Defence Capability Realisation: How New Preview T&E is De-risking New Project Approvals

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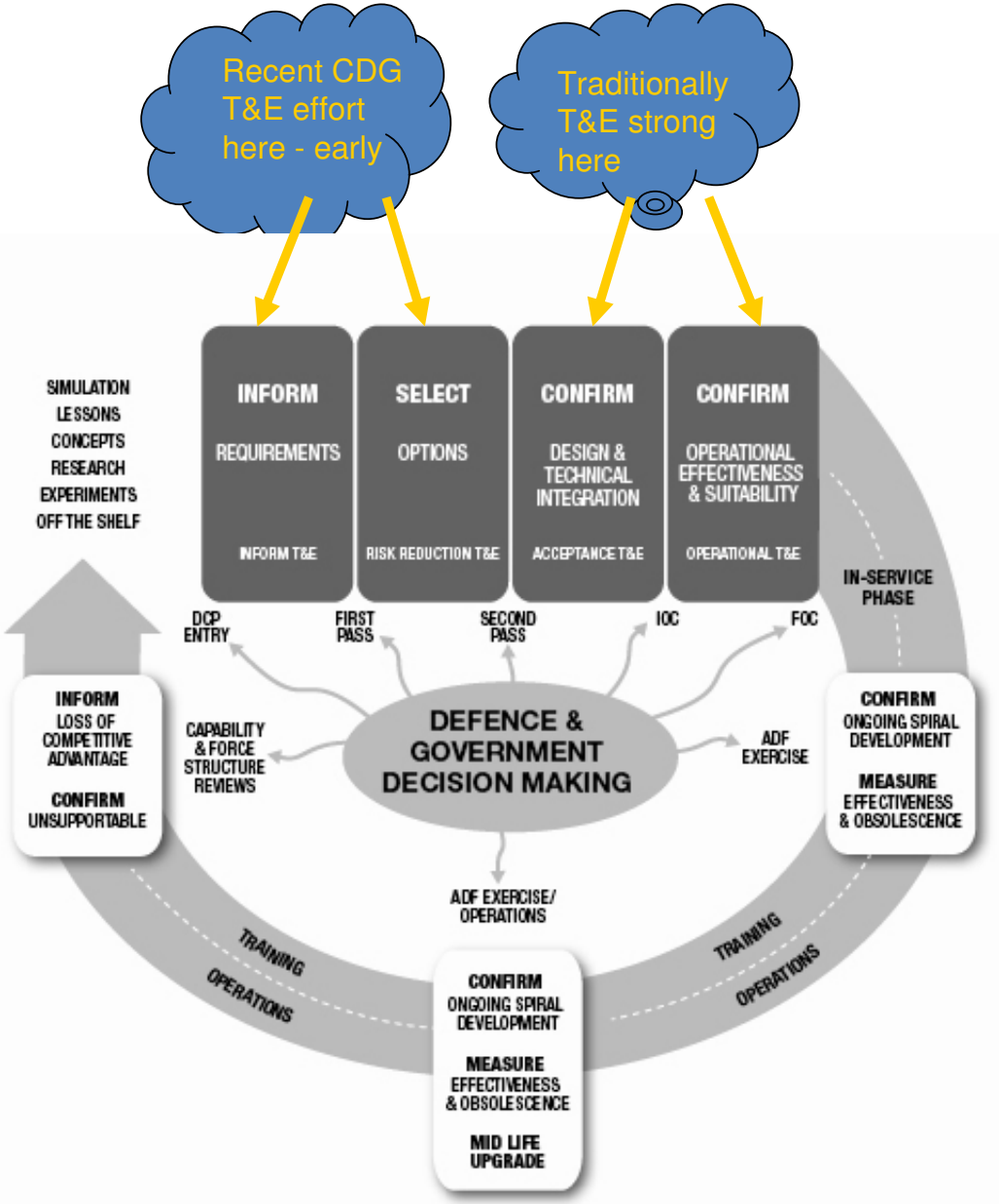
Background: Australia's Two-Pass Process & role of T&E

'Implementation of the 2003 Kinnaird reforms has delivered a marked improvement in schedule performance for Defence capability acquisition projects. … average schedule variance to FOC for pre-Kinnaird MPR projects is 71 percent, while the average variance for post-Kinnaird projects is 15 per cent.'

