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## **Assessing, Detecting, and Deterring the Threat of Maritime Nuclear and Radiological Smuggling in the Western Indian Ocean Region**

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## **Abstract**

This paper proposes that current maritime smuggling routes in the western Indian Ocean region are similar to those in the past and that the motivations of terrorist groups and the presence of radioactive sources in the Indian Ocean littoral and other states present a significant security threat. The majority of regional terrorist groups have a hybrid structure, piggybacking on criminal activity to fund their terror activities. Additionally, states have used maritime routes in the Indian Ocean region to transport nuclear materials and missiles. Thus, the maritime dimension of such threats remains, and may be increasing. This paper focuses on issues, motivations, pathways, and methods for detecting and interdicting nuclear and radiological trafficking. It analyzes the potential use of maritime technology for radiation detection and presents recommendations for states and multinational nonproliferation advocacy organizations to address the threat in the Indian Ocean region.

## **ACKNOWLEDGMENTS**

As the author of this report, I take full responsibility for its research, development, and content. It is my personal viewpoint and does not echo or endorse any other organization's perspective of the world. This report could not have been produced without the astute guidance and technical advice of my colleagues at Sandia National Laboratories' Center for Global Security and Cooperation and the Cooperative Monitoring Center (CMC). In particular, I especially appreciate the involvement of David Betsill, Paul Trask, Greg Stihel, and Adriane Littlefield. At Sandia's CMC, David was very patient and provided the requisite resources and input to make this project a success. I am also grateful to Suzanne Cordova for the numerous things she did to make my tenure at Sandia comfortable and to efficiently arrange travel, accommodation, and logistics in support the accomplishment of the research; and always with grace and a smile.

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## NOMENCLATURE

AIS	Automatic Identification System
BARC	Bhaba Atomic Research Center
BBC	British Broadcasting Corporation
CMC	Cooperative Monitoring Center
CNS	Center for Nonproliferation Studies
CPEC	China-Pakistan Economic Corridor
CSI	Container Security Initiative
DOE	U.S. Department of Energy
EU	European Union
DHS	U.S. Department of Homeland Security
FAO	United Nations Food and Agriculture Organization
GAO	U.S. Government Accountability Office
GPS	Global Positioning Satellite
IAEA	International Atomic Energy Agency
IOR	Indian Ocean Region
ISIS	The Islamic State of Iraq and Sham
ITDB	IAEA Incident and Trafficking Database
MMD	Mercantile Marine Department
MMSI	Maritime Mobile Service Identity
MRRCs	Maritime Risk Reduction Centers
NATO	North Atlantic Treaty Organization
NAVFOR	European Union Naval Force (Operation Atlanta)
NNSA	U.S. National Nuclear Security Administration
SALW	Small Arms and Light Weapons Trafficking
TTP	Tehreek-e-Taliban Pakistan
UAE	United Arab Emirates
UNODC	United Nations Office on Drugs and Crime



# 1 EXECUTIVE SUMMARY

This research proposes that current maritime smuggling routes are similar to those in the past and that the motivations of terrorist groups and the presence of radioactive sources in the Indian Ocean littoral and other states present a viable security threat. Additionally, this research analyzes the potential use of maritime technology for radiation detection in the Indian Ocean region.

Since the sixteenth century, traders have been involved in maritime smuggling in the Indian Ocean as a way to avoid the Portuguese navy, which had started regularizing trade. These historical smuggling routes have essentially remained the same, but the commodities smuggled have evolved from gold, ivory, and cloves to small arms and weapons, humans, and drugs. Currently, the majority of regional terrorist groups have a hybrid structure, piggybacking on criminal activity to fund their terror activities. The demand and motivation to use nuclear or radiological materials in terrorist attacks have been clearly expressed by Al-Qaeda, Aum Shinrikyo, and now the Islamic State of Iraq and Syria (ISIS). Additionally, states have used maritime routes in the Indian Ocean region to transport—and therefore proliferate—nuclear materials and missiles. Thus, the maritime dimension of such threats remains, and may be increasing.

Outside of port monitoring programs, there has been little research conducted on the detection of maritime nuclear or radiological trafficking via unregulated ports and vessels. As a result of the Nuclear Security Summits and other multilateral forums such as the Global Initiative to Counter Nuclear Terrorism, countries have strengthened their nuclear regulatory mechanisms to reduce the risk of orphan radiological sources and pilferage of nuclear material. Concomitantly, terrorist groups are also adopting new methods to inflict maximum financial and human suffering. The 2008 Mumbai attack and the 2000 attack on the USS Cole in the Port of Aden in Yemen are prime examples of terrorists using novel ways to carry out attacks.

This research focuses on issues, motivations, pathways, and methods for detecting and interdicting nuclear and radiological trafficking. Moreover, it presents recommendations for states and multinational nonproliferation advocacy organizations to address the threat, including approaches such as involving local fishing communities to assist in the detection and deterrence of nuclear and radiological smuggling. Recommendations include:

- Global Water Way Watch
- Installation of Identification and Geo-Locating Devices on Smaller Vessels
- Small Vessel Voluntary Reporting System
- Capacity Building of Coast Guards and Maritime Security Agency
- Shared Indian Ocean Littoral States Surveillance Systems
- Establishment of Maritime Risk Reduction Centers (MRRCs)
- Encouraging States to Establish a Nuclear Detection Architecture,
- Use of Crisis/Crime Informatics Software, and
- The Pivotal Role of Centers of Excellence for Nuclear Security.



## 2 MARITIME SECURITY RISKS IN THE INDIAN OCEAN REGION

### 2.1 Introduction

The Indian Ocean region (IOR) (Figure 1) has risen to paramount contemporary importance because of global economics and geopolitics, and because it is an avenue for powerful countries to project their might to other peripheral states. The United States, due to its blue ocean navy, has been a dominant power in the Indian Ocean; but other powers such as India and China are also trying to gain a foothold in the Indian Ocean. In the last two decades, the geo-strategic importance of the IOR has increased as a result of two major wars: the conflicts in Iraq and Afghanistan were both fought from the waters of the Indian Ocean.



Figure 1. Map of the Indian Ocean Region.<sup>1</sup>

Historically, the IOR has been the center of conflict and economic opportunities and the conduit for the spread of religion for major powers in the world. Islam, the second largest religion of the world, would never have expanded as far as the Iberian Peninsula, China, and South and South East Asia if it had not been for the naval fleets of the Muslim empire.

According to Kaplan, “Under the Arab-Persian cultural unity effected by the eclectic medieval Abbasid Caliphate in Baghdad, Arab and Persian sailings across the Indian Ocean from Africa to the Far East became nearly distinguishable, falling under the general rubric of Muslim trade and

<sup>1</sup> Source: University of Texas Libraries Maps, [http://www.lib.utexas.edu/maps/islands\\_oceans\\_poles/indianoceanarea.jpg](http://www.lib.utexas.edu/maps/islands_oceans_poles/indianoceanarea.jpg).

exploration.”<sup>2</sup> Trade helped Muslims to propagate their religion to different parts of the world, and by the end of fifteenth century, there were 30 coastal towns established by Muslim traders.

In the post-decolonization era, the Indian Ocean became the hub of trade, particularly for the shipment of oil produced by Middle Eastern countries. Unfortunately, non-state actors also used the region for various illicit activities including piracy and smuggling of contraband drugs and weapons. This paper analyzes the potential for nuclear and radiological trafficking by studying the smuggling patterns, trade routes, and non-state actors operating in the IOR. The geographical scope of the study is the IOR from the west coast of India to East Africa and the Middle East.

## 2.2 Background and Characteristics of the Indian Ocean

The Indian Ocean, the third largest ocean after the Pacific and Atlantic, covers an area of 68.5 million square km and connects three major land masses: Asia, Africa, and Australia.<sup>3</sup> There are 38 key littoral states that share their coastlines with the Indian Ocean. These states include Australia, Bahrain, Bangladesh, Comoros, Djibouti, East Timor, Egypt, Eritrea, India, Indonesia, Iran, Iraq, Israel, Jordan, Kenya, Kuwait, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Qatar, Saudi Arabia, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Sudan, Tanzania, Thailand, the United Arab Emirates (UAE), and Yemen.<sup>4</sup> According to David Michel and Russell Sticklor, Britain and France should also be included in this list since they have territories in the Indian Ocean.

The IOR includes the Andaman Sea, Arabian Sea, Andaman Sea, Arabian Sea, Bay of Bengal, Flores Sea, Great Australian Bight, Gulf of Aden, Gulf of Oman, Java Sea, Mozambique Channel, Persian Gulf, Red Sea, Savu Sea, Strait of Malacca, Timor Sea, and other tributary water bodies. The IOR has major ports at Chennai (Madras, India), Colombo (Sri Lanka), Durban (South Africa), Jakarta (Indonesia), Kolkata (Calcutta, India), Melbourne (Australia), Mumbai (Bombay, India), and Richards Bay (South Africa).<sup>5</sup> The IOR has seven choke points: the Mozambique Channel, the Bab el Mandeb, the Suez Canal, the Strait of Hormuz, the Malacca Straits, the Sunda Strait, and the Lombok Strait. The IOR can be divided into the following sub-regions:<sup>6</sup>

- Middle East and Gulf
- Red Sea and Horn of Africa
- East Africa and Sub-Saharan Africa
- South Asia
- Southeast Asia/Oceania

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<sup>2</sup> Robert Kaplan, “Monsoon: The Indian Ocean and the Future of American Power,” Random House, New York, 2010, page 27.

<sup>3</sup> “Indian Ocean: A Sea of Uncertainty,” Future Directions International, Perth, Australia, February 2012, page 9. Accessed April 12, 2016.

<http://futuredirections.org.au/wp-content/uploads/2016/01/IndianOceanASeaofUncertainty-.pdf>.

<sup>4</sup> Michel David, and Russell Sticklor, Editors, “Indian Ocean Rising: Maritime Security and Policy Challenges.” The Henry L. Stimson Center Report, September 2012, page 9. Accessed April 8, 2016.

[http://www.stimson.org/sites/default/files/file-attachments/IOR\\_chapter1\\_1.pdf](http://www.stimson.org/sites/default/files/file-attachments/IOR_chapter1_1.pdf).

<sup>5</sup> Anthony H. Cordesman and Abdullah Toukan, “The Indian Ocean Region: A Strategic Net Assessment,” Center for Strategic and International Security, 2014, page 1. Accessed April 9, 2016.

[http://csis.org/files/publication/140725\\_Indian\\_Ocean\\_Region.pdf](http://csis.org/files/publication/140725_Indian_Ocean_Region.pdf).

<sup>6</sup> Ibid., 2.

### **2.3 Importance of the IOR: Strategic Trade Routes**

Trade has always been a cornerstone of the countries in the Indian Ocean, be it the export of tons of frankincense from the Dhopari port of Yemen to the Roman Empire or the export of spices from the Marlabar coast of India to Europe. According to Robert D. Kaplan, “It is my contention that the Great Indian Ocean, stretching eastward from the Horn of Africa past the Arabian Peninsula, the Iranian plateau, and the Indian Subcontinent, all the way to the Indonesian archipelago and beyond may comprise a map as iconic to the new century as Europe was to the last one.” According to a proverb, “If the world was an egg, Hormuz would have been its yolk.”

Not only is the Indian Ocean home to more than 2 billion people, but it is also the hub of shipping and oil commerce throughout the world. Additionally, the world’s most critical sea lanes and trade routes are in the Indian Ocean. Although Saudi Arabia, Iran, UAE, and Kuwait are ranked in the top ten oil-producing countries and the Middle East produces 30 percent of the world’s oil, an estimated 40 percent of the world's offshore oil production comes from the Indian Ocean. Moreover, more than 50 percent of the global maritime oil trade occurs in or via the Indian Ocean.

### **2.4 Natural Resources**

Besides being a source of shipment of oil, the Indian Ocean is rich in fisheries and minerals. According to the United Nations Food and Agricultural Organization (FAO), the Indian Ocean supplies 14.6 percent of the world fisheries, worth \$11.3 billion. The majority of the states in the IOR are developing countries, and fisheries are therefore an important element of their economy. According to a recent report of the FAO, developing countries’ share of the overall fisheries trade has risen to approximately 54 percent. Along the coastlines of littoral states of the Indian Ocean, there are thousands of fishing communities that depend on traditional fishing. More than 15 million people are engaged in fishing along these coasts of IOR. In 2012, the total catch in the western Indian Ocean was 4.5 million tons and in the eastern Indian Ocean it was 7.4 million tons.

The bed of the Indian Ocean also contains heavy-minerals sand deposits. According to experts, it has the second largest reserve of mineral deposits after the Pacific Ocean. Polymetallic nodules and polymetallic massive sulphides are of primary importance among these minerals. Polymetallic nodules contain cobalt, iron, nickel, and manganese, while polymetallic massive sulphides are important because they contain copper, zinc, and gold. According to experts, there are other minerals such as titanium and zirconium off the coast of South Africa and Mozambique. Also, there are tin placer deposits off the coast of Thailand, Myanmar, and Indonesia. With increasing demand, the value of these minerals will also rise, thereby increasing the importance of the IOR.



### 3 RISK AND THREAT ASSESSMENT IN THE INDIAN OCEAN

The IOR has been beset by piracy, armed robberies, maritime terrorism, small arms and light weapons trafficking, along with human trafficking, conflicts, and insurgencies (Figure 2). This section will highlight the risks and threats posed by such activities in the IOR.

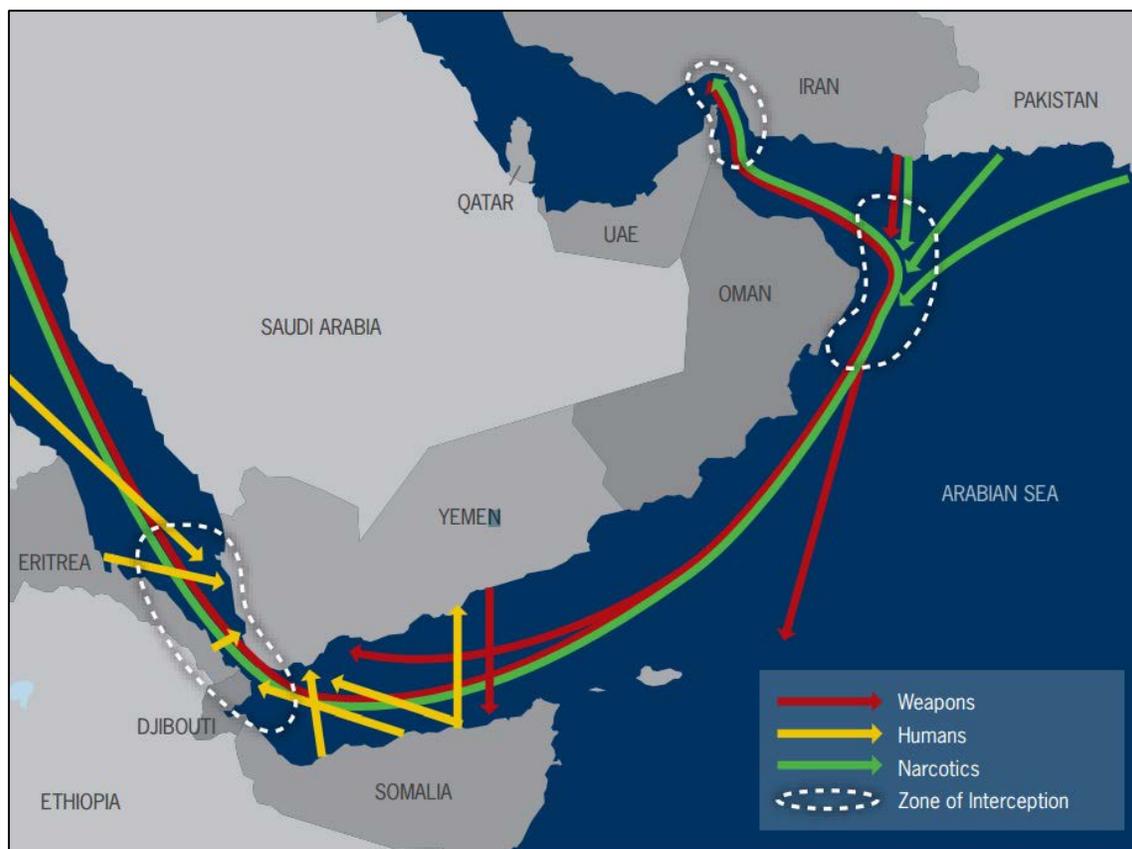


Figure 2. Known Smuggling Routes in the Indian Ocean.<sup>7</sup>

#### 3.1 Small Arms and Light Weapons Trafficking

The proliferation of small and light weapons (SALW) has been a major factor in the rise of violence in the world, with the most affected being the conflict-ridden countries of East Africa. A study conducted by the Stimson Center reported that Africa has lost up to US\$18 billion due to perennial conflicts, armed insurgencies, and ethnic violence.<sup>8</sup> Additionally, there has been a history of using the IOR as a pathway to smuggle small arms in the IOR. The sources of the SALW

<sup>7</sup> Source: Michel David, and Russell Sticklor, Editors, “Indian Ocean Rising: Maritime Security and Policy Challenges.” The Henry L. Stimson Center Report, September 2012, page 27. Accessed April 8, 2016. [https://www.stimson.org/sites/default/files/file-attachments/Book\\_IOR\\_2\\_1.pdf](https://www.stimson.org/sites/default/files/file-attachments/Book_IOR_2_1.pdf).

