Reverse Engineering Risk: Converging Medical Standards for Improved Systems Engineering

Pavel Fomin, Ph.D.
INCOSE Washington Metro Area (WMA)
540-394-5764
fomin@email.gwu.edu

William G. Scheible
The MITRE Corporation
703-983-1378
wscheible@mitre.org

Gina Guillaume-Joseph, Ph.D.
The MITRE Corporation
703-930-3591
ginagj@mitre.com

G'Day and Welcome

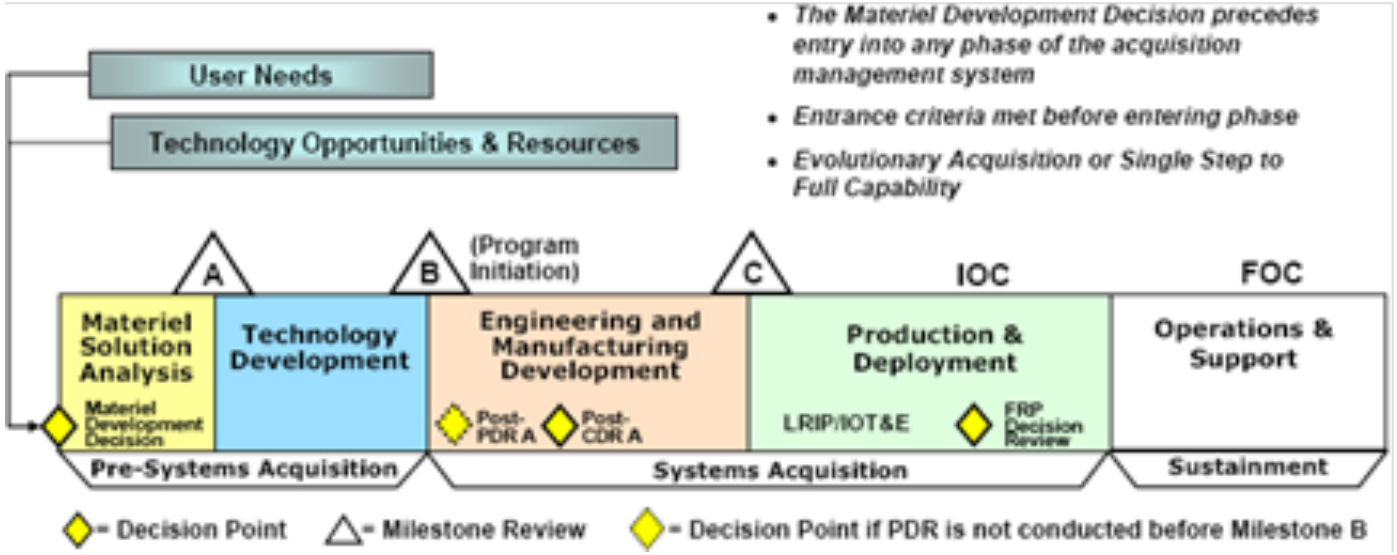
- Introductions:
  - Dr. Paul Fomin (INCOSE WMA) , Dr. Gina Guillaume-Joseph (MITRE Corporation, GWU), Mr. William Scheible (MITRE Corporation, INCOSE WMA)
  - All from the Northern Virginia, USA, outside Washington DC.
- Level Set…
  - How many of your are familiar with the US Department of Defense (DoD) Acquisition Program?
  - How many of you are familiar with programs that attempt to introduce new technologies and end up very late, very expensive, and with questionable results?
  - The DoD Acquisition process and Systems Engineering have much in common, but we are here today to discuss a specific concern dealing with technology, risk, and Systems Engineering
- Problem
  - As program complexity and interoperability continues to evolve and increase, the metrics, tools, and visualizations used to assess and present such risk have not.

The Problem and the TRA

As program complexity and interoperability continues to evolve and increase, the metrics, tools, and visualizations used to assess such risk have not.

An over whelming number of DoD acquisitions continue to experience project delays and cost overruns due to technical risk

