Hala Systems, Inc.

Milestone Four

Fixed Amount Award No. SYR080

11-29-2016

Table of Contents

A. Executive Summary

Overview

Through funding from SRPII, under Fixed Amount Award No: SYR080 (administered by Chemonics), Hala Systems, Inc. (Hala) developed and implemented a pilot project to deploy its emergency broadcast system (Sentry) in Idlib province. Hala was able to launch Sentry in coordination with Syrian Civil Defence, observatories, and traditional independent media and bring an improved early warning system to Syrian civilians. Additionally, via the pilot launch, Hala was able to assess the initial effectiveness of the system, document and communicate ceasefire violations, collect valuable insights into airstrike activity in the region, and improve the system accordingly. The following report provides a 60-day overview of the pilot project, its effectiveness, impact, lessons learned, and recommendations.

Summary of Activity

In the first 60 days of operations, 6,699 distinct observations were captured, for which 6,410 unique warning messages[1] were generated and distributed through Sentry's social media and messaging channels – Facebook, Twitter, and Telegram.

Table 1 Sentry 60-Day Operational Metrics Dashboard (August 2 – September 30)

High-Level Activity Overview		Geographic Reach & Depth of Human Network		Key Indicators	
# Days of operation	60	# Governorates for which observations have been submitted	6	# Districts currently receiving Sentry warning	17
# Unique observations received	6,699	Total # of distinct locations for which observations were received	62	% Documented airstrikes for which Sentry generated warnings*	58%
# Unique warning messages generated	6,410	# Observatories participating	5	Average minutes of warning time provided prior to attack	7.6
Avg. # unique observations per day	112	# Active observers in our primary network who are directly communicating with Hala (they may receive input from a secondary network of individual observers)	14	# SCD Centers with which Hala has an established a relationship	8

* This includes general warnings and sub-district specific warnings for the observed aircraft activity

Sentry's social media and messaging platforms are gaining followers, and digital engagement continues to grow rapidly despite a lack of emphasis on promoting these platforms. The primary function of these platforms is to act as conduits for information to civilians, first responders, media partners, and key influencers.

[1] Warnings for a single observation are distributed to multiple communication channels, and sometimes sub-channels (e.g. to Telegram's general channel in addition to a district-specific channel). Multiple messages originating from a single observation are considered one "unique warning."

Figure 1 Social Media Reach, September 2016

Hala is building on this momentum by continuously improving the efficiency and accuracy of its system via feedback surveys and regular communication with users. Hala's regional coordinator has begun visiting SCD centers throughout Idlib to directly engage, train, and gauge initial perception of the system. Eight of the 28 regional offices have been visited and 5 of the 8 have completed our initial feedback survey. Four out of five SCD centers that completed the survey consider Sentry to be "very useful" or "essential." The five SCD centers surveyed are Jisr Al-Shughoor, Darkush, Jabal Wastani, Salqeen, and Sahl Al-Roj Center. Please see Feedback Survey Results for additional information and responses. Hala's regional coordinator will continue to visit and administer feedback surveys across all SCD centers on a bi-monthly basis in order to strengthen Hala's relationship with SCD, gauge SCD's awareness and usage of Sentry, and incorporate its feedback into future system updates.

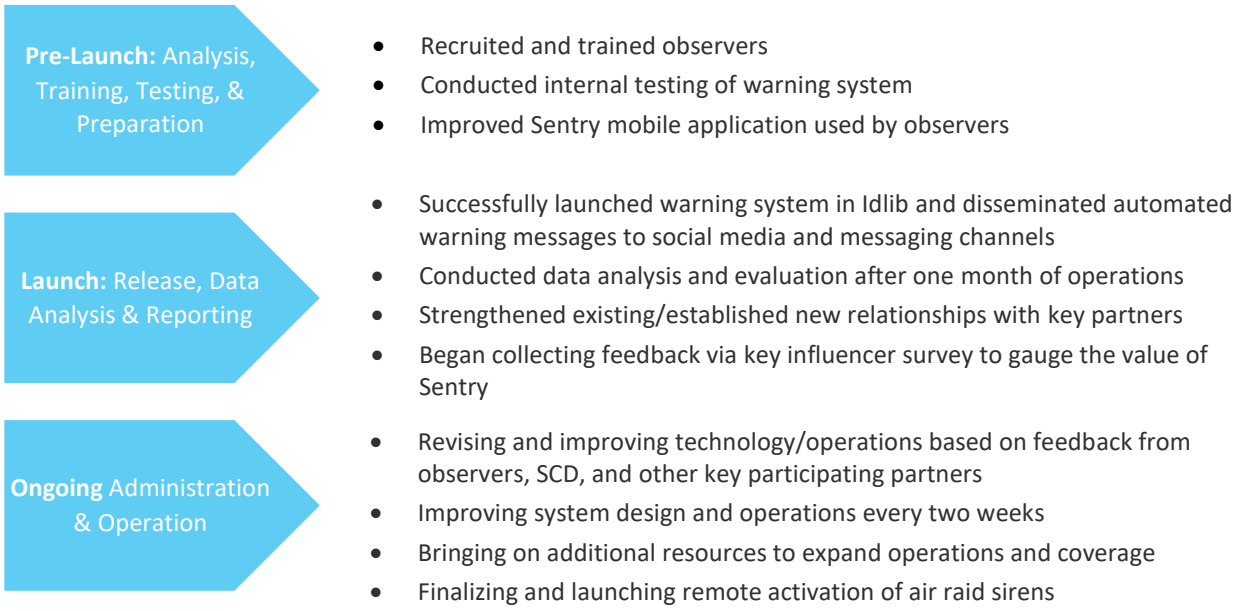
With the system launched and operational, Hala is currently focused on improving Sentry's accuracy, and specifically on improving the proportion of airstrikes for which it is able to provide accurate warning. Based on data between September 1-30, Hala estimates that Sentry provided advance warning for 58% of airstrikes in Idlib. This coverage rate reflects several specific challenges. Hala is making targeted resource investments and operational improvements to improve the percentage of total airstrikes for which it is able to provide early warning. Section **Accuracy – AAR Data** provides additional details about challenges and solutions related to system coverage. After-Action Reporting (AAR) is conducted by Hala's Platform Monitoring (PM) team on airstrikes. Currently, Hala's PM team only conducts AAR in Idlib province.[2]

Implementation Process & Achievements

Through this Fixed Award Amount (FAA) grant and support from Chemonics International, Hala successfully developed and implemented its pilot project in Idlib province following the process outlined in its proposal to SRP. The following summary of activities and outputs provides an understanding of how the Chemonics grants program funding contributed to objectives of the program and to the purpose and goals of the SRPII.

[2] During the recent ceasefire (Sep 12-19), Hala conducted AAR throughout Syria, including Aleppo, Idlib, Hama, and Homs

Figure 2 Summary of Implementation



Key Monthly Updates:

Since the last reporting period, Hala has made several system-wide improvements, including but not limited to:

- Developed a new warning algorithm that prioritizes high-probability threats. This allows for a reduction in warnings generated and ensures that the warnings delivered are relevant and timely.
- Expanded coverage to include Aleppo due to the dire humanitarian situation and because we have the capacity to generate warnings with relatively low effort. However, we lack the resources to a) properly verify the warnings, b) adjust the system to be more accurate and precise given the multitude of new data, and c) conduct After Action Reporting and accuracy analysis.
- Improved the user interface for both observers and monitors.