<sup>8</sup>Brian Finlay, Johan Bergenas, and Veronica Tessler, “Beyond Boundaries in Eastern Africa: Bridging the Security/Development Divide with International Security Assistance.” The Henry L. Stimson Center and Stanley Foundation Report, Preface. Accessed April 08, 2016. [http://www.operationspaix.net/DATA/DOCUMENT/4393~v~Beyond\\_Boundaries\\_in\\_Eastern\\_Africa\\_Bridging\\_the\\_Security\\_Development\\_Divide\\_With\\_International\\_Security\\_Assistance.pdf](http://www.operationspaix.net/DATA/DOCUMENT/4393~v~Beyond_Boundaries_in_Eastern_Africa_Bridging_the_Security_Development_Divide_With_International_Security_Assistance.pdf).

that are smuggled through the IOR are Ethiopia, India, Iran, Iraq, Mozambique, Myanmar, Pakistan, Somalia, South Africa, Sri Lanka, Sudan, Thailand, and Yemen. The small arms are mostly destined for Somalia (Kismayo, Mogadishu, Haradhere, Bossaso); Yemen (Hodeidah, Aden); Eritrea (Massawa, Aseb); Sudan (Port Sudan); and Gaza, Lebanon, and Syria (via Suez). When Oman was a closed society during the era of Sultan Said bin Taimur, weapons and ammunition were smuggled through the Gulf of Aden.<sup>9</sup> Even now in the twenty-first century, small arms are smuggled into conflict- and insurgency-ridden states. Since the start of hostilities in Yemen between the Houti rebels and Saudi Arabia in 2015, the U.S. Navy has interdicted stateless dhows trying to smuggle SALW into Yemen from Iran.<sup>10</sup> Importantly, the smuggling of explosives through the Raigad coast in Maharashtra, India, and their use in the 1993 serial blasts in Mumbai has been one of the factors contributing to the deterioration of relations between India and Pakistan.

### **3.2 Narcotics Smuggling**

Since the Soviet-Afghan war in the 1970s, the lack of law and order in Afghanistan has led to an exponential rise in the availability of drugs in the world. The United Nations Office on Drugs and Crime (UNODC) estimates that a quarter of a billion people used illicit drugs in 2013.<sup>11</sup> The rise in demand has led to an increase in production following the simple rule of supply and demand. In Afghanistan, the narcotics trade amounts to a staggering US\$3 billion.<sup>12</sup> Since Afghanistan is a land-locked country, the only viable route for narcotics smuggling other than Central Asia is via the Indian Ocean by way of Pakistan. Other than Afghanistan, the major producers of narcotics (which include opium, crystal methamphetamine, and cannabis) are Laos, Myanmar, Pakistan, Thailand, Vietnam, India, the Philippines, South Africa, and Sri Lanka.<sup>13</sup>

### **3.3 Armed Robberies and Piracy**

Piracy has been reduced by a large extent due to a multilateral effort started in 2008 to patrol the IOR; however, there is a constant threat of pirate attacks. Until 2012, the pirates were able to expand their operations near the Indian coastal state of Kerala.<sup>14</sup> Pirates, who were based mainly in Somalia, carried out armed robberies, took hostages, and hijacked cargo vessels. If not for the

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<sup>9</sup> Martin, Esmond Bradley. "The Geography of Present-Day Smuggling in the Western Indian Ocean: The Case of the Dhow," *The Great Circle*, Volume 1, Number 2, October 1979, pages 18-35. <http://www.jstor.org/stable/41562293>.

<sup>10</sup> Sam LaGrone, "U.S. Navy Seizes Suspected Iranian Arms Shipment Bound for Yemen," *USNI News*, April 4, 2016. Accessed April 17, 2016. <https://news.usni.org/2016/04/04/u-s-navy-seizes-suspected-iranian-arms-shipment-bound-for-yemen>.

<sup>11</sup> "Status and Trend Analysis of Illicit Drug Markets," UNODC. Accessed June 9, 2016. [http://www.unodc.org/documents/wdr2015/WDR15\\_Chapter\\_1.pdf](http://www.unodc.org/documents/wdr2015/WDR15_Chapter_1.pdf).

<sup>12</sup> Taimoor Shah and Mujib Mashal, "Bountiful Afghan Opium Harvest Yields Profits for the Taliban," *The New York Times*, May 4, 2016. Accessed June 9, 2016. <http://www.nytimes.com/2016/05/04/world/asia/taliban-afghan-poppy-harvest-opium.html>.

<sup>13</sup> Rupert Herbert-Burns, "Indian Ocean Rising: Maritime Security and Policy Challenges." *The Henry L. Stimson Center Report*, 2012, chapter 2, page 28. Accessed April 8, 2016. <https://www.stimson.org/content/indian-ocean-rising-maritime-security-and-policy-challenges>.

<sup>14</sup> United States Government Accountability Office, GAO-14-422, "Maritime Security Ongoing U.S. Counterpiracy Efforts Would Benefit from Agency Assessments," Washington DC, GAO, 2016, p. 10-11.

efforts of the Combined Maritime Forces, North Atlantic Treaty Organization (NATO) forces,<sup>15</sup> and European Union Naval force<sup>16</sup> to escort cargo vessels, pirates would have continued to attack vessels unabated. There have been 581 reported attacks on ships and vessels since 2008. Fortunately, due to diligent efforts by the shipping industry, coupled with the effects of the above-mentioned maritime security forces, there has been a significant reduction in this activity, and there were no successful pirate attacks in the western IOR in 2015 and 2016.<sup>17</sup> Efforts such as navigating at high speed and hiring armed guards have also deterred the pirates. However, these practices are unsustainable economically. Therefore, these stopgap arrangements should be replaced with long-term measures such as securing the coastline of Somalia and increasing employment opportunities for people residing along the coastline of the IOR.

### 3.4 Maritime Terrorism

According to the U.S. Coast Guard's Strategy for Maritime Safety, Security, and Stewardship, small vessels represent one of the greatest risks of terrorism to the United States in the maritime domain.<sup>18</sup> The IOR is no exception and has been used as a transit point to conduct major terrorist activities. In 2008, non-state actors from Pakistan used the Arabian Sea to attack the port city of Mumbai.<sup>19</sup> Prior to the attack, the terrorists carried out a reconnaissance mission on maritime traffic patterns near the coast of Mumbai in late 2006 to early 2007.<sup>20</sup> Subsequently in 2008, the terrorists started their journey from Karachi, hijacked Indian fishing vessels in Pakistan's exclusive economic zone, and then near Mumbai used inflatable boats to reach the coast. They covered a distance of 500 nautical miles from Karachi to Mumbai, most probably skirting the Pakistani and Indian littoral shores/areas. This attack, during which nearly 200 people lost their lives, reflects one dimension of the threat of maritime terrorism.

The Mumbai attack was not an isolated incident. In 2014, terrorists intended to stage an attack on a U.S. aircraft carrier by hijacking a Pakistani naval frigate docked in Karachi.<sup>21</sup> One of the attackers was a former Pakistani naval officer who managed to board the frigate. His accomplices were fired upon while trying to approach the frigate on an inflatable motor boat. A firefight between Pakistan marine commandos and the terrorists ended the hijacking attempt. This incident shows that terrorists see the Indian Ocean as a theatre for asymmetric terrorist operations. In

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<sup>15</sup> The European Union Naval Force (Op Atlanta) Somalia Operation Atlanta was launched on December 8, 2008 and is conducted in accordance with United Nations Security Council's resolutions. <http://eunavfor.eu/>

<sup>16</sup> Operation Ocean Shield is NATO's counter piracy mission in the Gulf of Aden and off the Horn of Africa. NATO has been helping to deter and disrupt pirate attacks, while protecting vessels and helping to increase the general level of security in the region since 2008. [http://www.nato.int/cps/en/natohq/topics\\_48815.htm](http://www.nato.int/cps/en/natohq/topics_48815.htm).

<sup>17</sup> European External Action Service (EEAS), European Union Naval Force ATALANTA (EU NAVFOR). Accessed June 11, 2016. <http://eunavfor.eu/key-facts-and-figures/>.

<sup>18</sup> United States Government Accountability Office, GAO-14-32, "Maritime Security DHS Could Benefit from Tracking Progress in Implementing the Small Vessel Security Strategy," Washington DC, October 2013, page 5. <http://gao.gov/assets/660/658703.pdf>.

<sup>19</sup> "Pakistan Charges Seven People Over Mumbai Attacks," BBC News, November 25, 2009. Accessed May 25, 2016. [http://news.bbc.co.uk/2/hi/south\\_asia/8378281.stm](http://news.bbc.co.uk/2/hi/south_asia/8378281.stm).

<sup>20</sup> Alan Cummings, "The Mumbai Attack: Terrorism from the Sea," Center for International Maritime Security, July 29, 2014. Accessed May 5, 2016. <http://cimsec.org/mumbai-attack-terrorism-sea/12280>.

<sup>21</sup> Vijay Sakhuja, "Maritime Terrorism: Karachi as a Staging Point," Institute of Peace and Conflict Studies, October 6, 2014. Accessed June 25, 2016. <http://www.ipcs.org/article/peace-and-conflict-database-pakistan/maritime-terrorism-karachi-as-a-staging-point-4680.html>.

October 2000, terrorists attacked the USS Cole, killing 17 sailors and injuring many others by slamming their small boat packed with explosives into the ship.<sup>22</sup> The USS Cole had stopped at the port of Aden in Yemen for refueling. It was later revealed that the attack was launched by Al-Qaeda and had the support of the Sudanese government.<sup>23</sup> The original plan was to destroy the USS The Sullivans, a guided missile destroyer, but due to operational hiccups, the original plan could not be carried out so the terrorists instead attacked the USS Cole.<sup>24</sup>

### 3.5 Maritime Proliferation Routes

In the past, the IOR has been used as a strategic arms proliferation route. A.Q. Khan, the Pakistani scientist, used the Indian Ocean as a transit route to ship thousands of centrifuges to Libya and Iran.<sup>25</sup> From his industrial plant in Malaysia, A.Q. Khan sent parts of centrifuges from the Strait of Malacca to Dubai. From there onwards, the cargo containers made their way to Libya via the Suez Canal. Investigators later discovered that not only enrichment technology, but also warhead designs, were passed to Libya.<sup>26</sup> In addition to non-state actors, states have also proliferated nuclear and missile technology through the IOR. For instance in 1988, China transported DF-3 missiles to Saudi Arabia via the Jeddah Islamic Port.<sup>27</sup> North Korea, a pariah state, has been a major proliferator of missile and nuclear technology. The North Korean regime has used the Indian Ocean to proliferate missile technology to states in South Asia, East Asia, and the Middle East.<sup>28</sup> For example, in 2011, the U.S. Destroyer McCampbell intercepted a North Korean cargo ship, the M/V Light, that was delivering illegal missile components to Myanmar.<sup>29</sup> The United States also buttressed the stigma of proliferation attached to North Korea by reporting that the Syrian nuclear reactor that was destroyed by an Israeli airstrike in 2007 was constructed with the assistance and cooperation of North Korea.<sup>30</sup>

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<sup>22</sup> "USS Cole Bombing," Federal Bureau of Investigation (FBI). Accessed August 2016.

<https://www.fbi.gov/history/famous-cases/uss-cole-bombing>.

<sup>23</sup> "USS Cole Bombing Fast Facts," CNN News, April 6, 2016. Accessed July 2016.

<http://www.cnn.com/2013/09/18/world/meast/uss-cole-bombing-fast-facts>.

<sup>24</sup> Kevin Ryan, "The USS Cole: Twelve Years Later, No Justice or Understanding," Foreign Policy Journal, October 7, 2012. Accessed June 25, 2016. <http://www.foreignpolicyjournal.com/2012/10/10/the-uss-cole-twelve-years-later-no-justice-or-understanding>.

<sup>25</sup> William J. Broad, David E. Sanger and Raymond Bonner, "A Tale of Nuclear Proliferation: How Pakistani Built His Network," The New York Times, February 4, 2004. Accessed July 25, 2016.

<http://www.nytimes.com/2004/02/12/world/a-tale-of-nuclear-proliferation-how-pakistani-built-his-network.html? r=0>.

<sup>26</sup> William J. Broad and David E. Sanger, "Warhead Blueprints Link Libya Project to Pakistan Figure," The New York Times, February 4, 2004. Accessed 25, 2016. <http://www.nytimes.com/2004/02/04/world/warhead-blueprints-link-libya-project-to-pakistan-figure.html? r=0>.

<sup>27</sup> Jeffrey Lewis, "Why Did Saudi Arabia Buy Chinese Missiles?" Foreign Policy Magazine, January 30, 2014. Accessed May 25, 2016. <http://foreignpolicy.com/2014/01/30/why-did-saudi-arabia-buy-chinese-missiles/>.

<sup>28</sup> "Arms Control and Proliferation Profile: North Korea," Arms Control Association, Updated January 2016. Accessed June 4, 2016. <https://www.armscontrol.org/factsheets/northkoreaprofile>.

<sup>29</sup> David Sanger, "US Set to Turn Back North Korea Missile Shipment," New York Times, June 12, 2011. Accessed June 16, 2016. <http://www.nytimes.com/2011/06/13/world/asia/13missile.html? r=0>.

<sup>30</sup> Office of the Director of National Intelligence, "Background Briefing with Senior US Officials on Syria's Covert Nuclear Reactor and North Korea's Involvement," Council on Foreign Relations, April 24, 2008. <http://www.cfr.org/syria/background-briefing-senior-us-officials-syrias-covert-nuclear-reactor-north-koreas-involvement/p16105>.

