

Australian Government

Department of Defence Capability Acquisition and Sustainment Group

Asset Management of an Ageing Aircraft Opportunities Lost and Wins Achieved



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The views expressed in this presentation are the presenters' own and do not necessarily reflect the views or policies of the Australian Government or the Department of Defence.

S-70A-9 Black Hawk Helicopter

1970s design, for combat, survivability driving design Novel features Small part of large production runs American support base with global liability Multi-environments, multiple usage profiles, optimised configurations Reliant on humans; to fly, to maintain, to supply, to manage over time

Asset Characterist

S-70A-9 is a relatively 'youthful' and 'homogenous' ageing orphan fleet

S-70A-9 Black Hawk Helicopter

Asset Role

Force multiplier

- by transportation of combat power
- by transportation of logistics
- contributing to mass effects
- conducting concurrent operations
- on land and off water
- too a tempo
- in isolation and with constraints
- surging from differing levels of preparedness
- increasingly integrated niche capability



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Asset History

Scare resource – over subscribed Redistributed – Townsville & Oakey to Sydney Operations – domestic, overseas, deliberate/reactive Complexity – reliability, maintainability, supportability

Scope

Analysis Methodology

Findings

So What?

Analysis Methodology

History

Assessed as Present Suitable Operating Effective

for a series of questions pose by CASG

Checked for coverage against a mapping of

- The Institute of Asset Management Asset Management BoK, to
- ISO55000

IAM BoK to ISO55000

An Anatomy of Asset Management

Version 3

December 2015

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CASG Key Asset Management Questions

- Is there an effective system of Asset Management in place?
- Is the Asset properly identified and characterised?
- Is there a suitable Asset Management strategy in place for the system overall and each system element?
- Has Asset Management responsibility for 'asset elements' been assigned?
- Has the Demand (requirement) for each asset element been defined and analysed?
- Do we understand the Total Cost of Ownership and cost attribution throughout the system?
- Has the supportability of each system element been properly analysed?
- Are system condition, performance, cost and life-consumption trends being tracked and analysed?
- Are ILS practices that prevent or reduce decay and cost in place?
- Are risks and issues being properly identified, acted upon and resourced?
- Are strategic Asset Management risks being properly identified and reported?
- Are opportunities for improvement being sought, proposed and implemented?

Key (asset) Management Questions

- 1. Effective system of (asset) management?
- 2. Asset properly identified and characterised?
- 3. (asset) management strategy in place for the system and each system element?
- 4. (asset) management responsibility assigned?
- 5. Demand (requirement) defined and analysed?
- 6. Understanding of Total Cost of Ownership based on sub-system cost attribution?
- 7. Supportability analysed?
- 8. System condition, performance, cost and life-consumption trends tracked and analysed?
- 9. Implementing ILS practices that prevent or reduce decay and cost?
- 10. Risks identified, acted upon and reported?
- 11. Strategic (asset) management risks identified and reported?
- 12. Opportunities sought, proposed and implemented?

Question 1 superimposed on BoK to ISO 55000 Matrix

10 Appendix A

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How the 39 Subjects map to the clauses ISO 55001:2014

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Question 3 superimposed on BoK to ISO 55000 Matrix

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How the 39 Subjects map to the clauses of ISO 35001 2014

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Question 6 superimposed on BoK to ISO 55000 Matrix

10 Appendix A

How the 29 Subjects map to the clauses of ISO 55001:2014

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Question 7 superimposed on BoK to ISO 55000 Matrix

