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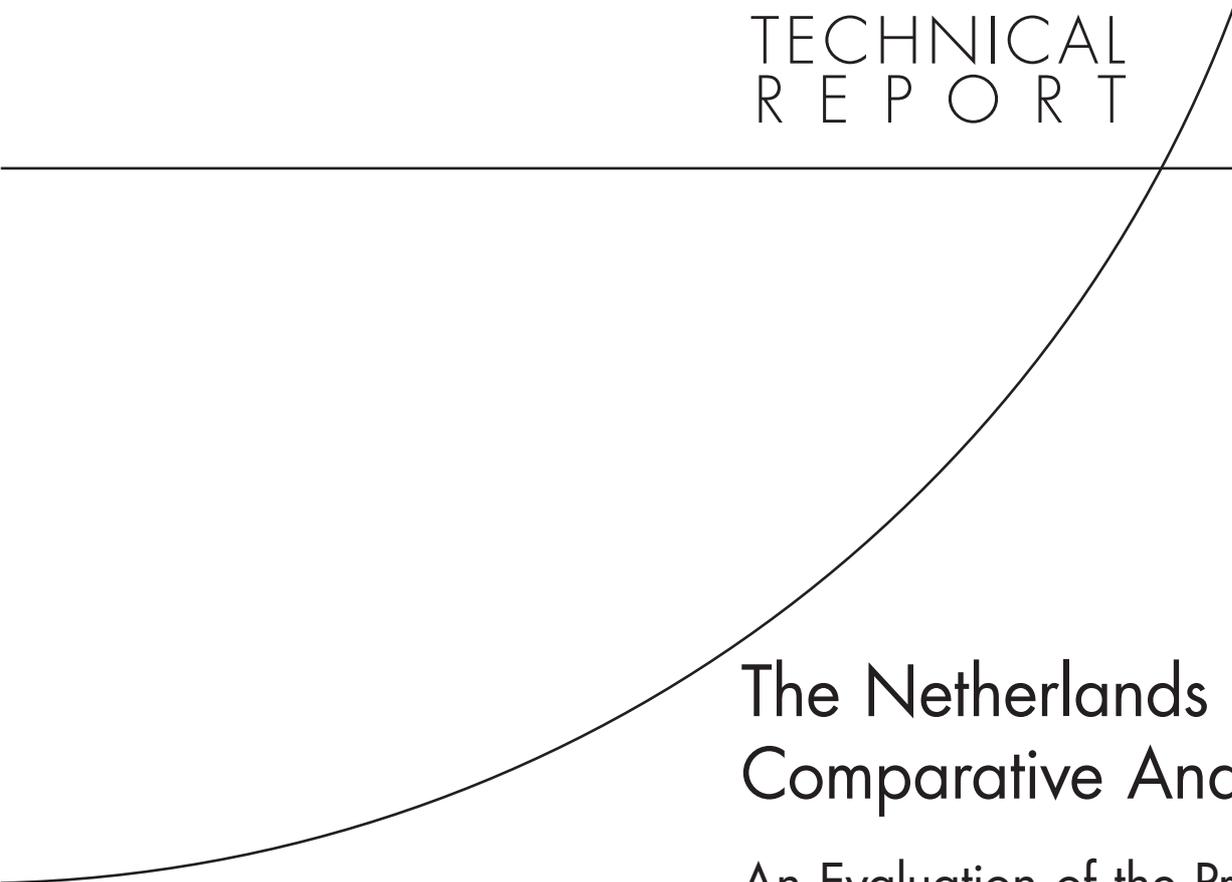
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TECHNICAL
R E P O R T



The Netherlands F-16 Comparative Analysis

An Evaluation of the Process

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Prepared for the Netherlands Ministry of Defence

The research described in this report was prepared for the Netherlands Ministry of Defence.

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Preface

The Netherlands Ministry of Defence (MoD) has been investigating the replacement of its F-16 combat aircraft since 1998. An analysis of potential replacement aircraft in 2001 concluded that the F-35 (also known as the Joint Strike Fighter) was best suited to replace the existing fleet of F-16 aircraft. Consequently, in 2002, the Netherlands government decided to participate in the development phase of the F-35. In 2006, the Netherlands government agreed to participate in the F-35's production, sustainment and follow-on development and remains an active partner in the development of the F-35. However, in February 2007 the coalition government stated its intention to conduct a final validation of whether the F-35 aircraft still fulfils the Netherlands' requirements in terms of quality, life cycle costs and delivery timeline.

The Netherlands government intends to take a definite decision on the replacement no later than 2010. As a result, the NL MoD was asked to conduct an update of the earlier assessment and perform a comparative analysis (CA) of potential candidates for replacing the F-16 aircraft. This purpose of the CA was to rank potential candidates against aspects of quality, life cycle costs and delivery timeline. It was conducted between May and December 2008. The output of the CA was a set of classified reports prepared within the MoD at the beginning of December 2008.

RAND Europe was asked to provide an independent, overall assessment of the CA conducted by the NL MoD. The purpose of the RAND Europe study was to evaluate whether or not the process of the CA was conducted satisfactorily, with particular focus on its objectivity and transparency.

This document presents a summary of key findings from the RAND evaluation of the Netherlands F-16 replacement CA process. RAND Europe anticipates that this report will be available to the Netherlands Parliament, alongside the final conclusions from the NL MoD. The report will be of interest to defence policy-makers working in the procurement field. It may also be of interest to other defence professionals, those involved in evaluation of public policy, and those with an interest in the Netherlands F-16 replacement programme.

The study was conducted in partnership with Stratelligence. Stratelligence is an independent consultancy that supports its clients in the public and private sector with evidence-based consultancy towards well-informed, well-reasoned and strategic decision-making. Prior to establishing Stratelligence in 2006, its founding members worked for RAND Europe. For more information about Stratelligence, please email: info@stratelligence.nl

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List of Acronyms

ADD	Auditdienst Defensie (Audit Services of the MoD)
ADEZ	Auditdienst Ministerie van Economische Zaken (Audit Services of the Ministry of Economic Affairs)
AF-16	Advanced F-16
CA	Comparative Analysis
CDA	Christen-Democratisch Appèl (Christian Democratic Appeal)
CU	ChristenUnie (Christian Union)
DMO	Defensie Materieel Organisatie (Netherlands Defence Materiel Organisation)
DMP	Defensie Materieel Proces (Defence Materiel Process)
FMS	Foreign Military Sales
FMV	Forsvarets Material Verk
FOC	Full Operational Capability
Gripen NG	Gripen Next Generation
HM Treasury	Her Majesty's Treasury (UK)
IOC	Initial Operational Capability
LCC	Life Cycle Costs
MCA	Multi Criteria Analysis
MLU	Mid-Life Update
(NL) MoD	(Netherlands) Ministerie van Defensie ((Netherlands) Ministry of Defence)
NLR	Nationaal Lucht- en Ruimtevaartlaboratorium (National Aerospace Laboratory)
OA	Operational Availability

OGC	UK Office Government Commerce
PvdA	Partij van de Arbeid (Labour Party)
RFI	Request for Information
RFP	Request for Proposals
RNLAF	Royal Netherlands Air Force
SAF/IA	Secretary of the Air Force / International Affairs
SDD	System Development and Demonstration
SRO	Senior Responsible Owner
TNO	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (Netherlands Organisation for Applied Scientific Research)

Summary

This document, prepared for the Netherlands Ministry of Defence (NL MoD), presents a summary from RAND Europe on its key findings from the evaluation of the Netherlands F-16 replacement comparative analysis (CA) process.

Study Context

The NL MoD currently operates a fleet of 105 F-16 combat aircraft. The aircraft, which entered service in 1979, were initially intended to be in service until about 2000. However, the F-16 has been regularly updated to extend its operational lifetime. The current replacement strategy aims to begin the replacement of the F-16 Mid-Life Update (MLU) fleet in the next decade and the Netherlands government intends to take a definite decision on the replacement no later than 2010. To inform this decision the NL MoD has recently conducted a CA of three potential F-16 replacement candidates, namely:

- Advanced F-16 (Lockheed Martin);
- F-35 (Lockheed Martin)¹;
- Gripen NG (SAAB).

The objective of the CA conducted by the MoD was to rank candidates against three main aspects, namely:

- quality;
- life cycle costs;
- delivery timeline.

Scope of RAND Study

RAND Europe was commissioned to provide an independent, overall evaluation of the CA process. In particular, RAND Europe was asked to evaluate the transparency and objectivity of the CA process. In order to maintain our independence and objectivity throughout the engagement with the CA process, the RAND project team did not contribute to the scoring of the candidates under consideration. The RAND study was

¹ Throughout this report we use the nomenclature *F-35* rather than *Joint Strike Fighter* or *JSF*

conducted in addition to a separate evaluation that was conducted by the Audit Services of the MoD (ADD) and the Audit Services of the Ministry of Economic Affairs (ADEZ).

RAND's Methodology

The RAND project team was asked to assess whether or not the CA was *sufficiently objective* and *sufficiently transparent* in both design and execution. Throughout the evaluation study, our benchmark for reaching an overall judgement was whether or not the design and execution of the CA was:

- *sufficiently transparent* to enable an external observer (such as RAND) to understand the provenance of the criteria used in the candidate ranking (quality, life cycle cost and delivery timeline) and whether candidate ranking was based on a logical utilisation of the information provided by Lockheed Martin and SAAB;
- *sufficiently objective* for the NL MoD to reach a ranking of candidates based solely on an unbiased comparison against the criteria of quality, life cycle cost (LCC) and delivery timeline.

The purpose of our evaluation was to determine whether or not the CA met these overarching criteria, rather than to grade the CA. Consequently, through this document we use the terms *satisfactory* and *sufficient* to indicate whether the CA has met (or exceeded) the required standards. The study approach is described in more detail in Chapter 3. To deliver our study objectives, we undertook three main phases:

- **Development of a set of evaluation criteria.** During the first phase of the study, the RAND project team developed a set of evaluation criteria. To do this, we surveyed the literature concerning good practice in large public procurement programmes. We then developed a structured framework for our evaluation that was based on the Successful Delivery Toolkit from the UK Office of Government Commerce (OGC).
- **Evaluation of the design of the comparative analysis methodology.** The second phase of the study focused on evaluating the design of the CA methodology. During this phase, we reviewed the methodology that had been documented by the Defence Materiel Organisation (DMO) regarding its approach to the comparison of candidates.
- **Evaluation of the execution of the comparative analysis methodology.** The third phase of the study focused on evaluating whether or not the CA process was objective and transparent in its execution. During this phase the RAND project team monitored the CA process executed by the MoD. We reviewed relevant documentation, attended the key meetings and scoring sessions that formed the assessment of candidates and also reviewed the final MoD reports on the ranking of candidates.

The RAND team provided an ongoing evaluation during the CA and provided feedback to the CA team at regular intervals throughout the process in order that the CA team could incorporate recommendations during the process.

RAND's Findings

Our overall evaluation of the transparency and objectivity of the CA was based on whether or not there was sufficient evidence in its design and execution to satisfy the evaluation criteria we had developed. To do this, we reviewed documents produced through the CA process and observed assessment meetings in which the CA team scored and ranked candidate aircraft. In addition, we applied our professional experience from other major procurement projects in our evaluation. We have divided our main findings into the following categories:

Overall Evaluation of Supplier Engagement and Internal Management

The RAND project team has reviewed the key documentation and interviewed key members of the CA team regarding their approach to supplier engagement (i.e. the NL MoD's engagement with Lockheed Martin and with SAAB). Our overall evaluation is that supplier engagement and internal management during the CA was sufficiently transparent for the RAND project team to confirm that manufacturers received appropriate formal communication at relevant stages in the process. Furthermore, when compared with good practice described by the OGC, we concluded that supplier engagement and internal management during the CA were sufficiently objective to enable candidates to be compared on a relatively level playing field.