## 4 MAJOR SMUGGLING ROUTES FOR DHOWS AND SMALL BOATS

Since the sixteenth century, traders have been involved in smuggling to avoid the Portuguese navy, which started regulating trade to strengthen Portugal's foothold in the Indian Ocean. Later on, the smuggling routes were used to ship slaves to avoid British anti-slavery patrols. Post decolonization, the Gulf countries needed labor to work in the sweltering Middle Eastern desert climate. Thousands of laborers were transported from Pakistan, India, and Bangladesh to provide this labor force.

“Dhow” is an Arabic name for small boats that have traditionally been a primary mode of transportation not only for the traders but also for smugglers in India, East Africa, and the Middle East (Figure 3, Table 1). According to Phillip Briggs, “The word dhow, commonly applied by Europeans to any traditional seafaring vessel used off the coast of East Africa, is generally assumed to be Arabic in origin.”<sup>31</sup> According to a NATO report on the dhow project,

The term “Dhow” is probably of Swahili origin, referring to the generic name of a number of traditionally-constructed vessels used as the primary maritime commercial mode of transportation throughout the Red Sea, Gulf of Aden, the Arabian Gulf, and the Indian Ocean. The structure and shape of Dhows differentiate them from other types of merchant vessels. One of a Dhow's greatest strengths is simplicity of design to maximize open hull cargo capacity and utility. The word Dhow is not commonly used by the Dhow community itself, who usually refer to the specific type of vessel according the shape of the hull. Despite a historical attachment to Arab traders, Dhows are essentially an Indian boat. Presently, the vast majority of Dhows are powered by diesel engines and often supplemented by sail. An increasing number of Dhows are built of fiber glass instead of wood, and are growing in size with less strict characteristics from the former Dhow types.<sup>32</sup>

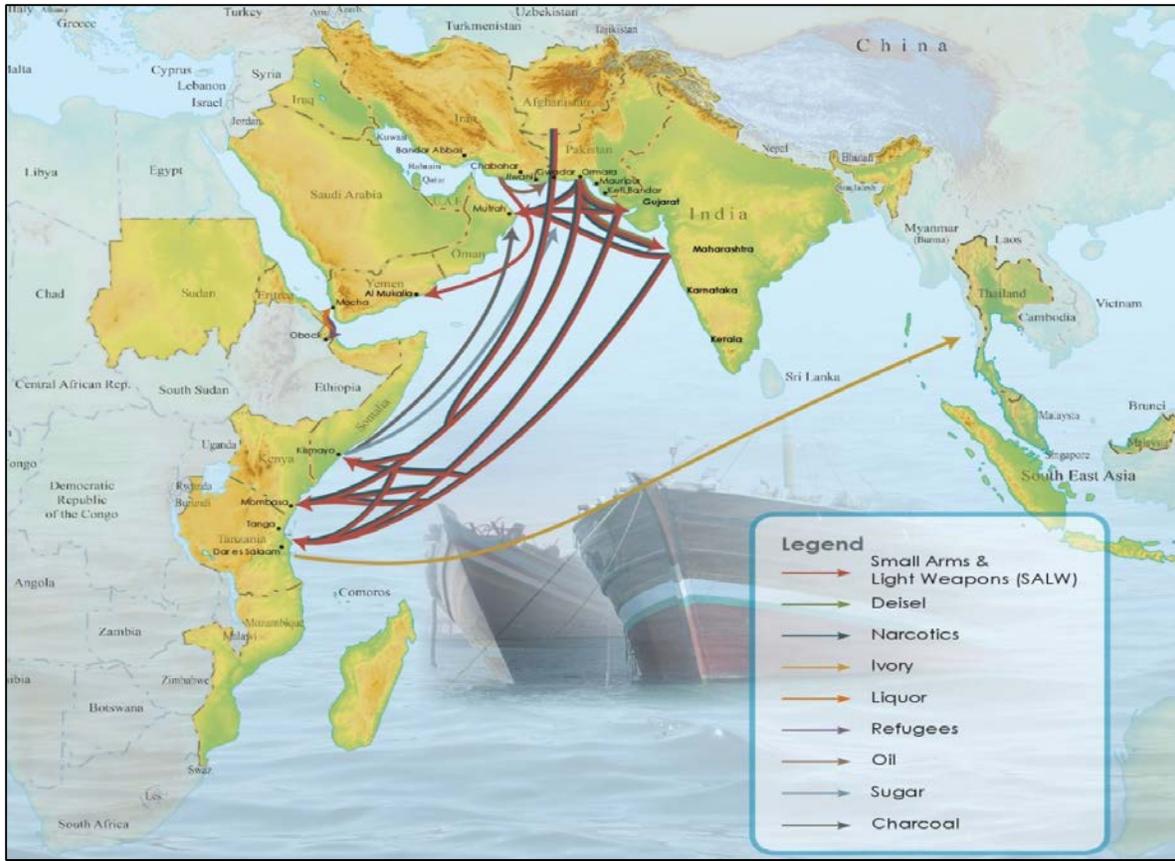
A dhow can carry a load of between 500 and 1500 tons. It is less expensive by 40 percent as compared to other ships of the same size and capacity.<sup>33</sup> Also, it is imperative to note that dhows carry legitimate goods for commerce, not just for smuggling.

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<sup>31</sup> Philip Briggs, “Dhows of the Swahili Coast,” Zanzibar Travel Guide. Accessed June 5, 2016. [http://www.zanzibar-travel-guide.com/bradt\\_guide.asp?bradt=1904](http://www.zanzibar-travel-guide.com/bradt_guide.asp?bradt=1904).

<sup>32</sup> NATO Publication, 2011, “The Dhow Project Identification Guide for Dhows, Skiffs and Whalers in the High Risk Area.” <https://www.norclub.no/assets/ArticleFiles/NATO-Guidance-for-ID.pdf>.

<sup>33</sup> Rupang Bhatt, “Pirates Threat: Gujarat Dhows Not Allowed to Sail Beyond Salalah,” Desh Gujarat, February 23, 2012. Accessed May 25, 2016. <http://deshgujarat.com/2012/02/23/pirates-threat-gujarat-dhows-not-allowed-to-sail-beyond-salalah/>.



**Figure 3. Major Smuggling Routes Used by Dhows (for references see Section 4 footnotes).**

**Table 1. Major Smuggling Ports in the Western IOR (for references see Section 4 footnotes).**

Countries	States/Provinces	Cities
India	Guajrat(1600 km)	Kandla, Gulf of Kutch Porbandar, Veraval, Jamnagar and Surat
	Karnataka	Mangalore, Ullal, Malpe and Karwar
	Maharashtra(720 km)	Shekadi coast (Raigad), Mumbai port
Pakistan	Baluchistan	Jeewani, Gawadar, Pasni, Ormara, Gaddani
	Sindh	Keti Bandar (Thatta), Mauripur(Karachi)
Oman	-	Mutrah
Tanzania		Tanga, Zanzibar and Dar es Salam
Yemen		Mocha
	State of Hadhramaut	Mukalla
Somalia		Kismayu
Djibouti		Obock
Kenya	-	Mambosa

## 4.1 Historical and Current Aspects of Smuggling by Dhows

### 4.1.1 Middle East

Oman has a 2,092 km shoreline and a long, rich history of naval mercantilism, considering that its hinterland consists of deserts.<sup>34</sup> If it were not for its strong historical maritime forces, Oman would not have been able to control Zanzibar, Mambosa, and Gwadar. Although Oman took effective maritime security measures, it could not stop illegal smuggling before the reforms introduced by Sultan Qaboos in 1970.<sup>35</sup> The major and minor ports in Oman are Salala, Mutrah, and Sur. Before 1970, motor parts, perfumes, and hair lotions were smuggled into Oman from Dubai while silks, perfumes, and narcotics were trafficked into Oman from India and ammunition was trafficked from Aden (Figure 4). The government of Oman had also prohibited its citizens from leaving the country and that led to people emigrating via dhows.

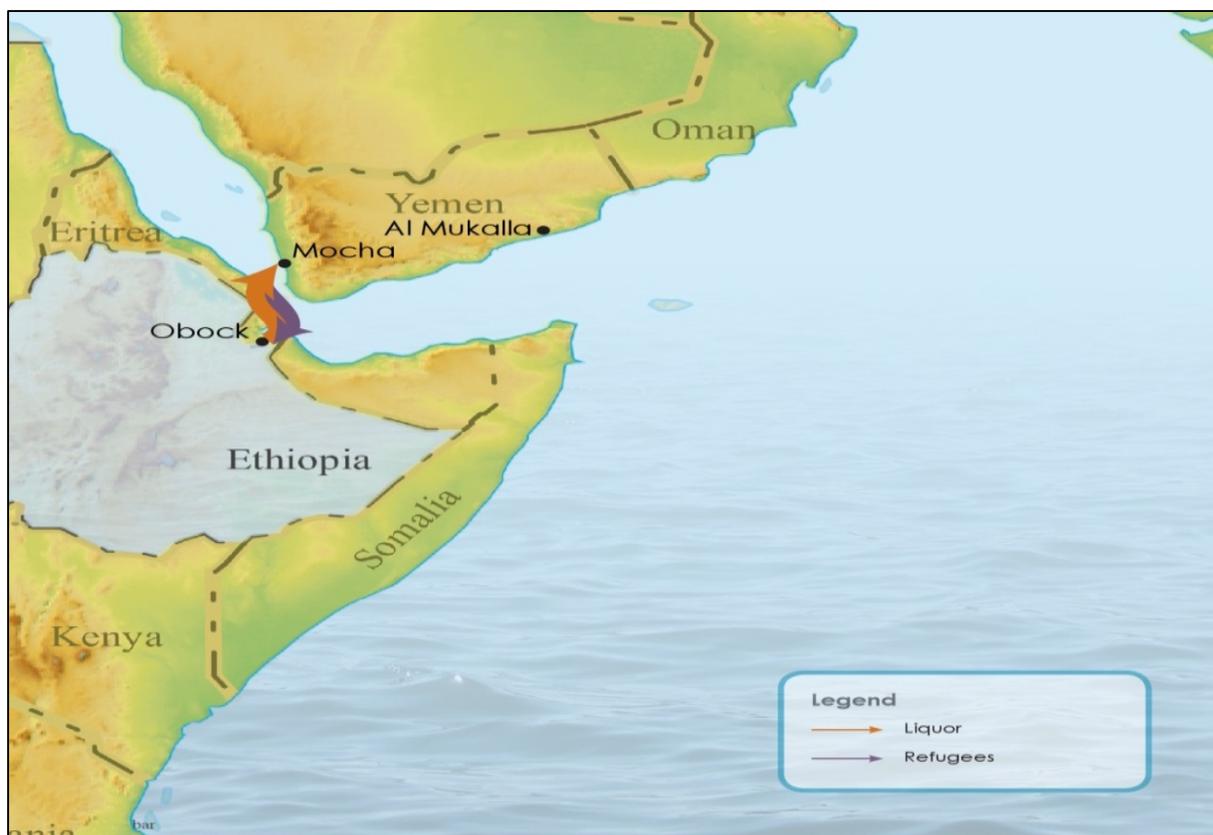


Figure 4. Smuggling Routes between Yemen and Djibouti (for references see Section 4, footnote 48).

Even now, smugglers transport arms and ammunition near Oman. Recently, a small boat carrying arms and ammunition, most probably bound for the Houthi rebels in Yemen, was interdicted 241 km from the port of Salala. The BBC reported, “The weapons found on the fishing boat were listed

<sup>34</sup> “Oman,” The CIA World Book Fact file. Accessed June 04, 2016. <https://www.cia.gov/library/publications/the-world-factbook/geos/mu.html>.

<sup>35</sup> “Oman profile – Timeline,” BBC World, October 26 2015. Accessed June 5, 2016. <http://www.bbc.com/news/world-middle-east-14654492>

by the coalition as 18 anti-armor Concourse shells, 54 anti-tank BGM17 shells, 15 shell battery kits, four firing guidance systems, five binocular batteries, three launchers, one launcher holder, and three batteries.”<sup>36</sup>

Unlike sailing ships and other steamers, dhows can be easily beached without any infrastructure. This resulted in the development of an informal economy and to the creation of ports, such as Sur in Oman. Historically, steamer ships used Muscat and the dhows harbored in Mutrah.<sup>37</sup> In 1975, 463 dhows called on Mina Qaboos, the main port of Oman. This figure decreased to 272 in 1977 and 83 by 1979 due to the availability of bigger and faster non-dhow boats. There was also a significant decrease of dhow traffic in other ports.<sup>38</sup>

#### 4.1.2 East Africa

The eastern coastline of Africa from Somalia to South Africa is approximately 6,400 km long. In Eastern Africa, dhows are not only being used to smuggle goods, but also people out of and between different states (Figure 5). Robert Kaplan views Zanzibar as the principle node of commerce in the Indian Ocean for centuries.<sup>39</sup> He further says that in the nineteenth century, “Dhows clogged this port, laden with pilgrims, drugs, coffee, fish, ivory, hides, red pepper, ambergris, beeswax, cloves, maize, sorghum, and spices.” The Zanzibar revolution of 1964 stifled the economic, political, and social life of Zanzibar and Pemba. The new leader of Zanzibar, Abied Karume, adopted the policy of nationalization and took over industries without compensating the owners. This led to massive outflux of people from Zanzibar. Approximately 30,000 people illegally left Zanzibar on small dhows called *jahasiz*, *mashuas*, and *ngalawas* for the Tanzanian mainland and Dar-es-Salam.<sup>40</sup>

The smuggling routes from Tanzania are now used to smuggle ivory out of Dar-es-Salam, Zanzibar, and Tanga. The crisis in Tanzania for decades has been punctuated with arms smuggling, poaching, criminal activity, and the breakdown of law and order due to poor governance. There was a brief period of success against poaching; however, there has been a resurgence of the ivory trade since 2009. According to a report by the international Environmental Investigation Agency,

Tanzania is a key player in the illegal ivory trade. While the escalation in poaching is generally traced to 2009, evidence suggests the trend started four years earlier, indicating deeper entrenchment than previously acknowledged. Between 2009-13, there has been a devastating decline. The Selous population fell by 66 percent in just over four years. Based on available evidence, Tanzania

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<sup>36</sup> “Yemen conflict: Iranian Boat 'Carrying Weapons' Seized,” BBC World News, September 30, 2015. Accessed June 5, 2016. <http://www.bbc.com/news/world-middle-east-34401246>.

<sup>37</sup> Mathew, Johan, *Margins of the Market: Trafficking and Capitalism across the Arabian Sea*, Oakland, California, University of California Press, 2016, page 39. <http://www.jstor.org/stable/10.1525/j.ctt1bj4smw>.

