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Angela Di Stasi

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WAR-CRIMES INVESTIGATIONS: NEW TECHNOLOGIES, NEW COMPLEXITIES, NEW VULNERABILITIES. A STRATEGIC SHORTFALL OR EVOLUTIONARY OPPORTUNITY FOR NATO

Luigi Bramati*

SOMMARIO: 1. Introduction – 2. New Complexities, New Forensic Techniques. – 3. An Example of a New Approach: Forensic Architecture. – 4. A Vulnerability for NATO Credibility: A “Policing Gap”? – 5. Conclusion.

1. Introduction

Investigations into war crimes imply a level of complexity generally unparalleled with reference to ordinary criminal investigations. Today, this complexity is amplified not only by the deployment of new technologies across modern warfare and decision-making at all levels, but also by advanced forensic practice, both of which allow access to an incommensurably wider set of information regarding the crime scene.

Most importantly, current major conflict scenarios demonstrate that war-crimes allegations serve as a powerful weapon in the war of narratives at the strategic level.

In this framework, a credible and fit-for-purpose forensic capability in support of war-crimes investigations – beyond merely a disciplinary or judicial perspective – serves as a vital tool for Commanders in the war of narratives, whether to unveil and prove the opponent's criminal behaviour or to deny, based on factual evidence, allegations of criminal behaviour by their own troops.

A limited forensic and investigative capability exposes the Force to the risk that, over time, groups of freelance forensic experts – such as an NGO or a popular investigative journalism firm, both with access to resources and advanced scientific skills – could execute a much more thorough investigation and disprove official findings.

The damage to institutional credibility would typically be enormous, yielding consequences that could endure for decades and range from accusations of ineptitude to allegations of complicity.

* Colonel of the Italian Carabinieri Corps and Director of the Stability Policing Centre of Excellence (NATO SP COE), in Vicenza. E-mail: director@nspcoe.org.

Observations conducted by the NATO Stability Policing Centre of Excellence on ongoing conflicts suggest the adoption of a different approach – a more structured one that goes beyond the simple programmatic inclusion of a theoretical capability within the “competence” of one or more units.

A potential approach to better meet modern investigative challenges, an insight that seems to emerge from the Observatories activated by the COE, would be a NATO standing investigative capability. This asset could be framed within the category of existing units (as an example, the Stability Policing Unit has the flexibility and structure from a police capability perspective to be tailored for this task), and this dedicated body could possibly operate independently of the ordinary NATO capability dynamics, belonging to the NATO Force Structure as a strategic asset.

This structural approach might well be encompassed within the concept of a NATO Constabulary Force – a possibility outlined by Ms. Charlotte Hallengren, NATO Director for Operations within the Operations Division of NATO International Staff, in her welcome speech on the occasion of the NATO SP COE 2024 *Diamond Event*¹. In the long term, such an approach could enable the creation of the capability and credibility needed to confront the complexity of war-crimes investigations and the challenges of confrontation in the global arena.

2. New Complexities, New Forensic Techniques

The investigation of war crimes and crimes against humanity, especially during an ongoing conflict, carries a set of complexities that make this kind of activity substantially different from and much more challenging – bordering on impossibility for a traditionally organized police unit – than a traditional investigation.

Particularly, from a forensic perspective, a “crime scene” in the context of an open warfare battleground might reach levels of extreme complexity for three basic reasons:

- due to its *magnitude*, meaning the physical extent of the crime scene, and the number of *factual elements* that must be observed and recorded from a forensic perspective;
- subsequently, due to the *enormous amount of data* – and potentially crucial clues – made available to the investigators for collection, interpretation, preservation, and context analysis, also thanks to the availability of new technologies;
- due to the *limits and constraints* that an ongoing conflict represents for the forensic team, where the preservation of the crime scene and the accurate, procedural collection of all relevant information from it inevitably collide with the evolution of the tactical situation on the ground and the connected risks for the investigators.

¹ C. HALLENGREN, *Welcome Address: Implications for NATO Constabulary Forces and Standing Strategic Investigative Assets* (speech, NATO Stability Policing Centre of Excellence Diamond Event, Vicenza, Italy, 2024), in NATO Stability Policing Centre of Excellence, *Stability policing within NATO: Rethinking the paradigm to address future security challenges – 2024 Diamond Event report*, pp. 12-25, NATO SPCoE, <https://www.nspcoe.org/books/>.

