

Chapter 1 – INTRODUCTION

1.1 BACKGROUND

The Research Task Group on cost structures and life cycle costs for military systems (RTG SAS-028) developed a Generic Life Cycle Cost Breakdown Structure (GCBS) and associated definitions that could be used in any military programme to construct its own cost breakdown structure (Reference RTO-TR-058). The group also conducted an analysis on the way to use life cycle costs in the decision making process.

The participating nations proposed a follow on activity to examine methods and models for life cycle costing. This was assumed to be a set of techniques for cost modelling, cost prediction and analysing the life cycle costs of a system at any stage of its life.

At the November 2002 meeting in Brussels, the SAS Panel decided to form the Exploratory Team SAS ET-AH on methods and models for life cycle costing (SAS ET-AH). The SAS Panel recommended that the first meeting of the new group must be organised not earlier than March 2003 to allow time for national distribution and scrutiny of the SAS-058 Technical Report.

The first meeting of the SAS ET-AH was held over the 8th and 9th July 2003 in Brussels. The SAS ET-AH presented their Terms of Reference (TOR) and Technical Activity Proposal (TAP) for approval at the SAS Panel business meeting in November 2003. The team recommended a task group as the most appropriate way to conduct this study. The SAS Panel accepted this proposal at its November 2003 meeting, and at its March 2004 meeting the NATO Research and Technology Board approved a new Task Group SAS-054/RTG on “Methods and Models for Life Cycle Costing”. The first meeting of SAS-054 took place on the 25th and 26th May 2004 at NATO Headquarters, Brussels, BELGIUM.

1.2 JUSTIFICATION

There is a long and documented history of both cost growth and estimating optimism within military programmes. This is particularly the case for multi-national programmes. The NATO ALP-10 –Guidance on Integrated Logistics Support for multi-national equipment projects (ILS) dated June 1990 (Reference NATO ALP10) states the following: multi-national equipment projects will be required to implement a life cycle cost programme. The purpose of this programme is to ensure that the developed system will have the lowest possible life cycle cost consistent with performance and schedule requirements. To achieve this goal, operation and support cost estimates assist designers and programme managers to focus their attention on those design aspects that drive costs. The process of generating realistic cost estimates is based on the application of appropriate methods and models. It is essential that future NATO programmes have a framework within which to start generating realistic and consistent life cycle cost estimates. The first step in this framework was to develop the generic life cycle cost breakdown structure under RTG SAS-028. The next step was to define methods and models within this framework which is the subject of this report.

The review and dissemination of the methods and models for life cycle cost estimates will enhance the procurement process where life cycle costs was a constituent part of the decision-making process. It was expected that the planned framework would:

- Ensure consistency of the life cycle costing approach within NATO programmes.
- Reduce the effort needed to conduct the life cycle costing analysis.
- Reduce the time schedule to conduct the life cycle costing analysis.
- Enhance individual nation’s life cycle costing practices.

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- Provide an understanding of NATO and PfP nations' methods and models.
- Provide guidance to nations not familiar with life cycle costing.

1.3 LIFE CYCLE COST MANAGEMENT IN NATO

1.3.1 Life Cycle Cost Management Purpose

Life cycle cost management (Reference: Life Cycle Management in NATO. A report to CNAD, edition 2, 2002) includes the processes required to determine which resources (people, equipment, services, material etc.) and what quantities of each should be used to perform project/system activities, develop an estimate, of the associated cost and allocate them to individual work items. These processes are aimed to estimate system life cycle cost for decision making and budget allocation and to ensure that the system activities are performed within the approved budget and according to the operational requirements fixed.

