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November 2023

OUT OF CONTROL

The Trafficking of Improvised Explosive Device Components and Commercial Explosives in West Africa

small arms survey

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Project coordination: Nicolas Florquin

Production and communications coordination:
Olivia Denonville, Katie Lazaro, and Lionel Kosirnik

Editors: Emile LeBrun and Anthony Morland

Fact-checker: Mira Fey

Copy-editor: Erin J. Brewer

Design and layout: Rick Jones

Cartography: Jillian Luff, MAPgrafix

Proofreader: Stephanie Huitson

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Cover photo: A UN armoured vehicle that was damaged by an IED 200 metres outside the gate of the MINUSMA camp in Kidal, northern Mali, 2017. Source: David Lochhead

About the authors

David Lochhead (lead author) has 15 years of peacekeeping field experience working on arms control; border security; conflict analysis; disarmament, demobilization, and reintegration; joint operations management; and security sector reform with the United Nations Development Programme and the United Nations Department of Peacekeeping Operations. Between 2019 and 2022, he worked as a Senior Researcher with the Geneva-based Small Arms Survey on arms and improvised explosive device component trafficking in the Sahel. David has been involved in numerous arms and ammunition-tracing, casualty-recording, fact-finding, and human rights missions and has chaired two UN Boards of Inquiry. He has contributed armed group- and arms-related analysis to the work of the EU Committee on Arms Control and Arms Exports, NATO Political and Arms Control Committees, UN Commissions of Inquiry, the UN Convention on Certain Conventional Weapons, UN Panels of Experts, and the UN Security Council. David is qualified as an explosive ordnance disposal reconnaissance team leader, is a director at the arms control not-for-profit Tech 4 Tracing, and currently works with the UN Office of the High Commissioner for Human Rights in Geneva.

Contributors and national researchers

Tidiani Diakité (contributor and researcher on Mali) holds a state engineering degree in Agronomy. He has worked for the Yeredon Foundation and the Permanent Secretariat of the Regional Coordination of NGOs in Ségou, Mali; the Programme d'Appui à la Société Civile (PAOSC 1), a project funded by the UNDP; the Gesellschaft für Internationale Zusammenarbeit (GIZ) office in Bamako; the Forum of Civil Society Organizations; and the Coordination Nationale des Organisations Paysannes. From 2015 to 2019, he was appointed technical advisor and later became the head of 'Transparency in extractive industries and participation of civil society and the media' for the Governance of Extractive Industries Support Program at GIZ. From 2019 to 2021, he worked as a research consultant for the Small Arms Survey. Currently, he serves as the chief of staff to the Minister of National Entrepreneurship, Employment, and Vocational Training of the Republic of Mali.

Roberto Sollazzo (contributor and researcher on Burkina Faso and Mali) holds a PhD in African History and Politics and since 2003 has worked as a conflict analyst, specializing in cross-border illicit trafficking of arms, goods, commodities, and persons in West Africa and the Great Lakes Region. He was appointed seven times by the United Nations Secretary-General as the Expert on Finance and Natural Resources in Côte d'Ivoire, Democratic Republic of the Congo, and Mali. He authored a publication for the Organisation for Economic Co-operation and Development, *Gold at the Crossroads: Assessment of the Supply Chains of Gold Produced in Mali, Burkina Faso, and Niger*, which remains among the references for commodity trafficking and illicit financial flows in the Sahel. In addition to contributing to 11 United Nations reports, Roberto has authored and co-authored published and unpublished reports on cross-border trafficking and security for the Small Arms Survey, the World Bank, and the GIZ Regional Resource Governance in West Africa.

Saikou Sow (contributor and researcher on Guinea) is the national coordinator on small arms at the UNDP for the 'Organized Crime: West African Response to Trafficking' project. He holds a Master 2 in international project management from the Université Senghor of Alexandrie (Guinea Campus), as well as a master's in economics from the Université Gamal Abdel Nasser of Conakry.

Raoul Sumo Tayo (contributor and researcher on Cameroon) is an associate researcher at the laboratory 'Observer les Mondes en Recomposition' of the University of Liège and a visiting professor at the University of Maroua. He has completed a Swiss Government Excellence Postdoctoral fellowship at the University of Lausanne after a French Ministry of Foreign Affairs postdoctoral fellowship at the Paris Cité University. His research interests include borders, counter-insurgency doctrines and practices, vigilantism, prospective analysis methods, and contemporary criminal threats. He recently co-edited a book for Routledge, *Perspectives on the State Borders in Globalized Africa*. His most recent publication is 'Jihad with a Woman's Face. Boko Haram Female Fighters in Cameroon', published in the Routledge series on gender and security.

Leonard Tettey (contributor and researcher on Ghana) is a lawyer specializing in international law. He has more than 12 years of experience in arms-control-related treaty implementation at the global level; the development of various tools for the implementation of arms control instruments at national, regional, and subregional levels; and related capacity-building, research, policy development, and reporting. He previously served as the senior programme officer with the Ghana National Commission on Small Arms and Light Weapons.

Acknowledgements

David Lochhead led the drafting of this Report, which was also made possible by the invaluable contributions from national country study researchers Tidiani Diakité (Mali), Boubacar Illiassou (Niger), Saikou Sow (Guinea), Raoul Sumo Tayo (Cameroon), and Leonard Tettey (Ghana), as well as from international experts Elodie Hainard (regional) and Roberto Sollazzo (Burkina Faso and Mali).

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management and guidance; Gianluca Boo for database and data analysis support; Emile LeBrun and Anthony Morland for content editing; Olivia Denonville, Katie Lazaro, and Lionel Kosirnik for production and communication coordination; Mira Fey for fact-checking; Erin J. Brewer for copy-editing; Rick Jones for layout; Jillian Luff for cartography; and Stephanie Huitson for proofreading. Thanks are also due to the Survey's Director, Daniel de Torres, for his overall support to the project. The authors are also grateful for the inputs provided by several additional experts who preferred to remain anonymous.

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List of abbreviations and acronyms

ADF	Allied Democratic Forces
AECI	Associated Electric Cooperative Incorporated
AN	Ammonium nitrate
ANFO	Ammonium nitrate and fuel oil
AOAV	Action on Armed Violence
APMBC	Anti-personnel Mine Ban Convention
AQIM	Al-Qaeda in the Islamic Maghreb
C-4	Composition number four
CAR	Central African Republic (*Note: also, Conflict Armament Research*)
CFA	Communauté Financière Africaine (African Financial Community Currency)
C-IED	Counter-improvised explosive device
COIED	Command-operated improvised explosive device
CWIED	Command wire improvised explosive device
DRC	Democratic Republic of the Congo
ECM	Electronic countermeasures
ECOWAS	Economic Community of West African States
EOD	Explosive ordnance disposal
EORE	Explosive ordnance risk education
EU	European Union
EUR	Euro
FAMA	Forces Armées Maliennes (Malian Armed Forces)
FC-G5S	Force Conjointe du G5 Sahel (G5 Sahel Multi-national Joint Task Force)

FGAN	Fertilizer-grade ammonium nitrate
HI	Humanity & Inclusion
HME	Home-made explosive
HRW	Human Rights Watch
IED	Improvised explosive device
IGAD	Intergovernmental Authority on Development
IGAN	Industrial grade ammonium nitrate
IHL	International Humanitarian Law
IME	Institute of Makers of Explosives
INTERPOL	International Criminal Police Organization
IS	Islamic State
ISCAP	Islamic State of Central African Province
ISS	Institute for Security Studies
ISWAP	Islamic State – West Africa Province
JAS	Jama'atu Ahlis Sunna Lidda'adati wal-Jihad (People Committed to the Propagation of the Prophet's Teachings and Jihad)
JNIM	Jama'at Nasr al-Islam wal Muslimin (The Group for the Support of Islam and Muslims)
LCBC	Lake Chad Basin Commission
LNA	Libyan National Army
MAG	Mines Advisory Group
MINUSCA	United Nations Multidimensional Integrated Stabilization Mission in the Central African Republic
MINUSMA	United Nations Multidimensional Integrated Stabilization Mission in Mali
MNJTF	Multi-national joint task force
MONUSCO	UN Organization Stabilization Mission in the Democratic Republic of the Congo
NATO	North Atlantic Treaty Organization
NGO	Non-governmental organization
NPK	Nitrogen, phosphorus, and potassium
PBIED	Person-borne improvised explosive device
PIED	Projected improvised explosive device
RAVOIED	Radio-armed, victim-operated improvised explosive device
RCIED	Radio-controlled improvised explosive device

RPG	Rocket-propelled grenade
SADC	Southern African Development Community
SPBIED	Suicide person-borne improvised explosive device
SVBIED	Suicide vehicle-borne improvised explosive device
TAG	Terrorist armed group
TNT	Trinitrotoluene
UAV	Unmanned aerial vehicle
UN	United Nations
UNCCW APII	United Nations Convention on Certain Conventional Weapons, Amended Protocol II
UNIDIR	United Nations Institute for Disarmament Research
UNODC	United Nations Office on Drugs and Crime
UNMAS	United Nations Mine Action Service
UNSC	United Nations Security Council
USD	United States Dollar
VBIED	Vehicle-borne improvised explosive device
VHF	Very high frequency
VOIED	Victim-operated improvised explosive device
WCO	World Customs Organization

Executive summary

The use of improvised explosive devices (IEDs) in West Africa expanded dramatically between 2014 and 2022. As of 2022, Burkina Faso, Cameroon, Mali, Niger, and Nigeria were heavily affected by these weapons, while Benin, Côte d'Ivoire, and Togo suffered from their use as an emerging threat. IED-building networks have established material and training links across conflict theatres in West and Central Africa, including the Lake Chad Basin, where armed groups have used IEDs extensively. IED designs have remained constant and inexpensive throughout the West Africa region, making them attractive for use in attacks against domestic and international security forces, UN peacekeepers, and civilians. The Small Arms Survey collected data on more than 2,200 IED-related incidents between March 2013 and September 2022, including the type, date, and location of these events. Information on perpetrators, their targets, and more than 6,600 casualties from deaths and injuries was also collected (Small Arms Survey, 2022). The data was collected through research undertaken in Burkina Faso, Cameroon,[1] Côte d'Ivoire, Ghana, Guinea, Mali, and Niger, as well as desk research and remote interviews concerning Benin, Chad, and Nigeria. Where relevant from a comparative perspective, discussion of other regions that have countries with IED incidents or components occurs throughout the Report, such as those in North Africa, Central Africa, East Africa, and the Middle East.

Most IED incidents analysed during this study involved IEDs containing explosive components or precursors specifically manufactured for the commercial extractive and construction sectors. Chemical products such as ammonium nitrate (AN), manufactured and supplied for bulk mining explosive emulsions, have entered IED-building networks, and are sourced principally from Ghana and Nigeria. Commercial explosives in bulk, including their precursors and accessories such as electric initiators and detonating cords, are diverted from the legal to illicit markets. This diversion primarily fulfils demand from the largely unregulated artisanal gold mining sector across West and Central Africa. A small subset of this diverted material also provisions IED construction. Captured, stolen, and recovered explosive ordnance[2]—including legacy anti-vehicle mines trafficked from Chad, Libya, and possibly Sudan—also constitutes a source of IED components.

Coordinated action among affected, source, and transit states is required to prevent armed groups and criminals from accessing commercial explosive materials and other IED components. Such action can involve:

- national stocktaking exercises;
- the development of national and regional counter-IED (C-IED) strategies;
- monitoring, information-sharing, and coordination mechanisms;
- regulatory modernization and harmonization;

- engagement with artisanal mining associations, the mining and explosives industry, states, and regional trade blocs in pursuit of regulatory reform; and
- efforts to establish minimum standards for bulk and individual traceability of commercial explosives.

Reducing the recovery of explosive ordnance requires renewed programmatic investment in clearing minefields and explosive remnants of war[3] across the Sahel.

Key findings

- The uncontrolled access to explosives and their accessories—primarily electric initiators, detonating cords, and bulk explosive precursors—resulting from fraud, poor controls, and lack of oversight within the subregion allows non-state armed groups to build low-cost weapons that they use to destabilize states by killing and wounding defence and security forces, peacekeepers, and civilians.
- Based on trends and the continued expansion of conflict towards the Gulf of Guinea states, the problem of IED use and related trafficking will likely increase without significant intervention.
- The majority of diverted, and thus illicit, commercial explosives documented during this study supply the artisanal extractive sector and represent economic costs to states through theoretically lost revenue from the formal mining sector. Since this often-dangerous activity provides livelihood benefits to individuals and families working within this grey sector, states often lack incentives to crack down on related activities.
- Almost all the IEDs documented during this study contained diverted commercial explosives or accessories. Very few factory-produced commercial explosive main charges[4] have been documented in IEDs, most likely because they are more expensive than bulk mining explosive precursors such as AN and may be more prone to environmental degradation.
- Addressing the root causes of IED use and implementing coordinated policy, regulatory responses, and law enforcement and intelligence-led operations will be required to address IED use and trafficking. IED networks could move to source slightly more expensive commercial explosives for IED use if access to cheaper bulk-mining explosive precursors were restricted through targeted interventions, underscoring the importance of a holistic approach to prevention.
- The human impact of IEDs is a critical dimension which requires increased focus. The Anti-personnel Mine Ban Convention (APMBC) framework offers an opportunity to support affected states to better understand and report on the problem, mitigate risks to civilians, and raise awareness of the impact. Fulfilment of states' obligations to clear legacy minefields can also address one potential source of IED explosives and components. The use of cluster munitions in IEDs suggests that the Convention on Cluster Munitions is also relevant in accelerating clearance, stockpile destruction, and universalization efforts.

Policy observations

For African regional bodies:

- A synergistic set of continental, regional, and national C-IED strategies, action plans, and coordination mechanisms are necessary for an effective regional response to the trafficking of IED components and diversion of commercial explosives.
- The African Union has developed a draft continental C-IED strategy, as has the Intergovernmental Authority on Development (IGAD).[5]
- Other regional economic communities could benefit from similar processes. Significantly, at the first Economic Community of West African States (ECOWAS) regional C-IED Conference on 21–22 November 2022, ECOWAS member states considered the development of a regional C-IED approach and committed to the development of a regional C-IED strategy and coordination mechanism.

For industry and national regulatory authorities:

- The development of modernized and harmonized commercial explosives regulations would benefit industry, producer and importing states, and counter-diversion and counter-proliferation efforts.
- Model regulations could represent a first step towards supporting a regional economic community-driven regulatory reform process.
- A modernization process involving the state and informal and formal industry actors is most likely to be effective, particularly if it ensures the development of agreed commercial explosive traceability features, tracing mechanisms, and complete product life-cycle management.
- For example, standards for the unique marking and traceability of commercial explosives throughout their life cycle, imposed by international or national regulations or due diligence by the industry, can be a key enabler to countering IED use. The absence of such standards hampers the detection of diversion when it occurs and makes investigations more challenging and typically less conclusive.

For states:

- Successful counter-proliferation efforts are evidence-based and undertaken alongside associated C-IED measures.
- States can support such initiatives by developing an information-sharing and operational coordination mechanism, improving IED exploitation[6] and forensic laboratory capabilities, monitoring trends and emerging threats, and enhancing information-sharing among national and international defence, security, customs, and intelligence services.

- State parties to the APMBC, including ECOWAS member states, can draw on this framework for increased support from the international community. To do so, they will need to take steps to meet reporting obligations, including on any IEDs designed to operate as improvised anti-personnel mines.
- States should also prioritize funding to clear legacy minefields that are fuelling IED networks in the Sahel, including those in northern Chad and Libya, which appear to be the primary source for PRB M3 anti-vehicle mines widely used in West and Central African IED designs, alongside other abandoned explosive ordnance.

For regional economic communities:

- Developing subregional strategies based on field research and on national self-assessment processes, combined with creating policy-focused and operational C-IED task forces and data-sharing mechanisms, would contribute to the emergence of a common C-IED approach.

For international security forces and UN peacekeeping missions:

- Collaboration between UN member states is crucial to strengthening counter-proliferation mandates and related mission capabilities—including assigning accountability for IED attacks on peacekeepers, ensuring a more coherent and comprehensive response to IED use, and supporting regional approaches to counter the IED threat—and is in line with the key findings of the independent strategic review of the UN response to explosive ordnance threats (Van Roosen, 2021).
- Section V of this Report provides further details on IED-related normative frameworks, regulatory gaps, and policy implications.

> “Untold numbers of people who live and work in IED-affected areas experience day-to-day stress and fear of sudden death or injury, and associated mental and physical health impacts.”

Introduction

For this Report, the Small Arms Survey documented more than 6,600 IED-related casualties (injuries and deaths) in seven West African states—Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, and parts of Nigeria—as well as in neighbouring Cameroon and certain border areas of the Central African Republic (CAR) and Chad.[7] A further breakdown reveals that there were 2,078 military, 536 peacekeeping, and 2,324 civilian casualties resulting from the use of IEDs in these ten states between March 2013 and September 2022 (Small Arms Survey, 2022).[8] These figures probably underestimate the real human toll of IEDs in the region, as injuries from IEDs are often under-reported. Other sources suggest that Nigeria as a whole accounts for the largest proportion of IED casualties within ECOWAS member states, with 8,405 combined military and civilian casualties recorded over 2014–mid 2022.[9] IEDs have also been used widely across East and Central Africa during the period of this study, with Somalia being an epicentre of their use in East Africa (AOAV, 2023).

Behind these statistics lie unquantifiable personal experiences of suffering, terror, and bereavement through death, injury, and loss of livelihoods. Untold numbers of people who live and work in IED-affected areas—be they security forces, peacekeepers, or civilians—experience day-to-day stress and fear of sudden death or injury, and associated mental and physical health impacts. Medical research suggests that, controlling for other combat and sociological factors, frequent exposure to IEDs over time increases a soldier's risk of suicide (Ursano et al., 2017).

The humanitarian impacts of IED use in West Africa can be difficult to distinguish from those associated with armed conflicts in the region, which have led to widespread displacement in Burkina Faso, Cameroon, Mali, Niger, and Nigeria. IED attacks on civilian infrastructure—including bridges, roads, radio masts, and mobile phone towers—endanger civil servants, security personnel, and humanitarian actors as they carry out their work. These attacks also endanger residents as they access markets, educational services, and medical care in a region experiencing significant levels of food insecurity.

The presence and use of IEDs have forced national and international defence and security forces to dedicate significant resources to reinforcements, expensive armoured vehicles, C-IED training, and the establishment of specialized search-and-detect, explosive ordnance disposal (EOD), and C-IED-enabled units. IEDs affect the morale of defence, security, and peacekeeping troops targeted by these devices, as well as civilian, UN, and NGO staff (UNODA, 2015). For example, a 2022 report by Human Rights Watch (HRW) highlighted the extrajudicial killing of civilians by defence forces following an IED strike in Mali (HRW, 2022).

During the period under review, the utilization of IEDs in harassing operations and more complex attacks against UN camps and bases used by national defence and security forces contributed to the loss of 936 lives among peacekeepers and defence and security forces (Small Arms Survey, 2022). By creating significant logistical and

security burdens, these attacks have also drained resources from already over-stretched peacekeeping budgets and diverted funds away from substantive mandated tasks. As a form of 'propaganda of the deed', IED use can serve as a deliberate strategy to undermine the authority of and confidence in the state, international security, peacekeeping, and stabilization interventions. Such drops in confidence can potentially fuel the proliferation of arms and ammunition among non-state armed groups (Berman, Racovita, and Schroeder, 2017). Mass casualty events can also exacerbate political instability in conflict-affected states, especially if non-state armed groups are able to repeat spectacularly complex attacks, including the capture of fortified government positions such as bases and checkpoints, despite bilateral and multilateral security assistance.[10]

In both conflict and crime contexts, there is documentation of IED use across Africa.[11] Today, these low-cost devices are particularly associated with insurgent, separatist, and Islamist armed groups waging asymmetric conflict against states. This Report examines their role in conflict rather than the emerging use of IEDs in crime, which is a documented trend in South Africa specifically (Chelin and Els, 2021). Instead, this report focuses on IED use in the period following the 2012 Mali crisis, during which the interconnected conflict systems affecting West Africa have steadily expanded.[12] As an illustration of an emerging dynamic of conflict-related criminal IED use, a C-IED analyst from the UN Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) described how non-state armed groups may have used IEDs to target civilian vehicles on the way to a market in central Mali to force commercial transporters to use a route that would require them to pay taxes at illegal checkpoints.[13] This is an illustrative example of the violent extremism–crime–IED nexus.

In the context of African armed conflicts more broadly, IED use grew noticeably during this study and can be seen in several geographic clusters beyond West Africa. One exception to this increase is Libya—a source country for IED components used in West Africa—where IED use has declined from a peak in 2018.[14] The findings indicate a link between training, components, tactics, and construction techniques for some clusters of IED use. The clusters, which do not cleanly conform to traditional geographic or economic communities, cover three broad groupings of countries where transnational linkages between the actors building and employing IEDs are established or suspected:

- Cameroon, CAR, Chad, Niger, and Nigeria.
- Democratic Republic of the Congo (DRC), Kenya, Mozambique, Somalia, and Uganda.
- Burkina Faso, Mali, and Niger primarily, with fewer incidents in Benin, Côte d'Ivoire, and Togo.

What links these clusters on a continental level, even with limited material connections, is that their constituent groups' use of IEDs is primarily associated with militant,

political Islam. While these groups currently operate under the umbrella of al-Qaeda or the non-state armed group, Islamic State (IS), many of them originally grew out of militant entities driven by local concerns. The emerging use of IEDs by Ambazonian separatists in Cameroon's north-west and south-west regions is a notable exception. In Central Africa, IED use in Cameroon, CAR, and the DRC appears largely unconnected,[15] even though some connections appear to exist in terms of arms and ammunition trafficking networks.[16] In East Africa, a cluster exhibits bomb-building networks that link Kenya, Somalia, and Uganda with the DRC. While IED use appears to be growing in Mozambique, it is currently unclear how this relates to other use in East Africa (ICG, 2022). Connections between IED use in West Africa and the Lake Chad Basin are thus far limited to bomb builders associated with the armed group known as Boko Haram. In 2016, this group split into two factions known as Jama'atu Ahlis Sunna Lidda'adati wal-Jihad (JAS) (People Committed to the Propagation of the Prophet's Teachings and Jihad), led by Abubakar Shekau, and the Islamic State – West Africa Province (ISWAP), led by Abu Musab al Barnawi, which were reportedly trained by armed groups in Mali (Sumo Tayo, 2022).[17] Niger is affected by two clusters: in its western part, by the cluster also affecting Mali and Burkina Faso; in its eastern part, by the cluster affecting north-eastern Nigeria, the Extreme North Region of Cameroon, and Chad.

This study highlights the importance of state and explosives industry regulation and oversight of commercial explosives. It places weight on the need for industry standards —whether imposed by international or national regulations or through due diligence by the industry itself—for commercial explosives' unique marking and traceability throughout their life cycle. The absence of such standards hampers the detection of diversion when it occurs and makes investigations more difficult and less conclusive. Research for this study found no evidence that the commercial explosives industry in West Africa has adopted standards or taken any steps to ensure the full traceability of its products, especially those used to manufacture IEDs. There is also a significant extent to which the proliferation of certain types of IEDs overlaps with humanitarian interventions and frameworks, notably the APMBC. Other initiatives, including Germany's 2023 presidency of the APMBC, will examine these interlinkages in greater detail, but some aspects are noted within this Report.

The human rights, humanitarian, security, judicial, and political consequences of the lack of marking and tracing standards cannot be overstated. Improvements in marking and tracing would curb the diversion of explosive materials from vendors and artisanal mining supply networks, minimizing associated injuries and fatalities and possibly IED production more generally. The majority of diverted and illicit commercial explosives documented during this study fed artisanal gold mining demand, providing livelihood benefits to individuals operating in this perilous grey sector. At the same time, in all cases where detailed information is available on the components used in the IEDs documented during the preparation of this Report, diverted commercial explosives and

their accessories—typically initiators, detonating cords, or AN manufactured for use in bulk mining explosives—have been used.[18]

This research project evolved from an initial focus on IED use in Mali, which represented the epicentre of violence for the countries studied during the review period.[19] The focus subsequently expanded geographically within West Africa and beyond between 2019 and 2022. Based on preliminary evidence gathered in Mali, the project began considering states with known IED use and suspected source and transit countries for IED components, chemical precursors, and commercial explosives. These states included Burkina Faso, Côte d'Ivoire, Ghana, Guinea, and Niger. The research focus then broadened to include neighbouring Cameroon as one of the Lake Chad Basin states affected by the Boko Haram insurgency and separatist violence.

Although the fieldwork for this Report did not cover Benin, Chad, or Nigeria, open-source data was collected remotely for these countries. Where relevant from a cross-regional comparative perspective, the project also collected data remotely on affected countries in other regions, including CAR, the DRC, Mozambique, and Uganda, through open sources and communication with the United Nations Mine Action Service (UNMAS). The project examines IED-related proliferation and counter-proliferation efforts; however, a comparative analysis of the effectiveness of other direct C-IED actions against bomb builders and networks is beyond its scope.

The research questions that framed this project include the following:

- What are the dynamics of the provenance, procurement, diversion, and trafficking of components used to build IEDs in West Africa?
- What are the connections between the commercial explosives industry, artisanal natural resource extraction, the formal mining and quarrying sector, and IED networks?
- What can be done by states, regional bodies, and industry actors and partners, based on research, to promote a more coordinated and comprehensive, fact-based response to the expanding IED threat in West Africa?

The following section of this Report presents the project methodology, research sources, and a set of terms and definitions. The next four sections explore the background to, and dynamics of, IED use in the states under study (Section II); the types of IEDs used and IED components documented in West Africa (Section III); sources and dynamics of trafficking in IED components (Section IV); and the regulatory gaps and policy implications identified during the research project (Section V). The conclusion provides final observations based on the research findings.