Additionally, Hala continues to make progress in finalizing the technology to utilize remotely controlled air raid sirens to ensure that a maximum number of civilians in a potential area of effect is alerted. Due to technical issues, which Hala is working with Outernet to resolve, the delivery of the working prototype has been delayed four weeks. Hala expects to have the fully-functioning prototype ready for delivery to the target market by the end of October. Hala will work with SCD to deploy and test the device. Hala is currently augmenting the Sentry system to monitor, control, and define sounding rules for the networked sirens. Once deployed, the siren network can be activated within seconds of a validated airstrike warning. Per feedback from SCD, Hala will develop a method for local activation of sirens from a Sentry smartphone application so that authorized SCD representatives may manually activate all sirens in their care with the push of a button.

B. Final Report

Introduction

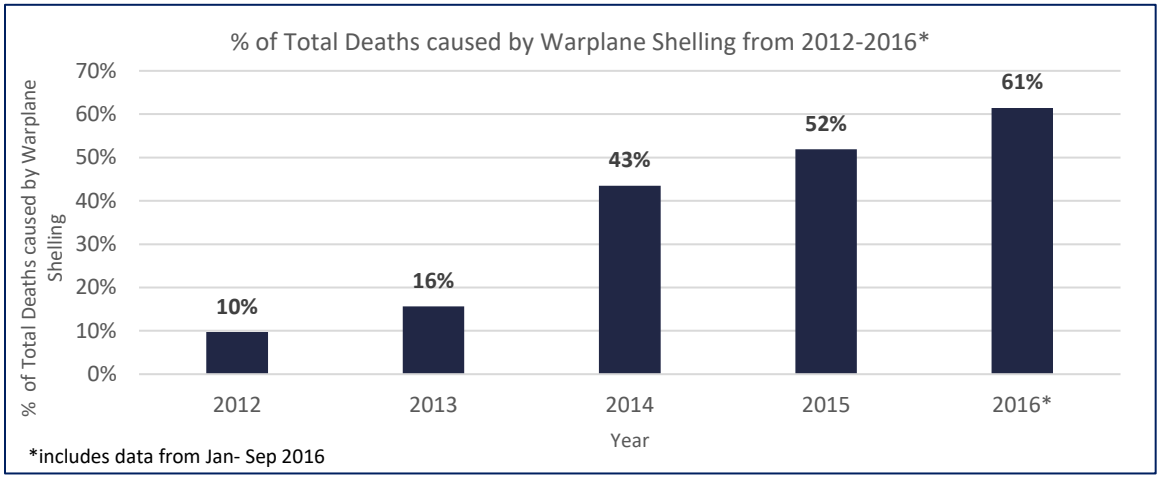
Hala Systems, Inc. (Hala) is a social enterprise focused on developing technology-driven solutions to problems related to conflict, crisis, and natural disasters. Hala seeks to save lives and reduce trauma through the development and implementation of innovative technology solutions. Ultimately, we aim to transform the nature of civilian protection during warfare, as well as to reduce casualties during post-conflict recovery, natural disasters, and other major crises.

Hala provides a platform for gathering, analyzing, and disseminating data using human networks, secure communications, and proprietary software. The initial use case for this platform is Sentry – an emergency broadcast system for airstrikes against civilians in Syria.

Problem

It is estimated that more than 450,000 people have been killed and at least 1.9 million wounded in Syria between 2011 and 2015.[3] By 2016, 61% of civilian deaths in Syria were caused by warplane shelling (airstrikes), compared to only 10% in 2012.

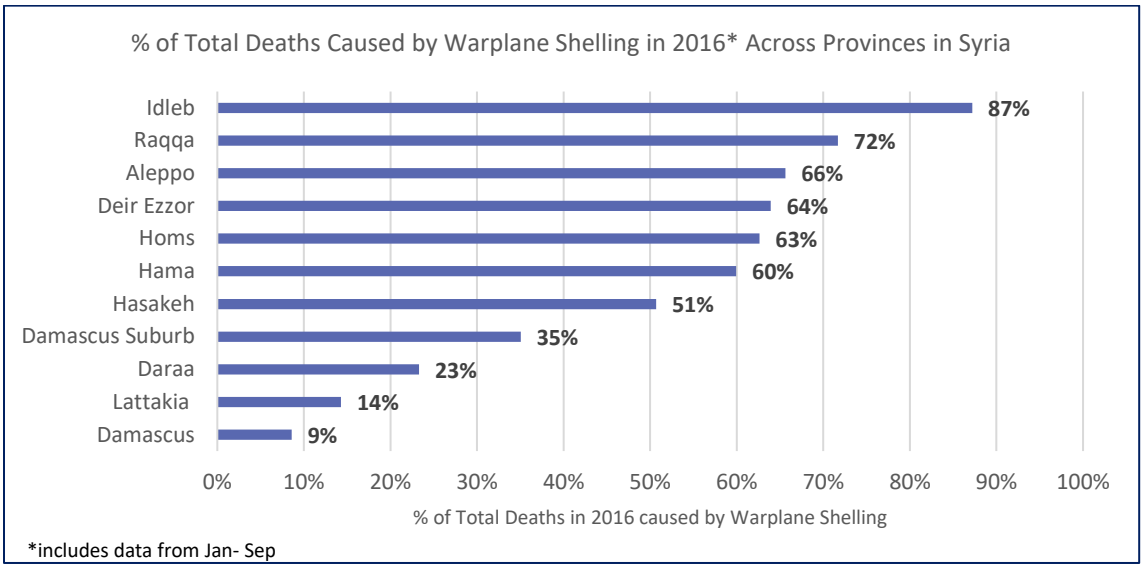
Figure 3 Percent of Civilian Deaths in Syria Caused by Warplane Shelling



Regionally, Idlib has been the hardest hit by airstrikes in 2016, with 87% of total civilian deaths in Idlib from January through September of this year attributed to warplane shelling.[4] Included in these warplane attacks are indiscriminate barrel bombs and munitions banned by international law, such as cluster bombs and phosphorous.[5] There are millions of civilians still in Syria. There was no dependable way to warn them of an imminent attack.

[3] Syrian Center for Policy Research (SCPR). "Confronting Fragmentation! Impact of Syrian Crisis Report," February 2016.
[4] Violations Documenting Center in Syria. September 2016. <http://vdc-sy.net/?lang=en>.
[5] Human Rights Watch. "World Report 2015- Syria," December 2015.

Figure 4 Percent of Total Deaths Caused by Warplane Shelling in 2016 Across Provinces



While civilian spotter networks ("observatories" made up of individual "observers") watch the skies day and night, they had no way to rapidly or dependably communicate warnings to affected populations. Warnings were unpredictably transmitted via walkie-talkie repeater networks, word-of-mouth, social media, and air raid sirens. There was no consistent, dependable way to rapidly disseminate warnings to all affected civilians in advance of attacks.

Solution

To address this problem, Hala, in coordination with Syria Civil Defense (SCD) and other key members of Syrian civil society, deployed Sentry. Sentry securely aggregates validated observations from proven civilian observatories, processes them through a predictive algorithm, then rapidly distributes accurate, relevant warnings to as many civilians as possible, as fast as possible. Sentry was officially launched on August 2nd, 2016 and currently generates warnings in Idlib province. Sentry also initiated basic coverage of Aleppo on September 10th in response to the dire humanitarian circumstances faced by civilians living under siege.

Analysis & Reporting

Accuracy – AAR Data

According to AAR data for September 1-30th, Hala estimates that Sentry delivered a warning for 58% of attacks in Idlib province. Small sample size aside, this coverage rate reflects several key challenges.

First, during this time period, one third of attacks occurred between 7pm and 6am. It is difficult for observers to record accurate warplane activity at night. The future implementation of remote sensing hardware is expected to drastically improve observations during the night, bad weather, and other unfavorable conditions for human observers.

