AFRL Systems Engineering Initiative
Risk Management for Science and Technology

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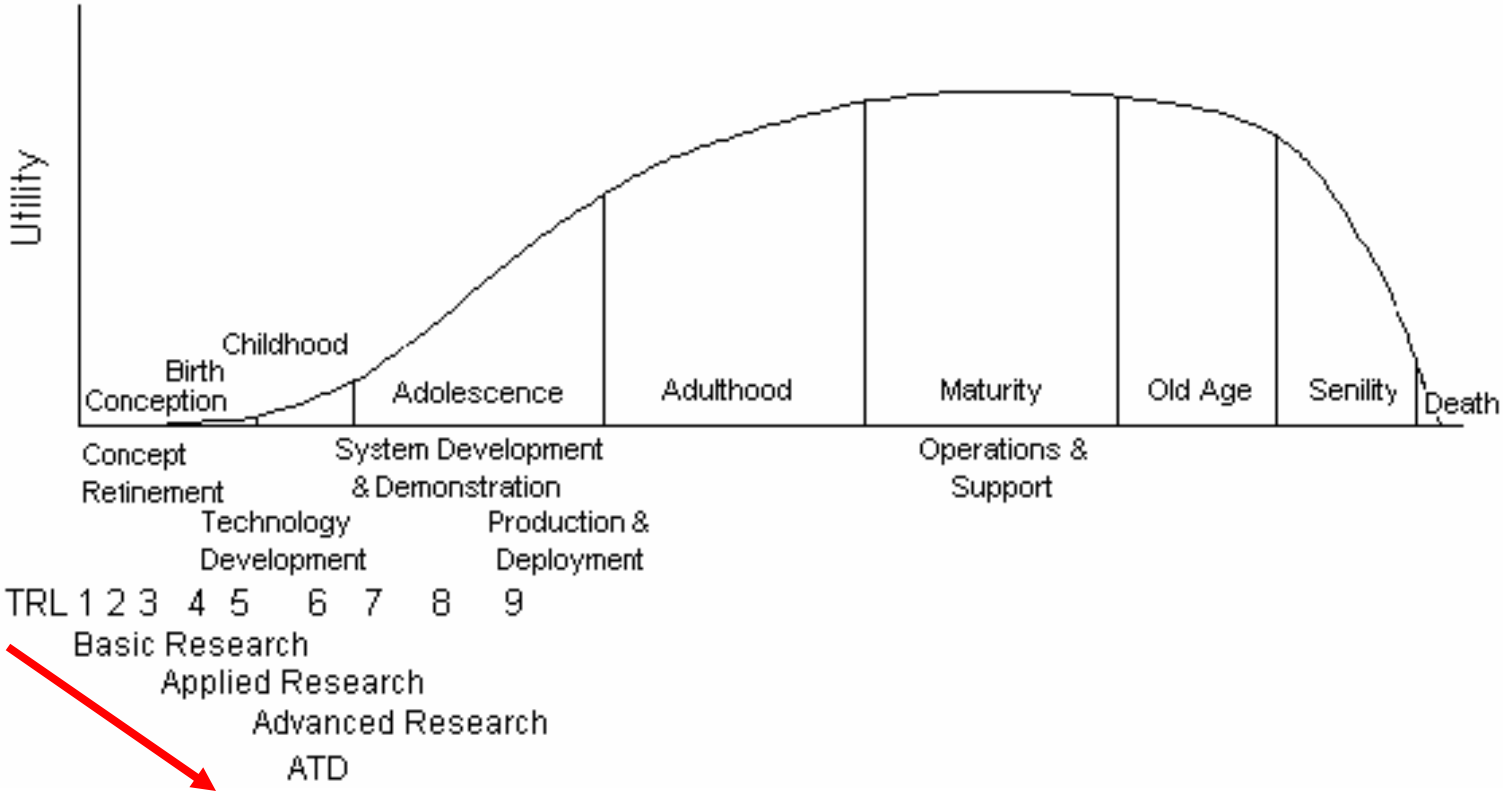
Technology Life Cycle
The Whale Chart



- **The Whale Chart maps the Life Cycle to the Readiness Levels and R&D Stages**
- **A technology's usefulness changes over time**
  - Utility increases as a technology matures
  - Utility decreases as a technology becomes obsolete