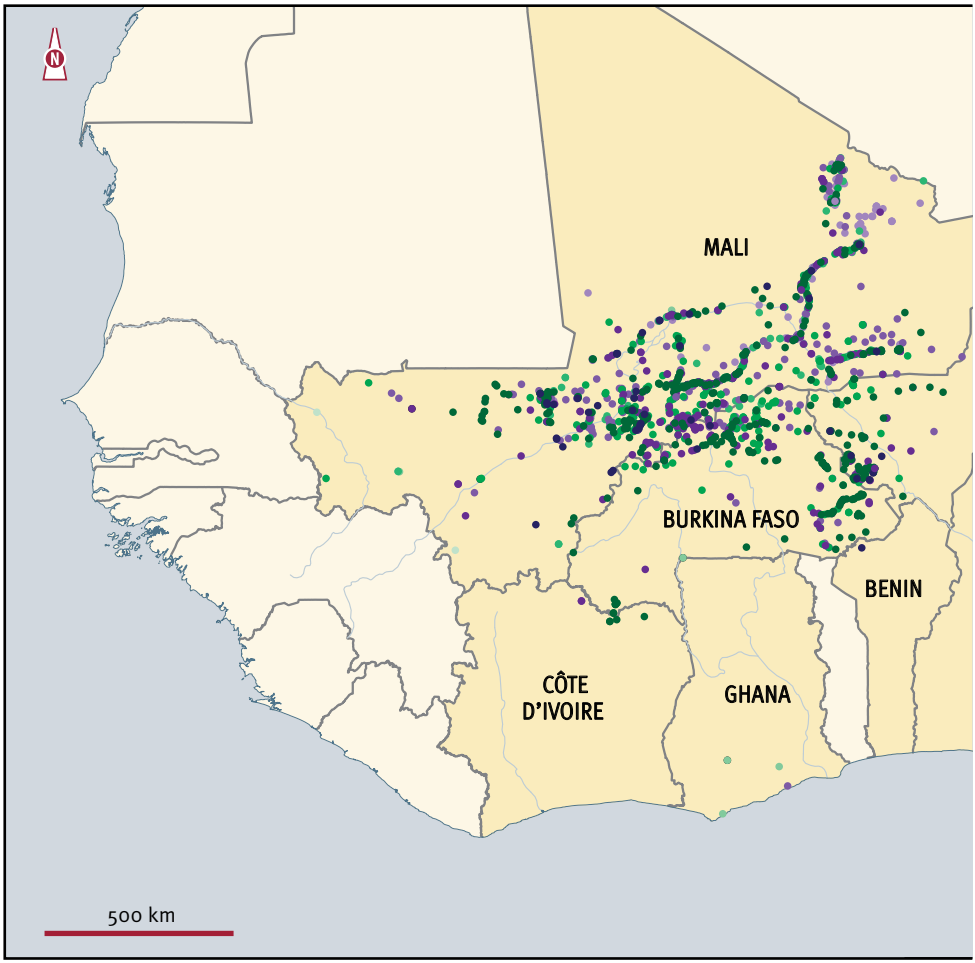
> “Six national small arms commissions—those of Burkina Faso, Côte d’Ivoire, Ghana, Guinea, Mali, and Niger—served as key interlocutors during the project.”

I. Methodology and sources

During previous project work on small arms and light weapons in the West African region in 2018, the Small Arms Survey developed strong partnerships with national small arms commissions in countries within ECOWAS. The Survey's IED research team drew on these ties to deepen relationships in the domain of IEDs and their components in a new project that spanned 2019 to 2022.[20]

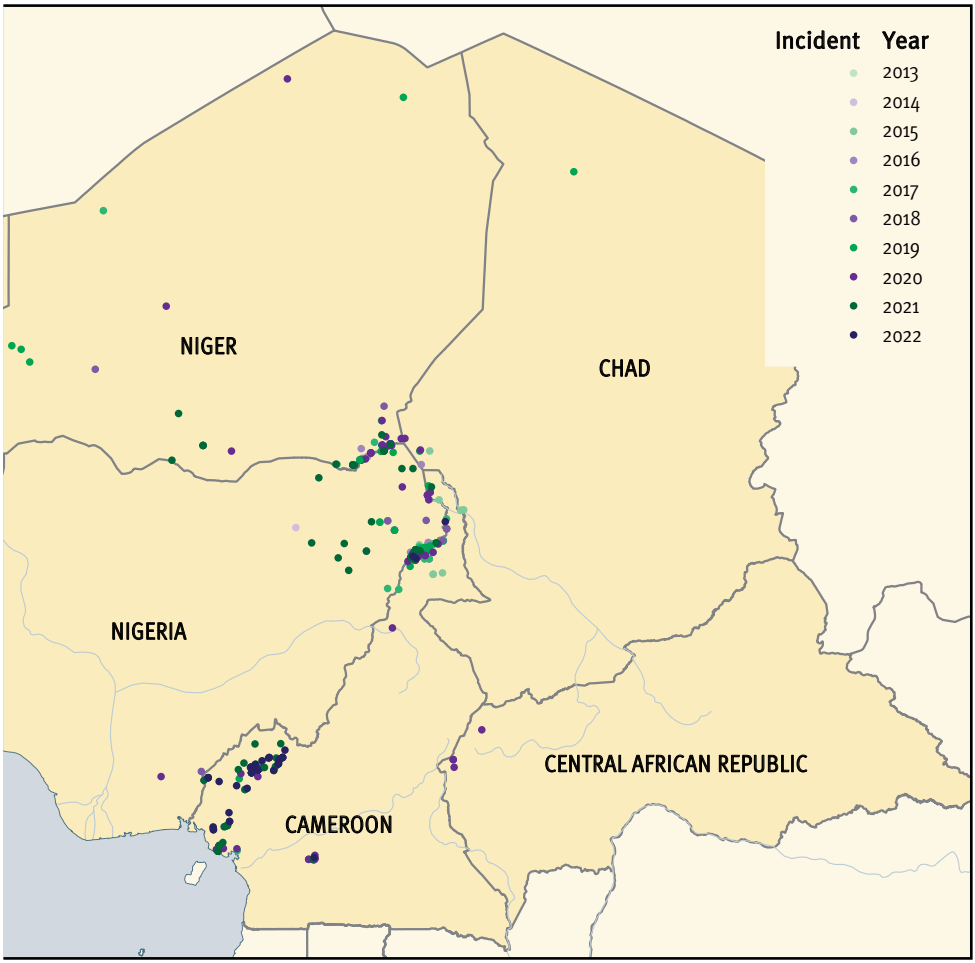
Six national small arms commissions—those of Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Mali, and Niger—served as key interlocutors during the project.[21] They pro-

Map 1 Distribution of IED incidents reviewed for this Report, March 2013–September 2022



vided invaluable support to the local researchers whom the Small Arms Survey had identified and contracted to conduct field research in every country under review. In each of these countries, the research included a series of semi-structured key informational interviews with national authorities and security forces, the private sector, civil society, and international stakeholders—as well as the analysis of a range of official data sets shared by these stakeholders. As part of this project, the Survey also helped national commissions organize workshops on IEDs in Burkina Faso in 2021,

Note: The data presented in this map should not be considered exhaustive. A focus has been operated on specific areas of some countries—for example, certain border areas in CAR, Chad, and Nigeria—and only partially captures the extent of the issue. Source: Small Arms Survey (2022). Base map data source: OpenStreetMap



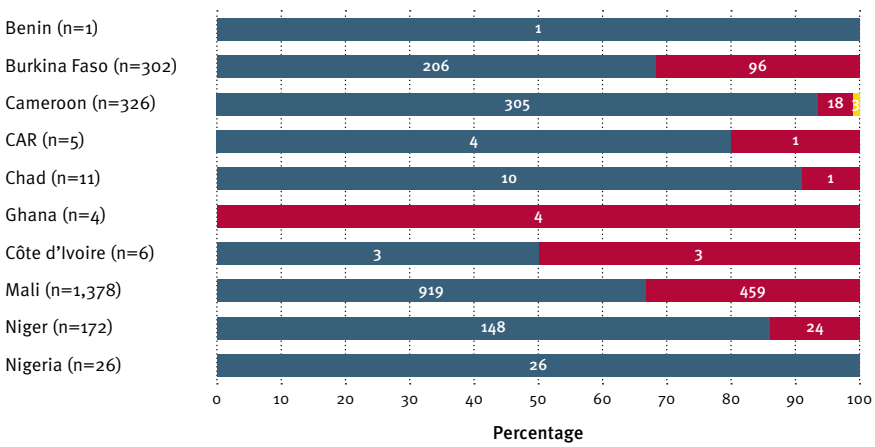
Ghana in 2021, and Mali in 2019, during which research findings and their policy implications were reviewed and discussed. Field research also occurred in neighbouring Cameroon. Under the auspices of the Cameroonian Ministry of External Relations, an IED workshop was held in 2022 in Yaoundé, Cameroon, where there is no national small arms commission. The project broadly focused on developments following the Mali crisis of 2012 until late 2022, although the research period was shorter in countries affected by IEDs only more recently.

The Small Arms Survey developed the semi-structured research questionnaire and introduced the local researchers to the national commissions of their countries. Once the Survey team had determined that the security and political conditions were satisfactory, field research began in all countries. The researchers engaged with a variety of actors, ranging from artisanal gold miners to ministry officials[22] and actors in the commercial extractive sector. In view of the sensitive nature of this project, the researchers' questions were limited to the diversion and trafficking of commercial material, such as explosives, AN, and fertilizers. They did not cover issues directly related to IED incidents, their perpetrators, or related techniques or strategies.

The project's research phase began in January 2019, focusing on Burkina Faso, Mali, and Ghana. The team then examined the situation in Cameroon, Côte d'Ivoire, Guinea, and Niger through research carried out from 2020. The COVID-19 pandemic impacted access, as did coups d'états in three countries under study—Burkina Faso, Guinea, and Mali. Field research was limited in these three countries and largely abandoned in Guinea.[23] Moreover, Geneva-based researchers coordinating the fieldwork and engagements with states could not travel to the region between March 2020 and July 2021 due to pandemic-related restrictions. The local researchers compensated for these constraints through their continuous presence and activities, which allowed for constant situation monitoring during this period.

Throughout the course of this research, the survey team also collaborated with various international actors, including those operating in peace operations. These actors include MINUSMA, the United Nations Multidimensional Integrated Stabilization Mission in CAR (MINUSCA), the United Nations Organization Stabilization Mission in the DRC (MONUSCO), UNMAS, the European Union Assistance Mission; armed forces representatives from France, Germany, and Sweden; international organizations focused on IED policy and enforcement, such as the International Criminal Police Organization (INTERPOL) and the World Customs Organization (WCO); research teams from Conflict Armament Research and the UN Institute for Disarmament Research (UNIDIR); and non-governmental mine action organizations, such as Humanity & Inclusion (HI) and the Mines Advisory Group (MAG). These collaborations helped develop a better understanding of the situation across the region and between regions, not only in terms of IED components, their use, and diversion, but also regarding the broader context in which IEDs are used and can potentially be addressed.

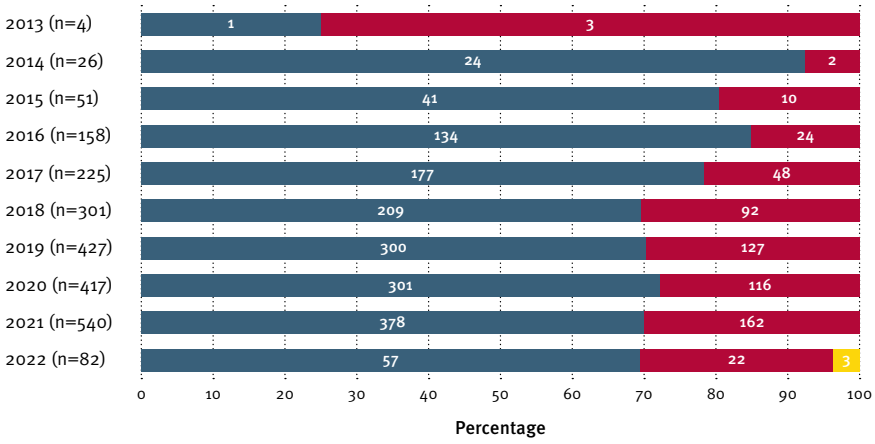
Figure 1 Distribution of IED incidents by type of incident per country, March 2013–September 2022



Note: The data presented in this figure should not be considered exhaustive. A focus has been operated on specific areas of some countries—for example, certain border areas in CAR, Chad, and Nigeria—and only partially captures the extent of the issue (see Map 1).

Source: Small Arms Survey (2022)

Figure 2 Distribution of IED incidents by type of incident per year, March 2013–September 2022



Source: Small Arms Survey (2022)

Box 1 Key terms and definitions

- **Improvised explosive devices (IEDs)**. These devices form a broad category of explosives or 'bombs' employed in a range of conflicts and other contexts. Various methodologies exist for the classification of IEDs, inter alia, the method of delivery and the means of initiation, which are based on the firing switch but may also include the means of arming.
- **Victim-operated IEDs (VOIEDs)**. VOIEDs use a switch that is 'activated by the actions of an unsuspecting individual' and 'rely on the intended target to carry out some form of action that will cause it to function' (UNMAS, n.d., p. 65). VOIEDs do not discriminate or target specific victims, unlike command IEDs. Notably, the function and indiscriminate nature of VOIEDs place them within the scope of the APMBC, where they are often referred to as 'landmines of improvised nature' (UN, 2019).[24]
- **Command-operated switch**. A type of switch that is activated by the attacker to control the moment of initiation. This category could include switches such as command wire, radio-controlled switches, etc.
- **Command wire IEDs (CWIEDs)**. CWIEDs employ a switch in which the firing location, initiator, and explosives are joined together by a length of wire, forming a simple circuit. They may contain several power sources close to both the firing point and the explosives 'to overcome the resistance in the length of the wire' (UNMAS, n.d., p. 52).
- **Radio-controlled IEDs (RCIEDs)**. These devices employ a switch initiated electronically by wireless means consisting of a transmitter and a receiver to target a specific victim (UNMAS, n.d., p. 60).
- **Radio-armed, victim-operated IEDs (RAVOIEDs)**. RAVOIEDs are armed using the same receivers and transmitters found in RCIEDs. They can selectively target an individual or group by the attacker observing the approach of the target to the IED, at which point the IED is armed remotely by the radio-controlled switch. Then, the IED is initiated by the victim carrying out some action to complete the firing circuit. These variants of VOIEDs represent the pinnacle of IED technical and tactical sophistication observed in the research area.
- **Vehicle-borne IEDs (VBIEDs)**. This type of IED is 'delivered by or concealed in a ground-based vehicle' (UNMAS, n.d., p. 64). VBIEDs qualify as **suicide VBIEDs (SVBIEDs)** if they are 'initiated by the attacker at a time of their choosing' and 'they intentionally kill themselves as part of the attack, or possibly to deny capture' (p. 62). It can be difficult to ascertain whether a VBIED that malfunctioned was meant to be an SVBIED, as attackers might flee or become neutralized before they can activate a device. For this reason, this Report generally does not distinguish between SVBIEDs and VBIEDs.
- **Person-borne IEDs (PBIEDs)**. PBIEDs are 'worn, carried, or housed by a person, either willingly or unwillingly' (UNMAS, n.d., p. 59). PBIEDs involving persons willingly acting as PBIEDs are considered **suicide PBIEDs (SPBIEDs)** and are called 'suicide bombers'. PBIEDs involving persons who are unwilling bombers are called proxy bombers. Owing to the lack of clarity in many PBIED cases if an attack involved a suicide or proxy bomber, this Report generally does not distinguish between these two types of bombers.

- **Projected IEDs (PIEDs)**. These IEDs involve using an improvised switch or launching platform to launch an improvised or conventionally manufactured rocket, mortar, or artillery projectile towards a target.
- **Counter-IED (C-IED)**. C-IED refers to a comprehensive, strategic approach to responding to the threat and use of IEDs. It represents the collective efforts at strategic, operational, and tactical levels to defeat the improvised explosive device network (UNMAS, 2018b). C-IED can include reactive and preventive approaches to respond to IED use.

This Report also examines the **precursor** chemicals and **components** used to build IEDs.

- **Precursors** are often 'dual-use' chemicals that are combined to be used in the manufacture of **home-made explosives (HMEs)**, typically including 'fuels' and 'oxidizers'. Precursor chemicals can be used throughout the explosives chain to make key components of an IED, including the main charge, a booster to increase the reliable ignition of the main charge, and the initiator of an IED. The precursor chemicals encountered include **AN**, various fertilizers, and other HME constituents. AN, which is not an explosive substance itself, is the base for bulk emulsion explosives used by the mining sector and for the HME, such as in **ammonium nitrate fuel oil (ANFO)** used in IEDs. AN comes in **fertilizer-grade (FGAN)** and **industrial-grade (IGAN)**.
- Common **IED components** include **initiators** and **detonating cord**, which contain high explosives and are used in mining and military applications. The industry considers these items to be 'accessories' rather than 'commercial explosives', a term reserved for the **main charge** of the explosive, when produced commercially.[25] This Report follows commercial explosives industry terminology, with the main charges used in the extractive sector in Central and West Africa mostly being nitroester- and nitroglycerine-based, such as trinitrotoluene (TNT). For commercial purposes, these explosives typically come in the shape of sticks, commonly known as 'baguettes' in the region under review. The main charges used in IEDs across the region, other than Cameroon and possibly Nigeria, are IGAN ANFO HMEs.

This Report uses the term **(non-state) armed groups** to refer broadly to groups that have the capacity to challenge the state's monopoly of legitimate violence (Florquin and Berman, 2005, p. 1; Policzer, 2005). Some of these groups are al-Qaeda or IS affiliates that appear on UN Security Council (UNSC) sanction lists (UNSC, n.d.); these groups are commonly referred to as **jihadists** (Islamic militants) or **terrorist armed groups (TAGs)**.

As part of this project, the Small Arms Survey compiled a data set on IED-related incidents, defined here as IEDs that initiated, IEDs found before initiation, IED components found in caches, and IED components seized by local authorities or defence and security forces. When available, the data set includes casualty data, and the time, date, and location of incidents. The data, collected during the research phase and provided by partners, covers the period from March 2013 to September 2022 and includes incidents documented in the fieldwork countries—Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Guinea, Mali, and Niger, with no incidents recorded in Guinea.

This data also includes the other documented countries and border areas—Benin, CAR, Chad, and Nigeria (see Map 1). The data set contains information on 2,231 incidents, 1,622 of which are confirmed cases of IEDs that initiated and 606 events that include IEDs found before being initiated, and IED materials recovered in caches, handed in, or seized by military, police, and customs authorities (Small Arms Survey, 2022; Figures 1 and 2).

> “Since 2013, IED proliferation in West Africa has expanded southward and eastward from the historical epicentre of IED use in Mali.”

II. Contextual background: IED use and component supply chains[26]

Since 2013, outside of Nigeria where IED use has expanded northward, IED proliferation in West Africa has expanded southward and eastward from the historical epicentre of IED use in Mali. IEDs have featured in complex attacks in Burkina Faso, Cameroon, Mali, and Niger, the principal countries in the region where the devices were used consistently between 2013 and 2022. These attacks resulted in unprecedented civilian injuries and deaths, mounting casualties within the defence and security forces, and damage to civilian infrastructure—including bridges—compared to the period prior to 2013, when IED use appears to have been negligible. In recent years, IED attacks have also occurred in states that had not previously experienced jihadist violence, such as Benin, Côte d'Ivoire, and Togo. In May 2022, Togo witnessed its first fatal attack by an external armed group, which left eight soldiers dead. Analysts suggest an al-Qaeda affiliate based in Mali or Burkina Faso may have perpetrated the raid (Al Jazeera, 2022). At the time of writing, two IED strikes were subsequently recorded in Togo (Weiss, 2022). According to UN sources, IEDs in Mali account for some 58 per cent of the fatalities occurring because of malicious acts against UN peacekeepers in the country, as well as hundreds of serious injuries among MINUSMA personnel between 2013 and 2019.[27]

Civilian infrastructure has also been targeted by IEDs—possibly to deny access to state officials, defence, security, and peacekeeping forces to communities—therefore weakening the link between communities and security providers. The Small Arms Survey's IED database includes 71 incidents where IEDs were placed either on, or on the immediate approach to bridges, which channel vehicles and ease their targeting (Small Arms Survey, 2022).[28]

West Africa is facing a precarious security situation complicated by the narrowing of official channels for effective collaboration between IED-affected countries, transit states, and explosive source countries. Warning signs include the withdrawal of European special forces operating under the aegis of the Takuba Task Force from Mali in early 2022, the subsequent withdrawal of all French forces from Mali and Burkina Faso, and the apparent collapse in May 2022 of the Force Conjointe du G5 Sahel (G5 Sahel Multi-national Joint Task Force) (FC-G5S) combating jihadist insurgents in the region (Reuters, 2022). New, common security arrangements such as the Multi-National Joint Task Force of the Accra Initiative, announced on 22 November 2022 and building on the model of the Lake Chad Basin's multi-national joint task force (MNJTF), may provide new opportunities for intelligence-led operational responses to IED proliferation (UNOWAS, 2022).

This section provides background information on the following states, which can be categorized as follows:

- IED-affected states: Burkina Faso, Cameroon, Mali, and Niger;
- source and transit states: Ghana and Guinea; and
- states with emerging IED threats: Benin and Côte d'Ivoire (see Map 1).

IED-affected states

Burkina Faso

In 2012, Burkina Faso played a key mediation role between Tuareg insurgents and the Malian government, leading to the Ouagadougou Ceasefire Accord of 2013. The ceasefire followed on from the French-led Operation Serval, which liberated northern Mali from jihadist occupation.

In 2014, Burkina Faso faced a popular uprising, which led to the ousting of President Blaise Compaoré. During the subsequent transition period in 2016, a new Islamist group, Ansarul Islam, launched an insurgency with linkages to the al-Qaeda affiliate Movement for Oneness and Jihad in West Africa (MUJAO). Operating along the border between Mali and Burkina Faso, Ansarul Islam quickly adopted IEDs, first using them in Burkinabé territory in 2016 (LCMM, 2021). The Small Arms Survey's IED analysis initially revealed similarities, with common designs and possible sources of supply between IED builders in Mali and Burkina Faso.

The creation of the FC-G5S—comprising Burkina Faso, Chad, Mali, Mauritania, and Niger—was in part a response to the expansion of the jihadist insurgency from Mali into Burkina Faso. It allowed the deployment of member states' forces in 'hot pursuit' operations up to 50 km across international borders into neighbouring states, which may have spurred jihadists to seek deeper sanctuaries within Burkina Faso. Over time, IED use in Burkina Faso moved southward towards the borders of Benin, Côte d'Ivoire, and Ghana. UNMAS reports that in 2020, 50 per cent of IED victims in Burkina Faso were civilians and that this percentage dropped to 30 per cent in 2022.[29]

The Small Arms Survey data set contains 303 IED-related incidents that occurred in Burkina Faso between January 2014 and January 2022, resulting in 398 deaths and 370 injuries. During the early phase of IED use, the devices primarily employed command-operated switches (see Section III). Since 2018, improvised anti-vehicle mines[30] have also been used occasionally—possibly to evade electronic countermeasures (ECM) deployed by international forces (LCMM, 2021). The use of RAVOIEDs in Burkina Faso represents the pinnacle of IED technical and tactical sophistication observed in the region.

IED use in Burkina Faso also reveals regional differences. For instance, the western tri-border area sees more VOIEDs. In contrast, the country's east—which shares a border with Niger's Tillabéri Region and Benin—is characterized by greater experimentation with IED design and reliance on RCIEDs. Moreover, using IEDs in eastern Burkina Faso has become a common tactic not only of armed groups but also of bandits and traffickers who seek to protect their territory and trafficking routes (see Map 1).

Tactical similarities in Burkina Faso and Mali include a reliance on CWIEDs, the use of Chinese-made electronic components in RCIEDs, the targeting of bridges, and the

booby-trapping of human corpses (see Section III and Box 5). The Small Arms Survey's IED data set includes 19 such cases where corpses were booby-trapped (Small Arms Survey, 2022). IED components found in both countries include certain anti-vehicle mines—PRB M3 and PTMi-BA-III—as well as receivers and transmitters, such as those produced by Shenzhen Kelvin and Shenzhen Toada (see Section III).[31]

The black market for explosives destined for the Burkinabé artisanal extractive sector appears to be discreet but not clandestine.[32] The importers are known, as are the wholesalers and retailers who sell the prohibited explosives to illegal end users. Packaging and labels associated with explosives used at artisanal and small-scale mining sites in Burkina Faso suggest that most are of European or South African manufacture; however, the production of some occurred in India and China. Unlabelled explosives made by illegal artisanal manufacturers may also be used in the country (Sidibé, 2020).

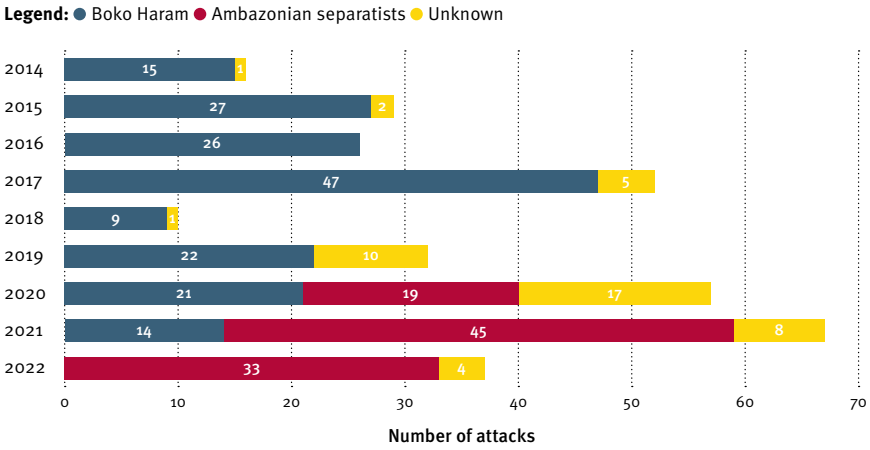
Seizures and unintended explosions provide some sense of the quantities of explosives that are illegally imported and sold in the Burkinabé artisanal extractive sector. In September 2020, national police and customs officials seized 330 sticks of dynamite. Earlier seizures include 5,040 explosive charges, 7,750 electric initiators, and 350 m of detonating cord in Ouagadougou in January 2016, as well as 250 kg of explosives and 200 pyrotechnic initiators in Tambao in April 2015. Large-scale, uncontrolled, and accidental explosions of illegally stored explosives shook Larlé in July 2015 and Kamboinsin in January 2019 (Sidibé, 2020, p. 21).

Cameroon[33]

IED use in Cameroon began with the expansion of the Boko Haram insurgency from Nigeria to Cameroon in 2014. Following the split within Boko Haram in 2016, both factions continued to operate in Cameroon, with ISWAP gaining ascendency over JAS following the death of JAS leader Abubakar Shekau in May 2021. The rise of ISWAP corresponds to a decline in attacks directly targeting civilians and a renewed focus on attacks on defence and security forces (Fru and Tayo, 2021). Historically, IED use by Boko Haram involved the frequent use of SPBIEDs, involving both willing persons and proxy bombers. In the Extreme North Region of Cameroon, the first IED incident took place on 31 October 2014. Since then, Boko Haram jihadists in the region have deployed PBIEDs and other IEDs or planted mines.