Overall Evaluation of the Comparative Analysis Design and Execution

The CA followed an approach that had been finalised by the NL MoD in August 2008. The RAND project team reviewed the CA methodology against our experience of other public procurement assessments and against the OGC's Successful Delivery Toolkit. The CA methodology, which was documented in August 2008, was finalised by the MoD prior to beginning their assessment of candidates. The methodology was well structured and described all of the key stages in the process prior to execution of the CA. Our overall evaluation is that the design of the CA methodology was satisfactory.

The RAND project team reviewed the key documentation and observed relevant meetings relating to the comparison of candidates on the main aspects of quality, LCC and delivery timeline. The execution of the CA followed the methodology that had been reviewed earlier on. Our overall evaluation is that the execution of the CA process for these main aspects was satisfactory.

Overall Evaluation of Transparency

Our overall evaluation is that the CA for the main aspects of quality, LCC and delivery timeline was sufficiently transparent for the RAND project team to confirm the provenance of the criteria used in candidate ranking. The RAND project team has reviewed the summary of results prepared by the DMO which presents a clear and balanced set of conclusions and reflects the assessments made during the CA process.

For the aspect of LCC, there were some imperfections regarding transparency; but the CA team made sufficient efforts to ensure that the conclusions in the final report were

transparent. The RAND project team was able to confirm the origin of most of the data used in the CA, although not all sources were fully referenced and some assumptions were not made completely explicit. The final report for LCC recognises the inherent challenges of validating and assessing the uncertainty of cost data, and that not all risks have been quantitatively assessed. Consequently, the relatively conservative uncertainty bandwidths presented for LCC do not fully reflect the total uncertainty.

For the aspects of quality and delivery timeline we were able to confirm the correlation of information used in the assessment with that provided by manufacturers. The analysis of operational effectiveness and delivery timeline was directly traceable to Netherlands political ambition. The input documents were well prepared and traceable to the source documents, which RAND has also reviewed.

Overall Evaluation of Objectivity

Our overall evaluation is that the CA for the main aspects of quality, LCC and delivery timeline was sufficiently objective to produce an unbiased ranking order. No evidence of bias was found. Assessment of each candidate was performed primarily on the basis of information provided by manufacturers, and the expert scoring panels made efforts to be consistent across candidates. Efforts were also made to validate cost data with respective manufacturers and through governmental agencies. The RAND project team has reviewed the final reports prepared by the MoD and has concluded that the reports provided an accurate reflection of the assessments conducted and are generally objective in tone.

Acknowledgements

We should like to thank the sponsor of this project, Rob de Jong (Director of Policy within the DMO). In addition, we thank all members of the Ministry of Defence comparative analysis team who provided relevant documents and access to all relevant meetings, within the constraints of national security and commercial confidentiality. In particular we acknowledge the assistance of Colonel Robert Geerdes and Major Andre Steur (Replacement Office F-16, DMO) and Bram Visser (TNO).

We also thank the two quality assurance reviewers from RAND Europe, Christian van Stolk and Samir Puri, who provided thoughtful comments and suggestions on our report. Furthermore, particular thanks go to Gigi van Rhee, who provided continuous quality assurance through the project and gave regular challenge, insight and advice to the project team. Thanks are also due to Peter Felix who provided very useful suggestions on the report. Finally, we should like to acknowledge the translation support provided by Joachim Krapels.

Although the individuals and organisations mentioned here helped us with data collection and analysis, we are fully responsible for the interpretation of the information received and the conclusions drawn, and thus we alone are responsible for any errors.

The Netherlands Ministry of Defence has been investigating the replacement of its F-16 combat aircraft since 1998. The Netherlands government has stated its intention to take a definite decision on the replacement of the F-16 fleet in the near future. In order to facilitate such a decision, the government has asked the Ministry of Defence to compare potential candidates against the aspects of quality, cost and delivery timeline. This chapter presents the historical context that has led to the comparative analysis (CA).

1.1 **Introduction**

The Netherlands Ministry of Defence (NL MoD) currently operates a fleet of 105 F-16 combat aircraft. One of the world's most widely-used fourth generation fighter jets, the F-16 Fighting Falcon first entered service for the MoD in 1979.

The aircraft originally procured by the Netherlands were initially intended to be in service until about 2000. However, its operational lifetime has been extended through the introduction of new avionics, weapon systems and communication systems. The current replacement strategy is to begin the replacement of the F-16 Mid-Life Update (MLU) fleet within the next decade and the Netherlands government intends to take a definite decision on the replacement no later than 2010. To inform this decision the NL MoD has recently conducted a CA of potential F-16 replacement candidates, which were ranked against aspects of quality, life cycle costs (LCC) and delivery timeline.

RAND Europe was asked to provide an independent, overall assessment of the F-16 CA conducted by the NL MoD. The purpose of the RAND Europe study was to evaluate whether or not the process of the CA was conducted satisfactorily, with a particular focus on its objectivity and transparency.

1.2 **The F-16 Replacement Programme prior to 2007**

The NL MoD applies a five-step procurement process (phases A–E) for procuring defence equipment, referred to as the Defence Materiel Process (DMP).² The first phase (A) involves the derivation of operational requirements from defence policy and plans. In

² Applies to projects exceeding €5 million. The E (evaluation) phase only applies to projects exceeding €250 million.

addition a total investment concept is prepared on the basis of the defence ambitions and the overall defence budget. For the F-16 replacement project, phase A started in 1999 with the results being released to Parliament in 2000.³

On the basis of the requirements derived in phase A, a combined B/C phase was conducted between 2000 and 2002. The purpose of the B/C phase was to study the six available candidates, namely: Advanced F-16, Eurofighter, F/A-18 E/F⁴, Gripen, JSF⁵ and Rafale. This analysis was based on the operational performance and LCC of each candidate, and was based on data from a Request for Information (RFI). In a letter to Parliament dated 11 February 2002 the government concluded that the F-35 was best suited to replace the existing fleet of F-16s, and justified its intention to participate in the development programme (System Development and Demonstration or SDD) together with other countries intending to buy the F-35.⁶

From 2002 the DMP entered the procurement or D phase, and in 2006 the Netherlands government agreed to participate in production, sustainment and follow-on development of the F-35.⁷ However no final decision has yet been made on procurement of the F-35 and the E (or evaluation) phase has not been entered.

1.3 The F-16 Replacement Programme since 2007

After general elections in 2006, a new coalition government was formed in February 2007 consisting of the Christian Democratic Appeal (CDA), the Christian Union (CU) and the Labour Party (PvdA). This government decided to re-examine the earlier assessment of F-16 replacement candidates. The decision was part of the 'coalition agreement' and stated that a comparison on quality, costs and delivery timeline between F-35 and other candidates would be performed prior to a final decision on replacing the F-16:

In 2007 the Memorandum of Understanding regarding the JSF test aircraft will be signed. In 2008 the business case will be recalibrated, before a decision is taken in 2009 on the closing of a contract for the procurement of two test aircraft. On the basis of the recalibration and a comparison regarding price, quality and delivery lead time with other possible aircraft, the government will propose decisions to Parliament in 2010 on the replacement of the F-16.⁸

The comparison of potential F-16 replacement candidates against quality, costs and delivery timeline is referred to as the CA.

³ Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 3).

⁴ The F/A-18 E/F is also referred to as the Super Hornet.

⁵ The JSF or Joint Strike Fighter is also referred to as F-35, which is the terminology adopted throughout this report.

⁶ Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 8).

⁷ Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 47 and 52).

⁸ Coalition Agreement, 'Coalitieakkoord tussen de Tweede Kamerfracties van CDA, PvdA en ChristenUnie', 7 February 2007, p14.

1.4 Independent Evaluation of the Comparative Analysis

During the debates on the CA in the spring of 2008, Parliament also asked the government to *set-up the comparative analysis such that objectivity and transparency are assured*.⁹ The State Secretary for Defence, by letter to Parliament¹⁰ and in the following debate, indicated that besides monitoring by the Audit Services of the MoD (ADD) and the Audit Services of the Ministry of Economic Affairs (ADEZ), RAND Europe would act:

*as an independent player in the process [and] will carefully monitor the update [of the 2002 study]. The [RAND] institute shall judge whether everything possible has been done to receive the correct information from the players involved. Furthermore, RAND will judge whether the data that have been made available have been correctly applied in the comparison. A report will be issued on this. Parliament will of course also receive the report.*¹¹

Consequently, RAND Europe was commissioned to evaluate whether or not the CA process was objective and transparent in its design and execution.

1.5 Structure of the Report

This report contains eight chapters and is RAND's independent overall evaluation of the CA of potential candidates that was conducted by the NL MoD. The first two chapters provide insight into the F-16 replacement programme and the CA process. The remainder of the report is the RAND project team's evaluation of the process.

Chapter 3 discusses RAND Europe's study methodology, including a breakdown of the stages of our engagement with the CA process and our approach to reviewing the process. Chapter 4 is evaluative, examining overall supplier engagement and internal management. Chapters 5–7 examine and evaluate the overall process both in design and execution for ranking candidates against the aspects of quality, LCC and delivery timeline respectively.

Finally, Chapter 8 provides an overall assessment on the objectivity and transparency of the design and execution of the CA process.

⁹ Motion Eijssink, 29 May 2008 (Kamerstuk 26488 nr. 87).

¹⁰ Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 89).

¹¹ Report of General Discussions, 3 July 2008 (Kamerstuk 26488 nr. 100).

CHAPTER 2 **Comparative Analysis of Candidates for F-16 Replacement**

The purpose of this chapter is to provide an overview of the CA of potential candidates conducted by the NL MoD between May and December 2008. In particular, this includes: the role of the CA in assisting the government in selecting a replacement for the F-16 MLU, the methodology employed by the MoD, and the constraints of the CA. We have included this chapter to provide a context for the RAND project team's evaluation (discussed further in Chapters 3–8), and to provide a basic insight into the CA structure.

2.1 **Basis for NL MoD Comparative Analysis**

The rationale for a CA of potential F-16 replacement candidates was first raised by the Netherlands government in a policy statement on 7 February 2007. The coalition government agreement stated its intent to conduct a recalibration of whether the F-35 still fulfils the Netherlands requirements in terms of quality, costs and timeline.

In May 2008 the specific objective of the CA was defined by the Netherlands government as a determination of how:

the [F-35] and the three alternative candidates¹² have developed since 2001 with respect to price, quality and delivery timeline.¹³

However, it has been confirmed that the CA of candidates should be an *actualisering* (update) of the earlier evaluation conducted by the MoD in 2002.¹⁴

¹² The candidates that were included in the 2002 shortlist, namely: Eurofighter, Rafale and Advanced F-16. Subsequently, the Netherlands government expanded the candidate field to include Saab Gripen Next Generation.

¹³ Letter to Parliament, 7 May 2008 (Kamerstuk 26488 nr. 68).

¹⁴ Motion Eijsink, 29 May 2008 (Kamerstuk 26488 nr. 87); Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 89).

2.2 Objective of the NL MoD Comparative Analysis

The objective of the CA was to determine the ranking of candidates for F-16 replacement based on the three aspects directed by government, namely: quality, LCC and delivery timeline. The NL MoD defined these aspects as follows:

- Quality: *quality equals operational effectiveness, i.e. the ability to execute a wide range of missions in a flexible and effective manner, while providing sufficient operational availability.*¹⁵
- LCC: *costs associated with the procurement, use, maintenance and disposal of the system.*¹⁶
- Delivery timeline: *the extent to which the delivery schedule provided by the candidates is in conformity with the NL MoD ambition and replacement strategy. Specifically, the focus will be on the ability of the candidates to execute necessary events in a way that requires minimal adjustments to the NL MoD ambition level.*¹⁷

The stated output of the CA of candidates is a report providing a ranking of candidates against each of the three aspects in order to support the Netherlands government in assessing whether to proceed with the procurement of the F-35. In addition to the ranking of candidates, the NL MoD was instructed to provide a comprehensive rationale to underpin the ranking.