These complexities are acutely amplified within contexts that are composite by definition, such as the urbanized environment. From this perspective, an extremely complex and urbanized battleground might well represent the epitome of the difficulties connected to the investigative endeavour.

For the purposes of this article, I will not refer to criminal investigations involving single violations of the applicable law that might easily fall, from a forensic perspective, into the general category of ordinary crime (e.g., a murder of a specific civilian/prisoner of war, committed in a specific timeframe and physical context, such as a prison or a specific building; these crime investigations can be definitely compared to traditional criminal investigations, particularly from a forensic perspective). Instead, the subject of these considerations will be the peculiar type of collective conduct relevant from a war crimes and crimes against humanity perspective. This conduct is characterized by a systemic set of institutional behaviours, connected to each other through a specific formal or informal decision-making process. Their effects might lie on a large scale (at the strategic or operational level; policies and guidance, or “General Orders,” fall under this category) or a small scale (at a tactical level, such as the decision of a specific field command), and they may be either repeated across an extended timeframe or limited to a single event.

This type of crime carries the highest level of complexity, both from the investigators’ and forensic perspectives, to the point where the skill set required to carry out this kind of enquiry might well be compared to that required for organized crime investigations².

At the same time, here lies a higher risk of a strategic setback for the Military Force, in case of failure or inadequacy of the ordered or conducted investigation, from a credibility and therefore strategic narrative perspective.

To summarize, investigating war crimes and crimes against humanity within the context of conflict defines a framework where extreme complexity – almost unbearable given the skills and resources of an ordinary criminal investigation team – corresponds directly with a high risk of strategic repercussions in the event of failure or simple mistakes.

A typical war-crimes scene, characterized by the mentioned level of complexity, would be *flooded* with data and raw information. These elements must be analysed and correlated with each other, with the objective of describing every aspect of a single incident – or the many incidents belonging to the investigation – that might reveal criminal behaviour at a *systemic level*.

As an example, some press agencies report that in the first 200 days of the Israel-Hamas conflict, approximately 75,000 tons of explosives were dropped on the Gaza Strip³. Given the average payload of the type of bombs utilized in the conflict, it is

² This position has been expressed, in particular, by Mr. Vladimir DZURO, former investigator of the International Criminal Tribunal for the former Yugoslavia ICTY, in occasion of the 2024 edition of the “*Crime Investigation Forum*”, 5-9 Feb 2024, in Bydgoszcz, Poland.

³ Anadolu Ajansi, Al Jazeera, among others.

therefore possible to roughly assess that at least a comparable number of distinct “incidents” took place. From an analytical perspective, each one of these incidents could potentially be investigated not as isolated events, but as a part of a comprehensive behavioural pattern that represents the ultimate focus of the investigation.

In fact, each one of those incidents would yield a significant amount of information, capable of unveiling the characteristics, magnitude, timing, objectives and contingencies of each event.

This information – or disparate pieces of evidence – might take the form of eyewitness and survivor testimonies, open-source media recorded on the scene, or specialized infrastructural, ballistic, chemical, and biological analyses.

It is in fact important to acknowledge that complex inhabited environments – such as urban contexts – are able to “register” happenings within their very infrastructure, functioning as a sort of metadata storage. This scattered metadata is available to investigators, thanks in particular to modern technologies and the application of advanced scientific methodologies. The problem, as said before, remains the sheer magnitude of the information flow available to investigators and the advanced skills required to detect, catalogue, and analyse those disparate pieces of data.

In the contemporary legal and technological landscape, military and governmental authorities can no longer easily conceal systemic criminal behaviours; however, exposing these violations ultimately relies on the political will to enforce International Humanitarian Law.

This is not science fiction. On these premises, an entirely new forensic method christened “Forensic Architecture”⁴ has been developed and tested by a group of architects and engineers for the exact purpose of investigating – or more precisely, counter-investigating – war crimes⁵. This approach synthesizes all the infrastructural, visual, atmospheric, acoustic, geological, biological, chemical, physical, and human data collected from the field. By linking these elements to a specific event or chain of events, investigators reconstruct a historical narrative backed by forensic evidence, collected, analysed and developed with a forensic level of certainty, meeting the requisite standards for utilization in criminal trials.