Second, we recognize the need for additional resources to conduct after action reporting and are currently developing an algorithm that will automate the matching of reported airstrikes to observations in Sentry's database. We are also considering engaging on-the-ground resources, specifically

coordinating with existing news agencies and reporters focused on reporting attacks. This will improve our ability to estimate coverage, as well as improve the predictive algorithms in the system by providing more, better training data.

Finally, there are sometimes personal circumstances that affect the ability of observers to issue warnings. Earlier this month, one of the key observers was injured and unable to contribute observations for several days. The use of remote sensing hardware and engagement of additional observers will help build in redundancies so that all activity is reported.

With these targeted resource investments and operational improvements, Hala expects to dramatically improve the percentage of total airstrikes for which it is able to provide early warning.

It is important to note that in Aleppo, during the ceasefire period of September 12-19, coverage was higher, and Sentry provided a warning for 85% of the attacks. This is a testament to our ability to provide improved coverage when our resources and efforts are fully focused and clear patterns emerge.

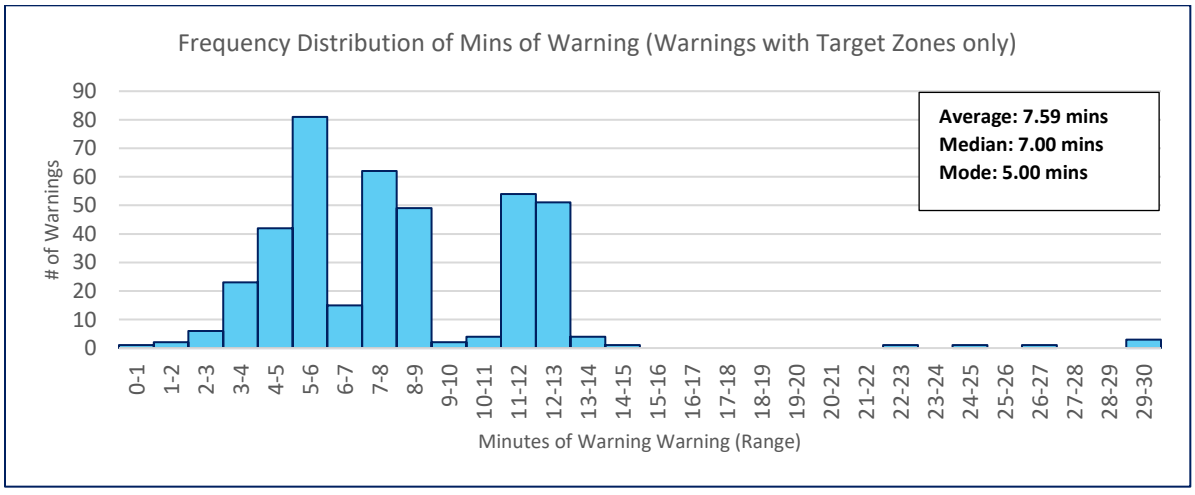
Accuracy – Anecdotal Data

According to 38 anecdotal quantitative assessments collected throughout Idlib province, including from Idlib City, Kafranbel, and Ma'rrat al-Nu'man, 71% of the time that a warplane was seen or heard, Sentry had issued a warning, and we provided at least 4 minutes of warning for civilians to take mitigating action (not counting instances when an aircraft was circling, which signals a potentially immediate attack). Furthermore, 73% of the time, Sentry's warning was received prior to other warning mechanisms (e.g. walkie talkie or sirens). While informative, this data reflects a relatively small sample size and was collected from a limited set of volunteers. Hala will continue to bolster After Action Reporting capabilities, supplemented with anecdotal evidence and user assessments.

Average Warning Time

According to system data, on average Sentry provided nearly 8 minutes of warning to civilians prior to an attack. This distribution of minutes of warning received is shown below. Of warnings sent, 82% provided 5 or more minutes of warning time prior to potential attacks. Due to data availability, only warnings sent between September 11-30, with a potential target zone, are included in this calculation. Warnings of circling aircraft are not included, as the estimated warning time defaults to zero.

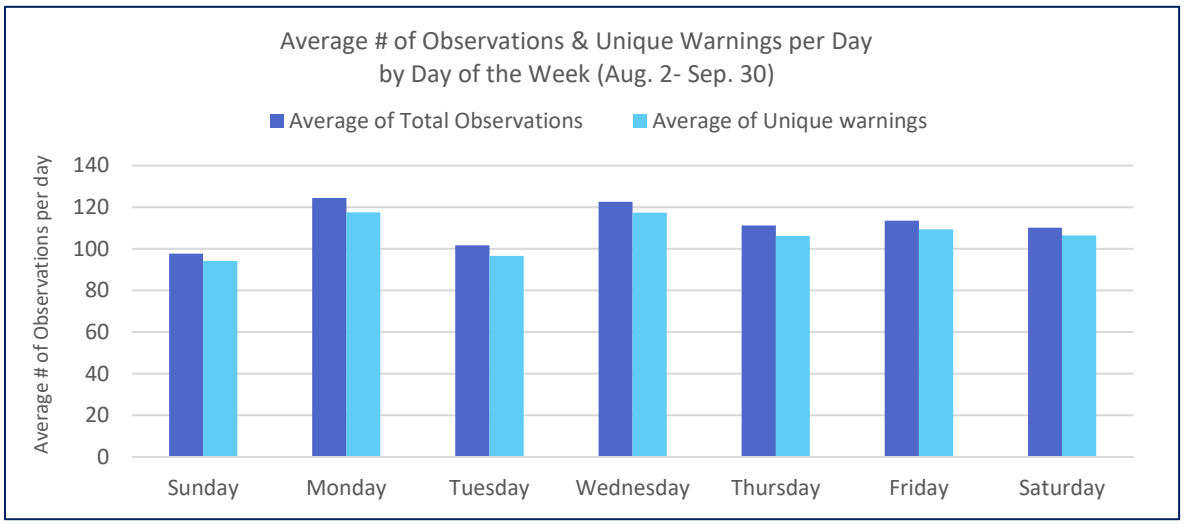
Figure 5 Frequency Distribution of Minutes of Warning Provided for Warnings with Potential Target Zones (Sep 11-30)



When

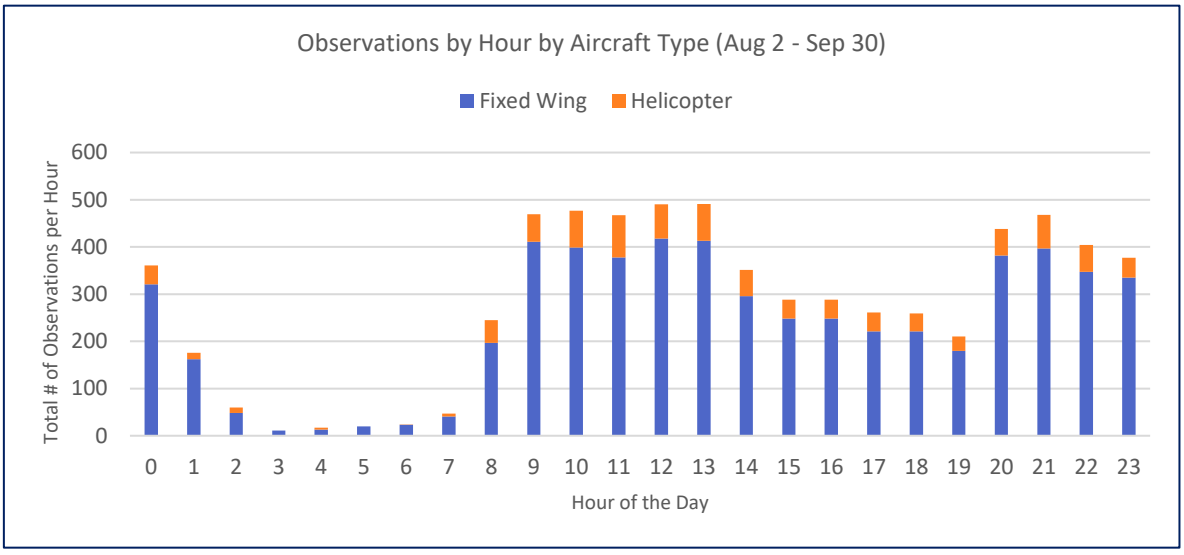
60-day data analysis confirms that there is a relentless threat of airstrikes – an average range of 98-125 observations each day of the week. Given the high volume of warplane activity, Sentry generates an average range of 94-118 unique warnings each day of the week.

