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Risk Management

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sk Management

What Is Risk Management

- Systematic Process to Identifying, Analyzing, Prioritizing and Tracking Risk Drivers; Developing Risk-handling plans; Mitigate Anticipated and Arising Risks
- Program Tool To Assess and Mitigate Events That Might Adversely Impact The Program Thereby Increasing The Likelihood Of Success.
 - Identifying Alternative to Achieve Cost, Schedule, and Performance Goals
 - Assist In Making Decisions On Budget and Funding Priorities,
 - Provide Risk Information For Milestone Decisions
 - Allow Monitoring The Health Of The Program

Risk Management Process

Identification Quantification and Prioritization Mitigation Planning Implementation of Risk Reduction Tracking Process

antification and Prioritization



ntification and Prioritization sequence of Failure Guidelines

Ct =**Ct Ct** =**Consequence** of failure due to technical factor $C_{c} = C_{cd} + C_{cp} + C_{cs}$

C_{cd}

and where I i and k are weighting factors whose sum equals one

=Consequence of failure due to change in development cost

 C_{cp} =Consequence of failure due to change in production cost

C_{cs} =Consequence of failure due to change in support cost

C_s =C_s

Cs =Consequence of failure due to change in schedule

Magnitude	Technical Factor (G)	Schedule Factor (C _s)	Cost Factor (C _c)		
			Development (C _{cd})	Production (C _{cp})	Support (Ces)
0.1 (very low)	Minimal or no consequences, unimportant	Negligible impact on program, slight development schedule change compensated by available schedule slack	Budget estimates not exceeded some transfer of money	Budget estimates not exceeded some transfer of money	Budget estimates not exceeded some transfer of money
0.3 (low) Small reduction in technica performance		Minor slip in schedule (less than 1 month), some adjustment in milestones required	Cost estimates increased by 1 to 5 percent	Cost estimates increased by 1 to 5 percent	Cost estimates increased by 1 to 5 percent
0.5 (medium)	Some reduction in technical performance	Small slip in schedule	Cost estimates increased by 5 to 20 percent	Cost estimates increased by 5 to 20 percent	Cost estimates increased by 5 to 20 percent
0.7 (high)	Significant degradation in technical performance	Development schedule slip in excess of 3 months	Cost estimates increased by 20 to 50 percent	Cost estimates increased by 20 to 50 percent	Cost estimates increased by 20 to 50 percent
0.9 (very high)	Technical goals cannot be achieved	Large schedule slip that affects segment milestones or has possible effect on system milestones	Cost estimates increased in excess of 50 percent	Cost estimates increased in excess of 50 percent	Cost estimates increased in excess of 50 percent

antification and Prioritization obability of Failure Guidelines

P_f=P_M+P_c+P_D

PM=a*PMhw+b*PMew

P_{Mmw} =Probability of failure due to degree of hardware maturity P_{Mmw} =Probability of failure due to degree of software maturity

