# Investigative Team to Promote Accountability for Crimes Committed by Da'esh (UNITAD)



## Harnessing Advanced Technology in International Criminal Investigations

Innovative Approaches in Pursuit of Accountability for ISIL Crimes



#### Foreword



The collection and preservation of evidence related to ISIL crimes presents a variety of challenges, but with these challenges comes opportunity. The criminality of Da'esh, and the quantity and variety of the evidence left behind, necessitated new thinking and new investigative approaches. UNITAD needed to chart new ground, and I was determined that innovation and advanced technology must supplement more established approaches to grappling with mass data sets and vast quantities of documentary, video, photographic, electronic and testimonial evidence.

The resources available to us today, if harnessed properly, can bring about a paradigm shift in how we approach international criminal investigations: integrating technology not as a stand-alone platform but as an integrated process focused on organisation, screening and analysis of evidence. This approach has been at the heart of the UNITAD model. Allied to these innovations, our partnerships with the UN family, as part of the Secretary-General's vision of "One UN", as well as with civil society, private sector entities and philanthropic organizations have allowed us to draw on an extensive range of expertise and resources.

UNITAD has sought to leverage modern technology in every aspect of our work, whether by designing innovative solutions in-house or partnering

with leading technology companies like Microsoft Corporation. Access to advanced technology, however, only gets us so far. It is the expertise of our staff to implement and refine the technology that matters most. I could not be more proud of the staff in UNITAD, who have not only embraced and encouraged this approach, but who have also mastered the technology in a way that has truly advanced our investigations. The opportunities remain limitless.

It is my hope that this publication not only demonstrates some of UNITAD's more innovative approaches, but also serves as a resource for national and international authorities who are seeking to leverage technological innovation in their investigations. Most importantly, I look forward to seeing the continued impact of these innovations on our collective efforts to deliver accountability for ISIL crimes and secure the right of victims and survivors of Da'esh crimes to their day in court.

Karim A. A. Khan QC, Special Adviser and Head of the Investigative Team



UNITAD Called to Tackle Complex Task of Collecting, Storing and Preserving Evidence of ISIL Crimes in Iraq



The liberation of large areas of Iraq from the control of ISIL served to expose the magnitude of the crimes inflicted on the Iraqi community. First-hand accounts revealed widespread abuses committed against the populations under ISIL control, including executions, torture, forced displacement, rape, sexual slavery and child recruitment.

In 2017, in a landmark response to the calls for justice for the victims of ISIL crimes, the United Nations Security Council, at the request of the Government of Iraq, unanimously called for the establishment of the United Nations Investigative Team to promote accountability for crimes committed by ISIL/Da'esh (UNITAD). In October 2018, the Team began its activities in Iraq to implement its mandate to support domestic accountability efforts through the collection of evidence of ISIL crimes in Iraq in line with international standards. This is a task of unprecedented scale and complexity. Vast quantities of evidentiary material exist, including documentary, testimonial, forensic and digital evidence, often extracted from captured ISIL devices.

In addition, ISIL left behind a crime scene covering 56,000 square kilometres of Iraqi territory, including more than 200 mass graves containing the remains of thousands of victims. The complexity of evidence-collection activities, coupled with an urgency to hold perpetrators accountable, has required innovation and new investigative approaches. Since its inception, UNITAD committed to leveraging the latest advances in technology and investigation techniques to ensure that its work is carried out in the most efficient and timely manner, and in accordance with the highest standards.

"The world has changed and, necessarily, so has our approach to investigations. The urgency of the task required a new way of thinking and an openness to embrace new technologies."

## **Components of an Investigation Journey Map**





### The Challenge: Vast and Growing Evidence Sources Require Innovation

The enormity of the data involved cannot be overstated. UNITAD is investigating, examining and analysing thousands of laptops, external hard drives, mobile and satellite phones, drones and other data-storing devices comprising millions of heterogenous file types, much of it encrypted. Millions of call-data records obtained now require analysis. Nearly half of the processed data consists of image and video files, posing additional access, analysis and storage challenges.



The harnessing of evidence contained in mass graves presents its own challenges, requiring advanced methods and tools. This includes the collection and



analysis of geospatial and imagery data, DNA profiling and matching, creating analytical reports and collection of data from other evidence sources.



The vast majority of documentary evidence is in Arabic and a significant portion is in Kurmanji, languages that are not well supported by most forensics and e-discovery products on the market. Many of the paper docu-

ments contain a significant amount of Arabic handwriting, which is not easily converted into searchable text by currently available text-recognition technologies.

Adding to the challenge is that much of the evidence is recovered from the battlefield. Electronic devices are often damaged and not operational, complicating data access and often requiring advanced methods of data extraction. Paper documents are acquired in unstructured form and often physically damaged.





Finally, ISIL used the public-facing web to incite and recruit, requiring open-source intelligence and forensic collection of web pages, online videos and social media feeds.

ISIL's use of encrypted messaging platforms such as Telegram and WhatsApp to communicate and share information provides further evidence-collection challenges.

To address these evidentiary challenges, UNITAD has sought out and implemented new and advanced technologies to collect, preserve, store and analyse evidence of ISIL crimes in accordance with the highest standards and with the ultimate goal of providing this evidence for use in domestic criminal proceedings to hold ISIL accountable for their crimes.