Figure 6 Average Number of Observations & Unique Warnings per Day



A distribution of observations over the 24-hour day reveals that 70% of warplane activity occurred between 8am-1pm and 8pm-12am, with 2.3x more observations recorded during peak hours.

Figure 7 Aircraft Observations by the hour

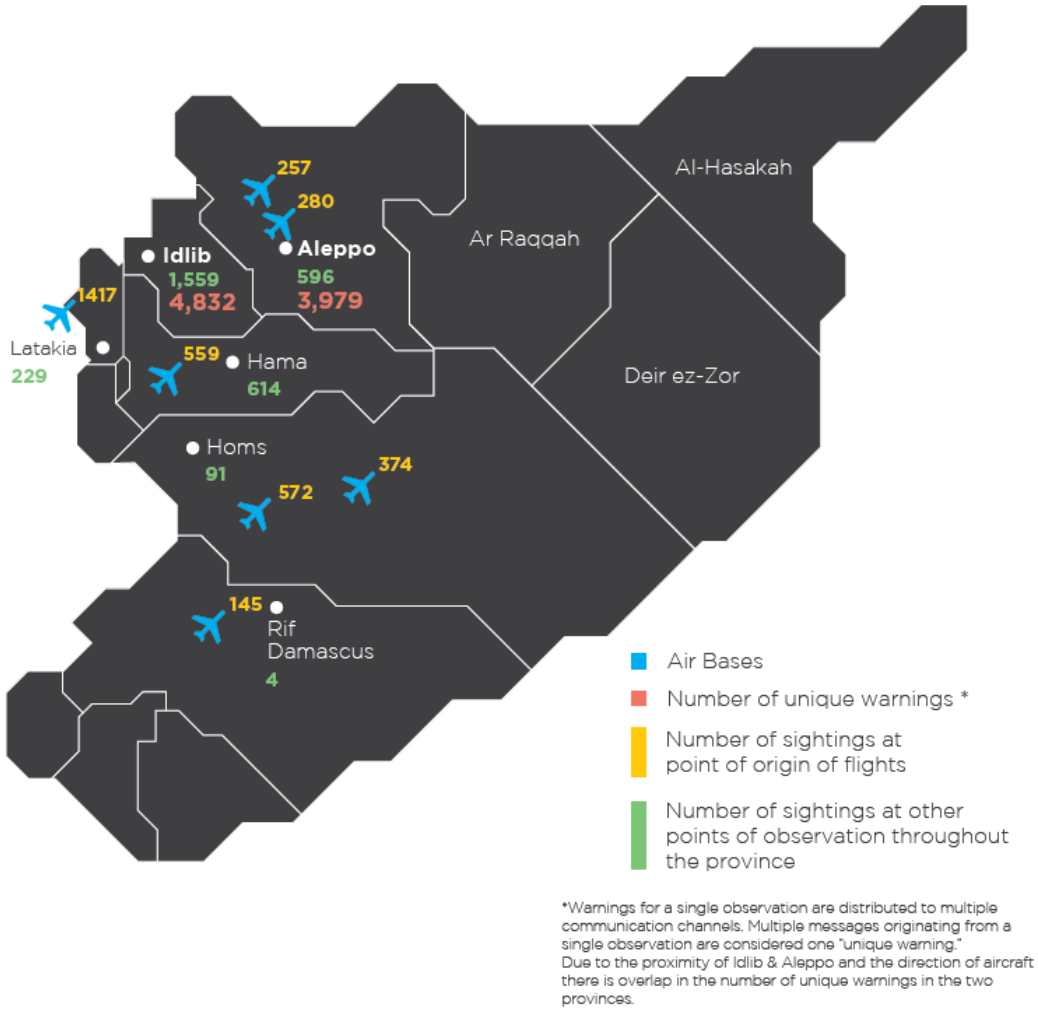


Where

Observations and Warnings:

As previously mentioned, within a 60-day period, Sentry collected 6,669 observations across 6 provinces and generated 6,410 unique warnings. The map below provides a visual representation of the distribution of observations and warnings across Syria.

Figure 8 Source of Observation and Coverage Across Six Provinces of Syria



According to **Table 5** below, Latakia, Idlib, and Aleppo rank the highest in terms of provinces with the most warplane activity observed in August and September.

Table 5 Ranking of Provinces by Number of Observations/Point of Origin for Aircraft (Aug 2 – Sep 30)

Rank	Province	# Observations
1	Latakia*	1646
2	Idlib	1559
3	Hama*	1173
4	Aleppo*	1133
5	Homs*	1037
6	Rif Damascus*	149
7	Other**	2
TOTAL		6,669

*These observation numbers include the observations made at airbases within the respective provinces (airbase observations marked separately on the map)
**Locations of these observations were geographically out of scope of operations

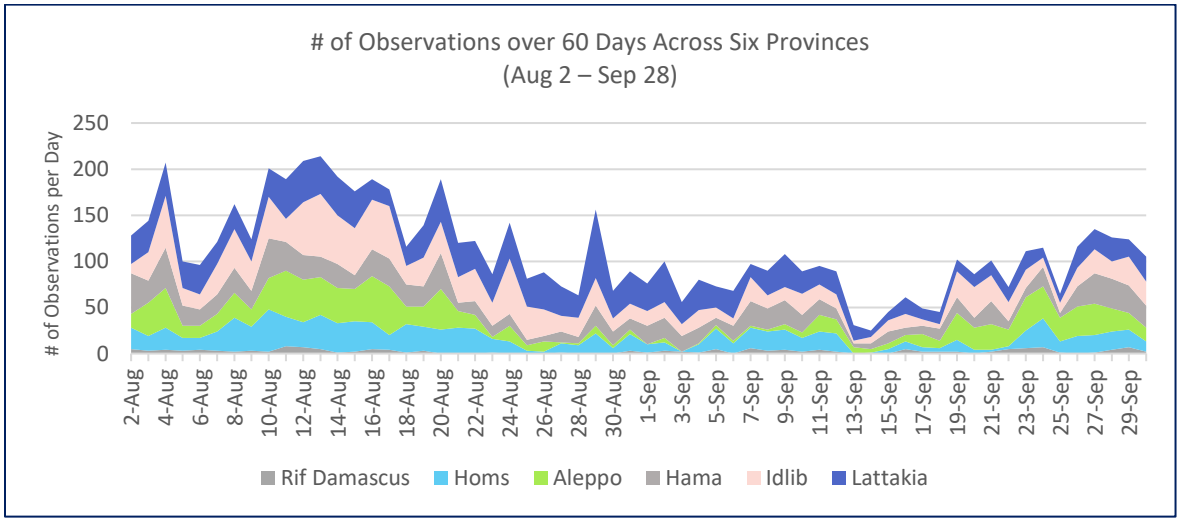
According to **Table 6** below, Hmemim, Shayrat, and Hama rank the highest in terms of airbases with the most warplane activity observed in August and September.

