



Report to the Public Accounts
Committee on the basis for a
possible acquisition of combat
aircraft

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I. Introduction and main findings

1. This report is about how the Ministry of Defence and the Danish Defence prepare the basis for a possible decision to acquire new combat aircraft for the Danish Defence.

The Defence's current F-16 aircraft were mainly procured in the 1970s and need to be replaced by 2020, according to current planning by the Danish Defence. Three combat aircraft are competing to replace the F-16: The Swedish Gripen, the American Joint Strike Fighter and Super Hornet. Since 1997, Denmark has participated in an international cooperation to develop the Joint Strike Fighter.

2. The government is expected to present its basis for decision in the spring of 2009, so that the Folketing (parliament) can decide whether the Defence should acquire new combat aircraft and in the affirmative, which manufacturer the Defence should then primarily open contract negotiations with. The basis for decision will also include an analysis of the possibility to extend the life of the existing F-16s which would postpone the replacement of the F-16 fleet by up to six years.

The Defence Commission is expected to present its position on a possible replacement of the F-16 by the end of March 2009 - before the government presents its basis for a decision. The Commission is considering the possible replacement of the F-16 as part of its overall conclusions on the future development of the Defence. The Commission is expected to determine whether Denmark has a requirement for new combat aircraft, and which tasks such aircraft would be required to perform.

3. The Ministry of Defence has involved several other ministries in its preparations. The government has established a cross-ministerial working group to prepare the financial part of the basis for a decision. Besides the Ministry of Defence and the Defence, also the Ministry of Foreign Affairs and the Ministry of Economic and Business Affairs, represented by the Danish Enterprise and Construction Authority, participate in the work.

The Defence is heading the Danish combat aircraft competition and will provide its military recommendation as to which combat aircraft, the Defence considers to be the best replacement for the F-16, if a replacement is decided. The recommendation will conclude in a prioritised ranking of the three candidates.

4. At its meeting on 13 September 2007, the Public Accounts Committee requested Rigsrevisionen to consider how an examination of the potential acquisition of new combat aircraft could be organised. The Auditor General described the process in a memorandum to the Public Accounts Committee dated 2 November 2007. Subsequently, at its meeting on 28 November 2007, the Public Accounts Committee asked Rigsrevisionen to submit a report.

5. The purpose of this report is to evaluate the work performed so far by the Ministry of Defence and the Defence to with respect to the elaboration of a basis for a decision. The report considers the following three questions:

F-16 is referred to as F-16 Fighting Falcon.

Gripen is referred to as Gripen Next Generation. The aircraft is developed from the original Gripen aircraft.

Joint Strike Fighter is referred to as F-135 Lightning II Joint Strike Fighter.

Super Hornet is referred to as F/A-18 E/F Super Hornet. The aircraft is developed from F/A-18 A/D Hornet.

The Danish Defence
The Defence is organized with the Ministry of Defence being responsible for the entire ministerial remit. The Defence is an umbrella term comprising Defence Command Denmark and underlying commands and authorities, like for instance the Tactical Air Command and functional services like the Danish Defence Acquisition and Logistics Organisation.

- How does the Defence determine its requirement for potential new combat aircraft?
- How does the Defence evaluate the combat aircraft candidates?
- How does the Defence estimate the cost of new combat aircraft?

The first question concerns how the Defence can perform its duties if F-16 is phased out by 2020. The two last questions are closely related to the Defence's evaluation of the three combat aircraft candidates that are competing to replace F-16.

6. The audit covers the period from the end of the 1990s to March 2009. The information has been gathered during the period November 2007 to mid March 2009. The timing of the report is such that Rigsrevisionen is reporting on the preparations made by the Ministry of Defence and the Defence before they have finished their work.

MAIN FINDINGS AND CONCLUSIONS

Rigsrevisionen assesses that the Defence's comparison of the three combat aircraft candidates will be made on a significantly better basis than what has been the case in relation to earlier defence acquisitions. The Ministry and the Defence has, particularly in the last phase of the project, ensured a framework that matches the complexity of the project. The Danish participation in the development of the Joint Strike Fighter has made the public doubt whether the decision to acquire this candidate has already been made. The Defence has carried out thorough analyses of all three candidates in order to eliminate this doubt.

Rigsrevisionen finds it a strong point that the financial part of the basis for a decision is being prepared by a cross-ministerial working group. It is also satisfactory that the Ministry of Defence has decided to use external consultants for the quality assurance of the entire basis for a decision.

