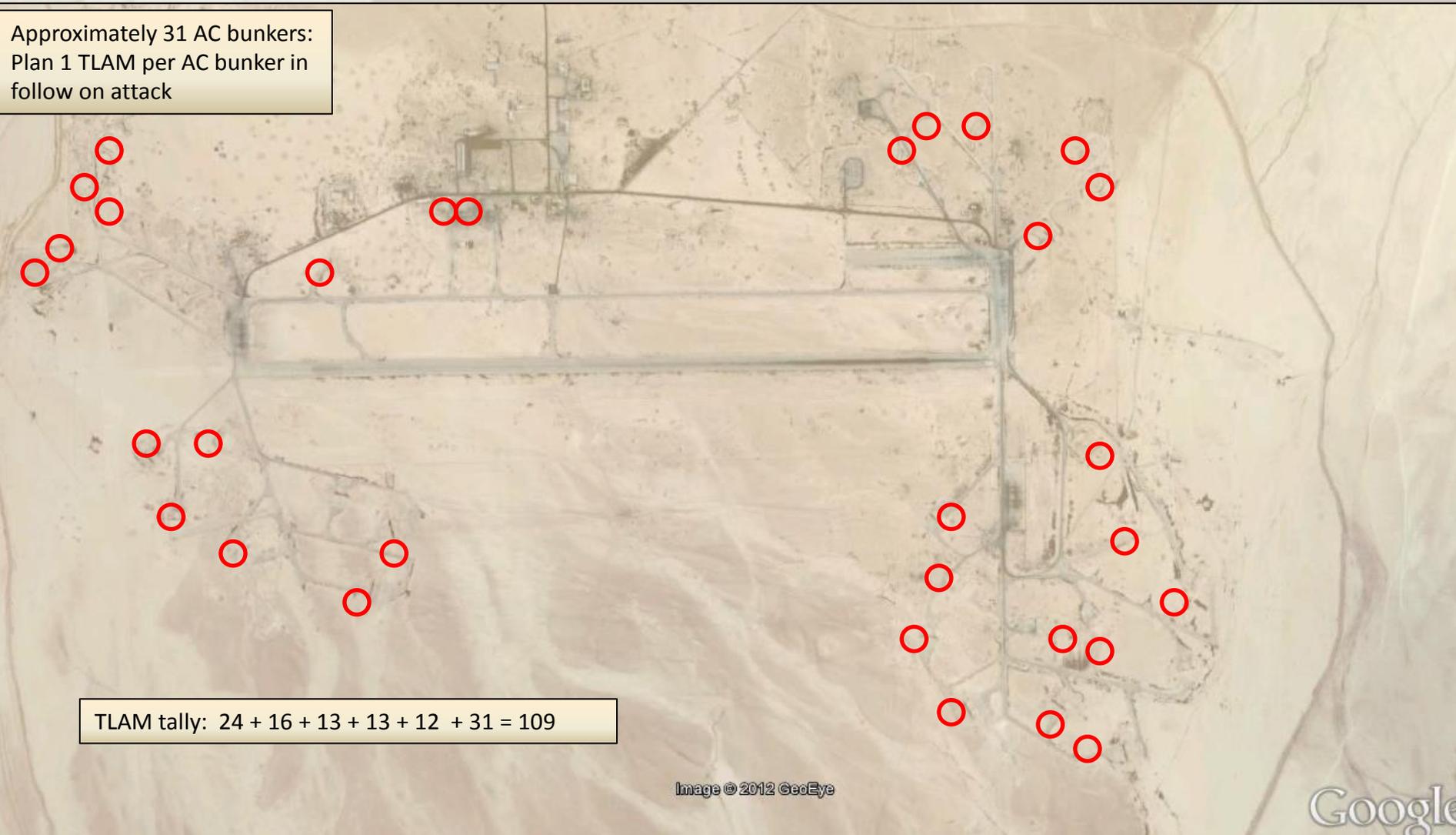


2 X Runway at Damascus, anticipate only targeting south runway with PGM in initial strike

TLAM tally: $24 + 16 + 13 + 13 + 12 = 78$

Approximately 12 AC bunkers:
Plan 1 TLAM per AC bunker in follow on attack

Approximately 31 AC bunkers:
Plan 1 TLAM per AC bunker in
follow on attack



TLAM tally: $24 + 16 + 13 + 13 + 12 + 31 = 109$

Syrian Regime Vulnerability- Equipment: Supply, Maintenance, and Training

Aircraft	Function	QTY (est)
Mi-8/17	Medium transport helicopter	100
An-24/26	Medium transport aircraft	7
IL-76	Medium-Heavy transport aircraft	5
Mi-2	Attack helicopter	10-20
Mi-24	Attack helicopter	35-48
SA-342	Attack helicopter	35
MiG 21/25	Air-to-Air aircraft <i>Low availability</i>	<i>160-240</i>
MiG 23/29	Attack aircraft <i>Low availability</i>	<i>135-225</i>
SU-22/24	Attack aircraft <i>Low availability</i>	<i>80-110</i>
L-39	Trainer aircraft	<i>40-70</i> <i>Medium availability</i>

- A majority of SAF fixed wing aircraft are legacy systems from the former Soviet inventory. These MiG and SU series aircraft require significant spare parts supply, maintenance man-hours, and training to remain in a mission capable status.
- These aircraft require a high level of technical expertise to fly and employ in combat. These skills take a long time to acquire, and they are perishable.
- The majority of SAF fixed wing airstrikes and resupply missions are conducted with aircraft that are easier to maintain and operate, specifically the L-39 for strikes and the IL-76 for transport.
- Therefore, when estimating the equipment capabilities of the SAF, it is important to recognize that the Soviet-era MiG and SU series aircraft have very low / nonexistent mission capable rates. In order to neutralize the SAF, it is primarily necessary to neutralize the L-39 and IL-76 fleet.