Table 6 Ranking of Airbases by Number of Observations (Aug 2 – Sep 30)

Rank	Airbase	# Observations
1	Hmemim Airbase	1,417
2	Shayrat Airbase	572
3	Hama Military Airbase	559
4	T4 West Airbase	374
5	Defense Factories	280
6	Nayrab Airbase	257
7	Sin Airbase	145

The following graph shows the 60-day trend in the number of observations across the six provinces. The total number of observations per day reflects heightened activity in mid-August, as well as reduced activity during the September 12 – 19 ceasefire. By the end of September, the level of activity returns to pre-ceasefire levels.

Figure 9 Number of Observations Across 6 Provinces in 60 Days



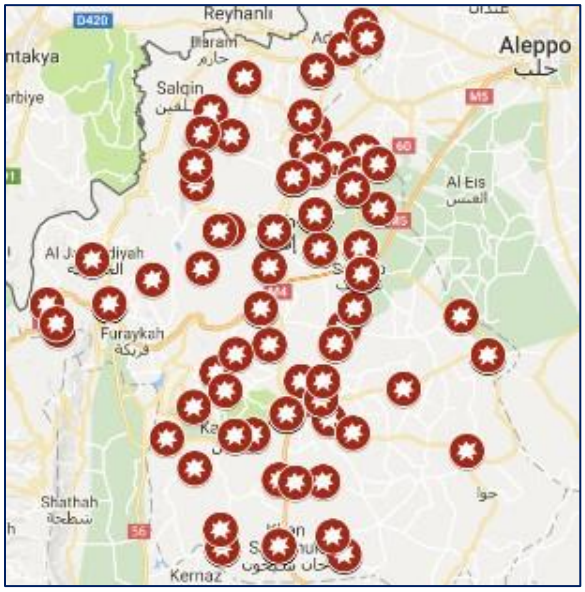
Attacks:

Hala's PM team, which conducts AAR on airstrikes, identified 286 reported attacks in Idlib from August 2nd to September 30th. The map below displays the location of these attacks, and Figure 10 graphs the percentage of total airstrikes across sub-districts in Idlib.

- 243 deaths and 475 injuries
- Of the attacks for which ordnance was identified, 26% involved cluster bombs, barrel bombs, or phosphorous

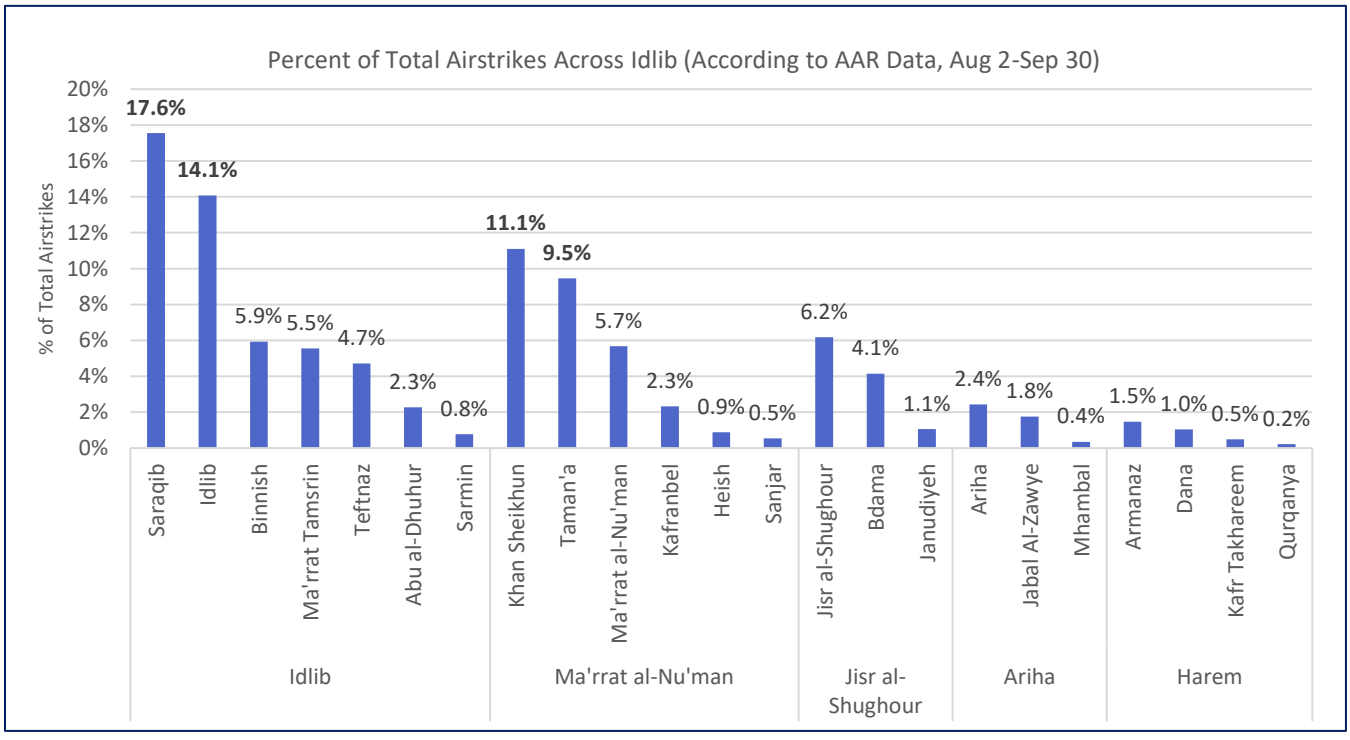
- More than 50% of the airstrikes accounted for in August and September in Idlib province occurred in the sub-districts of Saraqib, Idlib, Khan Sheikhun, and Taman'a (Figure 13)

Figure 10 Location of Airstrikes Confirmed by Hala Systems – Idlib (Aug 2 – Sep 30)



Note: 1) there is overlap of multiple points of attack, 2) 15 attacks are excluded because their exact location in Idlib could not be identified

Figure 11 Percent of Total Airstrikes Across Idlib (According to AAR Data, Aug 2 - Sep 30)

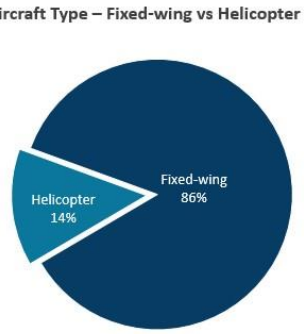


Who/What

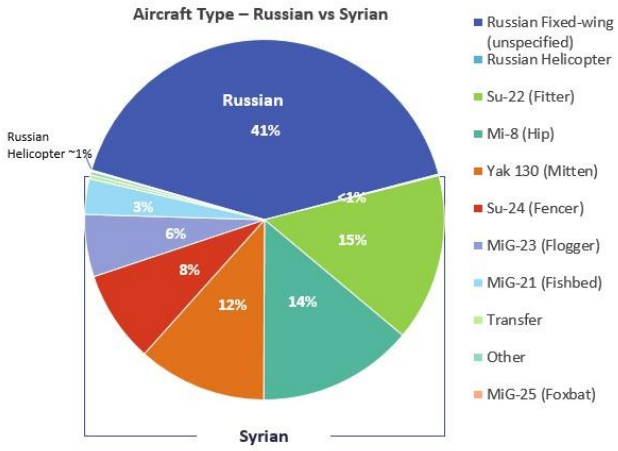
Our analysis sheds light on Russia's involvement in the Syrian war and the type of aircraft most widely used. According to Sentry data, observers primarily detect fast-moving aircraft; 86% of observations are for fixed-wing aircraft compared to 14% for helicopters. Over half (58%) of the aircraft are Syrian, while the remaining 42% are Russian.