Forensic Architecture – originated through the initiative of an Israeli-British architect, Eyal Weizman, founder of the eponymous NGO⁶ – serves as just one example of highly developed, multi-disciplinary approaches to forensics in the scientific investigations landscape. *Forensic Architecture*, both as an NGO and as a technique, has been involved in numerous investigations across many conflict areas, operating at the request of private or official international bodies or on its own initiative.

⁴ A different form of “forensic architecture” was developed in the 70’-80’s of last century, more for the purpose of supporting lawsuits on engineering failures. This *new* forensic architecture, despite sharing the name with the existing one, clearly focus on a totally different remit.

⁵ E. WEIZMAN, *Forensic Architecture: Violence at the Threshold of Detection*, Zone Books, New York, 2017, pp. 19-22.

⁶ E. WEIZMAN, *Forensis: The Architecture of Public Truth*, Sternberg Press, Berlin, 2014, p. 9.

3. An Example of a New Approach: *Forensic Architecture*

To illustrate the level of sophistication of their activities, alien to typical law enforcement methods, *Forensic Architecture* analysed an incident that occurred in the southern part of the Gaza Strip in 2014. On the occasion of this investigation, the team studied the shape and characteristics of *bomb clouds* generated by an Israeli bombardment⁷, utilizing numerous photographs and video frames recorded during that specific timeframe.

This activity enabled investigators to compile an archive of these bomb clouds and study them systematically, utilizing sophisticated technical expertise in fields such as ballistics, fluid dynamics, physics, and 3D modelling.

Because these bomb clouds altered their shape in a highly unique and consistent manner, they functioned as a form of *metadata* – serving as “indicators of an image’s time/space coordinates”. Using this framework, it was possible to synchronise and sequence many of the collected images from that specific 24-hour timeframe as the investigators constructed their narrative⁸.

To achieve this, the NGO revived a nineteenth-century science known as “nephanalysis”, which is defined as “the study of cloud form, types and movement”⁹, adapting its principles directly to modern forensic techniques.

The clouds observed and studied in Gaza were not caused by weather, although they interacted with it. The relevant expertise was not meteorology, but *blast engineering* and *fluid dynamics*.

This constantly evolving bomb cloud created a unique “fingerprint” that was determined by “the materiality of the target and the ammunition used to destroy it”, as well as localised micro-atmospheric variables including humidity, temperature variations, wind direction, and wind speed at varying altitudes¹⁰.

The investigators, in this particular case, carefully classified and grouped each cloud by its stage: blast, upward-moving columns, mushrooms, and dissipations.

This allowed investigators to estimate, with remarkable precision, how long after the explosion each photograph was taken. Furthermore, unique structural irregularities within each bomb cloud enabled them to cross-reference and identify the same clouds across different images. Some of these clouds were subsequently modelled volumetrically to establish the precise angle from which the images were captured¹¹.

In summary, the bomb cloud analysis in this specific case made it possible to locate each blast both spatially and temporally, ultimately allowing investigators to anchor raw media assets to testimonial evidence collected elsewhere.

⁷ Forensic Architecture and Amnesty International, *Rafah: Black Friday in Gaza*, 2015, <http://www.forensic-architecture.org/case/rafah-black-friday/>.

⁸ *Ibid.*

⁹ E. WEIZMAN, *Forensic Architecture: Violence at the Threshold of Detectability*, cit., p. 191.

¹⁰ E. WEIZMAN, *Forensic Architecture: Violence at the Threshold of Detectability*, cit., pp. 191-196.

¹¹ *Ibid.*

This complex and indeed time-consuming activity enabled investigators to reconstruct a detailed chronology of events across a 24-hour window, ensuring the precise spatial and temporal mapping of each incident. Considering that these military actions had caused dozens of casualties, this kind of rationalization of the “cloud of war” was essential to define roles and responsibilities for each event and track the whole battle in its evolution through time.

However, this remains just one example of how critical data useful for a war-crimes investigation can be uncovered through highly improbable or non-traditional forensic techniques.

Another unconventional technique utilized to reconstruct a combat incident involved identifying tank tracks through satellite imagery¹².

This analysis leveraged the tendency of armoured units in that specific conflict to avoid predictable roadways. By manoeuvring off-road, the vehicles systematically crushed local vegetation. Utilizing appropriate imagery filters to trace these paths of crushed vegetation backwards, investigators were able to locate the staging areas of the tank crews prior to an attack¹³.