#### Harnessing Innovative Technology Advances UNITAD's Capacity and Capabilities at Scale

"We've broken a lot of new ground. We're using technology in a way I've never seen the UN use. A lot of what we have done will be models for the UN moving forward."

#### Thomas Lynch, Director of the Office of Evidence Management

In conducting its investigations using scientifically backed and evidence-based approaches, UNITAD immediately sought technology-assisted solutions to best identify, collect, track, store and analyse evidence. Given that no tools on the market existed to meet its unique needs, UNITAD had to develop tailored technologies in support of its work.

UNITAD's framework is specific to the task in Iraq, yet may serve as a model for other investigations facing similar data-management and forensic challenges. UNITAD's approach demonstrates how partnerships and advanced technologies can be leveraged to accelerate investigation of atrocity crimes in ways that preserve the historical record, while giving a voice to survivors and their communities.

Customised systems sit at the heart of UNITAD's investigative framework, connecting an ecosystem of technologies that enables the Team to carefully document evidence while storing it in a dynamic format, where new information establishes connections between criminal acts and actors. When UNITAD's Office of Evidence Management looked at current models and historical approaches, it soon realised that traditional and off-the-shelf systems fell short in terms of capabilities, cost and time to implement.

"When our team arrived in Baghdad in September 2018, we were faced with unparalleled challenges: extensive and geographically dispersed crime scenes; extraordinarily large volumes of complex data; and the exigency to deliver our mandate to the highest international standards", recounts Karim Khan. "This forced us to think outside of the box and the result has been innovative and scalable solutions that accelerated the delivery of UNIT-AD's mandate. Our approach took less time, cost less and is effective and adaptable."



Karim A.A. Khan QC, Special Adviser and Head of the Investigative Team



"Our initial inclination to implement existing technologies gave way to the incredible benefits we saw in building custom solutions. We needed tools that could talk with other tools and we wanted something to manage all investigation, analysis and evidence-management processes in one place. The result is a more comprehensive system that is at the same time cost effective and flexible."

#### Paul C. Easton, Officer in Charge of the Information and Evidence Management Unit

From the outset, UNITAD needed an evidence-management platform that would protect the independence and integrity of its investigations while ensuring the utility and usability of the evidence in potential criminal proceedings. This required a system to track evidence throughout the investigative process from source development and field-investigative activity; through evidence collection, transfer, storage and processing; to evidence analysis, review, production and submission. To accomplish this,

the system or systems needed to interact and share data with each other.

In seeking to establish its technological infrastructure, the Team looked for a system or set of tools that seamlessly integrated investigation tasks with traditional evidence-management activities, forensic and e-discovery work, storage tracking and management of requests for information. Rather than drawing on commercial solutions piecemeal, UNITAD developed its Evidence Lifecycle Management System (ELMS) in-house, using a low-code database platform to build a bespoke system.



ELMS is adaptable in its customisation, allowing investigators and analysts to electronically manage workflows, track sources and record all activities and communications related to those sources. In addition, ELMS works both on-premises and remotely in the field using a mobile application, allowing for greater flexibility, mobility and efficiency.

UNITAD procured, developed and deployed ELMS within three months for a small fraction of the cost when compared to similar solutions used by other UN entities. Because ELMS was created in-house, the Information Systems Unit can make changes when necessary and create custom workflows as investigations advance. ELMS has the added benefit of working with other digital tools yet operates as a single system that is accessible for end users. The system is centralised and searchable, featuring automated workflows and supporting standardizations developed by UNITAD and consistent with international

## ELMS (cont.)

As its name implies, ELMS manages evidence through its entire lifecycle and assures that all relevant evidence is collected and stored in a manner consistent with international standards. This begins at the source, tracking all source development, investigation, forensics, e-discovery and analysis tasks related to UNITAD's mandate.

ELMS captures evidence intake and registration, including by investigators in the field with its companion mobile application. In keeping with the highest international standards, ELMS reliably documents chain-of-custody in an auditable format and records the location of physical and digital evidence. This careful tracking and activity logging continues through electronic discovery and the management of incoming and outgoing information requests.

Using QR-code labelling and scanning, with plans to implement radio-frequency identification technology, evidence is tracked when moved into or out of UNITAD's evidence room. The room itself is climate controlled and secured with biometric locks and CCTV cameras. The system also manages forensics and evidence-analysis tasks, and includes dashboards, visualisations and reporting features.

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The ELMS mobile app enables investigators to register evidence in the field.



## SHUHUD: Accessible Crime Reporting **Empowers Iragis to Bear Witness**

"SHUHUD is our guarantee that no matter the operational conditions on the ground, our teams are able to engage with affected communities, ensuring the progress of investigations."

#### David McIntire, Head of Crimes Against Minorities Investigation Unit

In its effort to conduct comprehensive investigations into ISIL crimes in Iraq, UNITAD undertook an initiative to ensure all affected individuals and communities could provide their accounts, regardless of their location. Such an initiative needed to have a broad reach, be easy to access and be easy to use. This led to the development of SHUHUD: a trilingual, web-based, mobile friendly crime-reporting tool. Using smart forms in Arabic, English and Kurdish, investigators can receive written accounts. photos and documents using a process that is convenient, highly secure and confidential.