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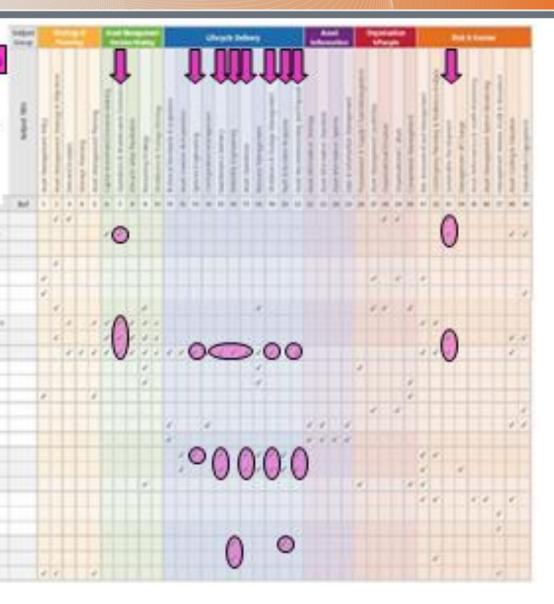
Question 9 superimposed on BoK to ISO 55000 Matrix

10 Appendix A

How the 39 Subjects map to the classes of ISO 35001:2014

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Question 10 superimposed on BoK to ISO 55000 Matrix

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Question 11 superimposed on BoK to ISO 55000 Matrix

10 Appendix A

How the 39 Subjects map to the clauses of 119 ISO 55001:2014 10010

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Question 12 superimposed on BoK to ISO 55000 Matrix

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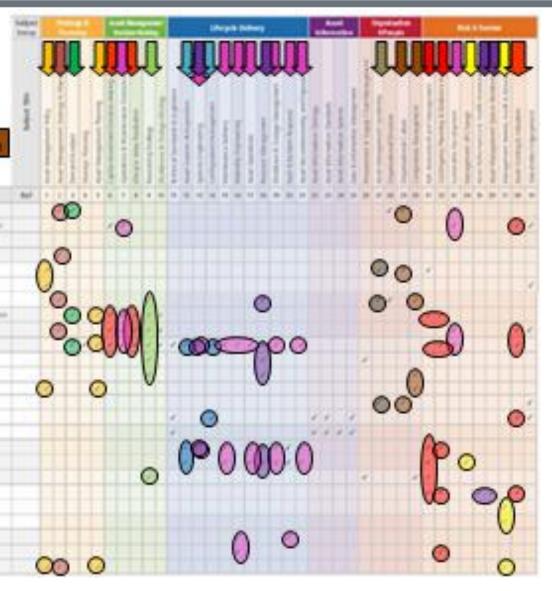
Twelve CASG Questions superimposed on BoK to ISO 55000 Matrix



How the 39 Subjects map to the clauses of rSO 55001 2014

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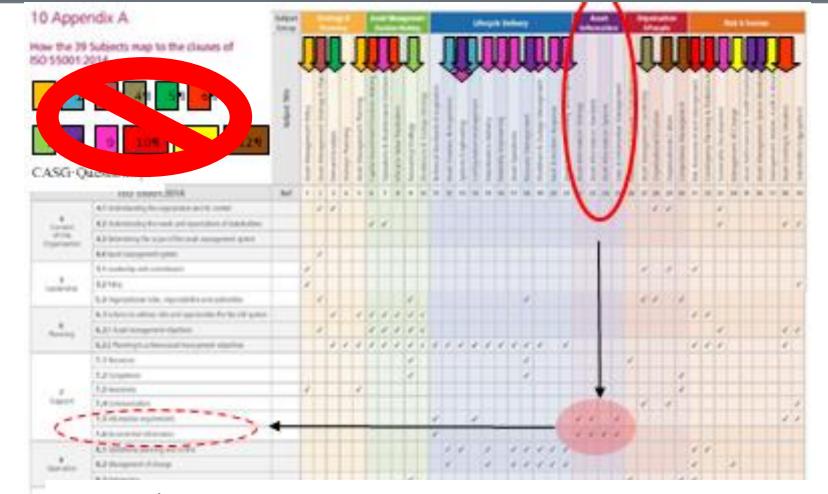
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Question Gap



Question 13: Is the (asset) management activity **integrated**?

