Australian Government
Department of Defence
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Australia's Experience in Technology Risk Assessment

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AUS TRA ≠ US TRA

- **In the US**

  TRA = Technology Readiness Assessment

  - ***Not* a risk assessment**
  - ***Does not* address system integration**

- **In Australia**

  TRA = *Technical Risk* Assessment

  - ***Is* a risk assessment**
  - ***Includes* both system integration and integration of the system**

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Why the difference?

- US is the leading developer of military technology
  - So must risk manage the development of technologies
- Australia acquires most of our capabilities
  - Modifies equipment to meet our needs
  - Develops military technologies only in niche areas
  - Comes from various nations
  - Have to manage developmental options very differently from off-the-shelf

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Defence Procurement Review 2003 (the Kinnaird Review)

- **Defence was experiencing delays in a significant number of projects**
  - **Collins submarine, Sea Sprite helicopters, Jindalee over-the-horizon radar etc**
- **Review was commissioned to improve the acquisition of defence capabilities**

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Kinnaird outcomes

- **Review recognised the role of complex technology development in these delays and recommended that:**
  - **Defence consideration of new acquisitions to include *'comprehensive analysis of technology, cost and schedule risks'* and**
  - **'*Government needs to be assured that adequate scrutiny is undertaken …. by DSTO on technology feasibility, maturity and overall technical risk'.***
- **As a result, the Chief Defence Scientist (CDS) became responsible for providing independent advice to Government on technical risk for all acquisition decisions**

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The Capability Development Process

- **Kinnaird Review also recommended the introduction of a formal two-pass process that ensures Government is well-advised in making decisions on Defence's major acquisition proposals**
  - **First pass sets the capability & options developed**
  - **Second pass seeks a decision on what option is to be acquired**

- **DSTO is required to provide a technical risk assessment at each pass which forms the basis for CDS to provide a technical risk certification to government**

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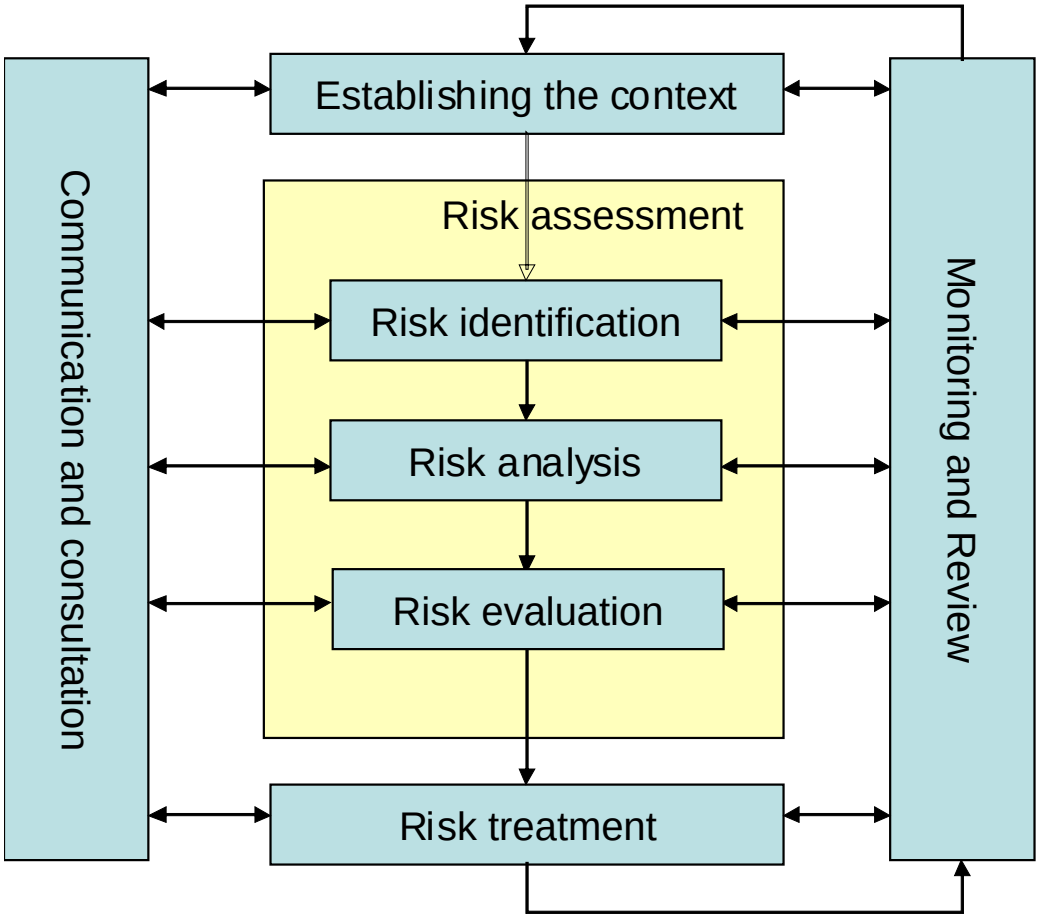
Risk management process



Risk management - Principles and guidelines, AS/NZS ISO 31000:2009

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Technical Risk Assessment

- **A systematic approach to identifying and assessing the technical risks for a major acquisition decision**
  - **Starts from risk management process**
  - **Draws on experience from UK Ministry of Defence and the US Department of Defence**
- **Aim is to inform decision-making and risk management**
- **Initial approach developed in 2004 and refined further with experience**
  - ***Technical Risk Assessment Handbook* currently in development**

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So What are *Technical* Risks?