DMO & ANAO
MPR 2014, pp. 140-141



Senate Inquiry into Defence Procurement: Findings on T&E

Two-year multi-party Senate Inquiry concluded in 2012:

- period 2000 to 2010 - some ten percent of projects by value ($7.6 billion) failed to deliver the capability sought (Chapter 2)
- inadequate T&E was a significant factor in the risks not being determined early enough for them to be mitigated (Chapter 12).

'risk…inadequately described during the capability definition & planning phase… risk identified by domain or subject matter experts but downplayed, misinterpreted, or ignored by more senior non-experts… failure to appreciate the challenge of being a customer of a first-of-type program; under-estimation or understatement of the level of technical maturity with programs proceeding without the requisite level of knowledge – numerous examples where developmental projects were deemed incorrectly to be MOTS;…. Under-estimation of complexity of integration; Inadequate specifications;… Poor understanding of overseas certification standards & Australia's requirements;… Inadequate planning of testing & acceptance;… Inadequate testing of contractors' claims with a "shallow" understanding of industry's capacity to deliver…' [pp. 34-35].

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Senate Inquiry into Defence Procurement: Findings on T&E

'W*itnesses have presented numerous cases whereby the expectation that a procurement activity is OTS (off the shelf) has led Defence to believe that a product is more mature or an outcome more predictable than experience (or an experienced review) would indicate. The conspiracy of optimism, referred to by a number of witnesses, appears to have led Defence to undervalue the role that developmental test & evaluation can play in the early stages of the acquisition cycle to identify & analyse risk in a quantifiable & defensible manner… This lack of knowledge about the technical maturity of a capability raises the question about the analysis undertaken of the proposed project, & highlights to the committee the absence of early test & evaluation conducted by qualified ADF T&E practitioners as part of a structured risk identification process. …'* [pp. 195-196]

'The focus on OTS however has led many to believe that Defence only requires a T&E capability at the end of the process: i.e. operational T&E as part of introduction into service. What numerous Defence projects have shown however is that Defence must sustain, develop & employ personnel with experience in developmental T&E in order to conduct precontract analysis with rigour.' [p. 200]

Senate Inquiry into Defence Procurement: Findings on T&E

Government agreed to:

> "*Building an improved test & evaluation (T&E) capability, including the development of an equal stakeholder relationship between the Services T&E organisations & the Defence Science & Technology Organisation (DSTO), enabling the early engagement (pre-first pass) of T&E activities for the identification & mitigation of risks*"
>
> (Minister for Defence, 2012, para. 6g).

Specific to this paper, Defence agreed to recommendation 25:

> *'T&E policy to make it mandatory at first pass to formally scope a preview T&E by a T&E agency before materiel contract, even if Military Off The Shelf (MOTS) equipment has been proposed, & offer that as a costed option in every Government capability submission.*'

Latest Major Project Report to Government: Still problems

Latest Major Project Report to Government (2014, p.65) states:

> '*a 36 per cent increase on the expected schedule since the main investment decision*'

with the reasons cited still including:

> '*underestimation of the difficulties associated with technical factors such as design problems, industry capacity & capability, difficulties in system integration to achieve required capability*'

Report again emphasises the *'importance of initial assessments of the purchase type i.e. MOTS, Australianised MOTS or Developmental.'*

Deeper analysis across three Major Project Reports to Government has found

'*that, generally, MOTS projects are more likely to be delivered on time while AMOTS* [Australianised MOTS] & *Developmental acquisitions are more prone to underestimating technical complexity & systems integration effort*' (2014, p. 136).

Findings & concerns are not unique to Australia, with the Senate Inquiry report citing several recent reports to Congress by U.S. equivalents (pp. 200-201).

Preview T&E: How does the term fit in T&E ontology?

Term arose from questioning by Senator Fawcett (Hansard, 13 June 2012) to clarify early 'try-before-buy' T&E from other later T&E that has more contractual depth, is more comprehensive & is usually focused on engineering acceptance & then operational release. The online Oxford dictionary (2015) defines preview as:

'*An opportunity to view something before it is acquired or becomes generally available … A publicity article or review of a forthcoming film, book, etc., based on an advance viewing… See or inspect (something) before it is used or becomes generally available*'

Popular use of the term concerning films is important because it captures that a **critic** will experience the item in advance of it being acquired or made available. Therefore the term now implies **independence** or even **contestability**, & **operational exposure** by a **representative user** – elements brought out in the new T&E policy.

How does the term fit in T&E ontology?