Key (asset) Management Questions + 1

- 1. Effective system of (asset) management?
- 2. Asset properly identified and characterised?
- 3. (asset) management strategy in place for the system and each system element?
- 4. (asset) management responsibility assigned?
- 5. Demand (requirement) defined and analysed?
- 6. Understanding of Total Cost of Ownership based on sub-system cost attribution?
- 7. Supportability analysed?
- 8. System condition, performance, cost and life-consumption trends tracked and analysed?
- 9. Implementing ILS practices that prevent or reduce decay and cost?
- 10. Risks identified, acted upon and reported?
- 11. Strategic (asset) management risks identified and reported?
- 12. Opportunities sought, proposed and implemented?
- 13. Is the (asset) management activity integrated?

Data History

Defence Annual Reports ANAO Reviews and Audits Project Closure Report Fleet Management Records Interviews

Caveat: incomplete records, eye of the beholder

Overall View what is

Asset Management Success ?

"in balance", "low volatility", "working to plan"

- "Achievements" trending with consistency
- Delivering outputs in an "good" range
- "Cost per unit" rationale

That reflects/approximates/empirical/proxy for *capability assurance*?

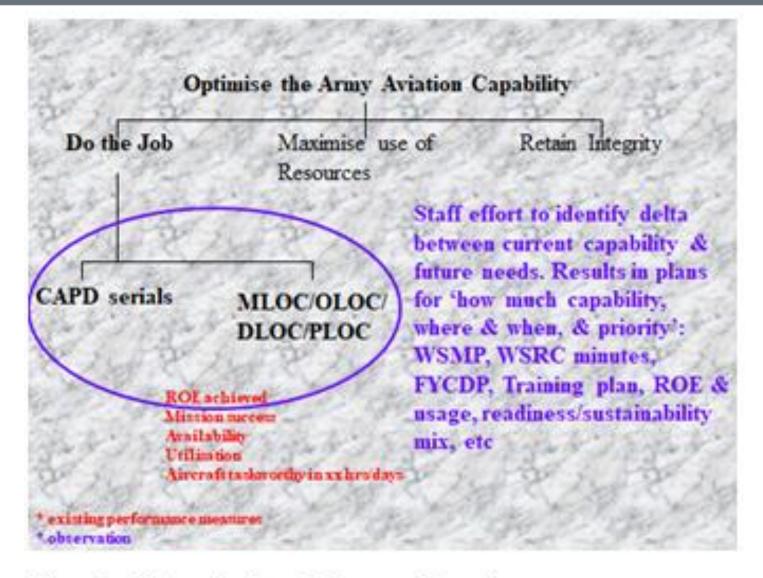


Figure 3 - ROE as a Dominant Performance Measure²

Capability Assurance

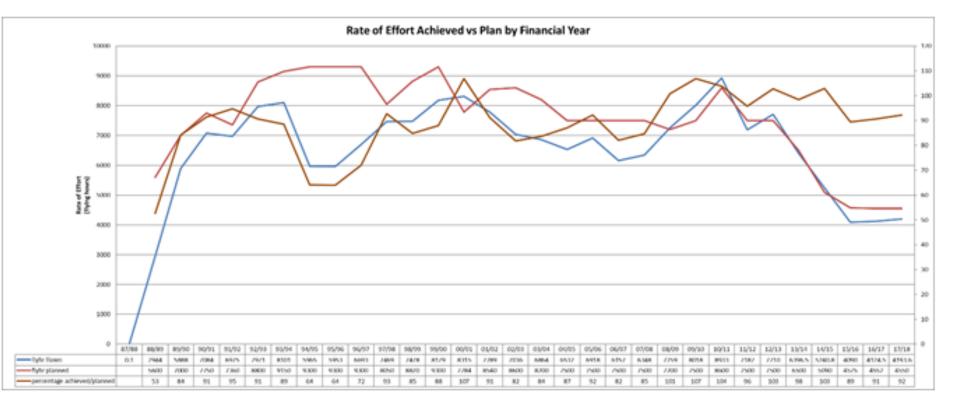
Asset Management Success ?