2.3 Selection of Candidates for the NL MoD Comparative Analysis

Initially, four possible successors for the F-16 combat aircraft were identified for the CA, all of which had been shortlisted in the 2002 assessment. These aircraft were: Advanced F-16 (Lockheed Martin), Eurofighter Typhoon (Eurofighter), F-35 Joint Strike Fighter (Lockheed Martin) and Rafale (Dassault). On 27 May 2008 a questionnaire was sent to these candidates to obtain information on quality, LCC and delivery timeline.

Parliament subsequently requested that *all options being considered by countries replacing F-16s be included.*¹⁸ Consequently, the Gripen Next Generation (SAAB) was included in the CA.¹⁹ On 20 June 2008 SAAB was also sent the questionnaire for the Gripen NG.

¹⁵ F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, TNO-DV 2008 311, NLR-CR-2008-460, p 16.

¹⁶ F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, TNO-DV 2008 311, NLR-CR-2008-460, p 44.

¹⁷ F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, TNO-DV 2008 311, NLR-CR-2008-460, p 50.

¹⁸ Motion Eijssink, 29 May 2008 (Kamerstuk 26488 nr. 87).

¹⁹ Letter to Parliament, 27 June 2008 (Kamerstuk 26488 nr. 89); Letter to Parliament 7 May 2008 (Kamerstuk 26488 nr. 68); answer to questions 53, 54, 55, 56, 83, 144, 155, 156, 157, 158 and 159.

2.4 Scope of the NL MoD Comparative Analysis

The overall approach for the CA of candidates was to request relevant information from manufacturers in order to make an assessment against quality, LCC and delivery timeline. It is important to state that this approach was not a Request for Proposals (RFP). Manufacturers were invited to submit information in response to a questionnaire, rather than to submit bids or enter into negotiation with the NL MoD.

However, following consideration of the questionnaire, both Dassault and Eurofighter informed the NL MoD that they would not be submitting responses, in spite of efforts by the NL MoD to encourage these manufacturers to participate in the CA.²⁰ This development was communicated to Parliament on 17 July 2008, through a letter from the State Secretary for Defence.²¹

Consequently, three candidates were included in the CA:

- Advanced F-16 (Lockheed Martin);
- F-35 Joint Strike Fighter (Lockheed Martin);
- Gripen Next Generation (SAAB).

2.5 Methodology for the NL MoD Comparative Analysis

The CA performed a ranking of the three candidate aircraft against each main aspect, namely: quality, LCC and delivery timeline. The CA considered each aspect discretely in order to determine a ranking order for each of the three aspects.

The ranking on the aspect of **quality** was based on a Multi Criteria Analysis (MCA) to assess overall operational effectiveness. This analysis considered both the effectiveness of each candidate in completing a series of stressful operational missions, and the operational availability (OA) of each candidate. Relevant components of operational effectiveness were assigned weightings in respect of their perceived importance in achieving Dutch political ambitions.

The ranking on the main aspect **LCC** was based on the relative LCC estimate in 2008 Euros, including uncertainty bandwidths and associated sensitivity analysis, if applicable. The MoD employed its standard technique for costing, which involves a bottom-up cost model based on a number of input cost parameters, including procurement costs, support costs and operational costs.

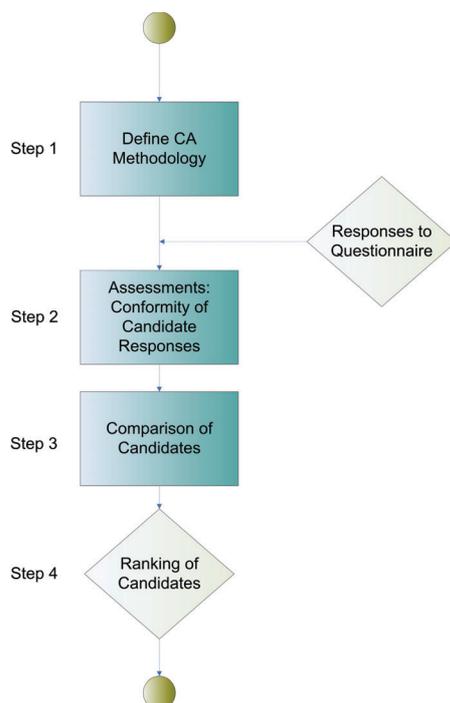
The ranking on the main aspect **delivery timeline** was based on a qualitative comparison of delivery schedules for each candidate with the preferred timeline for F-16 replacement.

An overview of the key stages in the CA is presented in Figure 2.1.

²⁰ The reasons why Dassault and Eurofighter declined to participate in the CA are outside the scope of this study.

²¹ Letter to Parliament, 17 July 2008 (Kamerstuk, 26488, nr. 99).

Figure 2.1 – Overview of Key Stages in the Comparative Analysis Process



2.6 Outputs of the NL MoD Comparative Analysis

The key outputs of the CA were delivered in two tranches.

Tranche 1 outputs comprised two MoD reports that described the methodological approach for the CA, which were finalised on 25 August 2008, prior to the beginning of the assessment of candidates. The methodology reports outlined the processes that would be followed by the MoD, the assessment criteria, the ground rules for the CA, the analytical techniques to be employed, and so on. The documents were as follows:

- F-16 Replacement Comparative Analysis of Candidates, Part 1: Methodology.
- F-16 Replacement Comparative Analysis of Candidates, Part 2: Required preparatory work.

Tranche 2 outputs comprised a further four MoD reports that were finalised on 4 December 2008. These documents were as follows:

- F-16 Replacement Comparative Analysis of Candidates, Part 3: overall assessment and ranking of candidates against the aspect of quality.
- F-16 Replacement Comparative Analysis of Candidates, Part 4: overall assessment and ranking of candidates against the aspect of LCC.
- F-16 Replacement Comparative Analysis of Candidates, Part 5: overall assessment and ranking of candidates against the aspect of delivery timeline.
- F-16 Replacement Comparative Analysis of Candidates, Part 6: overall assessment of the candidates against each aspect.

2.7 Constraints of the Comparative Analysis Process

There are a number of inherent constraints in the CA process, which are presented below:

- *The NL MoD has less detailed knowledge about Advanced F-16 and Gripen NG than about F-35.* The MoD has been a partner in the multi-national development programme for the F-35 since 2002. As a consequence, it is inevitable that the MoD has a much greater level of knowledge and understanding about the capabilities, risks and opportunities of the F-35 aircraft than about either the Advanced F-16 or the Gripen NG aircraft.²²
- *The CA was based on non-binding information.* The questionnaire submitted to manufacturers did not request contractually-binding information, nor did the NL MoD have the opportunity to negotiate alternative terms with the manufacturers. Consequently, the MoD had to validate the information, which complicated the assessment process.
- *There was a limited period of time available for the CA.* The time available was constrained by the requirement to make a timely decision on the procurement of test aircraft in the F-35 development programme. The time period was further reduced by the late addition of the Gripen NG and a delay in receiving complete data from the manufacturers. Consequently, there was little time contingency available for the CA team and limited flexibility for unforeseen tasks.
- *There was significant uncertainty over some of the data available for the CA.* All three candidates are in some phase of development, which presented constraints regarding the certainty of some information and challenges in validation. Confidence in data is typically correlated to the maturity of the development phase.
- *The CA only assessed quality, cost and delivery timeline.* In accordance with the coalition agreement, there are a number of other factors which, although likely to be considered in a final decision on F-16 replacement, were explicitly excluded from the CA. Those considerations may include environmental factors, foreign relations, and broader political concerns. An assessment of potential industrial factors is being conducted by the Ministry of Economic Affairs.
- *The CA assessed each of the three aspects discretely.* In accordance with the coalition agreement the CA was explicitly directed to consider quality, cost and delivery timeline. It did not consider all opportunities to trade between these three aspects.
- *Withdrawal of Rafale/Eurofighter.* As shared in the 17 July 2008 Letter to Parliament, Rafale (Dassault) and Eurofighter Typhoon (Eurofighter) declined to participate in the CA, limiting the number of candidates to be compared.²³

²² Chapter 4 describes how this constraint was addressed in the CA.

²³ Letter to Parliament, 17 July 2008 (Kamerstuk, 26488, nr. 99)

The purpose of this chapter is to define the scope and constraints of the RAND evaluation and to define our evaluation methodology. Specifically, we discuss the main phases of the study and summarise the information sources that were used. Finally, the remaining structure of this document is outlined.

3.1 **Objectives of the RAND Study**

RAND Europe was commissioned to evaluate the design and the execution of the CA conducted by the NL MoD, in particular to provide an overall assessment of the transparency and objectivity of the process. Throughout the evaluation study, our benchmark for reaching an overall judgement was whether or not the design and execution of the CA was:

- *sufficiently transparent* to enable an external observer (such as RAND) to understand the provenance of the criteria used in candidate ranking and to follow the logic from information provided by Lockheed Martin and SAAB via analysis to the final ranking;
- *sufficiently objective* for the MoD to rank candidates based solely on an unbiased comparison against the main aspects of quality, LCC and delivery timeline.

Consequently, throughout this document we use the terms *satisfactory* and *sufficient* to indicate that the CA has met (or exceeded) this benchmark. Our evaluation was based on comparison with good practice in public procurement and on the professional judgement of the RAND project team. The RAND evaluation monitored each element of the CA and gathered evidence through review of key documents, observation of relevant meetings and review sessions with the members of the CA team.

Our engagement with the MoD began in late June 2008, with the study formally beginning in August 2008. The study concluded with a review of the final tranche of reports produced by the MoD in early December 2008. Consequently, the evaluation presented in this report is limited to the time frame of the study. However, to inform our evaluation of supplier engagement the RAND team conducted a review of the written communication between MoD and manufacturers between May and August 2008.

The terms of reference for our study were confirmed to Parliament by the State Secretary for Defence, who had earlier agreed that the final RAND report would be sent to Parliament.²⁴

3.2 Scope and Constraints of RAND Study

In conducting our evaluation, RAND recognised the constraints of the CA process that were noted in Section 2.7. Our evaluation focused on design and execution of the CA process itself. For example, the wider factors that were excluded from the CA were also outside the scope of the RAND study.

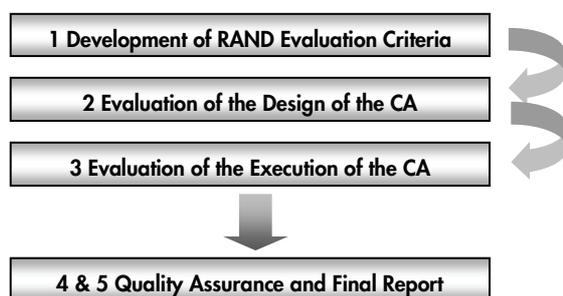
Throughout the process the RAND project team acted as independent observers rather than as participants or technical consultants. In order to maintain independence and objectivity throughout engagement with the CA process, RAND did not contribute to the scoring of the candidates under consideration. Consequently, our study excluded any validation of the information provided by suppliers which would have compromised our position as independent evaluators of the process.

We did, however, provide continuous evaluation during the CA and gave feedback to the CA team at intervals through the process. In particular, we reviewed the methodological design of the CA and provided detailed comments in mid-August. We also conducted review sessions with the CA team in order to provide an external perspective on the process and highlight any recommendations that the RAND project team had identified so that the CA team could incorporate them into the CA process.

3.3 RAND Study Phases

The RAND evaluation comprised three main study phases, plus quality assurance and preparation of this document. The study phases are summarised in the following sections and illustrated in Figure 3.1.

Figure 3.1 – RAND Study Phases



²⁴ Letter to Parliament, 11 November 2008 (Kamerstuk 26488, nr. 120); Report of General Discussions, 3 July 2008 (Kamerstuk 26488, nr. 100).