The preparation of a basis for decision has until now taken place without a political mandate concerning the future requirement for combat aircraft. The Ministry of Defence expects to adjust the basis for decision in accordance with the Defence Commission's evaluation of the future requirement. The Ministry currently expects a prioritised ranking of the three candidates for new combat aircraft to provide the basis for a decision. In addition, the basis for a decision will include one proposal for an extension of the life-span of F-16 for a shorter period of time. Any other politically relevant possibilities for the F-16 fleet are not included at this point in time. Rigsrevisionen considers it essential that the Ministry of Defence evaluates and documents other possibilities for the F-16 fleet in the basis for a decision.

This overall assessment is based on the following:

The basis for a decision has until now been prepared without a political decision on the tasks which combat aircraft would be required to perform in the future. The Defence has evaluated the requirement for new combat aircraft based on the same level of tasks currently performed by the F-16. The Ministry of Defence has stated that it will adjust the basis for a decision after the Defence Commission has finished its evaluation of the requirement. The basis for decision is currently focused on an evaluation of the three combat aircraft competing to replace the F-16 fleet. The basis for decision will include one proposal for an extension of the life span of the F-16 for a shorter period of time, but for the time being any other analyses regarding the continued use of F-16 are not being conducted.

- As the future tasks of the combat aircraft are not politically determined, the Defence's work is based on the assumption that the tasks which are currently performed by the F-16 are to be performed at the same level in the future.
- Rigsrevisionen finds that the basis for a decision should be based on an agreement on the future tasks for combat aircraft. As an example, other capabilities will probably be required if combat aircraft are to be used in high-intensive international operations and not only for the enforcement of national sovereignty.
- The Defence Commission's report and subsequent political negotiations may result in further adjustments of the basis for a decision. As a first step, the Ministry of Defence will adjust the basis for a decision in accordance with the Commission's evaluation of the future requirement for combat aircraft.
- The Ministry of Defence and the Defence's analyses of the requirement for combat aircraft have led the Ministry to propose a choice between three new combat aircraft. The basis for a decision will also – on the condition that new combat aircraft are acquired later – include an extension of the life span of the F-16 for a shorter period beyond 2020.
- The analysis of the possibilities of extending the life span of the F-16 fleet is not yet complete. The Defence's work does not yet include an evaluation of the consequences of changing the tasks currently performed by the F-16. The Ministry will include an evaluation of how the life span of the F-16 fleet can be extended if the present number of flying hours is being reduced. The basis for a decision will not include other possibilities regarding a continuation of the F-16 structure like, for example acquisition of new or used F-16s or a phased acquisition of new combat aircraft.
- The Ministry of Defence assesses that there is no alternative to the acquisition of new combat aircraft, if Denmark is to maintain a combat aircraft capability in the long term. The basis for a decision is not expected to include the analyses upon which this assessment is based.

The Defence's military recommendation is designed to prioritize the three combat aircraft competitors. The Defence compares the significant characteristics of the candidates. But the Defence has not determined in advance how excellent qualities in one area should be compared with less excellent qualities in another area in order to make it clear how the Defence is ranking the candidates. This makes the evaluation of the candidates less transparent.

- The Defence has worked with the potential acquisition of new combat aircraft for several years, but the work did not assume its current shape till in the most recent phases. The Defence did not separate the Danish participation in the Joint Strike Fighter programme from the combat aircraft evaluation till the autumn of 2007. Rigsrevisionen finds this separation satisfactory and considers it a necessary condition to ensure a fair competition on equal terms.
- The Defence originally selected the candidates for the Danish combat aircraft competition on the basis of a few high-level requirements to ensure that the aircraft could be used in a NATO context over 30 years and would be affordable. The field of candidates was adjusted over time, mainly as a result of the manufacturers' indications as to whether they wished to participate in the competition or not.