Figure 12 Aircraft Type (Aug 2 – Sep 28)

Observers primarily detect fast-moving aircraft:
– **86% fixed-wing** vs. **14% helicopters**



Both Syrian and Russian warplanes bombard Syria:
58% Syrian vs. **42% Russian aircraft** observed



Project Impact – Ceasefire Violations Reporting

The Cessation of Hostilities (CoH) period began on Monday, September 12th at sundown and ended on September 19th when the Syrian army announced its suspension of the CoH. The following analysis focuses on this time period. During the CoH, Sentry continued to track warplane activity and thus accumulated valuable data for reporting on ceasefire violations. Sentry's CoH Violations Report was shared with select governments, NGOs, and international media outlets to shed light on the fragility of the ceasefire deal and the numerous violations by Russia and the Syrian Regime. According to Sentry's observation and violations reporting data, Russia and Syria violated the ceasefire 71 times. The following section provides a summary of Sentry's CoH Violations Report.

Key Summary:

- Observed warplane activity decreased significantly during the ceasefire. However, airstrikes continued in non-Regime, non-ISIS held areas. Observable activity rapidly returned to pre-ceasefire levels in the hours following the unofficial suspension of the ceasefire.
- Aleppo was hit hardest during the CoH period at an average rate of four airstrikes per day, nearly 3-to-1 over the second most attacked province, Idlib.
- Sentry was able to confirm Russian and/or Syrian Regime airstrikes on targets outside of ISIS control in 7 provinces during the CoH.
- There was no significant reduction in the share of Russian-operated warplane activity during the ceasefire[6].

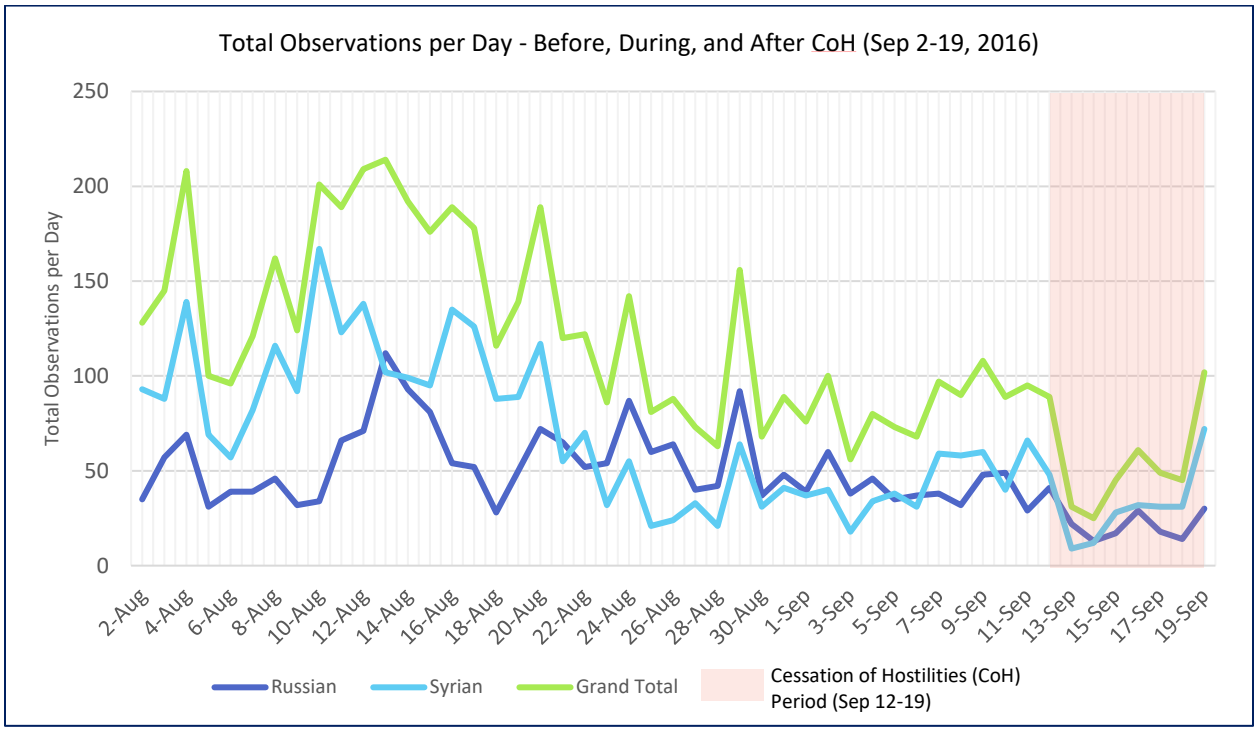
[6] Again, here we use airbase of origin to determine whether aircraft are Syrian or Russian.

- Approximately 1 in 5 airstrikes during the ceasefire appears to have been conducted by Russian-operated aircraft.
- Sentry created warnings that corresponded with 85% of the ceasefire airstrikes conducted in Aleppo, and over half of all airstrikes conducted throughout Syria.[7]

Observation of Warplane Activity:

Warplane activity did not end but was significantly decreased during the ceasefire. On September 19th, warplane activity returned to pre-ceasefire numbers:

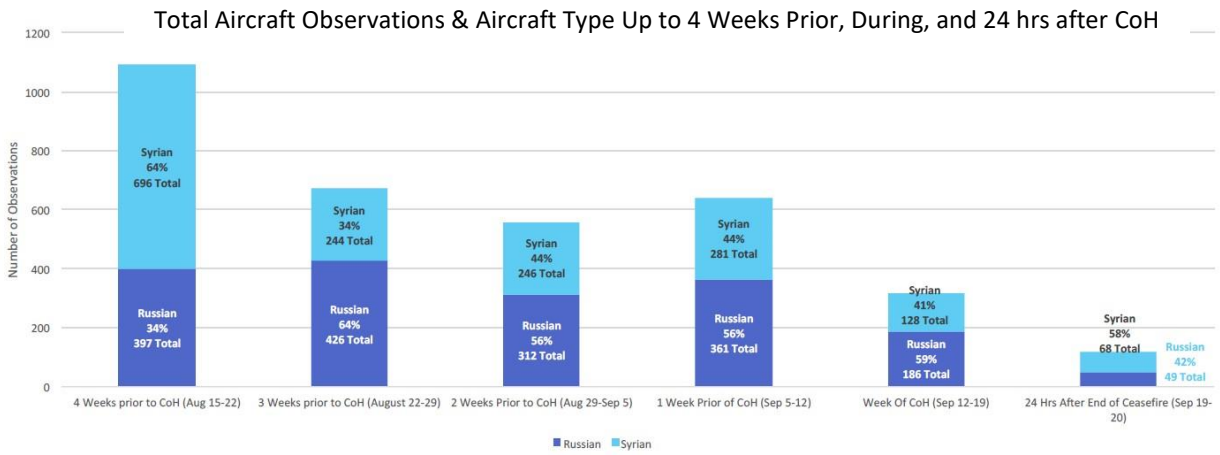
Figure 13 Total Observations per Day - Before, During, and After CoH (Sep 2-19, 2016)



[7] It should be noted that Sentry currently provides full coverage to Idlib only. However, we expanded our efforts to Aleppo due to the extreme humanitarian situation. We also have partial coverage of Lattakia and Homs and intend to expand coverage to other provinces pending additional resources.