"in balance", "low volatility", "working to plan"

- "Achievements" trending with consistency
- Delivering outputs in an "good" range
- "Cost per unit" rationale

Meaningfully achieving planned rate of effort over sequential years matched to Consistent resourcing for that output

Doing the Job



Is blue on red? Is brown consistent year-to-year?

Doing the Job – by Phases

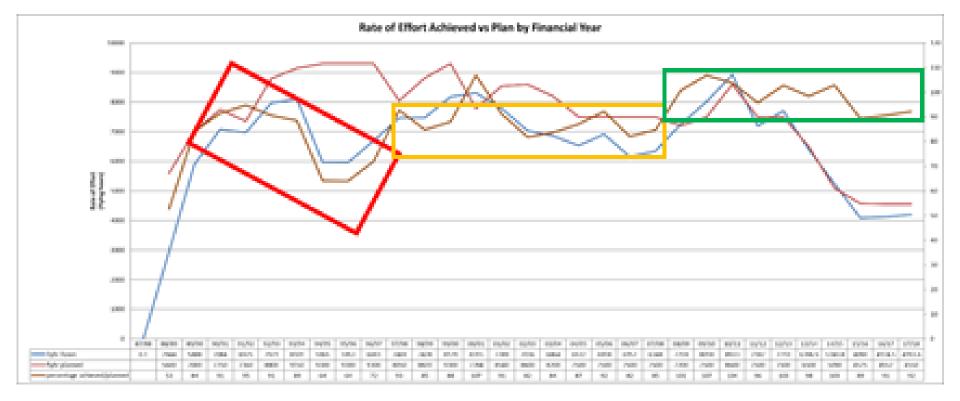


Figure 4 - ROE Achieved vs Plan³ by FY - Stability over Successive Years

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Rate of Effort matched to Funding by Financial Year

Is blue on red? Is purple consistent year-to-year?

Maximised use of Resources – by Phases

Rate of Effort matched to Funding by Financial Year 1000 1000 1.000 100 All and a second second 120 0.000 -100 1000 NUMBER OF STREET 100,000 tearing inspired and the second 10.00 1000 1.000 10.00 1000 10,000 1000 10000 100,000 10,000 states in the second States - States 1000 100,000 depine -100103 100103 1000 100,000 Colors, State Apple Name 11.1 1000 1000 1000 Acres 1 1.000 1000 hate strength and the (result) French. 10.000 1000 1000 1.000 100.00 10000 1000 1.000 100.00 and the second Press. 1000 And Sectors 100 1000 1000 1.000 1000 250 BAR 1000 1.1.11 1000.01 1.000 124.0 100.00 1.000 1000 1000 Autor Manager reason around reason around the second party ALC: NOT ALC: NOTE: N 100.000 100.1 122.00 100.00 82 A. Sec. 4

Figure 5 - ROE Achieved vs Plan by FY - Expended Funds/Flying Hour Stability

Phase 1 – Introduction to Service

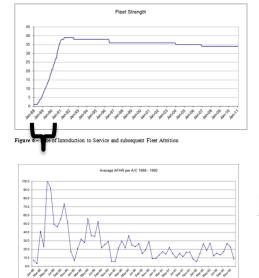


Figure 7- Average Flying Hours per Aircraft at start of Introduction to Service



1988 to mid-1990s

- 3 years to deliver inclusive of 14 mths delivery slippage
- Tracking to towards 9300 FLYHRS ROE but stalled in 1994
- Insufficient funding base
- Insufficient spares
- Insufficient maintenance capacity
- OP GEMINI 1993
- OP LAGOON 1994