The Small Arms Survey data set contains records of 310 IED-related incidents in Cameroon between January 2014 and July 2022, resulting in 570 deaths and 827 injuries. The localities that witnessed the most IED attacks in northern Cameroon were Kolofata and Mora, which together accounted for about 11 per cent of all recorded incidents. In the north-west and south-west provinces, nearly 75 per cent of IEDs deployed by separatists between 2018 and 2022 were aimed at targets in Bamenda, Buea, and Yaoundé.

Figure 3 Number of IED attacks in Cameroon, by alleged perpetrator per year, 2014–22



Source: Small Arms Survey (2022)

IED use attributed to Boko Haram in northern Cameroon dropped significantly after 2017 (see Figure 3).[34] In contrast, the north-west and south-west regions have seen an increase in the deployment of IEDs associated with the Ambazonian-Anglophone-separatist conflict, which began in 2016. Since the first known case in Ekok, Nigeria in the Mamfe border area on 21 November 2018, documented IED use in these regions has been doubling annually. Between 2020 and early 2022, IEDs were also used outside of conflict theatres, including in the capital, Yaoundé, and the coastal city of Douala (see Figure 3).

Findings show that Ambazonian separatists employed their IEDs against both civilian and military vehicles. Field data indicates that of 73 incidents attributed to the separatists, 40 targeted civilians, with 29 against army convoys and 4 against installations of police forces or checkpoints. Research also suggests that Mbororo (Fulani) communities in Cameroon have also been targeted—including with IEDs. This targeting was due to their perceived antipathy towards Cameroonian and Nigerian ethnic groups in the border areas and based on alleged collaboration with Cameroonian security forces against Ambazonian separatists (Craig, 2021).

Interviews suggest that cross-border IED collaboration at the technical and ideological levels is linking armed groups across the region. Interviews conducted for this study indicate that Boko Haram's IED-building networks extend across the region, connecting Cameroon, Mali, and Nigeria. According to a former Cameroonian bomb builder, Boko Haram sent him and several of his peers from Nigeria to Mali to learn how to construct IEDs (see Box 2). Meanwhile, the leadership of the Ambazonian movement

Box 2 Snapshot of a bomb builder

Jean, a Cameroonian Christian born in northern Cameroon, moved to Bama in northern Nigeria to work as a trader. According to differing accounts, he either was abducted by Boko Haram during an ambush on a convoy while returning to Cameroon and then taken to Sambisa Forest or willingly joined their ranks. Jean recounted that while he was living in 'Timbuktu'—a Boko Haram camp near Damboa and Gonéri in Nigeria, named after the Malian city—Malian and Arab instructors arrived and had a meeting with Fia Abou Fatima, a Boko Haram military leader. They asked him to entrust them with seven people for training in Mali—in the 'real' Timbuktu—by the group al-Qaeda in the Islamic Maghreb (AQIM). This group now forms part of the coalition known as Jama'at Nasr al-Islam wal Muslimin (JNIM) (The Group for the Support of Islam and Muslims) and predates the period when the IS had a significant foothold in Mali.

Boko Haram sent three Cameroonians, including Jean, and four Nigerians for training. Three of them received training to lay mines, while Jean and the other three learned how to manufacture IEDs. After a year of training, all returned to Nigeria. For five years, Jean served as an IED builder for Boko Haram. He surrendered to Cameroonian authorities at the end of 2017 and subsequently joined the Cameroonian army. He now works as a de-miner, carrying out field-level IED disposal, training Cameroonian military personnel, and providing insight into Boko Haram IED techniques, tactics, and procedures.

Source: Sumo Tayo (2022, p. 12)

in Cameroon announced an alliance with Nigerian Biafran separatists operating under the banner of the indigenous people of Biafra (Craig, 2021), who have also been accused of employing IEDs inside Nigeria, creating the potential for new opportunities for cross-border IED collaboration (Nathaniel, 2021).

The armed groups active in Cameroon differ markedly in terms of their tactics. While no documented cases involving PBIEDs exist in the Ambazonian separatist conflict, Boko Haram has made extensive use of this approach. Between 2015 and 2022, Boko Haram carried out 172 PBIED attacks, killing 519 people and injuring 700 in northern Cameroon (Small Arms Survey, 2022). At least 115, or 65 per cent, of these attacks were carried out by women and girls. Due to the effect of the explosives, authorities were unable to identify the gender of 29 bombers.

Boko Haram and Ambazonian separatists have used both military-grade explosives and HMEs in IED production. In the early phase of their conflict, separatists used low-grade explosives such as home-made black powder, which led to many failed IED initiations (Sumo Tayo, 2022). Over time, they increasingly made use of TNT and RDX—used in C-4 explosives—sourced from Nigeria (Ntuda Ebode, 2021). Both jihadists and separatists have reportedly used Semtex, a military-grade plastic explosive originally

developed and produced in the former Czechoslovakia. As in other theatres across West Africa, jihadists have also used the HME ANFO (see Section III).

While IED builders in Cameroon appear to rely primarily on Nigeria for their source materials, they purchase components such as fertilizer, monosodium glutamate, nails, gas cylinders, telephones, batteries, and metal plumbing pipes at local markets (Sumo Tayo, 2022) (see Section IV).

Mali

The Small Arms Survey data set contains records of 1,378 IED-related incidents in Mali between January 2014 and January 2022, resulting in 923 deaths and 1,797 injuries (Small Arms Survey, 2022). The Mali crisis that erupted in 2012—which pitted several insurgent groups against the Malian government for greater autonomy in northern Mali, or 'Azawad'—is difficult to understand outside the historical and regional context. Al-Qaeda-linked Algerian fighters from the Salafist Group for Prayer and Combat had an intermittent presence in northern Mali prior to the crisis. Large numbers of Malian Tuareg—as many as 10,000 by some estimates—had fought for Libyan President Muammar Qaddafi during his country's 2011 civil war, while previous generations of Malian Tuareg served as combatants in Libya's Islamic Legion (Gwin, 2011). In 2012, Tuareg separatists claimed initial victories in northern Mali, such as when fighters of the National Movement for the Liberation of Azawad routed Malian government forces in January 2012, while al-Qaeda-linked groups co-opted the conflict and attempted to establish a caliphate by July of the same year. During their brief occupation of northern Mali, jihadist forces began to manufacture IEDs.[35]

In January 2013, allied forces of the French-led Operation Serval, which included Chadian and Malian forces, began to advance against the jihadists who left behind bomb-building workshops and booby-trapped vehicles as they retreated.[36] Some of these IEDs caused casualties among Operation Serval and allied troops and its successor mission, Operation Barkhane.[37] Troops from Operation Barkhane were targeted during a total of 122 IED-related events, resulting in 30 deaths and 131 people wounded. These figures, collected from open sources, suggest that IEDs and mines were the cause of approximately 70 per cent of deaths and injuries experienced by those from Operations Barkhane and Serval between 2013 and 2022 (Deveaux, 2021; Magoria, 2022).

Although Operation Serval recaptured northern Mali and pushed al-Qaeda affiliates out of northern and central Mali, it did not eradicate jihadist networks. By May 2013, shortly after the withdrawal of French troops, jihadists were able to carry out suicide IED strikes in Kidal and Timbuktu. They targeted UN peacekeepers with IEDs soon after their deployment to northern Mali in June 2013. In December of that year, following

1

A large crater resulting from the discovery and destruction of an IED by an EOD search-and-detect team from the Malian armed forces (FAMA), while supporting a UN assessment mission in Douentza, central Mali, 2019.

Source: David Lochhead

the redeployment of the Malian government and armed forces, an SVBIED killed two UN peacekeepers from Senegal outside of a bank in Kidal (Diarra and Dialla, 2013).

Over time, attacks against UN peacekeepers came to involve PIEDs, including large-calibre rockets, VOIED pressure plates, and VBIEDs. In February 2016, a suicide armoured VBIED—the only IED of its kind documented in Mali to date—breached the MINUSMA camp in Kidal, killing five Guinean peacekeepers and wounding 30 other people (Al Jazeera, 2016a). Two years later, attackers placed magnetic mines under the vehicles of UN police and a UN commercial contractor in Timbuktu; however, the discovery of one before it could initiate and the deflagration of the other avoided any casualties.[38] Spectacularly complex attacks against UN bases continued throughout the period under review. In addition to VBIEDs and PBIEDs, some of these assaults involved mortar and rocket fire. In Ber, Gao, Kidal, Mopti, Sévaré, and Timbuktu, these devices were reinforced by ground assault teams, sometimes wearing suicide vests.[39]

Efforts by the Malian defence and security forces between 2016 and 2019—to take the initiative and re-establish administrative control over territory lost to Islamic militants—meant that these forces were more exposed to IEDs while on operations between

forward operating bases in central and northern Mali. Jihadist groups also employed IEDs against the civilian population and community self-defence groups, such as the Dogon militia operating in the Bandiagara escarpment. The southward and westward expansion of militant attacks in Mali continued during 2020–22 (Nsaibia and Duhamel, 2021). As early as September 2020, jihadists were able to carry out the first IED strikes in the village of Boura, which is in the Sikasso Region in the far south of Mali (Xinhua, 2020).

Since late 2019, armed groups have expanded their tactics to target not only peacekeepers, French troops, and national defence and security forces but also civilian infrastructure such as bridges and antennas. As in Burkina Faso, Survey field teams also documented several incidents involving the booby-trapping of corpses (see Section III and Box 5). In addition, Russian private military contractors operating alongside Malian forces as part of the Wagner Group were allegedly killed by IEDs (Landal, 2022).

Outside of Nigeria, Mali—together with Burkina Faso—continues to be the epicentre of IED use in West Africa, as well as for IED-related casualties and demand for components used to build IEDs. There are no indications that IED-building networks are under significant pressure to adapt from counter-proliferation measures, as neither their design nor their components changed significantly over the period under review. To prevent the diversion of explosives from legal suppliers and end users, the Malian government has begun to review and restrict the issuance of licences to purchase explosives.[40] Commercial explosives remain available on the black market, however, as a consequence of trafficking from neighbouring countries—including Burkina Faso and Ghana—and the associated high demand for explosives from Mali's artisanal gold mining sector (see Section IV).

Niger

Like Mali, Niger has faced recurring rebellions and Tuareg insurgencies in the post-colonial period, including between 1990–2000 and 2007–09. These rebellions fuelled the proliferation of weapons, ammunition, and explosives, as well as the stockpiling and use of anti-vehicle mines by non-state armed groups. Since 1998, Niger has been a member of the MNJTF—whose other members are Benin, Cameroon, Chad, and Nigeria—to combat Boko Haram and its subsequent splinter groups.

Following some spill over of the 2012 Mali crisis, the Movement for Oneness and Jihad in West Africa employed two IEDs in Niger in 2013 (AOAV, 2017); however, the country did not witness the widespread use of IEDs until September 2015. Earlier that year, Boko Haram had expanded its attacks into Niger's Diffa border area with Nigeria, where former Boko Haram group JAS under Ibrahim Bakura Doro made extensive use of IEDs.[41] The Diffa Region has experienced fewer IED incidents but a greater number

of casualties per incident than Tillabéri, in western Niger. Several factors may help to explain this discrepancy; for instance, the Tillabéri Region is less densely populated and typically experiences IED attacks that target infrastructure—such as roads and antennas—and military camps are far from residential areas. Another critical factor is the ideology of the different groups. In the Diffa Region, Bakura—a JAS commander considered to be the successor to Shekau and killed in 2021—remained faithful to the tactics employed by Shekau's JAS when Boko Haram split. JAS deliberately targeted civilians as part of its modus operandi, unlike ISWAP, who tends to target defence and security forces over civilians.[42]

Jihadi expansion from Mali and Burkina Faso into eastern Niger has led to the deployment of IEDs in western Niger, in the regions of Tillabéri and Tahoua. The groups behind these attacks include the IS in the Greater Sahara, in northern Tillabéri, and the confederation of al-Qaeda affiliates, known as the Group for the Support of Islam and Muslims, in south-western Tillabéri (Pavlik et al., 2021). In these regions, anti-vehicle mines, CWIEDs, and pressure plate VOIEDs have harmed civilians, disrupted humanitarian access, and interfered with industrial mining operations (MEO, 2019; Reuters, 2020).

The Small Arms Survey data set contains records of 174 IED-related incidents in Niger between January 2014 and January 2022, resulting in 285 deaths and 272 injuries. IEDs resulted in at least 171 civilian and 365 military casualties—both killed and wounded—in Niger (Small Arms Survey, 2022). While Nigerien defence and security forces have been the primary target of IEDs in the western part of the country, insurgents have also targeted civilian infrastructure, such as mobile phones and radio masts. In July 2021 in Torodi, in south-western Tillabéri, 15 soldiers were killed in a single ambush involving IED use (Mosaique Guinée, 2021). Civilians and government officials have been similarly affected, with a notable incident in the Tillabéri Region being the death of seven members of the electoral commission when their vehicle drove over an IED on polling day in February 2021 (Al Jazeera, 2021). International forces have also been targeted by IEDs, including United States forces undertaking bilateral training in 2019 (Menastream, 2019a).

The trafficking and illegal use of explosives is widespread in certain areas of Niger, facilitating access to IED-making materials. External sources of explosives include Burkina Faso and Algeria. Field research carried out for this study identified extensive non-compliance with national gold extraction regulations in the artisanal mining sector, including the widespread illicit use of commercial explosives (see Images 2–3). The Nigerien customs service has seized explosives and initiators at Abalak and Yaya in the Tahoua Region, and police have confirmed the frequent use of explosives at artisanal gold mining sites in both the Agadez (Tchibarakatan, Djado) and Tillabéri (Koma Bangou and Tamou) regions (Illiassou, 2020). This information is consistent with the findings of a 2016 study commissioned by Niger's ministry of mining (Illiassou, 2020).

As of late 2020, the most common unauthorized use of explosives in Niger was in subsurface mining, known as tunnel or gallery gold mining. Small Arms Survey researchers observed mining in galleries at sites in the Tillabéri and Agadez regions—in Djado North, Koma Bangou, and Mbanga—operating at a subsurface depth of 30 to 60 m. In the north-west (in Emi Lulu), some mines have a depth of more than 100 m. At these depths, mining is only possible through explosives (Illiassou, 2020, p. 11).

Source and transit states

Ghana[43]

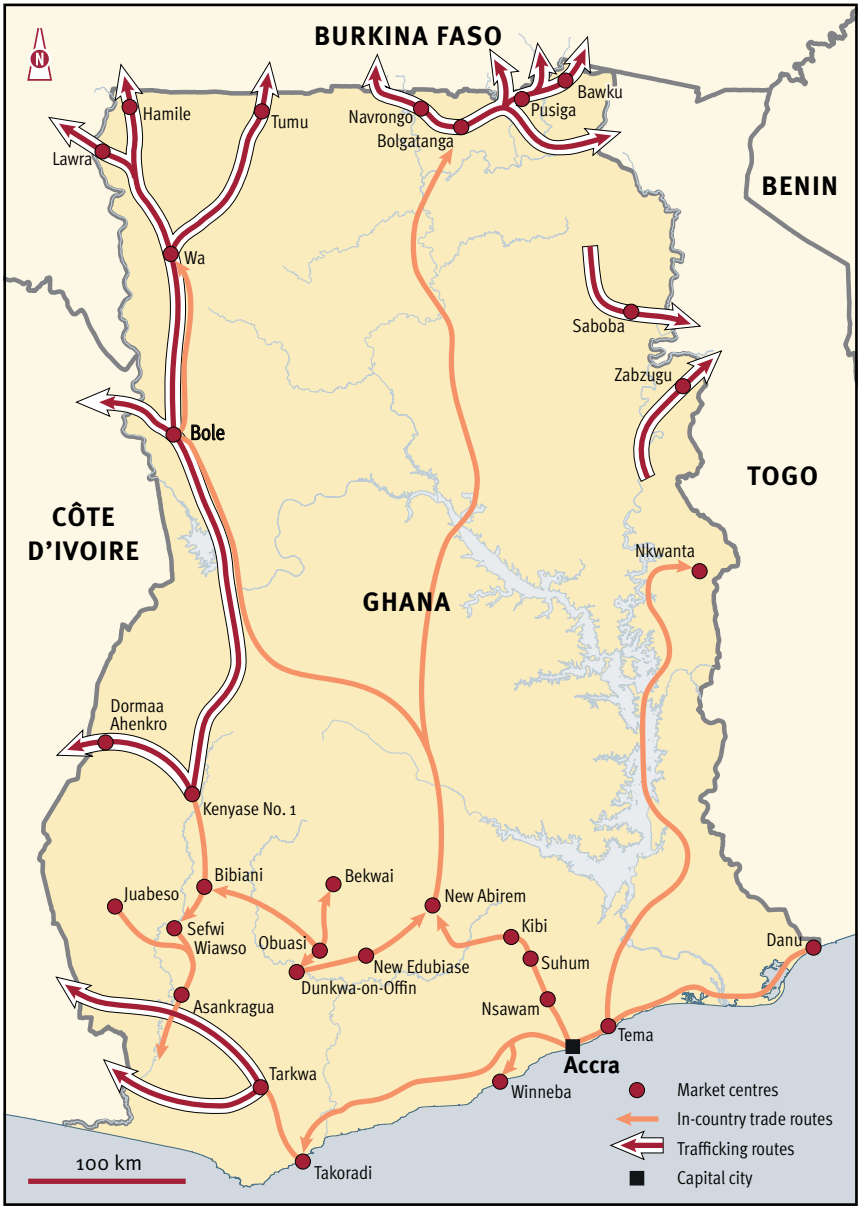
Small Arms Survey field research indicates that while Ghana has not been significantly affected by IED use, concerns are growing regarding expanding insurgencies to the north and north-west in Burkina Faso and Côte d'Ivoire. Domestic cases to date have involved crudely manufactured IEDs but no related explosions. Ghana's first reported seizure of domestic IEDs was in connection to an alleged coup d'état plot uncovered in September 2019.

Field research generally reveals that Ghana is an important centre of West Africa's commercial gold mining sector; it also serves as a regional distribution hub for the associated commercial explosives industry. Commercial explosives are legally distributed within Ghana and exported to recipients throughout the region. A boom in artisanal mining across West Africa has seen a massive demand for commercial explosives in the region. Illegal imports and manufacturing of explosives, along with unregulated supply through lax compliance and enforcement of licensing and regulations, partially feed this demand.

These trends have also facilitated the provisioning of bomb-building networks in Burkina Faso, Mali, and Niger, with a more recent expansion into Benin, Côte d'Ivoire, and Togo.

Two companies distribute explosives through Ghana: the Johannesburg-based African Explosives Ltd.—known since 2020 as Associated Electric Cooperative Incorporated (AECI)—and the Spain-based MAXAM Corporation. They are also the major legal suppliers of explosive materials to Mali, alongside the South African company Bulk Mining Explosives, which imports explosives and precursors through Dakar, Senegal. Products such as electric initiators and AN that AECI and MAXAM Corporation manufacture for the mining sector are the most easily identifiable commercial items making their way into IED production in Mali, where they have been documented in caches and during post-blast investigations.[44] These items are likely diverted from the legal supply in Ghana and trafficked into Mali. The seizure of MAXAM Corporation explosives has occurred in criminal investigations in Ghana since 2014 (News Ghana, 2014).

Map 2 Trafficking and trade routes of commercial explosives within and exiting Ghana, 2014–20



Source: Tettey (2019, p. 51). Base map data source: OpenStreetMap

The company recently agreed to pay a fine of USD six million in a case involving an explosion in western Ghana that killed 13 people and injured many others in January 2022 (Forson, 2022).

Small Arms Survey researchers examined legal and illicit production, diversion, and trafficking of explosives in Ghana (see Map 2). Findings showed that the trafficking of legally produced supplies flows from Ghana into neighbouring Burkina Faso, Côte d'Ivoire, and Togo. Onward movement into Mali appears to occur through Burkina Faso or Côte d'Ivoire, following a pattern observed in previous Survey research (Mangan and Nowak, 2019). Research also suggests that legally produced fertilizers and illegally produced explosives are trafficked into neighbouring countries, including Burkina Faso, Côte d'Ivoire, and Togo.

Map 2 shows that illicitly produced explosives of Ghanaian origin eventually make their way into Guinea, Liberia, Mali, and Niger via the same transit countries, some of which are also affected by IED use—Burkina Faso, Côte d'Ivoire, and Togo. Survey researchers observed unlabelled explosives in artisanal mining sites in Burkina Faso and Mali that could have been illicitly manufactured in Ghana, the only country where locally produced explosive main charges in the form of baguettes have been documented (Tettey, 2019). The field research also indicates that there is use of illicit Chinese-branded explosives in Chinese-controlled quarries in Ghana (Tettey, 2019). Undercover operations undertaken by Ghanaian authorities in 2021 demonstrated that commercial explosive main charges could also be obtained illegally in Ghana.

Evidence related to seizures at Ghana's borders shows that diverted commercial explosives are trafficked into neighbouring countries on commercial transport vehicles and pack animals. Traffickers hide explosives among used clothes and other legitimate

French-manufactured Titanobel-labelled explosives documented during black-market-related undercover operations by Ghanaian authorities in Kumasi, Ghana, 2021.

Source: Leonard Tettey

goods to avoid detection. Research conducted in 2019 at Agbogbloshie Market in Accra indicates that smugglers conceal explosives with other contraband goods in hidden compartments and fake fuel tanks in cargo vehicles.

Field studies conducted for this project further suggest that dealers and mining or quarry companies deliberately procure more explosives than they need or are permitted to import to resell the surplus on the illegal market. Another factor that facilitates the illicit manufacture and trafficking of explosives is fraud, such as falsifying licences and corporate certificates for mining and explosives companies.

Ghanaian law enforcement officials have also caught certified dealers diverting and selling commercial explosives to unauthorized users. In 2014, for instance, police intercepted numerous shipments of MAXAM explosives in Amansie Central, Ellembelle, Lower and Upper Denkyira, Obuasi, Tarkwa-Nsuaem, and Wassa Amenfi. In Obuasi, police seized 89 pieces of MAXAM Riodin plastic explosives and detonating cord from illegal miners. In a similar operation in the Abeka suburb of Accra, police apprehended three suspects and retrieved 104 sacks of mining explosives and two sacks of initiators.

Guinea

Guinea's post-election violence in late 2020, coup d'état in September 2021, and subsequent suspension from ECOWAS have made it significantly more difficult to engage with the government regarding research on IEDs and explosives trafficking. As a result, this Report presents the results of preliminary field research undertaken in late 2020.[45]

The Survey's research team found no indication that Guinea had witnessed any IED incidents; however, one source stated that Guinea's Ministry of Security and Civil Protection had reported the discovery of a single IED on 23 March 2020 (Max Security, 2020). The Small Arms Survey has not been able to verify this account. What is more certain is that commercial explosive products are used illegally at artisanal mining sites in Guinea—as they are in Burkina Faso, Mali, and Niger—and that the country is both a destination and a source of illegal commercial explosives. Guinea reportedly also has substantial caches of abandoned explosive ordnance in border areas, which are particularly vulnerable to diversion.[46] Caches including grenades, arms, and ammunition have been recovered inside Malian territory close to the Guinean border.[47]

The field research found that artisanal gold mining has grown considerably in recent years, particularly in two Guinean prefectures bordering Mali—Siguiri and Mandiana. Accompanying the boom is a significant influx of people from other countries in the region, including Burkina Faso, Ghana, and Mali, as well as an increase in the trafficking and use of explosives and other related chemicals.

In interviews conducted by the Survey's researchers, artisanal gold miners and defence and security forces confirmed that explosives are obtained clandestinely and used illicitly at illegal mining sites. Their testimony is corroborated by evidence from military seizures of diverted explosives at these sites, as well as documentation of related accidents. Some interviewees said that foreigners mostly used explosives—in particular, Burkinabé and Malians—whom they referred to as 'experts in their use' (Sow, 2021, p. 7).

During visits to artisanal mines in Siguiri and Mandiana, the field research team observed piles of debris at sites where there was use of explosives. As indicated by interviewees, these sites included areas of high use, such as those in the districts of Bebemta and Sala, in the subprefecture of Doko; areas of low use, as in the Niagassola district; and areas of probable use, such as in Kintinian and Siguiri (Sow, 2021). The principal entry points for trafficked explosive products are through the Doko subprefecture at the Kourémalé border crossing and Niagassola on the border with Mali. Trafficked explosive products leave Mali via Kalana for the Gbonkô district in Guinea via Niantanina. Local sources indicate that trafficked explosive products from Mali come from the 'Fadafina' mining company, which they say is managed by a national of the Russian Federation.

Confirming findings of Survey research conducted in Mali in 2019, fieldwork undertaken for this study in both Guinea and Mali indicates that commercial explosives have been diverted from Guinean suppliers or end users and employed at artisanal mining sites in Mali (Diakité, 2020, p. 9). Similarly, research suggests that explosives from Côte d'Ivoire are trafficked into Guinea and Liberia, although further research is needed in this area (Kouassi, 2020).

States with emerging IED threats

Benin

Terrorist-designated networks have become increasingly operational in immediate proximity to the border with Benin since jihadist activity began to spread south from Mali and through Burkina Faso in 2016. The areas surrounding the W National Park, which straddles the tri-border region of Benin, Burkina Faso, and Niger, are particularly exposed (Konrad-Adenauer-Stiftung, 2021, p.9).

IED use in Benin emerged in 2021 following several armed confrontations between jihadists—who had crossed into northern Benin from Burkina Faso—and local park rangers and security forces. The first such skirmish took place some 70 km inside Benin. In December 2021, Benin experienced its first IED incident: a military vehicle struck a roadside bomb near the town of Porga, wounding four soldiers (Lyammouri,

2022). In early February of the following year, the deployment of an IED, small arms, and light weapons against a mixed patrol of rangers and Benin armed forces occurred. The confrontation killed five rangers, a soldier, a civilian, and a French instructor and left 12 others wounded. Two days later, another soldier died when an IED hit a Beninese commando unit (African Parks, 2022).

Sources suggest that IED designs employed in Benin match those of devices used by JNIM in Burkina Faso. IED use in both countries has involved HMEs, pressure plates, initiators, and detonating cord (Hainard, 2022). The Small Arms Survey has not examined the possible role of Beninese civilian or commercial actors in the diversion or trafficking of explosives into the artisanal mining sector or connected to IED networks within Benin or neighbouring states.

Côte d'Ivoire

The Ivorian civil war in 2002–04 led to a de facto partitioning of the country until 2011 and contributed to weapons proliferation. Research by the Small Arms Survey shows arms and ammunition diverted from defence and security forces in Côte d'Ivoire entering into circulation and trafficked to Mali for use by rebel, terrorist-designated, criminal, and self-defence groups (Mangan and Nowak, 2019).