3.3.1 Development of RAND Evaluation Criteria

During the first phase of the study, the RAND project team developed a set of evaluation criteria for monitoring the MoD CA process. Following a survey of accepted good practice in large public procurement programmes, we concluded that the UK Office of Government Commerce (OGC) provided a suitable framework for the evaluation. The OGC is an independent office of HM Treasury established to help the UK government deliver best value from its spending, and is widely acknowledged to have broad and deep knowledge of good practice in public procurement programmes.

We utilised the OGC's Successful Delivery Toolkit as the basis on which to develop a set of evaluation criteria for the CA.²⁵ In developing a final set of evaluation criteria that was specifically applicable for evaluation of the CA, we applied our collective experience of defence and public procurement projects to tailor the good practice described by the OGC. The RAND evaluation criteria are presented in Table 3.1 under two headings:

1. Supplier engagement and internal management.
2. CA process for quality, LCC and delivery timeline.

These criteria are used throughout the evaluative chapters of this report (Chapters 4–7) to structure our evaluation of the CA. It may be seen from Table 3.1 that the same criteria were used to evaluate the CA process for quality, for LCC and for delivery timeline.

Table 3.1 – Summary of RAND Evaluation Criteria

Evaluation of process for supplier engagement and internal management (Chapter 4)	Evaluation of comparative analysis process for quality, life cycle costs and delivery timeline (Chapters 5, 6 and 7)
<ul style="list-style-type: none"> • Were appropriate candidates considered? • Was correct information requested from suppliers about their capability? • Were suppliers informed about the purpose of the CA and which processes would be followed? • Were suppliers provided with the same information at the same time? • Were suitable protocols in place for managing communication with suppliers? • Was the governance framework fit for purpose? • Were the terms of reference for the CA satisfactory? • Were potential conflicts of interest documented and managed? 	<ul style="list-style-type: none"> • Was a structured methodology for the analysis defined in advance? • Were requirements explicitly linked to Dutch political and military ambitions? • Was the assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced? • Were assessors suitably skilled and allocated defined roles within the process? • Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed? • Was assessment based on evidence and robust rationale? • Were risk and uncertainty addressed sufficiently and reflected in the final report?

²⁵ The UK Office of Government Commerce, *Successful Delivery Toolkit*, gathers together a wide range of resources to create a single source to guide procurement processes. Accessed 18 September 2008. As of 1 December 2008: http://www.ogc.gov.uk/resource_toolkit.asp

3.3.2 Evaluation of the Design of the Comparative Analysis Methodology

The second phase of the study focused on evaluating the design of the CA methodology. During this phase RAND reviewed the methodology that had been documented by the Defence Materiel Organisation (DMO) regarding its approach to comparison of candidates. Specifically, RAND used the evaluation criteria summarised in Table 3.1 to conduct a review of two key documents prepared by the DMO:

- F-16 Replacement Comparative Analysis of Candidates Part 1: Methodology.
- F-16 Replacement Comparative Analysis of Candidates Part 2: Required preparatory work.

3.3.3 Evaluation of the Execution of the Comparative Analysis Methodology

The third phase of the study focused on evaluating whether or not the CA process was objective and transparent in its execution. Our approach relied on the RAND team's professional judgement as independent and objective observers of the design and process, and was structured using the evaluation criteria summarised in Table 3.1. To facilitate the evaluation of execution of the CA methodology, the RAND project team:

- had one representative in all scoring and ranking sessions in which candidates were assessed against the main aspects of quality, LCC and delivery timeline;
- attended internal meetings of the CA team, and maintained weekly dialogues with the top-level representatives of the CA team;
- reviewed all relevant information and documentation by the DMO to facilitate the comparison of candidates (listed in the References section);
- reviewed the final tranche of reports prepared by the DMO that contained a summary of the CA of candidates against each aspect of quality, LCC and delivery timeline.

3.3.4 Quality Assurance and Preparation of Final Report

In the final phases of the RAND study, we prepared this document summarising our findings. In accordance with standard RAND practice, this document has been reviewed by two quality assurance reviewers, who have each provided a critical challenge to ensure that our methodology was robust and that our findings are based on evidence.

3.4 Summary of Information Sources utilised by RAND

In order to conduct an independent evaluation, RAND utilised a wide variety of information sources and approaches. A list of all documents reviewed is presented in the References section.

A review of all key documentation relating to supplier engagement was performed between August and December 2008. These documents included:

- correspondence between DMO and manufacturers;
- replacement F-16 questionnaire;

- summaries of the visits to the manufacturers by the State Secretary for Defence;
- summaries of visits to manufacturers by the CA team;
- the NL MoD Communication Plan;
- a logbook prepared by the NL MoD summarising all contacts with manufacturers relating to the CA.

A review of documentation relating to the design of the CA, including:

- F-16 Replacement Comparative Analysis of Candidates Part 1: Methodology;
- F-16 Replacement Comparative Analysis of Candidates Part 2: Required preparatory work.

A review of documentation relating to the execution of the CA, including:

- F-16 Replacement Comparative Analysis of Candidates Facilitators Guide v1.0;
- preparatory guidance issued to expert scoring panel members;
- the LCC and bandwidth models;
- biographies of the participants of the F-16 Replacement Comparative Analysis of Candidates.

A review of the final reports prepared by the MoD, namely:

- F-16 Replacement Comparative Analysis of Candidates, Part 3: overall assessment and ranking of candidates against the aspect of quality;
- F-16 Replacement Comparative Analysis of Candidates, Part 4: overall assessment and ranking of candidates against the aspect of LCC;
- F-16 Replacement Comparative Analysis of Candidates, Part 5: overall assessment and ranking of candidates against the aspect of delivery timeline;
- F-16 Replacement Comparative Analysis of Candidates, Part 6: overall assessment of the candidates against each aspect.

It was not practicable to attend all meetings held within the MoD that related to the CA, but the RAND project team monitored the execution of the CA through attendance at all key meetings relating to scoring and ranking of candidates. It should be noted that there were certain data sources that the RAND project team was unable to review due to security or commercial sensitivities. In these cases we utilised a reviewer from the National Aerospace Laboratory (NLR).

3.5 Relationship between the Evaluation conducted by RAND and that conducted by ADD and ADEZ

The RAND evaluation was conducted in parallel with a separate audit by ADD and ADEZ.

In a letter to the Dutch Parliament,²⁶ the State Secretary for Defence stated that ADD and ADEZ would answer the following central question:

Has the MoD, in line with its commitments to Parliament, executed the start of the candidate comparison in a manner which takes into account quality, price / life cycle costs and delivery lead time, so that the decision-making regarding the successor to the F-16 based on this process will be done in an accountable fashion?

In addition to this objective, it was also stated that the ADD and ADEZ audit reports would also consider whether:

RAND Europe has fulfilled its monitoring task in a satisfactory manner, and has the MoD dealt with the recommendations and remarks made by RAND Europe in an acceptable manner?

During the CA, the RAND project team had regular communication with ADD/ADEZ in order to provide feedback on the CA process and ensure transparency of the methodology we have employed.

3.6 Summary

This chapter has presented the methodology of the RAND project team for our evaluation of the transparency and objectivity of the CA process. We have outlined the evaluation criteria developed for this study. The remainder of this document contains our evaluation:

- Chapter 4 evaluates the CA processes for supplier engagement and internal management;
- Chapter 5 evaluates the CA process for assessing the quality of candidates;
- Chapter 6 evaluates the CA process for assessing the LCC of candidates;
- Chapter 7 evaluates the CA process for assessing the delivery timeline of candidates.

Each of these chapters is structured in line with the evaluation criteria presented in Table 3.1. This document concludes with an overall summary of our evaluation.

²⁶ Letter to Parliament, 11 November 2008 (Kamerstuk 26488, nr. 120).

CHAPTER 4 **Supplier Engagement and Internal Management**

RAND evaluated the design and the execution of the process by which the CA team engaged with suppliers. We also evaluated the CA team's internal management structure. This chapter provides our evaluation of supplier engagement and internal management. The evaluation in this chapter is structured using the criteria described in Table 3.1.

4.1 **Supplier Engagement**

4.1.1 **Were appropriate candidates considered?**

Yes, in line with Parliamentary discussions

Five candidates were identified that could meet the criteria for a replacement of F-16: the Advanced F-16 (Lockheed Martin), Eurofighter (Eurofighter), F-35 Joint Strike Fighter (Lockheed Martin), the Gripen Next Generation (SAAB) and the Rafale (Dassault).

Documents reviewed by RAND show attempts to encourage the participation of Eurofighter and Dassault from June 2008 following the withdrawal of these candidates.²⁷ In separate letters dated 25 June 2008 and 26 June 2008, the State Secretary of Defence of the Netherlands responded to the Eurofighter and Dassault decisions not to respond to the questionnaire. In them, he assured both suppliers that the outcome of the CA would determine further steps and stressed that the CA would be objective and transparent:

With the results of that [comparative] analysis, the Netherlands government will be able to determine its course of action concerning the F-16 replacement ... the current comparative analysis is the opportunity for offering your aircraft as a potential candidate aircraft to replace the Netherlands F-16 MLU aircraft.

*The process in which the comparative analysis will take place has been designed to be as objective and unbiased as possible ... we have created a process in which all contenders are in the same, competitive environment.*²⁸

The State Secretary of Defence visited both suppliers on 8 July 2008 in Paris and Munich to encourage again their participation in the process.²⁹ The RAND team has reviewed

²⁷ Evaluation of supplier engagement prior to May 2008 was outside the scope of the RAND evaluation.

²⁸ DMO Letter to Eurofighter, 25 June 2008, VP2008017655; DMO Letter to Dassault Aviation 26 June 2008, VP2008017656.

meeting notes from these meetings, which show that the State Secretary of Defence conveyed the purpose of the CA and stressed that the methodology would be unbiased and transparent.

4.1.2 Was correct information requested from suppliers about their capability?

Yes.

The CA questionnaire presented manufacturers with a comprehensive list of questions that was required to inform the CA of candidates.³⁰ However, there are inherent restrictions associated with obtaining information through a questionnaire when compared with an RFP. Because the CA team did not receive all of the information that was necessary in the supplier responses to the questionnaire, the team issued two sets of follow-up questions and visited the suppliers to clarify and confirm their answers.³¹

4.1.3 Were suppliers informed of the purpose of the comparative analysis and of which processes would be followed?

Yes.

The manufacturers received formal communication from the MoD in advance of the process. In the first letter, dated 19 May 2008, the Director of the DMO communicated with suppliers regarding the following:

- The decision of the Netherlands government to perform an additional CA.
- The purpose, the time frame and the methodological design of the questionnaire.
- The final decision on the F-16 replacement date (2009/2010).

The Director of the DMO also requested a formal point of contact and asked to visit suppliers during the week beginning 2 June 2008.³² Lockheed Martin, and later SAAB, acknowledged receipt of the questionnaire and confirmed their participation.

Further, when developments occurred during the initial questionnaire process – such as the withdrawal of Dassault and Eurofighter from the process, the introduction of RAND Europe and the ADD and ADEZ oversight, and time extensions – the Director of the DMO formally alerted the suppliers in writing.³³

²⁹ Visit notes Eurofighter and visit notes Dassault, both dated 8 July 2008.

³⁰ Replacement F-16 Questionnaire; DP&V/PRPP/2008013038; 27 May 2008.

³¹ No new questions were added to the original set in the questionnaire

³² DMO Letter to Eurofighter, 19 May 2008, DP&V VWVP/2008013740; DMO Letter to Dassault Aviation 19 May 2008, DP&V VWVP/2008013741; DMO Letter to Lockheed Martin Aeronautics, 19 May 2008, DP&V VWVP/2008013742.

³³ DMO Letter to Lockheed Martin Aeronautics (AF-16), 18 July 2008, DP&V VWVP/2008019667; DMO Letter to SAAB 18 July 2008, DP&V VWVP/2008019671; DMO Letter to Lockheed Martin Aeronautics (F-35), DP&V VWVP/2008019673, 18 July 2008

4.1.4 Were suppliers provided with the same information at the same time?

No, but suppliers were provided with equal time to submit responses.