Knowledge Growth

Technology Life Cycle

AFRL SE Initiative

Risk Management

Interim Conclusion

Tools

Conclusion

Key Question	Basic Research	Applied Research	Advanced Research	ATD	Man Tech
1. Who is your customer?	Partial	Nearly Complete	Complete	Complete	Complete
2. What are customer's requirements?	Partial	Partial	Nearly Complete	Complete	Complete
3. How will you demonstrate you have met the requirements?	Partial	Partial	Nearly Complete	Complete	Complete
4. What are the technology options?	Extremely Limited	Nearly Complete	Complete	Complete	Complete
5. Which is the best approach?	Extremely Limited	Nearly Complete	Complete	Complete	Complete
6. What are the risks to developing the selected technology?	Partial	Partial	Nearly Complete	Complete	Complete
7. How will you structure your program to meet requirements and manage risk?	Partial	Nearly Complete	Complete	Complete	Complete
8. What is your business-based transition plan that meets customer approval?	Extremely Limited	Partial	Nearly Complete	Complete	Complete

Key Questions and Systems Engineering

Technology Life Cycle

AFRL SE Initiative

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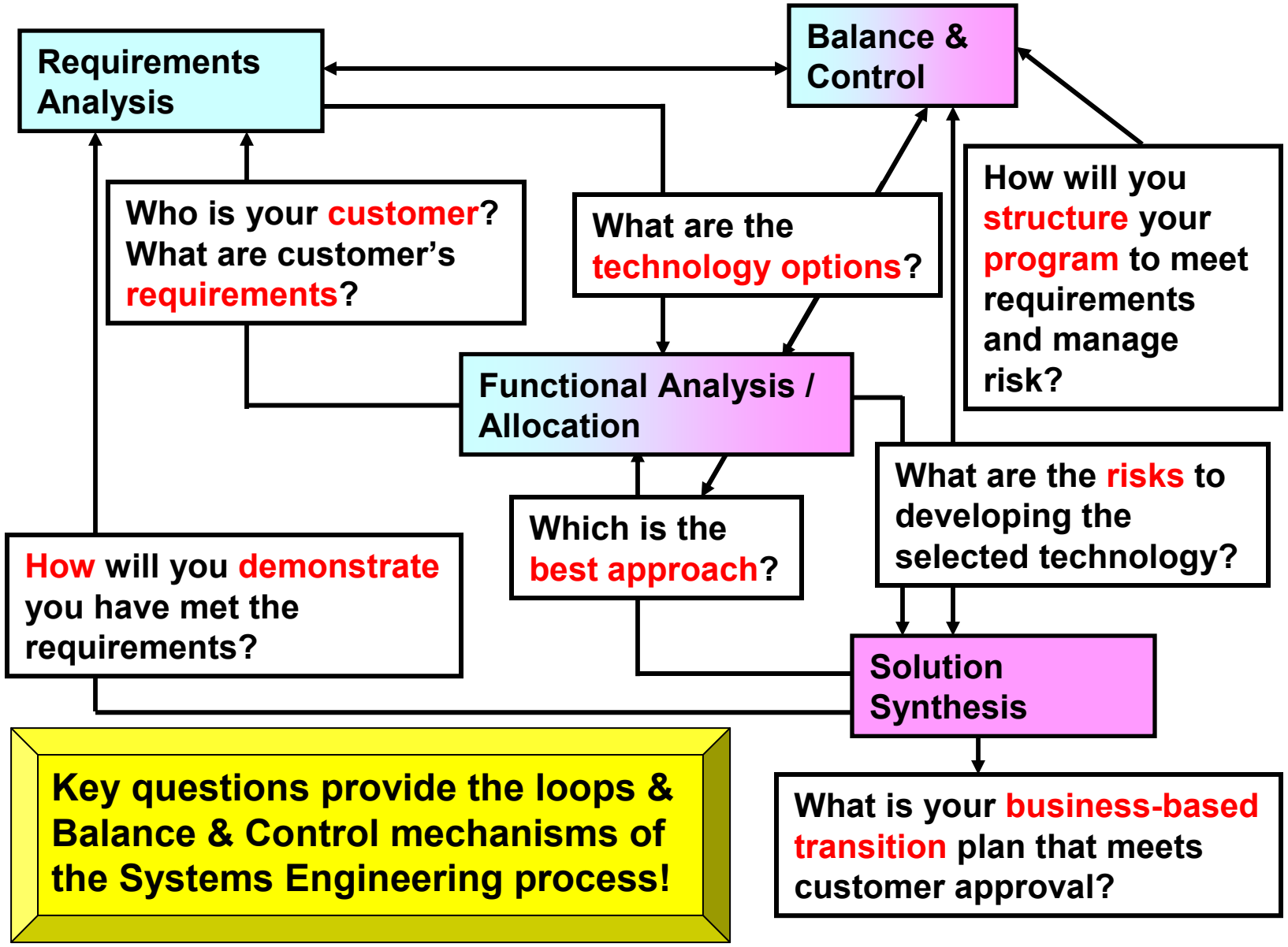
Gov't Lead