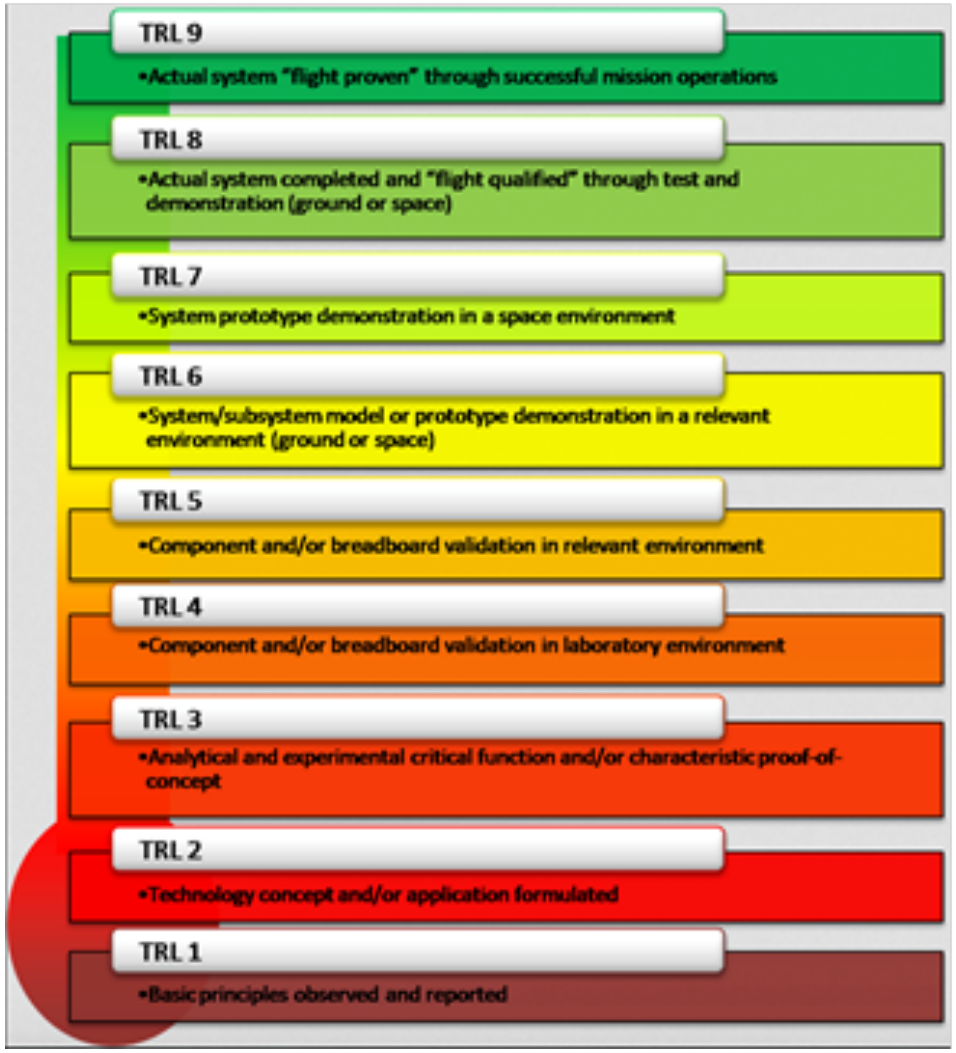
A Technology Readiness Assessment (TRA) is a systematic, metrics-based process that assesses the maturity of, and risk associated with, critical technologies to be used by a program. It is often contained in the Capability Development Document (CDD)



More Processes

- Depending on the perceived risk and impacts, and during what is called a Material Solutions Analysis (MSA) processes, various technology risk analysis, estimating, and assessment efforts can be made. One process is the Technology Maturation Risk Reduction (TMRR). The TMRR phase in an RFP requires bidding contractors to identify risks and to provide an integration plan, an Integrated Master Schedule (IMS) through prototype delivery, and drawings/models so the government can assess (1) the contractors' understanding of the technical risks and (2) the required planning to execute the plans.
- One a technology or solution is accepted, there follows (or can follow) a long process of reviews, reports and meetings in an attempt to determine the technical acceptance and risk.
- In the end, the analysis is usually a best guess/SME/what have others said and/or what do you really think? which is then presented in some graphic form.

