INSTITUTE FOR DEFENSE ANALYSES

Data to Decisions—Terminate, Tolerate, Transfer, or Treat

Laura A. Odell

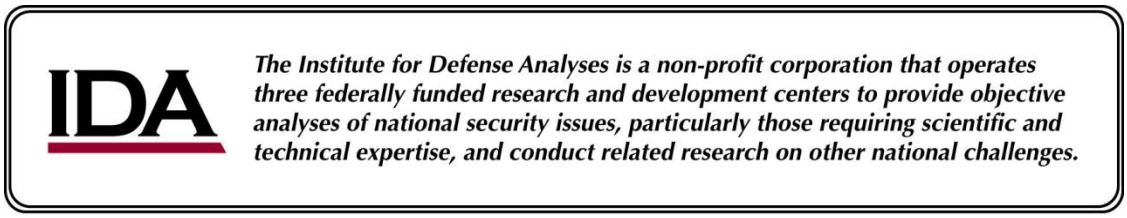
25 July 2016

Approved for public release; distribution is unlimited.

IDA Non-Standard
NS D-8094
Log: H 2016-000881
Copy

INSTITUTE FOR DEFENSE ANALYSES
4850 Mark Center Drive
Alexandria, Virginia 22311-1882

Approved for public release; distribution is unlimited.



About This Publication

This work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, Task BK-5-3889, "Creating an Affordable Strategy for Policy Issuance and Buying Power for the DoD CIO," Office of the Secretary of Defense, Chief Information Officer. The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

Approved for public release; distribution is unlimited.

The Department of Defense (DoD) is increasingly concerned that the loss of sensitive data to our adversaries is eroding the competitive advantage of the United States. This sensitive data includes business proprietary information on key programs of record and infrastructure, including government documents at the Federal and State levels that describe gaps in and limitations of our national assets. This loss of data compromises the effectiveness of our readiness for defense of the nation, and it minimizes the investments we have made to build advantages into our offensive and defensive capabilities—needed for protection in the event of an attack. The customary kinetic thin line, a basic level of survivability and resiliency to protect our most critical assets at the Federal level, may not be broad enough to include the full scope of issues that arise as adversaries seek to compromise our key defenses and national physical assets through breaches of our networks and other electronically initiated means.

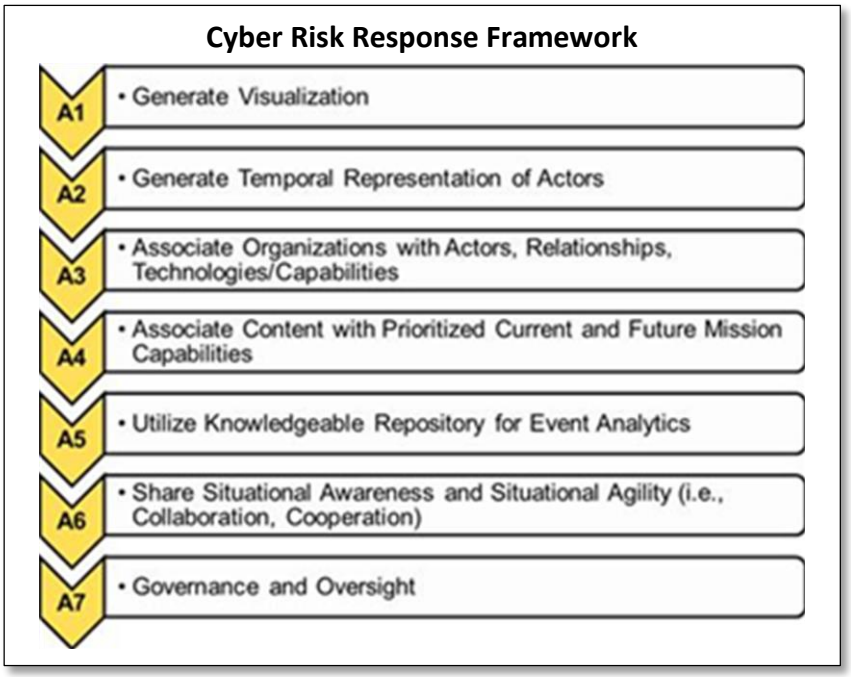
For these reasons, the DoD Office of the Chief Information Officer (CIO) is beginning to share knowledge and create templates that the States and territories can leverage nationally. The Institute for Defense Analyses (IDA) assisted the DoD CIO in formalizing a proof of concept for cyber initiatives and developed frameworks for operationalizing the data and intelligence produced across State structures and organizations. While States are pursuing the resolution of cyber issues across many fronts, a significant gap remains between the ability to gather and share information and intelligence and the mitigation of breaches that have already occurred.