Industry Lead



R&D Focus on Risk

Two of the Key Questions Focus on Risk in R&D

What are the risks to developing the selected technology?

How will you structure your program to meet requirements and manage risk?

RM Tailored to R&D Goals

- Three Distinct Levels of Research and Development
  - Basic Research – develop a fundamental understanding of selected physical properties
  - Applied Research – investigate application of physical properties to selected technical needs
  - Advanced Technology Development – explore application of technology to assess military relevance

Philosophy of RM in Basic Research

What

- Develop cost estimates for advancement of technology to useful level
- Identify development options and relative difficulty of options
- Maintain budget within pre-defined boundaries

How

- Establish knowledge incremental goals
- Estimate cost/time needed to achieve
- Determine risks associated with maintaining cost/schedule
- Track variances for periodic cost/schedule replan

Primary purpose of RM in Basic Research is to refine development roadmap

Philosophy of RM in Applied Research

What

- Develop technology into a repeatable engineering capability
- Identify extent of applicability of technology to military needs
- Determine the cost/benefit parameters of this new caapability

How

- Explore range of application of technology
- Refine development roadmap for specific applications
- Determine risks associated with achieving required performance at known cost/schedule
- Identify issues of repeatability and define mitigation approaches

Primary purpose of RM in Applied Research is to balance cost & performance

Philosophy of RM in Advanced Technology Development

What

- Apply engineering capability to specific military need
- Identify issues causing uncertainty in application
- Refine cost/performance relationship.

How

- Manage to cost/schedule
- Provide mitigation options and go/nogo gates
- Determine risks early, maintain constant awareness
- Identify potential of cost/schedule failure early (precursors), manage proactively

Primary purpose of RM in ATD is to balance cost, performance, schedule

Risk Management Summary

Key Questions 6 and 7 provide the basis of the AFRL Risk Management process

Questions apply to R&D programs at all stages of maturity

Knowledge available to the program manager changes with program maturity

Risk Management philosophy changes with program maturity

Risk Management Tools

Disclaimer:

This is a partial listing of risk management tools that have proved to be useful in the science and technology environment

The presence of a tool's name and description in this presentation does not constitute an endorsement by the US Air Force or any of its officers or personnel

The absence of a tool's name and description from this presentation does not constitute a finding of unsuitability or a criticism of the product by the US Air Force or any of its officers or personnel

Risk Management Tools

AFMC/TRIP Risk Mgmt
Active Risk Manager (ARM)
IPPD Control Suite
Probability /Consequence Screening (P/CS)
Risk Matrix
RiskNav

Risk Management Tools

Risk Radar
Risk Radar Enterprise
Technical Risk Identification & Mitigation System (TRIMS)
@Risk
Consolidated Risk Assessment Methodology (CORAM)
Risk Matrix

Risk Management Tools

Pertmaster
Risk +
Crystall Ball
Dynamic Insight
Active Risk Manager
Risk Nav

Microsoft Excel user created applications can also be useful

- **RiskHammer**
- **TRL Calculator**
- **FMEA**

Summary

The AFRL Systems Engineering Initiative is a method of managing risk in Science and Technology

- Applicable early in the technology life cycle
- Key questions test risk management during program reviews

A variety of risk management tools exists

- COTS
- User created applications

Discussion / Questions

- Technology Life Cycle
- AFRL SE Initiative
- Risk Management
- Interim Conclusion
- Tools
- Conclusion