Today's Common Metrics



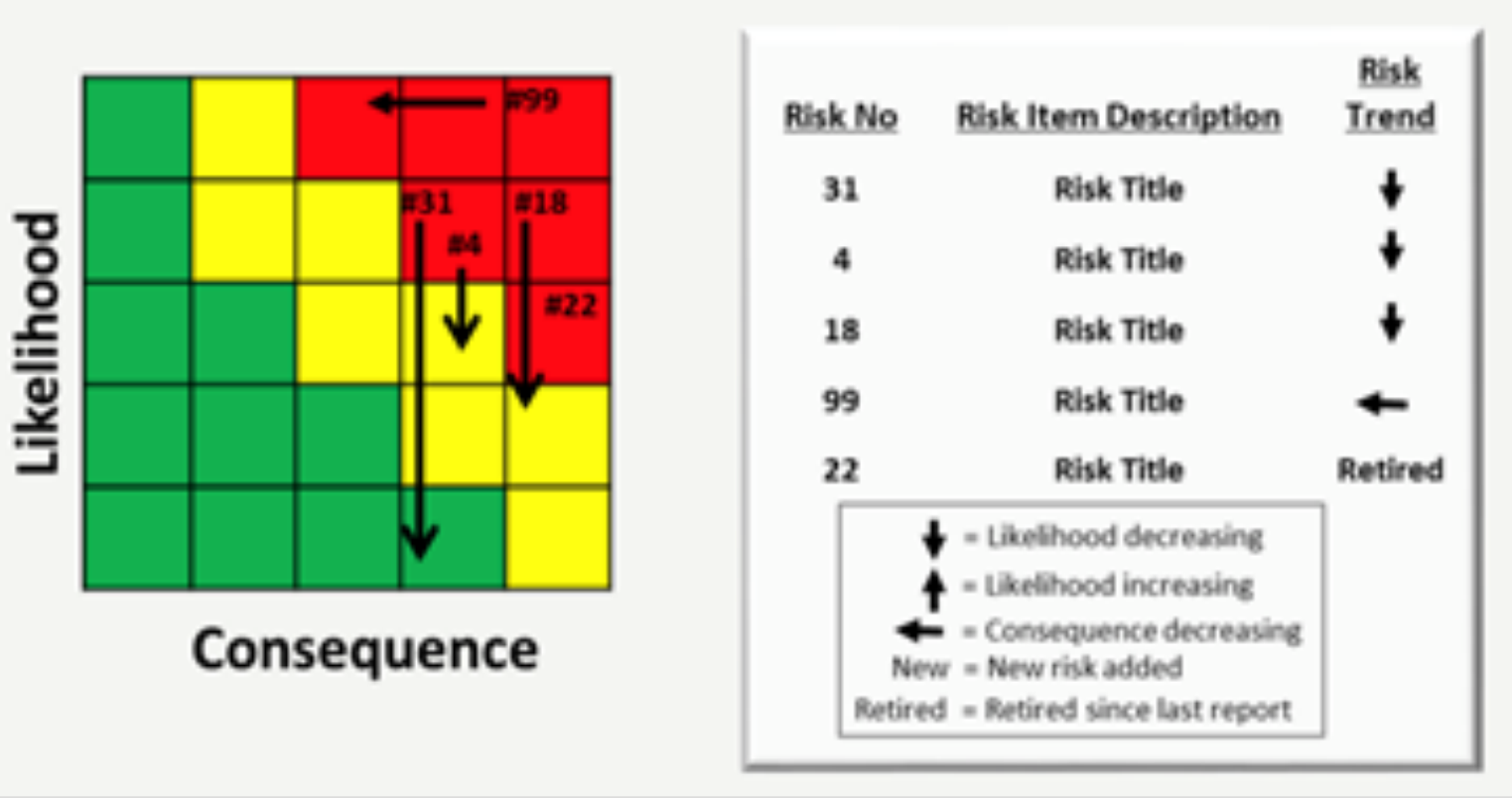
IML / IRL	Definition
1	Interface identified with no previous characterization
2	Ability to influence technologies through the interface exists
3	Common language between technologies exist
4	Detail on Quality Assurance of integration exists
5	Control between the technologies exist
6	Integration technology can Accept, Translate, and Structure Information
7	Integration technology has been verified and vaildated
8	Mission Qualitified through T&E
9	Mission Proven

- The DOD Technology Risk Assessment Guide borrows heavily from TRL concepts and thoroughly integrates them with an acquisition's master schedule.
  - For example, for major acquisition programs (generally those exceed USD $2.8B), a TRL six (6) is mandated just prior to MS-B and a TRL seven (7) to MS-C. These are executive criteria that are used to assess a program's risk and maturity at a given time.

DOD Risk Management Guide & TRLs

How to you visualize technical risk today?

- The preferred reporting matrix is a ‘five by five’ risk cube with color coded areas that represent the overall rating of a risk ID



Traditional Risk Assessment Model

- This results of these activities are usually presented in documents, reports, test results, graphs, pictures, power point or some other written/visual method to communicate the outcomes and results of these steps.
- Outcomes include TRL/IML and occasionally a Systems Level assessment known as the Systems Readiness Level or (SRL).
- Focus remains on the individual risk(s)