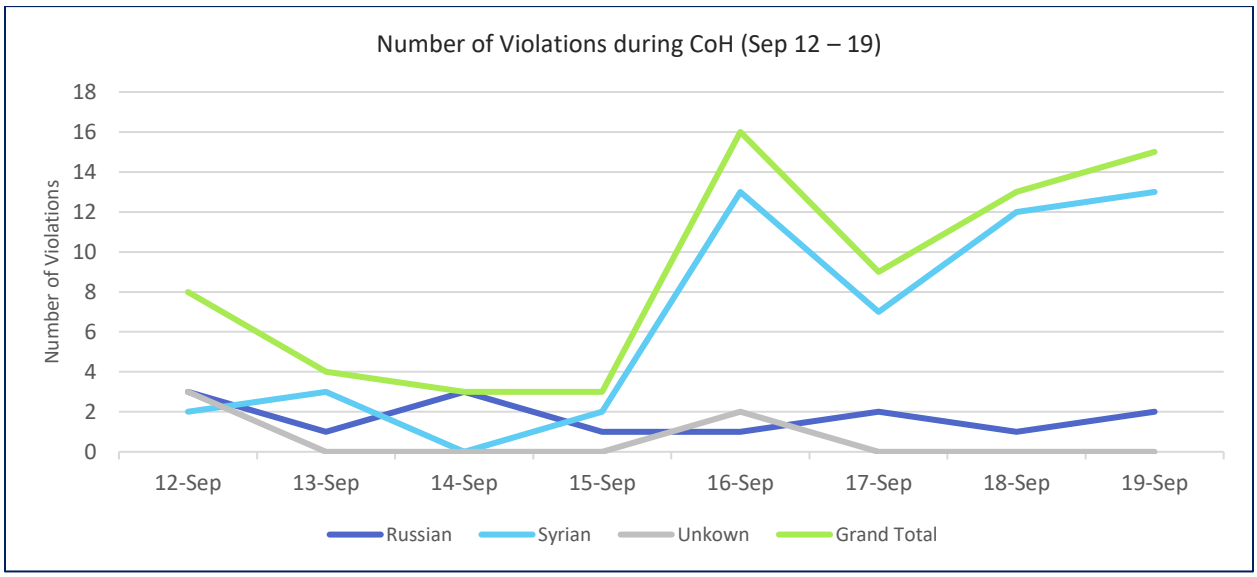
Russian-operated warplanes held a fairly consistent share of observed activity in the weeks prior to, during, and immediately after the ceasefire:

Figure 14 Total Aircraft Observations & Aircraft Type Up to 4 Weeks Prior, During, and 24 hrs after CoH



The number of violations peaked on September 16th and 19th and Syrian airstrikes increased as the ceasefire progressed:

Figure 15 Number of Violations during CoH (Sep 12-19)



The highest number of alleged airstrike violations were reported in Aleppo:

Figure 16 Violations by Province (Sep 12-19)

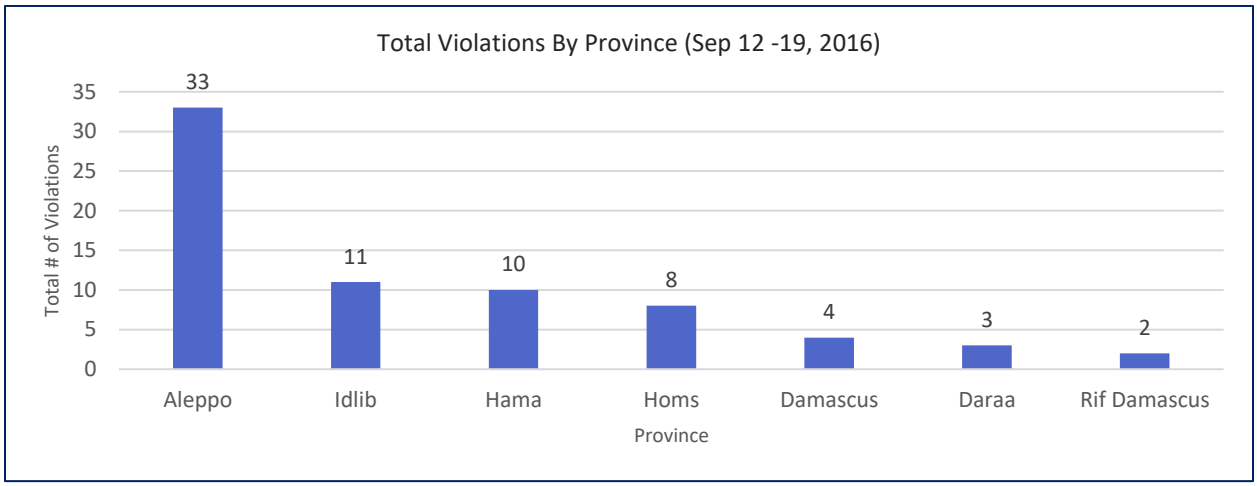
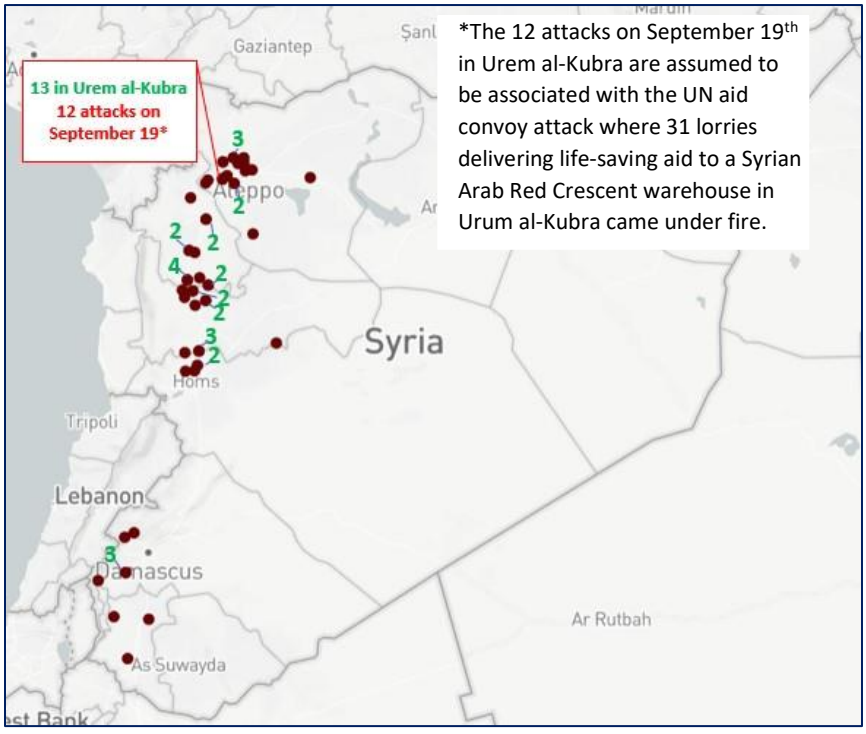