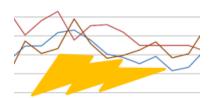
Phase 1 POSE Assessment

			1200422250			
	Question	Synopsis during Introduction into Service	P	S	0	E
1	Effective system of (asset) management?	Acquisition transition resulted in inadequate in-service logistics. Navy, Army and Air Force in-service management unable to deliver capability as planned.	х			
2	Asset properly identified and characterised?	Characterisation incomplete.	х			
3	(asset) management strategy in place for system and each system element?	Assumptions for sustaining weapon system and major components – turn times, usage, cost – flawed. Fleet well sized for attrition and flight simulator	x			x4
4	(asset) management responsibility assigned?	Improved during period. Enactment of the WSLM construct in late 1993 established unity of command for the major system and sub-systems. Friction existed with 'commons' and ADFLM support arrangements.	x	x		
5	Demand (requirement) defined and analysed?	Limited to Acquisition estimates.	х			
6	Understanding of Total Cost of Ownership based on sub-system cost attribution?	Limited to Acquisition estimates.				
7	Supportability analysed?	Excessive 'noise' from inherent and repeated instability in-service support system rendered elements incomprehensible.	х			
8	System condition, performance, cost and life-consumption trends tracked and analysed?	Early in life-cycle; instability in all support systems. Bottom-up zero-based budgeting initiated with adoption of WSLM in 1993 drew upon very limited known cost drivers data.	x			
9	Implementing ILS practices that prevent or reduce decay and cost?	Project IL SP created late 1987, focused on interim support in 1988 and 1989. Significant interlude to first in-service IL SP created in 1994.	х			
10	Risks identified, acted- upon and reported?	Regular reporting by Operating Units and flow of US Army and OEM data. Incorrect in-service maintenance man-hours, repairable item turnaround time and inadequate funding - all 'surprises'.	x	x	x	
11	Strategic (asset) management risks identified and reported?	Acquisition assumptions not identified as risks - maintenance man-hours, repairable item turnaround and inadequate funding - all 'surprises' – and no contingency in place when they were realised.				
12	Opportunities sought, proposed and implemented?	Activity was reactive - dominated by response to emerging constraints; insufficient spares, unscheduled nuisance cracking, and funding shortfalls.				
13	Is the (asset) management activity integrated?	Acquisition to In-service - no. Between Services at in-service - no. Within Army capability elements - no. Within logistics - yes, tentatively only after implementation of WSLM	x			

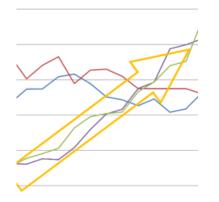
- By mid 1991 backlog of 10 aircraft for R3 (ILM activity)
- 'Operators yet to realise that capacity of logistics support arrangements is the limiting factor in setting and achieving flying rates, not authorised ROE' 1991
- Seven years to outpace logistics support basis 1994
- WSLM formed 1993
- Joint Directive 1995



Phase 2 – Capability Recovery







00/01 01/02 02/03 03/04 04/05 05/06 06/07 8179 8315 7788 7096 6864 6532 6608 6157 6348 9300 7784 8540 8600 8200 7500 7500 7500 34/3 4160 51/3 665/ 6331 7513 7858 9749

mid-1990s to mid-2000

Dominated by Operations

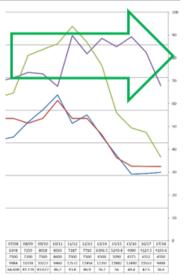
- PLES DRAI
- AUS INDO JAYA
- GOLD
- PAKISTAN ASSIST
- INTERFET 2000-2004 & East Timor 2006-2013 •
- Realistic management of ROE requirement
- Structural nuisance cracking
- Some year to year performance consistency, flown ROE tracking plan in band 80-100%
- Funding \$3k/FLYHR to \$10k/FLYHR over 10 years