Conflict associated with the Mali crisis threatened to spill over into Côte d'Ivoire as early as 2015, when a cell of Ansar Dine, an al-Qaeda affiliate based in northern Mali, emerged in southern Mali near the Ivorian border. Attacks by this cell in the Sikasso border region, near the border at Misséni and Fakola, prompted the Malian armed forces to carry out operations in both countries. The 'Ansar Dine South' cell was soon dismantled by Malian defence and security forces, and Ansar Dine withdrew (Maïga, 2015). By 2016, however, Côte d'Ivoire had experienced a high-profile attack just south of its capital, at Grand Bassam beach. Claimed by al-Qaeda, the armed attack injured 33 civilians and took the lives of 16 civilians and 3 soldiers, raising fears of a rapidly expanding Islamic insurgency (Al Jazeera, 2016b).

Over the following years, the regional security situation gradually deteriorated as jihadist attacks spread westward and southward in Mali and across the border in south-western Burkina Faso, leading to renewed attacks in the Sikasso Region of Mali. In June 2020, that violence spilled into northern Côte d'Ivoire as an assault blamed on jihadis claimed the lives of 14 soldiers in Kafolo (Campbell, 2021). In April 2021, Côte d'Ivoire experienced its first IED attack, followed by at least another three IED incidents that year (France 24, 2021).

The Small Arms Survey team carried out preliminary research in Côte d'Ivoire in late 2020, prior to the country's first reported IED incident. Fieldwork took place against the backdrop of election-related instability and pandemic-related restrictions, which

limited the team's access to evidence. The findings nevertheless echo those of studies conducted in neighbouring states, highlighting regional similarities in the production and trafficking of IEDs.[48]

In terms of IED production, the components used in Côte d'Ivoire are similar to those used in Burkina Faso and Mali. IEDs in all three countries feature RCIED receivers of the same make and model—Shenzhen Toada TAD-80—and modified anti-vehicle mines, both PRB M3 and PTMi-BA-III (see Section III).[49]

As in other countries under study, one of the main drivers of explosives diversion and trafficking in Côte d'Ivoire appears to be artisanal and small-scale gold mining. The Ivorian mining code prohibits using chemicals for extracting and refining gold and explosive substances in unlicensed mining operations (Côte d'Ivoire, 2016). The Ministry of Mines and Geology has recorded at least 241 illegal mining sites and approximately 23,400 artisanal gold miners. While the research did not find evidence of the artisanal mining sector serving as a source of explosives for IED-building networks, this risk is worth highlighting.

Field research suggests that local and cross-border networks in Côte d'Ivoire support the trafficking of chemicals, precursors, and explosives used by both licensed and unlicensed miners working in gold extraction and leaching. Diversion takes place at industrial mining sites, following the delivery of supplies purchased by mining actors who are authorized to buy and use chemical precursors. Control officers escort such deliveries to the mining sites and ensure they are placed into storage. Company employees allegedly resell these products on the black market in unmarked containers.

Another method allegedly employed by local smugglers is using forged customs declarations to import chemicals. By paying bribes, some companies can secure fraudulent import licences or transit documents that allow them to import commercial nitrate-based chemicals declared as agricultural fertilizers, or explosives declared as fireworks.

In December 2019, elements of the gendarmerie and anti-drug brigades of central-western Côte d'Ivoire seized explosives and mercury during a joint operation in the village of Kouégo, which has a clandestine mining site. This operation took place following a series of local attacks, and led to the arrest of three men, including two gold miners, a *dozo* or traditional hunter, and a female trader involved in explosives trafficking (Kouassi, 2020, p. 18).

The fieldwork for this study indicates that Côte d'Ivoire also serves as a transit hub for the diversion and trafficking of explosives and chemical precursors, specifically via illicit re-exports. Having legally transited through Côte d'Ivoire on the way to Burkina Faso and Mali, these products allegedly get smuggled back into Côte d'Ivoire for artisanal and small-scale mining purposes. In September 2020, the regional customs department of the Poro Region, on Côte d'Ivoire's border with Burkina Faso and Mali,

seized 1,561 sticks of explosives, 756 initiators, 6 rolls of detonating cord, 24,723 12-gauge shotgun shells, and 0.3 kg of mercury. These items were exhibited at the premises of the Regional Directorate of Customs in Korhogo (Kouassi, 2020, p. 20).

At the time of the research in 2020, Côte d'Ivoire had established a dedicated cell responsible for monitoring and analysing the diversion and trafficking of explosives (see Box 6). Comprised of representatives of the police, gendarmerie, customs service, and military, this joint unit has benefitted from WCO's Programme Global Shield and the cooperation of INTERPOL and the UN Office on Drugs and Crime (UNODC). The programme offers training, technical assistance, operational exercises, information-sharing, and intelligence to equip the unit better and prevent product diversions from the legal supply chain. In 2021 and 2022, UNODC conducted workshops in Côte d'Ivoire to help the government assess its level of preparedness for IED threats. These workshops employed the UNIDIR C-IED maturity model and self-assessment tool, which was designed for this purpose. ●

“The Survey’s research has identified that the IEDs employed in West Africa involve both command-operated IEDs and victim-operated IEDs.”

III. IED types and components in West Africa

This section presents an analysis and mapping of the information gathered in the Small Arms Survey IED database (Small Arms Survey, 2022) (see Figures 4 and 5), which comprises data and evidence from open sources, national and international military and government sources, and UNMAS (see Section I). It discusses trends in the use of IEDs, technical aspects of IED switches, and the main components to manufacture IEDs.

Out of the countries covered by the study, Mali has been the most heavily affected country in terms of the number of IED incidents and the duration of the current crisis; however, there have been few 'innovations' in terms of the techniques, tactics, and procedures observed since 2013. At the same time, the situation in the neighbouring countries—predominantly Niger and Burkina Faso—has rapidly deteriorated. In 2022, some observers started to refer to Burkina Faso as the epicentre of violence and civilian casualties in the subregion.

Based on data from the Armed Conflict Location & Event Data Project (ACLED), IED casualties in Burkina Faso have eclipsed those in Mali since 2021 (Deutsche Welle, 2022). While the Burkina Faso border region with Mali has not seen any significant evolution regarding the typology of IEDs employed, the Est Region of Burkina Faso and the Tillabéri Region in Niger have seen worrying signs of innovation. Some field experts[50] consider these regions as 'laboratories' for the whole region as they predict that new developments could migrate towards Benin, Côte d'Ivoire, and Togo. It is also possible that these developments in Burkina Faso and Niger could have adverse effects on the already deteriorating situation in Mali, especially following the departure of the French Operation Barkhane[51] and Operation Sabre[52] from Mali and Burkina Faso.

Trends in IED types

The type of switch used to build an IED can help classify IEDs to understand the techniques and tactics employed by the IED builders and 'emplacers'. In this Report, IED 'switches' refer to the systems by which IEDs are initiated, by either a 'firer' or victim, through an action which completes an electrical circuit. This action can cause an electric detonator to initiate the explosive chain and the IED main charge. The type of switch can, therefore, help determine whether IED users intend to cause indiscriminate damage or whether they are discerning in their targeting. They can also provide information on:

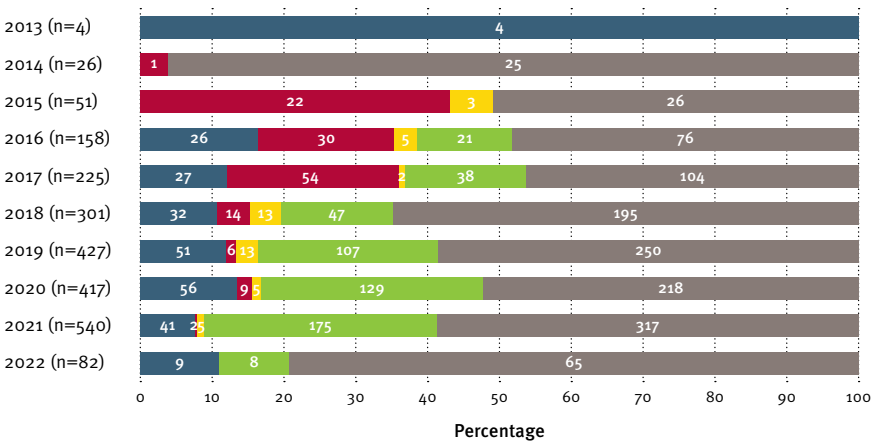
- the modus operandi of a particular armed group employing the device;
- the level of technical knowledge of the group—RCIEDs are more complex than VOIEDs, for example;

- the deliberate intent to cause or avoid civilian casualties—RCIEDs allow users to discriminate their targets, which is not the case for VOIEDs; and
- the operating environment (use of CWIEDs is typical in places where the trigger operator can remain in close vicinity while hiding, such as in the bushes, whereas RCIEDs can be used from a distance when there is no cover available close to the IED location).

Switches are also an indicator of the psychological effect that armed groups want to instil among the local population and the defence and security forces. The booby-trapping of corpses, in addition to being a violation of international humanitarian law (IHL), is particularly traumatizing and may be seen as a violation of cultural norms and an effort to terrorize and demonstrate ruthlessness. This technique has been documented in Afghanistan, Iraq, and Syria by the IS and in other historical conflict theatres, including Vietnam and Mozambique (Huitt, 2016).

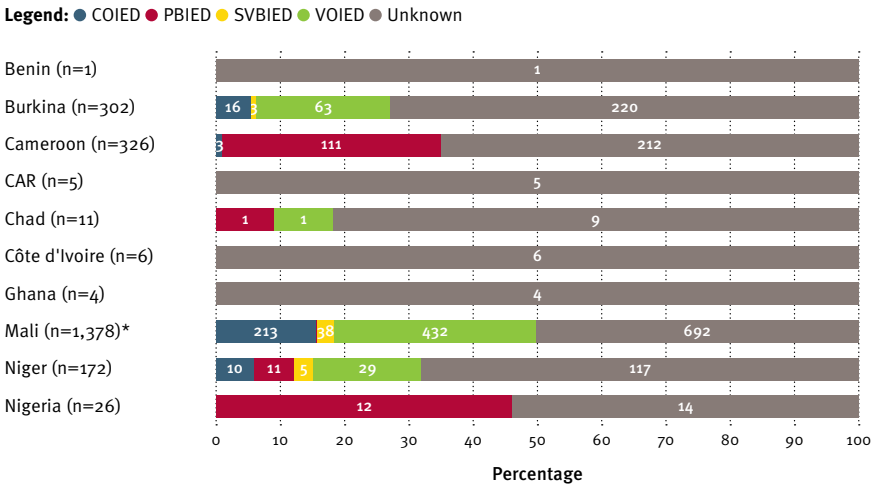
The Survey's research has identified that the IEDs employed in West Africa involve both command-operated IEDs (COIEDs) and VOIEDs (see Figures 4 and 5). COIEDs include command wire and radio-controlled firing switches, while VOIEDs include pressure plates and booby-traps. The most sophisticated IEDs in use in West Africa are a combination of both command- and victim-operated switches in RAVOIEDs. This research also highlights several means of IED delivery. These include PBIEDs, VBIEDs, and PIEDs; however, PIEDs are not covered in detail in the study, as they typically

Figure 4 Distribution of IED incidents, by type of IED per year, March 2013–September 2022



Source: Small Arms Survey (2022)

Figure 5 Distribution of IED incidents, by type of IED per country, March 2013–September 2022



Note: The data presented in this figure should not be considered exhaustive. A focus has been operated on specific areas of some countries—for example, certain border areas in the Central African Republic, Chad, and Nigeria—and only partially captures the extent of the issue. * PBIED segment is equal to 3.

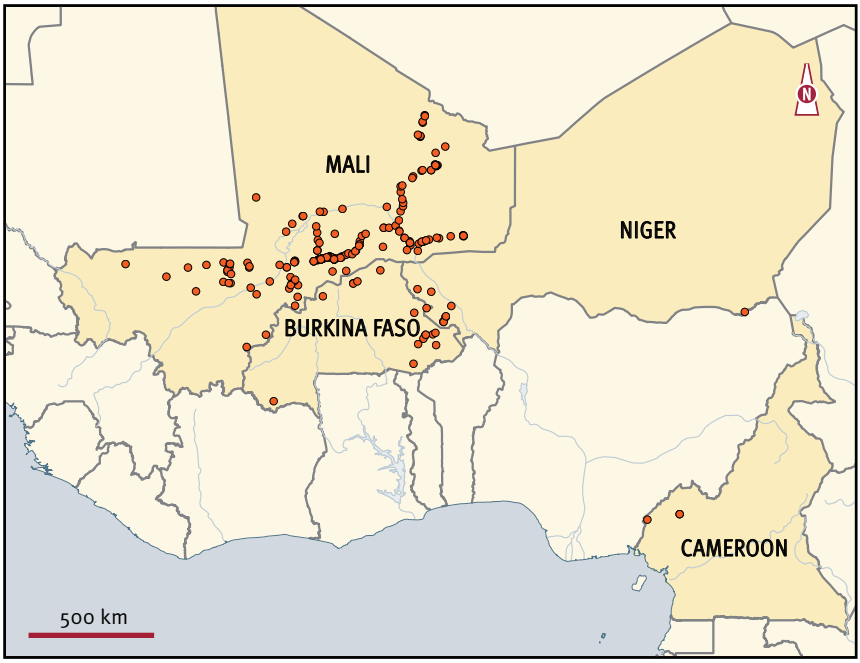
Source: Small Arms Survey (2022)

use factory-manufactured rockets acquired through battlefield capture and are employed with improvised launchers such as a tree, sand-dune, sandbag, or simple welded tripod, and timers such as mobile phones. Overall, the research could not reveal the type of firing switch involved when an IED was classified by means of delivery in most cases.

Command-operated IEDs

A COIED contains a switch activated by the attacker, who retains control over the device. These devices usually feature a degree of separation between the main explosive charge and the switch at the firing point, allowing the trigger person to choose the optimum time for initiation and create the greatest targeted effects. The Small Arms Survey IED database documents COIEDs that use two main types of command-operated switches in West Africa: radio-controlled and command wire (see Map 3). Radio-armed switches constitute a third type of command-operated switch but are used to arm, rather than initiate, an IED. Their use is more limited and appears confined to Burkina Faso and Mali. The most sophisticated IED tactic in the theatres under study is the use of these switches in RAVOIEDs.

Map 3 Distribution of COIED incidents in West Africa, March 2013–September 2022



Note: As a focus has been operated on specific areas of some countries, the data presented in this map should not be considered exhaustive.

Source: Small Arms Survey (2022)
Base map data source: OpenStreetMap

Command wire IEDs

CWIEDs employ a physical wire connection between the initiator and a power source, typically involving a motorcycle battery locally in use. They require the person operating the trigger to be near the main charge, which allows a more precise discrimination of targets but increases the risk of detection.

Given the difficulties many states experience in carrying out post-blast investigations in remote areas, it can be challenging to determine whether there was the use of an RCIED or a CWIED. Some CWIED incidents may, therefore, be reported as RCIEDs and vice versa. The Small Arms Survey IED database contains only 54 confirmed cases of CWIED incidents (Small Arms Survey, 2022). Use of these devices occurred in Burkina Faso, Niger, and—most often—Mali's Mopti Region.

Radio-controlled IED switches

Small Arms Survey research has identified commonalities in the components and design of RCIEDs in Mali and Libya. RCIEDs documented in this research include Chinese-made radio-controlled transmitters and receivers, handheld very high frequency (VHF) radios, and car or motorcycle alarm systems. Studies have also revealed that RCIED switches using mobile phones of the same design are used in Mali and Nigeria, as well as in Iraq, Kenya, Somalia, and Yemen (Small Arms Survey, 2020, Annexe).

Radio-armed, victim-operated IEDs

RAVOIEDs are a combination of RCIEDs and VOIEDs. RAVOIEDs are armed with an electronic device, which is typically the same as the receivers and transmitters used for RCIEDs in the region. Once armed, the IED is triggered when a victim steps or drives on a pressure plate. Unlike standard VOIEDs, RAVOIEDs allow for the targeting of a specific person or group of persons; however, they require the attacker to remain in the vicinity of the IED to identify the target and arm the switch, much like CWIEDs.

Six RAVOIED incidents took place in Mali between 2017 and 2021, all of them in the Kidal Region of Mali. The devices combined the same model of receiver or transmitter with a pressure plate, but none of them detonated. It is, therefore, possible that other functioning RAVOIEDs were in use but mistakenly categorized as RCIEDs or VOIEDs. The Small Arms Survey IED database also documents RAVOIEDs in Burkina Faso (Small Arms Survey, 2022).

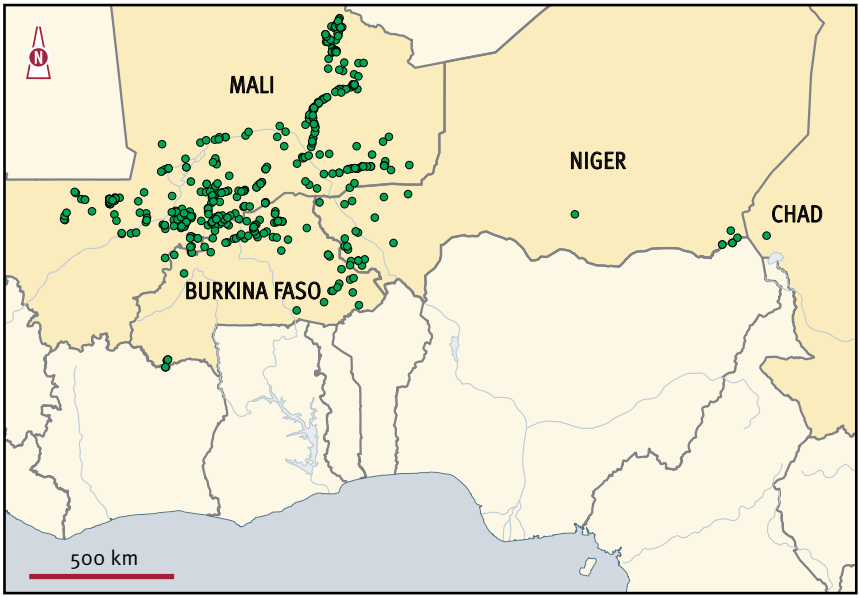
Victim-operated IEDs

Unlike COIEDs, VOIEDs cannot discriminate or target specific victims. They use a switch that is 'activated by the actions of an unsuspecting individual' and 'rely on the intended target to carry out some form of action that will cause it to function' (UNMAS, n.d., p. 65). The Small Arms Survey IED database documents VOIEDs (see Map 4) that rely on two types of victim-operated switches: pressure plates and booby-traps.

Pressure plates

A pressure plate IED is a VOIED, typically initiated by a person stepping on, or a vehicle driving over, the pressure plate, causing the firing circuit to complete and initiate the main charge.[53] Pressure plates are the most common switches in VOIEDs in West Africa. Different designs exist, but they are relatively similar throughout the region. In most cases, they are made with motorcycle tyres and are sometimes housed in wooden structures. The use of cans or bolts allows electrical current to circulate. The only design development over recent years has been the limited use of M60 fuses,

Map 4 Distribution of VOIED incidents in West Africa, March 2013–September 2022



Note: As a focus has been operated on specific areas of some countries, the data presented in this map should not be considered exhaustive.

Source: Small Arms Survey (2022). Base map data source: OpenStreetMap

typically used in conjunction with the PRB M3 mine (see case study in Section IV). Armed groups in Mali and Libya share this novel pressure plate design.

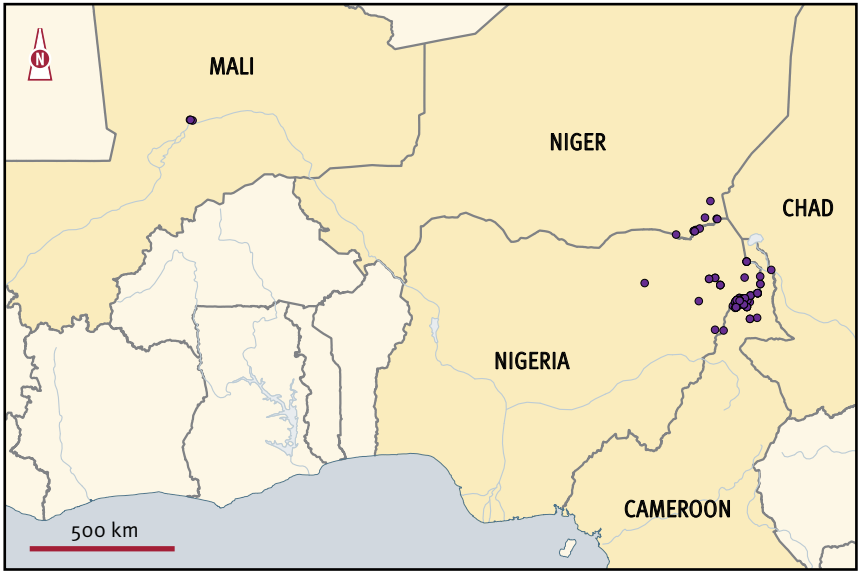
Booby-traps[54]

In 2019, Small Arms Survey field teams documented several confirmed cases of booby-trapped human corpses in Mali and Burkina Faso. Booby-traps that have been recorded in the Small Arms Survey IED database since then have used bodies, cars and motorbikes, and military equipment (Small Arms Survey, 2022). Of the 19 cases of booby-trapped bodies documented by the Survey, at least nine were civilians who had been abducted or declared missing (Small Arms Survey, 2022). Booby-traps have targeted both civilians and defence and security forces. Recent research indicates that booby-traps, including anti-lift devices of the same design connected to mines or IEDs, were used nearly simultaneously in Burkina Faso, Mali, and Niger. This use suggests a possible shared technique, tactic, and procedure or common training of armed groups operating in all three countries (Hainard, 2022).

Person-borne IEDs

PBIEDs are comparatively rare in the countries under review, except in Cameroon and the bordering regions of Nigeria (see Map 5). Cameroon has seen the highest number of PBIED incidents in the region under study, with 111 incidents recorded in the Small Arms Survey IED database (Small Arms Survey, 2022). Some PBIEDs may fall under the category of *proxy IEDs*, where the suicide bomber is an unwilling victim of the group employing the device. Such coercion can occur through the use of a remote switch, such as a mobile phone or radio, that the suicide bomber does not control. By nature, it is often difficult to reconstruct after an attack whether the bomber willingly initiated the PBIED or was coerced into being its vehicle. Niger has recorded 13 PBIED incidents, almost exclusively in the Diffa Region, which is in the south-east of the country near the border with Nigeria (Small Arms Survey, 2022). PBIEDs have also been used in central and northern Mali in Sévaré and Timbuktu, including as part of complex attacks involving SVBIEDs, mortar fire, and direct fire by assault teams. These attacks are similar to the 2017 assault on MINUSMA, Barkhane, and the Timbuktu Airport.[55]

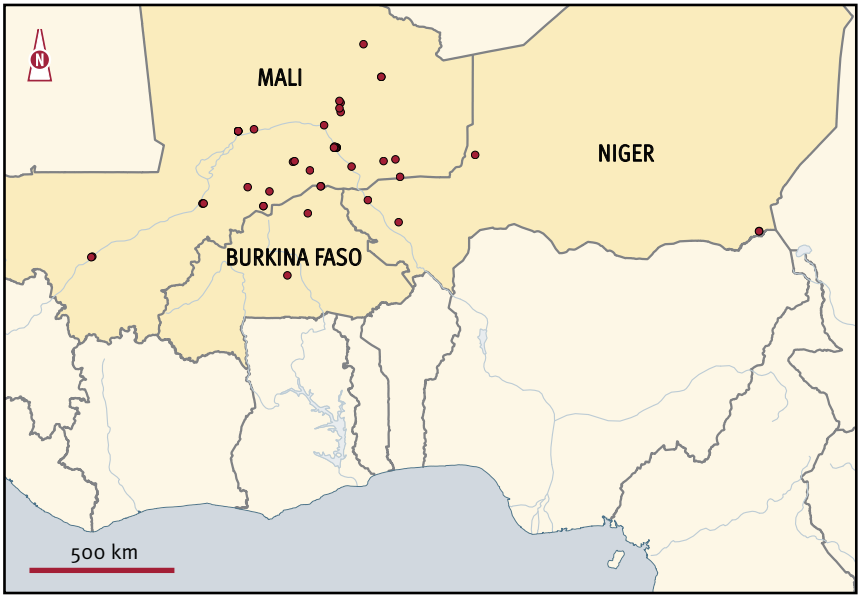
Map 5 Distribution of PBIED incidents in the countries and border regions under study, March 2013–September 2022



Note: As a focus has been operated on specific areas of some countries, the data presented in this map should not be considered exhaustive.

Source: Small Arms Survey (2022)
Base map data source: OpenStreetMap

Map 6 Distribution of SVBIED incidents in the countries and border regions under study, March 2013–September 2022



Note: As a focus has been operated on specific areas of some countries, the data presented in this map should not be considered exhaustive.

Source: Small Arms Survey (2022)
Base map data source: OpenStreetMap

Vehicle-borne IEDs

As shown in Map 6, the use of SVBIEDs has occurred in Burkina Faso, Mali, and Niger. These suicide attacks have targeted international armed forces involved in counter-terrorism operations, UN peacekeepers, domestic non-state armed groups participating in ceasefire-related confidence-building mechanisms, and national defence and security forces.

SVBIEDs require large quantities of material. While HMEs used as the main charge for an IED usually weigh 15 kg to 40 kg, SVBIEDs can reach 800 kg. Assembling and deploying these devices for complex attacks requires significant logistical and technical preparations. SVBIEDs used in Mali and Niger show apparent design similarities (see Images 4–5). VBIEDs, including a limited number of armoured VBIEDs, have also been used in Nigeria (Campbell, 2018), but no VBIEDs have been documented in Cameroon so far (Sumo Tayo, 2022).

4

This vehicle, which was stolen from an NGO, was converted into an SVBIED and subsequently abandoned after it failed to detonate. Weidabangou, Niger, May 2019.

Source: Menastream (2019b)

5

An SVBIED used in the attack on Gao Airport, Mali, claimed by the al Qaeda-linked Al-Mourabitoun in late 2016.

Source: Menastream (2016)

While the use of SVBIEDs is rare in Burkina Faso, the country experienced a double SVBIED attack in April 2022 as part of a coordinated cross-border attack that simultaneously targeted three sites in neighbouring Mali. The double SVBIED attack targeted two military detachments in Burkina Faso's Soum province (France 24, 2022a). In Mali, the SVBIED attacks were conducted against military infrastructure in Sévaré, in the Mopti Region, and in Bapho and Niono, in the Ségou Region (France 24, 2022b). SVBIED incidents also occurred in Burkina Faso in 2018–20.