SHUHUD enables the collection of stakeholder evidence in an accessible way that helps keep those most impacted by the crimes of ISIL at the centre of investigation efforts. It is fully integrated into UNITAD's investigative process, creating another core channel for crime reporting by survivors and witnesses in remote areas who may have difficulty meeting with investigators in person. Witnesses may submit statements via SHUHUD at anv time, regardless of their physical location, using mobile devices or personal computers. To date, 79% of information received via SHUHUD is data previously unreported to any other entity, as indicated by the submitter.

Notably, there is no software to download or retain on a respondent's device, a key feature that assures privacy and security. Community members reporting information via SHUHUD can be assured that no residual indications of their submission to UNITAD are retained by SHUHUD on their device. This approach appears to have resonated. Of the app users, 25% are female and SHUHUD has

already facilitated



We are all witnesses. We are all SHUHUD.

Scan to go to SHUHUD.



reporting of valuable information linked to more than a dozen forms of international crime alleged to have been committed by ISIL in Iraq.

A team of dedicated Arabic and Kurdish speakers review all submissions to assess their veracity and relevance to the mandate of the Team. Receivable submissions are assigned to field investigators for further review and outreach. Where appropriate, specific information sources are then integrated into investigation plans, leading to a wide range of investigative activities, such as initial witness-screening and interviews, witness protection, psychological evaluations and evidence collection.

SHUHUD enables a sophisticated understanding of the origin and type of information and evidence being submitted. This, in conjunction with data from other collection channels, helps investigation teams ensure the widest possible engagement with victim and survivor communities. Arriving via SHUHUD in a largely structured format, key data is rapidly processed by UNITAD's analytic suite to support decision making, resource prioritization and investigative activity.

To increase stakeholder participation, UNITAD is conducting regular community outreach campaigns on social-media channels, broadcast networks and through

## SHUHUD (cont.)

paid media placements. In-person training sessions have also been provided to non-governmental and faith-based organisations in order to support its use by local communities.



SHUHUD is available from the UNITAD website, accessible by any Web browser on a computer or mobile device.



Submitting an incident is a simple two-step process: first, the witness selects a language (Arabic, Kurdish or English) and agrees to the informed-consent language. Next, the witness is asked to complete a form providing information about the incident, including when and where it occurred, the type of incident and other details.



Witness can indicate locations of incidents by clicking/tapping on a map.



An admin dashboard provides investigators with statistics on submissions, including: incident types and locations, victim ethnicity and religion, consent to contact and other information.



## A Holistic and Tech-Driven Approach to Mass-Grave Investigations

To date, more than 200 mass graves associated with ISIL crimes have been identified. UNITAD supports Iraqi authorities in their investigation of mass graves, helping ensure that the grave is examined as a crime scene, while maintaining respect for the victims and their surviving families. UNITAD has provided Iraqi authorities with equipment, technology and training to enhance the use of forensic evidence in judicial proceedings and accelerate the recovery and DNA-based identification of victims. Witnesses often provide the first clues to the location of a mass grave, either through direct testimonial accounts or via SHUHUD. But confirmation of the location can be complicated by many factors, including remote settings and environmental changes over time. A technology-driven approach is critical in ensuring excavations are completed in a manner that allows for the collection of evidence in line with international standards, while also ensuring that excavations can be completed quickly and discreetely.

#### A Strategic, Integrated Approach — Using Advanced Technology to Better Inform Strategy and Understand Site-Formation Processes



Satellite imagery from during or just after the event enables the identification of perpetrator activity on the landscape and aids the development of excavation strategies through a better understanding of site-formation processes.



Validation on the landscape is enabled through reconnaissance missions and site assessments, developing further lines of inquiry and validating witness testimony and information gathered during the desk-based assessment phase.



The use of terrestrial laser-scanning technology can produce micro-topography surveys quickly and to a high level of accuracy. This again enables UNITAD to capture large amounts of data efficiently during the site assessment phase.



The millions of points that are gathered in the field are registered in post-processing software, enabling the production of large point cloud data sets that can then be analysed using other geospatial software packages.



Further analysis allows the Team to break out valuable metrics from the topographical survey data. Developing new lines of inquiry and possibly changing our understanding or assumptions about the way the site was formed. This valuable analysis can determine how we proceed with Phase II excavations and vastly increase our understanding of the site. By breaking down the scanner data into point clouds, the data can be transformed into highly useful vector data sets that can be easily analysed in geographical information systems. Conducting spatial and 3D analysis can extract useful insights into site-information processes and the development of the forensic landscape.

#### Mass-Grave Investigations (cont.)

UNITAD uses satellite imagery and geographical information systems (GIS) technology to evaluate the information it receives from human intelligence. The investigation then moves to on-the-ground validation, again using GIS technology, but also real-time capture of imagery. For example, Insta360 Pro cameras can be used to lock in landscape features to compare with ISIL videos of victims. Finally, the crime scene is fully recorded, including the use of 3D laser scanners to record topographical features, reconstructions of the crime scene, analysis of data to develop metrical data sets and patterns of earth movement related to the construction of the grave and concealment of remains.

Vast amounts of geospatial data are aggregated during an investigation, potentially covering large geographic areas and long periods of time. GIS helps reconstruct the forensic landscape by layering multiple geospatial data formats



Image capture from UNITAD drone footage

within one environment. This enables investigators to extract unique, qualitative data through temporospatial analysis stored in a geo-database. These platforms also enable investigators to work with and share data at an enterprise scale, where analysis from desk-based assessments can be shared directly with those investigators in the field and, conversely, provide mobile teams with tools for real-time capture of data on mission.