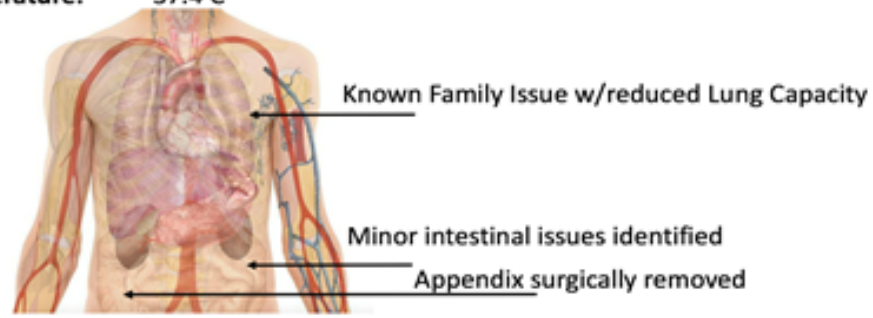
Is there a better way

- Question? Would, the next time your visit your doctor or medical specialist, be happy if they applied the TLC method to his/her analysis of your problem?

  Probably not

- You expect to answer historical questions, get inspected, palpated, tapped here and there, and listened to/further tested. Then the doctor will write up his/her observations/test results, observations and concerns. And then provide a graphic something like:

Patient Name: Doe, John
Age: 33
Weight: 105 kg
Blood Pressure: 160 / 82; P = 103
Temperature: 37.4 C



General Comments:
[01 January 2020] Patient is overweight for his height and has an elevated BMI. Patient has hypertension blood pressure that impact general blood circulation. Recommend consulting a specialist for additional screening and root cause assessment. Patient has a history of intestinal and appendix ailments. Recommend additional monitoring.

Medical School or CSEP

- You don’t have to chose, but we can learn from the medical world.
- The closest analogy to medicine and systems is engineering is that of a general practitioner and a chief systems engineer
  - Both being general holistic practitioners looking at the big picture.
  - Both are evaluating the situation (technology) and trying to assess the risk.
- The medical approach may look at risk, not as a random phenomenon, but something that is predicable, can be bound, and may be even reverse engineerable.
- Remember, the issue is the risk of adopting new technologies, the assessments of maturity and actuality, and it impacts on programs and projects.

Different Approach - Holistic

Collect Prior Lessons Learned and Known Areas of Concern

Collect Holistic Known Indicators on Critical Areas

Overlay Metrics on a Representative Diagram (i.e. Operational View)

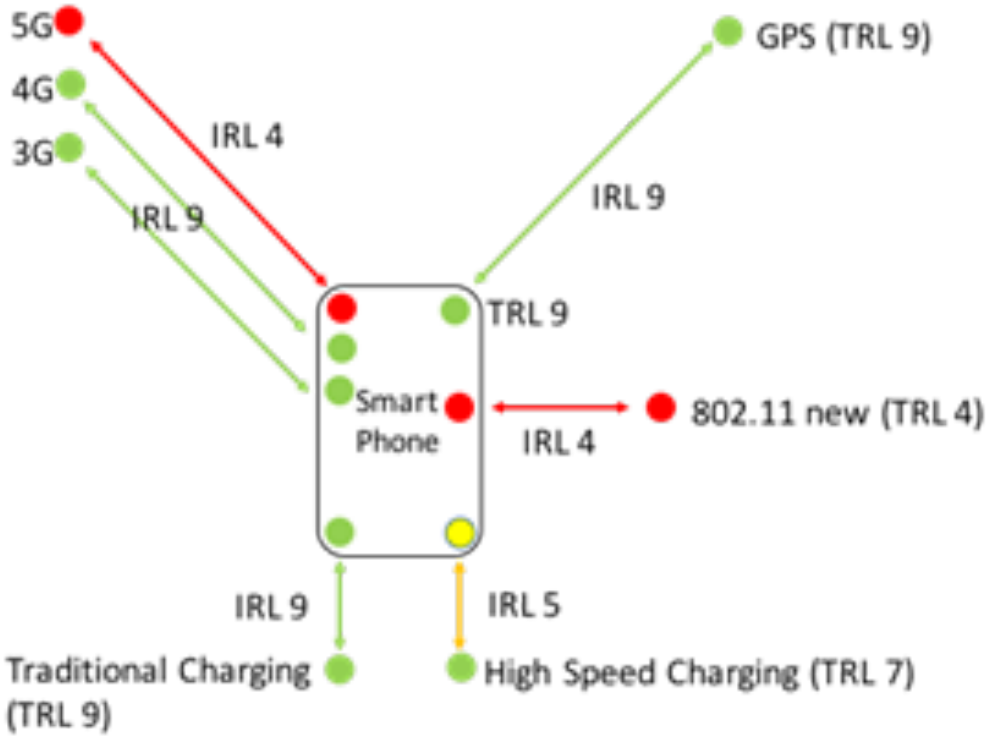
Assess Identified Risk areas by a specialist