The use of SVBIEDs has also damaged strategic infrastructure and equipment such as airfields and aircrafts. In Mali, such attacks took place at the airports of Gao in 2016 and Timbuktu in 2018.[56]

Overall trends in command versus victim-operated IED employment

In Mali, the number of RCIED incidents remained relatively constant from 2016 to 2018. In 2019, the number nearly doubled, and in 2021, it dropped significantly. In Burkina Faso and Niger, where the use of RCIEDs was rare until 2020, the number of incidents spiked in 2021 (Small Arms Survey, 2022).

Sources suggest that two factors may be the primary reasons for these diverging trends. The first factor is that components used to make RCIEDs are imported regularly in small quantities to avoid raising suspicion among customs agents. As a result, the availability of these components remains constant throughout the region, such that if their use increases in Burkina Faso and Niger, it must decrease in Mali.[57] The second factor revolves around the relationship between non-state armed groups and local populations. In countries where non-state armed groups are relative newcomers or are still trying to establish themselves and win local support—as was the case in Burkina Faso and Niger a few years ago—these groups might have a greater incentive to avoid killing civilians.[58]

The data also shows that some geographical areas witness more VOIEDs while others see more RCIEDs. This difference reflects local groups' techniques and tactics, access to materials, and knowledge of the effects they desire to create through IED use. VOIEDs are used primarily in the north of Burkina Faso, where the Malian theatre on the other side of the border may influence TAGs. In contrast, RCIEDs are used almost exclusively in the IED 'laboratories' of West Africa (Hainard, 2022, p. 12),[59] which are the Est Region of Burkina Faso and Todori Region of Niger, just across the border.

Data indicates that RCIEDs are used predominantly on the main roads, particularly in Burkina Faso. Criminals and 'bandits' are suspected of using IEDs to keep civilians and the military out of their territories and redirect traffic onto routes where they collect illegal taxes and tolls.[60] An increasing number of casualties and use of VOIEDs has

been observed. Interviews suggest that, unlike most armed groups, traffickers and bandits do not remove IEDs that have not functioned as intended. This method may partly account for the increase in the number of civilians and livestock killed and wounded by IEDs in 2022, based on reports provided by international forces (Hainard, 2022, p. 14).

IED components

The average VOIED documented in Mali and Burkina Faso contains an AN-based HME, initiator, detonating cord, battery, container, and crude pressure plate. Costing roughly USD 35, such an IED can defeat a half-a-million-dollar armoured vehicle fielded by national defence and security forces, peacekeepers, or international security forces.[61]

The original IED designs used in West Africa may have been inspired by practices seen in countries such as Afghanistan, Iraq, Libya, and Syria, as foreign jihadist fighters took part in the occupation of northern Mali in 2012. These groups used AN, potassium chlorate, and urea to make HMEs.[62] When they first arrived in Mali and other West African states, where the same products were available in large quantities, they may not have seen a need to adapt their methods to incorporate other components such as commercial nitroglycerine-based explosives. The latter, alongside plastic explosives, might also be less suitable for use by terorist-designated groups because they are more difficult to safely transport and store in caches in hot, dry climates. Commercial nitroglycerine-based explosives are unlike the precursors used in HMEs, which are relatively stable prior to being combined into HMEs. Nevertheless, while not widely used in most of the research area, commercial main charges have been documented in a small number of IEDs in Mali and are more widely used in Cameroon (Sumo Tayo, 2022).

The components that typically make IEDs—AN, initiators, and a detonating cord—are not classified as 'explosives' by regional industry actors (see Sections IV and V). AN is a precursor chemical that can be mixed with other chemicals to produce explosives. It is the base both for bulk explosive emulsion used in the mining sector and for the HME ANFO, which is used to make IEDs. Similarly, commercially produced initiators and detonating cord may contain high explosives, but the industry defines them as 'accessories' rather than 'commercial explosives', a term reserved for the main charge.[63]

The most widely used system for initiating main charges—for mining and quarrying explosives and for IEDs—are electric initiators used with detonating cords, which contain high explosives. The reliance on electric initiators remains strong, although many large-scale commercial mining operations have replaced electric initiators with non-electric initiation systems. Some documented IEDs, such as improvised grenades employing a 'time fuse' initiated by fire and a non-electric blasting cap, have been documented.[64]

While circular battlefield captures and re-captures of all types of military materiel are routine features of the conflicts within this study, the available data does not suggest a significant increase in incidents using military materiel in IED construction over the years (Hainard, 2022). But this could change with the increased number of attacks on defence and security force bases and convoys in Burkina Faso, Mali, and Niger. During these attacks, armed groups stole unknown quantities of military equipment and later displayed them in propaganda videos and photos. It appears, however, to be relatively rare for armed groups in these countries to capture heavy weapons above 23 mm and integrate their ammunition into IEDs for their explosive content and fragmentation. For example, 40 mm rocket-propelled grenade (RPG) high explosive anti-tank (HEAT) rockets are routinely captured but are not found in IEDs, potentially because they are more effective weapons when used as designed, and RPG launchers are ubiquitous in the research area.[65]

Where there is use of large calibre rockets, it is primarily in improvised, indirect fire attacks as a component of PIEDs targeting military and UN camps or airports,[66] which is not covered by this study. The use of these munitions—such as 120 mm Grad rockets, which were captured by armed groups early in the Mali crisis—in an improvised manner is likely because the launching systems are quite rare in the theatres under study. Disrupting the trafficking and diversion of AN could also potentially lead armed groups to turn more frequently to military materiel.

The illicit demand for commercial explosives, initiators, and detonating cord in West Africa comes primarily from the artisanal mining sector. Authorities have routinely seized all three products from artisanal mines in the countries under study. Both artisanal gold miners and IED manufacturers use initiators and detonating cord; however, unlike miners, bomb makers rarely use commercial explosive main charges. This discrepancy indicates that while miners are not necessarily collaborating with jihadists or other non-state armed groups that manufacture IEDs in West Africa, they both benefit from the illegal diversion of such material from commercial supply chains.

Commercial explosives, initiators, and detonating cord

Commercial explosive main charges. In West Africa, most commercial explosive main charges are nitroester-based or nitroglycerine-based. These explosives come in the shape of sticks, commonly called baguettes in the region. In recent years, authorities seized large quantities of diverted commercial explosive main charges. Yet they remain in constant supply on the black market, fuelled by demand from the informal extractive sector. As noted above, however, commercial explosive main charges are seldom used in the manufacturing of IEDs.[67] Rare exceptions involve the use of dynamite to sabotage telephone masts and a bridge, and some reported use of TNT in IEDs in Cameroon (Sumo Tayo, 2022).[68]

Initiators. Almost all documented initiators used as IED components in West Africa are from industrial manufacturing.[69] These items are widely available on the black market throughout the Sahel at low cost and documented in numerous seizures throughout the research period for this Report (Sollazzo, 2019). Observers in the field have noted a recent increase in the variety of sources of commercial initiators used as IED components. This trend may reflect the growing presence of foreign companies in West Africa's commercial extractive sector. Many of these companies import products such as initiators from their home countries.[70] The use of improvised initiators, however, is more common in other regions. In the DRC, recent documentation shows pentaerythritol-tetranitrate-based improvised initiators used by the Allied Democratic Forces (ADF), an affiliate of IS Central Africa Province (ISCAP).[71] In Libya and Syria, improvised initiators are common IED components, possibly because commercial initiators may not be as readily available.

Detonating cord. Unlike in some other conflict theatres, all the IEDs documented for this study in the West African context feature commercial—rather than home-made—detonating cord. This item is widely available on the black market across the region. Authorities have seized significant numbers of diverted detonating cord throughout this study (Sollazzo, 2019).

Ammonium nitrate, urea, and fertilizers

As noted above, there is a rare use of commercial explosives as main charges for IEDs in West Africa as the use of HMEs is more common.[72] The composition of an HME is currently the main knowledge gap concerning IED components. The near absence of post-blast investigations in countries such as Benin, Burkina Faso, Côte d'Ivoire, and Niger makes it very difficult to fill this gap. HME analyses that have been conducted —either before or after detonation—show that explosives are typically AN-based. Urea is seldom found in IEDs in West Africa, although Boko Haram makes wide use of it in northern Cameroon (Sumo Tayo, 2022).

In practice, C-IED operations lack terminological precision regarding HME components, sometimes using 'ammonium nitrate', 'fertilizers', and 'urea' interchangeably or incorrectly. As a result of this lack of clarity, governments have introduced ineffective measures, such as ones targeting the fertilizer industry in Mali (see Section V).[73]

Ammonium nitrate. AN comes in two varieties: fertilizer-grade ammonium nitrate (FGAN) and industrial-grade ammonium nitrate (IGAN). FGAN is used directly as a fertilizer, while IGAN is employed to make commercial explosives—mostly ANFO. Both FGAN and IGAN come in the form of prills, or small spheres, of the same colour and chemical composition. FGAN prills have a diameter of 2 mm, while IGAN prills are half as wide (GICHD, 2021, pp. 22–23). Being less dense and more porous, IGAN allows for better absorption of fuel oil to make commercial ANFO as a bulk mining emulsion explosive (Hainard, 2022).

Once the AN has been ground and mixed with other products, chemical analysis cannot distinguish whether there was use of FGAN or IGAN. It is, therefore, impossible to determine whether the original destination of the AN used to make an HME was for the trade in fertilizers or commercial explosives. Detailed seizure documentation, original packaging, and photos—if available—can provide clues as to the variety of AN used in an HME.

Urea and other fertilizers. The West African fertilizer industry imports urea in large quantities every year, but its use in the production of HMEs appears to be limited. In Mali, for example, only a few post-blast investigations have identified traces of urea in HMEs. While authorities in the region regularly seize large quantities of diverted urea, the substance is unlikely to be destined for IED-building networks in the region.[74] In contrast, Boko Haram makes wide use of urea as the basis for HMEs in northern Cameroon, as noted above (Sumo Tayo, 2022).

Urea itself is not an explosive. Its conversion into urea nitrate is the first step in making a urea-based HME. The process is complex, requires equipment, and can be difficult to conceal due to unpleasant odours, noise, and the need for a large amount of space. Unlike urea, which has a high nitrogen content, most fertilizers in West Africa are unsuitable for making HMEs because their nitrogen content is too low at less than 24.5 per cent. The majority are nitrogen, phosphorus, and potassium (NPK) types, which contain various proportions of these elements; the most common is NPK 15-15-15. Another widespread type is di-ammonium phosphate (DAP) 18-46-0, which does not contain potassium.

Niger appears to rely entirely on imports for its fertilizer supplies.[75] In Burkina Faso and Mali, the domestic production of fertilizers—such as NPK types and urea—accounts for only one to five per cent of supplies needed to meet demand; the balance is imported (Feed the Future, 2022). In Burkina Faso, about ten per cent of the total quantity of imported fertilizer goes missing every year; in Mali, the proportion is twice as high.[76]

Trafficking fertilizers is common in West Africa because subsidies in some states make it lucrative to smuggle the products across borders and sell them at a profit. While this illicit trade may represent a source of financing for TAGs, non-AN fertilizers are not likely to be destined for IED-building networks themselves, as they cannot produce as powerful of an explosion as AN. The fact that some analysed IEDs contain traces of non-AN fertilizers most likely indicates that bomb makers use them in the absence of available AN.[77]

Military materiel

Mortar shells, grenades, artillery shells, and rockets. The lack of information on the design and components of IEDs in Burkina Faso precludes an accurate assessment

Mortar shells connected by detonating cords in an SVBIED that was recovered intact from the 2016 Gao Airport attack.

Source: Menastream (2016)

of the volume and type of military materiel used in their production. More details are available for Mali and Niger, where IED makers employ the same designs and military materiel, which are typically 122 mm rocket artillery projectiles, 120 mm mortar shells, 82 mm mortars, 60 mm mortars, and grenades. Analysis of IEDs indicates that when there is use of military materiel, it generally serves as the main charge; however, it is sometimes coupled with HMEs or anti-vehicle mines or used as a booster in large SVBIEDs such as the 2016 Gao Airport attack (see Image 6).[78] Spent small arms cartridges are also sometimes added to the HME to increase the fragmentation effects.

In West Africa, ordnance of various types has been linked to pressure plates to create VOIEDs. The use of other types includes HME boosters in SVBIEDs—such as the 2016 SVBIED attack on Gao Airport[79]—or as the main charge in RCIEDs. SPBIEDs typically involve grenades of Russian or Chinese manufacture, cluster sub-munitions,[80] or mortars hidden in a backpack. In contrast, others worn by PBIEDs include HMEs, detonating cord, and electric initiators sewn into suicide vests (Sumo Tayo, 2022).[81] IED analysis suggests that ordnance used in these devices may be stolen from national stockpiles, collected following attacks on national defence and security forces, or trafficked from Libya (see Image 7 and Section IV).

Ordnance stolen from the Libyan Ministry of Defence in Benghazi, Libya, and found in a cache in northern Mali. Source: MINUSMA

Research indicates that in Cameroon's Extreme North Region, Boko Haram has been using explosives stolen from military arsenals in Cameroon, Niger, and Nigeria, including 81 mm and 120 mm mortar shells. Boko Haram has reportedly harvested the explosive content[82] from unexploded Nigerian anti-tank weapons, as well as unexploded French-manufactured Belouga BLG 66 cluster bomb sub-munitions, at least some of which were repurposed in PBIEDs in northern Cameroon in 2015. Boko Haram has paid civilians to collect unexploded ordnance for use in IEDs, with each recovered unexploded 57 mm air-to-surface rocket fired from helicopters fetching about EUR 75 (USD 85) (Sumo Tayo, 2022, p. 24).

Anti-vehicle mines. In Mali and neighbouring states, numerous documented IEDs contained legacy PRB M3 anti-vehicle mines manufactured in Belgium (see Map 7 and the case study in Section IV). These mines were used as designed to target vehicles; modified to serve as anti-personnel mines; or adapted to function as booster charges in IEDs. Their fuses have also been used to build pressure plates. While more research is required to allow for an assessment of the market rates of these units, fieldwork indicates that they were available in significant quantities on the black market from January 2019 to May 2022. In addition to Mali, the Small Arms Survey documented

these mines in Cameroon, Côte d'Ivoire, and Niger, where they are in use by armed groups (Hainard, 2022; Small Arms Survey, 2020, Annexe).[83]

Military-grade explosives. Research to date suggests that frequent use of military-grade explosives does not occur in West African bomb-making but that armed groups in Cameroon have integrated them into their IEDs. Small Arms Survey sources indicate that Ambazonian separatists have used TNT and plastic explosives such as C-4 and Semtex in their IEDs. Similarly, Boko Haram has used Semtex (Sumo Tayo, 2022). In Mali, where a small number of military-grade explosives was lost in a battlefield capture incident, documented IEDs did not show any trace of their use.[84]

Electronic components

With few exceptions, the manufacturing of the electronic components used to build RCIEDs in Mali is from the Shenzhen Special Economic Zone in China. Among these components are radio-controlled transmitters and receivers documented at IED sites or recovered in caches, many of which bear labels of Shenzhen Kelvin Electronics Co. Ltd. or Shenzhen Toada Co. Ltd. Motorcycle and car alarm systems, as well as VHF radios and mobile phones, have also been used in RCIED designs (Small Arms Survey, 2022). Specific electronic components documented during this study include the following models (Lochhead, 2020):

Receivers and subcomponent models

- KL400C
- KL-K120LA
- CX9-2C
- KL RX LORA
- TAD T-80
- KL-RF211A subcomponent

Transmitter models

- KL3000
- KL5000-8
- KL5000-12
- CX9-2R
- TAD-80

In Cameroon, RCIEDs have been widely used by separatist Ambazonian armed groups. International sources reported that these fighters use the Shenzhen Toada TAD-80

receiver, a device whose use the Small Arms Survey has also documented in Burkina Faso, northern Côte d'Ivoire, and Mali (Small Arms Survey, 2022).[85] The separatists' integration of the TAD-80 into IEDs is the only known use outside of jihadist networks, whose members actively share techniques (Sumo Tayo 2022). The TAD-80 has also been incorporated into at least two of the IEDs recovered in northern Côte d'Ivoire in early 2022, employed as part of RAVOIEDs. Starting in 2020, Cameroonian separatist groups also began to use motorcycle quick-start remote-control systems in IEDs (Sumo Tayo, 2022, p. 31).

Some of the more advanced electronic components produced by Shenzhen Kelvin and Shenzhen Toada used to manufacture RCIEDs in the countries under review are better suited to armed groups' needs. Compared to some dual-use items used by armed groups elsewhere—such as mobile phones, vehicle alarms, and garage door openers—these components can operate at longer ranges and do not require the presence of the cellular phone network to function. The latest documented models feature, or are modified to feature, long-range antennas. These antennas make the components ideally suited to initiate IEDs at a safe distance in an attack on a specific target or for use in RAVOIEDs.

RAVOIEDs incorporating radio-controlled switches, such as the Shenzhen Kelvin CX9 transmitter, represent the pinnacle of IED sophistication in the subregion. In practice, the placement of the radio-controlled receiver is at a greater distance from the charge than the effective range of the ECM deployed to counter it. This distance allows a trigger person to select a target at the optimal time and remotely arm the pressure plate IED safely. The Small Arms Survey database shows that 40 documented IED incidents in Mali involved the use of the CX9 between 2016 and 2020 (Small Arms Survey, 2022).[86]

The durability of electronic components may allow armed groups to rely on cached supplies for extended periods. Small Arms Survey research in Mali showed the use of electronic receivers of the same model from a single batch in the same area but in two distinct incidents four years apart. Separately, there was use of two electronic receivers from the same batch in two incidents involving RCIEDs at the same location and ten months apart.[87] These findings indicate that the importation of receivers and transmitters may occur in limited quantities, with storage in caches for long periods before being incorporated into RCIEDs.

There has not yet been documentation of some electronic components in West or Central Africa that have begun to filter into IED manufacturing techniques in other regions. These include RCIED trigger systems of passive infrared-operated IEDs, as have been documented in Libya (see Box 6).[88]

> “Trafficking in commercial explosive precursors and accessories is mostly due to the demand from the artisanal extracting sector, with a very small proportion of this trafficking feeding into the IED-building network.”

IV. Sources and trafficking of IED components

As discussed in Section II, IED use has been expanding outward from Mali into other West African states since 2013. The fieldwork conducted for this Report identified five trafficking and diversion dynamics:

- diversion of products in countries that legally imported them, followed by trafficking to other countries;
- diversion of products during transport;
- diversion of products at the official end user's site;
- illicit use of legally imported products, especially electronic components used to make RCIEDs, motorcycle tyres, motorcycle batteries, and other batteries; and
- battlefield capture of military materiel.

This section reviews international, regional, and national sources of trafficked IED components and presents a case study on cross-border trafficking in anti-vehicle mines from Libya and Chad.

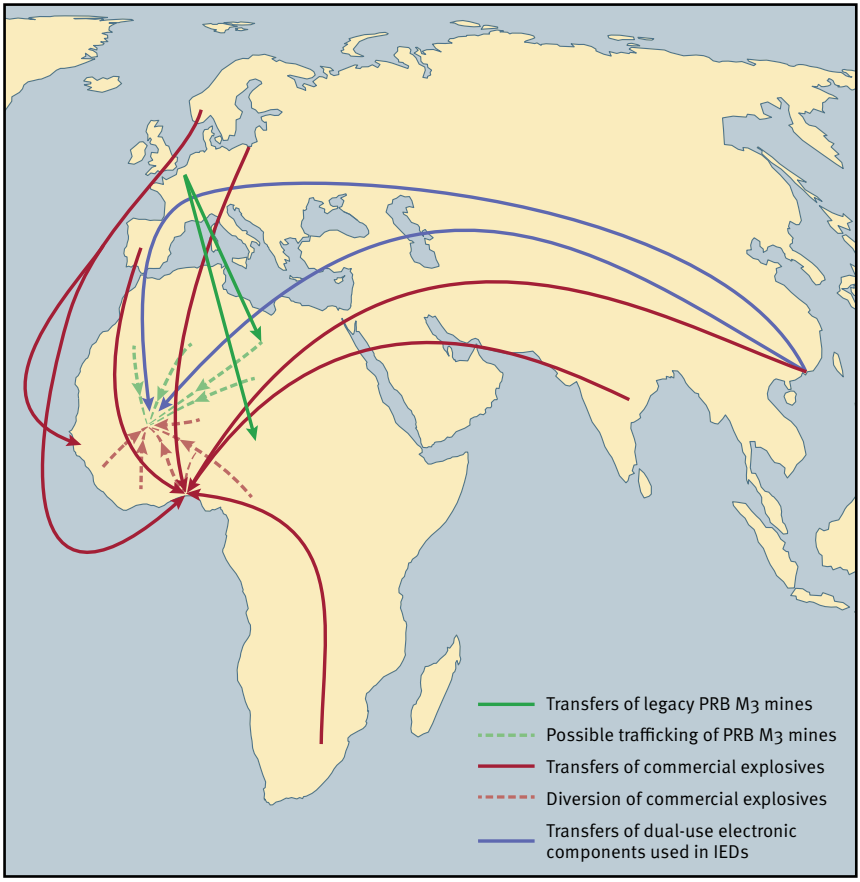
International trafficking

At the international level, items that end up in use for manufacturing IEDs in West Africa are typically not trafficked for that purpose, except for the more sophisticated RCIED components. Trafficking in commercial explosive precursors and accessories is mostly due to the demand from the artisanal extracting sector, such as quarries and mines, with a very small proportion of this trafficking feeding into the IED-building network. Some of these components are conventional weapons or their parts. In contrast, IED-building networks in the region have relied on dedicated trafficking in anti-vehicle mines, with trafficking most likely occurring from Chad and Libya to West Africa.

Documented IED incidents in Burkina Faso, Côte d'Ivoire, and Mali include Chinese-made electronic components that may have been legally imported into West Africa; the same models and makes have been observed in IEDs in Cameroon and Libya. UK officials seized three shipments of electronic components that were transiting through the UK en route from China to Mali and using a fast parcel service. France also seized a shipment of electronic components on its way from China.[89]

Map 7 shows international supply chains—including possible points of diversion and regional trafficking routes—of electronic components, commercial explosives, and PRB M3 anti-vehicle mines that are used in the manufacturing of IEDs in West Africa (see case study at the end of this section).

Map 7 Supply chains and trafficking routes of PRB M3 anti-vehicle mines, electronic components, and commercial explosives into IED networks in West Africa



Source: Small Arms Survey research, 2019–20

Regional trafficking

Trafficking routes and sources of supply

Overall, the trafficking in IED components uses the same routes that have been relied on for decades, even centuries, for smuggling weapons, drugs, and people. Most of the regional trafficking in West Africa involves commercial explosive main charges, initiators, detonating cord, and AN. Demand from the artisanal extracting sector largely

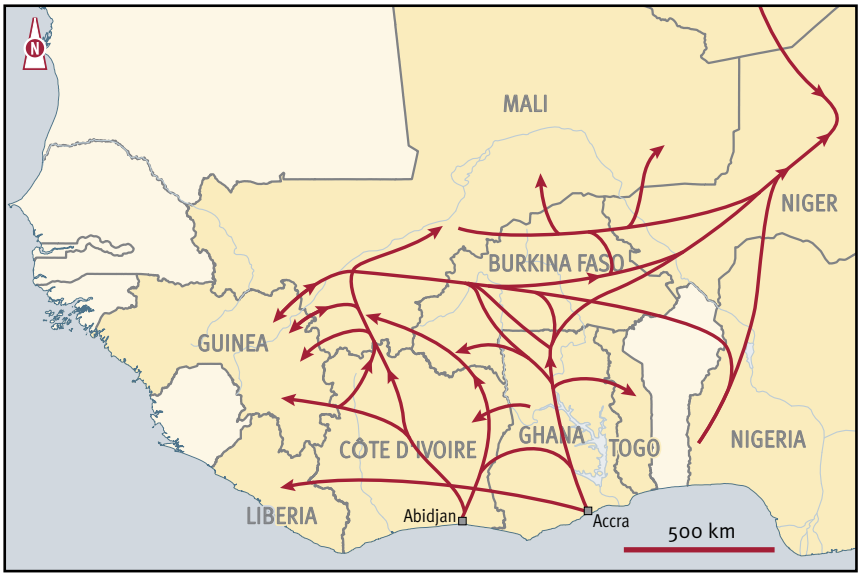
fuels this trade, while only a small proportion feeds into IED-building networks by using other trafficking routes.

As shown on Map 8, most trafficking of IED components occurs on routes leading from Ghana to Mali. There are fewer traffic flows from Ghana to Guinea and Côte d'Ivoire, and from Côte d'Ivoire to Senegal via Mali. In April 2022, there was a large seizure of commercial explosives in Mali. The material originated in Côte d'Ivoire and was transiting towards Senegal via Mali, indicating that components flow both into and out of Côte d'Ivoire (Direction Générale des Douanes du Mali, 2022).

Some material makes its way from Nigeria north to Niger and on to Burkina Faso. Traffickers are also known to have smuggled products from Nigeria eastward into Cameroon (Sumo Tayo, 2022). In October 2021, for instance, the Cameroonian military intercepted an Ambazonian separatist group crossing illegally from Nigeria into Cameroon at Ishion, with 30 explosive charges weighing 250 g each, electric initiators, remote-control receivers and transmitters, and batteries.

There has been a repeated identification of Nigeria as a source of IED building material in the Ambazonian conflict. Court documents and media reports indicate that there

Map 8 Trafficking routes for commercial explosives in West Africa, 2019–20

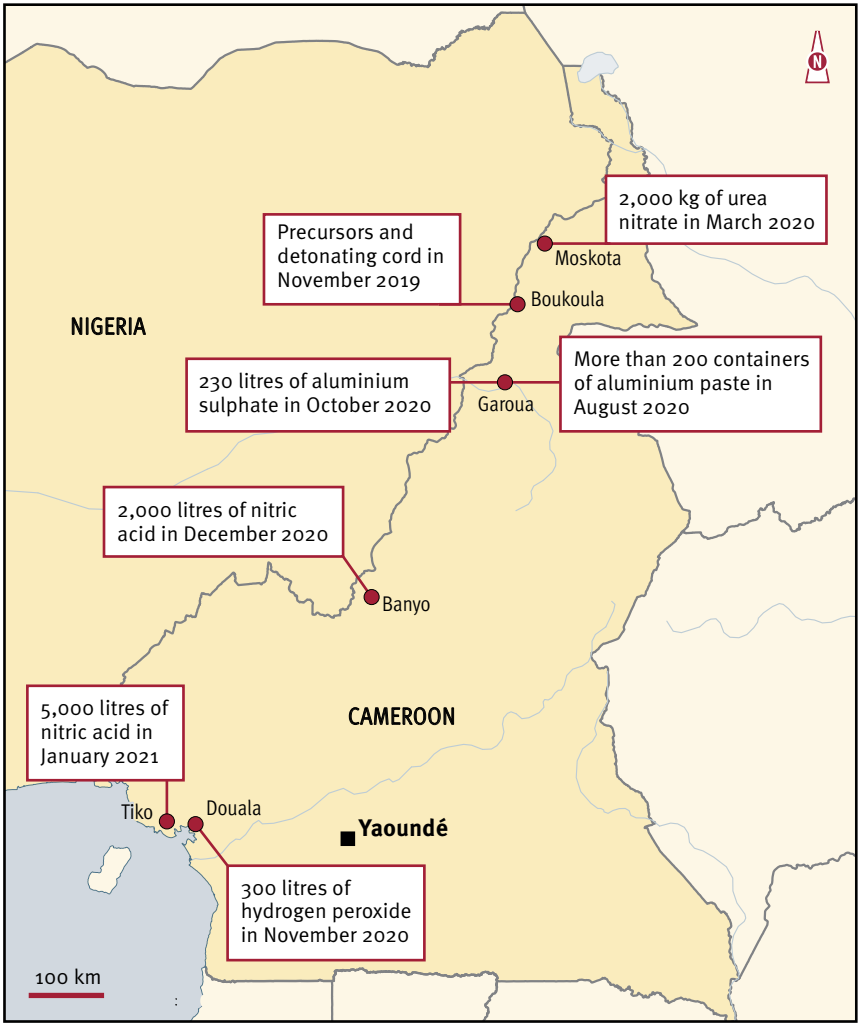


Note: See also Map 9 for the locations of seizures at the border between Nigeria and Cameroon, which are not covered in Map 8.