The analysis of geospatial data in a GIS can build new lines of inquiry and enable validation on the landscape. An important component of that validation is the use of satellite imagery. Temporal-changes are detected by analysing dated images. This allows investigators to identify significant changes to the landscape and cross-correlate that information to witness testimony and other evidentiary data sets. This helps accurately sequence events at execution locations, holding/detention centres and mass graves. The process also serves to eliminate events that pre- or post-date the investigation's scope.

Satellite imagery also helps isolate a geographic location by detecting ground disturbances. UNITAD drones then survey the area to confirm a site's precise location and/or spatial relationships between different landscape features and visualizations. This spatial data is critical to demining efforts, giving visual access to a suspected site where there is a risk of mines or IEDs.

Before and during an excavation, 3D laser scans of the site are taken, allowing for the creation of accurate 3D models of the grave. The models create a forensic landscape, preserving a digital signature of the site's attributes and



Creation of scale cemetery map with ID remains geolocated to maintain chain of custody with the return of remains to Kocho.

enabling in-depth analysis. This further analysis identifies spatial relationships, the break of slope and patterns such as earth moving by heavy machines or excavators that reveal a complete picture of the grave and possible insights into how victims were killed and buried.

UNITAD also works with Iraqi authorities in support of victim identification. In this regard, the Team has procured, and donated to Iraq, a Disaster Victim Identification System also known as a Plass Data System, in addition to providing training on that system. This internationally recognized software offers state-of-the-art processing of data relating to missing persons and dead bodies.

Recognizing that DNA testing is crucial to establish robust scientific identifications of human remains, UNITAD



#### **Mass-Grave Investigations (cont.)**

remains committed to supporting Iraqi efforts to explore rapid-DNA profiling technology through the provision of rapid-DNA instruments and related training. The Team has worked closely with the rapid-DNA company ANDE to deliver targeted support in this area.

DNA-based identification relies on matches between the DNA profiles generated from human remains and relatives of the victims. Profiles from bone samples are compared with profiles from blood samples of individuals with miss-



Analysis of the 360-degree images and stills from video in the forensic science lab.

ing family members. Sophisticated software searches are performed to identify possible associations and statistical calculations are performed to evaluate the strength of the evidence supporting or refuting possible relationships. DNA match reports are issued when the certainty of a specified family relationship reaches or exceeds 99.95%.

Through the combination of these technologies and in cooperation with Iraqi authorities, the Investigative Team seeks to ensure that forensic evidence from major crime

scenes is effectively drawn upon as part of domestic criminal proceedings and contributes to the prosecution of ISIL members on the basis of a diverse range of evidentiary material.



ANDE rapid-DNA technology has been provided to Iraq with associated training.

"There was a significant investment in technology and equipment, resulting in the commissioning of UNITAD's forensic science laboratory and its application in the field. Technology is a powerful tool when leveraged with human intelligence. By combining human intelligence with advanced technologies and modern equipment, we have strengthened evidence collection and analysis of the data."

Caroline Barker, Chief of the Forensic Archaeology and Anthropology Section

#### **Use Case: Leading from Behind**

#### Leading from Behind to Accelerate the Investigation of Mass Graves

From its inception, UNITAD has prioritized close working relationships with Iraq's medical and scientific communities. The technology and skilled talent available to UNITAD is being mirrored in Iraq and an extensive and comprehensive program to equip and train Iraqi counterparts is underway. Theoretical training in 3D laser scanning is augmented with field-based mentoring on complex mass-grave crime scenes and provision of data processing and storage capability to analyse imagery.

DNA-based identifications have been used to corroborate witness and survivor accounts, providing scientific, evidence-based links to sequence the executions of victim groups in Kocho. Mapping scientific results onto crime



scene reconstructions enables the creation of definitive time-lapse narratives of the crimes committed.

The scale and scope of ISIL mass-grave investigations in Iraq are extensive. The families of the victims want and deserve answers. The challenge is how to square the circle. Accelerating the technological and skilled talent locally available to collect, preserve and analyse the evidence is central in achieving this. Thanks to generous extra-budgetary contributions from Member States, UNITAD has provided equipment ranging from autopsy tables and crime scene kits to 3D laser scanners and access to two mobile, rapid-DNA machines.

UNITAD also constructed its own secure state-of-the-art forensic science laboratory in Baghdad, complete with advanced forensics tools, a decontamination room and rooms for evidence storage. Access to evidence is monitored biometrically and all access is part of the chain of custody. These advancements and processes further assure prosecutors and the courts that evidence was collected, analysed and stored in ways consistent with the highest international standards.



#### **Crime Scene Reconstruction Brings Evidence to Life**

Scene-reconstruction tools are used as a powerful companion to testimonial and other physical evidence. Using three-dimensional imaging, aerial drone photography and satellite images, investigators can create an interactive evidence-presentation platform and timeline of the events.

UNITAD investigators began capturing this physical forensic information in Sinjar and Mosul, where they took 3D scans, created 3D models, and then mapped locations that are key to constructing case files. These visual recreations are informed by traditional physical representations including newspaper articles; photographs of landscapes, buildings and mosques; blueprints; and other sources. This immersive picture of the crimes is a powerful way to visually demonstrate a crime scene or pattern of criminal conduct. Through this approach, victim accounts are corroborated by forensic and other data displayed in a visual format and digitally preserved. This creates an option for investigators and prosecutors to display visual recreations of these crime scenes and analyse the metric data even years later.