New Notional Example

Step one (1) Lessons Learned

Budget reduced by 7% over previous year
Previous issues with battery manufacturing were identified
Software bugs resulted in 15% of user complaints

Step Two (2) and Three (3)

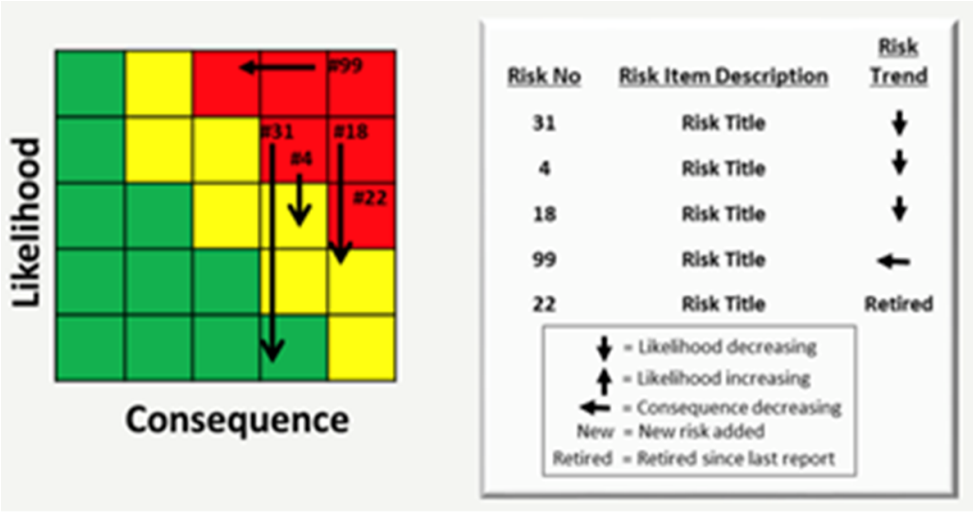


Step 4

Promote identified areas to specialists to invoke specific risk management

1. Battery / charging known issues
2. Wireless interfaces are high risk
3. 5g interface is high risk
4. Like issues with software

Today and Tomorrow



Risk No	Risk Item Description	Risk Trend
31	Risk Title	↓
4	Risk Title	↓
18	Risk Title	↓
99	Risk Title	←
22	Risk Title	Retired

↓ = Likelihood decreasing
↑ = Likelihood increasing
← = Consequence decreasing
New = New risk added
Retired = Retired since last report

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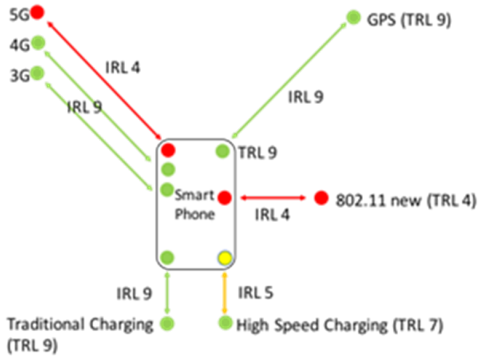

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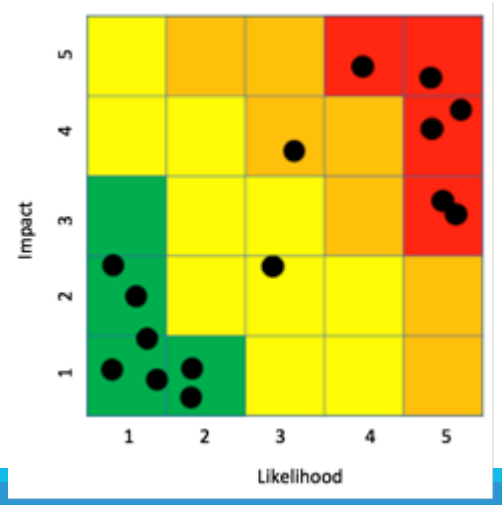

Summary

- Risk and Risk Management continue to plague the DoD (and others) acquisitions and projects.
- The DoD Technology Risk Assessment Process (TRA) tends to focus on individual risks and not the whole system problem
- It is suggested in the presentation that that a holistic approach, based upon the medical professional approach to risk management, may provide a more global and clearer risk picture to management and program/project members.
  - The proposed 4 step Hybrid process adds, we believe, rigor and structure to what currently is, at times, an uncertain process.
- A complete integration of all programmatic risks, combined with the suggested four step process, and integrated into Systems Engineering, could, we believe, reduce the risk and delays/costs of many of today's DoD projects.

And in the end…

Questions?