

3. Program/Project Management Factors

- The project management team has five years of experience in managing this program although there are some shortfalls in knowing about the cost of COTS products, the degree of critical technology readiness, and data rights (rate Do-Know as 8); individual exposure is 2
- The technical personnel are the same as those that developed the Chimera avionics (rate Do-Know as 10); exposure is zero (0)
- The technical processes use by the contractor are unknown possibly causing quality and delivery acceptance issues (rate Do-Know as 0); exposure is 10

Rating Table

Operations and Sustainment	Management Personal Capability	Technical Personal Capability	Technical Process Capability	Facilities & Infrastructure Support	Sustainment / Funding Rhythm	Project & Program Management	Sum
What Should We Know?	10	10	10				30
What Do We Know?	8	10	0				
Individual Exposure	2	0	10				12
Category Exposure	$12 / 30 = 0.4$						

Assessment range: 10 means Full Understanding of the Attribute; 5 means Partial Understanding; 0 means Major Uncertainty



4. External Program Environment Factors

- Besides the Army, the Marine Corps are a participating stakeholder. They have worked well with the management team, and they provide maintenance funding (rate Do-Know as 10); individual exposure is zero (0)
- The mandated policies and guidelines have not changed and are fully funded (rate Do-Know as 10); exposure is zero (0)
- While the funding stream for both services look secure, there has been changes in funding priorities in the past (rate Do-Know as 2); exposure is 8

Rating Table

Operations and Sustainment	External Stakeholders	Mandates	Policy-driven Sustainment / Funding Rhythm	Sum
What Should We Know?	10	10	10	30
What Do We Know?	10	10	2	
Individual Exposure	0	0	8	8
Category Exposure	8 / 30 = 0.26			

Assessment range: 10 means Full Understanding of the Attribute; 5 means Partial Understanding; 0 means Major Uncertainty



Assessing “Do Know” – “Should Know” Knowledge Gap

- Total material information category exposure
 - Sum the “should-we-know” values across all categories
 - Sum the “individual exposure” values across all categories
 - Divide the individual sums by the should-know sums
 - The resulting value should be between 0.0 and 1.0

$$Total\ Exposure = \frac{\sum All\ Individual\ Exposures\ sums}{\sum All\ Should - We - Know\ sums} = \frac{54}{140} = 0.39$$

- Total exposure assessment guidelines:
 - If the percentage is between 0 – 0.2, it is satisfactory
 - If the percentage is between 0.2 – 0.5, collect more information or increase the estimate uncertainty range
 - If the percentage is above 0.5, collect more information or significantly increase the estimate uncertainty range
- For the case study:
 - Critical Technology, Data Rights, and Technical Process Capability had high individual exposures (10) indicating the need for more information



CRED Limitations

- Has been applied experimentally on several test cases
 - Research still needs to be conducted to recommend a cost estimate uncertainty range, e.g., increase the estimate by 25%
- Weighting of material information attributes (0 to 10) may need to be tailored.
 - Each attribute is currently weighted equally but in reality may be different
- It is possible that material information attributes may not cover all the unknowns
 - Specific program vulnerabilities may not be represented as an attribute
- If attributes interact in specific situations, there is a possibility of double counting or discounting
 - Ex: Lack of material information in the Cost Environment could interact with the assessment of Management Capability



Conclusions

- The CRED model makes visible the “knowledge gap” (if any) between “what should be known” and “what is known” about the system under estimation – *the specific number isn't important as much as understanding that a gap exists and whether it affects the credibility of the cost estimate*
- By using the assessment tables, the CRED model provides documentation on what is known and unknown
 - The model, as its name implies, highlights how much credibility and trust a given cost estimate should be given
 - A cost estimate where large knowledge gaps exist should be treated with extreme caution
- The CRED model is highly adaptable to other domains
 - There is the ability to create material information categories and add/remove attributes
 - Any domain where knowledge uncertainty exists is a candidate for use
 - Categories and attributes could be created as the result of
 - Conducting retrospectives on past projects
 - Lessons learned from prior cost estimates that have underperformed
 - Brainstorming session with experienced cost estimators



Next Steps

- Research still needs to be conducted to recommend a cost estimate uncertainty range based on total exposure
- Total Exposure

$$Total\ Exposure = \frac{\sum\ Individual\ Exposures\ sums}{\sum\ Should - We - Know\ sums}$$

- Low: If the percentage is between 0 – 0.2
- Medium: If the percentage is between 0.2 – 0.5
- High: If the percentage is above 0.5

- We need DATA!

- Once enough programs have been completed using CRED with the estimate, what was the:
 - o Total Exposure score
 - o Estimation accuracy
- With this data, we can determine values for the tables above

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Early Lifecycle Estimation Uncertainty Ranges

Total Exposure	Best Case	Most Likely	Worst Case
Low	1.00	1.25	1.50
Medium	1.00	1.50	1.90
High	1.00	1.75	2.50

Late Lifecycle Estimation Uncertainty Ranges

Total Exposure	Best Case	Most Likely	Worst Case
Low	0.95	1.05	1.10
Medium	1.00	1.10	1.15
High	1.00	1.15	1.25



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