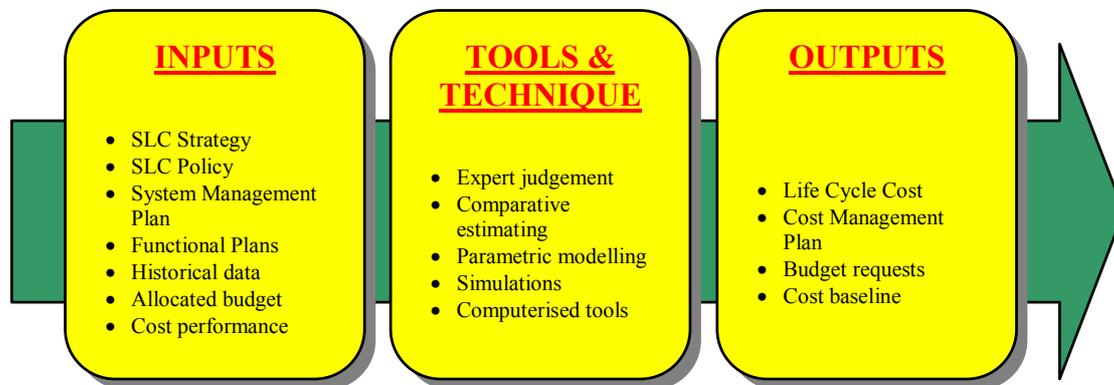


Figure 1-1: NATO Life Cycle Cost Management.

1.3.2 Life Cycle Cost Management Activities

- **COST PLANNING**
 - Develop the life cycle cost management plan and define the procedure by which the data are collected and managed.
 - Define the procedure for cost baseline allocation, change and configuration control.
 - Define the cost breakdown structure (CBS) that will be used throughout the system life cycle.
- **COST ESTIMATING**
 - Identify the activities related to the CBS and estimate the associated cost.
 - Establish a cost baseline for measuring life cycle cost performance improvement.
- **COST BUDGETING**
 - Allocate cost estimates to individual work items (related to the financial policy) in order to initiate the procedure for the allocation of the budget.
 - Monitor and record cost performance¹.

¹ In this context cost performance means the monitoring and control of the cost estimate against the actuals.

- **COST ASSESSMENT AND CONTROL**

- Detect cost variances from baseline.
- Assess the “why” of both positive and negative variances and their impact (level of risk) on LCC and the allocated budget.
- Ensure that all appropriate changes are recorded in the cost baseline.
- Initiate the change request procedure for the allocation of budget.

1.4 OBJECTIVES OF SAS-054

There are many methods and models available to conduct life cycle cost analysis. It was important to understand the applicability and boundaries of each method and model in order to recommend and use them appropriately when conducting life cycle cost analysis.

The core objective of the SAS-054 task group was to understand NATO and PfP nations’ methods and models and promulgate good practice. The primary focus was on methods and models that were developed within member nations. However, it was pertinent to recognise that commercial methods and models form an important and integral part of the toolset available to cost estimators and analysts. In order to meet the above aspiration the following objectives for the SAS-054 Task Group were defined as:

- Review of cost forecasting models.
- Review of cost forecasting methods.
- Guidelines for the collection and understanding of cost related data for national and multi-national programmes.
- Treatment of uncertainty and risk.
- Guidelines for multi-national programmes.
- Awareness of new developments in methods and models.
- Review and possible enhancement of the NATO generic cost breakdown structure.

The final deliverable of the study is a technical report containing the outputs from the objectives above. It was also expected that the SAS-054 task group will implement additional mechanisms for presenting the results. This could take the form of a symposium, lecture series, workshops or other formats.

The task group was initiated in Spring 2004 and submitted its final report to the SAS Panel at the Fall 2006 meeting.

1.5 SAS-054 STUDY APPROACH

At the initial meeting a matrix was developed for capturing the methods and models used by all the participating nations. This comprised a number of questions (see Table 1-1) that were applicable to each of the NATO Phased Armaments Programming System (PAPS) (The handbook was published in February 1989 as AAP-20 (Allied Administrative Publication) by the Defence Support Division of the NATO International Staff).

The responses from the questionnaire were used to understand and debate the issues that were relevant to life cycle costing. In this way information was captured in a cohesive and auditable manner. Each nation was then allocated a task that could be presented at a collective meeting and thoroughly discussed to gain a clear understanding of the topic. The completed matrix for each nation is given at Annex A.