With these reconstruction and presentation tools, investigators can create—and importantly, preserve—accurate depictions of crimes through animation, video, and immersive, 3D, augmented-reality environments. The resulting depictions offer a unique perspective, especially when prosecutions are conducted years later, after landscapes and environments are fundamentally altered. The preservation of scenes in both remote and populous areas are critical for future investigators, prosecutors and courts to get a full picture of the crime and its impact on victims and their communities.

The recreations may in some cases eliminate the need to call witnesses, thereby protecting their identities and shielding them from re-traumatisation. They allow survivors' perspectives and experiences to be shared and complement their witness testimony without putting them in further physical or emotional danger. This is especially critical in remote areas where witness-protection capabilities are limited and would otherwise require uprooting survivors and witnesses to keep them safe.



"What's important is the combination of the evidence. The technology enhances even the most basic investigative techniques. Through its compilation, a more complete and accurate representation of the crime is revealed. By accessing all the data, judges will be able to navigate and query the crime scene as if they were there."

Xavier Laroche, Former Head of UNITAD's Forensic Science Unit

#### Crime Scene Investigations (cont.)

Building on the collection and analysis of visual assets such as 3D scans, geospatial data and drone footage, advanced evidence-presentation platforms can be used to create an integrated, virtual environment to both assist investigators in reviewing information collected and support witnesses in engaging with crime scenes. To this end, UNITAD has engaged with SITU Research, a visual investigations practice, in the development of a platform for the electronic presentation and analysis of the various types of evidence collected by the Team.



This project has focused on the incorporation of documentary, digital, forensic and testimonial evidence collected as part of the investigations by the Team into crimes committed by ISIL against the Yazidi community in Sinjar. By geographically marking each piece of evidence and integrating them into a spatial context, the Team can more effectively review and analyse evidence collected. With respect to crimes committed at Kojo Village, 3D laser scans of mass grave sites are integrated into drone footage collected of the village, while autopsy reports and DNA results of individual victims can be placed visually at the specific locations they are identified in the crime scene.

The utility of this platform is not just limited to the work of UNITAD investigators. A key challenge continually underlined by national authorities is their inability to access crime scenes in Iraq. Connected to this is the challenge



of communicating the gravity and scale of ISIL crimes to judges who have no visual or spatial frame of reference with respect to what is being described. By harnessing platforms such as those it has developed with SITU and making them available to domestic authorities, UNITAD is able to bring the crime scene to national courtrooms globally.





## Powerful Forensic Tools for Extracting Data from Battlefield Evidence

"There isn't an out-of-box playbook for what we are doing. We're collecting some of the world's most complex data everything from detonator phones, encrypted hard drives that are full of viruses and malware, to drones and radios captured on the battlefield."

#### David Hasman, Head of the Information Systems Unit

When it comes to evidence analysis, the sheer volume of data is not the primary hurdle. After all, a routine civil litigation might involve terabytes of data and include years of email exchanges and documents. However, the evidence base that UNITAD must contend with is not so structured or uniform. Evidence of ISIL crimes comes from varied and complex sources, such as paper records, mobile phones, memory cards, external hard drives and laptops.

Additionally, ISIL has used social media and the Internet to incite, recruit and showcase their crimes. Therefore, UNITAD needs tools to organise, translate and transcribe video and audio collected from the public-facing web, social media and personal devices. In many respects, this type of evidence is readily available, but the task is making sense of all it and determining how it fits together in building criminal cases. This is where modern technology, equipment and training can play a crucial role.

UNITAD employs highly skilled forensic experts who leverage the latest hardware and software to collect, extract and preserve data. For example, EnCase, FTK, Cellebrite, XRY and Tableau technologies are used to extract data from hard drives, computers, mobile devices and other electronic devices. VPER mobile kits allow for forensic acquisition of data in the field. Other software tools include Passware for encryption and password cracking; Griffeve DI Pro and Amped for image and video forensics; and Cedar audio equipment for enhancing, isolating and identifying voices. Potentially relevant data is further processed and analysed in Nuix and exported to the Relativity document-review system or IBM i2 for more advanced data analysis. These and other industry-leading digital-forensic solutions allow the Team to effectively extract and analyse data for use in investigations and eventual criminal proceedings.

Security hardened, isolated, ephemeral virtual-machine platforms, pre-configured with industry-leading digitalforensics tools, are used to conduct open-source intelligence (OSINT) and to find and capture evidence from the dark web. The use of specialised OSINT tools-including Hunchly, X1 Social Discovery and various open-source and in-house developed software-allows forensics officers to securely search for digital traces left by ISIL online and establish relationships between them and physical evidence collected by UNITAD. As accumulated, these linkages result in actionable intelligence that leads to the identification of possible perpetrators. Currently, the Forensic Science Unit is also equipped with data-analysis tools such as Nuix and IBM i2 that enable parsing and visualization of the collected data. Together, these technologies constitute an agile stack, flexible enough to meet the challenges presented by a complex data environment.

In addition to call logs extracted from captured mobile devices through cooperation with Iraqi authorities, UNITAD, with the support and facilitation of the Iraq government, has collected call-data records pertinent to ISIL crimes from mobile service providers. The analysis of call records provides valuable insight into the relationships and associations between persons of interest. By establishing communication patterns between perpetrators, and between victims, and by establishing the geo-locations of various persons of interest, call-data records enhance investigations by revealing relationships and connecting individuals to the locations of crimes.

