Ebola: The Maritime Vector

No one would dispute that it is essential to monitor airports where passengers are arriving from Ebola stricken countries as a measure for containing the spread of the disease. West African seaports and merchant shipping is another potential means for spreading the disease abroad. This is not a topic that has drawn much attention.

Owing to the highly contagious nature of Ebola and the close quarters onboard ships, there is high risk of an outbreak rapidly affecting an entire crew. Such a ship entering port would pose a grave health threat to persons in the port and surrounding area. US authorities and shippers are aware of Ebola Maritime Vector threat, but detection and prevention measures appear less rigorous than those in the air travel sector. Ships must file a notice of arrival 96 hours prior to US landfall and those notices must include declaring visits made to any Ebola risk ports during the ship's last 5 port visits. In addition, ship captains or owners are required to self-report any communicable disease onboard during the 15 day period prior to entering port. If such a report is filed, the appropriate US authorities are notified and the ship may be boarded, inspected, and possibly be quarantined.

There are compelling incentives for non-compliance with disease reporting because ship owners face major commercial revenue losses if their ships are quarantined, contract conditions are not met owing to delays, or if the ship is diverted and fails to reach the port specified in a bill of lading.

ICG believes its LUX product can help mitigate risk associated with the Ebola Maritime Vector threat.

What LUX Does

- LUX ingests, enriches and applies analytics to millions of raw data events in real time as a precursor to subjecting the data to discovery and reporting rules crafted by system users. Users can direct the creation of new enrichments and analytics.
- Users can easily formulate rules and direct LUX to exploit data streams. Users may refine rules or create new ones at anytime, on the fly, and continue exploiting data streams without disrupting system operations.
- Rules specify user conditions, which if met, cause LUX to generate real time alerts to users.
- Rule conditions may include specifications based on geospatial areas of interest, time frames, named objects (in this case ships), activity (lingering, course and speed changes, proximity to other ships) and other factors.

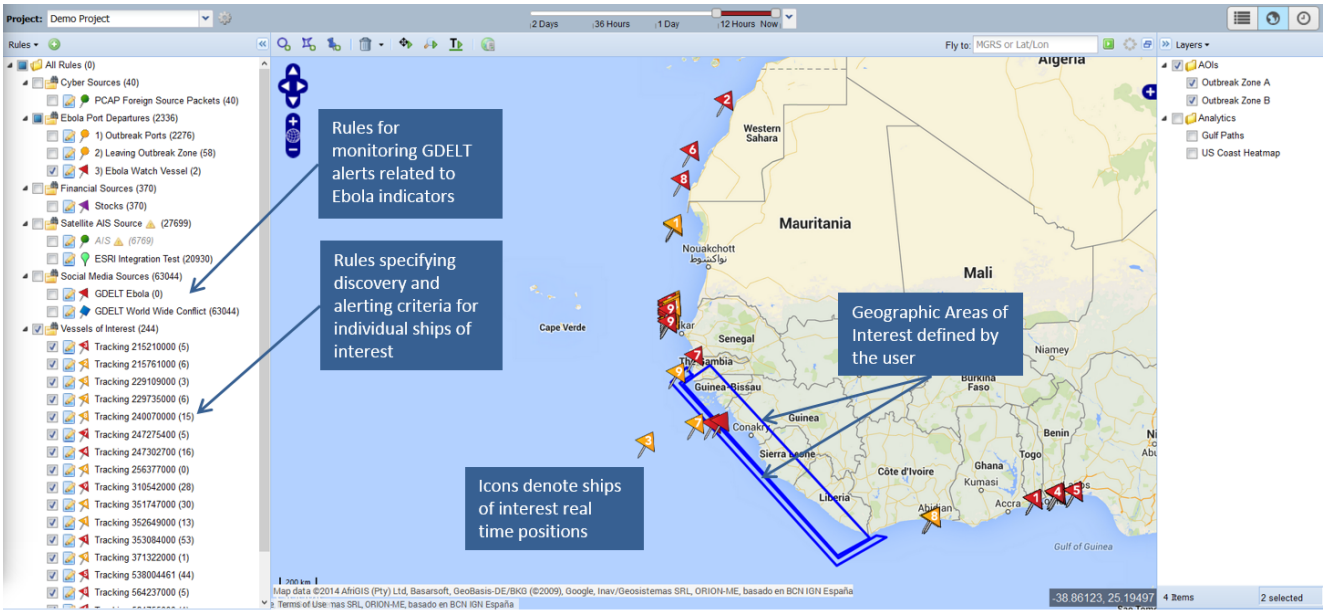
LUX's Application to the Ebola Maritime Vector Threat

To illustrate how LUX can be used in mitigating the Ebola threat, two real time data streams are used to perform analysis:

1) The first is the data stream from internationally mandated[1] Automatic Identification System (AIS) reporting. AIS is installed on all merchant ships in the world is especially relevant to monitoring ships traveling to and from West Africa ports.
2) The second source is data generated by the Global Data on Events, Location, and Tone (GDELT) project[2].