U.S. Theory Developmental T&E	ADF Focus of Preview T&E
U.S. definitions 3 assumptions: -system contractor to work with, -sufficient Government resources to check contractor's T&E, & -a system to be developed US also increasingly contractor led T&E	- Developmental is reluctant term for OTS - Most ADF submissions involve OTS or major mature elements - Proportion increasing & giving schedule benefits - ADF has term acceptance T&E to cover V&V - AT&E increasingly contractor led
Expertise largely contractor	Customer focused, led & independent
Complex contract required	Pre-contractual Tender or Offer Definition Activity
Looks for design improvements to iterate	Selective – determine *if it is even worthwhile to proceed* (i.e. leaves out the how)
Follows strict checklists, very complete	Risk-focused, challenging, usually incomplete by normal acceptance T&E standards

Preview T&E is ontologically proposed "***as that developmental T&E conducted to evaluate the feasibility & performances of alternative capability options & identify risk areas prior to a final decision to acquire***."

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New Defence Policy: How is Preview T&E Planned?

Plan preview T&E per the new T&E Policy in Defence Capability Development Manual (DCDM) Pt 2, Ch 7 as part of First Pass Test Concept Document

TCD Status: OCD, FPS & TCD are the core System Engineering documents that define the capability support, the rest our how you will project manage

TCD Purpose: to inform how capability will undergo real testing to confirm …

Caveat: < 1st Pass & solicitation, lack access to industry & maybe foreign governments to establish detailed T&E plans = concept

Who Develops TCD:

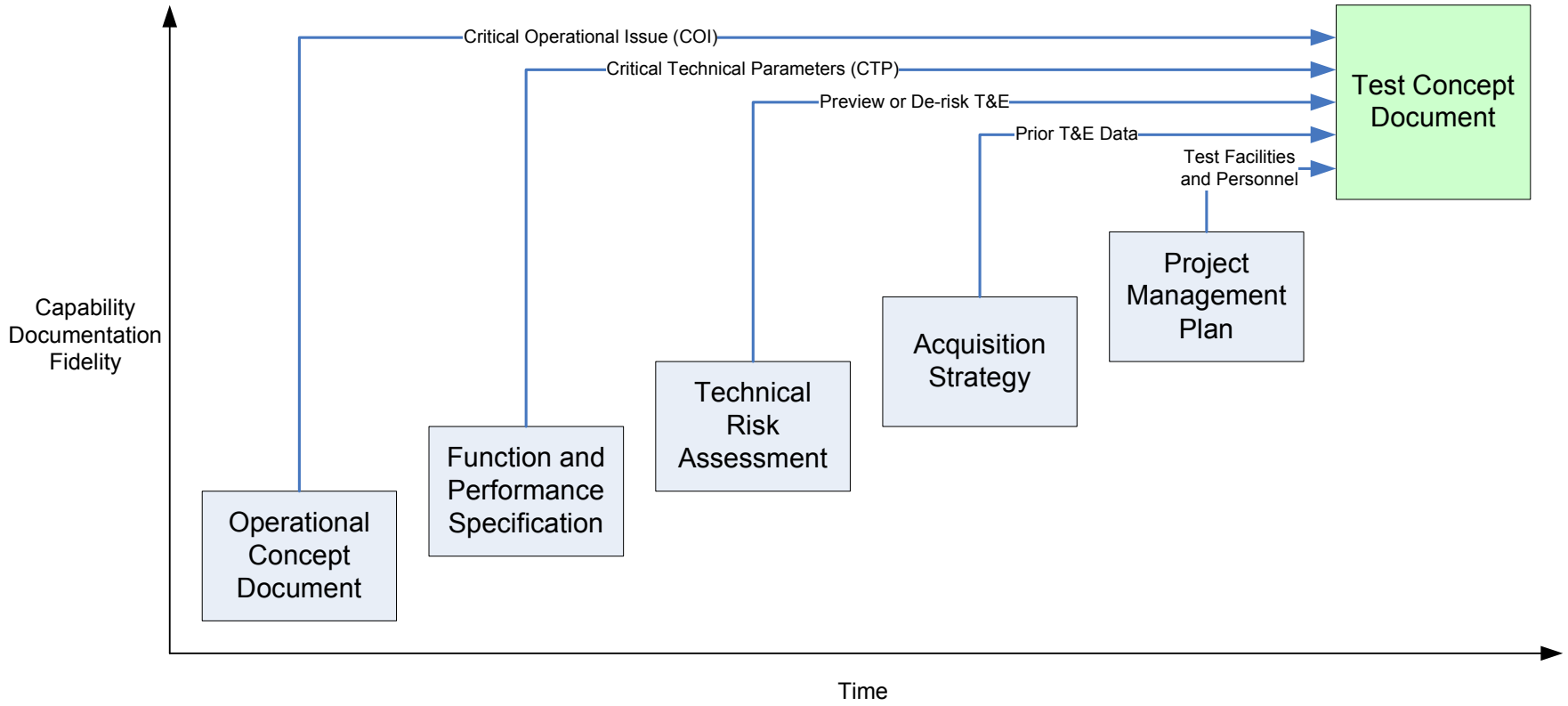
ACAT I. CDG/DMO full-time person with high T&E experience