#### ZETEO: Seeking Truth in a Sea of Data

Given the complexity and sheer magnitude of the data involved in UNITAD's mandate, the Team has sought ways to leverage the latest technological advances in machine learning, artificial intelligence and big-data analysis. More than half of the digital evidence collected is in video and image formats and nearly all text and audio is in Arabic, which needs to be translated for investigators, analysts and for use in criminal proceedings.

UNITAD found the professional and technological resources it needed in the form of partnerships and collaborations with a multidisciplinary team from UN entities and private sector businesses, notably Microsoft Philanthropies, e-discovery industry leader Relativity, the United Nations International Computing Centre and the United Nations Office of Information and Communications Technology.

Working with a team of technology experts fully engaged in creating a cutting-edge solution, UNITAD developed Zeteo, a custom enrichment pipeline for electronic data using the latest in artificial intelligence, Microsoft Cognitive Services, machine learning, facial recognition and identification, machine translation and image analysis. Zeteo, which roughly translates to "to seek and reveal", is a powerful system that learns and makes connections from the data it is fed. Before Zeteo's development, UNITAD processed its digital evidence using industry-standard forensics and e-discovery software. While powerful, these technologies lacked ways to extract insights from non-textual data or ways to search and find patterns in UNITAD's extensive volumes of image and video files. Investigators had very little information about the content of documents until they manually reviewed them. Even when Arabic text was properly recognized and extracted, it could not be used effectively because many investigators are not fluent in Arabic, and the volume made human translation cost prohibitive. Zeteo changes the paradigm.

With Zeteo, after initial processing, the data is further enriched using custom software and processes leveraging Microsoft Cognitive Services, PhotoDNA, video indexing, automatic speech recognition, optical character recognition and machine translation. This allows UNITAD to catalogue more fully everything from faces, voices and extracted audio and text to identifying emotional content, disturbing imagery and context.

The data and its enrichments are then automatically loaded into Relativity, where a custom review panel displays the data enrichments. For images, a human readable and







## ZETEO (cont.)

searchable description of the image is created based on identified objects. For images and videos, all faces are extracted and displayed, as are text descriptions of identified objects, and graphic and disturbing content is flagged.

Video and audio files are further enriched with text transcripts generated from automated speech recognition software, which investigators can search and view in the document viewer. This allows investigators to search all processed images, videos and audio files alongside all documentary evidence in UNITAD's holdings. Where further review analysis of videos and audio is required, the investigator can launch the original file from Relativity into Microsoft Video Indexer for playback. Specialised machine-learning processes can extract insights from video, including face detection, gender and age identification, transcripts and object and landmark recognition. The indexing includes contextualisation of images and video, labelling images identified as containing graphic and/or adult content. The video indexer also detects written text, including from license plates or street signs, and brand names on clothing or shop windows.

The information collected and assembled creates an unprecedented visual context for events over time in a format that can be reviewed and shared in an organised way. The result is a powerful tool to analyse and present evidence of atrocities in a manner that significantly contributes to



More than half of the digital evidence collected is in video and image formats and nearly all text and audio is in Arabic, which needs to be translated for investigators, analysts, and for use in domestic criminal proceedings.

## ZETEO (con't)



investigative narratives being developed by the Team. Zeteo is also a tool that continues learning and improving as information is added and verified. Facial recognition and cross-identifications can become more sophisticated. Machine-translation accuracy continues to improve as Arabic language experts regularly help train the system. Because of its use of machine learning, Zeteo will continue to improve, furthering the ability of investigators to search for individual names, locations and objects relevant to their investigations.



"We started with vast amounts of complex data from which it was challenging to produce meaningful analysis. We had to build systems to extract the information and make it work as one seamless application—whether that data was in the form of photographs, documents, video, or voicemail extracted from phones."

#### David Hasman, Head of the Information Systems Unit

Electronic-discovery tools are central to the investigative process, providing evidence storage, processing power, review and collaboration features, analysis, reporting and disclosure functionality.

The Team has sought to significantly enhance its own electronic-discovery capacities through the addition of cutting-edge, AI-powered capabilities of Zeteo. This has made it possible to cost-effectively review UNITAD's multimedia, multilingual data sets. But UNITAD remains faced with extremely large and dense data sets to process. Automation was the next piece in the puzzle.

The Team designed standardized processing workflows and specification templates for the various data sources it works with. It then automated those workflows. When working copies of collected evidence are put into the processing directory, the new data is recognized and automatically processed. After processing, load files are automatically exported and integrated into Relativity. Data which requires it, determined by pre-set rules, is automatically enriched by Zeteo and pushed into Relativity where it is now ready for human search and review. Automated workflows ensure e-discovery processing is done exactly to UNITAD specifications and that the work is well documented. It also helps onboard new team members more quickly and ensures that work can continue smoothly regardless of personnel changes. Especially valuable is the result for end users. While there is inevitable training involved, those preparing cases for prosecution benefit from these machine-driven enhancements and improved search capabilities. The systems were built to preserve evidence and records beyond the life of a case, with plans for archiving information well after information is passed to Iraqi authorities and once investigations and prosecutions have concluded.