The RAND team has reviewed correspondence between the MoD and relevant manufacturers, and considers that the MoD treated suppliers equitably in that both suppliers had the same length of time to respond to the questionnaire.

On 27 May 2008 identical questionnaires were sent to the manufacturers of the four candidates initially identified as potential replacements for the F-16. Responses were requested by 31 July 2008. The MoD received responses to the questionnaires in respect of the Advanced F-16 and the F-35.

Due to the subsequent inclusion of the Gripen NG, SAAB was not sent the questionnaire until 20 June 2008. To ensure that SAAB was provided with a similar period to prepare its reply, the MoD requested a response to the questionnaire by 25 August 2008. To ensure equitable treatment of the candidates, responses from Lockheed Martin were sealed and securely stored until 25 August 2008.

On 25 August SAAB Gripen indicated that they would be unable to respond in full in a timely manner to the questionnaire and would need an extension. On 2 September 2008 the MoD granted SAAB an extension until 30 September 2008.³⁴ This extension was also provided to Lockheed Martin to enable them to update their responses to reflect market developments.³⁵

4.1.5 Were suitable protocols in place for managing communication with suppliers?

Yes, although not formally documented at the start of the comparative analysis.

The OGC defines the purpose of a communication strategy as to:

*document how information will be disseminated to, and received from, all stakeholders in the activity. It identifies the means/medium and frequency of communication between the different parties. It is used to establish and manage on-going communications throughout a programme or project.*³⁶

The CA team prepared a communication plan with the intention of formalising a set of protocols for all communication with suppliers.³⁷ However, this was not documented until October 2008.

The RAND project team has reviewed the CA communication plan and judges that it was sufficient to satisfy these goals by establishing ground rules for communicating with suppliers. The NL MoD's ground rules outlined in the communications plan include the following:

³⁴ Letter from DMO to SAAB, reference DP&V VWVP/2008022797, 2 September 2008.

³⁵ Although Lockheed Martin did not exercise the opportunity to update responses

³⁶ Office of Government Commerce, Communications Strategy, http://www.ogc.gov.uk/documentation_and_templates/communications_strategy_.asp, accessed 16 November 2008.

³⁷ Communications Plan Comparative Analyses F-16 Replacement; DP&V/PR/PP/VF.2008.025452, 13 October 2008.

- appointing one person as a point of contact for all suppliers;
- ensuring that all communication is documented in a logbook of informal and formal communication;
- ensuring that rules regarding the treatment of classified information are adhered to;
- ensuring that the same information is provided simultaneously to suppliers;
- restricting communication to CA-specific content.³⁸

The communications plan further mandated that all interactions (e.g. site visits, interviews, questionnaires) would be documented as soon as possible. A logbook of communication was maintained that provided a high-level overview of all contacts between personnel from the CA team and personnel from Lockheed Martin and SAAB. The RAND project team has reviewed the logbook and agendas that were prepared for meetings between the MoD and manufacturers. These documents provide sufficient evidence that the protocols in the communications plan were adhered to.

4.2 Internal Management

4.2.1 Was the governance framework fit for purpose?

Yes.

The CA governance framework was fit for purpose. OGC good practice recommends a Single Responsible Owner (SRO) of programmes of change, whose responsibility it is to:

ensure that a project or programme of change meets its objectives and delivers the projected benefits³⁹

The CA team had a clear SRO, with single leads for most of the tasks and subtasks. A clear escalation route for the communication of issues existed within the process, and was delineated further in the communication plan. Additionally, the oversight from the Director of Materiel Policy within the DMO added a beneficial external viewpoint and strategic perspective.

4.2.2 Were the terms of reference for the comparative analysis satisfactory?

Yes.

As far as the RAND project team could determine, a memo dated 18 February 2008 initiated the CA process within the DMO.⁴⁰ This was used as the basis for the CA scope that was described in the questionnaire sent to manufacturers, and in the methodology

³⁸ Communications Plan Comparative Analyses F-16 Replacement; DP&V/PR/PP/VF.2008.025452, 13 October 2008.

³⁹ Office of Government Commerce, OGC Best Practice, Single Responsible Owner. http://www.ogc.gov.uk/User_roles_in_the_toolkit_senior_responsible_owner.asp, accessed 16 November 2008.

⁴⁰ Vervanging F-16 / Kandidaten Evaluatie, LUSVF2008003220.

documentation that was finalised on 25 August 2008. Consequently, the terms of reference for the CA were drafted prior to commencing the assessment of candidates.

On 24 October 2008 the DMO prepared a document outlining how the results of the CA would be used to inform the final decision on whether or not to proceed with procurement of the F-35.⁴¹

The RAND project team has reviewed these documents and considers that they were sufficient to provide a coherent understanding of the CA and to guide the activities undertaken.

4.2.3 Were potential conflicts of interest documented and managed?

Yes.

Potential and perceived conflicts of interest for members of the CA were documented prior to the ranking of candidates. The DMO, TNO and the NLR all have connections with the F-35 programme through the F-16 replacement programme and the participation of the Netherlands in the SDD phase. TNO and NLR also have a commercial relationship with Lockheed Martin as a subcontractor on the F-35 programme. These relationships are maintained by different parts of the organisations, which are separated by firewalls and a clear delineation of tasks.

The CA team took two steps prior to the scoring sessions in order to manage conflicts of interest:

- Firstly, all members of the CA team were asked to highlight any potential conflicts of interest. This included direct and bilateral contacts with suppliers in the past, and contacts with suppliers for current position within the CA team. These documents were reviewed by RAND.
- Secondly, the CA team was asked to present organisational Conflict of Interest documentation, as well as the Project Security Instruction. The purpose of both documents is to install a firewall to separate information and personnel working in support of the government (Replacement F-16) and personnel working for the subcontractor to the F-35 project.

The RAND project team considers that these represent sufficient measures to manage potential conflict of interests.

⁴¹ Kandidatenvergelijking VF-16, 24 October 2008, VP2008027970.

4.3 Overall Evaluation of Supplier Engagement and Internal Management

Overall Evaluation

The RAND project team has reviewed the key documentation, interviewed key members of the CA team and observed relevant meetings relating to supplier engagement and internal management through the CA. Our overall evaluation is that both of these elements were conducted satisfactorily.

Transparency

Our overall evaluation is that supplier engagement and internal management during the CA was sufficiently transparent for the RAND project team to confirm that manufacturers all received formal communication stating the purpose of the CA and the processes which would be followed. Informal communication with Lockheed Martin and SAAB was controlled effectively by the MoD, although protocols were not completely documented at the start of the process. All contact with both manufacturers was documented in a logbook, which was reviewed by the RAND team on a weekly basis to confirm that communications were managed.

It is the stated intent of the MoD to debrief each candidate following the conclusion of the CA process, which is in accordance with good practice.

Objectivity

Our overall evaluation is that supplier engagement and internal management during the CA was sufficiently objective to enable candidates to be compared on a relatively level playing field.

The DMO, TNO and the NLR all have connections with the F-35 programme through the F-16 replacement programme and the participation of the Netherlands in the SDD phase. Potential conflicts of interest were sufficiently documented for each member of the CA team in order to ensure that these could be managed by the MoD.

Manufacturers were provided with the same questionnaire and the same length of time to respond. As noted earlier, one constraint of the CA process is that the MoD does not have the depth of knowledge on Advanced F-16 and Gripen NG that it has for F-35. However, in our opinion the MoD sought appropriate means through which to develop a more complete view of Advanced F-16 and Gripen NG, including visits to supplier facilities.

CHAPTER 5 **Evaluation of Process for Assessing Quality of Candidates**

The first of the three main aspects in the CA of candidates for the F-16 replacement was quality. This chapter provides a summary of the process followed by the CA team, our evaluation and the supporting evidence for the quality section of the CA. The evaluation in this chapter is structured using the criteria described in Table 3.1.

5.1 **Summary of Comparative Analysis Process for Quality**

The Netherlands government requires its armed forces to provide a credible military contribution throughout the entire spectrum of conflict (from peacekeeping and peace enforcement through to full-scale conflict).⁴² The operational concept of the replacement of the F-16 is based on its ability to accomplish a set of tasks (or missions) successfully.

In the quality section of the CA the responses of the candidates were assessed against two elements:

- *mission effectiveness*: the ability to execute a defined set of six operational missions successfully;
- *operational availability*: the ability to execute missions whenever required to do so.

The NL MoD assessed these two elements in parallel during the CA and then combined them using a standard multi criteria analytical technique. This chapter presents separate evaluations of the two elements and an evaluation of the MCA that combines the results of mission effectiveness and operational availability.

The RAND project team has reviewed the methodology, the questionnaire, the input documents for the appraisal and scoring sessions, and relevant meeting notes documented by the CA team. In order to monitor the execution of the CA, a member of the RAND project team attended all sessions of the MoD scoring panel in the role of an independent observer.

⁴² See for example: Actualisering van de *Prinsjesdagbrief 2003*, 2 June 2006, HDAB2006018085.

5.2 Mission Effectiveness

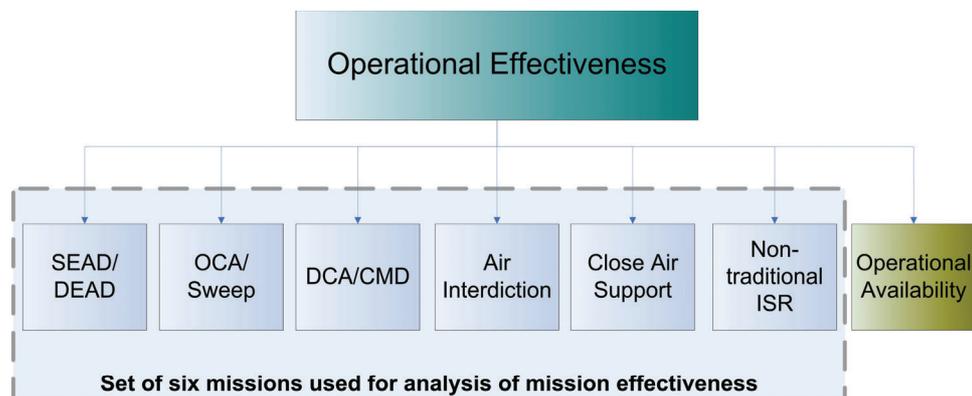
5.2.1 Was a structured methodology for the analysis defined in advance?

Yes.

The methodology employed for assessing mission effectiveness was well documented prior to the assessment of candidates.⁴³ The objective of the operational effectiveness analysis was defined in terms of the ability of the candidate aircraft to execute a wide range of stressing missions that will allow the Netherlands to fulfill its political and military ambitions.⁴⁴

The RAND project team has reviewed the CA methodology documents, which clearly state the evaluation hierarchy for the analysis of operational effectiveness and describe the missions that were to be used for the assessment. A schematic diagram of the approach is shown in Figure 5.1, which highlights the six missions (used together with OA) that were used by the MoD to assess operational effectiveness.

Figure 5.1 – Evaluation Hierarchy and Missions



5.2.2 Were requirements explicitly linked to Dutch political and military ambitions?

Yes.

The set of missions used to assess operational effectiveness was drawn from Netherlands military ambition, which provides a transparent link to Dutch policy.⁴⁵ Based on review of the relevant reports and through attendance at the scoring meetings, the RAND project team considers that this was a suitable approach for assessing candidate performance. Assessing quality against a set of six operational missions has a number of advantages over assessing technical specifications for a number of reasons, primarily:

- It ensures that the focus of the assessment is on outcomes rather than inputs.

⁴³ F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, Chapter 2; Part II: Required preparatory work, Chapter 2.