	Question	Synopsis during Capability Recovery	P	S	0	E
1	Effective system of	Aviation command and control effected.	r	2	•	E
1	(asset) management?	Quality management system enacted.				
	(asset) management.	Navy-Air Force WSLM coordination matured	х	Х	х	
		Minor project synchronisation improved.				
2	Asset properly	ADFLM and commons items teams better defined 'asset'				\vdash
-	identified and	boundary. Aircraft sub-systems still 'surprising'.				
	characterised?	Integrated aircraft and support system to multiple Navy	х	х		
	cildideterised:	ships.				
3	(asset) management	Inventory management and MRD matured.				\vdash
1° .	strategy in place for	Data gathered and purified to populate bespoke models.				
	system and each system	Performance monitored.	Х	х	х	х
	element?	Data driven, reliability-based, decision making.				
4	(asset) management	WSLM construct bedded in				\vdash
· ·	responsibility assigned?	Capability management interaction maturing.	х	х	х	х
5	Demand (requirement)	Use of predictive models - PATTRIC, AIMS - but				\vdash
-	defined and analysed?	challenged to work with repairables.	Х	Х	х	
6	Understanding of Total	Purifying data to feed DSTO model, decision to have				\vdash
l °	Cost of Ownership	organic cost modelling capability.				
	based on sub-system	Modelling informed fleet strategic decisions.	х	х	х	х
	cost attribution?	Roderning informed neer strategic decisions.				
7	Supportability	Fleet management cause and effect relationships				\vdash
1	analysed?	understood, budgeted and enacted.	х	Х	х	
8	System condition.	Number of corporate and in-house performance				\vdash
•	performance, cost and	measurement systems meeting decision-maker RFIs. Data				
	life-consumption trends	and analysis lagging by up to 2 months.	х	х	х	
	tracked and analysed?	and analysis lagging by up to 2 months.				
9	Implementing ILS	In-service IL SP periodically updated.				\vdash
	practices that prevent or	Improved industry support-base.	x	x	х	x
	reduce decay and cost?	Insights from Ageing Aircraft Audit reduced conservatism.	^	^	^	^
10	Risks identified, acted-	Defect reporting management able to draw on purified				\vdash
1.0	upon and reported?	failure data for better maintenance/reliability response.	х	Х	х	
11	Strategic (asset)	Monthly report internal to DMO/CASG.				\vdash
	management risks	Twice yearly reporting to Chief of Army.	x	x	х	x
	identified and reported?	rente yearly reporting to onler or runny.	^	^	^	^
12	Opportunities sought,	Limited by discretionary resources and commercial				\vdash
1.4	proposed and	opportunity.				
	implemented?	Regularly updated comprehensive procedures synchronised	х	Х	Х	
	ing remember :	across capability.				
13	Is the (asset)	New minor capability Acquisition to In-service – yes.				\vdash
	management activity	Between Services – improved.				
	integrated?	Within Army capability elements – yes.	х	х	х	х
	uneBarea:	Between WSLMs/SPOs - improved				
		Detween wonneror of - improved				

- HQ Aviation Support Group 1996
- COMD Divisional Aviation 2000
- HQ 16 Bde (Avn) 2002
- 6 Avn Regt 2007
- Gaining knowledge:
 - Ageing Aircraft Audit
 - Life Cycle Costing
 - Education
 - MRD
- Twelve years to recover support basis

Phase 3 – Delivering Capability





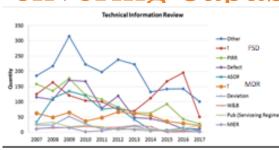
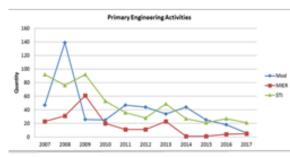
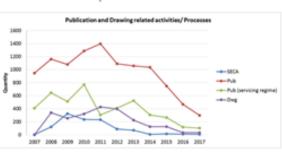


Figure 8 - Change in Technical Information Review 2007 - 2017







mid-2000 to present

- Flown ROE tracking plan in band 90-110%
- Funding stabilised in band \$10-12k/FLYHR over 10 years
- Consolidation in Sydney region
- Engineering workload decreasing:
 - ASORs & MDRs
 - Modification
 - MIERs