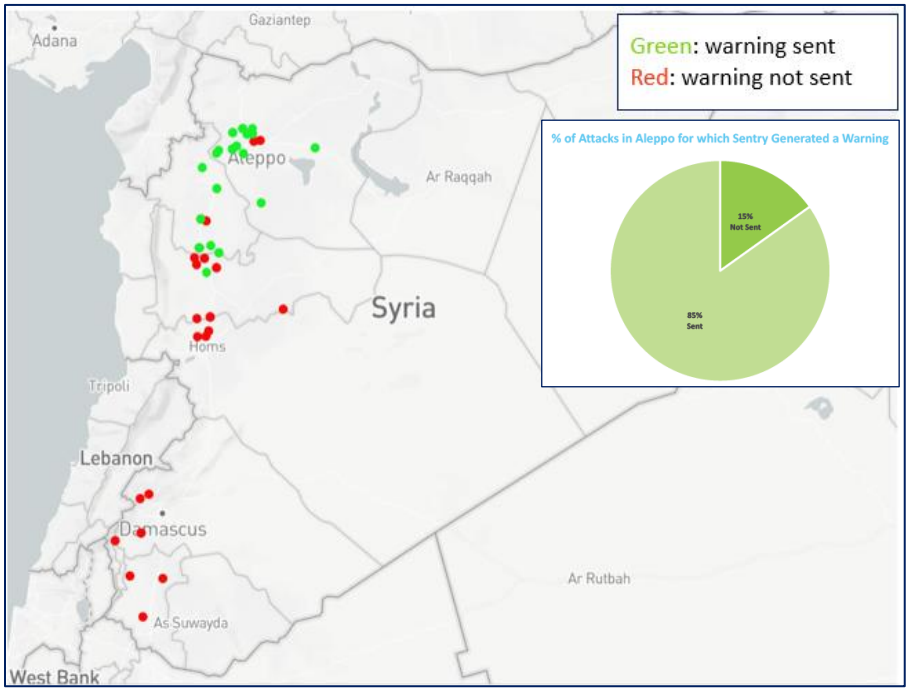
Figure 17 Locations of Recorded Violations, Sep 12-19



Excludes the following violations due to lack of precise location: Homs Ameriyeh (September 18, 9:42), Aleppo Division 46 (September 16, 17:02), Aleppo Qatban Al-Khashab (September 15, 10:48)

In Aleppo, Sentry sent warnings for 85% of all airstrikes during the CoH period:

Figure 18 Geographic Analysis of Sentry's Coverage of Recorded Violations, Sep 12-19:



Excludes the following violations due to lack of precise location: Homs Ameriyeh (September 18, 9:42), Aleppo Division 46 (September 16, 17:02), Aleppo Qatban Al-Khashab (September 15, 10:48)

Impact - Public Perception

Testimonials

Hala is currently in the process of gathering testimonials from individuals and families whose lives have been saved by Sentry. During the first week of August 2016, the Syrian Regime and Russian air forces hit the town of Saraqeb, Idlib Province, with 167 airstrikes. The ordnance that they dropped included two chlorine-filled barrel bombs and 16 cluster munitions, leaving more than 100 people killed or injured. We have three video testimonials and one verbal testimonial of Sentry saving the lives of four different families during this time. To watch one of the powerful testimonials captured on video, please go to https://vimeo.com/180073004 and use the following passcode: bluekey. Hala is finalizing a second video which captures testimonials from three separate families.

Figure 19 Testimonial Video

Hala maintains a database of the names and count of civilians whose lives have been saved by Sentry. So far, Hala has recorded 22 people protected from airstrikes due to Sentry's warnings based on volunteered self-reporting. The database also includes key biographical and geographical information such as name (not a required field), gender, age, # of family members affected, and location of residence. Hala will continue to build this database as it enhances data collection activities in the field.

Feedback Survey Results

As previously mentioned, Hala's HRC collected five surveys from the following SCD centers: Jisr Al-Shughoor, Darkush, Jabal Wastani, Salqeen, and Sahl Al-Roj Center. All five centers rated Sentry to be "useful," "very useful," or "essential" and would recommend using Sentry to civilians in their designated areas. The survey answers can be found below:

Figure 20 SCD Feedback Survey

SURVEY QUESTIONS	JISR AL-SHUGHOOR CENTER	DARKUSH CENTER	JABAL WASTANI CENTER	SALQEEN CENTER	SAHL AL-ROJ CENTER
1. Are you aware of Sentry?	YES	YES	YES	YES	YES
2. Have you used Sentry information on airstrikes?	YES	YES	YES	YES	YES
3. How currently useful is Sentry for protecting civilians in your area?	Useful	Very useful	Very useful	Essential	Very useful
4. With improvement, how useful do you think Sentry can be for protecting civilians in your area?	Useful	Useful	Very useful	Very useful	Very useful
5.Would you recommend using Sentry to the civilians in your area?	YES	YES	YES	YES	YES
6. Do you have any recommendations regarding the warning message itself?	NO	Sentry should generate its warnings via WhatsApp, as it is used more frequently by civilians	NO	I propose that there is a broader circulation of SENTRY inclusive of all public and private observatories. Also, to send out voice messages in parallel to text messages.	NO

The other three SCD centers which are now aware of Sentry but have not yet completed the survey are Kafr Takhareem, Maaret Misreen, and Kelli.

Conclusion

The results of the two-month report and the positive feedback received indicate that Sentry's launch was successful – response is favorable, lives have been saved, and adoption is rising.

Our primary goals now are to build on the momentum, improve the performance of the system through software upgrades and siren hardware deployment, more effectively measure impact, and increase adoption. Hala has learned important lessons throughout the launch of Sentry and will continue to incorporate these key lessons as its operations grow.

Lessons Learned

The difficulties of operating in a war zone are vast. Through the launch of Sentry and its first two months of operation, Hala has been continuously learning and discovering new opportunities for improvement.

Develop a direct communication plan for SCD and key influencers: to overcome communication hurdles and better understand the dynamic needs of SCD, it is essential to establish a direct relationship with SCD centers and key influencers. Having a communication plan in place will allow Hala to strengthen its relationship with key SCD regional coordinators, establish a recurring feedback loop, and ultimately increase its usage among first responders. Most recently, Hala's Relationship Manager had the opportunity to present Sentry at the May Day Office during a meeting for the heads of Civil Defense sectors. Hala is establishing its regional coordinator as Sentry's main liaison to in-country SCD personnel to improve coordination and collect feedback on the system.

Make continuous improvements to the underlying technology of Sentry: in order to achieve its goal of saving lives, Hala must continuously evaluate and improve the entire system. This includes upgrades to the predictive algorithm, the mobile application, and the system monitor interface. Hala currently develops, tests, and releases improvements to Sentry every two weeks.

Avoid international recognition and de-emphasize explicit marketing: Hala believes it is more important to focus its efforts on improving the effectiveness, functionality, and influencer engagement of the system in Sentry's launch phase than to emphasize broad-based marketing. Sentry is largely relying on Facebook, Twitter, and Telegram to communicate current warnings, and its media sites have gained followers rapidly, despite a lack of focus on promoting these platforms. This lack of emphasis on marketing has helped Hala gain more credibility among its target user base as awareness of the system has been chiefly spread via word of mouth and volunteer promotion by its supporters.

Recommendations & Next Steps

- Boost resources for Platform Monitoring, Evaluation, and Reporting in order to conduct deeper impact assessment and improve AAR coverage
- Continue to focus on achieving full coverage of Aleppo, particularly given the recent surge in attacks
- Continue efforts to scale to target areas in Syria, particularly those with the highest number of attacks
- Move forward with efforts to network sirens for use with all high-priority warnings
- Continue to build relationships with SCD, local media outlets, and other key influencers that will amplify warnings and awareness of the system in order to reach a larger civilian population
- Continue development of a hardware remote sensing platform
- Create a marketing and awareness campaign to further increase awareness inside Syria

Sentry will be most effective if its users are engaged, and thus Hala's goal is to improve the system's accuracy in order to increase its credibility, gather feedback, establish and strengthen influencer and user relationships, and expand coverage inside Syria.

C. Time Sheets

Google spreadsheet with timesheets sent separately.

D. Boarding Passes

Boarding passes for all trips funded under this activity sent separately.