ACAT IV. CDG PM who does TCD writers course. ADTEO oversight

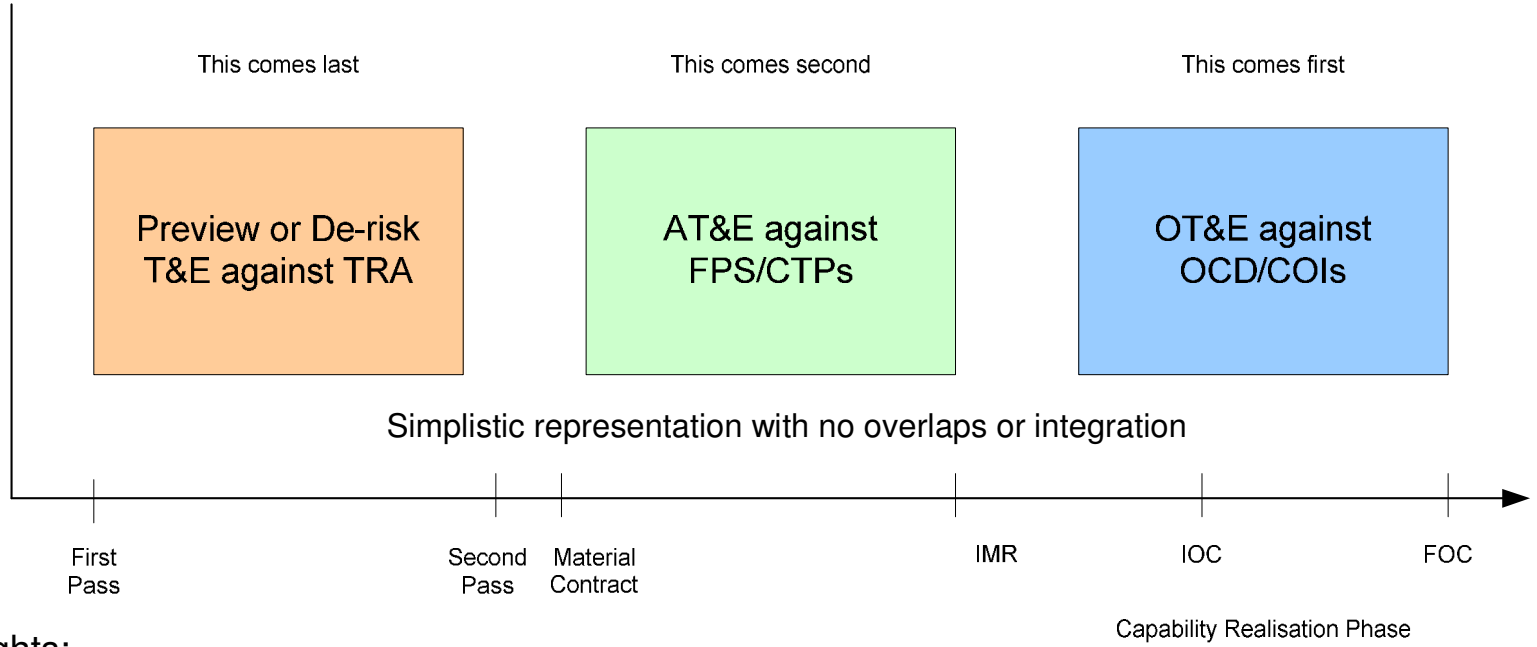
ACAT III. complex T&E = ADTEO, low risk T&E = CDG or DMO PM