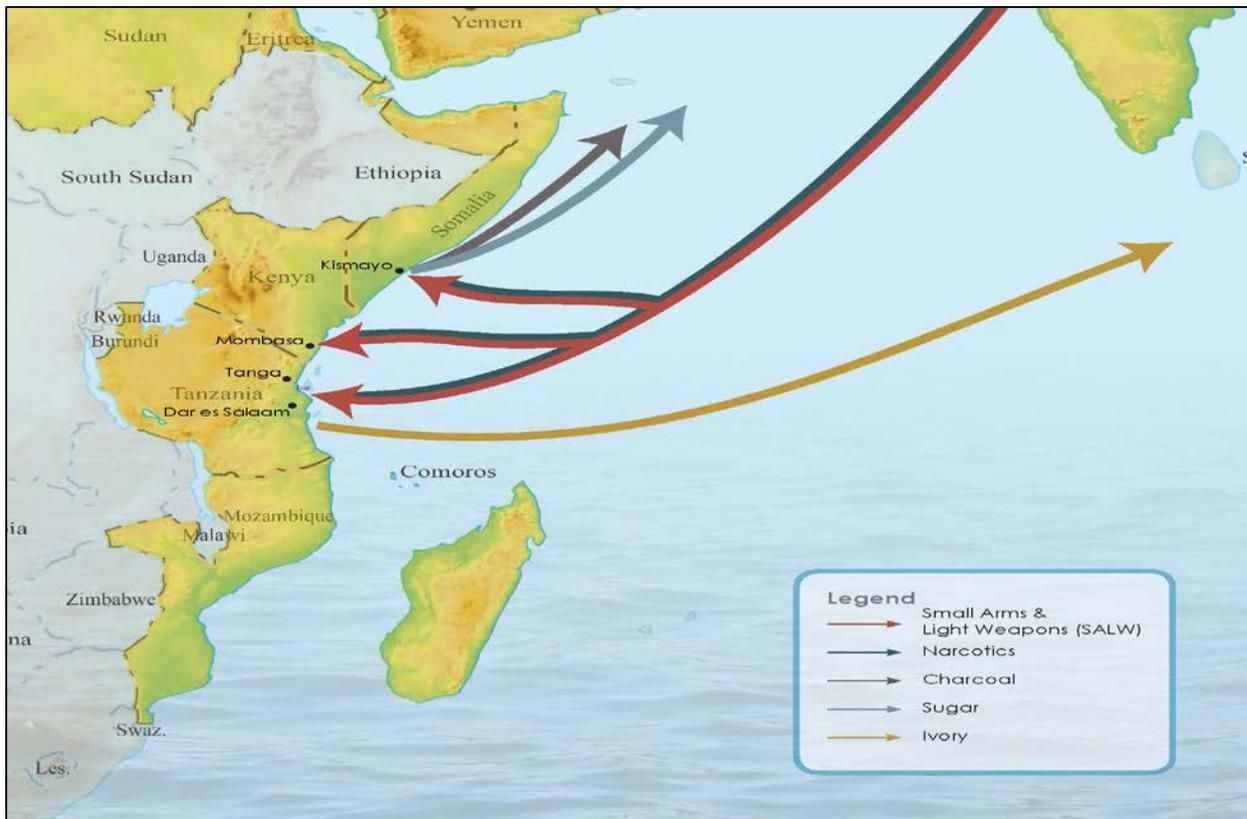
<sup>38</sup> Martin, Esmond Bradley, “The Geography of Present-Day Smuggling in the Western Indian Ocean: The Case of the Dhow.” *The Great Circle*, Volume 1, No. 2 (1979), page 21. <http://www.jstor.org/stable/41562293>.

<sup>39</sup> Kaplan, 307.

<sup>40</sup> Martin, page 23. <http://www.jstor.org/stable/41562293>.

has lost more elephants to poaching during this period than any other country. In 2013 alone, it reportedly lost 10,000 elephants, equivalent to 30 a day.<sup>41</sup>

The report further blames corruption by government officials and involvement of elements of trans-national criminal elements for the increase in elephant poaching. This felonious nexus of government officials and criminals is satiating the ivory markets of Asia and China. The major trans-shipping nodes to smuggle ivory to China are Malaysia, Hong Kong, Vietnam, and the Philippines.<sup>42</sup>



**Figure 5. Major Smuggling Routes in East Africa (for references see Section 4, footnotes 40 to 47).**

As mentioned, Africa is ridden with conflicts that generate an environment where corruption and other criminal activities thrive. One such country is Somalia, which collapsed in 1991 following the overthrow of the military regime of President Said Barre.<sup>43</sup> A civil war ensued that led the country to chaos. A unity government formed in 2000. However, two northern regions, Somaliland and Puntland, became autonomous regions. The Al-Shahab group benefited from the breakdown of law and order during this time to deeply entrench itself in Somalia. In 2006, African Union

<sup>41</sup> “Vanishing Point Criminality, Corruption, and the Devastation of Tanzania’s Elephants,” Environmental Investigation Agency, November 2014. Accessed June 6, 2016. <https://eia-international.org/wp-content/uploads/EIA-Vanishing-Point-lo-res1.pdf>.

<sup>42</sup> Ibid.

<sup>43</sup> “Somalia Country Profile,” BBC World, February 4, 2016. Accessed June 5, 2016. <http://www.bbc.com/news/world-africa-14094503>.

forces intervened to neutralize Al-Shahab, a group allied with Al-Qaeda in Africa. Although the Kenyan military was tasked to eliminate Al-Shahab, the military started developing stakes in the same smuggling networks that financed the operations of the Al-Shahab group.<sup>44</sup> In order to sustain itself financially, Al-Shahab imposed taxation on the export of charcoal, which has high consumption in the Middle East. Also, smugglers make profits of US\$400 million per annum by smuggling sugar into Kenya via the Kismayo port.<sup>45</sup> In 2012, the Kenyan military crushed Al-Shahab and took control of the Kismayo port, but to the dismay of many experts, it has been unable to stem the illicit trafficking of sugar and charcoal. It has been alleged that the Kenyan army, in collusion with Al-Shahab and Jubaland authorities (in charge of the Kismayo port), operates the smuggling racket out of the port of Kismayo. The smuggling of sugar is encouraged by the high tariff rate on the import of sugar imposed by the Kenyan government intended to protect the local industry. According to one report, around 230 trucks carry sugar from Kismayo each week.<sup>46</sup> Moreover, the proximity of Kismayo to Ethiopia and Kenya makes it a lucrative port for smuggling of arms, narcotics, charcoal, and sugar. The United Nations Security Council banned the export of charcoal from Somalia, yet the trade is flourishing. UN investigators have reported that 1 million sacks of charcoal worth US\$14-\$15 million are exported every month.<sup>47</sup>

Additionally, there has been a historic smuggling pathway between Djibouti and Yemen. In the 1970s, liquor smuggling was rampant between Djibouti and the port of Mocha in Yemen. The price of liquor increases as it is smuggled further inland in Yemen to cities such as Taiz and Sana'a. This smuggling route is now also being used by refugees fleeing the Yemeni civil war between government forces and Houthi rebels. Bombing by the Saudi Arabia-led alliance has further deteriorated living conditions in Yemen, thus, forcing people to seek refuge in Djibouti. The refugees sail across the Bab-el-Mandeb strait to Obock in Djibouti while smugglers continue to use the historic smuggling route from Obock to Mocha.<sup>48</sup>

#### 4.1.3 *India and Pakistan*

With a coastline approximately 7,000 km long, India also has been the epicenter of smuggling carried out via dhows. Historically, the major Indian states affected by illegal trade have been Gujarat and Maharashtra. These states share a coastline of 2,320 km (720 km in Mumbai and 1600 km in and Gujarat). It was by dhows that Indians migrated to the East African countries in large numbers at the end of the nineteenth century. In addition to providing labor in colonized Africa, they also gave an impetus for trade particularly between Gujarat and East African countries. Apart from trade, during different eras smugglers have profited from smuggling of gold, ivory, cigarettes, wood, arms, and narcotics to and from India. Even precursors for chemicals have been smuggled to the Middle East, most probably because of the demand of the booming economy in

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<sup>44</sup> "The Kenyan army is Accused of Running a Sugar-Smuggling Racket with Somali Terrorists," *The Economist*, Nov 23, 2015. Accessed July 4, 2016. <http://www.economist.com/news/middle-east-and-africa/21678914-army-denies-splitting-profits-400m-smuggling-industry-al-qaedas>.

<sup>45</sup> *Ibid.*

<sup>46</sup> *Ibid.*

<sup>47</sup> *Ibid.*

<sup>48</sup> Rachel Savage and Mohammed Ali Kalfoud, "All Roads Lead to Djibouti as Refugees Flee Yemen Even as Migrants Head There," *The Guardian*, May 23, 2016. Accessed June 05, 2016. <https://www.theguardian.com/global-development/2016/may/23/all-roads-djibouti-refugees-flee-yemen-civil-war-migrants-head-there>.

that region.<sup>49</sup> Considering the fact that the distance between India's western coast and the Middle East is less than 2,000 km, the trade between them should not come as a surprise.

After its independence in 1947, India closed its economy to the world and the import of gold was banned. Gold has traditional and financial importance in Indian culture. Not only it is the preferred choice of metal for wedding adornments, but also people prefer to have their savings in gold rather than cash. This demand for gold led to smuggling from the Middle East to India's western coast on dhows called *Padaos*.<sup>50</sup> In addition to gold, ivory was also smuggled into India because of its religious value. Ivory was smuggled from East African countries in large quantities to the western Indian coast. In South India, particularly in the state of Kerala, the possession of ivory is considered a symbol of prestige and prosperity.

The modus operandi of smuggling by dhow is the same now as it was in past centuries. The dhows, instead of sailing to India's coast, remain in the international waters and transfer the smuggled goods to local boats that then carry those goods to the shore. Currently, there are 350 registered dhows in the state of Gujarat providing direct employment to approximately 10,000 people. While 125 boats are operated from Kutch, a border town with Pakistan, others are based in the coastal port towns of Porbandar, Veraval, and Jamnagar.<sup>51</sup> The important coastal towns that are associated with smuggling in Gujarat are Kandla, Gulf of Kutch, Porbandar, Veraval, Jamnagar, and Surat. In Karnataka, ports associated with smuggling are Mangalore, Ullal, Malpe and Karwar. In Maharashtra, the Shekadi coast in the town of Raigad and Mumbai are favored by smugglers. Kandla is also famous for being smuggling friendly. For example, in 2011, Indian customs and intelligence officials unearthed racketeers who were involved in smuggling of around 15 tons of red sandalwood worth Indian Rs. 22 crore (US\$7.3 million) in the international market.<sup>52</sup> In March 2016, agencies of the Indian Intelligence Bureau and Rajasthan Police's Anti-Terrorism Squad captured a smuggling gang involved in trafficking 31 tons of beryl to China.<sup>53</sup> Beryl is a mineral containing beryllium, a metal that is used in nuclear power plants, high-speed aircraft, missiles, spacecraft, and communication satellites. It was also reported in October 2015 that the same criminals smuggled 20 tons of beryl to Hong Kong via Kandla port.<sup>54</sup>

On New Year's Eve in 2015, the Indian Coast Guard sank a Pakistani dhow suspected of being involved in smuggling off the coast of Porbander, Gujarat.<sup>55</sup> Initially, the Indian intelligence

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<sup>49</sup> Pushpita Das, "Coastal Security: The Indian Experience," Institute for Defense Studies and Analysis, September 2013, page 10. Accessed June 4, 2016. <http://www.idsa.in/system/files/Monograph22.pdf>.

<sup>50</sup> Martin, Esmond Bradley. "The Geography of Present-Day Smuggling in the Western Indian Ocean: The Case of the Dhow." *The Great Circle*, Volume 1, Number 2 (1979), page 25. <http://www.jstor.org/stable/41562293>.

<sup>51</sup> Rupang Bhatt, "Pirates Threat: Gujarat Dhows Not Allowed to Sail Beyond Salalah," *Desh Gujarat*, February 23, 2012. Accessed May 25, 2016. <http://deshgujarat.com/2012/02/23/pirates-threat-gujarat-dhows-not-allowed-to-sail-beyond-salalah/>.

<sup>52</sup> Neel Shah, "Kandla Port is Infamous Corridor," *The Afternoon Despatch and Courier*, September 3, 2011. Accessed June 4, 2016. [http://afternooncd.in/city-news/kandla-port-is-infamous-corridor/article\\_33797](http://afternooncd.in/city-news/kandla-port-is-infamous-corridor/article_33797).

<sup>53</sup> Anil Sasi, "Atomic Material Smuggling Racket Busted, Rajasthan ATS Arrests 6," Updated March 21, 2016. Accessed June 5, 2016. <http://indianexpress.com/article/india/india-news-india/atomic-material-smuggling-racket-busted-rajasthan-ats-arrests-six/>.

<sup>54</sup> *Ibid.*

<sup>55</sup> "BJP Hails Indian Coast Guard for Averting 26/11 Like Terror Attack, Says It Reflects Frustration of Pakistan," *The Indian Express*, January 3, 2015. Accessed June 5, 2016. <http://indianexpress.com/article/india/india-others/bjp-hails-indian-coast-guard-for-averting-2611-like-terror-attack-says-it-reflects-frustration-of-pakistan/>.

agencies reported that the boat belonged to terrorists who were trying to attack India along the lines of the Mumbai 2008 attacks.<sup>56</sup> However, news reports challenged these assertions and noted that they were simply petty smugglers trying to ferry in liquor and drugs from the Pakistani port of Keti Bandar.<sup>57</sup>

The Indian state of Maharashtra also has had its fair share of security lapses. There are 100 small boats/dhows, which are registered with the shipping ministry's Mercantile Marine Department (MMD) in Mumbai. However, the coastal authorities are not aware of the exact locations, owners, crews, maritime routes, or mercantile activity of the boats. In 2013, the Indian Coast Guard during a three-month exercise failed to locate these Indian boats.<sup>58</sup> The bureaucrats at the MMD are of the view that these boats no longer exist. During the same exercise, it was revealed that only one small boat had the mandatory security identification equipment, the Automatic Identification System (AIS).<sup>59</sup> The use of AIS is indispensable in addressing security gaps on the Indian coastline. AIS could help improve security by identifying different small vessels in the seas using their unique credentials.

There are approximately 200 minor ports in India that are not regularized and are usually used by local fishing communities (Table 2):

**Table 2. Table Minor Ports in India by Region<sup>60</sup>**

Indian States	Number of Minor Ports
Gujarat	41
Maharashtra	53
Karnataka	10
Goa	5
Kerala	13
Tamil Nadu	15

By comparison, Pakistan has a 1,046 km coast that stretches from the Iranian border in the west to Sir Creek in the Rann of Kutch (a disputed boundary creek that it shares with India). To comprehend Pakistan's maritime challenges, its coast can be divided into two parts: the Makran coast to the west, and the Sindh coast to the east. The Makran coast holds strategic importance in terms of geo-politics and economy. This barren and rugged coastal region is punctuated by the small towns of Omara, Pasni, and Gwadar.

<sup>56</sup> Praveen Sami, "Doubts Mount Over India's Claims of Destroying 'Terror Boat' from Pakistan," The Indian Express, January 3, 2015. Accessed June 5, 2016. <http://indianexpress.com/article/india/india-others/little-evidence-of-terror-link-may-have-been-petty-smugglers/>.

<sup>57</sup> Ibid.

<sup>58</sup> "Non Existent Boats' Pose Real Threat to National Security," News Bharti, 16 May 2013. Accessed June 5, 2016. [http://www.newsbharti.com/Encyc/2013/5/16/-Non-Existent-boats-pose-real-threat-to-National-Security#.V2CR\\_PkrK70](http://www.newsbharti.com/Encyc/2013/5/16/-Non-Existent-boats-pose-real-threat-to-National-Security#.V2CR_PkrK70).

<sup>59</sup> Ibid.

<sup>60</sup> G.S. Dwarakish, Geetha Kuntoji, Subba Rao, International Conference on Water Resources, Coastal and Ocean Engineering (ICWRCOE'15), "A Review on Development of Minor Ports to Improve the Economy of Developing Country," Aquatic Procedia, Volume 4, 2015, pages 256-263, ISSN 2214-241X. <http://dx.doi.org/10.1016/j.aqpro.2015.02.035> (<http://www.sciencedirect.com/science/article/pii/S2214241X1500036X>).