These findings served to raise credible suspicions that local civilian settlements were being utilized as “human shields” to protect the staging baselines of an attack from the risk of counter strikes by the opponent.

In 2016, *Forensic Architecture* collaborated on an investigation commissioned by *Amnesty International* regarding a Syrian detention facility where regime opponents were allegedly detained, tortured, and executed¹⁴. The investigators successfully reconstructed the interior spaces of the facility by cross-referencing satellite imagery with the “acoustic reconstruction”¹⁵ provided by former detainees.

This operation was uniquely challenging because all the prisoners interviewed were constantly kept blindfolded, preventing any of them from visually mapping their surroundings. Ultimately, in March 2017, investigators submitted their findings to the German Federal Prosecution as part of a universal jurisdiction case against the Syrian leadership¹⁶.

The physical reconstruction of the interior of the detention facility was necessary to geo-locate each testimony, and therefore to assign credibility *in court* to their narrative¹⁷.

On the occasion of another investigation carried out in a different geographical quadrant, *Forensic Architecture* was able to reconstruct the exact positions of victims following the bombing of a civilian residence. By mapping all identifiable blast traces on the inner walls of the building, investigators were able to reconstruct the trajectories

¹² E. WEIZMAN, *Hollow Land: Israel's Architecture of Occupation*, Verso, London, 2007, pp. 185-87.

¹³ *Ibid.*

¹⁴ Amnesty International and Forensic Architecture, *Saydnaya: Inside a Syrian Torture Prison*, London, 2016.

¹⁵ J. E. K. PARKER, *Listening about law in the sonic arts*, in *Routledge Handbook of International Law and the Humanities*, Abingdon, Oxfordshire, 2021, pp. 104-118.

¹⁶ *Ibid.*

¹⁷ *Ibid.*

of individual pieces of shrapnel to isolate the exact detonation point – much like traditional forensics handles a single firearm shot. This full-scale reconstruction of the targeted room enabled the team to determine where individuals were likely positioned at the moment of the blast. This analysis relied on tracking fragment distribution across the walls, where identifying “areas of lower density” made it possible to “3D locate the bodies” that had absorbed the flying debris¹⁸.

These cases serve as prime examples of a level of complexity driven not only by the unique nature of modern crime scenes, but also by continuous evolution of forensic and scientific detection techniques.

Indeed, architectural elements almost bear witness to an event; their “metadata” stems from the shocks they absorb across highly diverse and sophisticated scientific domains, including acoustic, thermal, physical, chemical, and seismic dimensions¹⁹.

Nevertheless, this level of analysis still refers to the reconstruction of single incidents.

While highly relevant from a criminal investigation perspective, the true utility of this forensic approach lies in its capacity to “connect the dots” across a multitude of analysed incidents, categorizing them by their specific characteristics.

This approach is demonstrated in other investigations carried out by the NGO. By focusing on the unique operational signatures or “trademarks” of a specific type of attack – whether implying the use of drones or the deliberate targeting of civilian infrastructure – investigators were able to successfully identify patterns of behaviour, unveiling a possible, coherent strategy that appears non-compliant with International Humanitarian Law.

In fact, as mentioned by Eyal Weizman, “to understand an incident, it is necessary to locate it in the world of which it is a part”²⁰.

Independent of the origin or application of the mentioned techniques, what is relevant to the purpose of this paper is the acknowledgement that traditional forensics is currently unequipped to manage the complexity and magnitude of a modern war-crimes investigation with this level of sophistication and multidisciplinary depth. Conversely, within the private sector, this comprehensive approach is already highly developed and utilized.

Consequently, this disparity poses a direct risk to the credibility and legitimacy of the Force. If traditional – and limited – investigations mandated by military or official institutions can be easily discredited or proven inadequate by private entities such as NGOs or investigative journalism firms, their institutional authority is severely undermined.

From the perspective of the observer, the critical takeaway is that the forensic investigation of large-scale war-crimes scenes requires a combination of skills,

¹⁸ E. WEIZMAN, *Forensic Architecture: Violence at the Threshold of Detection*, cit., pp. 42-43.