#### **Data Reveals Financiers of International Crime**

Financial crime investigations are an emerging area in international criminal investigations, and another example where advanced technology plays a key role. Like in any domestic criminal investigation, financial crime investigators collect statements, identify and screen witnesses and store and preserve evidence for prosecution. But when investigating financial crimes, the universe of information is expansive, often involving larger sets of transaction or communication data. It is especially tricky to find patterns and make connections that demonstrate culpability.

The challenge is even greater in Iraq where instead of entrenched national and international financial institutions, many conduct business through informal means or unlicensed brokers. Transactions are done at the local level, primarily conducted using hawala (honour-based networks of money brokers), outside the scope of state or international banking institutions.

These discreet transactions pass through an informal but trusted network of hawaladars and are mainly recorded in low-tech ledgers. Although low-tech, the information is voluminous and disconnected. UNITAD leverages the data- and network-analysis features of IBM i2, Nuix Investigate and Relativity to gain insights from these large, disparate data sets, linking ISIL communication patterns, movements and transactions to financiers and, ultimately, to the larger international crimes. By aggregating unstructured and structured data sets together, these connections reveal how ISIL exploited the hawala system and show how certain financial businesses became an integral part of ISIL's support network, moving money from various illicit revenue streams into ISIL's war machine.

Using a mix of information available on the public-facing Internet and financial records shared by authorities, and from devices captured on battlefields, financial crime investigators use digital forensics, electronic discovery and data-analysis technologies to mine large data sets and turn granular elements into concrete evidence for prosecutors. Using OSINT and web-collection software such as X1 Social Discovery and Hunchly, skilled investigators forensically track individuals operating online, following digital breadcrumbs that ISIL's membership, rank and file, and financiers left on websites, messaging services and social-media channels. As investigators reveal the identities of individuals and their relationships to the group and each other, then more extensive networks and connections to ISIL can be mapped, using an array of data analysis and imaging software.

As is typical in any criminal investigation in which phone calls are evidence of connections between persons of interest, for financial investigations, call records between hawaladars or financial businesses and ISIL leaders can confirm the existence of nefarious transactions. The data-analysis capabilities of tools such as i2 and Nuix are required to blend this data with the range of other data points brought together by the Investigative Team.

"We're finding that some networks were so embedded within ISIL's ranks that they became the financial network of ISIL, responsible for aiding and abetting ISIL's criminal activities. For [those networks], unlike those operating under duress, their operations actually grow, flourish and proliferate."



## Technology Used to Support the Mental Health of Reviewers and Witnesses

By its very nature, UNITAD's work involves disturbing information and imagery. Many photographs and videos in UNITAD's evidence holdings are graphic, depicting the horrors of ISIL crimes. UNITAD has prioritized protecting the mental health and wellbeing of its staff whose functions include reviewing such material.

In its holistic, trauma-informed approach, UNITAD has employed specific technologies to minimise unnecessary exposure to violent and potentially traumatic content. During processing, duplicate images and videos are filtered out, thereby decreasing the number of times images are encountered during review. Further, Zeteo detects and flags violent and other graphic content in images and videos so that investigators can filter such material out of searches when it is not necessary for a review. Investigators can also manually flag any such content that is missed by automated processes. Content flagged by artificial intelligence or by human review can then be filtered to avoid unintentional exposure.

Images flagged as disturbing can also be pixelated, requiring the investigator to make it viewable to protect from unnecessary exposure. Lastly, forensic software used to analyse image and video evidence can enforce time limits and breaks to avoid prolonged exposure.

UNITAD's trauma-informed approach extends beyond personnel involved directly with investigations. In collaboration with Sesame Workshop and the International Rescue Committee, UNITAD has created a child-friendly witness space complete with psychoeducational resources in Arabic and Kurmanji. These resources come in the form of video clips, story books and emotion-focused flash cards addressing themes at an age-appropriate level. Themes include conflict resolution, emotion and self-regulation, parenting, perseverance, positive social skills and emotional learning.

The videos—called Ahlan Simsim or Welcome Sesame portray characters from the popular children's program Sesame Street. These stories are aimed at helping children cope with transitions, understand emotions, and deal with trauma, conflict and problem solving. These videos will soon enhance a new UNITAD web section featuring mental health and wellbeing resources for children and families.



## **Use Case: Leveraging Partnerships**

#### Leveraging Partnerships with the Private Sector for Rapid Innovation

The development of Zeteo is a model for partnering with the private sector. Working with Microsoft, the United Nations International Computing Centre (UNICC), the United Nations Office of Information and Communications Technology (OICT) and Relativity, UNITAD developed an advanced evidence-analysis solution that leverages Microsoft's Azure Cognitive Services and integrates with the Relativity evidence review and analysis platform. This partnership not only helps UNITAD fulfil its mandate in a more efficient and cost-effective manner, but it creates new business opportunities that its partners can take to other entities facing similar challenges.

The Microsoft team helped UNITAD refine a detailed and specific problem statement and business case, with the expectation that UNITAD would ultimately assume full ownership of the developed solution with a stable and sustainable business continuity plan.

Securing future funding was critical to ensure that UNITAD would have the resources and technical expertise to take over the maintenance and continued improvement and adaptation of the solution developed. Generous extra-bud-getary support from States to UNITAD's Trust Fund helped make Zeteo a reality. At the same time, UNITAD lever-aged existing relationships with the UNICC and OICT for infrastructure, development and security expertise.