In lieu of a compliance-based cybersecurity model focused on the state of networks, malware, and patching, a risk-based cybersecurity decision model that enables a predictive capability to respond to impending cyber-attacks is needed. Operationalizing the analysis of data, information, and intelligence from disparate sources across multiple service sectors to provide a common operating picture and decision framework for State governments, law enforcement, emergency services, the Department of Homeland Security, the National Guard, industry, international stakeholder "partners," and others must begin now.

Data to Decision. If an adversary has the technology or capability to do harm, then an ***incentive*** (desire to invest time, resources) to use the technology/capability is required to effect plausibility of a cyber incident. That is, even if an adversary has the means to do harm, there may not be an incentive to do so. Determining the appropriate investment necessary to address high priority ***impact*** events is a key consideration given fiscal constraints, and plausibility includes both the technology involved and the motive to use it.

The framework below provides context and a common understanding for cyber decision-making to help Federal and State leaders operationalize intelligence and information:

1. *Generate visualization* – Geospatial representation is important to consider when dealing with actors—but it can be misleading. Hackers for hire and other third-party actors may be state-sponsored and not physically located at the origination point of the attack. Although the association of location to content may be manipulated, every actor has signatures that machines can identify.
2. *Generate temporal representation of actors* – In

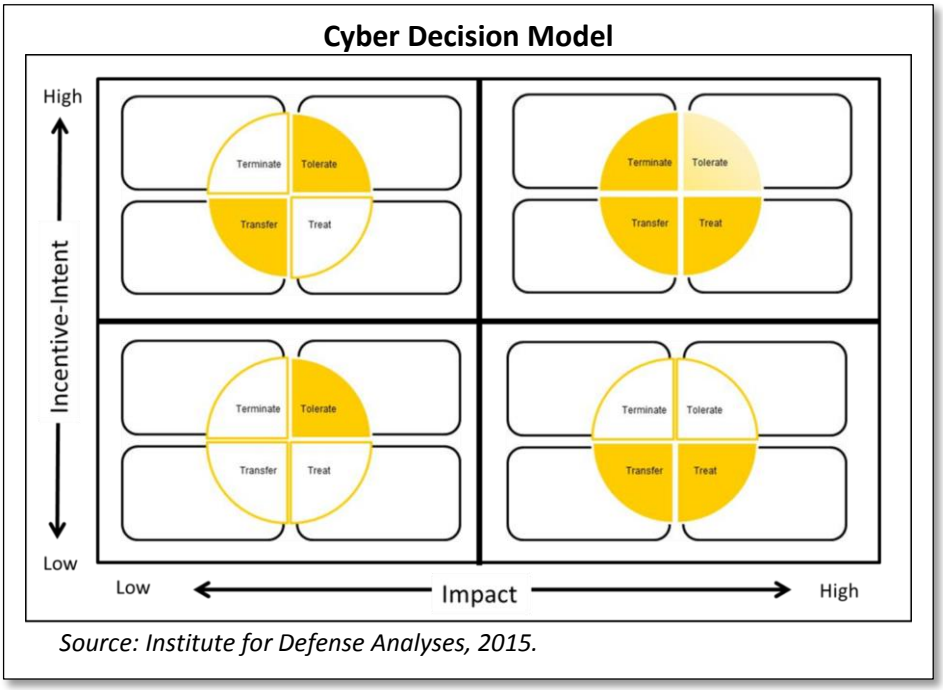


For more information
Laura Odell (lodell@ida.org, 703-845-2009

cyberspace, time is both relevant and irrelevant. It is irrelevant because incidents only occur when there is a congruence of sufficient intent and capability (i.e., Bash was a vulnerability for over twenty years but only became relevant when hackers sought to exploit it). However, domestic and international triggers/hooks (i.e., lifting sanctions, which puts more funding into play to hire third-party actors to commit cyber-attacks) may be an indicator (forcing function) in predicting an attack. The ability to anticipate/control the progression of events to maximize the opportunity to observe the adversary and know the time when they are most prepared to act is critical.