- **Two types of risk**
  - **Immature technology will not be developed in time**
  - **And they may not be integrated into the system or Australian Defence Force**
- **Technology risk**
  - *the risk that the project will not achieve its objectives due to an underpinning technology not maturing in the required timeframe*
- **Technical risk**
  - *the risk that the project will not achieve its objectives due to risks which arise in the integration of critical technologies, and/or sub-systems dependent on them, or to the integration of the system into the ADF*

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How are the technical risks assessed

- Use readiness levels to assess maturity
- Assess likelihood of not maturing in time based on
  - Are the technical requirements known?
  - What are the time and resources available?
  - What is the level of difficulty in maturing the technology?
  - Is this an extension of previously developed technology or is it leading edge technology?
  - Does the system use new technology or components?
  - Is a new manufacturing process or technique involved?
  - Do the developers have expertise in this area?
- Impact on project's objectives
  - Performance
  - Cost
  - Schedule
  - Supportability
  - Safety

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Project AIR1234 F/A-18 Missile

Use systems breakdown to identify technologies

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For technology maturity use TRLs
(From DoD TRA Deskbook)

Technology Readiness Description	Readiness Level
Basic principles of technology observed and reported.	1
Technology concept and/or application formulated.	2
Analytical and laboratory studies to validate analytical predictions.	3
Component and / or basic sub-system technology validated in a laboratory environment.	4
Component and / or basic sub-system technology validated in a relevant environment.	5
System sub-system technology model or prototype demonstration in a relevant environment.	6
System technology prototype demonstration in an operational environment.	7
System technology qualified through test and demonstration.	8
System technology qualified through successful mission operations.	9

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Technology risks example

Technology	TRL	Development required	Likelihood of technology not maturing in time	Impact on project's objectives	Risk
Battery	9	Same battery proven in service on another missile			Nil
Guidance set	5	Shock resistance still to be demonstrated	UNLIKELY (10-15%)	Moderate (Could delay schedule)	Low

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For technical maturity use System Readiness Levels

(adapted from TRLs by DSTO using MOD concept)

System Readiness Description	Readiness Level
Basic principles observed and reported.	1
System concept and/or application formulated.	2
Analytical studies and experimentation on system elements.	3
Sub-system components integrated in a laboratory environment.	4
System tested in a simulated environment.	5
System demonstrated in a simulated operational environment, including interaction with simulations of external systems.	6
Demonstration of system prototype in an operational environment, including interaction with external systems.	7
System proven to work in the operational environment, including integration with external systems.	8
Application of the system under operational mission conditions.	9

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Technical risks example

Sub-system	Technologies in each sub-system	TRL	SRL	Integration required	Likelihood of not being integrated in time	Impact on Project's Objectives	Level of Risk
Guidance System	Battery	9	5	Guidance set to be integrated	Less than likley	Moderate	MEDIUM
	Guidance set	5					
	etc						
etc							
System							
Missile System				To be integrated with aircraft mission system	Less than likely	Major	HIGH

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Summarising the Risks

Project AIR 1234 TRA Summary			
Likelihood	Consequence/Impact		
	Minor	Moderate	Major
More Than Likely		Seeker development	Warhead effectiveness
Less Than Likely	Weapon integration	GPS integration	
Unlikely	Missile development		
Overall Technical Risk Level	HIGH		

Experiences

- TRAs have influenced decisions and management
- Distinguishing risks and issues
- Military/Commercial Off-the Shelf
  - Perceived as low risk
  - BUT can be technical risks in integration and in supportability
  - And can be issues if not demonstrated in mission conditions
- TRA as an input to risk management
  - Integrating TRA into project risk management and into the capability development process
- Consistency of assessment across TRAs
  - TRA Handbook being developed
- Human science risks
  - Included as a source of technical risk

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Next steps

- Improving the risk assessment part
  - To date have used expert judgement
- Will examine potential to use other techniques where possible
  - e.g. probabilistic simulation modelling
- Formalise training in TRA
  - To cover both process and techniques

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Thanks to

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Reference

Technical Risk Assessment of Australian Defence Projects (2004), *J. Smith, G. Egglestone, P. Farr, T. Moon, D. Saunders, P. Shoubridge, K. Thalassoudis and T. Wallace, DSTO-TR-1656.*

available from

http://dspace.dsto.defence.gov.au/dspace/bitstream/1947/4011/1/DSTO-TR-1656%20PR.pdf

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