¹⁹ T. KEENAN, E. WEIZMAN, *Mengele's skull: The advent of a forensic aesthetics*, Berlin, 2012.

²⁰ E. WEIZMAN, *Forensic Architecture: Violence at the Threshold of Detection*, cit., p. 221.

professional expertise, and technical resources – particularly in data processing – that far exceed the capabilities of traditional, ordinary forensic units.

To some extent, these investigations can be compared to investigations into major civilian disasters, such as airplane crashes, which now routinely deploy specialized “Mass Disaster Identification Units” like the one established within the Italian Carabinieri forensic organization. In these scenarios, the primary factor that risks hampering the investigation – including basic victim identification – is the overwhelming volume of data to be processed, which includes an enormous amount of biological (DNA) and engineering data driven by the sheer physical scale of the crime scene and the highly complex dynamics of the accident.

By way of example, similar complexities are often encountered upon the discovery and investigation of mass graves.

In these cases, beyond the overwhelming volume of biological data, the primary complexity of the forensic investigation lies in the necessity of connecting that data to its surrounding context. This includes mapping the spatial relationships of the bodies or human remains, their layering within the grave itself, clothing and textile fragments found on-site, other materials or pieces of equipment, and the chemical composition and oxidation of the soil.

Currently, traditional forensics – whether civilian or military, considering the typical composition and equipment of a forensic team – is ill-equipped to manage the magnitude and complexity of large-scale war-crimes investigations.

This limitation does not stem from a lack of skills within an entirely new forensic discipline. As previously noted, even within *Forensic Architecture*, there is nothing fundamentally new from a scientific perspective. Rather, in the case of war-crimes investigations, the true challenge – and what is to some extent the primary limitation of traditional forensics – lies in the sheer volume of raw data that must be recovered and processed, alongside the highly advanced multidisciplinary expertise required to extract meaningful information and evidence from it.

Paradoxically, as the *Forensic Architecture* experience demonstrates, the capability to conduct these sophisticated forensic investigations currently belongs to non-institutional actors. This is arguably true only on a small scale, as each investigation requires an immense amount of time, the cooperation of professionals in a multitude of scientific disciplines, and even the integration of artists utilized to reconstruct visual models of the crime scene to support the interrogation of eyewitnesses.

4. A Vulnerability for NATO Credibility: A “Policing Gap”?

In contemporary conflict environments, allegations of war crimes have emerged as a powerful weapon in the war of narratives at the strategic level.

As an *ethical* organization, NATO's respect for all applicable international laws – most compellingly, International Humanitarian Law – is a core institutional tenet.

Consequently, any potential violations demand immediate and thorough investigation, serving not only as vital counter-narrative measures but also as a mechanism to preserve the morality and integrity of military operations at all levels.

Within this framework, a credible and fit-for-purpose war-crimes forensic capability extends far beyond a purely disciplinary or judicial function. It has become an indispensable tool for Commanders within the war of narratives, allowing them to unveil and prove an opponent's criminal behaviour or decisively refute – based on factual evidence – unfounded allegations against their own troops.

However, recent history demonstrates that during military operations, war-crimes investigations are typically conducted using a *traditional approach*. This limits the search for evidence and data to a largely superficial layer, restricted to the expertise of standard forensic teams.

This limited capability exposes the Force to the risk that over time, subsequent, more thorough independent investigations can disprove the official findings.

The resulting damage to institutional credibility is typically catastrophic, with consequences that can reverberate for decades, ranging from accusations of ineptitude to allegations of complicity.

As previously noted, the chaotic nature of an active war zone directly compounds these challenges, severely limiting any attempt at a thorough analytical approach. This operational reality makes it virtually impossible for investigators to maintain the standard care and meticulousness that typically characterize peacetime forensic investigations.

In the contemporary landscape of the war of narratives, such a vulnerability is entirely unsustainable for an ethical politico-military organization like NATO.

Consequently, NATO must be equipped to deploy sophisticated, multidisciplinary investigative and forensic assets across the entire spectrum of conflict. These capabilities must possess the agility to operate within complex, non-permissive environments and be scaled to process data volumes that far exceed the capacity of traditional forensic units. Ultimately, their findings must reflect a level of thoroughness and reliability that matches the highest benchmarks of the international scientific and legal communities.