3. *Associate Organizations with Actors, Relationships, Technologies/Capabilities* – Not all cyber risk is high-impact. Intent and capabilities should put these in the context of a wider knowledge of actors and relationships (i.e., nation–states, corporate states, and criminal organizations) to improve insight into the threat.
4. *Associate Content with Prioritized and Future Mission Capabilities* – National assets should be prioritized based on their potential impact on our nation. Responses to threats or data losses should be weighed in the context of their importance to the overall mission outcome.
5. *Utilize Knowledgebase Repository for Event Analytics* – Federal and State governments should expand their sources of information to include international actors, non-state actors, event histories, social media, and episodic behaviors. These sources could assist in contextualizing and filling gaps in knowledge. The United States should begin to leverage non-traditional data sources to better protect and defend against cyber intrusions and attacks.
6. *Share Situational Awareness and Situational Agility* – Awareness is important, but alone, it is not enough. The accelerated nature of many cyber-attacks requires a readiness to act and commitment to a rapid response with already established trusted systems and communities of interest.
7. *Governance and Oversight* – As Federal and State governments seek to develop and expand automated courses of actions and thresholds, the global community is a key resource in developing a better understanding of the cyber risk (i.e., agreements across shared borders with Canada and the Soo Locks in the State of Michigan).

The Decision to Terminate, Tolerate, Transfer, or Treat Risk. A cyber vulnerabilities risk management approach should offer decision makers several choices when assets are assessed as being vulnerable to or experiencing cyber exploitation. Rather than simply accepting risk or investing in a mitigation action, using a framework based on the choices of Terminate, Tolerate, Transfer, and Treat is more appropriate for managing the dynamic and accelerating pace of cyber intrusion incidents. These choices present both opportunities and consequences.



Source: Institute for Defense Analyses, 2015.

The framework ensures that a decision maker is not limited to the more traditional yes/no and if/then/else decision construct to afford a deeper understanding of what could be gained or lost. The framework applies equally well to early invest-

For more information
Laura Odell (lodell@ida.org, 703-845-2009
Approved for public release; distribution is unlimited.

ments and fully operational systems. Specific considerations for fully operational systems include the following.

Terminate – Opportunities and Consequences:

- Terminating a capability/technology may notify the adversary that he is DISCOVERED.
- There is no longer an opportunity to observe adversary targets and techniques.
- Although the incident is no longer a degradation to the system or environment, the capability/technology is lost and may have to be replaced if there are no substitutes.

Tolerate – Opportunities and Consequences:

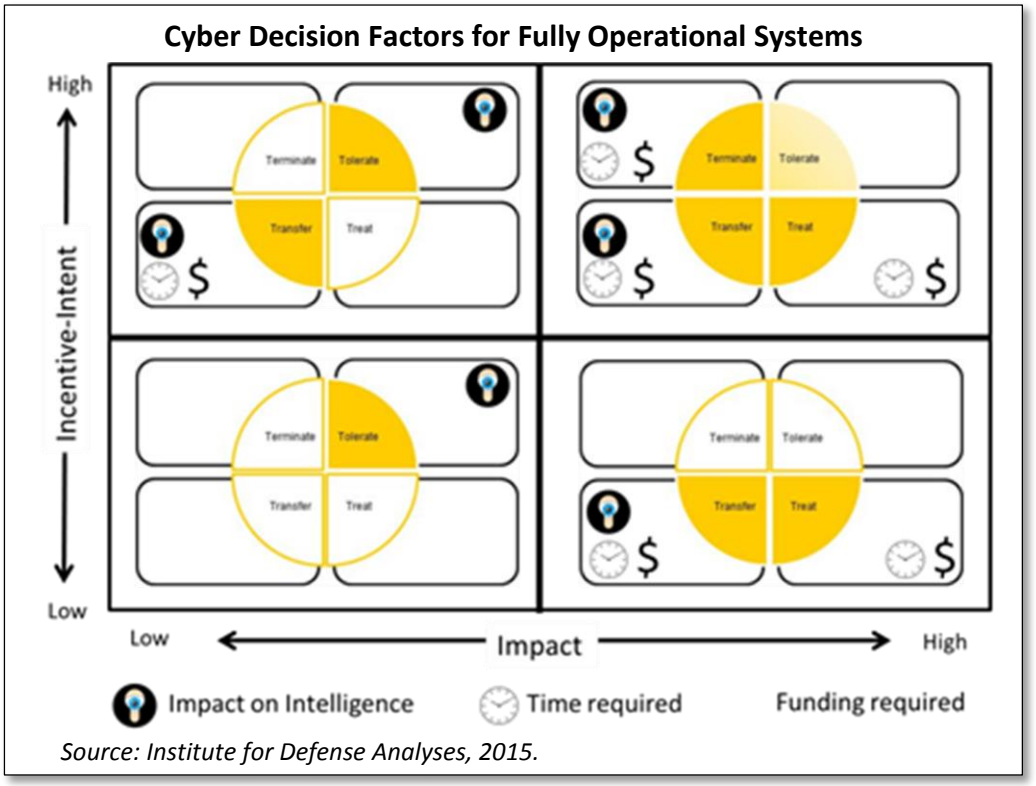
- Avoids investment in lesser priorities deemed low impact.
- Allows time to develop a more informed understanding of the adversary and defend against future attacks afforded by the opportunity to observe.
- However, observation takes time and resources.
- Degradation of current capability continues.