[1] International Maritime Organization's International Convention for the Safety of Life at Sea

[2] GDELT is the largest, most comprehensive, and highest resolution open source database of human society ever created. GDELT monitors and analyzes the world's news media from nearly every corner of every country in print, broadcast, and web formats, in over 100 languages, every moment of every day.



LUX User Interface

The LUX Ebola Maritime Vector monitoring methodology is outlined below:

- A LUX user defines geographic Areas of Interest (AOI). In this case there are two on the map as shown in the above illustration of the LUX user interface. The outer AOI is to provide alerts on arrivals and departures from the zone of concern. The inner AOI is to monitor activity in an around port areas.

- The user then writes rules instructing LUX to generate alerts on any inbound or outbound ship crossing the boundaries of the AOIs.

- When an alert is first received on an inbound or outbound ship, AIS data is used to determine the ship's name, its AIS unique identifier number, and other data such as course, speed, flag, declared destination port, and cargo embedded in the AIS reporting.

- Once the ship is identified, the user writes another rule containing the ship's name and AIS identifier instructing LUX to track and generate alerts on its location and activity.

- LUX tracks the ship to its next port (declared or not) and sends the user alerts based on rules and geographic areas of interest related to that port. A useful LUX tool in this regard, is the Dynamic Area of Interest (DAOI). The DAOI is centered on ship itself and moves with it. A DAOI of any radius may be established. For example, an alert could be generated anytime a ship is within 50nm of land providing warning of a pending port visit.

- The user then instructs LUX to generate alerts on information collected by GDELT that matches the user's rule parameters such as reports of Ebola cases, quarantining of ships, illness among ship crew members etc. This is a potential source for discovering Ebola's spread through the maritime vector.

- LUX also provides the means to detect abnormal behavior (such as, a ship deviating from course, diverting to a port other than its declared port destination, or, particularly, cessation of its AIS reporting stream)

- If a ship's AIS reporting were to cease, LUX's forecasting analytics would still provide an estimated track and the ship's progress along it.

- To facilitate monitoring of multiple ships (thousands), rules alerts can be sent to a user-established Watchboard. The Watchboard displays, as color-coded cells, aggregates of AIS alert reporting on as many individual ships as desired. It also monitors and displays GDELT alerts. In this way a user may be relieved of constantly monitoring activity for situational awareness and let LUX take up that task 24X7. When the number or type of alerts reaches a user specified threshold the Watch Board changes the color of the appropriate watch item cells as a visual notification. An audible tone may be added as an additional notification aid.

If additional data sources were used in this scenario, the power and decision advantage provided by LUX would increase substantially.

LUX 2.0

LUX V 1.0 performs all the functions described above and more. However, LUX 2.0 is scheduled for release on November 15, 2014 adding significant new features and capabilities:

- Completely new user interface components and database - 40% overall LUX component performance improvement
- Dual monitor operations and interaction across multiple displays
- Reorientation of the user experience to a project collaborative environment permitting teams to work common problems.
- Members of the collaborative environment are given various levels of access and interaction permissions (based on security clearance level and status as an observer, participant, or administrator access).
- Introduction of real time machine-learned predictive modeling. This is a major bridging of Complex Event Processing and machine learned model building to leverage the advantages and strengths of both in real time, large scale streaming analytics. We believe this may the first capability to perform these functions at unlimited data scale and velocity.
- New interactive visual displays providing increased analytical productivity by means of time line filtering, temporal and geospatial displays, alert lists, analytic heat maps, and anomalous activity analytics with more on the way…
- New Real-Time Watchboard builder making it easier and faster to aggregate analytics and rules into situational awareness and continuous monitoring
- Even more scalable; LUX can perform distributed, parallel analytics at a scale of 2 billion events per day, on 2 laptops
- There is an improved LUX Engine administration interface including real time display of current users, rules, and counts
- V 2.0 includes a new LUX Platform Developer Kit (PDK)

The maritime scenario in this post is only a small example of LUX's application to analysis of streaming data. LUX is data agnostic, has virtually unlimited scalability, and its relevance to real world missions and analytical challenges is limited only by the imagination of users.

If you are interested in knowing more about LUX or have suggestions for improving analysis of the Ebola Maritime Vector, contact ICG Solutions at: http://www.icgsolutions.com