In other words, NATO Commanders must have access to an investigative capability offering a level of accuracy that would guarantee the undeniability of official findings, thereby securing the established strategic narrative.

This is an evolution that is not easily achievable, as it demands a radical shift in how forensics and war-crimes investigations are approached from a political, legal, and operational perspective.

First, NATO leadership must recognize the immense strategic messaging impact that results from a successful – or a disproven – investigation into war crimes. This reality dictates that any deployed NATO force, independent of mission type or geographical theatre, *requires* a realistic, advanced, and internationally recognized investigative and forensic capability. This asset serves as a vital deterrent to prevent

unlawful behaviour by NATO personnel, while simultaneously shielding the Alliance from disinformation campaigns by adversaries.

Furthermore, such a capability would serve as a mechanism to construct an effective, undeniable strategic narrative against the opponent.

NATO leadership must also realize the inherent challenge of establishing this capability as a multinational expression of shared political will.

This is not merely a matter of numbers. Integrating an advanced multidisciplinary approach demands a profound shift in mindset among the professional investigators and forensic experts ordinarily tasked with these operations (typically national Military Police units). Most importantly, it requires a collective acknowledgement of the fundamental insufficiency of this traditional approach and skill set.

Implementing this capability requires new protocols, procedures, collaborative frameworks, and cutting-edge technologies – including AI²¹ – all functioning together as a well-tuned and appropriately funded orchestra.

Ultimately, NATO's credibility as an ethical institution is directly at stake. A sustained conceptual and doctrinal investment in this sector might be crucial to sustain this posture that forms the very foundation of the Alliance.

5. Conclusion

The evolution of modern warfare has fundamentally transformed the investigation of war crimes. The stark asymmetry between the resources that military commands allocate to these crucial investigations and those deployed by private actors – such as NGOs or investigative journalism firms – exposes NATO to a significant vulnerability. Specifically, it creates the risk that inadequate investigative efforts may be discredited, yielding long-lasting consequences for institutional credibility, strategic messaging, and the Alliance's perceived adherence to International Humanitarian Law and all applicable legal and ethical standards.

To mitigate this vulnerability, NATO must recognize that war-crimes investigations are no longer a peripheral judicial function confined strictly to national jurisdictions, but a core strategic capability.

A credible, deployable, multinational, and multidisciplinary investigative structure – capable of operating across the full spectrum of conflict while matching the highest scientific standards – might be the answer. This asset must be fully harmonized with the national regulations that currently govern war-crimes investigations, supported by new protocols, new technologies, new professional cultures, and sustained investment.

In the contemporary, fast-evolving technological and scientific landscape, NATO cannot rely on traditional, fragmented forensic models.

²¹ J.D. ARONSON, *Computer Vision and Machine Learning for Human Rights Video Analysis: Case Studies, Possibilities, Concerns, and Limitations*, in *Law & Social Inquiry*, 2018, n. 4, pp. 1188-1209.

Building a standing, fit-for-purpose investigative capability is not merely an operational enhancement; it is a strategic necessity to safeguard legitimacy, reinforce ethical commitments, and ensure that the Alliance's actions – and the truth about them – remain undeniable.

ABSTRACT: Modern war-crimes investigations feature an unprecedented level of complexity, amplified by advanced technologies and sophisticated forensic practices. In contemporary conflicts, war-crimes allegations also serve as powerful weapons in strategic narratives, making a credible forensic capability vital to verify or refute claims. However, traditional military and institutional forensic teams are not equipped to process the massive volumes of multidisciplinary data generated on modern urban battlegrounds. This creates a critical paradox: independent NGOs and private investigative firms utilize cutting-edge, non-traditional techniques to conduct superior and more effective investigations and counter-investigations. To resolve this paradox, NATO must recognize war-crimes investigations not as peripheral, only-national functions, but as core strategic capabilities. The Alliance should establish a permanent, deployable, multinational standing investigative asset, potentially integrated into a NATO Constabulary Force or a Stability Policing framework. Supported by modern protocols, multidisciplinary expertise, reliable academic networks and emerging technologies, this dedicated capability would ensure that official findings match the highest scientific and legal standards and credibility, effectively safeguarding NATO's ethical legitimacy and guaranteeing the undeniability of its strategic narrative.

KEYWORDS: War-Crimes Investigations – NATO – Forensic Architecture – Strategic Narrative – Stability Policing.