Gwadar until 1958 was a territory of Oman and many residents of this town now hold dual nationality. This enabled them to trade in the Persian Gulf without any legal limitations. Since it is an old fishing town, most of the dhows are constructed in Gwadar. The mariners of the coastal region of Baluchistan still follow the Arabian tradition of sailing on the new dhows on the first and fifteenth days of the moon cycles.<sup>61</sup> Their major subsistence is fishing; however, the economy of these fishing communities is being affected by the deep-sea fishing by large foreign trawlers. In 2001, Pakistan implemented its deep-sea fishing policy, which envisaged enhancing foreign exchange earned by relaxing regulations for fishing trawlers. Although this increased revenues, it also led to the paucity of fishing opportunities for the local fishermen. According to reports, the daily catch of the fishermen has decreased by 70 to 80 percent. If the destruction of fishing opportunities continues, the fishermen will have no option other than to look for new employment opportunities, such as smuggling. Also, criminal and terrorist elements can tap into the knowledge and expertise of these disgruntled fishermen.

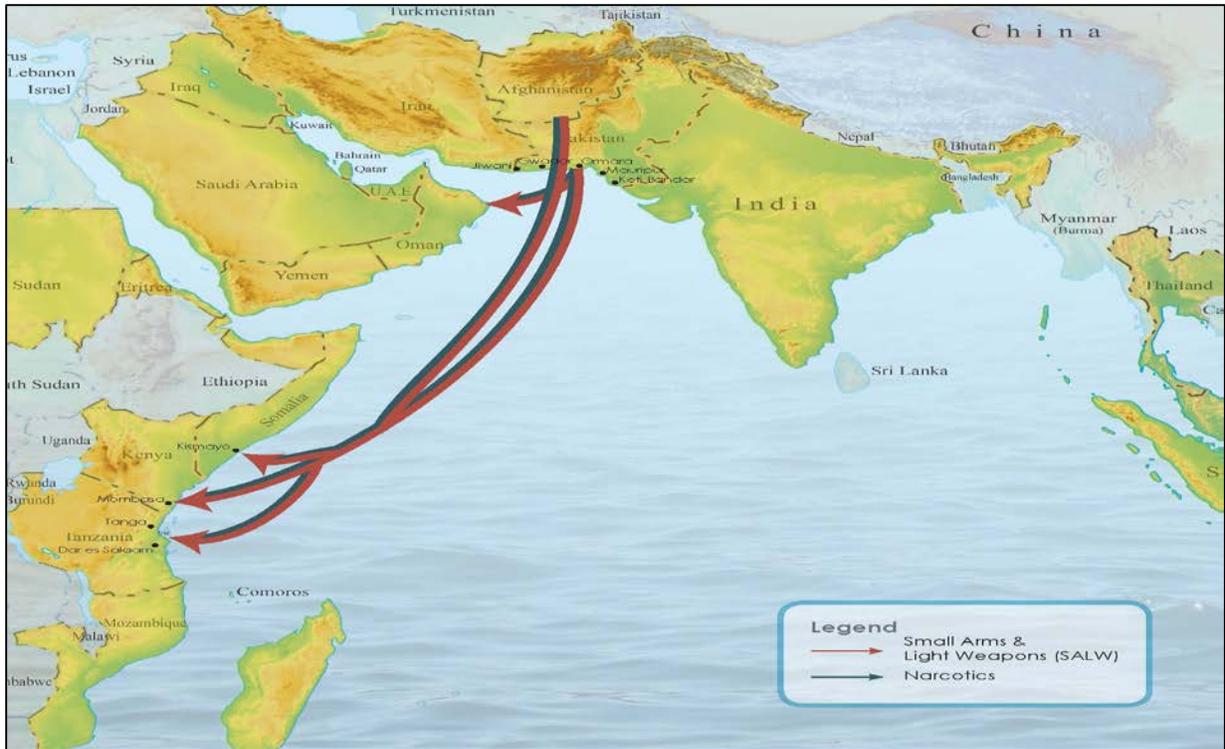
Pakistan is a point of origin, destination, and transshipment for smugglers (Figure 6). The confluence of conflict and corruption makes it significantly easier for smugglers to use Pakistan as a conduit for smuggling. Smuggling cartels are involved in trafficking of narcotics, human, migrants, precursor chemicals, liquor, and arms. According to United Nations Office on Drugs and Crime (UNODC), 40 percent of the opium produced in Afghanistan is destined for Pakistan as a market and a transshipment point.<sup>62</sup> There are opium-processing plants near the Pakistan-Afghanistan border that cater to drug demand in Pakistan and other parts of the world. Also, it is pertinent to mention that the provinces of Khyber Pakhtunkhwa and Baluchistan are suffering from insurgencies and terrorism. These two provinces are the ideal breeding grounds for smuggling as the writ of the state is absent to a large extent.

Regarding terrorism, Pakistan has been unable to completely stop non-state actors operating from its soil against the neighboring states. Terrorists groups driven by the ideology of Jihad have used tactics ranging from suicide bombings to fidayeen gunmen attacks in India and Afghanistan. As mentioned in Section 3 of this study, terrorists have successfully used Pakistan's coastal regions to launch an attack on the Indian city of Mumbai.

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<sup>61</sup> Kaplan, 72.

<sup>62</sup> "Country Profile, Pakistan," UNODC. Accessed June 5, 2016. <https://www.unodc.org/pakistan/en/country-profile.html>.



**Figure 6. Direct Smuggling Routes from Afghanistan and Pakistan to Africa (see Section 3, footnotes 11-13 for references).**

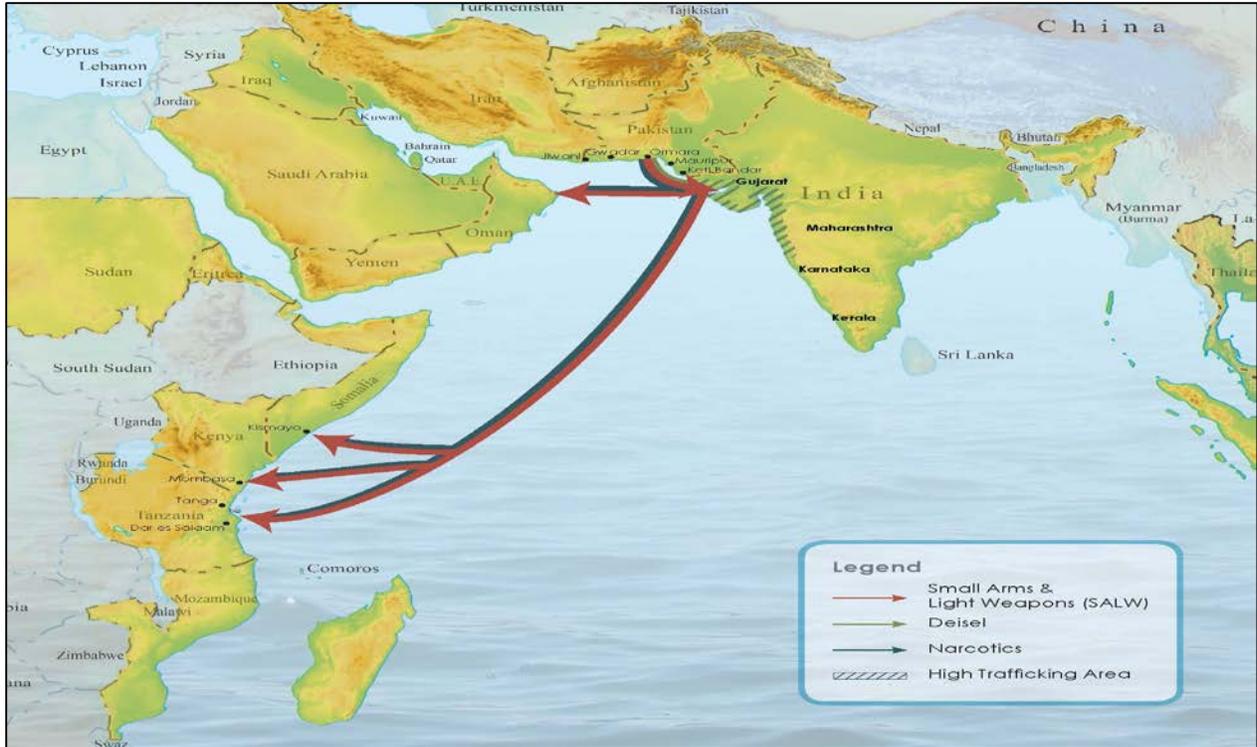
Dawood Ibrahim’s terrorist infrastructure stretches from Southeast Asia to East African countries. The major nodes in his terrorist and racketeering empire are Mumbai, Dubai, and Karachi (Figure 7, Figure 8). His drug trade has consumers in Europe and has involved groups such as the Liberation Tigers of Tamil Eelam (LTTE). All this trade is carried out via small boats and dhows. The D-company smuggles drugs into India through the Rann of Kutch border from Pakistan. These drugs are then shipped in small boats/dhows from Mumbai to Africa and eventually make their way to Europe.<sup>63</sup> The drugs are usually ferried on boats having livestock on board. On their way back from the Middle East and Africa, the dhows have layovers in Iran and Pakistan on the pretext of refueling. They use carcasses of animals stuffed with drugs in order to avoid maritime law enforcement agencies. The smell exuded by these carcasses and animal excreta serves to deter law enforcement organizations from boarding and carrying out thorough searches of these small boats.<sup>64</sup>

<sup>63</sup> “Dawood Inc.,” Outlook India, September 29, 1997. Accessed May 25, 2016.

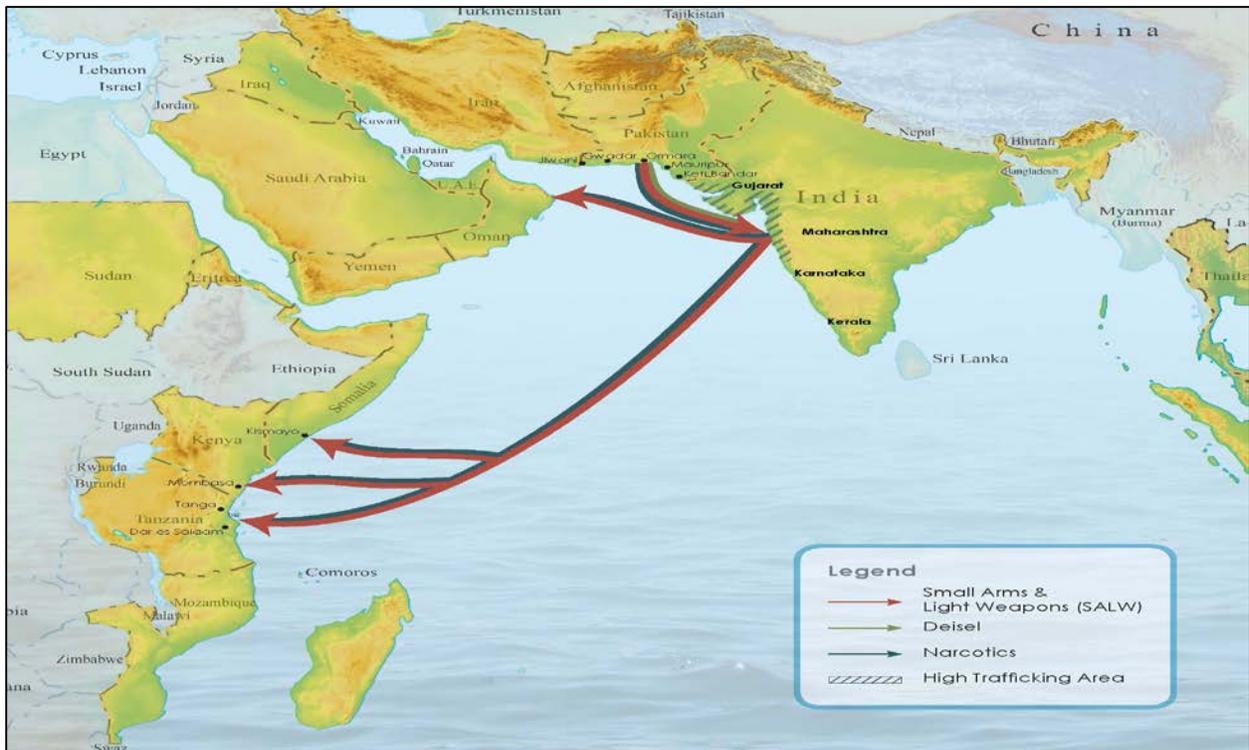
<http://www.outlookindia.com/magazine/story/dawood-inc/204303>.

<sup>64</sup> J. Dey, “Coastal Smuggling Gets Rich Again,” MiD DAY News, January 18, 2011. Accessed March 14, 2016.

<http://www.mid-day.com/articles/coastal-smuggling-gets-rich-again/109435>.



**Figure 7. Smuggling Routes from Pakistan to Africa and the Middle East via Gujarat (India) (see footnotes 49-64 for references).**



**Figure 8. Smuggling Routes from Pakistan to Africa and the Middle East via Maharashtra (India) (see footnotes 49-64 for references).**



## 5 POTENTIAL USE OF NUCLEAR AND RADIOLOGICAL MATERIAL BY TERRORISTS

The attacks in Brussels, Paris, Lahore, and Nice have shown that terrorists will not miss any chance to terrorize and kill innocent people. Every passing year, terrorists have tried to up the ante by adopting innovative methods to inflict maximum financial and human loss to nations around the world. There have been multiple reasons behind these terrorist attacks: ideological, apocalyptic, and political. And terrorists have reiterated their intent to use nuclear or radiological materials in their campaigns of terror.

It is important to know the ideological motivations of terrorist groups and the evolving cooperation among such groups. This section will try to identify the motivations of the terrorists to smuggle nuclear and radiological materials.

### 5.1 Ideologies and Motivations of the Major Terrorist Groups in South Asia

Analyses of South Asia reveal that there are five major types of terrorists groups operating in South Asia:

- Sunni-Shia sectarian groups, present particularly in Pakistan.
- Indian-centric jihadi groups (Jaish-e-Mohammad and Lashkar-e-Taiba) that are carrying out attacks in India.
- Al Qaeda and its affiliates that espouse to spread Islam all over the world through violent means.
- Tehreek-e-Taliban Pakistan (TTP), which has attacked major organizations of the Pakistani state.
- The Islamic State of Iraq and Syria (ISIS).

Among these groups, ISIS and Al-Qaeda have shown considerable interest in acquiring nuclear or radiological material. Osama Bin Laden categorically called upon followers to use weapons of mass destruction to carry out their global agenda of Jihad. This call could inspire Al-Qaeda-affiliated groups to seek nuclear and radiological material from the black market.

