System Security Engineering and Program Protection Case Study for the Materiel Solution Analysis Phase Tutorial

Exercise Exemplars

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15th Annual NDIA Systems Engineering Conference
San Diego, CA | October 22, 2012

Distribution Statement A – Approved for public release by OSR on 10/09/2012, SR Case # 13-S-0074 applies.

Criticality Analysis (CA) Exemplar

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Criticality Analysis Exercise Possible Solution

Use these results for future exercises:

#	Critical Function	Level
1	**Search** -Conduct a search in the area assigned using onboard sensors at standoff distances required for survival purposes based on pre-mission intelligence as well as in-flight intelligence updates	I
2	**Detect** - Analyze sensor systems responses for possible surface contact	I
3	**Locate** -Establish target position and vector (course and speed); quality of position and vector within the strike platform engagement requirements	I
4	**Classify -** Use onboard sensors combined with multi-intelligence data obtained from non-organic systems to determine if contact is: friendly, neutral, hostile or unknown; if hostile – determine type	**II**
5	**Communicate -** Pass surface ship contact information and video feed via tactical data link back to airborne E-2D; receive intelligence and tasking updates via tactical data link or secure voice	**I**
6	**Track -** maintain surface contact plot of area of interest; once enemy surface group is located, maintain track until directed otherwise; provide target updates location and vector at X frequency via tactical data link	**II**

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Vulnerability Assessment (VA) Exercise I Exemplar

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Vulnerability Assessment Exercise
Part I - White Board Discussion Exemplar

Supply Chain 1

Critical Component: *EO/IR FPGA*	Critical Component: *Tracking Algorithm Code*
Supply Chain Vulnerability	**SW Development Vulnerability**
OEM Manufacture Process	SW Configuration Management Repository
Vendor FPGA fabrication process	SW development facility
Vendor FPGA parts supplier	SW developer design activity
OEM design process	

Supply Chain 2

Critical Component: *Sensor Control SW*	Critical Component: *Custom Tracking Algorithm SW*
Supply Chain Vulnerability	**SW Development Vulnerability**
Open source math libraries	SW development facility
SW Configuration Management repository	SW developer design activity
SW development facility	SW developer baseline
	Open source math libraries

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Vulnerability Assessment (VA) Exercise II Exemplar

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Vulnerability Assessment Exercise Part II Results – for future Exercises

- **Supply chain vulnerabilities to consider (put a "Y" or "N" next to each question)**

FPGA: Sub HIJ	Custom Tracking Algorithm: Sub SSS	
Y	N	1. Does the Contractor have a process to establish trusted suppliers ?
Y	N	2. Require suppliers to have similar processes for the above questions?
N	N	3. Has the prime contractor vetted suppliers of critical function components (HW/SW/Firmware) based upon the security of their processes?
Y	Y	4. Are secure shipping methods used to ship? How are components shipped from one supplier to another
Y	Y	5. Does receiving supplier have processes to verify critical function components received from suppliers to ensure that components are free from malicious insertion (e.g. seals, inspection, secure shipping, testing, etc.)?
Y	N	6. Does the supplier have controls in place to ensure technical manuals are printed by a trusted supplier who limits access to the technical material?
N	N	7. Does the supplier have controls to limit access to critical components?
Y	N	8. Can the contractor identify everyone that has access to critical components?
N	N	9. Are Blind Buys Used to Contract for Critical Function Components?
N	Y	10. Are Specific Test Requirements Established for Critical Components?
N	N	11. Does the Developer Require Secure Design and Fabrication or Manufacturing Standards for Critical Components?

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Vulnerability Assessment Exercise Part II Results – for future Exercises

Software vulnerabilities to consider (put a "Y" or "N" next to each question)

FPGA: Sub HIJ	Custom Tracking Algorithm: Sub SSS	
N	Y	1. Does the Developer Have a design and code inspection process that requires specific secure design and coding standards as part of the inspection criteria? – Secure design and coding standards which considers CWE, Software Engineering Institute (SEI) *Top 10* secure coding practices and other sources when defining the standards?
N	N	2. Have common Software Vulnerabilities Been Mitigated? – Derived From Common Weakness Enumeration (CWE) – Common Vulnerabilities and Exposures (CVE) – Common Attack Pattern Enumeration and Classification (CAPEC)
Y	N	3. Are Static Analysis Tools Used to Identify violations of the secure design and coding standards?
N	N	4. Are design and code inspections used to identify violations of secure design and coding standards?
Y	N	5. Does the Software Contain Fault Detection/Fault Isolation (FDFI) and Tracking or Logging of Faults?
N	N	6. Do the Software Interfaces Contain Input Checking and Validation?
N	N	7. Is a separation kernel used to control communications between lvl I critical functions and other critical functions
N	N	8. Is Access to the Development Environment Controlled With Limited Authorities and Does it Enable Tracing All Code Changes to Specific Individuals?
Y	N	9. Are Specific Code Test-Coverage Metrics Used to Ensure Adequate Testing?
Y	Y	10. Are Regression Tests Routinely Run Following Changes to Code?