Source: Small Arms Survey research (2019–20)
Base map data source: OpenStreetMap

were numerous individuals arrested for attempting to enter Cameroon with IED components and precursors, including from as far away as the United States (Bagnetto, 2021) (see Map 9). According to Nigerian sources, precursor chemicals entering Cameroon from Gabon were also seized (Sumo Tayo, 2022).

Map 9 Large seizures of explosive precursors entering Cameroon from Nigeria, 2019–21



Source: Sumo Tayo (2022, p. 50)
Base map data source: OpenStreetMap

In Cameroon, customs officials have intercepted aluminium powder and drain cleaners, often used to manufacture HMEs. They have also seized hydrogen peroxide, which, when combined with acetone, can be used to manufacture triacetone triperoxide (TATP) —a powerful explosive (Sumo Tayo, 2022, p. 23).

Throughout this research, some routes changed due to the worsening situation in West African countries. In Burkina Faso, for instance, the roads in most regions of the country are no longer safe to travel on, leading traffickers to use alternative routes—mainly via Togo and Niger.[90] In Mali, the coup d'état and other recent political events led to the official closure of many borders. As Senegal closed its borders with Mali in 2022, a new, temporary trafficking route was identified from Senegal to Mali[91] via Mauritania.[92]

According to sources at informal mining sites, Ghanaians are known throughout the region as specialists in using explosives on artisanal mining sites (Sollazzo, 2019). The Ghanaians exported not only their technical knowhow but also material, such as commercial explosives, initiators, and detonating cords. In recent years, the government and the armed forces of Ghana mounted numerous operations against artisanal gold mining sites. Consequently, many nationals and foreigners involved in artisanal gold mining crossed the border into Burkina Faso, and beyond.[93] The movement of people—between the region's countries—with explosives expertise facilitates knowledge and skills transfer and contributes to the regional IED threat (Hainard, 2022, p. 40).

More recently, experts in the field have noticed explosives appearing from other countries, such as Nigeria. Such changes in supply chains could be partly due to the crackdown by authorities in Ghana, which may have succeeded in reducing the quantities of material trafficked out of the country. The situation needs monitoring to determine whether this observed dynamic is confirmed and continues.

Researchers documented three sources of supply for explosives in Mali, namely Burkina Faso, Ghana, and Nigeria. Commercial explosives from Burkina Faso and Ghana reportedly cost between CFA 5,500 and 10,000 per unit (USD 10–20).[94] Explosives originating in Nigeria reportedly cost between CFA 40,000 and 50,000 per unit (USD 80–100), and are used more frequently in the Agadez Region of Niger (Sollazzo, 2019; Illiassou, 2020).

If the demand for explosives remains constant in the face of government crackdowns on supplies, new trafficking routes may emerge. In Niger, a ban on imports of certain explosives has led artisanal mining networks to bribe officials in Mali and Algeria to secure illicit supplies (see Box 3).

Traffickers use multiple means to transport illicit explosives, such as motorcycles, trucks transporting goods, private vehicles, and public transport buses. There are reportedly several circuits to sites in the Agadez Region, including from Nigeria to Niger crossing the Sokoto area via Konni (Illiassou, 2020). Currently, more information is necessary to determine the origin of these explosives in Nigeria.

Box 3 The role of fraud in diversion and trafficking in Niger

One interviewee familiar with the illicit procurement and use of explosives in the artisanal mining sector gave the following account:

> *We initially used explosive materials such as dynamite in the Tchibarakatan area north of Arlit and also nitrate mixed with gas oil [ANFO]. Since the fatal accident that happened in Agadez, however, authorities have strictly prohibited the importation and use of these materials. This prohibition suddenly slowed down our activities but considering the fraud rampant in Algeria and Mali, we managed to acquire some materials which are very [valuable] to us. We use these explosive materials to break up granite but also to dig deep holes and bring out gold. All explosive materials from Algeria and Mali come in due to fraud. After use, we bring the sand [mined pieces of granite] back to Arlit, where the treatment occurs in Guidan Daka with cyanide and other specific artisanal gold-processing products. Nowadays, fraud is the only way to meet our need for explosive materials to break up granite rocks, which is not without danger. Sometimes, we use materials such as wood, fertilizer, and others to produce an explosion to break up the rocks at various gold mining sites in the region* (Illiassou, 2020, p. 13).[95]

From Algeria, Ghana, and Nigeria, explosives are trafficked through Burkina Faso and either arrive in Niger at sites in the Tillabéri Region or they continue their journey towards sites in the Agadez Region. Explosives also enter Niger from Nigeria via Sokoto and from Algeria (Illiassou, 2020).

Diversion during transport

Small Arms Survey researchers have collected reports of incidents during which commercial explosives, initiators, detonating cord, and AN are stolen while being transported. This theft feeds the illicit market, which ultimately feeds IED-building and artisanal mining. Employees of transport companies in Ghana, for example, have been caught making holes in bags of AN and stealing some of the contents.[96] In Burkina Faso, bags of AN are transported in open platform trucks, which makes it easy for anyone to access.[97] In other cases, unidentified individuals pressured truck drivers to stop by the roadside at a specific location and then stole the truck's contents.

In Burkina Faso, vehicles that transport commercial explosives, initiators, and detonating cords must, by law, have a gendarmerie escort. Researchers have learned, however, that escorts sometimes do not drive directly in front or behind the transport truck but at a greater distance.[98] While, legally, the escort ends once all the material

has been unloaded and stored at the final destination, it has been noted in countries such as Burkina Faso and Niger that the escort sometimes leaves before the unloading of the truck.[99]

When escorted explosives cross borders, the company or individual importing these products must organize for the gendarmerie of the recipient or transit country to meet the convoy at the border post. The current security situation, however, has had an impact on this procedure, especially at the border between Niger and Burkina Faso. Due to recent attacks against the gendarmerie in the area, they have withdrawn from some of their positions on the border with Burkina Faso. Some truck drivers arriving on the Burkina Faso side have expressed their fear of staying at the border crossing while waiting for the escort from the Nigerien gendarmerie, particularly when the trucks arrive at the border at night. Some truck drivers have allegedly left the area because of insecurity.

Recent attacks have created a security void, which could have a direct effect on the transportation safety of commercial explosives and other sensitive materials.[100] Border security and customs units and other defence and security forces who find and confiscate such items often cannot handle, transport, and destroy these items safely. This incapacity poses a high risk of accidental detonation and vulnerability to re-diversion if these items are not quickly secured and destroyed.[101]

Some other products, such as IGAN, are not escorted in countries where they are not recognized as explosives. In countries where IGAN counts as an explosive for tax purposes, some companies avoid paying these taxes by falsely declaring the product as imports destined for the fertilizer industry (see Section V) (Kaceto, 2020). As noted in Section III, some West African states subsidize fertilizers, which can render cross-border smuggling of IGAN financially attractive for armed groups. IED-building networks in the region do not typically use fertilizers, however, as they produce less powerful explosions than AN.[102]

Domestic trafficking

While the cross-border trade accounts for a large proportion of trafficked commercial explosives, initiators, and detonating cord, more is needed to meet the demand from the artisanal extractive sector. Small Arms Survey fieldwork in Burkina Faso, Mali, and Niger indicates that artisanal gold miners and people working in artisanal quarries also source explosives from commercial mines and quarries in their own country, as they did even before cross-border trafficking networks expanded.[103]

This section examines mining and quarrying sites—both commercial and artisanal—as sources of demand for commercial explosives and as sites of their diversion. It also reviews the role of battlefield capture as a source of IED components.

Diversion from mines and quarries

Small Arms Survey field researchers documented incidents of diversion from mining sites in Côte d'Ivoire, Ghana, and Niger (see Box 4). In these cases, employees of mining companies were caught stealing explosive material—in some cases in large quantities—and then reselling it on the black market (Kouassi, 2020).

In Burkina Faso, most commercial mines use the services of explosives companies for storing and securing explosive material and conducting blasts. Diversion of explosives from these commercial mining sites is less common than in other cases. In Burkina Faso, Mali, and Niger, commercial mines located close to each other sometimes lend each other explosives when they are running out of supplies, largely to avoid having to ask for import authorizations.[104] While most of these transports are escorted, they are not recorded or notified to the ministries and the inspectors in charge of controls.

Niger is distinct from other countries in the region as commercial mines or explosives companies do not store explosives, initiators, and detonating cords since the military does this. As a result, commercial mines and quarries use the army base closest to their site to store their explosives and must have the army's authorization to access their stocks. The commercial explosives, initiators, and detonating cords necessary for a blast are then collected from the army base on the specific day of the blast and escorted to the blasting site. In some instances, however, mine employees who tried to return explosives left over after a blast, as provisioned by law, found the military storage site closed. The employees then had to take the leftover explosives home—mostly initiators and detonating cords. The military personnel in charge of storing the explosives do not generally have specific training in handling such material.[105]

In Mali, quarry sites are proximate sources of AN for use as ANFO in IEDs. Both artisanal mining sites and quarries in the country appear to be proximate sources of the electric and pyrotechnic initiators used in IEDs. Artisanal miners and quarrying actors,[106] as opposed to commercial actors, primarily purchase illicitly imported explosives. This trafficking occurs on various routes to Mali: from Ghana via Burkina Faso; Guinea, where trafficked explosives allegedly originate from a bauxite mine; Nigeria; Côte d'Ivoire, possibly as a transit route after a diversion of explosives from Ghana; and Algeria.[107]

While commercial quarries are required to comply with the same laws and regulations as commercial mines regarding the handling and storage of explosives, security is not as respected in quarries throughout the region, and authorities conduct fewer controls. A Small Arms Survey researcher witnessed the use of ANFO with initiators and detonating cord in an artisanal quarry in Mali. The material was acquired illegally from a commercial company licensed and legally authorized to import these products to Mali.[108]

In Niger, villagers close to a commercial quarry reportedly fabricate chairs using the plastic remnants of non-electronic initiation systems left over after a blast. The villagers routinely go into the site of the commercial quarry once blasts have taken place and collect the plastic remains. In theory, and by law, companies conducting the blast should collect these remains. It appears that this procedure is not always applied or fully effective. In one incident, a villager collected remnants of a detonating cord left behind; however, the cord must still have had a live initiator attached, as his hand was reportedly blown off while holding it.[109]

IED builders in the region also use recycled items, including dual-use components, such as motorcycle batteries, motorcycle tyres, and other types of batteries; however, these may also be available from the local market (Small Arms Survey, 2020, p. 15).[110] Apart from the electronic components used in RCIEDs, there has been no sign of direct bulk purchases of dual-use components specifically to build IEDs.

Box 4 Diversion of explosives from commercial mining sites in Ghana

Notwithstanding safeguards put in place by mining companies, workers in major mining and quarry companies reportedly steal explosives and traffic them into illegal markets. A mining engineer who worked in major mining towns such as Nsuta, Obuasi, and Tarkwa said:

> *Whatever blast men will do to get extra money, they do. During blasts, they do everything not to have some of the explosives detonate. Some workers [bribe] the security personnel at checkpoints to briskly [and superficially] search them. They usually hide the explosives in their pocket and sell [them] outside. [The explosives are] very expensive. As for the quarry companies, blasters equally conspire with outsiders to sneak immediately into a blast area and carry away misfires to sell them outside. There is a good price for these explosives, especially the 'potopoto' . . . so some men engage in these practices. The 'potopoto' is very expensive to come by as a small part can massively blast a whole area, which is why it is normally used* (Tettey, 2019, p. 45).

In another interview, a principal mine inspector suggested that illicit diversion occurs in areas where small-scale mining and quarrying occur. In Ghana, the most widely smuggled explosives and related material include 'Goma', Riodin, Riocord, and Nitroerg branded explosives and detonating cord. Several cases of explosives seized near the borders with neighbouring countries or found in IEDs have been traced to popular mining areas in south-western Ghana near the border with Côte d'Ivoire, such as Takoradi and Tarkwa. Other explosives have been traced to northern Ghana, where artisanal and small-scale gold mining and quarrying sites are common.

Source: Tettey (2019, pp. 45–46)

Battlefield capture of military materiel

Battlefield capture of arms and munitions is an important source of materiel used by non-state armed groups to carry out attacks; however, with the notable exception of PIEDs, which this study does not cover in detail, captured materiel is only sometimes used in the manufacturing of IEDs in West Africa. In northern Mali, for instance, jihadists and other armed groups captured large volumes of materiel from the Malian armed forces in 2011–12. Additional materiel from previous Tuareg rebellions remains in circulation in northern Mali despite weapon buy-back programmes.[111]

Throughout the research period, open-source imagery provided as part of terrorist information campaigns and propaganda showed significant quantities of purportedly captured materiel. Confirming the authenticity of these images is problematic, however, and national defence and security forces rarely acknowledge such losses. Images of the capture of larger-calibre weapons systems are rare, although they sometimes include anti-aircraft weapons up to 23 mm, as well as 40 mm RPGs and SPG-9—a Soviet-design recoilless gun—ammunition.[112]

In northern Mali, armed groups have made frequent use of 107 mm, 122 mm, and 130 mm PIEDs against international forces since 2013. It is not clear, however, whether this materiel is a historical capture, trafficked from Libya, or a recent capture from overrun bases in locations such as Boulkessi, Burkina Faso, and Inadiatafane, Mali. Armed groups are known to have captured multi-launch rocket systems such as the Soviet-designed BM-21 from Malian forces.[113] In Burkina Faso, terrorist-designated groups have also allegedly captured armoured vehicles (Caliber Obscura, 2021).

Case study: trafficking in anti-vehicle mines from Libya and Chad

Unlike other abandoned or captured ordnance, the recovery and trafficking in legacy anti-vehicle mines plays an essential role in the manufacturing of IEDs in West Africa. Among the most widely used are the PRB M3 and PRB M3A1[114] mines, produced in Belgium. Documentation of the use of Czechoslovakian-manufactured PTMi-BA-III anti-vehicle mines in West Africa by non-state armed groups in recent years also exists. These mines have yet to be documented in national stockpiles in the countries under study, which suggests that there was trafficking into the region.

The sources of anti-vehicle mines

Research suggests that the smuggling path of these mines was from Libya and Chad into West Africa. Libya placed several substantial orders for PRB M3 anti-vehicle mines

between 1973 and 1974, totalling 930,000–1,130,000 units.[115] Massive stockpiles of these mines were stolen during the Libyan civil war, and HRW reports from the period describe tens of thousands of PRB M3 mines at abandoned munitions depots in eastern Libya (HRW, 2011).

In 2020, the Government of National Accord Forces recovered PRB M3 mines in several incidents in areas under their control (Woland, 2020a). The Libyan National Army (LNA) claimed to have seized 238 mines hidden in a smuggling truck, allegedly at 'Checkpoint 200', on the road between Tobruk and Ajdabiya (Libya Monitoring, 2020). These seizures occurred during the conflict between the LNA and the UN-backed Government of National Unity (GNU), during which there were no reports on the use of such mines. The lack of reports raises the possibility that material is being sourced 'commercially' for other conflict theatres in North Africa, West Africa, or Central Africa. The recovery and seizure of these mines continued to be documented throughout the research period (Woland, 2020b), which is not surprising considering the sheer volume of mines in circulation in Libya, and poses a significant challenge to stop this flow of material into IED networks.

The recovery of PRB M3 mines also occurred during security operations in Libyan districts near the Egyptian border. These operations may have been part of smuggling efforts to move mines towards West Africa or for use elsewhere in Libya. According to

A doorbell and PRB M3 mine that were used as components of an IED built by IS, Libya, 2018.

Source: Menastream (2018)

9

PRB M3 mines that have most likely been buried—either in minefields or in caches—and recovered by the Libyan National Army in Tobruk, eastern Libya, 2017.

Source: Mansour (2017)

some open-source commentators, however, traffickers may have attempted to smuggle the mines from Libya into Egypt for use by terrorist-designated groups operating against Egyptian forces in the Sinai Peninsula.[116] The Small Arms Survey has yet to see clear evidence that confirms this, and further research is necessary.

During the 2011 Libyan civil war, PRB M3 mines were recovered from warehouses and employed by rebel groups against the LNA (Hughes, 2011). Stolen stockpiles also became a source of explosives used by fishermen after the conflict ended (HRW, 2011). These mines were widely used in IEDs by the IS in Libya during their conflict with the LNA. They have been used in VBIEDs (Kaaman, 2020) and RCIEDs and have been a source of harvested explosives (Small Arms Survey, 2020, Annexe).

Through recovery from minefields emplaced by Libyan forces occupying areas of northern Chad during the 1978–87 Libya–Chad conflict, Chad is another country identified as a possible source of PRB M3s. The Small Arms Survey previously documented the presence of PTMi-BA-I, PTMi-BA-II, and PTMi-BA-III mines in northern Chad, and other research has documented their use in the area of Benghazi, Libya, during the Libyan civil war (King, 2011; Tubiana and Gramizzi, 2017) and in Niger as early as 2008.[117] It is unclear whether the appearance of these mines in West Africa signifies a challenge with the sourcing and trafficking of the PRB M3 mines previously used or whether

they are simply mines with similar characteristics and performance to the PRB M3. The PRB M3 has been added to a diversified illicit market that fuels insurgent and terrorist attacks.[118]

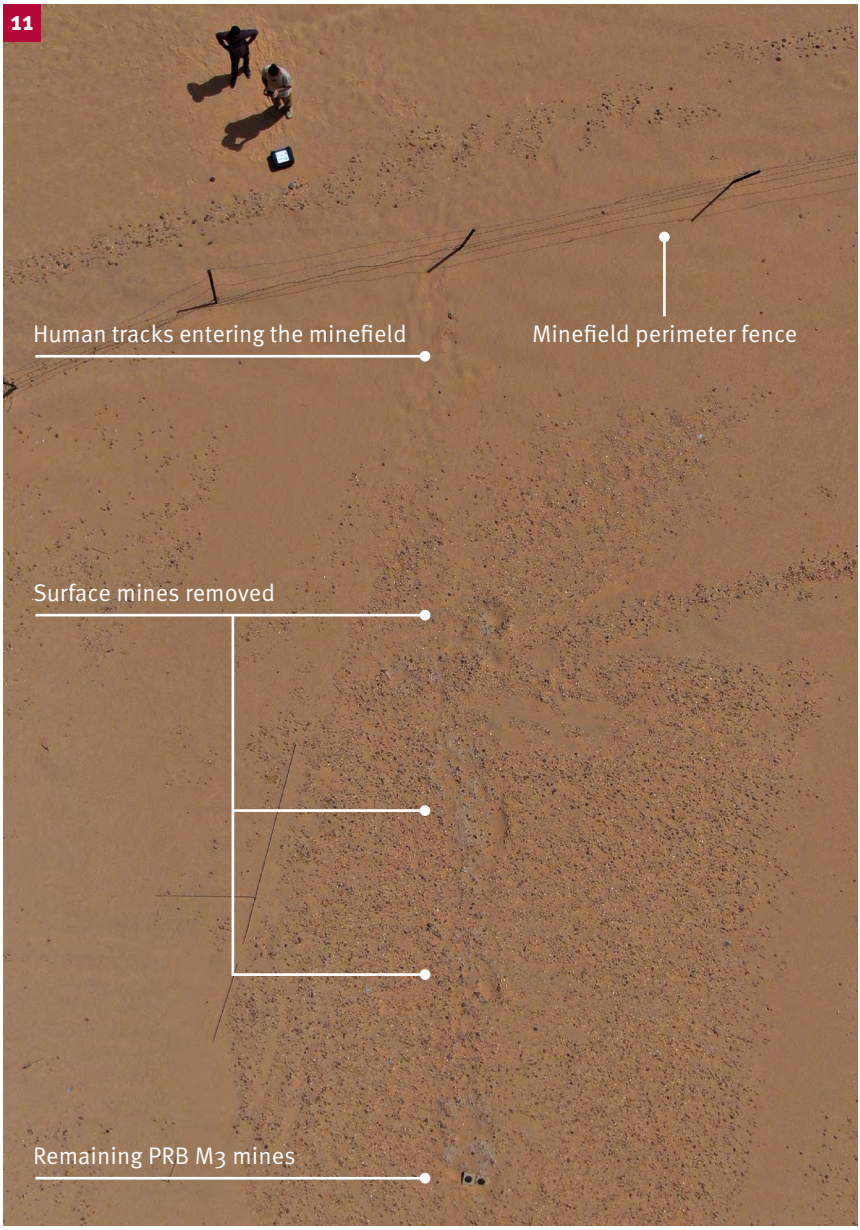
Recovery of anti-vehicle mines

In 2019, HI carried out research in northern Chad on the application of unmanned aerial vehicles to landmine detection in coordination with the Chadian National Mine Action Centre, Haut Commissariat National au Déminage (National High Commission for Demining) (Fardoulis et al., 2019). HI and MAG have a long history of involvement in mine clearance programmes in northern Chad. Libyan forces established minefields containing PRB M3 anti-vehicle mines during the Libya–Chad civil war from 1973 to 1987. Throughout this research project, legacy minefields containing PRB M3 mines were identified—including buried mines and mines exposed on the surface by shifting sands—and evidence of recent mine recovery by unknown actors was also observed (see Images 10–11).

10

Exposed and buried PRB M3 anti-vehicle mines are seen in a minefield where mine recovery occurred, northern Chad, 2019.

Source: HI and Mobility Robotics



Researchers documenting traces of the illegal recovery of exposed PRB M3 mines in a minefield in northern Chad, 2019.

Source: HI and Mobility Robotics

Previous research by the Small Arms Survey suggests that mines may have been removed from these areas by rebel groups for use in operations against the Chadian armed forces. These operations include the Movement for Democracy and Justice during their rebellion against the Chadian government in 1998–2003. The same mines were also reportedly recovered to sell in Libya and Niger, where a weapon buy-back process made trafficking lucrative (Tubiana and Gramizzi, 2017). It has also been proposed that entrepreneurial civilians in Chad's Tibesti area involved in the artisanal gold sector have recovered, stockpiled, and employed these mines to prevent the Chadian government from establishing control over their illegal gold mining operations.[119]

At the other end of the suspected trafficking network, MINUSMA, French forces in Mali, and the Malian armed forces have documented PRB M3 mines in Mali.[120] Rebels from the National Movement for the Liberation of Azawad have also reportedly captured these types of mines in Aguelhok, Kidal Region, from would-be terrorists or traffickers (MNLA, 2015).

12

A PRB M3 mine allegedly recovered by children in Kidal, Mali, in 2014.

Source: Carlier (2020)

Destinations and use of trafficked anti-vehicle mines

In relative proximity to Mali, international actors and national forces consulted for this study have documented anti-vehicle mines in Burkina Faso, Cameroon, CAR, Chad, Côte d'Ivoire, and Niger. In West Africa and beyond, mines are either used as designed, modified for use in IEDs, or harvested for explosive content used in IEDs. In Mali, as in Libya, the M60 fuses found in the PRB M3 mines have been employed in novel pressure plate and initiator designs. As in Mali and Burkina Faso, the employment of PRB M3 mines in CAR may have also been designed as anti-vehicle mines and in a CWIED configuration.[121]

Members of the Malian armed forces report that Malian Tuareg rebel groups initially sourced these PRB M3 mines in Libya in 2007, after which fighters of the Democratic Alliance for Change introduced them in Mali for use against the Malian military. Analysts have identified matching lot numbers between Mali and Libya.[122]

In Mali, military ordnance is seldom used in buried IEDs, although notable exceptions are PRB M3, PRB M3A1, and PTMi-BA-III anti-vehicle mines. In the past, military ordnance—especially 57 mm, 107 mm, 122 mm, and 130 mm rockets—was used extensively in indirect fire attacks in the form of PIEDs, using improvised launch and timing systems. The use of mortar shells as booster charges for large IEDs—to increase the likelihood of a successful detonation of bulk HMEs in 800–1,000 kg SVBIEDs—has also been employed.[123]

Since 2021, the PTMi-BA-III anti-vehicle mine has increasingly been documented in use in Mali and Burkina Faso by national authorities, UNMAS, and international security forces. This mine, originally produced in the former Czechoslovakia, is a low-metal content mine like the PRB M3 with a bakelite or polymer body, making it difficult to detect. The Small Arms Survey IED database contains records of some 11 incidents involving the use of the PTMi-BA-III in Burkina Faso and Mali since their emergence in those theatres in 2021, with one in Burkina Faso and ten in Mali (Small Arms Survey, 2022).

Targets of anti-vehicle mines in Central Africa

In 2020, PRB M3 anti-vehicle mines were used for the first time against MINUSCA, resulting in the death of a UN peacekeeper. Between 2020 and the time of writing, wide use of PRB M3 mines against CAR's armed forces and Russian private military contractors operating as part of the Wagner Group occurred. A Wagner vehicle, for example, detonated an explosive device in 2021, killing five people (Matyushenko, 2021).