⁴⁴ The missions included were: Suppression / Destruction Enemy Air Defences (SEAD/DEAD), Offensive Counter Air/Sweep (OCA); Defensive Counter Air / Cruise Missile Defence (DCA/CMD); Air Interdiction (AI); Close Air Support (CAS); Non-Traditional Intelligence Surveillance Reconnaissance (NTISR).

⁴⁵ A list of sources used is included in F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, TNO-DV 2008 311, NLR-2008-CR-460, p 55.

- It allows scope for assessment of alternative solutions to a defined capability gap by using functional specification.
- It increases traceability back to endorsed Netherlands political and military ambition.
- It enables objective comparison against different concepts of operations.
- It enables critical success factors to be defined as successful completion of operational missions.

5.2.3 **Was assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced?**

Yes.

The tasks involved in the assessment of operational effectiveness followed a logical sequence and were allocated sufficient time for the MoD to complete the candidate assessment and to document the outputs. Furthermore, additional margins of time were available in case unexpected delays occurred. The sequence of tasks was documented and executed as follows:

- Initial analysis of candidate information to check for coherence, completeness and clarity.
- Request for clarification / additional data from suppliers.
- Preparation of overall reports for each candidate, synthesising information provided in response to the questionnaire against each element of kill/live chains (see Section 5.2.5).
- Pre-briefing to expert panel.
- Scoring sessions by expert panel.
- MCA and preparation of overall assessment.

5.2.4 **Were assessors suitably skilled and did they have defined roles within the process?**

Yes.

The operational effectiveness scoring team consisted of five Royal Netherlands Air Force (RNLAf) personnel and two technical experts. The RAND project team analysed the biographies and observed the contributions of the scoring panel, which provided evidence that the assessors had sufficient skills to conduct the analysis. In particular:

- The technical experts on the team brought particular expertise in evaluating the technical components of candidate responses. This enabled an assessment of the ability of each candidate to complete the required mission sequences based on the data provided by manufacturers.
- The uniformed personnel had significant experience of flying multi-role combat aircraft. The skills and experience drawn on for the assessment included, inter alia:

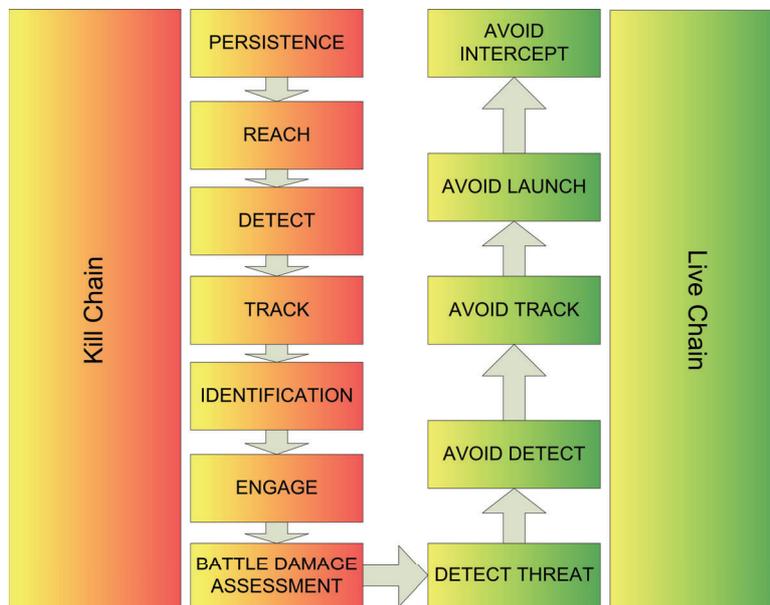
understanding of the operational context, operational employment, policies and plans, and technical expertise.

5.2.5 Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed?

Yes.

For each mission considered, an appropriate mission sequence was described in the methodology. The CA employed the concept of a *kill chain* and a *live chain*, which consisted of a number of sequential steps. To complete a mission successfully, candidates were assessed against their ability to forge each link in the chain successfully. The RAND project team considers this to be a suitable approach and in accordance with the approach used by other national defence ministries to evaluate mission effectiveness.⁴⁶ A schematic diagram of a kill and live chain is shown in Figure 5.2.

Figure 5.2 – Generic Kill Chain and Live Chain for Combat Air Mission



The RAND project team reviewed documentation that was provided to the scoring panel. Prior to the assessment and ranking of candidates, three scoring points were defined in order to delineate the scoring scale. The calibration points for each mission corresponded to scores of 1, 6 and 10, which related to minimum useful capability, achievement of a stressing mission and maximum useful capability. A standard scoring template was provided to the experts during the scoring session in order to facilitate independent scoring of missions. Through attendance at the scoring sessions, the RAND project team observed that this was sufficient to enable the scoring panel to calibrate their scores for each candidate within the required confidence levels.

⁴⁶ Such as the UK and the US

5.2.6 Was assessment based on evidence and robust rationale?

Yes.

Prior to the scoring of each candidate, supplier responses were analysed by the CA team in order to prepare a consolidated set of assessment material. This preparatory material was solely based on information provided by manufacturers and provided evidence on which an expert scoring panel could then assess performance against the set of six missions. The RAND project team reviewed the preparatory analysis, which was correlated with the information supplied by manufacturers and did not introduce leading text. It should be noted that incomplete responses were received to a number of the questions put by the MoD, even following two rounds of clarification questions. In these cases, the MoD applied an assessment of likely performance and applied uncertainty bandwidths to reflect the incomplete information.

The RAND project team observed the facilitation of the scoring panel, which was conducted through a combination of individual expert scoring and group discussion and challenge. For each score, experts provided rationale to underpin the assessment of each candidate aircraft. Review of the final MoD report on the comparison of candidates provides sufficient documentation of the evidence that underpins the final ranking for mission effectiveness.

5.2.7 Were risk and uncertainty addressed sufficiently and reflected in the final report?

Yes.

A base score was attributed to each candidate according to most likely mission performance, as scored by the expert panel. Uncertainty and risk were also considered by the scoring panel, and addressed through the use of bandwidths around the base score to reflect the highest and lowest probable scores. Consequently, the scoring panel determined lower and upper bandwidths corresponding to a 90% confidence level. This is a standard approach to treating uncertainty, which was suitable for the comparison of candidates. It should be noted that the MoD team did not conduct a full risk assessment of candidates as it was deemed to be outside the scope of the CA and specifically did not consider high impact / low probability risks.

Scorers were provided with sufficient explanation about the use of bandwidths before the start of the sessions. Through attendance at the scoring sessions and detailed review of the final reports, the RAND project team observed that the scoring team included uncertainty in the scores of the candidates. The final MoD report contains a qualitative risk assessment for each candidate.

5.3 Operational Availability

To assess the candidates' expected performance on operational availability (OA), an approach was executed that was similar to that employed in 2002, in which the factors that most influence OA have been taken into account. The responses to the questionnaire provided sufficient information to assess the candidates against the criteria developed by the MoD.

5.3.1 Was a structured methodology for analysis defined in advance?

Yes.

The methodology employed for assessing OA was documented prior to assessment of the candidates. The procedure for executing the operational availability was defined in the methodology report:

- Step 1: Establishing the evaluation hierarchy and criterion weights.
- Step 2: Scoring of the candidates.
- Step 3: Aggregation and analysis of results including sensitivity analysis.
- Step 4: End scores provided to quality MCA.

The RAND project team reviewed the preparatory documents, which clearly stated the steps to be followed. The evaluation hierarchy and the criterion weights were defined in advance and the approach was described in the preparatory report in sufficient detail.⁴⁷ A reader was issued to assist the MoD experts in preparing for the scoring session, which was reviewed by a member of the RAND project team.

5.3.2 Were requirements explicitly linked to Dutch political and military ambitions?

Yes.

Requirements were explicitly linked to political and military ambition, which was documented in the methodology report. Dutch political and military ambition states that the F-16 replacement aircraft needs not just to offer air power, but also has to comply with OA requirements to ensure that the RNLAf can deploy sufficient air power when required to do so. The OA criterion was subdivided into 30 bottom-level criteria, which were grouped into five intermediate criteria: sustainment concept; inherent availability; supply support and provisioning; operational mission support; organisation.

The use of functionally specified criteria is in accordance with good practice (such as the OGC Successful Delivery Toolkit) that RAND has reviewed. Functionally specified criteria allow scope for different solutions to the requirements and do not prejudice the outcome towards any particular solution.

⁴⁷ RAND did not attend this preparatory session.

5.3.3 Was assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced?

Yes.

The RAND project team reviewed the timetable and monitored the execution. The timetable allowed a sufficient amount of time to execute the tasks in the right order. A suitable series of activities was defined in order to perform the analysis of OA.

During execution, the timetable was generally adhered to. Documentation was issued to members of the scoring panel, which provided them with sufficient time to prepare in advance of the session. The scoring sessions were held as planned, with an additional half-day session scheduled to provide sufficient time for scoring to be completed.

5.3.4 Were assessors suitably skilled and did they have defined roles within the process?

Yes.

The assessment and ranking panel consisted of RNLAf personnel with a broad range of operational experience, in addition to technical experts from TNO and NLR.

The RAND project team has reviewed biographies which provide evidence that the combined experience of the assessment panel was sufficient to provide the breadth of technical and operational expertise required for the scoring session.

5.3.5 Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed?

Yes.

A template was made available to the experts during the scoring session, in which they were able to score the candidates independently against each element of OA. Both ends of the scoring range (1 and 10) were defined beforehand and documented in preparatory materials reviewed by the RAND project team.

The RAND project team has reviewed the final report prepared by the MoD, which documents that weightings of each of the bottom-level criteria have been applied as described in the preparatory report.

5.3.6 Was the assessment based on evidence and robust rationale?

Yes.

Preparatory materials provided to the scoring panel were reviewed by the RAND project team. The information provided to the scoring panel corresponds to that provided by the supplier for each candidate aircraft. This provided a sufficient evidence base on which to assess operational availability.

The RAND project team monitored the facilitation of the scoring panel and concluded that the assessment of each candidate aircraft was conducted through a combination of individual expert scoring and group discussion and challenge. This required scorers to provide robust rationale to underpin their scores. The RAND project team was satisfied that the OA scoring sessions followed the process as described in the methodology.

**5.3.7 Were risk and uncertainty addressed sufficiently and reflected in the final report?
Yes.**

Sufficient effort was made by the scoring team to include risk and uncertainty in the scores of the candidates. This was evident from the detailed discussions and the judicious use of uncertainty bandwidths. Scorers were given sufficient explanation about the use of bandwidths before the start of the sessions.

5.4 Multi Criteria Analysis used for combining Mission Effectiveness and Operational Availability

Following the conclusion of the expert scoring panel, a number of steps were taken by the CA team to combine the separate scores from the six missions and individual elements of OA, and to assess the robustness of the overall ranking. The results from each mission contributing to operational effectiveness and each element contributing to OA were consolidated using standard statistical techniques. In order to incorporate uncertainty into the final ranking, Monte Carlo simulations were employed. In addition, sensitivity analyses were conducted to establish the robustness of the ranking to different weightings or assumptions. Standard statistical packages were used to perform the calculations.

We have reviewed the final reports regarding operational effectiveness and confirm that the assessments and conclusions relating to quality reflect the expert assessments and the outputs from the MCA.

5.5 Overall Evaluation of Comparative Analysis Process for Quality

Overall Evaluation

The RAND project team has reviewed the key documentation and has observed relevant meetings relating to the comparison of candidates on the main aspect of quality. Our overall evaluation is that the CA process for quality was satisfactory. The analysis was well structured and planned, operational missions and availability criteria were drawn from political and military ambition, personnel involved were sufficiently skilled, the assessment was based on evidence and transparent rationale, and uncertainty was addressed.

Transparency

Our overall evaluation is that the CA for quality was sufficiently transparent for the RAND project team to confirm the provenance of the criteria used in candidate ranking and the correlation of information used in the assessment with that provided by manufacturers. In particular, the set of six missions was directly traceable to Netherlands political and military ambition and scoring sessions followed the methodology as documented. The input documents were well prepared and traceable to the source documents, which RAND had previously reviewed.