In addition to Al-Qaeda, the TTP has been a major terrorist actor in Pakistan. Although the operational space enjoyed by TTP has shrunk to a large extent, it still has the capability to carry out attacks on major population centers and military installations. In the latest major terrorist attack carried out by TTP in September 2015 on a Pakistan Air Force camp, 29 people lost their lives.<sup>65</sup>

The TTP has employed every tactic in the book to kill military personnel and civilians. This is a reason that leads one to believe that they have the intention to employ nuclear and radiological material if they are able to acquire these materials. In fact, law enforcement agencies intercepted a communication between TTP members that it was planning to attack a nuclear facility in Dera Ghazi Khan, a city in Pakistan. The facility has uranium mining, milling, and hexafluoride

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<sup>65</sup> Mateen Haider, "Army Captain Among 29 Killed in TTP-Claimed Attack on PAF Camp in Peshawar," Dawn.com, September 2015. <http://www.dawn.com/news/1207710>.

conversion plants. Although the plan never materialized due to the efforts of security forces, it established that TTP is interested in attacking nuclear facilities.<sup>66</sup>

The Indian-centric jihadi groups, such as Lashkar-e-Taiba and Jaish-e-Muhammad, initially attacked Indian troops in Jammu and Kashmir, a disputed territory claimed by both India and Pakistan. With the passage of time, these groups have started changing their tactics by striking military and civilian targets in the heartland of India. Lashkar-e-Taiba is believed to be behind the 2008 Mumbai attacks.<sup>67</sup> These jihadi groups have shown an interest in and capability to target nuclear and radiological facilities. For example, David Headley, the Lashkar-e-Taiba mastermind behind the 2008 Mumbai attacks, admitted to videotaping the Bhaba Atomic Research Center (BARC) in Mumbai.<sup>68</sup> Also, in 2007 a BARC facility in Srinagar came under attack from militants but fortunately, there was no damage to the facility.<sup>69</sup> An attack on the Indian Air Force's Pathankot airbase by six terrorists in January 2016 reflects the audacity of these groups. It took Indian security forces four days to neutralize the attackers.<sup>70</sup> The handling of the security operation shows the importance of the physical protection systems required for such sensitive military and nuclear installations to detect and deter the jihadi groups from infiltrating India's nuclear facilities.

## 5.2 Terrorist Groups Operating in the Middle East

The creation of the Islamic State was announced by Abu Mus'ab al-Zarqawi in April 2006. Although he was killed by a U.S. airstrike two months after the announcement, he had already laid the ideological foundations of the Islamic State.<sup>71</sup> According to Cole Bunzel of the Brookings Institution, "Zarqawi directly contributed to the Islamic State's two most prominent ideological tenets: an extreme anti-Shi'ism and a focus on restoring the caliphate."<sup>72</sup> The Islamic State also has an apocalyptic vision. Muslims have always believed that the Mahdi ("Rightly Guided One"), a messianic figure, will appear near the end of times. Historically, Sunnis have believed that Mahdi is yet to appear. On the other hand, Shias believe that Mahdi is in occultation and will appear near the Day of Judgement. Both the sectarian groups, Sunnis and Shias, are of the view that Mahdi will create unity among Muslims and end fissures within the Islamic world. According to Sunnis, Mahdi will appear with Christ and together will take on the Dajjal (the "Anti-Christ").

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<sup>66</sup> Abdul Manan, "Taliban Threat: Nuclear Site in DG Khan Cordoned Off," Tribune.com, September 6, 2012. Accessed April 5, 2016. <http://tribune.com.pk/story/432295/taliban-threat-nuclear-site-in-dg-khan-cordoned-off>

<sup>67</sup> "Profile: Lashkar-e-Taiba," BBC World, May 3, 2010. Accessed October 28, 2016. [http://news.bbc.co.uk/2/hi/south\\_asia/3181925.stm](http://news.bbc.co.uk/2/hi/south_asia/3181925.stm).

<sup>68</sup> "Quick Read: 8 Things David Headley Told Us Today," The New Indian Express, February 12, 2016. Accessed March 15, 2016. <http://www.newindianexpress.com/nation/Quick-Read-8-Things-David-Headley-Told-Us-Today/2016/02/12/article3273523.ece>.

<sup>69</sup> T.S. Subramanian, "No damage to BARC Facility in Srinagar Attack," The Hindu, July 27, 2007. Accessed March 15, 2016. <http://www.thehindu.com/todays-paper/tp-national/no-damage-to-barc-facility-in-srinagar-attack/article1880536.ece>.

<sup>70</sup> "Why India's Response to Pathankot Attack Was a Debacle," BBC News, January 6, 2016. Accessed October 27, 2016. <http://www.bbc.com/news/world-asia-india-35232599>.

<sup>71</sup> Bunzel, Cole. "From Paper State to Caliphate: The Ideology of the Islamic State," Washington DC, Brookings Institution, March 2015, page 16. Accessed November 11, 2016. [https://www.brookings.edu/research/from-paper-state-to-caliphate-the-ideology-of-the-islamic-state/..](https://www.brookings.edu/research/from-paper-state-to-caliphate-the-ideology-of-the-islamic-state/)

<sup>72</sup> Ibid, page 13.

ISIS has evoked this belief in Mahdism through its actions. It wants to achieve prophecies related to the coming of Mahdi. One such prophecy was realized when ISIS captured the town of Dabiq, a border town in Syria. This is an important town to Islamic eschatological beliefs, which state that a final battle will take place in Dabiq between Christians and Muslims near the Day of Judgement. Although there are many other terrorist groups that have declared themselves as a Caliphate, the apocalyptic ideology of ISIS should be a cause of worry for the world.

According to the Federation of American Scientists, experts sort nuclear and radiological terrorism in four threat categories:<sup>73</sup>

- The possibility of non-state actors acquiring an intact nuclear weapon;
- The acquisition of enough fissile material to manufacture a bomb;
- The acquisition of radiological material to make a radiological dispersal device; and
- A possible attack or sabotage of a nuclear power plant or waste storage facility.

In 2014, Iraq reported to the UN that ISIS has stolen 40 kg of Uranium compounds from a nuclear facility in Mosul.<sup>74</sup> There have been serious apprehensions voiced by international security experts and politicians that there is an emerging threat that ISIS would like to employ nuclear and radiological weapons to inflict maximum financial and collateral damage. These fears were further aggravated when Belgian authorities discovered video footage of a Belgian nuclear scientist confiscated from the house of the suspect involved in the 2016 bombing of Brussels metro stations and airports.<sup>75</sup>

The transfer of knowledge and expertise is also a worrying issue. In 2012, two employees of a nuclear reactor in Belgium quit their jobs and went to Syria to fight for ISIS. One of them died in Syria and the other fighter was charged with terrorism in Belgium. In 2014, he was released from prison after serving his sentence. In December 2015, a private security consultancy company estimated that more than 27,000 foreign fighters had left their countries for Iraq and Syria to fight for the ISIS.<sup>76</sup> The academic and professional background of these foreign fighters is unknown. Also, not only does ISIS hold large territory, but it ideologically inspires other “lone wolves” in western countries who might have access or know-how to use nuclear or radiological materials to make an improvised nuclear device or dirty bomb, respectively.

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<sup>73</sup> “Nuclear and Radiological Terrorism,” Federation of American Scientists. Accessed March 31, 2015.

<https://fas.org/issues/nuclear-and-radiological-terrorism>.

<sup>74</sup> Michelle Nichols, “Exclusive: Iraq tells U.N. that ‘Terrorist Groups’ Seized Nuclear Materials,” Reuters, July 9, 2014. Accessed July 14, 2016. <http://www.reuters.com/article/us-iraq-security-nuclear-idUSKBN0FE2KT20140709>.

<sup>75</sup> Alisa J. Rubin and Milan Scheurer, “Belgium Fears Nuclear Plants Are Vulnerable,” The New York Times, March 25, 2016. Accessed June 19, 2016. [http://www.nytimes.com/2016/03/26/world/europe/belgium-fears-nuclear-plants-are-vulnerable.html?\\_r=0](http://www.nytimes.com/2016/03/26/world/europe/belgium-fears-nuclear-plants-are-vulnerable.html?_r=0).

<sup>76</sup> “Islamic State group: Crisis in Seven Charts,” BBC News, August 3, 2016. Accessed August 09, 2016. <http://www.bbc.com/news/world-middle-east-27838034>.

In the book, *The Four Faces of Nuclear Terrorism*, experts William Potter and Charles Ferguson are of the view:<sup>77</sup>

While terrorists may have strategic reasons and tactical opportunities to pursue nuclear terrorism, few in fact have contemplated such an incident. Even fewer have ever attempted to develop a plan to pursue one of the types of nuclear terrorism, and only a handful has actually operationalized their interest. The factors influencing terrorists who decide not to resort to nuclear terrorism are numerous and can be divided into four groups: implementation challenges, philosophical or moral issues, response fears, and insufficient capability.

Given the barbarity reflected in the actions of ISIS, moral issues and response fears seem to be of no concern to them. Therefore, it is important to investigate the capability of ISIS. Currently, ISIS holds vast swath of land where there are radioactive sources present in nuclear compounds, universities, hospitals, oil fields, and other industries. For instance, in 2014, ISIS started using a lab in Mosul where 40 kg of uranium compounds were present.<sup>78</sup> Although ISIS as an organization has not yet made any statement on acquisition of nuclear and radiological material, a smuggler in Moldova tried to convince an undercover agent, posing as an ISIS member, that he could supply Cesium-137 to ISIS.<sup>79</sup>

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<sup>77</sup> Charles D. Ferguson, William C. Potter, and Amy Sands, "The Four Faces of Nuclear Terrorism," New York, Routledge, 2005, p.32.

<sup>78</sup> "ISIS Bomb & Chemical Weapons 'Research Center' in Mosul Barely Targeted in US Strikes," RT, April 2, 2016. Accessed October 7, 2016. <https://www.rt.com/news/338086-isis-chemical-lab-mosul/>.

<sup>79</sup> Kathy Gilsinan, "Why Moldova may be the Scariest Country on Earth," The Atlantic, October 8, 2015. Accessed May 27, 2016. <http://www.theatlantic.com/international/archive/2015/10/moldova-nuclear-weapons-isis/409456/>.

## 6 INCIDENTS, MATERIALS OF CONCERN, AND NUCLEAR SECURITY CULTURE

A dirty bomb is considered to be the most likely threat from terrorists that aspire to obtain nuclear and radiological materials.<sup>80</sup> At this point, no one can reliably estimate the capabilities of ISIS and other terrorist organizations, thus it is germane for our study to note the kind of radioactive sources present around the world that can potentially be used in a dirty bomb.

Radioactive materials (sources) are found in equipment used for cancer treatment, oil well logging, carbon dating, and other research and scientific purposes. There are many radioactive sources, but most of them have short half-lives so they are not particularly suitable to be used in a dirty bomb.

Next, there is the potential threat of using spent fuel in a terrorist attack. Although spent fuel from a commercial nuclear reactor may be too lethal to handle for a terrorist group, fuel from a research reactor may be able to be transported and according to experts,

May be more vulnerable to terrorist use.... The research reactor spent fuel typically contains fewer fission products than does commercial power spent fuel because of the lower power levels in most reactors. Thus, research reactor spent fuel may not require as many special precautions to prevent a lethal dose. Because research reactor spent fuel assemblies tend to weigh much less than commercial assemblies, hauling away the former would be easier than the latter.<sup>81</sup>

In a study conducted by the Center for Nonproliferation Studies (CNS), Americium-241, Californium-252, Cesium-137, Cobalt-60, Iridium-192, Plutonium-238, and Strontium-90 are seven identified radioactive sources that could be attractive for nefarious uses (Table 3).<sup>82</sup>

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<sup>80</sup> Andrew Bieniawski, "We Need to Take the Dirty Bomb Threat Seriously," Nuclear Threat Initiative, August 25, 2015. Accessed October 28, 2016. <http://www.nti.org/newsroom/news/ntis-sen-sam-nunn-and-andrew-bieniawski-publish-washington-post-op-ed-isis-dirty-bomb/>.

<sup>81</sup> Ferguson, Charles D., William C. Potter, and Amy Sands, "The Four Faces of Nuclear Terrorism," New York, Routledge, 2005, page 261.

<sup>82</sup> Charles D. Ferguson, Tahseen Kazi and Judith Perera, "Commercial Radioactive Sources: Surveying the Security Risks," page 16, Report No. 11, James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, January 2003. Accessed July 5, 2016. <http://www.nonproliferation.org/wp-content/uploads/2016/09/op11.pdf>.

**Table 3. Common Radioactive Sources Found in Industrial and Research Applications.**<sup>83</sup>

Radioisotope	Half-Life	Specific Activity (Ci/g)	High Energy Alpha Emissions	High Energy Beta Emissions	High Energy Gamma Emissions
Cobalt-60	5.3 years	1,100	N/A	Low Energy	Yes
Cesium-137 (Barium-137m)	30 years (2.6 min)	88 (540 million)	N/A	Low Energy (Low Energy)	N/A (Yes)
Iridium-192	74 days	>450 (std) >1,000 (high)	N/A	Yes	Yes
Strontium-90 (Yttrium-90)	29 years (64 hours)	140 (550,000)	N/A	Yes (Yes)	N/A (Low Energy)
Americium-241	433 years	3.4	Yes	No	Low Energy
Californium-252	2.7 years	536	Yes	No	Low Energy
Plutonium-238	88 years	17.2	Yes	No	Low Energy

Many of these sources can be found in industrial and research applications, including in conflict-ridden countries in the Middle East and South Asia. Yemen, which has been struggling with civil war, the ever-present danger of Al-Qaeda in Arab Peninsula, and massive bombing by Saudi Arabia, has had radioactive sources including Cobalt-60, Iridium-192, and Cesium-137 for industrial and research purposes since the 1960s.<sup>84</sup>

## 6.1 Incidents and Tracking

The International Atomic Energy Agency (IAEA) maintains a database of nuclear and radioactive material considered out of regulatory control. The database logs the reported incidents of illicit trafficking, orphan radioactive sources, thefts, losses, and other unauthorized use of nuclear and radioactive materials (Figure 9, Figure 10, Figure 11). According to the IAEA:

As of 31 December 2015, the Incident and Trafficking Database (ITDB) contained a total of 2,889 confirmed incidents reported by participating states. Of these 2,889 confirmed incidents, 454 incidents involved unauthorized possession and related criminal activities, 762 incidents involved reported theft or loss and 1,622 incidents involved other unauthorized activities and events. In the remaining 71 cases, the reported information was not sufficient to determine the category of incident.<sup>85</sup>

<sup>83</sup> Ferguson, Charles, Tahseen Kazi, and Judith Perera, "Commercial Radioactive Sources: Surveying the Security Risks," p. 16, Report No. 11, James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies, January 2003. Accessed July 5, 2016. <http://www.nonproliferation.org/wp-content/uploads/2016/09/op11.pdf>.

<sup>84</sup> "There Are Radiation Sources Out There," International Atomic Energy Agency. Accessed August 3, 2016. [http://www.iaea.org/inis/collection/NCLCollectionStore/\\_Public/32/051/32051566.pdf](http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/32/051/32051566.pdf).

<sup>85</sup> IAEA Incident and Trafficking Database (ITDB), "Incidents of Nuclear and Other Radioactive Material Out of Regulatory Control," 2016 Fact Sheet. <https://www-ns.iaea.org/downloads/security/itdb-fact-sheet.pdf>.