Table 1-1: Summary Matrix Questions for Each Participating Nation

Question	Description
Indicate the type of costing studies required.	Nations were to state the reason for undertaking the cost study and show what the output was used for.
Description of the process or national guideline to be followed – how are we going to do this?	Nations were to state if there is a national guideline or process to be followed.
What methods are used?	Nations were to state the methods (Reference: Chapter 4) used at the different phases of the life cycle.
What models are available? – Commercial models.	State the commercial off the shelf (COTS) models (Reference: Chapter 5) used to achieve the required costing outputs.
What models are available? – In-house developed models.	List any formal models (Reference: Chapter 5) that had been developed in-house. Ideally these models would have been verified and validated as being “fit for purpose”.
Requirements to apply national guideline.	State if mandated by national government approval authorities or by departmental procedures.
Requirements to apply methods.	State if mandated by the national government approval authorities or by departmental procedures.
Requirements to apply models.	State if mandated by the national government approval authorities or by departmental procedures.
Restrictions on applicable methods or models depending on the goal.	State any barrier that may cause the method or model to be either unworkable or to rely on subjective judgement instead of data.
How can data be collected?	State if any automated system is used for collecting data (Reference: Chapter 6).
How is risk and uncertainty considered?	State the method used to identify, collect and analyse risk and uncertainty data (Reference: Chapter 7).
What models and tools are available to assess uncertainty?	State the commercial or in-house models used to produce stochastic or deterministic results through Monte Carlo modelling.
What models and tools are available for risk analysis?	State the commercial or in-house models used to collect and manage risk information.
Requirements to apply risk methodology.	State if risk assessment methodology is mandated by national government approval authority or departmental procedures.

1.6 IMPLEMENTATION OF THE GUIDELINE

The use of life cycle costing should be encouraged both within government departments and defence contractors. Therefore, the overall objective of this report is to produce a guideline that can be used by NATO and PfP nations, defence contractors and equipment suppliers in both national and multi-national programmes. To achieve this, the implementation process for the guideline may include:

- Advertising and publishing the guideline.
- Developing some examples to demonstrate the life cycle costing process that can be adopted at the various stages of the product life cycle.
- Organising technical seminars, lecture series and workshops.
- Develop an improved NATO Standardisation Agreement (STANAG) on life cycle costing. However, this would have to explicitly describe in detail how it should be conducted and what is realistically achievable at each stage of the life cycle.

The above list is not exhaustive and other implementation approaches may be considered. However, to be successfully conducted by NATO and PfP nations and equipment suppliers it will be essential to disseminate the life cycle costing process and techniques together with worked examples in order to gain the support of everyone.

During the study, SAS-054 contacted the life cycle management group (AC/327). One of the tasks of this group is the responsibility for the development of NATO policies (e.g. STANAGs) related to life cycle management. In December 2005, the AC/327 subgroup B working group 3 was established. This working group is tasked to develop guidance on the application and implementation of NATO policy relating to life cycle costing in support of the NATO System Life Cycle Management (SLCM) policy (Reference: C-M(2005)0108-AS1 dated January 2006).

The working group (AC/327) is the official and proper body to implement the RTO SAS-054 guideline within NATO and PfP nations.

Further details on the work of AC/327 subgroup B Working Group 3 can found in their Terms of Reference (Reference: PFP(AC/327-SG/B)D(2005)0003 dated December 2005).

1.7 STRUCTURE OF THE REPORT

In addition to this introduction, the structure of the report comprises the following chapters.

- Chapter 2:** Describes the role of life cycle costing in the decision making process. It examines the scope to be considered, its limitations and purpose in terms of budget planning, option analysis and cost reduction.
- Chapter 3:** Provides a detailed insight into life cycle costing activities across each of the NATO PAPS phases.
- Chapter 4:** Gives details on the life cycle costing methodologies that can be employed during each of the NATO PAPS phases.
- Chapter 5:** Discusses life cycle costing models in terms of what is available, the appropriate applications and a brief on current models employed by NATO and PfP nations in conducting life cycle costing and subsequent cost analysis.

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- Chapter 6:** Discusses the issues and considerations found when examining each nation's processes for data collection to support the life cycle costing activities.
- Chapter 7:** Provides the basis for the measurement of uncertainty and risk and how this should be used in life cycle costing and subsequent cost analysis.
- Chapter 8:** Considers any other life cycle costing issues and considerations that have been identified during the study.
- Chapter 9:** Highlights new developments in life cycle costing and cost analysis.
- Chapter 10:** Discusses any enhancement to the SAS-028 cost breakdown structure as a result of this study.
- Chapter 11:** Provides a summary of the findings and conclusions.
- Chapter 12:** Provides the recommendations.
- Annex A:** Provides the completed matrix completed by each nation.
- Annex B:** Provides examples of data forms for capturing the costs at the production phase.
- Annex C:** Provides examples of typical life cycle cost questionnaires.
- Annex D:** Provides a list of life cycle cost definitions.
- Annex E:** PAPS milestone definitions.