ACAT II. Most projects. ADTEO with IPT support

How Preview T&E is Planned

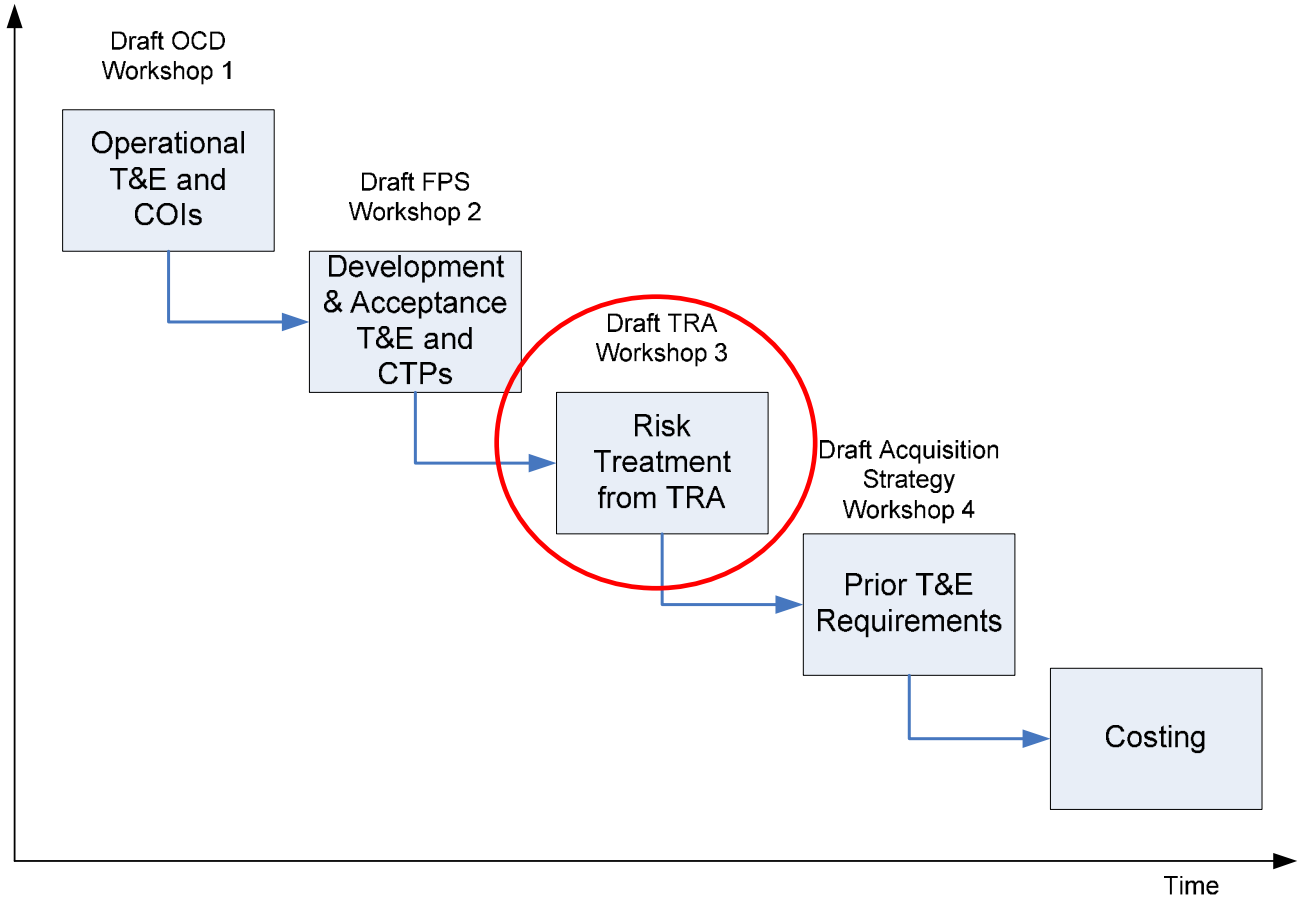


How Preview T&E is Planned



Highlights:
-TCD can begin as soon as OCD is in draft
-T&E planners begin with operational end in mind
-Order ensures comprehensive operational & acceptance T&E plans in place before planning preview T&E – keeps focus on risks & not costly early start