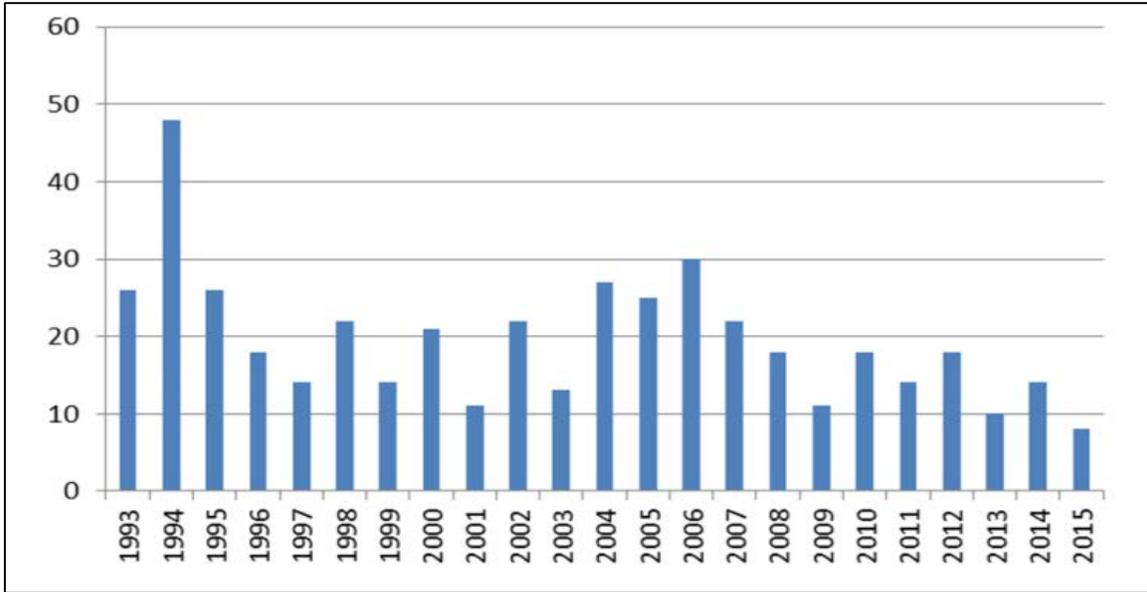


Figure 9. Confirmed Incidents Involving Unauthorized Possession and Related Criminal Activities, 1993- 2015.<sup>86</sup>

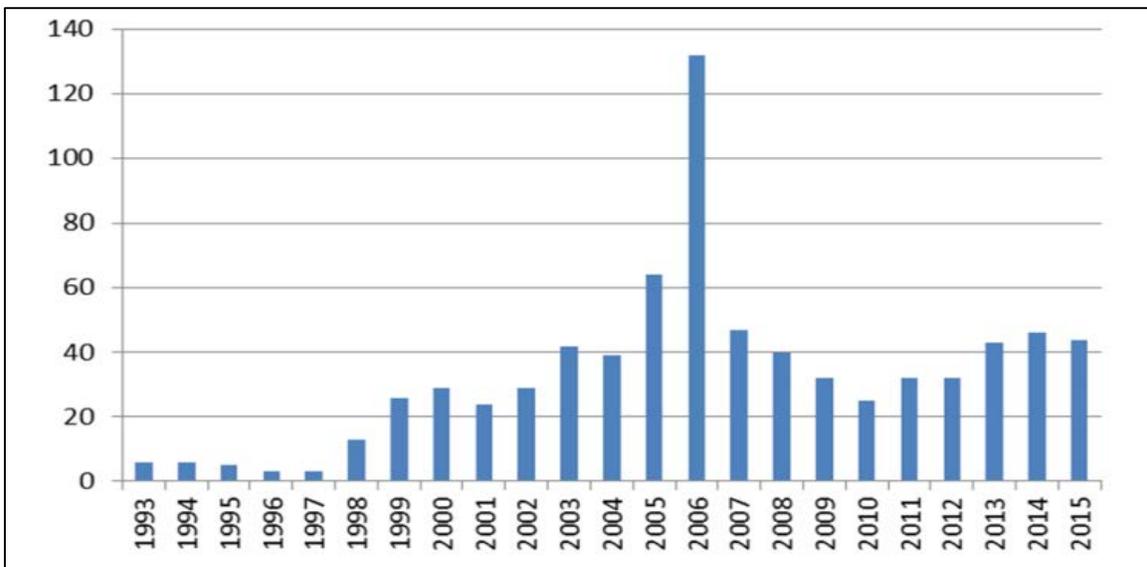
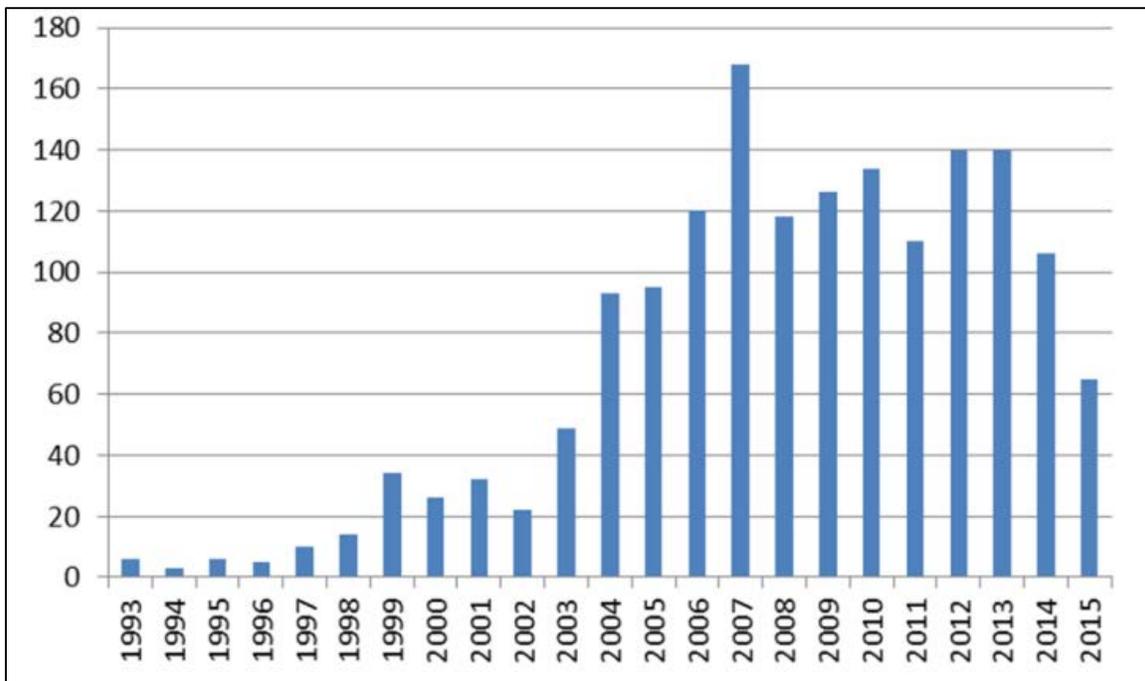


Figure 10. Confirmed Incidents Involving Theft or Loss, 1993-2015.<sup>87</sup>

<sup>86</sup> Source: IAEA Incident and Trafficking Database (ITDB), “Incidents of Nuclear and Other Radioactive Material Out of Regulatory Control,” 2016 Fact Sheet. <https://www-ns.iaea.org/downloads/security/itdb-fact-sheet.pdf>.

<sup>87</sup> Ibid.



**Figure 11. Incidents Involving Unauthorized Activities and Events, 1993-2015.<sup>88</sup>**

The IAEA report further mentions that there have been 13 incidents involving highly enriched uranium and 3 incidents each involving plutonium and plutonium-beryllium neutron sources. On some occasions, there were also attempts to smuggle such materials across international borders. The report mentions that most of the attempts have been made by amateurs who lacked the technical proficiency to handle such material, but in some instances, the traffickers showed ample expertise to attempt to smuggle radioactive material.

## 6.2 Thefts and Losses

Smuggling can be facilitated, sometimes to a large degree, with insider helpers who know the location of the radioactive sources present at the storage sites as well as the security measures and access details. It has also been reported to ITDB that the majority of the sources stolen were from university research labs or hospitals, confirming the assumption that due to lower security, such locations are more likely to be targeted by malicious actors. According to the ITDB report, there were three confirmed incidents of theft including both highly enriched uranium and plutonium neutron sources. The majority of industrial radiological sources that are reported stolen or lost are those used for non-destructive testing and for applications in construction and mining. The majority of such devices use relatively long-lived isotopes such as Iridium-192, Caesium-137, and Americium-241.<sup>89</sup>

<sup>88</sup> Ibid.

<sup>89</sup> Ibid.

### 6.3 Other Incidents Involving Unauthorized Activities and Events

There are other incidents mentioned in the IAEA report suggesting there is a constant potential threat of nuclear and radioactive material falling into the hands of terrorists. According to the report, the majority of incidents involving “other unauthorized activities or events” fall into one of three categories: unauthorized disposal (e.g., radioactive sources entering the scrap metal industry), unauthorized shipment (e.g., scrap metals contaminated with radioactive material being shipped across international borders), and the discovery of radioactive material (e.g., uncontrolled radioactive sources).<sup>90</sup> These incidents indicate that the security of nuclear and radioactive materials needs to be increased. The report explicitly mentions the increasing trend of scrap metal shipments having radiological materials from sealed sources shipped to junkyards across the world for recycling. The deficiency pointed out by the report is the lack of controlled nuclear and radiological waste disposal sites around the world. The majority of the Indian Ocean littoral states are developing countries; therefore, there are reasons to believe that there is a paucity of sites to handle, store, and properly dispose of nuclear and radiological wastes.

### 6.4 The Variable Nuclear Security Culture in South Asia and the Middle East

An analytical report published by the CNS describes the variable reporting of nuclear and radiological incidents of theft and trafficking around the world (Figure 12).

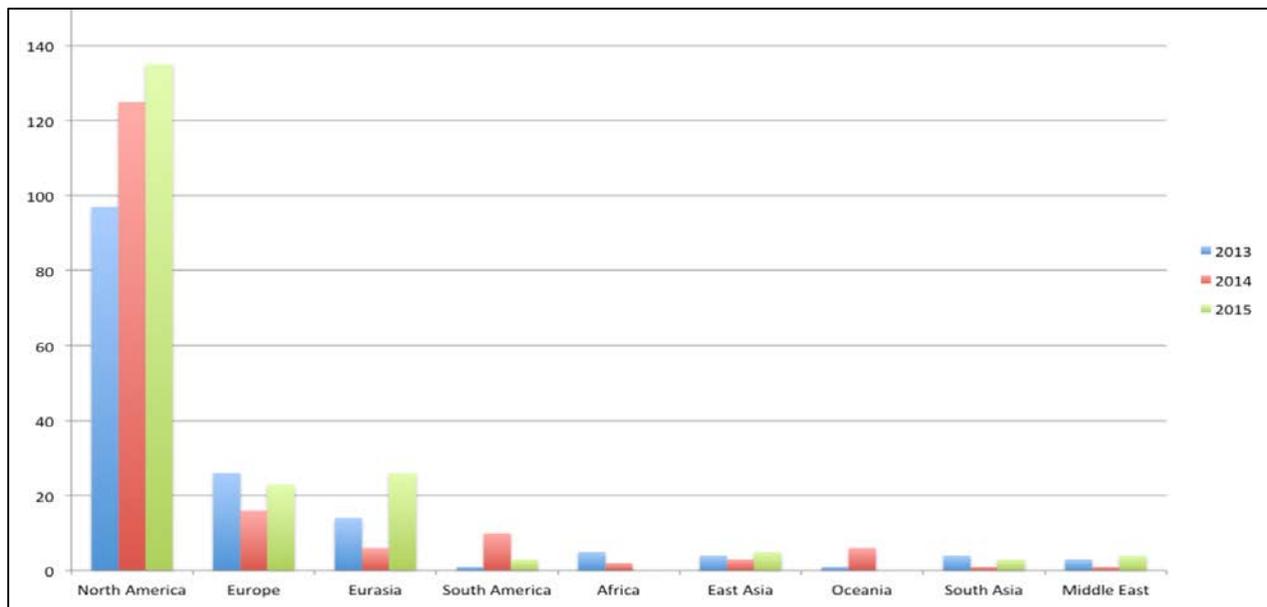


Figure 12. Variable Nuclear Security Culture in the World (Source: CNS Trafficking Report 2016).

In the past three years, CNS has logged 514 incidents of such material out of regulatory control. It is important to note that most of the incidents have been reported by states in North America and Europe due to a better and transparent self-reporting mechanism. On the other hand, there has been negligible reporting from states in South Asia, Africa, and Middle East, the regions within the scope of the report. There are three possible reasons for this inconsistent reporting around the

<sup>90</sup> Ibid.

world: a) there have been hardly any incidents reported in the Indian Ocean littoral states, b) the governments in the region have weak regulatory mechanism that limits their ability to maintain and secure nuclear and radioactive material, or c) the governments have censored reporting of such incidents.

In most of the states in South Asia and the Middle East, regulations are made and implemented by the relevant state competent authorities. The data in Figure 12 reflect a lack of robustness in all regions of the world except for North America, which has taken the topic to heart. The IAEA clearly emphasizes that each state has a pivotal role to play in creating a nuclear security culture in the organizations dealing with nuclear material and radioactive sources. In its *Nuclear Security Series 7*, the IAEA describes the role of the state in maintaining a rigorous nuclear security culture as follows:<sup>91</sup>

Security culture has three major components. The first concerns the policy that the state wishes to put into practice, in particular given the national and international contexts. The second is the organization introduced within each body concerned, particularly to apply the policy fixed by the state. In this component, a distinction must be made between what comes under the organization itself and what concerns its managers. The third component is the attitude adopted by the various individuals at all levels to implement this policy and to incorporate it into their work.

The responsibility for the establishment, implementation, and maintenance of a nuclear security regime within a state rests entirely with that state. Hence, the state has the responsibility for establishing the legal and regulatory framework to foster an effective nuclear security culture. There may be several organizations within the State that have both responsibility for, and interest in, a nuclear security culture, e.g. the nuclear regulatory body, operating organizations of nuclear facilities, law enforcement authorities, the military, health ministries, intelligence organizations, emergency response authorities and public information officials.

A culture is hard to either impose or cultivate, but it can be fostered through role models, training, positive reinforcement and systematized processes. These elements should be considered as the State develops or modifies its regulatory and policy documents.

Thus, the data shown in Figure 12 indicates that there is ample room for improvement in fostering a robust nuclear security culture in many states of the world, including in South Asia, where the emerging Centers of Excellence could make the region's states leaders and examples of the concept.

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<sup>91</sup> IAEA, "Nuclear Security Culture," IAEA Nuclear Security Series 7, page 7-8, 2016. Accessed 7 Oct. 2016. <http://www-pub.iaea.org/books/IAEABooks/7977/Nuclear-Security-Culture>.

## 7 TECHNOLOGY AND METHODOLOGIES FOR DETECTING AND DETERRING MATERIALS OF CONCERN

The attacks of September 11 proved to be a catalyst in securing airports, ports, and other commercial activities across the world. Although many countries contributed to this effort, the United States spearheaded the effort to make sure that its own ports of entry are safe and secure. The U.S. leadership helped to produce results in the shape of the Container Security Initiative (CSI) and the Megaports Initiative to deter, detect, and interdict illicit trafficking in special nuclear and other radioactive materials at seaports across the world. CSI to date covers 58 major seaports around the world.<sup>92</sup> The equipment being used includes Personal Radiation Detectors, Handheld Survey Meters, Radiation Isotope Identification Devices, and Radiation Portal Monitors. Taking a cue from the United States, every country needs to take prudent steps to secure its ports so that they can help to address the smuggling of nuclear and radiological materials. This section will suggest programs, methodologies, and technology that could be adopted by IOR littoral states to further secure their coastlines.

### 7.1 Global Water Way Watch

Under the program called “America’s Water Way Watch,” the U.S. Coast Guard encourages citizens residing on the coasts to report any suspicious activity. A global public outreach program could be initiated emulating the U.S. program by countries in the IOR. Since not every coast or creek can be fully protected by law enforcement authorities, involving local populations seems to be the best available option to help ensure that any untoward incident of terrorism or smuggling could be detected and averted. This public outreach program can also include reporting environmentally damaging activities on the coasts. The primary target audiences in South Asia and the Middle East for this type of program are fishing communities. Communities could be made aware of the hazardous effects of nuclear and radiological smuggling to human health. Since most of the countries will have issues with another country conducting awareness campaigns, a global effort could be overseen by United Nations.