Figure 10 - Change in Supplementary Engineering Changes, Publications and Drawings activities 2007 - 2017

			ter fr	-//		<u>_</u>	7
	Question	Synopsis during Capability Delivery	P	S	0	E]
1	Effective system of (asset) management?	Aviation command and control matured; surges managed. Integrated Aviation safety review and management conducted. Capability expansion and then contraction managed. Minor capability projects effectively integrated.	x	x	x	x	
2	Asset properly identified and characterised?	Whilst an ageing aircraft, relatively few 'surprises'.	х	х	х	x	
3	(asset) management strategy in place for system and each system element?	Efficient policy in place but gradual loss of MRD capability risks opportunity to make bold adjustments.	x	x	x	x	
4	(asset) management responsibility assigned?	WSLM construct remains robust. Effective transition of Regulatory frameworks.	х	х	х	х	
5	Demand (requirement) defined and analysed?	High organic proficiency and knowledge of cost drivers, industry performance and logistics effect.	х	х	х	х	
6	Understanding of Total Cost of Ownership based on sub-system cost attribution?	Effective systems developed, but loss of effective costing modelling capability during 2010-2015/16, partially restored. Knowledge retained by key individuals (not systemic).	x		x	x	
7	Supportability analysed?	Fleet management cause and effect relationships understood, budgeted and enacted with accuracy.	х	х	х	х	
8	System condition, performance, cost and life-consumption trends tracked and analysed?	In-house performance measurement systems meeting decision-maker RFIs.	x	x	x	x	
9	Implementing ILS practices that prevent or reduce decay and cost?	In-service ILSP current and refocused for withdrawal and disposal.	x	х	х	х	
10	Risks identified, acted- upon and reported?	Defect reporting improved with greater use of digital pictures and electronic forms.	х	х	x		
11	Strategic (asset) management risks identified and reported?	MSA/PMP effective. Prompt crisis resolution.	x	x	x	x	
12	Opportunities sought, proposed and implemented?	Better aviation planning has allowed for both realistic contingency planning and concurrent cost minimisation.	x	x	x	x	
13	Is the (asset) management activity integrated?	Aided by system simplification as all operations conducted from a single airfield. Cessation of S-70B-2 Seahawk operations negated common item management arrangements.	x	x	x	x	

- Able to recover from surge
- Exploiting knowledge:
 - Strategic LOT investments
 - Synchronised VFM contracting
 - BAU replacing crisis