The Syrian Air Force (SAF) is highly vulnerable to a limited strike from US Naval and Air forces using Precision Guided Munitions (PGM).

That limited strike would:

- **Take place from beyond the effective range of the Syrian Integrated Air Defense System (IADS)**
- **Place no US personnel at risk**
- **Be accomplished at very low cost**
- **Have a limited, dual purpose effect**
 - **Degradation of SAF infrastructure and support systems**
 - **Degradation of the operable SAF fixed wing aircraft**
- **Result in a significant reduction in the SAF ability to conduct these three missions**
 - **Receive aerial resupply from Russia and Iran**
 - **Conduct aerial resupply of Syrian Arab Army**
 - **Conduct area bombardment of rebel forces**

- ***Syrian Air Defense Force Attack on Turkish Reconnaissance Aircraft (July 2012)***, by Christopher Harmer
[http://www.understandingwar.org/publications?type\[0\]=backgrounder&type\[1\]=map&type\[2\]=other_work&type\[3\]=report&tid\[0\]=293&field_lastname_value=&sort_by=created&sort_order=DESC&page=1](http://www.understandingwar.org/publications?type[0]=backgrounder&type[1]=map&type[2]=other_work&type[3]=report&tid[0]=293&field_lastname_value=&sort_by=created&sort_order=DESC&page=1)
- ***Threat and Response: Israeli Missile Defense (August 2012)***, by Christopher Harmer
<http://www.understandingwar.org/backgrounder/threat-and-response-israeli-missile-defense>
- ***Iranian Strategy in Syria (May 2013)***, by Joseph Holliday, William Fulton, and Sam Wyer
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- ***Syria Update: Implications of Chemical Weapon Use on U.S. Aid Decision (May 2013)***, by Liam Durfee
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- ***The Syrian Army Renews Offensive in Homs (July 2013)***, by Elizabeth O'Bagy
<http://www.understandingwar.org/backgrounder/syrian-army-renews-offensive-homs>

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