The UNODC is already operating in most regions of the world and has established field offices to stop small arms and light weapons and narcotics smuggling, and terrorism. As it depends on voluntary contributions, major world powers could pool resources to augment the operational capacity and capability of UNODC. Research and analytical work regarding smuggling nuclear and radiological material for UNODC could potentially be carried out by technically competent organizations such as the IAEA or the U.S. Department of Energy/National Nuclear Security Administration (DOE/ NNSA). Since the IAEA is already cash-starved and under-resourced, other organizations may be a likely resource to conduct joint awareness programs with local law enforcement authorities. For example, NNSA is already involved in securing ports by implementing its Megaports Initiative. NNSA has also developed cordial working relationships with customs, port authorities, port operators, and other relevant institutions as it implemented its Megaports Initiative to secure ports in more than 40 countries around the world.

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<sup>92</sup> “CSI: Container Security Initiative,” U.S Customs and Border Protection. Accessed October 25, 2016. <https://www.cbp.gov/border-security/ports-entry/cargo-security/csi/csi-brief>.

## 7.2 Installation of Identification and Geo-Locating Devices on Smaller Vessels

The International Maritime Organization mandates that ships larger than 300 tons and all passenger ships install Automatic Identification Systems (AIS). AIS is an automatic tracking system that identifies and geo-locates ships and shares this information with other ships, coastal base stations, and satellites. Singapore is the only country that requires the use of AIS transponders for every maritime vessel, even small vessels down to the size of jet skis. In the wake of the 2008 Mumbai attacks, the Indian Directorate General of Mercantile Marine Department made it compulsory to install AIS on all small vessels more than 20 meters long. It even asked the vessels to obtain a Maritime Mobile Service Identity (MMSI) number for AIS.<sup>93</sup> Although it has not been successful in this initiative, India is on the right track for prioritizing maritime security.

Other countries in the region should adopt this practice, as it will help to deter smugglers from using their boats in illicit activities. Pakistan can also benefit by following India's footsteps since it is relying heavily on the success of Gwadar port and the China-Pakistan Economic Corridor (CPEC). According to Daniel Markey of the Center for Foreign Relations, "The China-Pakistan Economic Corridor (CPEC) is part development scheme, part strategic gambit."<sup>94</sup>

In 2015, Pakistan and China formalized the CPEC after signing 51 agreements worth US\$46 billion. The economic corridor will connect Gwadar with China's northwestern autonomous region of Xinjiang through a network of highways and roads. This corridor, in addition to bringing investments into Pakistan, will give China a land access route to the Indian Ocean.

Pakistan is taking added security measures to make this project a success. It has already raised a Special Security Division headed by a two-star general to protect the CPEC. This division comprises regular army troops, special commandos, and civil armed forces.<sup>95</sup> In addition to increasing physical security, Pakistan could also consider augmenting existing law enforcement capabilities with innovative solutions such as creating a database of small boats and involving local communities in law enforcement activities.

## 7.3 Small Vessel Voluntary Reporting System

In May 2010, U.S. Customs and Border Protection introduced a mechanism where small vessels voluntarily submit reports about their foreign travels, routes, and date of arrival in the United States. This aids in dedicating resources to identify threats. Since the majority of the people in the Indian Ocean littoral states have limited access to technology, such an online system of reporting is not currently a viable option.

In South Asia, the local and the district officials need to be incorporated into this system so that a voluntary reporting mechanism can be made effective and efficient. The local and district officials

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<sup>93</sup> "‘Non Existent’ Boats Pose Real Threat to National Security," News Bharti, May 16, 2013. Accessed June 4, 2016. <http://www.newsgharati.com/Encyc/2013/5/16/-Non-Existent-boats-pose-real-threat-to-National-Security#.V3L6fPkrK71>.

<sup>94</sup> Daniel S. Markey and James West, "Behind China's Gambit in Pakistan," Council for Foreign Relations, May 12, 2016. Accessed May 21, 2016. <http://www.cfr.org/pakistan/behind-chinas-gambit-pakistan/p37855>.

<sup>95</sup> Raza Khan, "15,000 Troops of Special Security Division to Protect CPEC Projects, Chinese Nationals," Dawn News, August 12, 2016. Accessed October 25, 2016. <https://www.dawn.com/news/1277182>.

of every coastal community can be asked to voluntarily report to the local district administration their foreign travels, routes, and date of arrival. The district administration office would in turn exchange this information with the local maritime security agency, which can then log this data into a central database. The local small vessel operators can be incentivized to report their routes by stating that the information will help the coast guard rescue them in case of bad weather or other emergency.

#### **7.4 Capacity Building of Coast Guards and Maritime Security Agency**

In an effort to block all potential pathways to smuggling nuclear and radiological materials, there is a dire need to build the capacity of IOR littoral states' coast guards and maritime security agencies to interdict such materials on the high seas and in coastal waters. This effort can emulate the West Coast Maritime radiation detection project formulated in the United States to enhance the ability of federal, state, local, and tribal agencies to detect and interdict nuclear and radiological materials, particularly small vessels.<sup>96</sup> In the initial phase, the IOR coast guards and maritime security agencies can be given awareness trainings about the hazards of nuclear and radiological materials. Once they are able to absorb the potential dangers of illicit smuggling and handling of these materials, they could be provided with training and essential equipment such as portable radiation detectors, portal monitors, and personal dosimeters. Additionally, existing patrolling boats can be improved by installing boat-mounted nuclear and radiological detection equipment. This proposal requires a cooperative mechanism with coast guards and maritime law enforcement agencies to make this effort sustainable in the long term. Maritime law enforcement agencies can be trained in the Centers of Excellence of Nuclear Security in various countries in South and East Asia. Those countries in the Middle East and East Africa that do not currently have the requisite technical capability could send their personnel to be trained in the Centers of Excellence of host countries such as Pakistan, India, China, and Japan. Trainers from these countries, the IAEA, and international subject matter experts could also deliver in-country trainings to requesting countries.

#### **7.5 Shared Indian Ocean Littoral States Surveillance Systems**

An integrated database could be developed that would aid the exchange of real-time data about suspicious small boats operating in the Indian Ocean. Each participating country would be able to update its own data but would not be able to make changes to other countries' data. Also, suspicious vessels and those previously involved in smuggling attempts can be earmarked for extra vetting or surveillance. Since ideally, every small boat would have an AIS, it could be easier to update the database. NNSA and the U.S. Department of Homeland Security could jointly lead this initiative by bringing Indian Ocean littoral states on a joint platform. Of course, countries' political sensitivities would have to be considered before beginning such a project.

#### **7.6 Establishment of Maritime Risk Reduction Centers**

States' navies are the only armed military forces that cooperate during peacetime. This peacetime cooperation can help build up trust that later on can be translated into close cooperation during different emergency situations. For example, after the 2004 Tsunami in South East Asia, the navies

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<sup>96</sup> "DHS Announces West Coast Maritime Radiation Detection Project," American City and County, September 6, 2007. Accessed August 1, 2016. <http://americancityandcounty.com/security/homeland/radiation-detection-project>.

of various countries closely collaborated to carry out search and rescue operations and other disaster management activities. Also, as mentioned in this paper, navies are part of a multinational task forces such as the Combined Maritime Forces that are conducting anti-piracy and counter terrorism operations in the Indian Ocean.

This cooperation can also be institutionalized bilaterally. The two major countries that will highly benefit from such cooperation in the maritime domain are India and Pakistan. Currently, there are two hot lines between India and Pakistan: one between the Foreign Ministers and the second between the Directors General of Military Operations. Additional hotlines or other means of communication between India and Pakistan could possibly help avert another Mumbai 2008 style attack if Pakistani and Indian naval forces could efficiently and quickly interact with each other on impending threats.

As far back as 2000, Ayesha Siddiqi, in her paper titled “*Maritime Cooperation between India and Pakistan: Building Confidence at Sea*” introduced the concept of the Maritime Risk Reduction Center. She says,<sup>97</sup>

The two navies could directly interact with each other on less sensitive issues like search and rescue operations. Initially, joint exercises could be conducted to train personnel for such operations. The navies could consider exchanging port visits and visits of coast guard and naval officers. This would be done through noncombatant vessels. A permanent forum such as a ‘Commanders Conference’ may also be established at this stage with participation from the foreign offices. This forum could review the state of communication and discuss matters of common interest. Curbing smuggling at sea is another area where the two navies can cooperate. The Indian and Pakistan navies could agree on monitoring specified areas for anti-smuggling operations. Information could be exchanged through the two MRRCs. If a suspect vessel is not apprehended by a navy or coast guard of one country the information could be passed onto the other country’s MRRC for appropriate action. This would allow the various agencies to integrate efforts to curb smuggling.

## **7.7 Encouraging States to Establish a Nuclear Detection Architecture**

It is imperative for countries to develop a nuclear detection architecture to ensure that there is radiation portal monitoring at major ports of entry into a country. Also, equipping law enforcement personnel with basic hand-held radioactive detection equipment should be a priority. This would not only bolster the capability of law enforcement personnel but also deter criminals from nuclear and radioactive smuggling. Criminals who are not ideologically motivated will avoid being caught and facing prison time if they know that law enforcement personnel have the requisite technical capability to detect and apprehend them. Also, countries that have nuclear programs such as the UAE, Iran, Iraq, India, and Pakistan should develop a nuclear forensics capability. According to

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<sup>97</sup> Ayesha Siddiqi-Agha, “Maritime Cooperation Between India and Pakistan: Building Confidence at Sea,” Cooperative Monitoring Center Occasional Paper, No. 31, 2000, Albuquerque, NM, Cooperative Monitoring Center, Sandia National Laboratories. <http://www.sandia.gov/cooperative-monitoring-center/assets/documents/sand98-050518.pdf>.

the IAEA, “Nuclear forensics is the analysis of intercepted illicit nuclear or radioactive material and any associated material to provide evidence for nuclear attribution. The goal of nuclear analysis is to identify forensic indicators in interdicted nuclear and radiological samples or the surrounding environment, e.g., the container or transport vehicle.”<sup>98</sup> If countries have the capability to analyze and trace the source of smuggled nuclear and radioactive material, then they can help to stop the pilferage of such materials and catch any insider who is helping smugglers.

## **7.8 Use of Crisis/Crime Informatics Software**

There are no “turnkey” crowdsourcing websites or software currently in use for detecting nuclear or radiological trafficking. However, there have been a number of systems designed by private organizations, law enforcement agencies, or governments to map crimes in particular regions. These crime-mapping systems are a good place to start in exploring the potential application of crowdsourcing in anti-nuclear smuggling efforts.

An interesting example is systems designed to map information for first responders in support of humanitarian aid/disaster relief operations in regions affected by natural or human-made disasters. Known as “crisis mapping,” these systems often utilize a form of crowdsourcing called “mobile” or “ubiquitous” crowdsourcing, where data is either submitted by participants via cell phones and other mobile devices, or collected by more passive means (e.g., pulling GPS data from a device).

The participation of coastal communities is imperative for the successful implementation of such crowdsourcing systems. Since most of these communities are not affluent, they can be attracted to participate using financial incentives or in-kind offerings such as mobile device “minutes” or “data.” Also, one of the most daunting challenges in crowdsourcing systems is the reliability of the information collected from myriad sources, which in some cases might have their own vested interests in intentionally misleading the authorities. In such a scenario, patterns will emerge that would help identify individuals who are trying to mislead the authorities.

## **7.9 Pivotal Role of Centers of Excellence for Nuclear Security**

Although, it has become a cliché to mention Centers of Excellence for Nuclear Security in the nonproliferation field, the importance of such centers cannot be emphasized enough. First responders can be trained by experts at these centers and bi-annual refresher courses can be arranged. Moreover, a research group dedicated to investigate and review cases of potential nuclear and radiological smuggling can be developed at these Centers of Excellence.

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<sup>98</sup> “Nuclear Forensics Technical Support,” IAEA Nuclear Security Series No. 2. Accessed April 21, 2015. [http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1241\\_web.pdf](http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1241_web.pdf).



## 8 CONCLUSIONS AND RECOMMENDATIONS

Summing up, it can be ascertained from this study that commerce and smuggling follow the traditional routes of trade in the IOR. The grave concern is that terrorists and criminals have piggybacked on these trade routes to generate funds for their unlawful activities. The major terrorist groups such as Al-Qaeda and ISIS and its affiliates could also possibly use these smuggling routes to traffic nuclear and radiological materials. In addition to these groups, rogue states have used the Indian Ocean as a transit point to fund and aid insurgents with small arms and light weapons. This study purports that adequate detection apparatus and methodologies in the IOR can deter the proliferation of nuclear and radiological materials and technology by state and non-state actors. Therefore, it is imperative for global security and international peace to develop and implement detection mechanisms, raise awareness, and increase collaboration with IOR states.

TO summarize, the recommendations for detection, deterrence, and collaboration in Section 7 of this report include:

- Global Water Way Watch
- Installation of Identification and Geo-Locating Devices on Smaller Vessels
- Small Vessel Voluntary Reporting System
- Capacity Building of Coast Guards and Maritime Security Agency
- Shared Indian Ocean Littoral States Surveillance Systems
- Establishment of Maritime Risk Reduction Centers
- Encouraging States to Establish a Nuclear Detection Architecture
- Pivotal Role of Centers of Excellence for Nuclear Security
- Use of Crisis/Crime Informatics Software

Through these recommendations, regional states and global powers can collaborate to implement a maritime nuclear detection architecture. The following section stipulates ideas to further make this architecture attainable and sustainable by suggesting potential short- and long-term future projects. These projects could help to lay a firm platform for developed and developing countries to stem potential nuclear and radiological smuggling in the IOR.



## **9 POTENTIAL NEAR-TERM AND LONGER-TERM PROJECT IDEAS**

This section suggests a number of follow-up project ideas to ensure that the threat of nuclear and radiological smuggling from minor ports via small vessels is accounted for when designing maritime nuclear detection architecture.

### **9.1 Short Term**

- Reach out to opinion makers to discuss the threat of maritime nuclear and radiological smuggling, such as in Track-2 dialogues.
- Conduct a comparative study of the capabilities, experiences, and techniques of the U.S. Coast Guard and coast guards in the IOR to evaluate and recommend potential areas of cooperation.
- Conduct an in-depth analysis of the links between land and maritime smuggling and potential terrorist use of these routes.
- Conduct a thorough assessment of current threats, capabilities, and requirements of IOR coast guards and states in order to detect and deter nuclear and radiological smuggling.
- Hold table-top exercises among active and retired coast guard personnel, naval officers, and subject matter experts to formulate solutions for countering nuclear smuggling.

### **9.2 Longer Term**

- Encourage international maritime security exercises between coast guards of the IOR states, including interdiction procedures and sharing of best practices.
- Develop close collaboration with regional and international Centers of Excellence for Nuclear Security for sharing best practices and tracking smuggling activities in littoral states of the IOR.
- Engage maritime first responders and train them on radiation detection equipment.
- Engage fishing communities and involve them in Water Way Watch program.

### **9.3 Final Thoughts**

In conclusion, terrorists have started adopting novel ideas to inflict maximum human and financial loss, including by sea. The mounting challenge to counter such threats in the maritime realm necessitates a concerted, collaborative, and innovative effort by states. Global powers that have the required financial and technical wherewithal and states that may not have this wherewithal are encouraged to work together to implement and integrate a global maritime security architecture to further ensure global peace and security.

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