How Preview T&E is Planned



Examples Preview T&E Planning: Submarine

Indicative Risk	Indicative Mitigation
Poor signature assessment capability	Purchase assessment equipment. Practice assessments with extant submarine.
Anthropometric differences between Australia & country of origin	Measure sailor force to prepare for human factors assessments of computer-aided design or land-based test sites (LBTS)
Insufficient T&E plans or T&E infrastructure from current submarine (i.e insufficient LBTS) to spirally develop systems. (see RAND 2011)	Develop or access multiple LBTS (power, combat, sonar, C4ISR, Integrated Platform Management System) to prove as much of the submarine before first-of-class build

Examples Preview T&E Planning: Fighting Vehicle

Indicative Risk	Indicative Mitigation
Improvised Explosive Device (IED) survivability testing is variable between manufacturers & countries, especially to soil preparation	Conduct consistent blast tests to confirm claims
Power, space, weight & electromagnetic compatibility insufficient for unique battlegroup command & counter-IED equipment fits	Demonstrate integration
Vehicles not trialled in hot-wet climates or anthropometrically fit Australian crew	Limited user trials in hot-wet training area

Examples Preview T&E Planning: Maritime UAV

Indicative Risk	Indicative Mitigation
Radar maybe effective against small maritime targets in littoral clutter in hot-wet environment	• Embed Australian radar specialist in radar final development • Invite operational test opportunity in Australia
Remote piloting maybe ineffective in Australian SATCOM infrastructure or in direct support of Australian major fleet units	• Embed Australian communications specialist in final development • Invite operational test opportunity in Australia
Capability gap of several years if Australia waits for foreign milestone before placing production orders	• Insight through cooperative T&E program with embedded T&E personnel • Explore contributing to joint operational squadron using test crews & aircraft

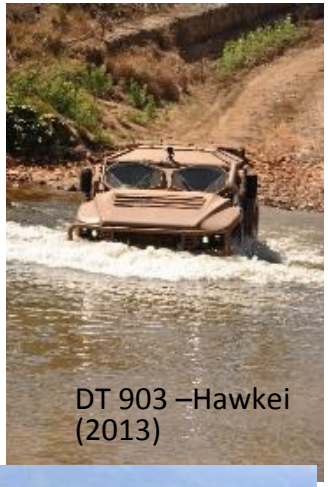
Preview T&E Conducted

DT 887 – RFA LARGS BAY (2011)

DT 921 – Pilot Training AOSG (2014)

DT 871 – LAND 121 Ph3 (2009)

DT916 L531BR Night Vision Aids (2015)


DT 903 –Hawkei (2013)

DT890 AIR 5408 MICRO-DAGR (2012)

DT 908 – LAND 125 Ph3B SCE-LCE (2013)

DT 919 – CBNRE Equip' (2015)

DT891 – Combat Boot (2012)

DT 915 – Helicopter Pilot Training AMAFTU &AOSG (2014)

- Confirm manufacturer claims of performance
- Understand different manufacturer's design philosophies
- Quantify capability differences between tendered options

What if we fail to conduct: Could this be a good outcome?

Risks to conducting preview T&E include:

(1) that the prototype is not released to foreign countries & would only be released if a commitment to buy is received,

(2) the system is no longer in production or the precise configuration we tendered is not available,