In early 2022, MINUSCA noted a significant increase in the use of explosive devices in the north-west of the country (Bonny, 2022). A preliminary assessment suggested that the first explosive device used against MINUSCA in 2020, suspected to be a PRB M3,

may have been modified and employed in an improvised manner as an IED by using a separate pressure plate or command wire. UNMAS has now recorded 30 cases of confirmed and suspected uses of anti-vehicle mines and four confirmed cases of anti-personnel mines. UNMAS has also documented 20 cases of booby-trapped explosive remnants of war, which could be considered as improvised anti-personnel mines or IEDs under certain circumstances.[124]

In CAR, the use and documentation of anti-vehicle mines is increasing. A report of the UN Office for the Coordination of Humanitarian Affairs finds that 82 per cent of those killed by explosive devices in CAR since 2021 have been civilians. In 31 incidents involving explosive devices in CAR between January and May 2022, 8 civilians were killed and 19 injured, with an additional 10 non-civilians also injured (UNOCHA, n.d.).

> “IEDs are weapons, and as with the use of any other type of weapon in conflict contexts, IHL and international human rights law apply to their use.”

V. Legal frameworks, regulatory gaps, and policy implications

International guidance and frameworks

Ultimately, IEDs are weapons, and as with the use of any other type of weapon in conflict contexts, IHL and international human rights law apply to their use. IED use in an international or domestic armed conflict is not necessarily illegal if the only targets are legitimate conflict parties. States under such circumstances may legitimately take actions to prevent armed adversaries from acquiring lethal tools. The deliberate targeting of IEDs against civilians and civilian objects, however, is illegal under IHL—including the Geneva Conventions and Article 48 of the Additional Protocol of 1977—according to the principle of 'Distinction' (ICRC, 1987). VOIEDs, however, function as improvised landmines, making them inherently indiscriminate and, therefore, a violation of IHL. This also brings VOIEDs within the scope of the APMBC (MAG, 2016).

Understanding the specific dynamics of IED component procurement in the area under study provides opportunities to make the assembly of IEDs more difficult for would-be bomb builders. It is still unclear, however, whether this represents the most efficient means to reduce the number of IEDs, compared to the direct disruption and arrest of bomb-building networks and actors. Further comparative study is necessary in this area.

International guidance and policy frameworks related to IEDs have been emerging over the past decade. A key aspect of the response remains underdeveloped: the development of standardized and effective industry and state oversight over commercial explosive materials—including accessories such as initiators and detonating cords that are common diversions into IED networks—in jurisdictions where oversight is weak or there is not application of traceability standards. International discussion and norms related to IEDs have been maturing and evolving, with IED-specific UN General Assembly and UNSC debates occurring (UNGA, 2015; UN, 2021).[125] Related resolutions, including UN Security Council Resolution 2370 on preventing terrorists from accessing weapons, including IEDs, have also stimulated the development of more detailed technical guidelines, such as those issued by UNIDIR (UNIDIR, 2022).

The UN Convention on Certain Conventional Weapons, Amended Protocol II (UNCCW APII) on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices—as amended from the original 'Additional Protocol' to the UNCCW on 3 May 1996—also considers some types of IEDs to fall within the definitions of 'booby-traps' and 'mines' under the convention. The UNCCW APII has treated the issue of IEDs on an annual basis through the Annual Conferences of the High Contracting Parties and meeting of the Group of Experts (UN, 1996).

From a normative development perspective, the UN has also developed IED disposal standards (UNMAS, 2018a), as well as guidance on dealing with IEDs in UN peacekeeping and political mission settings (UNMAS, 2018b). Similarly, new International Mine Action Standards have also been developed relating to IED disposal, IED disposal

Box 5 The UN Guiding Principles on Business and Human Rights

The UN Guiding Principles on Business and Human Rights can help to understand what responsibility business actors have for the diversion of commercial explosives in conflict situations, and whether the explosives industry complies with such principles.

The vast majority of IEDs documented in this study contained explosives or explosive accessories manufactured by the commercial explosives industry.[126] These devices were involved in hundreds of potential human rights or IHL violations, related primarily to the killing of civilians and UN peacekeepers, the booby-trapping of corpses, and the targeting of civilian infrastructure. In that sense, this Report makes a strong case for the UN Guiding Principles on Business and Human Rights to be applied as a tool of analysis to understand corporate and state responsibility with respect to IEDs.

These guiding principles recognise that states have a duty to protect everyone within their territory from human rights abuses committed or aided and abetted by business enterprises. The framework also addresses the human rights responsibilities of businesses: companies have the responsibility to understand and address the actual or potential impacts of their business practices, regardless of the capacity of the state to provide oversight. The principles also call for businesses to participate in legally redressing the impacts of any human rights abuses that have occurred because of their business practices.

Critically, the due diligence imposed upon businesses by these guiding principles includes their responsibility for the entire supply chain of their products, services, and partners:

> The Guiding Principles on Business and Human Rights affirm that business enterprises must prevent, mitigate, and where appropriate, remedy human rights abuses that they cause or contribute to. Businesses must seek to prevent or mitigate any adverse impacts related to their operations, products, or services, even if these impacts have been carried out by suppliers or business partners. Where businesses identify that they have caused or contributed to adverse impacts, they should cooperate in remediation through legitimate processes (OHCHR, 2011).

The application of this framework to the findings presented in this Report suggests that both states and explosives industry actors have a responsibility for the human rights impacts of their unwillingness or inability to prevent the diversion of commercial explosives products into IED-building networks, particularly if they are aware that their products are being diverted and used in this way. The current lack of traceability standards for commercial explosives products throughout their life cycle—and in all jurisdictions globally—is a contributing factor to explosives diversion. This lack of traceability also facilitates corrupt and lax business practices that have contributed to the death and injury of hundreds of protected persons within the time and geographical boundaries of this study.

competency standards, and IED risk education (IMAS, n.d.). UNMAS has led efforts to establish a C-IED task force to coordinate action on IEDs within the UN system.[127] The fourth review conference of the APMBC in 2019 also places VOIEDs within the scope of the convention and requires states to disaggregate data on their use (UN, 2019).

The UN Guiding Principles on Business and Human Rights represent another relevant normative framework (OHCHR, 2011). Unanimously endorsed by the UN Human Rights Council in 2011, this set of guidelines is designed to help 'states and companies prevent and address human rights abuses committed in business operations' (UNWGBHR, 2013). Box 5 discusses its potential role in limiting the harms associated with diverted commercial explosives that are used in the manufacturing of IEDs.

Meanwhile, WCO, INTERPOL, and UNODC have partnered to create Programme Global Shield, which supports states to monitor the licit movement of as many as 15 of the most common chemical precursors and other materials that could be used to manufacture IEDs to prevent diversion and trafficking (see Box 6).[128]

INTERPOL itself has a variety of initiatives and projects focused on chemical and explosive terrorism, which fall under its Chemical Biological, Radioactive, and Nuclear Directorate. These include the 'Watchmaker', 'Chase', and 'Crimp' projects. These initiatives dovetail with what is covered under Programme Global Shield. INTERPOL's presence throughout West and Central Africa, including through regional presences in Abidjan, Côte d'Ivoire, and Yaoundé, Cameroon, seeks to facilitate national and regional-level cooperation and awareness around IED issues (INTERPOL, n.d.).

Regional efforts

The African Union has been developing a continental C-IED strategy. This draft strategy contains reference to the development of regional strategies, one of which is already under development between IGAD member states in the East and Horn of Africa. ECOWAS has also expressed the desire to develop a regional C-IED strategy.

East Africa also hosted an annual regional C-IED steering committee and working group under the auspices of the Kenya-based International Peace Support Training Centre, with bilateral support from the United States and British governments, as well as the British Peace Support Training Team in Nairobi. The former African Union Mission in Somalia, now rebranded as the African Union Transitional Mission in Somalia, is the multi-national mission which faced the greatest IED threat for over a decade and possibly has the best-established C-IED support programme. The East African Regional C-IED Steering Committee and Working Group present a possible model for emulation in West Africa. In November 2022, with support from the Small Arms Survey, ECOWAS hosted the first regional C-IED meeting for West African states in Lomé, Togo,

and committed to the development of a regional response—including a Regional C-IED Strategy (ECOWAS, 2022).

While the use of IEDs has occurred within all the regional economic communities of Africa, at the time of writing, only IGAD had developed a regional C-IED strategy. The IGAD Committee of Ambassadors endorsed the 'Regional Strategy to Prevent, Counter, and Respond to the Threat of Improvised Explosive Devices (IEDs) in the IGAD Region' in February 2023 (IGAD, 2023). The small arms unit of ECOWAS has also expressed its intention to develop a regional C-IED strategy (ECOWAS, 2022).

Outside of the regional economic communities, additional operational partnerships active in C-IED include the MNJTF operating in the Lake Chad Basin under the auspices of the Lake Chad Basin Commission (LCBC) and the FC-G5S conducting counterterrorism operations in Burkina Faso, Mali, and Niger. The LCBC is in a good position to promote a coordinated regional approach to dealing with the IED threat and trafficking of components into IED networks, even though it has yet to do so. In August 2022, Mali withdrew from the FC-G5S, and the force's future is uncertain (Reuters, 2022). Such setbacks notwithstanding, intelligence-sharing and ad hoc operational coordination between affected states will likely continue.

Member states from the Economic Community of Central African States have also experienced a growing use of IEDs. For example, in the conflict-affected areas in Cameroon by separatists and Boko Haram, CAR by Return, Reclamation, Rehabilitation (3R) rebels, and DRC by ADF rebels under the banner of ISCAP. The example set by the development of a regional C-IED strategy in the IGAD region could be emulated within other regional economic communities or under subregional arrangements or operations such as the Accra Initiative to Combat Violent Extremism in West Africa, the LCBC, or the MNJTF.

Regional police chief coordination committees—including in West Africa and Central Africa—have also provided an information-sharing platform related to explosive threats, mainly through their collaboration with INTERPOL. At the national level, in many of the states most affected by IEDs, C-IED support has been provided according to bilateral protocols and projects. EU Common Security and Defence Policy missions, including training and capacity-building operations such as the EU Assistance Mission and Capacity-Building Mission operations in Mali and Niger, Libya, CAR, Somalia, and Mozambique, contribute to C-IED and counter-proliferation. This contribution is done through border management and security initiatives and direct training and mentoring to defence and security forces.

Regional training and capacity-building initiatives—including the annual 'Flintlock' training and mentoring exercises conducted by the United States Africa Command, with support from Canada, France, Norway, the United Kingdom (Nostrant, 2022), and the Trans-Sahara Counterterrorism Partnership—have also included C-IED-related

training, mentoring, equipment, and intelligence-sharing. The Trans-Sahara Counter-terrorism Partnership is a multi-country effort jointly funded by the United States Department of State, in conjunction with the Department of Defense and United States Agency for International Development, to combat violent extremism in the Sahel (US Congress, 2021). The Centre for Advanced Training in Post-conflict Demining and Decontamination Operations in Benin also hosts a C-IED course in French (CPADD, 2022).

There is a need to strengthen the humanitarian dimension of the IED response, particularly as it applies to VOIEDs or mines of improvised nature. This strengthening requires robust data collection practices, clarity around the disaggregation of different types of IEDs, and an improved explosive ordnance risk education (EORE) response in all affected areas. EORE not only reduces the immediate risk to the population but provides an opportunity for data collection and can serve to warn of the significant risks involved to those who may have an economic drive to engage in explosives harvesting.[129]

Beyond training, cooperation, and operational collaboration, new tools are beginning to establish a shared awareness of the gaps in states' preparedness to deal with explosive threats holistically. One such tool is UNIDIR's C-IED Capability Maturity Model and Self-Assessment Tool. Its purpose is to 'assist states in developing coherent national responses to the threat posed by IEDs' and 'help donors assess the likely scale of contributions and priority of work in enhancing national C-IED capabilities' (Seddon and Malaret, 2020). As of November 2022, three African states had tested this tool—Somalia and Burkina Faso, with support from UNMAS in 2020 and 2022, respectively, and Côte d'Ivoire, with support from UNODC in 2022. Such a tool, if widely employed on a regional or continental basis, would not only facilitate the development of national strategies, policies, and action plans related to IEDs and explosives but also give substance to regional approaches and—importantly—a comparable 'dashboard' of IED preparedness that can be used to target scarce resources.

An initiative that could be replicated and adapted to counter the IED threat under study in West and Central Africa is the Institute for Security Studies' (ISS) response to explosives trafficking in the Southern African Development Community (SADC) subregion. As a result of explosives trafficking between Zambia, Zimbabwe, and South Africa, which has fuelled the use of IEDs in crime in South Africa, the development of a strategy for SADC for transnational organized crime includes a plan for the control of explosives and an implementation plan. ISS has proposed to hold a roundtable with SADC member states to develop a preliminary explosives protocol for the region and to draft a 'Model National Explosives Act' and 'Model Explosives Regulations'.[130]

Such harmonization efforts would benefit the response to explosives diversion and trafficking, and improve the economic integration of the subregion between explosives industry suppliers, importers, exporters, brokers, and licensed end users. The inclusion of standardized and mutually readable traceability features among these model regulations would make a significant contribution to the tracing of diverted

and trafficked explosives. The ISS initiative also represents a possible way forward for establishing continental explosives traceability standards and information-sharing mechanisms. This initiative would ideally be a collaboration between government and industry to ensure that regulatory harmonization serves the needs of both sectors and results in standardized and harmonized regulatory frameworks across the region.

Among the areas that would benefit from harmonization are the terminology, laws, and regulations related to the explosives sector. As discussed in Section III, imprecision regarding what defines explosives can lead to ineffective policies, a failure to escort certain explosive substances, substandard security measures during transport, tax avoidance, fraud, and a general lack of clarity regarding related obligations and risks. Streamlining could help identify precisely what constitutes different types of explosive substances and precursors, whether they must be escorted, their original intended use, and whether they could potentially be or already are in use as IED components. In turn, the clarity gained through such harmonization can further cooperation among authorities that grant transfer permits, authorities at points of entry, law enforcement in charge of the escorts, customs officers—especially at border crossing points—and legal end users.

Improving national responses

At the national and local levels, police, intelligence, customs, military, medical, legislative, and judicial authorities in each of the countries under study all work on aspects of the IED and explosives issue, albeit in ways that may lack coherence. The same can be said of the many bilateral support projects and initiatives that involve collaboration with a wide variety of national interlocutors, often in a 'siloed' way. Even in states such as Mali, where IEDs have been a direct and daily threat to defence and security forces, peacekeepers, and civilians for almost a decade, there is still no unified platform for information exchange and C-IED collaboration—let alone a joined-up operational response to the use of IEDs or the realities of explosives trafficking and diversion that feeds IED networks. New, nationally led approaches are needed, both between national agencies themselves and between national and international forces.

In Mali, several parallel systems for countering the IED threat were operational while the French-led Operation Barkhane was active in the country. Until its withdrawal in 2022, the operation shared aspects of its C-IED work with the Malian defence and security forces, the United States, and, to a lesser extent, MINUSMA. Its laboratory in Gao was one of the best equipped IED-related forensics centres in the region, where most countries do not have national laboratories with such IED-specific capabilities; however, national, and even UN, partners reportedly had unreliable access to results and analysis produced at the Barkhane facility.[131]

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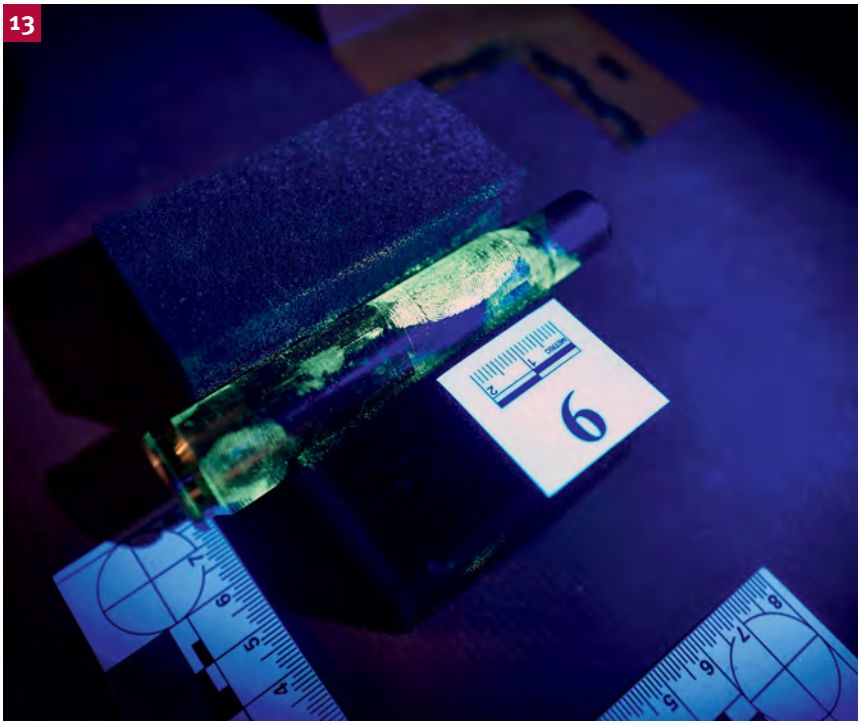

Fingerprint analysis on an IED component in the laboratory of the French army base in Gao, Mali, 17 November 2019.

Source: Michele Cattani/AFP Photos

In the case of MINUSMA alone, several entities carry out IED-related forensics post-blast investigations, sensitive site exploitation, laboratory analysis, and related operational planning.[132] Unlike Operation Barkhane, however, MINUSMA has not targeted IED-building networks directly, nor does it provide extensive in-operation mentoring or collaboration with Malian defence and security forces. In Mali, as elsewhere in the region, the sharing of IED-related technical intelligence, and the establishment of a 'common operating picture' and joint C-IED task force involving all national and international actors, would strengthen the efficiency of the measures taken to counter the IED threat at both the national and regional levels.

Targeting the supply of IED electronic components delivered through legitimate courier systems may be a worthwhile C-IED initiative. Consultations with courier services operating in the region—such as the ones used to ship electronic components—should also be considered. By conducting detailed market surveys and investigating electronics importers and retailers, ECOWAS states could determine whether local, regional, or

international sources for RCIED components exist. Since the materials in question are uncontrolled dual-use items, efforts to limit IED builders' access to these components require significant international cooperation, including from China as the main manufacturer and exporting state.

Similarly, to address the availability of explosives used to manufacture IEDs, states need to impress upon those involved in the explosives industry that despite such commodities being economically critical, they are also a significant source of insecurity if not appropriately secured. The onus is on governments to provide adequate regulatory control and oversight over relevant sectors, such as by requiring improved traceability and life-cycle management features. Governments can also play a role in ensuring that the producers of explosives adhere to the UN Guiding Principles on Business and Human Rights (see Box 5).

Many overlapping 'security sector reform' and 'train and equip' initiatives touch on aspects of IED response, but countries in the region lack overarching national frameworks for cooperation, prevention, and joint action to counter IED and explosives trafficking. The engagement of this project with national authorities in each state has emphasized the need for policy and strategy development that involves baseline data collection, self-evaluation, and stocktaking exercises. Emerging efforts to carry out national assessments of C-IED preparedness or to develop national C-IED action plans are a step in the right direction and will allow states to contribute to and situate themselves within future subregional, regional, and continental policies and strategies.

At the national level, monitoring is a critical yet underdeveloped aspect of C-IED preparedness throughout West Africa. As discussed in Box 6, states require training and equipment to enable them to conduct effective monitoring of the use, spread, trafficking, availability, and technical development of IEDs and their components and the impact of related regulatory measures on these dynamics. Upgraded national monitoring capacities would, in turn, contribute to regional preparedness and response. States can also engage with the APMBC framework by identifying national focal points for the convention process and taking the first steps towards reporting. This will support the strengthening of the extent, nature, and impact of the problem; raise awareness among the international community; and support mobilization of much needed resources.[133]

These policies and strategies alone are not enough to curb the proliferation of IEDs and the trafficking of their components. Their development, however, helps to focus the discussion around IED and explosives trafficking issues between states, which may lead to better cooperation, information-sharing, and the creation of routine, formalized platforms for cross-border exchange. All these elements can support law enforcement, military, and intelligence operations in their efforts to counter the criminal and terrorist-designated networks that use IEDs and supply the materials for their manufacture.

Box 6 Enhancing national monitoring capacities

The research conducted for this study highlights the need for enhanced national monitoring capacities throughout West and Central Africa. The findings indicate that the following emerging and potential risk factors require particular attention, especially if new regulations or military countermeasures are introduced:

- **Trafficking of commercial explosive main charges**. This research has found no evidence that TAGs in West Africa are using commercial main charges to manufacture IEDs, although they appear to do so in both conflict-affected areas in Cameroon. Monitoring of their diversion and trafficking would become particularly important if the components that are currently being used—AN and military materiel—become less easy to procure, as groups might turn to using commercial explosives, which are easily available in large quantities in the region. This risk is also relevant to countries that are not currently affected by IEDs but that see significant trafficking of commercial explosives.
- **Availability of commercial initiators**. Commercial electric initiators are widely available on the black market throughout the Sahel at a low cost (Sollazzo, 2019) and appear to be used in all known IED designs in the area under study. As a result, armed groups are under no pressure to manufacture their own. If new regulatory measures were to succeed in curbing the diversion and trafficking of commercial initiators, these groups could look for alternative components and sources of supply.
- **Emerging trafficking routes for electronic components**. Armed groups make use of transmitters, receivers, and handheld VHF radio and vehicle alarm systems to build RCIEDs, particularly in Mali and Burkina Faso. Many of these items are manufactured in the Shenzhen Special Economic Zone in China. As early as 2016, the same electronic components were documented in use with IS forces in Libya, where they have largely been replaced by newer models since. While a similar upgrade could follow in West Africa, these new components have not yet been observed on the commercial market in the region. Market surveys carried out by domestic law enforcement and customs agencies could help to monitor the availability of these items in local markets and the possible emergence of trafficking routes for new electronic components to Mali, Burkina Faso, and other countries in the region.
- **Trafficking of electronic IED components**. Ongoing monitoring of electronic RCIED and VOIED components is important for identifying possible sources of supply, the modalities of sourcing, and the introduction of new items into the IED builders' range of resources. Items whose use has recently spread include passive infrared switches, which have begun to migrate from Yemen—where Houthi rebels likely received them from Iran—to Bahrain, where they have been used in IEDs (CAR, 2019). Iran has also been suspected of providing IED technology to the al-Qaeda affiliate al-Shabaab in Somalia, from where it could spread deeper into Africa, particularly via al-Qaeda-linked networks (Fraser-Rahim and Fatah, 2020). Multiple passive infrared-operated IEDs and their RCIED trigger systems and components were also documented in Derna, Libya, in 2018.[134] While it is possible that their use has or will spread, this study has not documented their presence in West or Central Africa.

- **Weaponization of commercial unmanned aerial vehicles (UAVs)**. While improvised drone-based IEDs have been used in many conflict theatres since their invention by IS forces in Iraq and Syria, there is not yet any evidence of their deployment in West or Central Africa. Throughout the region, however, terrorist-designated groups are routinely using commercial drones for surveillance and propaganda purposes. Peacekeeping operations such as MINUSMA have begun to deploy counter-UAV systems to tackle the use of UAVs in surveillance and the possible emergence of weaponized UAV-IEDs in their areas of operation.[135]
- **Technology transfers from Libya to West Africa**. IED builders in West Africa have inherited IED designs from Libya in the past and may continue to do so in the future. While still unconfirmed, the first documentation of a possible IED attack on MINUSCA forces occurred in CAR in 2020 and involved a modified PRB M3 anti-vehicle mine. As discussed in the case study, these mines appear to have been trafficked into West Africa from Libya and merit close monitoring throughout the region (see Section IV).

Efforts to equip and train national actors to conduct effective monitoring require adequate funding and planning. Essential equipment includes forensic laboratory equipment, X-ray machines, drones, and software. Training can usefully build specialized capacities, such as through sessions on chemical security control lists for customs officers at the border crossing. Côte d'Ivoire has established a monitoring and analysis unit that could serve as a model.

Field research can also help various actors—including intelligence services, international law enforcement, and customs officials—in identifying problematic procurement and supply dynamics for monitoring. As noted elsewhere in this Report, however, a joined-up regional approach is required if monitoring and other C-IED activities are to be effective.

The role of peace operations

More research and discussion are needed to explore how UN peacekeeping operations can better contribute to countering the proliferation of explosive threats and IEDs in countries such as CAR, DRC, Mali, and Somalia, as well as in states outside this Report's purview where IEDs are commonly deployed by non-state armed groups. UN peacekeeping operations, particularly UNMAS, have worked on a variety of aspects of the IED problem and had significant successes in reducing the impacts of IEDs on peacekeepers over time. They may, however, simultaneously have almost no impact on the dynamics of the IED threat itself, apart from projects to finance basic skills for national authorities.

Mandate limitations, lack of cross-border mandates, and dilemmas associated with neutrality and impartiality often place limits on the ways in which peacekeepers may collaborate with host nation security forces on C-IED. These limits are especially true in contexts where state security and defence forces may be implicated in human

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Senegalese troops carrying out search-and-detect for IEDs and mines using drones and metal detectors in central Mali, December 2022.

Source: Harandane Dicko/MINUSMA

rights abuses associated with their own counterterrorism and counter-insurgency strategies. Such limits can, very appropriately, result from the application of the UN's Human Rights Due Diligence Policy (UNGA, 2013). In 2021, the UN Secretary-General commissioned a review of explosive threats in peacekeeping contexts. This independent strategic review of the UN response to explosive ordnance threats (Van Roosen, 2021) explores the growing threat of explosive ordnance, including IEDs, on the delivery of peacekeeping mandates to peacekeeping forces and affected communities and makes recommendations to mitigate these threats.

Peacekeeping operations are often faced with the practical challenges of post-blast investigations and forensic IED work in insecure and remote environments. These can include difficulties gaining access to and securing incident sites, and when access can be secured, limitations in the ability to transport key evidence by air to laboratories due to interdictions imposed by civilian aviation contracts. Accessing remote incident sites can also require dedicated security, medical, and weapons intelligence elements with an organic mix of capabilities to be able to rapidly respond to sites of IED use before these sites are contaminated.[136]

Beyond exploitation and analysis, peacekeeping operations have struggled to design and mount operations to disrupt IED networks, even where they are directly targeted by terrorist -designated groups with these devices, leading to significant casualties. Intelligence-led C-IED operations require a special mix of assets and capabilities—including the use of weapons intelligence assets, special operations military, and police forces—and very few have specifically disrupted or attacked such networks to reduce their effectiveness.[137]

In some cases, missions need the asset mix, posture, and political support for such responses. In other cases, peacekeeping operations may rely on the existence of parallel national, bilateral, regional, and multi-national counterterrorism operations to do such work while focusing on their protection and prioritizing other mandated tasks. The withdrawal of forces providing a protective umbrella, such as the departure of Operation Barkhane from Mali, which leaves MINUSMA with a weaker potential response to IED attacks, suggests that to operate and survive in such a hostile environment, peacekeepers must be mandated, staffed, trained, prepared, and equipped to deal with these threats.

