



SCIENCE, TECHNOLOGY AND GLOBAL SECURITY WORKING GROUP

Massachusetts Institute of Technology
77 Massachusetts Avenue, E51-165
Cambridge, Massachusetts 02139

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Ambassador Christoph Heusgen
President of the UN Security Council
Germany's Permanent Representative to the UN
New York, New York, USA

Dear Mr. Ambassador Heusgen:

I am writing to inform you of serious inaccuracies in the UN OPCW reports S/2017/904 and S/1510/2017 dated, 26 October 2017 and 29 June 2017 respectively on events at Khan Sheikhoun on April 4, 2017. These reports inaccurately describe cited evidence from satellite imagery, photographs and videos. They also cite conclusions and analysis based on physics and phenomenology that are not based on sound scientific principles and show little evidence of real expertise on munitions, explosive effects, and delivery mechanisms.

Attached are three key documents that back up our findings that these reports are inaccurate. We also have additional analysis and findings that we would be happy to provide the UN on request.

The first of the three documents is a scientific manuscript titled *Computational Forensic Analysis for the Chemical Weapons Attacks at Khan Sheikhoun on April 4, 2017*.

This manuscript has been accepted for publication by *Science and Global Security*, a refereed science-based journal published out of Princeton University. The paper has seven authors all of whom are established scientists plus it has been refereed under the supervision of the editors of the Journal.

The manuscript reports supercomputer calculations that show that the OPCW finding is incorrect that a crater at Khan Sheikhoun was produced by the kinetic impact of a bomb that was the source of a sarin release. The crater was instead produced by the explosion of an improvised artillery rocket warhead. The supercomputer calculations show that all of the important observable physical characteristics of the crater were produced by the detonation of an explosive warhead weighing roughly 6 to 10 kg with a large length to diameter ratio oriented at an angle to the ground of roughly 45 to 65° relative to horizontal.

The supercomputer calculations show that the geometry of the charge and its orientation relative to the ground produce a classic crater that has a tear-drop shaped perimeter (that is, a perimeter that is not circular).

Craters with this shape are known by UN peacekeepers to be produced by artillery rockets, as is documented in the UN manual for peacekeepers in the document, *Introduction to UN Peacekeeping Pre Deployment Training Standards*, which can be found at the following UN URL:

<http://repository.un.org/bitstream/handle/11176/89584/STM%20Military%20Expert%20on%20Mission.pdf?sequence=1&isAllowed=y>

Section 1.2, titled, *Verification of Minefields, Explosive Remnants of war and Crater Analysis* contains the basic information on crater recognition used by UN peacekeepers in the field. Similar discussions about how to identify such craters can be found in US Army Artillery Officer Field Manuals. These characteristics of artillery rocket craters are therefore well known to true professionals who deal with these matters.

The second document attached to this letter is an annotated and highlighted version of the *letter of 26 October 2017* transmitted by the *Leadership Panel* of the OPCW to the UN Security Council. This document contains comments correcting inaccurate or misleading statements along with the original text of the letter.

The third critical document is an *Attachment* to the annotated and highlighted version of the *letter of 26 October 2017*. The attachment is titled *Forensic Evidence Cited by the OPCW that Contradict Its Reported Analysis and Conclusions* henceforth referred to as *The Attachment*. *The Attachment* contains original satellite imagery and other images that show the descriptions of evidence cited in the OPCW reports are inaccurate.

The discussion and supporting evidence in these three documents show, to professional scientific standards, the following.

1. All of the descriptions of cited evidence from satellite imagery in the OPCW reports are inaccurate and incomplete.

Satellite imagery of the area around the crater misidentified by the OPCW as produced from the kinetic impact of a bomb weighing 300 to 450 kg shows two similar craters produced at the same time at a distance of only 150 and 180 meters to the north northeast. 130 meters directly to the east there is also damage to a concrete roof panel of a nearby grain storage warehouse (See pages 8, 9, and 10, and the image at the bottom of page 5 in *The Attachment*). This information was not provided to the UN Security Council in the OPCW reports.

All three craters in the satellite imagery (including the crater where the OPCW alleges a sarin release) are consistent with the impact and detonation of artillery rockets carrying the same explosive warhead (See image at the top of page 5 in *The Attachment*). The damage to the concrete panel on the warehouse roof is also consistent with the impact and detonation of an artillery rocket with a similar explosive warhead.

Other Satellite imagery cited by the OPCW report of three locations where bomb-damage from bombs weighing 500 pounds or more show no evidence of any bomb damage (See pages 14, 15, and 16 for details of the satellite images in *The Attachment*). These bomb-damage sites were supposedly found by the OPCW investigators using line-of-sight data from videos of bomb debris clouds taken from the north of Khan Sheikhoun looking south during the time of the attack on April 4, 2017 (See image at the bottom of page 11 in *The Attachment*). The bomb debris clouds appear to be from 500 pound (or possibly 1000 pound) standard high explosive bombs. However, the motion of the bomb debris clouds is in the opposite direction of the wind direction reported for Khan Sheikhoun at that time and on that day. This indicates that the ground-video was taken on another day of a different attack.