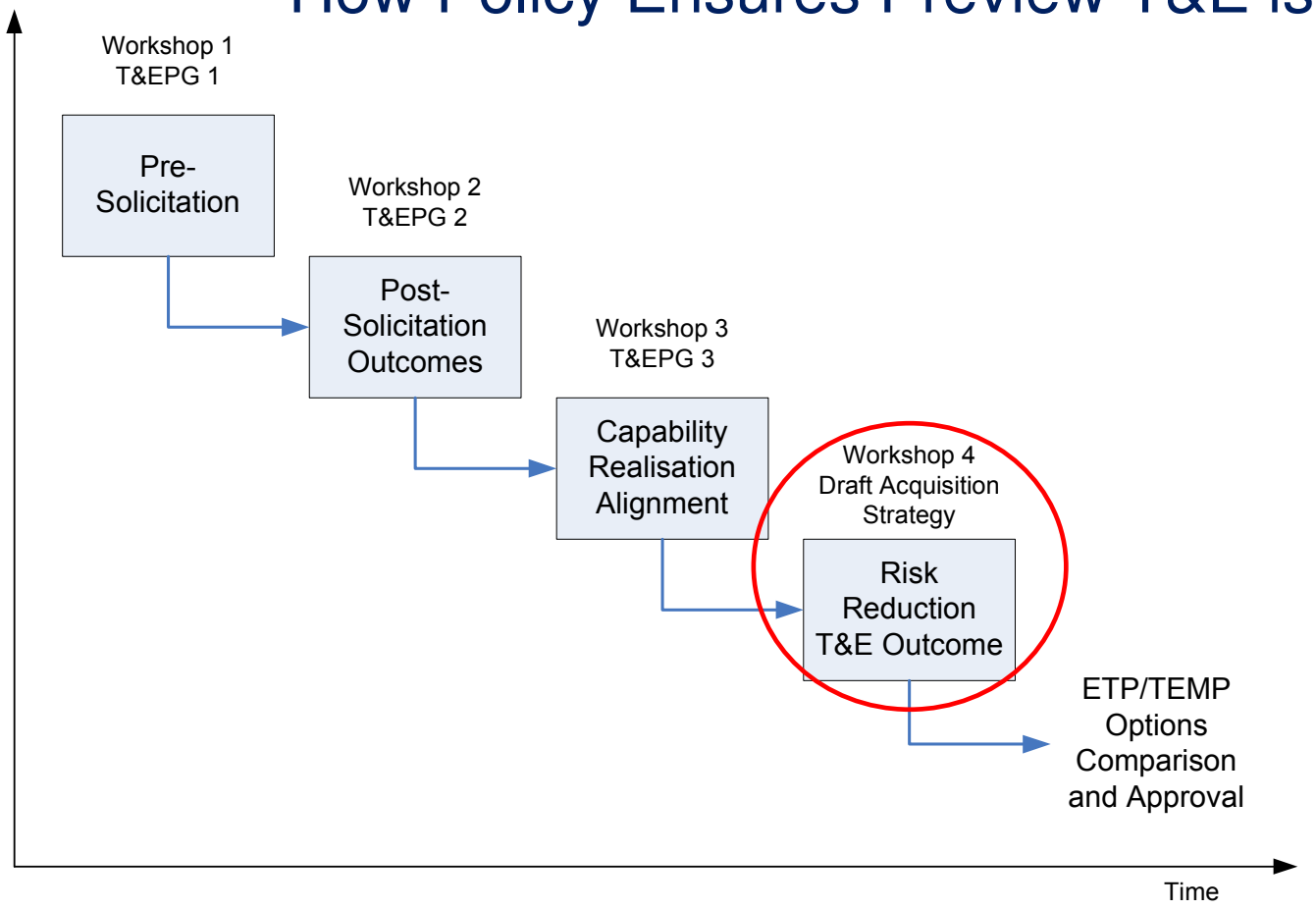
(3) Foreign government access approvals are required.

(4) Delivery to, & contractual support in Australia are problematic

Respectfully, such impediments to preview T&E are risks in the project that need to be overcome anyway before seeking Government approval to contract.

Example: The lightweight torpedo project undertook at selection to do a preview trial (ANAO, 2010, p. 110, para. 4.5). Had this occurred in 2001 it is highly likely the misunderstanding concerning the developmental nature of the torpedo would have been disclosed to Government much sooner than it was in 2005, & importantly, before contractual commitment to ship integration, aircraft integration & warstocks (ANAO, 2013). Despite extensive auditing, the reasons that the in-water trial did not proceed are unknown.

How Policy Ensures Preview T&E is Used



Legacy Submissions: Mixed Success

Legacy submissions in 2013-14 fell in three categories:

- Some T&E done but to lesser standard than preview T&E
  - SF vehicles – extensive review by test agency
- Preview T&E planned but needed to transition to Defence Trial
  - One aerospace was contentious about amount & type of T&E to conduct as it was certified OTS - found valuable issues to resolve for aircraft & simulator during contract negotiation
  - Another aerospace easily done under Defence trial
- No preview T&E planned
  - SATCOM Terminals – allowed to pass - latest example of under-estimated OTS with 1 year delay, so far
  - Large land project – inserted trial but under audit due long delays getting into contract

Even Earlier Preview T&E: Requirements Phase

Done when operationally revolutionary for ADF & it is difficult to be confident of requirements

Trial Description	Indicative Findings or Objectives
Exemplar UUV trialled in rapid environmental assessment & mine countermeasures roles to develop requirements for three maritime projects. The trial operated with a temporary fit to a Naval vessel in turbid tropical waters. A follow-on trial with an ally is examine their solutions to the risks seen.	• Multiple numbers & types of UUV necessary to perform the tasks beyond horizon. • Accuracy proportional to surfacing frequency & needs improving for revisit tasks • Very high rate of data generation by UUV. • Post-processing of data time consuming necessitating some real-time datalink & real-time re-task. • Australian turbidity & marine-life noise are significant