The final report prepared by the MoD was reviewed by the RAND project team. This provided an accurate reflection of source documents and of the arguments presented during the scoring sessions.

Objectivity

Our overall evaluation is that the CA for quality was sufficiently objective to produce an unbiased ranking order. Assessment of each candidate was performed solely on information provided by manufacturers, and the expert scoring panel made efforts to be consistent across candidates concerning configurations, underlying assumptions and mission performance. The use of individual scoring minimised the opportunity for subjectivity to be introduced as all scores were accompanied by supporting rationale.

The final report prepared by the MoD was reviewed by the RAND project team. The report provided an accurate reflection of the assessments conducted for mission effectiveness and operational availability, and was objective in tone.

CHAPTER 6 Evaluation of Process for Assessing Life Cycle Costs of Candidates

The second of the three main aspects in the CA of candidates for the F-16 replacement was LCC. This chapter provides a summary of the process followed by the CA team, the RAND evaluation and the supporting evidence for the LCC section of the CA. The evaluation in this chapter is structured using the criteria described in Table 3.1.

6.1 Summary of Comparative Analysis Process for Life Cycle Costs

A comparison of candidates with regard to LCC was conducted through an assessment of the total costs due to procurement (i.e. capital investment) and in-service costs (i.e. support and operational costs). It is important to note that only future costs were considered in the CA as development costs already incurred for the F-35 (SDD-related costs) are sunk costs. The LCC analysis was performed using a generic approach that is routinely applied to NL MoD procurement projects.⁴⁸ The key steps in the LCC analysis are presented in Figure 6.1.

Figure 6.1 – Structure of the Approach for Analysis of Life Cycle Costs⁴⁹



In the development phase of the LCC analysis, a generic cost breakdown structure was developed and populated with data provided by manufacturers in response to the questionnaire. Candidates were given the opportunity to define both their own operational concept with regard to the execution of missions and their own support concept. After initial analysis of the answers to the questionnaire, Lockheed Martin and SAAB were approached through two additional rounds of questions to clarify and complete responses. Finally, the CA team visited the manufacturers to address any remaining issues and gather sufficient information to populate the LCC models. In addition to challenging the

⁴⁸ Referred to as the FELSALDO approach

⁴⁹ Diagram based on that in F-16 Replacement Comparative Analysis of Candidates Part I: Methodology, TNO-DV 2008 311, NLR-2008-CR-460,

manufacturers, the CA team confirmed the inputs with relevant governmental agencies: F-35, Joint Strike Fighter Program Office; AF-16, Secretary of the Air Force / International Affairs (SAF/IA), Foreign Military Sales (FMS); and Gripen NG, Swedish Forsvarets Material Verk (FMV).

Following the receipt of data from manufacturers, analysis of LCC for each candidate was conducted in two parts:

1. An initial cost estimate based on supplier data.
2. An uncertainty analysis based on the cost assessments of an expert panel.

Where appropriate, cost data from internal MoD sources were also used to populate the LCC model for cost parameters such as personnel and infrastructure.

The RAND project team monitored the process described above from design (methodology) via inputs (responses to the questionnaire), data processing (development of the LCC model) and uncertainty analysis (in bandwidth sessions) to conclusions (final report). We have based our conclusions on the evidence observed through reviewing these steps.

There are inherent constraints and challenges of conducting LCC analysis based on non-binding responses to the questionnaire. Additionally, cost data provided by the candidate suppliers was uncertain since candidates are still under development and the candidate suppliers themselves cannot be sure of future costs. Validation of such cost data is challenging and has inherent uncertainties, which complicated the analysis of LCC. Furthermore, the CA was directed to reach conclusions within a relatively short period of time, which was reduced due to late delivery and incomplete responses by suppliers.

6.2 Was a structured methodology for the analysis defined in advance?

Yes, although with some omissions in detail.

The RAND project team reviewed the methodology reports, which defined the key stages of the LCC methodology in advance of the assessment. The methodology was also clear about the steps that would be taken to validate data inputs from manufacturers. Some elements of the LCC assessment, particularly the assessment and treatment of uncertainty and the validation sources, were not determined in advance and evolved through the CA process.

The RAND project team also reviewed the questionnaire, which clearly described what supplier inputs were required and in what format these inputs were to be delivered.

6.3 Were requirements explicitly linked to Dutch political and military ambitions?

Not applicable for comparison of LCC.

Requirements in the field of LCC are dictated by budgetary and affordability constraints. Since no explicit requirements were in place, this criterion is not applicable for LCC.

6.4 **Was assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced?**

Partly, some tasks were constrained by time limitations and late responses.

The RAND project team reviewed the initial project timetable for LCC and concluded that it was logically structured, although the schedule contained little margin for flexibility. Our observation of the LCC assessment throughout the process was that all available time margins were consumed due to delays in the execution of several main tasks. The main reasons for the time delays were the late responses from manufacturers and the challenge of obtaining and validating their cost information. In addition, unforeseen changes to the timeline increased time pressure.

These delays did not change the order of the activities in the LCC, which were executed in the appropriate sequence. However, the RAND project team observed that the delays provided limited time for the expert cost team to consider uncertainty bandwidths (both in preparation and in session). This also led to a delay in the development of the LCC model that limited the ability of the CA team to check the model and adhere to sourcing discipline (e.g. consistent use of source and price-level columns).

6.5 **Were assessors suitably skilled and did they have defined roles within the process?**

Yes, although limited external expertise was employed.

The roles of the personnel undertaking the LCC analysis were well defined. The RAND project team has reviewed the biographies of those people involved in the LCC analysis and observed their participation in meetings. There is sufficient evidence that the core LCC team was experienced in developing cost models for defence procurement projects. In addition, there was sufficient expertise within the team to cover most of the elements of the LCC, including operational and sustainment costs. However, there was limited expertise on macro-economic developments such as uncertainties in future exchange rates.⁵⁰

The uncertainty analysis was conducted by an expert panel that mainly drew on personnel from MoD, NLR and TNO. This panel assessed the data used in the LCC model and determined uncertainty bandwidths for cost inputs. The total number of experts attending the session was sufficient, although there was only one expert from outside the CA team. This limited the opportunity for the introduction of different views to the uncertainty assessment and increased the reliance on judgement of experts from within the CA team. The involvement of external panel members was particularly important for LCC due to the challenges of validating cost data noted earlier and the breadth of skills required for the LCC analysis.

⁵⁰ Exchange rates were identified as a key uncertainty in the overall LCC.

6.6 Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed?

Yes.

The RAND project team reviewed the preparatory guidance which made clear the purpose and the structure of the bandwidth analysis. This guidance was issued to members of the LCC assessment team who were also provided with guidelines for assigning bandwidths. This guidance helped elicit the rationale behind the uncertainty bandwidths that were applied to cost parameters. Scoring templates made available were clear and allowed for individual scoring.

For the LCC analysis, assessors were asked to provide mid-cost (expert assessment of most probable value) and upper and lower bandwidth costs. The CA team suggested a selection of parameters on which they deemed bandwidth should be applied using defined factors.

During the bandwidth session for most parameters, uncertainty bandwidths were assigned based on an understanding of the cost drivers of the parameter. For parameters where less information was available, percentage bandwidths were applied through group consensus. Based on our experience of cost analysis, the RAND project team considers that this way of scoring was sufficient to assign uncertainty bandwidths to individual cost parameters.

6.7 Was the assessment based on evidence and robust rationale?

Yes in general, but not fully evidenced for all elements.

As stated earlier, the RAND project team monitored the processes of data collection, data processing and drawing conclusions. In general, rationale was documented by the CA team to support their analysis and conclusions. The CA team made a large effort to validate non-binding manufacturer data, but did not fully document their analysis nor explain all of the differences between the different sources, or the selection of used sources (e.g. no specific source for fuel prices and cost breakdown structure references are missing). In the final products we reviewed, assumptions were not always made explicit (e.g. VAT).

These observations prevent a completely transparent monitoring from data collection through data processing to final results, which may be explained by the time pressure that prevented the CA team from fully documenting the analysis.

6.8 Were risk and uncertainty addressed sufficiently and reflected in the final report?

Yes.

The RAND team has reviewed the methodology reports for the CA which identified the main steps for validation of cost data. The LCC team visited and consulted governmental agencies (JPO, SAF/IA, FMV) and consulted some external sources in order to validate cost data supplied by manufacturers. The challenges of validating such data are recognised in the final reports prepared by the MoD. The effect of consulting external sources and the horizontal comparison on the assessment is only partially made explicit.

An uncertainty analysis was performed as one of the two parts on which the conclusions on LCC are based. In this analysis, uncertainty associated with individual cost inputs was assessed and quantified by an expert panel, which assessed uncertainty and risks, assigning bandwidths to these inputs accordingly. An exhaustive assessment of risks for each candidate was not conducted as this was beyond the scope of the CA. Some types of risk, particularly low probability / high impact risks, certain development risks and programme-related risks, were either excluded or included in a qualitative. Additionally, some cost risks that are common between all candidates (such as infrastructure costs) were excluded in the LCC analysis, while these costs were included. As a result, the bandwidths assigned are relatively small compared to the costs.

The RAND project team attended the bandwidth sessions and observed that sufficient rationale was provided to underpin most of the bandwidths assigned, but for a small number of cost inputs the assessments were incompletely evidenced (e.g. fuel prices). Individual assessors were able to express divergent opinions, which were discussed by the panel and incorporated in the values that were assigned to cost parameters. The RAND project team has reviewed the conclusions presented in the final reports which reflect the uncertainties assessed by the expert panel.

6.9 Overall Assessment of LCC Process

Overall Evaluation

The RAND project team has reviewed the CA process for LCC from data collection, through analysis to ranking. Our overall evaluation is that the CA process for LCC was in general satisfactory but with some imperfections regarding transparency.

Personnel in the scoring sessions involved were sufficiently skilled in operational and sustainment costs, although there was limited expertise to assess macro-economic developments. The CA team made a large effort to validate non-binding manufacturer data. The final report for LCC recognises the inherent challenges of validating and assessing the uncertainty of cost data. Uncertainty and risk were addressed using a structured process, with uncertainty bandwidths applied to individual costs elements. Some types of risks were excluded or included in a qualitative assessment rather than using bandwidths. As a result, the bandwidths assigned are relatively small compared with the costs.

Transparency

Our overall assessment is that the CA for LCC was sufficiently transparent for the RAND project team to confirm the provenance of the key conclusions of the LCC analysis; from data collection through analysis. In addition, the RAND project team was able to confirm the origin of most of the data used in the CA and the correlation of information used in the assessment with that provided by manufacturers. Documents describing the guidance and methodology for LCC bandwidth sessions were, in our opinion, well prepared and traceable to source documents. The CA team made efforts to ensure that the conclusions in the final report provided an accurate reflection of the process.

However, there were some imperfections regarding the transparency of the CA process. In the final products we reviewed, sources were not always complete or fully referenced; assumptions were not always made explicit; nor were the results such as the horizontal comparison of costs of the candidates completely transparent.

Objectivity

Our overall evaluation is that the CA for LCC was sufficiently objective to produce an unbiased ranking order. The assessment of LCC was made primarily on information provided by manufacturers and efforts were made to be consistent in the treatment of these data. Efforts were also made to validate data with manufacturers and through governmental agencies. There was only one external member of the expert panel (in addition to TNO and NLR) that performed the uncertainty analysis, which increased reliance on the judgement of experts from within the CA team. No evidence of bias was found.

The summary of results prepared by the DMO and reviewed by the RAND project team presents a clear and balanced set of conclusions regarding LCC analysis.

CHAPTER 7 **Evaluation of Process for Assessing Delivery Timeline of Candidates**

The third of the three main aspects in the CA of candidates for the F-16 replacement was delivery timeline. This chapter provides a summary of the process followed by the CA team, the RAND evaluation and the supporting evidence for the delivery timeline section of the CA. This chapter is structured using the criteria described in Table 3.1.