- The Defence compares the combat aircraft candidates in several areas which in addition to traditional military and technical capabilities include project risk and life cycle costs. This means that the Defence evaluates not only how well the aircraft are performing, but also the risks related to the procurement and the cost of the aircraft. This is a significant improvement taking into consideration the Defence's experience with other major acquisitions.
- Rigsrevisionen finds it relevant that the Defence intends to base its evaluation on a comparison with the F-16, as this will provide the Defence with a known, well defined basis for the evaluation. Thereby the transparency of the assessment will be increased at a time when the future tasks of combat aircraft have not yet been determined.
- The Defence is working systematically to identify the risks associated with each candidate. The purpose of the Defence's risk analyses is to identify and follow up on risk factors recognised during the project.
- Rigsrevisionen finds that the Defence should have established the parameters which will be decisive for the evaluation in advance. The final ranking could be very sensitive to the qualities which the Defence considers to be the most important. For instance, it could be decisive for the ranking if price is valued over quality of task performance. In Rigsrevisionen's opinion, the transparency of the subsequent ranking is reduced because the Defence has not set these parameters in advance.
- The Defence should seek to counter the problems related to the fact that the parameters have not been set for the evaluation in advance. Rigsrevisionen recommends that the Ministry, in connection with the publication of the basis for a decision, should elaborate a clear and comprehensive description of the factors which have been decisive for each candidate, and make it clear that the ranking of the candidates has also been subjected to external quality assurance.
- The information provided by the manufacturers is not binding. However, the Defence has set requirements for the reliability of financial information and is testing the information in various manners. Rigsrevisionen recommends that the Defence, during the process leading to the possible signing of a contract, should ensure that the information provided on financial matters was indeed reliable. The Defence has stated that this recommendation will be included in the strategy governing the possible future contract negotiations.

A key point in the military recommendation is the calculation of the cost of acquiring and maintaining one of the three candidates, the so-called life-cycle cost. The Defence is facing considerable challenges in determining the life-cycle cost of the candidates, especially in relation to risk factors and uncertainties. Rigsrevisionen finds that the cross-ministerial working group's contribution to handle uncertainties and risks is a prerequisite for the elaboration of an adequate financial basis.

- The Defence estimates the cost of acquiring and using new combat aircraft over 30 years. This is a huge investment of several billion Danish kroner. Operation and maintenance costs are estimated to account for about 2/3 of the total life-cycle cost. In agreement with the Ministry of Defence, the preliminary figures on the life-cycle cost have been left out of this report to preserve the Defence's negotiating position.

- The Defence's estimate of life-cycle cost is based on general guidelines that are being used for the first time on this project, and which the Defence has had to elaborate. Rigsrevisionen finds that the Defence has been targeted in its efforts to make the financial information on the three candidates as complete as possible.
- The number of aircraft to be acquired has considerable impact on the level of the life-cycle cost. The Defence's calculation of the required number of aircraft is based on several underlying assumptions. Rigsrevisionen finds that these assumptions should be subjected to a critical evaluation to ensure transparency and reduce the total number of aircraft, if possible
- The cross-ministerial working group will evaluate the financial implications of reducing, keeping the same number or increasing the number of aircraft in relation to the present capability of the F-16 fleet. Rigsrevisionen agrees with this approach and recommends that the basis for a decision should include a clear description of the tasks which can be performed with a given number of aircraft.
- The figures for life-cycle cost for the Joint Strike Fighter presented by the Norwegian Ministry of Defence are at a significantly higher level than the cost currently estimated by the Defence. Rigsrevisionen finds that the Ministry of Defence should be able to explain the differences at an aggregate level. Rigsrevisionen recognises the difficulty of procuring comparable figures at a detailed level.
- The Defence intends to calculate the operation and maintenance cost of the present F-16 fleet. Rigsrevisionen finds this relevant to enable comparisons between the operating cost of the candidates and the F-16. It would also provide a good basis to determine the extent to which acquisition and operational cost can be financed within the existing budgets, and what the impact will be on other Defence acquisitions and activities.
- The life-cycle cost of the candidates calculated by the Defence includes risks, their probability of occurring and the financial consequences related to the occurrence of each individual risk. This is done to ensure that the life-cycle cost reflects the risks associated with each of the candidates. Rigsrevisionen recommends that the Defence should estimate the cost of all significant risks and include it in the life-cycle cost. The external quality assurance will address this part of the Defence's calculations.
- The cross-ministerial working group is determining how uncertainties and risks should be handled in the basis for a decision. This work is a prerequisite for the preparation of a financial basis which is as complete as possible. The work is not finished yet.
- The working group will also estimate how sensitive life-cycle cost are to changes in areas characterised by major uncertainty, such as currency rates and the price of fuel. Rigsrevisionen finds that the analyses should also disclose how cost fluctuations will affect the comparison of the candidates.
- The Defence's estimation of life-cycle cost has so far been based on unit costs for currency rates, fuel and real wages fixed by the Defence. The Ministry of Finance will determine the rates in the cross-ministerial working group. Rigsrevisionen agrees with this approach.