A more effective approach to network disruption might require direct collaboration with host nation forces in investigations and law enforcement operations. While potentially fruitful, such an approach risks drawing UN peacekeepers deeper into a peace enforcement or counterterrorism stance. The perception of peacekeepers could, thus, be of a party to a conflict—even though terrorist-designated groups already perceive UN peacekeepers in this way and attack them with deadly force. Identification of a more nuanced middle ground could allow peacekeeping operations to address the uncontrolled proliferation and access to explosives, arms, and ammunition in the conflict theatre they are mandated to stabilize by the UNSC. At a minimum, investigations into the killing and wounding of UN peacekeepers require improved technical and forensic analysis related to IEDs (Lochhead, 2021).

Commercial sector initiatives and corporate social responsibility

One key observation based on the engagement of the Small Arms Survey research team has been the notable lack of national and regional explosives industry associations in the areas under study. South Africa is the only country on the continent with a well-developed chemical and explosives industry sector and is an important manufacturer and exporter of commercial explosives into West Africa. As such, South Africa had annual sales of more than USD 14 billion in 2017 (Mahomedy, 2018). In addition, the Survey's collaboration with the National Small Arms Commission of Ghana led to the organization of an industry–government workshop in August 2021 to discuss

explosives diversion. This event, a 'Multi-stakeholder Workshop on the Complexities of Commercial Explosives Leakages', led to the establishment of a local explosives dealers association to engage the government to improve explosives management and reduce diversion.[138]

The manufacturing of many commercial explosives used in West Africa occurs in Europe, where there are multiple professional associations for the explosives industry. Some of these associations include the European Federation of Explosives Engineers, the International Society of Explosives Engineers, and the Federation of European Explosives Manufacturers. In addition, coordinated guidance and regulation of the civilian explosive sector is provided by EU regulations such as the 2014 Directive 2014/28/EU of the European Parliament and Council of 26 February 2014 on the Harmonisation of the Laws of the Member States Relating to the Making Available on the Market and Supervision of Explosives for Civil Uses (EU Parliament, 2014).

North American and Asian associations fulfil similar roles by engaging with states, regional trade and industry bodies, and related processes. For example, the US-based organization the Institute of Makers of Explosives (IME) has positioned itself as a 'non-partisan advocate for effective and sensible regulations and legislation that increases safety and security across the full life-cycle of commercial explosives' (IME, 2019). IME has positioned itself on issues such as the introduction of taggants standards—as traceability features—in bulk commercial explosives, explosive chemical precursor regulations, and the regulation of AN (IME, 2019).

While driven by a desire to ensure market access and maintain voluntary regulation, these professional associations can contribute to dialogue with governments and the development of technical standards, processes, regulations, and policies that shape explosives market access and safe use globally. Based on fieldwork conducted in the research area, however, there needs to be more evidence that similar professional bodies exist or are active in engaging with states or regional bodies. This engagement would improve the safety and security of commercial explosives in contexts where their products have become an important contributor to instability and violent death and injury through their use in building IEDs.

The industry has a role to play in contributing to developing appropriate remedies, even if the costs of their products rise slightly due to the introduction of improved traceability and life-cycle management features. Indeed, such costs can be borne by the highly lucrative extractive industry and potentially be passed along to consumers, leaving little excuse for inaction or foot dragging by explosives industry actors on what has become a critical national security issue for many states. Global, multilateral efforts to promote corporate social responsibility may point to another way forward to promote mining and explosives industry responsibility for death and injury associated with ubiquitous explosives diversion.

One explosives industry actor said his company was aware that a significant portion of their commercial explosives and accessories product was making its way into the illicit market. He estimated that more than 30 per cent was lost through diversion into the illicit market. He noted that companies were factoring projected losses into their business models and import requirements due to diversion.[139] Instead of further inflating their costs by ordering more, however, companies could help reduce the diversion costs by agreeing to comply with voluntary industry standards for commercial explosives throughout the complete product life cycle—from the time of manufacture to the time of consumption or disposal. Businesses could also address this issue through compliance with the UN Guiding Principles on Business and Human Rights (see Box 5).

Bottom-up efforts by artisanal mining associations

In recent years, artisanal mining and quarrying associations in Burkina Faso, Mali, and Niger have launched initiatives to form larger legal entities that could be considered official interlocutors and licensed buyers of commercial explosives (Diakité, 2020). In Burkina Faso, there are discussions on the possibility of having a single storage site for commercial explosives, initiators, and detonating cords on each artisanal mining site (Hainard, 2022). The police could guard these sites, and only a limited number of persons officially trained and registered would be allowed to access the storage site, take the necessary quantities of material, and conduct explosions.[140]

This initiative could improve explosives security, traceability, and accountability for commercial explosives used in artisanal mining and quarrying sites, from a licensed wholesaler to the actual end user. If adequately implemented and resourced, such measures would have important benefits for countering diversion and trafficking.

> “Without a synchronized and common approach at the regional level, traffickers will simply identify new clandestine sources and take advantage of weak and inconsistent laws and regulations to procure the materials they seek.”

Conclusion

The research conducted for this Report shows that institutional responses have failed to address many of the factors contributing to IED construction in West Africa, in part because they have been underdeveloped or poorly managed. They have also been ineffective in addressing the contributing factors, including the uncontrolled proliferation of deadly bomb-making materials.

As there are many possible supply sources of IED-building materials, it is tempting to think there are no ways to stem access to such materials; however, although the research identified that all IEDs in West Africa had some commercial explosive components, these components are typically restricted to electric and pyrotechnic initiators, detonating cords, and precursor chemicals such as AN. Efforts to restrict access to these items may prove to be effective C-IED measures.

Restricted access to these items cannot occur without dealing with the broader commercial explosives diversion problem; however, the formalization and management of explosives in the artisanal mining sector[141] and improved traceability features will likely also help. It is highly likely that if these key materials were more effectively controlled, terrorist-designated groups would switch to other widely available commercial explosives main charges, which represent an equally effective and only slightly more expensive alternative. Consequently, a holistic approach is needed—and, to be effective, the approach should cover a broad geographic region.

Without a synchronized and common approach at the regional level, traffickers will simply identify new clandestine sources and take advantage of weak and inconsistent laws and regulations to procure the materials they seek. There are a few downsides to a regional approach and many potential benefits, assuming that the political will exists and there is management of the complexity of coordinated action, as in other jurisdictions. Historically, West African states have spearheaded regional arms control approaches through the Bamako Declaration and the ECOWAS Convention. This convention specifically includes landmines within its scope—meaning that it can strengthen aspects of the response to VOIEDs and link to a regional approach to the APMBC. Coordinated regional action on explosives diversion and C-IED is a natural extension of such approaches and can be built on this existing architecture of meetings of ECOWAS member states and emerging frameworks for cooperation and joint action.

While IED-building and C-IED activities will always be engaged in an action–reaction–counteraction cycle, insurgent or terrorist-designated groups have the advantage of rapid innovation and opportunistic substitution. Where holes in responses exist—such as the easy but illegal civilian access to explosives, precursors, and accessories—a lot can be done to make IED-building harder and less effective. The net effect of this approach would be fewer lives lost, livelihoods disrupted, or key infrastructure destroyed.

In the future, we may see an expansion of the use of IEDs by bandits and other non-terrorist criminal groups present in the West Africa region. Given the availability of

IED components and the expertise shared throughout these regions, IEDs could become another tool at the disposal of criminals, as they have been in countries such as South Africa (Chelin and Els, 2020).

It is also likely that the number of IED incidents in Niger will increase, especially if the international presence in this country grows due to the relocation in Niger of troops previously based in Mali. The departure of these troops will leave a vacuum in Mali, and there may be an increase in IED activities in this country, including complex attacks targeting MINUSMA. While the design of IEDs in Mali has been relatively stable in the past two years, with no real technical evolution, this could change rapidly, influenced by the 'laboratories' and the emergence of new trends in both Burkina Faso and Niger since the end of 2021.

The absence of regulations requiring 'whole of supply chain', or 'whole of life', explosives security and the lack of agreed standardized traceability features across the explosives industry hamper tracing and associated counter-proliferation efforts. Law enforcement and intelligence actors must be able to identify the point of explosives diversion when proliferation is detected to ensure an adequate law enforcement and judicial response. Where traceability features do exist, this does not mean that national authorities or international organizations will carry proper identification and tracing out. Effective responses by national and international law enforcement would still require adequate training and financial and human resources. These responses would be applied to investigate, mount interdiction operations, make arrests, and prosecute explosives traffickers or companies whose lax standards or corruption contribute to explosives proliferation.

Measures taken to prevent the diversion of IED components must also be context-sensitive responses. While improved oversight of the artisanal extractive sector and economy should be governmental priorities, counter-proliferation efforts should not unduly stifle commercial activities, such as agriculture, commercial extraction, or construction. These efforts should also encourage informal economic activities, such as artisanal gold mining. While such activities can also become a source of financing for TAGs and armed groups through illegal taxation of artisanal miners, the revenue generated is also crucial to the economies of the region's countries and a significant source of livelihood for many otherwise impoverished and underdeveloped communities.

Across the research area, violent extremists often use the economic difficulties experienced by youth as rallying cries to their causes and take advantage of unemployment for recruitment. Weakening communities' rare sources of revenue, even if they are illicit, exclusively through law enforcement and other security responses—particularly where they are heavy-handed—would potentially reinforce the appeal of joining TAGs. The aim should instead be to improve the traceability of explosive materials through the entire supply chain to the real end user, limiting the possibilities

of diversion and trafficking of this material and associated risks with use as IED components. The humanitarian aspect of IED use is also somewhat neglected, and there is an opportunity to find synergies between research, technical intelligence, engagement on IED use, and operational, regulatory, and humanitarian responses.

IEDs are an extremely cost-effective weapon, and their use is both tactical and political. They are increasingly used as criminal tools as well. Addressing the root causes of violence and crime will always be a preferable way of reducing IED use; however, when faced with adversaries who reject fundamental concepts of the state or IHL, every legal tool at the disposal of the state, regional political and security bodies, and international actors should be used to reduce the illegal use of these weapons—and access to the materials with which to build them.

Endnotes

1 Although Cameroon is usually categorized as a Central African state, it was included in the study given the transnational nature of its IED problem, particularly with Nigeria.
2 'Recovered explosive ordnance' refers to items of explosive ordnance that have been dropped, fired, launched, projected, or placed—and subsequently removed—for reuse in some way. This term may involve the recovery of explosive remnants of war items or removing mines from the location of placement.
3 According to UNODA (2021), explosive remnants of war (ERW) cover unexploded ordnance (UXO) and abandoned explosive ordnance (AXO) that remain after the end of an armed conflict.
4 Examples of factory-produced commercial explosive main charges encountered include nitroglycerine- and nitroester-based explosives.
5 IGAD comprises eight member states: Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan, and Uganda.
6 This competence aims at collecting contextual information and physical evidence—such as soil samples, IED components or their remnants, and any other materials connected to the incident—following the IED incident to analyse the data and develop knowledge on the IED threat.
7 A focus has been operated on specific areas of some countries—for example, certain border areas in Chad and Nigeria—therefore, the data only partially captures the extent of the issue (see Map 1).
8 Information about the victims of an incident was either unclear or not available for some incidents, which is why the total number of casualties does not match the total for this breakdown.
9 Data supplied by Action on Armed Violence (AOAV) to the Small Arms Survey, June 2022.
10 Observations of a former MINUSMA official, 2022.
11 See, for example, Stevens (2019) and Chelin and Els (2020; 2021).
12 For more information on cross-border trafficking dynamics in this region, see Mangan and Nowak (2019).
13 Interview with MINUSMA IED expert, Mali, December 2019.
14 Raw data supplied by AOAV to the Small Arms Survey, June 2022.
15 Regular correspondence and information exchange with international and national government sources in Cameroon, CAR, and DRC, 2021–22.
16 In mid-2022, the Governments of Cameroon and CAR highlighted their concerns over the proliferation of arms and ammunition from armed groups in CAR into Cameroon, including to armed groups (Kindzeka, 2022).

17 See Section II for further details on Cameroon.
18 It has not been possible to distinguish between commercial electric initiators and any electric initiators that might have been seized from security forces due to battlefield capture, although the research has only documented one case of military explosives being seized.
19 During this period, significant IED incidents occurred in Nigeria. While not a case study country, data on Nigeria was nevertheless collected remotely for this Report, notably with respect to transborder dynamics affecting the situation in Cameroon.
20 While IEDs are not specifically mentioned in the ECOWAS Convention on Small Arms and Light Weapons, Their Ammunition, and Other Related Material (2006), it states that 'other related materials' include '. . . any chemical substance serving as active material used as a propelling or explosive agent' (art. 1, para. 4). In practice, the national small arms commissions of several ECOWAS member states take a similar approach to IEDs by acting as a focal point for small arms, mine action, and IEDs, in the absence of a dedicated body designated to coordinate on this multifaceted issue.
21 The Survey worked with the following national commissions: Commission Nationale Contre la Prolifération et la Circulation des Armes Légères (Guinea); Commission Nationale de Contrôle des Armes (Burkina Faso); Commission Nationale de Lutte Contre la Prolifération des Armes Légères (Mali); Commission Nationale de Lutte Contre la Prolifération et la Circulation Illicite des Armes Légères et de Petit Calibre (Côte d'Ivoire); Commission Nationale pour la Collecte et le Contrôle des Armes Illicites (Niger); and National Commission on Small Arms and Light Weapons (Ghana). Although the project did not carry out fieldwork in Benin, it also held preliminary consultations with the Commission Nationale de Lutte Contre la Prolifération des Armes Légères (Benin).
22 Respondents included individuals from the ministries of mines, environment, finance, commerce, and customs.
23 For this reason, and a lack of public reports on the matter, the Survey did not document any IED incidents in Guinea.
24 The UN (2019) provides an explicit reference to VOIEDs under Action 21 of the Oslo Action Plan agreed at the Fourth Review Conference of the APMBC in 2019, giving rise to obligations to disaggregate and report relevant IED data.
25 Interview with industry experts, Bamako, Mali, June 2019.
26 Unless noted otherwise, casualty and incident figures in this section are drawn from the Small Arms Survey's IED database, as are technical and tactical details of IED use in the countries under review.
27 Based on UNMAS and MINUSMA data and interviews, February 2019.
28 Author correspondence with a senior international source in Mali, December 2019.
29 Written correspondence with Burkina Faso's national commission, November 2022. This Report does not cover subsequent incidents, such as the one that happened on 5 September 2022, killing 35 civilians, and injuring 37 (AFP, 2022), or the 9 August 2022 IED strike that killed 15 Burkinabé soldiers (Torelli, 2022).
30 Available data on IED incidents often makes it difficult to distinguish between 'improvised anti-vehicle mines' and VOIEDs, which fall within the scope of the APMBC.
31 Presentation by the Burkina Faso National Small Arms Commission at an online UNMAS event on West Africa and the Sahel, 19 November 2020.
32 Field visits by Small Arms Survey researchers in 2020 to artisanal mining sites near Bamako, Mali, confirmed the use of large quantities of illegally acquired explosives. According to local civilian sources, this illicit trade occurred in full view of authorities.

33 This subsection is largely based on Sumo Tayo (2022).
34 During interviews conducted by the Survey in Cameroon, some interlocutors used the term 'Boko Haram' not only with reference to the JAS faction but also to cover associated Islamist groups, such as the IS, al-Qaeda, and local affiliates.
35 Interview with former MINUSMA staff member, November 2022.
36 Interview with MINUSMA staff, February 2020.
37 Interview with MINUSMA staff, February 2020.
38 Interview with former MINUSMA staff member, November 2022.
39 Interview with MINUSMA staff, February 2020.
40 Interview with an officer at the Malian Ministry of Mines, Bamako, Mali, January 2019.
41 Written correspondence with international C-IED expert, 14 February 2023.
42 Written correspondence with international C-IED expert, 14 February 2023.
43 This subsection is primarily based on Tettey (2019).
44 Interview with MINUSMA staff, February 2019.
45 Unless otherwise noted, the information in this section is drawn from Sow (2021).
46 Written correspondence with international mine action expert, 12 February 2023.
47 Interview with former MINUSMA staff, November 2022.
48 The rest of this section is based on Kouassi (2020), unless otherwise noted.
49 Confidential source.
50 Field research, Burkina Faso, February 2022.
51 Discussions with field specialists, Mali, February 2022.
52 Confidential source, 2022.
53 Although VOIEDs in West Africa are typically placed on vehicle tracks to target vehicles and motorcycles, their low threshold of a few kilos means that they can also be activated by the weight of a person, and therefore fall under the scope of the APMBC.
54 The UN (1996) defines a *booby-trap* as 'any device or material which is designed, constructed, or adapted to kill or injure, and which functions unexpectedly when a person disturbs or approaches an apparently harmless object or performs an apparently safe act'. UNMAS (2018a) states that the term booby-trap is used by many involved in EOD to refer to both: (1) 'Conventional anti-handling devices which can be used in association with mines or as clandestine devices, and (2) improvised explosive devices which utilize a victim-operated firing switch more commonly referred to as VOIED. From an EOD perspective, there is a difference between an anti-handling device that has a level of quality assurance associated with its manufacture and the switch used in a VOIED, which, owing to the improvised nature of the device or part thereof, has a lower certainty of reliability in construction and method of function. For this reason, booby-trap is taken as a non-technical generic term, with the preferred terms of anti-handling device and VOIED as the preferred technical term. Not all persons qualified to dispose or render safe anti-handling devices are improvised explosive device disposal qualified, which is a requirement to dispose of or render safe VOIED.'
55 Interview with former MINUSMA staff member, November 2022.
56 Interview with former MINUSMA staff member, November 2022.
57 Interviews with experts, Burkina Faso, Mali, and Niger, November 2021–February 2022.
58 Correspondence with experts, February and April 2022.
59 Interviews with international experts, Mali, February 2022.
60 'Bandits'—or *coupeurs de route* in French—are armed robbers who target vehicles on regional roads (Sollazzo and Nowak, 2020).
61 Interview with UNMAS-MINUSMA staff, Bamako, Mali, November 2019.

62 Written correspondence with international C-IED expert, 14 February 2023.
63 Interview with industry experts, Bamako, June 2019.
64 Interview with former MINUSMA staff member, June 2018.
65 Interview with former MINUSMA staff member, February 2020.
66 A notable exception to this was the capture of a 122 mm BM21 multi-launch rocket system and a single tube 122 mm Grad P launcher in Kidal, Mali, by the armed group coalition known as the Coordination des Mouvements de l'Azawad (Coordination of Azawad Movements) in 2014. The Grad P launcher was destroyed by the UN in Tabankort later that year, however (interview with former MINUSMA staff member, November 2022).
67 Email correspondence with international technicians in West Africa, February–April 2022.
68 Interview with a local technician, West Africa, February 2022.
69 Interviews with local and international experts, Burkina Faso, Mali, and Niger, January–February 2022.
70 Interviews and correspondence with international military officers, West Africa, January–May 2022.
71 Author communication with an UNMAS DRC official, February 2022.
72 Confidential international forces report, 2019–22.
73 Interview with MINUSMA staff, Bamako, Mali, February 2019.
74 Interviews with military experts, Mali, February 2022.
75 Written correspondence with Niger law enforcement source, April 2022.
76 Interview with industry experts, Bamako, Mali, November 2019.
77 Interviews with international military officers, Mali, 2021.
78 Interview with former MINUSMA staff member, February 2020.
79 Interview with former MINUSMA staff member, February 2020.
80 French manufactured cluster sub-munitions have been documented in use as a component of IEDs in Cameroon (see Section II on Cameroon) and in Nigeria. Interview with an international IED expert, 14 February 2023; Sumo Tayo (2022).
81 Interview with former MINUSMA staff member, November 2022.
82 Explosive harvesting refers to the practice of removing the explosive content from items of explosive ordnance by various means for reuse in other ways, such as in blasting for agricultural or mining purposes or use in IEDs. In some cases, the term cannibalization refers to the same practice.
83 There is also anti-vehicle mine contamination in Senegal, which presents a risk given the insecurity in Casamance and routes via Senegal–Guinea Bissau–Guinea (written correspondence with international mine action expert, 12 February 2023).
84 Interview with a member of the Malian armed forces, Bamako, Mali, July 2019.
85 Confidential source.
86 The incidents break down as follows: 2 in 2016, 12 in 2017, 11 in 2018, 13 in 2019, and 5 in 2020 (Small Arms Survey, 2022).
87 Small Arms Survey investigations based on confidential reports and exchanges with MINUSMA.
88 Restricted private intelligence report, 2018.
89 Confidential sources.
90 Interviews with local experts, Niger, February 2022.
91 Interviews with international experts, Belgium, March 2022.
92 Mauritania has maintained an open border with Mali.
93 Discussions held during a multi-stakeholder workshop in Accra, Ghana, August 2021.

94 The specific 'unit' in question is unknown; however, based on imagery and knowledge of the situation in Burkina Faso (Sollazzo, 2019), where explosives are sold as a kit, it may indicate the sale of a kit comprising an explosive charge, a pyrotechnic detonator, and a safety fuse. Alternatively, in the case of an electrically initiated charge, the kit may comprise an explosive charge, electric initiator, and possibly a detonating cord.
95 Excerpt translated from French.
96 Discussions held during the multi-stakeholder workshop conducted, Accra, Ghana, August 2021.
97 Discussions with extracting sector experts, Ouagadougou, Burkina Faso, February 2022.
98 Discussions with extracting sector experts, Ouagadougou, Burkina Faso, February 2022.
99 Discussions with extracting sector experts, Niamey, Niger, February 2022.
100 Discussions with an extracting sector expert, Niamey, Niger, February 2022.
101 Written correspondence with international mine action expert, 12 February 2023.
102 TAGs may also be seeking to control the availability of urea and fertilizers for strategic reasons. Withholding fertilizers and then distributing them at the time of their choosing fits with the rhetoric of groups that aim to be perceived as the sole providers for local populations.
103 Interviews with local artisanal gold miners and operators in artisanal quarries conducted in Niger, Burkina Faso, and Mali, June 2020–February 2022.
104 Discussions with commercial explosives experts, Bamako, Mali, June 2019, and Ouagadougou, Burkina Faso, 2022.
105 Discussions with extracting sector experts, Niamey, Niger, February 2022.
106 Quarrying actors are involved in the unlicensed extraction and processing of rock into crushed stone for construction applications.
107 Little is known about Algeria as a potential source of commercial explosives, although research undertaken in Niger suggests that it is a source or transit country for commercial explosives.
108 Field research, Bamako, Mali, March 2020.
109 Discussion with an extracting sector expert, Niamey, Niger, February 2022.
110 Interview with former MINUSMA staff, November 2022.
111 Interview with former MINUSMA staff member, November 2022, and members of the Malian army, October 2020.
112 Interview with former MINUSMA staff member, October 2020.
113 Interview with former MINUSMA staff member, October 2020.
114 The PRB M3A1 version of the mine has additional fuse wells that can be used to create anti-handling mechanisms or to link mines (CISR, n.d.).
115 Export control data on Poudreries Réunies de Belgique (PRB) sales to Libya provided by the Groupe de recherche et d'information sur la paix et la sécurité (GRIP) with permission from the Belgian government.
116 In Egypt, legacy mines from Second World War battlefields in the country's western desert have made their way into IED networks (Schwartzstein, 2016).
117 Confidential source.
118 In addition to Chad and Libya, documentation of anti-vehicle mines also exists for South Sudan and Sudan, where they were recovered during humanitarian demining operations and in accidents (CISR, 2010; DDAS, 2013, p. 9; HRW, 1998, p. 47; Mine Risk Education, 2013). These mines may remain in stockpiles of the Sudanese armed forces and be illegally diverted or recovered and sold on the illicit market, as mines from Chad appear to have been. Close monitoring of the use of anti-vehicle mines could help determine which models

and makes are being trafficked from which countries. While a UN Panel of Experts previously reported on arms and ammunition trafficking from Sudan's Darfur region to armed groups in CAR (Dabanga, 2019), there is no evidence to determine whether the use of PRB M3s in CAR was a result of trafficking from Sudan.

119 Author interview with humanitarian mine action staff, Chad, 2019.

120 Interview with MINUSMA staff, members of the FAMA, and members of the Barkhane Operation, February 2020.

121 Interview with UNMAS-MINUSCA staff, 2020.

122 Interview with MINUSMA official, February 2020.

123 This configuration was used, for example, during the devastating VBIED strike against Gao Airport in 2016 (Menastream, 2016). Interview with former MINUSMA staff member, October 2020.

124 Interview with UNMAS-MINUSCA staff, June 2022.

125 The report of the Secretary-General, 'Countering the Threat Posed by Improvised Explosive Devices' (A/71/187), frames the UN response to the IED threat globally (UNSG, 2016). In Resolution A/RES/71/72, UN member states welcomed the report of the UN Secretary-General and its recommendations (UNGA, 2016).

126 To be more precise, no IEDs have been noted during this study that did not contain at least one component manufactured for the commercial explosives sector.

127 Author's discussion with UNMAS, January 2019.

128 For more information, see WCO (n.d.).

129 Written correspondence with international mine action expert, 12 February 2023.

130 Interview with William Els, ISS, June 2022.

131 Interview with MINUSMA staff, October 2020. In the past, national forces in Mali and Niger collected IED samples and provided them to international forces for forensic analysis. In some cases, the national forces reportedly did not receive the lab results and became reluctant to provide further samples for analysis. Some expressed concerns about transferring their own DNA or fingerprints found on IED parts to lab analysts, for fear that biometric information would find its way into counterterrorism databases. Small Arms Survey interviews with local defence and security forces, Bamako, Mali, 2019–22 and Niamey, Niger, February 2022.

132 These entities are UNMAS, the UN Police, MINUSMA's Joint Mission Analysis Centre, and military forces—including national weapons intelligence teams and EOD and IED disposal units.

133 Written correspondence with international mine action expert, 12 February 2023.

134 Restricted private intelligence report, 2018.

135 Presentation by Anton Antchev, MINUSMA Director of Mission Support at the Partnership for Technology in Peacekeeping Symposium, Pretoria, South Africa, June 2022.

136 Interview with former MINUSMA staff member, January 2023.

137 Interview with former MINUSMA staff member, January 2023.

138 Written statement of the Local Explosives Dealers Association of Ghana, 2021, as provided to the Small Arms Survey.

139 Interview with an explosives industry actor, Accra, Ghana, August 2021.

140 Interviews with organizations of artisanal gold miners, Ouagadougou, Burkina Faso, February 2022.

141 If IED-building networks are in fact sourcing material from mining and quarrying sites rather than directly from diverted commercial supplies.

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Small Arms Survey
Maison de la Paix
Chemin Eugène-Rigot 2E
1202 Geneva
Switzerland

t +41 22 908 5777
e info@smallarmssurvey.org

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