2. Videos of dead animals that were poisoned with sarin indicate that the animals were almost certainly poisoned elsewhere and placed near the crater that was misidentified as the source of a sarin release by the OPCW (See pages 1, 2, and 3 in *The Attachment*).

OPCW laboratories identified sarin on the hair of a goat and on the feathers and internal organs of two dead birds that were provided to the UN OPCW by local *Idlib Authorities*. These detections by independent laboratories used by the OPCW are cited by the OPCW as strong evidence of a sarin release at that crater.

However, video images of the goat carcass show drag marks behind the dead goat carcass (Page 1 in *The Attachment*) and a rope attached to its neck that appears to have been used to drag it to the location where it was videoed.

Video images also show two dead birds that have feathers of orange/yellow coloring at the bottom of a bird cage (Page 2 in *The Attachment*). The images show scattered seeds and bird droppings on the floor of the cage suggesting that the birds were living in the cage at an earlier time. Other images (available on request) show an individual taking one of the dead birds from the cage and inserting its dead body into a plastic bag. Still other images show individuals carrying a sample collection box to the crater scene where samples were allegedly collected and put into the box. The sample box is later shown sitting next to the crater with its lid open where two plastic bags containing dead birds with orange/yellow colored feathers can be seen.

These data raise serious questions about whether these animals were killed by exposure to sarin at another location (possibly in a confined room) and then planted as evidence of a sarin release at the crater. The OPCW investigators state that they reviewed roughly 250 videos from Khan Sheikhoun following the attack of April 4, 2017 during their evidence collection process but did not find or report this video-evidence to the UN Security Council.

Such potential uncertainties from possible tampering with evidence are traditionally addressed through the stringent enforcement of chain of custody procedures mandated in the *Chemical Weapons Convention*.

3. Annex II of the 26 October 2017 report to the UN Security Council argues that a bomb of weight roughly 300 to 450 kg hit the ground at “high speed” causing a crater and dispersing between 200 and 300 kilograms of sarin (See comments on pages 9 and 29-33 in the annotated and highlighted version of the *letter of 26 October 2017* included with this letter). This amount of sarin is roughly comparable to what we believe was delivered in the massive nerve agent attack of August 21, 2013 in Ghouta, Syria.

There is absolutely no forensic evidence in any of the video images of the crater area to indicate that the crater was produced by a bomb impacting at high speed (See images and text on page 7 in *The Attachment*).

In particular, such a bomb would leave behind large pieces of sheet metal from the thin outer wall of its barrel-shaped sarin container, heavy endplates from the front and back ends of the barrel, and tailfins which would be fitted with a parachute that would have not been deployed because the proximity fuse in the front end-plate of the bomb did not work as designed (See image of the pipe on the top of page 7 in *The Attachment*). The only “objects” in the crater was a piece of metal of roughly 100 mm diameter that looks like it could be the filling cap for a chemical weapon, and a pipe of roughly 122 mm diameter and 1 m in length (Page 7 again).

4. The OPCW report never identifies the metal “object” in the crater as a pipe of roughly 120 mm diameter. It instead describes the pipe as an *object* that the investigators assess was produced by the impact of a bomb of roughly 300 to 500 mm diameter. There is no explanation for how a sheet of metal could be rolled into a uniform diameter pipe of 122 mm diameter. The object that is a pipe is never described as pipe in the reports while the other object is identified in the reports as a filler cap.

The JIM has no explanation for how a thin metal sheet torn off the walls of a barrel of diameter 300 to 500 mm could be rolled up into a pipe of near-uniform diameter of roughly 122 mm while also being bent along its axis of symmetry, and propelled in a near vertical orientation into the ground at the front end of the crater with the plane of the bend in the pipe pointing forward into the direction of arrival of the munition. The JIM provides no physical explanation of how this complex and convoluted set of events, reminiscent of a Rube Goldberg cartoon, could possibly occur.

Multiple views of the pipe, which was moved from its original position and laid flat at the center of the crater show a tear along the full length of the pipe where opposing edges have complementary shapes, as would occur if the weld along the length of a pipe manufactured according to standard procedures failed due to extreme internal overpressures. Our supercomputer calculations predict such a tear in a rocket motor casing using standard manufactured pipe from the impulse of gases propagating up the tube when the warhead detonates. The same calculations also predict that the pipe would not tear if it was instead manufactured from monocoque (seamless) pipe of the type used in artillery rockets manufactured by advanced industrial states. This is one of *several* clear indications that the detonation crater on the asphalt road was produced by an improvised rocket (See second image on page 6 of *The Attachment*.)