But signs of weakening with loss of corporate know-how

Phase 1, 3 and 3 POSE Assessments

	Question	Synopsis during Introduction into Service	Р	SOE	Synopsis during Capability Recovery	Р	S (E	Synopsis during Capability Delivery	P	\$	0	E
1	Effective system of (asset) management?	Acquisition transition resulted in inadequate in-service logistics. Navy, Army and Air Force in-service management unable to deliver capability as planned.	x		Aviation command and control effected. Quality management system enacted. Navy-Air Force WSLM coordination matured. Minor project synchronisation improved.	x	x		Aviation command and control matured; surges managed. Integrated Aviation safety review and management conducted. Capability expansion and then contraction managed. Minor capability projects effectively integrated.	x	x	x	x
2	Asset properly identified and characterised?	Characterisation incomplete.	x		ADFLM and commons items teams better defined 'asset' boundary. Aircraft sub-systems still 'surprising'. Integrated aircraft and support system to multiple Navy ships.	x	x		Whilst an ageing aircraft, relatively few 'sarprises'.	x	x	x	
3	(asset) management strategy in place for system and each system element?	Assumptions for sustaining weapon system and major components - turn times, usage, cost - flawed. Fleet well sized for attrition and flight simulator	x		Inventory management and MRD matured. Data gathered and purified to populate bespoke models. Performance monitored. Data driven, reliability-based, decision making.	x	х		Efficient policy in place but gradual loss of MRD capability risks opportunity to make bold adjustments.	x	x	x	
4	(455c) management responsibility assigned?	Improved during period. Enactment of the WSLM construct in late 1993 established unity of command for the major system and sub-systems. Friction existed with 'commons' and ADFLM support arrangements.	x		WSLM construct bedded in. Capability management interaction maturing.	x	х		WSLM construct remains robust. Effective transition of Regulatory frameworks.	x	x	x	x
5	Demand (requirement) defined and analysed?	Limited to Acquisition estimates.	х		Use of predictive models – PATTRIC, AIMS – but challenged to work with repairables.	х	X)	¢.	High organic proficiency and knowledge of cost drivers, industry performance and logistics effect.	х	х	х	х
6	Understanding of Total Cost of Ownership based on sub-system cost attribution?	Limited to Acquisition estimates.			Purifying data to feed DSTO model, decision to have organic cost modelling capability. Modelling informed fleet strategic decisions.	x			Effective systems developed, but loss of effective costing modelling capability during 2010-2015/16, partially restored. Knowledge retained by key individuals (not systemic).				
7	Supportability analysed?	Excessive 'noise' from inherent and repeated instability in-service support system rendered elements incomprehensible.	x		Fleet management cause and effect relationships understood, budgeted and enacted.	x	хJ	¢.	Fleet management cause and effect relationships understood, budgeted and enacted with accumey.	x	x	x	x
8	System condition, performance, cost and life-consumption trends tracked and analysed?	Early in life-cycle; instability in all support systems. Bottom-up zero-based budgeting initiated with adoption of WSLM in 1993 drew upon very limited known cost drivers data.	x		Number of corporate and in-house performance measurement systems meeting decision-maker RFIs. Data and analysis lagging by up to 2 months.	x	хJ	c i	In-house performance measurement systems meeting decision-maker RFIs.	x	x	x	
9	Implementing ILS practices that prevent or reduce decay and cost?	Project ILSP created late 1987, focused on interim support in 1988 and 1989. Significant interlude to first in-service ILSP created in 1994.	x		In-service ILSP periodically updated. Improved industry support-base. Insights from Ageing Aircraft Audit reduced conservatism.	х	хЭ	٢	In-service ILSP current and refocused for withdrawal and disposal.	x	x	x	x
10	Risks identified, acted- upon and reported?	Regular reporting by Operating Units and flow of US Army and OEM data. Incorrect in-service maintenance man-hours, repairable item turnaround time and inadequate funding - all 'surprises'.	x	x	Defect reporting management able to draw on purified failure data for better maintenance/reliability response.	x	x		Defect reporting improved with greater use of digital pictures and electronic forms.	x	x		
	Strategic (asset) management risks identified and reported?	Acquisition assumptions not identified as risks - maintenance man-hours, repairable item turnaround and inadequate funding - all 'surprises' - and no contingency in place when they were realised.			Monthly report internal to DMO/CASG. Twice yearly reporting to Chief of Army.	x	хJ	¢.	MSA/PMP effective. Prompt crisis resolution.	x	x	x	x
	Opportunities sought, proposed and implemented?	Activity was reactive - dominated by response to emerging constraints; insufficient spares, unscheduled nuisance cracking, and funding shortfalls.			Limited by discretionary resources and commercial opportunity. Regularly updated comprehensive procedures synchronised across capability.	x	x	¢.	Better aviation planning has allowed for both realistic contingency planning and concurrent cost minimisation.	x	x	x	x
13	Is the (asset) management activity integrated?	Acquisition to In-service – no. Between Services at in-service – no. Within Army capability elements – no. Within logistics – yes, tendatively only after implementation of WSLM.			New minor capability Acquisition to In-service – yes. Between Services – improved. Within Army capability elements – yes. Between WSLMs/SPOs – improved	x	xJ	c	Aided by system simplification as all operations conducted from a single airfield. Cessation of S-70B-2 Seahawk operations negated common item management arrangements.	x	x	x	x

What Worked – the wins

Unity of Command

Data purification, Information analysis, Knowledge retention

Growing an informed and educated vertically integrate team

Synthesis of 'system, support arrangements, people managing' by experience

In Retrospect ... if ... the losses

Timeliness: evolve, crawl, walk, run

- Suboptimal starting conditions, not even empirical relationships
- Incomplete model of 'asset' being managed = long learning curve
- Lack of integrated efforts; develop trust
- Lack of a philosophy, schema of 'big picture'

Responsive Resourcing

- Time effect of cash on changing support base cycle time
- Contingency matched to risk

Flexible Planning compensated by hard work