DT 885 – UUV for SEA 1778/JP1770 (2011)

DT 929 – US LCS MCM for SEA 1180 (2015)

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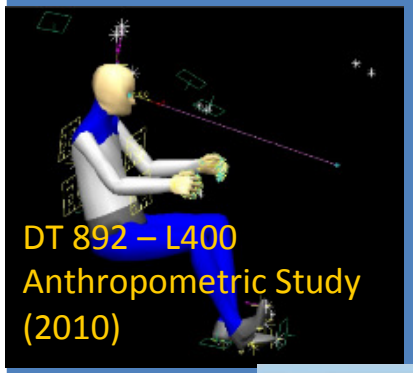
Even Earlier Preview T&E: Requirements Phase

Trial Description	Indicative Findings or Objectives
Exemplar light protected vehicle prototypes trialled for the necessary mobility & survivability to be a landrover replacement in a high-IED threat environment. DT 877 – PMV-L – LAND 121 Ph 4 (2011)	• All prototypes had features that improved the requirements in areas like visibility, safety, mobility, carrying capacity, reliability & maintainability. • Requirement to under-sling a helicopter is fundamentally challenging, causing design compromises to save space & weight. • All prototypes needed more attention to human factors in their design.
No military has an expeditionary e-Health system deployed, so proposed a trial of a developmental demonstration version. DT 917 Health Knowledge Management – JP 2060 Ph 3 (2015)	• Determine the value-for-money proposition of delivery of electronic health records in a number of expeditionary treatment conditions with representative health users.

Even Earlier Preview T&E: Requirements Phase

Trial Description	Indicative Findings or Objectives
Two trials captured anthropometric profiles of Australian soldiers & sailors to prepare for human factor assessments of candidate combat vehicles, ships & submarines.	• Australian anthropometric profiles differ from other countries. • Army profiles differ from general population • Special forces profiles differ as a subset from Army • Army profiles have undergone generational change from data of previous decades • Sailor results are not yet available • Has substantially assisted uniform & other close-equipment designs & purchases



DT 892 – L400 Anthropometric Study (2010)

DT 922 – SEA1000 Prep' for Human Factors Assess' (2015)

Conclusions

- Senate Inquiry found numerous complex projects where unrealised technical complexity lead to substantial acquisition difficulties that could have been mitigated with better T&E planning, policy & compliance.
- Government agreed to improve T&E, including mandatory provision of options for preview T&E in all capability submissions, even if the acquisition is off-the-shelf.
- New T&E policy provides a structured process to plan, conduct & assess preview T&E designed to capture & mitigate high operational & technical risks
- Aims to take preview T&E from what was largely an undocumented process involving best practice of some projects to a compulsory & comprehensive process for all.
- The process of planning & conducting preview T&E has been applied in capability submissions for two years, including use in some legacy submissions.
- Term preview T&E should be defined *as that developmental T&E conducted to evaluate the feasibility & performances of alternative capability options & identify risk areas prior to a final decision to acquire*.
- Preview T&E is usually applied during the solicitation phase through offer definition activities, however in some operationally revolutionary capabilities it should, & has been, used in the requirements phase using exemplar systems.

Future Work Studying Preview T&E

- Measure the project performance impact of the new preview T&E policy on Defence acquisitions, taking care to screen out projects that were already ‘best practice’.
- Qualitative structured interview & survey of the decision-makers & key capability submission staffs.
  - there is significant human & organisational aspects to capability submissions reflected in elements like trust, empowerment, teamwork, credibility & accountability.
  - Preview T&E brings a practical exposure component to project proposals that involves trained professionals & representative users being consulted & involved in structured ways that directly inform decision-makers.
  - Need to confirm anecdotal evidence that practical T&E activity resonates with a military culture & provides credibility & thus impetus to decision makers that is preferred over more paper-based decision-making methods.
- Broaden preview T&E to non-military complex projects.
  - Mining, transport & energy sectors where significant technical risks exist such as driverless vehicles, unmanned aerial & underwater surveying, fatigue monitoring systems, & satellite communication.
  - IT projects where there is high mortality of projects (Jenner, 2015; Flyvbjerg & Budzier, 2011)

Questions