5. The report also contains numerous inaccurate technical embellishments that no true expert would claim.

One claim in the UN Annex II is that the alleged 300 to 450 kg bomb was dropped from an altitude of between 4 and 10 km (See comments on page 31 in the annotated and highlighted version of the *letter of 26 October 2017* included with this letter). No responsible expert who has true expertise on bombs would volunteer such an inaccurate technical embellishment. Such a glaring and inaccurate technical embellishment should also have been caught during the review process of the letter of 26 October 2017 before it was transmitted by the Leadership Panel to the UN Security Council.

A knowledgeable expert would know that such a bomb reaches a terminal velocity due to atmospheric drag and tends to impact the ground at the same velocity regardless of the altitude from which it was dropped. Calculations we can provide to the UN show that such a postulated bomb would hit the ground at a speed of roughly 350 to 400 km/h (230 to 250 mph) – which is about the same velocity as the chemical munition artillery rockets that were used to deliver nerve agent in the attack on Ghouta in August 21, 2013. This is simply because the bomb eventually reaches a speed where aerodynamic drag is equal to the pull of gravity on the bomb. In this circumstance, the bomb neither increases nor decreases in speed. The gravity bomb postulated by the JIM would be constructed from metal pieces that are quite similar to the metal pieces from the rocket propelled barrels of sarin that hit the ground in Ghouta at roughly the same speed, producing copious and easily identified pieces a bent metal fragments around impact sites (See an image of an impact crater surrounded by debris of a rocket propelled barrel of sarin at Ghouta at the bottom of page 7 in *The Attachment*).

Another inaccurate technical embellishment by experts cited in Annex II of the JIM report states a conclusion that the walls of a “metal cabinet” that was “3 to 5 m” from the center of the crater that was misidentified as created by a bomb impact would have been damaged by if the crater were instead produced by an exploding warhead from an artillery rocket. A knowledgeable technical expert would not have referred so loosely to a range of 3 to 5 m. At 3 m range a 6 kg explosive would produce a peak overpressure of 441 kPa (greater than 60 psi) while at 5 m range the overpressure would be more than three times lower (less than 20 psi). Anyone who understood the effects of blast waves on structures would know that a factor of three in this particular range of blast overpressures could be the difference between a wall showing no damage from the blast wave or a wall that fails catastrophically.

Yet another expert assertion that no expert would make is that the absence of fragmentation damage to the nearby metal cabinet indicates that the crater could not have been produced by an exploding artillery rocket warhead.

Any expert on munitions would know that the fragments from the artillery rocket warhead would spray out in a direction slightly forward of perpendicular to the axis of arrival of the artillery shell. The shape of the crater indicates that the axis of arrival would result in fragments directed away from the metal cabinet.

Finally, the “metal cabinet” should have been identified by experts as an *electrical substation*. Any expert would know that electrical substations are by design highly resistant to blast and other environmental insults. This is because they are designed for environments that can include tampering from malicious individuals. If there is sufficient interest at the UN in this matter, we can provide our analysis that shows that the conclusion voiced in this matter by the JIM is not based on true expertise on the effects of munition detonations.

Another expert false embellishment is that damage at the bombed sites where the satellite imagery shows no evidence of bomb-damage was caused by either a *thermobaric bomb* or a *fuel-air-explosive*. We comment on this in detail in the annotated Annex II, but here it suffices to say if the satellite imagery shows no evidence of any bomb damage, there is no data that an expert could use to determine a thermobaric bomb or fuel-air-explosive was a source of bomb damage (See comments on pages 26 and 27 in the annotated and highlighted version of the *letter of 26 October 2017* included with this letter).

There are many other inaccurate technical embellishments in the JIM report that raise questions about the true expertise of the individuals relied on for expert input by the JIM.

In summary, there are glaring inaccuracies and omissions in the descriptions of cited evidence and embellished inaccuracies in the expert analysis associated with the report by the OPCW on the events in Khan Sheikhoun on April 4, 2017. Our review of the cited evidence from photographs and videos show that the descriptions of the cited materials are not accurate. We also find that the physics and phenomenology

used to explain the data that is cited as evidence by the investigators is not based on sound scientific principles.

We believe that the UN and its agencies are a unique resource for the enforcement of international law, and we are deeply committed to helping in every way to the achievement of this important goal. Towards that end we are poised to provide all the help we can to see that an accurate report on the events at Khan Sheikhoun on April 4, 2017 be produced for the Security Council and the General Assembly.

Most respectfully,



Theodore A. Postol
Professor Emeritus of Science, Technology,
and National Security Policy
Massachusetts Institute of Technology
Phone: (617) 543-7646
Email: postol@mit.edu

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France's Permanent Representative to the United Nations
Russia's Permanent Representative to the United Nations
United Kingdom's Permanent Representative to the United Nations
United States' Acting Permanent Representative to the United Nations