Pc=c*Pchw+d*Pcew

Pchw = Probability of failure due to degree of hardware complexity

PCsw =Probability of failure due to degree of software complexity

Pcost = Probability of failure due to dependency on Cost

Psch = Probability of failure due to dependency on Schedule

P_p =Probability of failure due to dependency on Producibility

Psup = Probability of failure due to dependency on Supportability

Pn=e*Pp+f*Psup+g*Pcost+h*Psch

Pr=a*P_{Mhw}+b*P_{Msw}+c*P_{Chw}+d*P_{Csw}+a*P_P+f*P_{Sup}+g*P_{Cost}+h*P_{Sob}

and where:				and where:	a,b,c,d, e, f, g, and h are weighting factors whose sum equals one.			
Magnituda Maturity Factor (Pa)			Complexity Factor (P _C)		Dependency Factor (PD)			
Magmilline	Hardware PMme	Software PMm	Hardware Pow	Software Pcre	Producibility Pr	Supportability Psup	Cost P _{Cost}	Schedule Pson
0.1(Very Low)	Existing	Existing	Simple Design	Simple Design	Herdware. An Identical Rem Meeting All Performance Registric Jurrently In Production Software: Reusable or COTS SAV is Available, Almost No New Coding Is Required To Execute Functions.	A Similar tem Has Been Fielded & le Being Supported with an Established & Mature Logistics System, No New Support Technologies or Procedures Are Required To Sup-port the tem	Cost Estimate Based On Vendor Quotes for a Well Defined Item, an Off-the-Sheft Item or a Catelog Prices for an Item, No H/W or SW Change is Required; Achieving Cost Estimates is Independent of the Success of Any Other Efforts; Source Lines of Code	Schedule Estimates Based On Vendor Quotes for a Well Defined Rem, an Off-the- Sheff Rem or a Catalog Rem; No HAV or S/W Changes Are Required, Achteving Schedule Estimates is Independent of the Success of Any Other Efforts
0.3 (Low)	Minor Redesign	Minor Redesign	Minor Increases in Complexity	Minor increases in Complexity	Herdware: Sinaler item is Currently in Production, Simple Retooling end/or Minor Capital Investment is Needed; Software: Equivalent SW in Another Language, or Significant Reusable Modules May Be Used, or COTS May Be Used, or COTS Available for a Portion of the Functionality, Code is Functionality, Code is Translated to Another Language or Rehosted On Different Mechine with Minimal New Functionality.	A Similar item Hes Been Currently Supported, or Hes Been Demonstrated To Be Supporteble; Only Minor Changes to Existing Support Technologies or Procedures Will Be Required to Support the item	Iem Cost Estimate Bessed On, or Extrapolated from, Program Actuals or Suppler Informati on for a Very Sinder Iem That Is Alveedy In Production; Minor Increase in HW/8 S/W Complexity or Performance Rents; Achievement of Cost Estimate May Be Slightly Dependent of the Success of Other Program, Contractor or Government Activities, (SLOC) Estimates Bessed On Some Appropriate Legacy & Minimal Prototype Activity	tem Schedule Estimates Besed On, or Ext repolatedrom, Program Actuals or Suppler Information for a Very Smither item That is Already in Production, Minor Increase in H/W 8 S/W Comparisoly or Performance Ramts; Achievement of Schedule Estimates May Be Sightly Dependent of the Success of Other Program, Contractor or Government Activities
0 5 (Medium)	Melor Change Feasible	Major Change Feasible	Moderate Increases	Moderate Increases	Herdware: An Bern with Siniar Performance Has Not Been Produced in Cuarsty Bud All Materials & Romts Are All Materials & Romts Are Software: Siniar SAV Functions Have Previously Been Used; Modifications to Algorithms & SAV implementate on Differences Are Known But Significant, with Moderate New Functionality	tems Similar in Concept Have Been Supported As Fielded Systems or During Test: Substantial Modifications May Be Required to Existing Support Technologies or Procedures to Support the tem	Results from a Cost Model in Which the Estimate is Feesble & the Scope of the System is Adequate ; Moderate Increase in HAV & SAV Complexity and/or Performance Rights; Achievement of Cost Estimat os Mey de Dependent On the Success of Other Program, Contract or Oovernment Activities, SLOC Estimates Besed On Very Litte Appropriate Legacy & No Prototyping Activity	Result is from a Schedule Model in Which the Scope/Defnition of the System is Adequate, Moderate Increase in HAV & SAV Complexity of Parformance Ronts, Achievement of Schedule Estimates May Be Dependent upon the Success of Other Progrem, Contractor or Government Activities
0.7 (High)	Technology Available Complex Design	New Software Similar to Existing	Significent Increase	Significant Increase	Herdware: Production Hes Been Linked to the Leboretory Environment, Most But Not All Metheries Required for the Production Process Are Known; Software: SAV Prototypes & Simulations Heve Been Used In an Engl noering H/W Environment, S/W Created Mostly from Scretch with Mejor Engineering Development Using Existing Technology	Sinder Items Have Been Under Some Degree of Development, But No Fielded, Supportsbillty Romte May Have Been Established to Some Degree, Substantial Modifications to Existing Technologies or Procedures Together with New Technology Will Probably Be Required To Support the Ren	Cost Estimate Based On Uncertainties in Scope/Definition of the item, Significant Increase in Complexity, Major Increase in S/ W Modules, Achievement of Cost Estimate Mey Depend Significantly On the Success of Other Program, Confractor or Oovernment Activities, S/W Application Represents New Development & Very Little Legacy Can Be Applied to SLOC Estimation Process	Schedule Estimate Developedwith Uncertainties in the Scope/ Definition of the tem, Significant increase in Complexity, Major Increase in Number & Size of S/W Modules; Achievement of Schedule Estimates Mey Depend Significantly on the Success of Other Program, Contractor or Government Activities
0.9 (Very High)	State of Art Some Research Complete	State of Art Never Done Before	Extremely Complex	Extremely Complex	Hardware: Production Experiance Has Been Limited to RAD Environment; Material Ronts Are Not Well Defined; Software: An Integrated	No Similar System Has Been Fielded or Developed to Any Substantial Degree; Existing Support Technologies & Procedures Are Inadequate, New Technologies Will	Major Uncertainties Exist Related to the Scope/Definition of the tem To Be Estimated; Highly Complex H/W & SAV, Achievement of Cost Estimates May Be Highly Dependent upon the Success of Other Program,	Major Uncertainties Exist Related to the Scope&Definition of the Item To Be Estimated, Highly Complex HW & S.W., Achievement of Schedule Estimates May Be Highly dependion upon the Success of Other Program, Control of Courses of Other Program,