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Vulnerability Assessment Exercise Part II Results – for future Exercises

- **UAV and design specific vulnerabilities to consider from brainstorming (put a "Y" or "N" next to each question):**

FPGA: Sub HIJ	Custom Tracking Algorithm: Sub SSS
N/A	N/A
N	Y
N	N
N	N
N	N/A
Y	N/A
N	N
Y	N
N	N

1. Will the development tools undergo acceptance testing before installation in the development facility
2. Is red team testing planned for the supply chain and development facility each component ?
3. Does the UAV zero memory if system is brought down outside of US control
4. Does UAV have anti-tamper to protect technology intellectual property?
5. Does the FPGA utilize encryption for loading bit streams onto the component?
6. Are custom designed ASICs sourced from a trusted supplier?
7. Has the maintenance port on the classification / sensor processor been disabled to prevent backdoor access
8. Does the configuration management system require two authenticated users to process a change?
9. Is a code review done on all open source software used by the component

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Initial Risk Assessment (RA) Exemplar

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Risk Assessment Possible Solution

Overall risk likelihood exemplar for use in determining the risk rating:

Component	Threat Assessment Likelihood	Supply Chain VA Likelihood	Software Developme nt VA Likelihood	Program Generated Questions	Overall Likelihood
FPGA (Sub HIJ)	H	L (45%)	M(60%)	M(50%)	M
Custom Tracking Algorithm SW (Sub SSS)	M	M (72%)	H(80%)	H(83%)	H

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Risk Assessment
Possible Solution

Overall risk rating exemplar:

Component	Overall Likelihood	Consequence (from Criticality Analysis)	Risk Rating
R1 - FPGA (Sub HIJ)	M (3)	H(5)	H(3,5)
R2 - Custom Tracking Algorithm SW (Sub SSS)	H (4)	H(4)	H(4,4)

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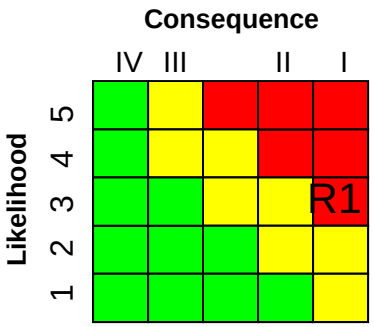
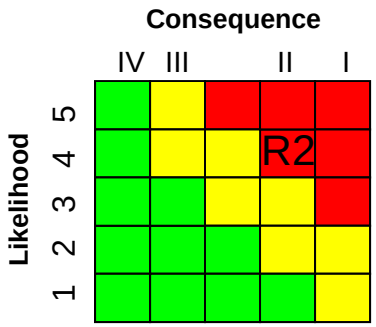
Risk Assessment Exercise

Initial Risk Posture for two or more selected Critical Components

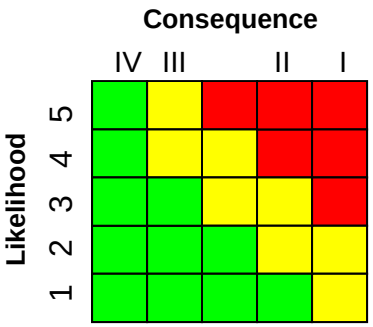
FPGA: R1



Track: R2



CC3:



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Countermeasures Selection (CS) Exemplar

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Cost-Benefit-Risk Trade Study Exemplar

Component	Risk Rating	Countermeasures	Cost impact	Risk reduc-tion	Residual Risk Rating
Custom Tracking Algorithm SW (Sub SSS)	H (4,4)	Secure design and coding stds	L	-1	M (3,4)
		Wrappers	M	-2	M (2,4)
		Separation Kernel	H	-2	M (2,4)
FPGA (sub HIJ)	H (3,5)	Anonymity plan that	H	-2	L (1,5)
		Access control	M	-2	L (1,5)
Math Lib (open source)	H (4,4)	Static analyzer	M	-1	M (3,4)
		Manual inspection	L	-2	M (2,4)

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