Transfer – Opportunities and Consequences:

- Requires a surgical knowledge of what alternatives are technically available and what is feasible.
- Funding and other resources may be required.
- May need cooperation and collaboration from stakeholders (sometimes difficult to coordinate) outside an organization or country.
- Time is needed for correction, socialization, and application of solution.
- May afford an opportunity to promote a solution from a singular platform to an enterprise-level application.

Treat – Opportunities and Consequences:

- Time and funding are required to treat and mitigate a risk.
- Know-how or knowledge is required that may not be contained in the original solution.
- There may be an opportunity to manipulate or create a false provenance or misinform the adversary (i.e., in cases of exfiltration).
- New opportunity to build in defensive design.



Source: Institute for Defense Analyses, 2015.

A decision to terminate, tolerate, transfer, or treat risk must include at a minimum: (1) what is known about (intelligence) the adversaries' current capabilities, (2) the incentive of the adversary to use those capabilities against a target of importance, and (3) an assessment of the impact level of the asset (priority to the organization).

Note: This paper is a companion document to IDA publication number NS D-8008, A State Cyber Hub Operations Framework, dated June 2016, approved for public release; unlimited distribution.

For more information
Laura Odell (lodell@ida.org, 703-845-2009

Approved for public release; distribution is unlimited.

IDA

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE (DD-MM-YY)	2. REPORT TYPE	3. DATES COVERED (From – To)
25-07-16	Non-Standard	

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Data to Decisions—Terminate, Tolerate, Transfer, or Treat	HQ0034-14-D-0001
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBERS

6. AUTHOR(S)	5d. PROJECT NUMBER
Laura A. Odell	BK-5-3889
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESSES	8. PERFORMING ORGANIZATION REPORT NUMBER
Institute for Defense Analyses 4850 Mark Center Drive Alexandria, VA 22311-1882	NS D-8094 H 2016-000881

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR'S / MONITOR'S ACRONYM
Kevin Garrison Principal Director/Director Analytics, Office of the Secretary of Defense, Chief Information Officer The Pentagon, Rm. 3B1056	OSD CIO
	11. SPONSOR'S / MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Project Leader: Laura A. Odell

14. ABSTRACT

The Department of Defense (DoD) is increasingly concerned that the loss of sensitive data to our adversaries is eroding the competitive advantage of the United States. A framework is needed for building the context and common understanding for cyber decision-making. Federal and State leaders must operationalize intelligence (Incentive and Impact) and information.

15. SUBJECT TERMS

Data to Decisions, Cyber Hub, Terminate, Tolerate, Transfer, Treat, Incentive/Impact framework

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Kevin Garrison
Unclassified	Unclassified	Unclassified	Unlimited	3	19b. TELEPHONE NUMBER (Include Area Code) 703-614-2778

Approved for public release; distribution is unlimited.

Approved for public release; distribution is unlimited.