uantification and Prioritization culation of Probability Factor P_f

Probability of Failure $P_f = P_M + P_C + P_D$

- Maturity P_M
 - $-P_M = a^* P_{MHw} + b^* P_{MSw}$
- Complexity P_c
 - $-P_C = c^* P_{CHw} + d^* P_{CSw}$
- Other Dependency P_D
 P_D=e*P_P+f*P_{Sup}+g*P_{Cost}+h*Psch

vantification and Prioritization ulation of Consequence Factor C_f

$C_f = i^* C_t + j^* C_s + k^* C_c$

- Technical C_t
- Schedule C_s
- Cost C_c
 - Development
 - Production
 - Support

antification and Prioritization Iculation of Risk Factor R_f

$R_{f} = (P_{f} + C_{f}) - (P_{f} * C_{f})$

- *High (Rf* ≥ 0.7)
 - Risk Reporting
 - Risk Mitigation Plan
- *Medium (Rf* ≥ 0.3)
 - Risk Reporting
 - Risk Mitigation Plan
- Low (Rf < 0.3)
 - Periodic Review

uantification and Prioritization Three Levels of Uncertainty

Risks

- Limited Experience
- Risk Consequences Have Substantial Impact to Cost, Schedule, or Performance
- Knowledge base is usually derived from Laboratory and Occasionally Component Tests.
- Category Is Assigned When The Knowledge Base Sufficiently Establishes The Proposed Technology Is Feasible
- Risk Mitigation Requires The Following To Change Risk To Low
 - Technology Refinement
 - Design and Fabrication Development
 - Component Testing
 - Large Scale System Tests

uantification and Prioritization Three Levels of Uncertainty

jum Risks

Partial Knowledge and Experience

- Knowledge base is derived from Component and Limited Subscale Testing.
- A Moderate Amount Of Additional Analysis, Design Development, And Testing Is Necessary To Achieve Low
- Testing Performed Establishes Desired Performance Is
 Achievable

uantification and Prioritization Three Levels of Uncertainty

Risks

- Substantial Knowledge And Experience
 - Technology and/or Process
- Ordinary Engineering and Established Manufacturing Practices Are Used
- Consequences From Any Remaining Uncertainties Are Small

Mitigation Planning Isorisk Chart



@24 Risk Title EI49 Bisk Title 54 Risk Title 48 Risk Title @34 Risk Title E44 Risk Title **▲**3 Bisk Title ●4 Risk Title @35 Risk Title #45 Risk Title @33 Risk Title @22 Risk Title 246 Risk Title @23 Risk Title ▲37 Risk Title EI 40 Bisk Title ♦ 5 Risk Title ▲27 Risk Title ▲28 Risk Title @21 Risk Title EI42 Bisk Title 38 Risk Title 39 Risk Title **\$6 Risk Title** 53 Risk Title ▲29 Risk Title ♦9 Filsk Title 247 Risk Title E 51 Risk Title **♦**8 Riak Title 1 50 Risk Title #43 Risk Title ♦7 Risk Title **III**41 Risk Title ■ 52 Risk Title ▲32 Risk Title ▲30 Risk t ▲31 Risk Title +10 Risk Title With The Lowest Rf Value

©25 Risk Title With The Highest Rf Value

@20 Risk Title



ML Inc.

Tracking Process Waterfall Chart

3 Risk Title





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What Risk Management Is Risk Management Process

- Identification, Quantification, Prioritization, Mitigation Planning, Implementation of Risk Reduction and Tracking Reductions
- Develop Example Risk
- Questions/Answers