Zeteo's creation was accomplished through an intensive six-month Agile project involving a diverse team of code developers, data analysts, language experts, e-discovery specialists and cloud-infrastructure architects. The result is not only transformative for UNITAD's work, but may also be a model for partnerships with the private sector to enhance criminal accountability initiatives.





#### **Digitizing and Preserving Iraq's Evidence Holdings**

"The preservation and organization of evidentiary material in relation to ISIL crimes will serve to deepen the evidential foundations available for ISIL prosecutions. By establishing a comprehensive documentary record of these acts, we also contribute to global efforts to promote peace and security by ensuring that the ideologically bankrupt nature of ISIL is exposed."

Karim A.A. Khan QC, Special Adviser and Head of the Investigative Team

Since the commencement of its investigative activities in Iraq, the Team has consistently sought to ensure that it is able to effectively share knowledge and expertise with Iraqi authorities in order to strengthen their capacity to collect and analyse evidence of ISIL crimes.

To ensure Iraq is equipped with the necessary technology to maintain further investigations of ISIL crimes well into the future, UNITAD embarked on a large-scale digitization project in cooperation with the Iraqi government. Through this project, UNITAD and Iraqi authorities are collectively seeking to ensure the comprehensive and systematic identification, archiving and digitization of physical and digital evidentiary material related to ISIL crimes. This effort sets the foundation for a future national archive of all Da'esh evidence for use by criminal investigators and researchers, and which will stand as an objective, public record of the impact of ISIL crimes in Iraq.

The purpose of the digitization project is two-fold: first, the project aims to convert hardcopy documentation into digital surrogates using basic technology such as laptops and scanners and to extract data from seized electronic devices and other digital-storage media. Second, the project introduces information-management capacitybuilding to improve record-keeping practices within the varied Iraqi government entities in charge of the document repositories.

As part of this project, UNITAD procured and will progressively donate more than 30 high-capacity scanners and digitization workstations; 15 data-acquisition kits with requisite forensic-analysis software; 10 high-capacity, network-attached storage (NAS) devices; and extensive physical archiving equipment, including hundreds of metallic archiving cabinets, thousands of acid-free archiving boxes and dozens of fire extinguishers. This project will address the archiving requirements of the different security services and judicial entities in Iraq and the Kurdistan Region. By establishing modernized information-management protocols, large volumes of documents are not only stored digitally in accessible locations in accordance with international long-term storage standards but are also easily searchable using enriched metadata and newly created finding aids. These interventions are also consistent with international standards for cataloguing, archival description, provenance management, identification of ownership and sensitivity levels, and information security.



## What's Next: Building on Momentum

Even with the development and implementation of the state-of-the-art systems outlined in this guide, UNITAD continues to face significant challenges in fully exploiting its evidence base. Despite the advances implemented to date, further innovation in UNITAD's work is required. Reflecting this, UNITAD is researching additional technologies to increase its effectiveness and efficiency.

The following areas are currently under development:

#### Arabic Handwriting Recognition and Indexing

While the technology to recognize English handwriting and convert it into searchable text is mature, Arabic handwriting continues to pose a challenge. Many documents collected and processed by UNITAD contain Arabic handwriting, which is currently unsearchable, requiring time-consuming manual review by fluent Arabic readers. UNITAD is exploring partnerships with academic institutions and software developers to develop solutions to meet this challenge.



#### **Detecting Fingerprints on Scanned Paper Documents**

UNITAD possesses many documents in its holdings that contain inked fingerprint impressions. Such documents could provide crucial evidence tying individuals to ISIL and to specific crimes. Flagging such documents, however, its currently a laborious task, involving manual review. UNITAD is exploring technology that will recognize whether a document contains fingerprints and tag it accordingly.

#### **Stamp Identification and Grouping**

ISIL sought to organise itself as a state with the bureaucracy that entails. Many ISIL leaders and organisational units used stamps to authenticate documents or track their status. The ability to recognize stamps in documents and group documents according to similar stamps would help UNITAD's investi-

gators more quickly build a complete picture of ISIL's organisational structures and link individuals and groups to crimes. UNITAD is working with its partners to leverage machine-learning technologies to make this a reality.

#### Custom AI Models for Recognizing Locations and Landmarks in Iraq

While Zeteo includes functionality for recognizing important landmarks, it does not perform well with Iraqi landmarks or in identifying locations in Iraq using geographical features. As UNITAD gathers and categorizes location imagery, it intends to train its machine-learning models to enable automatic detection and categorization of known locations.

UNITAD continues to explore technology at the cutting-edge of forensics, electronic discovery and data analysis, advancing investigations and sharing its experiences along the way.





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"Harnessing new technologies requires having the adequate human skills to design, develop and deploy these solutions in a sustainable and cost-effective manner.

"Our human resource department has done amazing work identifying talent within the organization and doing outreach to specialized industry associations to recruit the people who can make these technologies useful.

"To fully leverage these cutting-edge solutions in a broader and more systematic way, our organization will inevitably need to upskill its workforce and attract new talent.

"We hope this paper will contribute to showcasing to the talented IT professionals out there that the UN is a place where one can work on the most advanced technologies to effectively support the organization in the delivery of its challenging yet extremely rewarding mandates."

El Hadji Babacar Ndiaye, Chief of the Information Systems Management Section