7.1 **Summary of Comparative Analysis Process for Delivery Timeline**

Candidates were assessed against the preferred timing of the Netherlands government, which is based on the anticipated dates of certain key events in the future. Through the questionnaire each manufacturer was requested to supply their own delivery timeline, indicating the anticipated dates of major events for their respective aircraft. A team of experts appraised these responses, and where necessary amended them to ensure consistency with the configuration as assessed in the aspects of quality and LCC. Candidates were ranked according to how closely they matched the Netherlands preferred timeline. The RAND project team has reviewed the methodology, the questionnaire, the input documents for the assessment and ranking sessions, the meeting notes and the final report. A representative attended the appraisal and ranking sessions to observe the process through which candidates were assessed and ranked.

7.2 **Was a structured methodology for the analysis defined in advance?**

Yes.

The RAND project team has reviewed the methodology for the delivery timeline analysis.⁵¹

The objective of the analysis was defined in advance, which was to assess how aligned candidate timelines were with the required schedule of the NL MoD. Three separate assessment criteria were used by the MoD to assess candidates on delivery timeline:

- Consistency criteria for events/milestones: candidate responses were assessed for realism and internal consistency.

⁵¹ F-16 Replacement Comparative Analysis of Candidates Part 1: Methodology report and Part 2: Required preparatory work.

- The Netherlands preferred time frames for each event/milestone: derived from the factors described in Section 7.3.
- Constraints other than those defined by the Netherlands preferred time frames, for example: training throughput limitations, consistency between training and delivery, and time between Initial Operational Capability (IOC) and Full Operational Capability (FOC).

The RAND team has reviewed the guidance material issued to the assessment team for delivery timeline, which provide a sufficient basis for candidate comparison.

7.3 **Were requirements explicitly linked to Dutch political and military ambitions?**

Yes.

The NL MoD has derived a preferred time frame for the replacement of the F-16 on the basis of four defined factors:⁵²

- The threat environment assessed by the NL MoD Defence Intelligence Service.
- The end of the F-16 MLU lifespan.
- NL MoD Defence Investment Plan.
- The earliest time that the Netherlands coalition government is willing to commit to the replacement of the F-16.

The key milestone within the Netherlands preferred time frame is the IOC of the F-16 replacement aircraft. The other milestones and events have been traced back from IOC. The RAND project team concludes that the preferred time frame is explicitly drawn from military ambition, as evidenced in preparatory documentation.

7.4 **Was the assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced?**

Yes.

We reviewed the assessment timetable that had been developed by the CA team and were content that it was structured logically. Broadly speaking, the timetable was adhered to and sufficient time was allotted for each activity in the delivery timeline assessment. The RAND project team observed there were minor changes to the timing of certain tasks when compared with the original timetable, but that these changes did not alter the overall sequence of events.

⁵² RAND did not have access to all of these source documents due to their highly classified nature.

7.5 **Were assessors suitably skilled and did they have defined roles within the process?**

Yes.

The delivery timeline assessment team consisted of RNLAf employees with air and ground operational experience, and technical experts from TNO and NLR. The roles of facilitator and scribe were appropriately designated to non-participating attendees. The RAND project team has reviewed the biographies of the assessors, which provide evidence that the team has sufficient technical and operational expertise to assess the candidates.

7.6 **Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed?**

Yes.

The assessment of delivery timeline for each F-16 replacement candidate was carried out against the Netherlands preferred time frame as explained in Section 7.3. In order to delineate the delivery timeline, candidates were assessed against their ability to comply with the preferred IOC. Three time periods were defined:

- *Preferred*: IOC fully consistent with the NL preferred time frame.
- *Acceptable*: IOC achieved within four years of the NL preferred time frame.
- *Undesirable*: IOC not achieved within four years of the NL preferred time frame.

The RAND project team reviewed the methodology and preparatory materials that guided the ranking sessions, and observed the ranking sessions. The use of a graphical representation of each delivery schedule against the Netherlands preferred time frame provided sufficient guidance for assessors to rank candidates. The assessment for delivery timeline was based on a qualitative assessment by all individual experts.

7.7 **Was the assessment based on evidence and robust rationale?**

Yes.

The CA team used comparison by analogy to assess the realism of candidate delivery timelines. The duration of some activities were estimated by using the average duration of comparable events in the past (historical data F-16, F-16 MLU). Before the delivery timeline scoring session, experts received preparatory materials to introduce them to the session. The RAND project team reviewed this material, which was based on information supplied by the manufacturers.

The RAND project team observed the facilitation of the scoring panel. In order to elicit rationale to underpin assessments, a combination of individual expert scoring, group discussion and facilitated challenge was employed. The RAND team has reviewed the final MoD report, which documents the underpinning rationale for the assessment of each candidate aircraft.

7.8 **Were risk and uncertainty addressed sufficiently and reflected in the final report?**

Yes.

During the assessment, sufficient attention was given to identification of risks that would compromise the ability of each manufacturer to deliver against the timeline presented. The RAND project team observed that risk and uncertainty were assessed based on comparison with previous combat aircraft delivery and expert judgement.

7.9 **Overall Assessment of Delivery Timeline Process**

Overall Evaluation

The RAND project team has reviewed the key documentation and has observed relevant meetings relating to the comparison of candidates on the main aspect of delivery timeline. Our overall evaluation is that the CA process for delivery timeline was satisfactory. The analysis was well structured and planned, the preferred timeline for IOC was drawn from political and military ambition, personnel involved were sufficiently skilled, the assessment was based on transparent rationale, and uncertainty was addressed.

Transparency

Our overall evaluation is that the CA for delivery timeline was sufficiently transparent for the RAND project team to confirm the provenance of the criteria used in candidate ranking and the correlation of information used in the assessment with that provided by manufacturers. The input documents were traceable to the source documents, which RAND had previously reviewed. The final report prepared by the MoD was reviewed by the RAND project team. The report provided an accurate reflection of source documents and of the arguments presented during the scoring sessions.

Objectivity

Our overall evaluation is that the CA for delivery timeline was sufficiently objective to produce an unbiased ranking order. Assessment of each candidate was performed using information provided by manufacturers and the expert scoring panel used experience of other combat aircraft delivery to assess realism. The use of independent scoring by an expert panel minimised the opportunity for subjectivity to be introduced as all scores were accompanied by supporting rationale. The final report prepared by the MoD was reviewed by the RAND project team. The report provided an accurate reflection of the assessments conducted for delivery timeline and was objective in tone.

CHAPTER 8 **Overall Evaluation of Comparative Analysis Process**

This chapter provides a summary of our overall evaluation of the CA process, with a focus on the transparency and objectivity.

8.1 **Overall Evaluation of Supplier Engagement and Internal Management**

The RAND project team has reviewed the key documentation, interviewed key members of the CA team and observed relevant meetings relating to supplier engagement and internal management through the CA. Supplier engagement and internal management during the CA was sufficiently transparent for the RAND project team to confirm that manufacturers all received formal communication stating the purpose of the CA and the processes that would be followed. Informal communication with Lockheed Martin and with SAAB was controlled effectively by the MoD, although protocols were not fully documented at the start of the CA. All contact with both manufacturers was documented in a logbook which was reviewed by the RAND team on a weekly basis to confirm that communications were managed.

Manufacturers were provided with the same questionnaire and the same length of time to respond. As noted earlier, one constraint of the CA process is that the MoD did not have the depth of knowledge on Advanced F-16 and Gripen NG that it has for F-35. However, in our opinion the MoD sought appropriate means through which to develop a more complete view of Advanced F-16 and Gripen NG, including visits to supplier facilities. SAAB was also granted an extension to enable them to respond fully to the questionnaire. Potential conflicts of interest within the CA team were documented.

Our overall evaluation is that supplier engagement and internal management during the CA were sufficiently objective to enable candidates to be compared on a relatively level playing field. A summary of the evaluation against our criteria is presented in Table 8.1.

Table 8.1 – Summary of Supplier Engagement and Internal Management against RAND Evaluation Criteria

Evaluation Criteria	Supplier Engagement and Internal Management
Were appropriate candidates considered?	Yes, in line with Parliamentary discussions
Was correct information requested from suppliers about their capability?	Yes
Were suppliers informed of the purpose of the CA and of which processes would be followed?	Yes
Were suppliers provided with the same information at the same time?	No, but suppliers were provided with equal time to submit responses
Were suitable protocols in place for managing communication with suppliers?	Yes, although not formally documented at the start of the comparative analysis.
Was the governance framework fit for purpose?	Yes
Were the terms of reference for the CA satisfactory?	Yes
Were potential conflicts of interest documented and managed?	Yes

8.2 Overall Evaluation of Process for Comparison of Candidates

The RAND project team has reviewed the key documentation and observed relevant meetings relating to the comparison of candidates on the main aspects of quality, life cycle costs and delivery timeline. Our overall evaluation is that the CA process for these aspects was satisfactory. A summary of the overall CA process against our evaluation criteria is presented in Table 8.2.

Table 8.2 – Summary of Comparative Analysis Process against RAND Evaluation Criteria

Evaluation Criteria	Quality	Life Cycle Costs	Delivery Timeline
Was a structured methodology for the analysis defined in advance?	Yes	Yes, although with some omissions in detail	Yes
Were requirements explicitly linked to Dutch political and military ambitions?	Yes	Not applicable for comparison of LCC	Yes
Was the assessment timetable adhered to, were tasks allocated the appropriate amount of time, and were they appropriately sequenced?	Yes	Partly, some tasks were constrained by time limitations and late responses	Yes
Were assessors suitably skilled and did they have defined roles within the process?	Yes	Yes, although limited external expertise was employed	Yes
Was a scoring mechanism employed that was clearly delineated and appropriate for the level of information to be assessed?	Yes	Yes	Yes
Was assessment based on evidence and robust rationale?	Yes	Yes in general, but not fully evidenced for all elements	Yes
Were risk and uncertainty addressed sufficiently and reflected in the final report?	Yes	Yes	Yes

8.3 Overall Evaluation of Transparency

Our overall evaluation is that the CA for the main aspects of quality, LCC and delivery timeline was sufficiently transparent for the RAND project team to confirm the provenance of the criteria used in candidate ranking. The RAND project team has reviewed the summary of results prepared by the DMO which presents a clear and balanced set of conclusions and reflects the assessments made during the CA process. The final report for LCC recognises the inherent challenges of validating and assessing the uncertainty of cost data, and that not all risks have been quantitatively assessed. Consequently, the relatively conservative uncertainty bandwidths presented for LCC do not fully reflect the total uncertainty.

For the aspects of quality and delivery timeline we were able to confirm the correlation of information used in the assessment with that provided by manufacturers. The analysis of operational effectiveness and delivery timeline was directly traceable to Netherlands political ambition. The input documents were well prepared and traceable to the source documents, which RAND has also reviewed. For the aspect of LCC, there were some imperfections regarding transparency, but the CA team made sufficient efforts to ensure that the conclusions in the final report were transparent. The RAND project team was able to confirm the origin of most of the data used in the CA, although not all sources were fully complete or referenced and some assumptions were not made completely explicit.

8.4 Overall Evaluation of Objectivity

Our overall evaluation is that the CA for the main aspects of quality, LCC and delivery timeline was sufficiently objective to produce an unbiased ranking order. Assessment of each candidate was performed primarily on the basis of information provided by manufacturers, and the expert scoring panels made efforts to be consistent across candidates. Efforts were made to validate cost data with respective manufacturers and through governmental agencies. No evidence of bias was found. The final reports prepared by the MoD providing the overall assessments were reviewed by the RAND project team. In our opinion, they provided an accurate reflection of the assessments conducted and are generally objective in tone.

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CVs of the participants of the F-16 Replacement Comparative Analysis of Candidates

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