- Should the Folketing decide to acquire Gripen or Super Hornet, or extend the life span of the F-16, then the respective manufacturer will – in accordance with current Danish regulations – be under obligation to place orders with or establish an industrial co-operation with Danish firms. The industrial co-operation related to the Joint Strike Fighter are exempt from these regulations. The evaluation of the candidates should reflect the unequal terms.
- Rigsrevisionen finds that the analysis of the socioeconomic consequences of acquiring new combat aircraft should include an evaluation of core uncertainties. The Danish Enterprise and Construction Authority has provisionally pointed to uncertainties related to the future Danish industrial co-operation. It is essential that uncertainties are handled during the process and during the future potential contract negotiations.

II. Preface

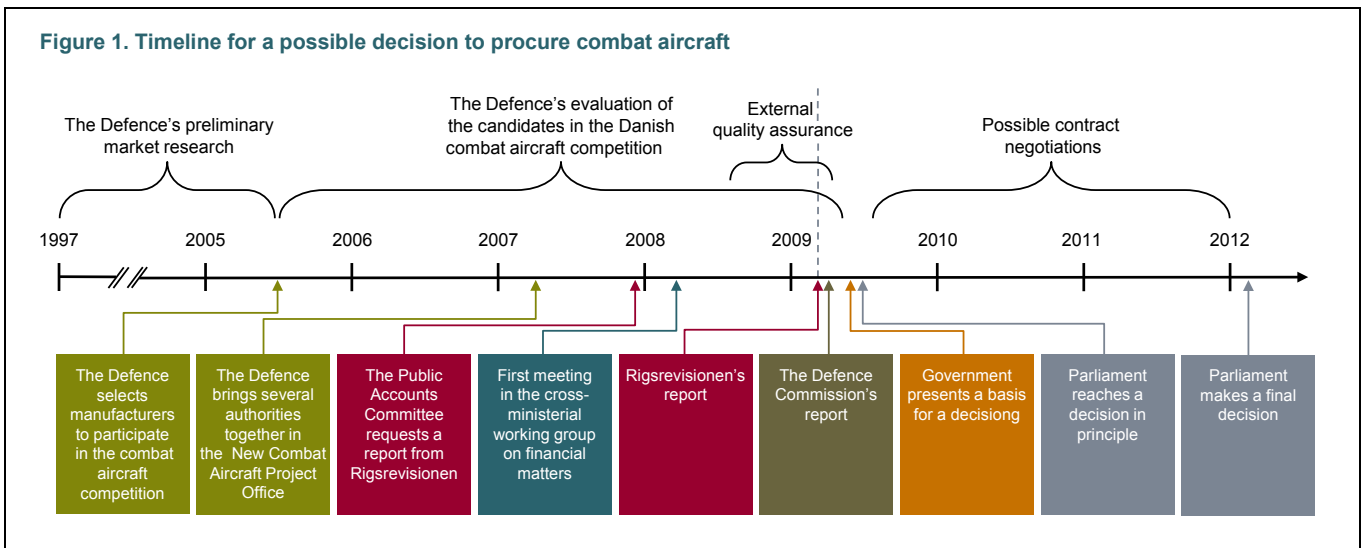
A. Background

7. This report is about how the Ministry of Defence Denmark and the Danish Defence prepare the basis for a possible decision to acquire new combat aircraft for the Danish Defence.

The Defence's F-16 aircraft were mainly procured in the 1970s and need to be replaced by 2020, according to current planning by the Defence. Three combat aircraft are competing to replace the F-16: The Swedish Gripen, the American Joint Strike Fighter and Super Hornet. Since 1997, Denmark has participated in an international cooperation to develop the Joint Strike Fighter.

8. Figure 1 shows some of the important steps in a decision to replace the F-16.

The Candidates
 Gripen is manufactured by Saab.
 Joint Strike Fighter is manufactured by Lockheed Martin. Lockheed Martin has also manufactured the Defence's F-16.
 Super Hornet is manufactured by Boeing.



9. Since the end of the 1990s, the Defence has carried out a number of activities related to the possible replacement of the F-16. These activities have been carried out concurrently with the Defence's participation in the Joint Strike Fighter programme. The Defence's preliminary market research was conducted up until 2005, when the Defence selected a number of manufacturers for participation in the Danish combat aircraft competition.

The Danish government is expected to present a basis for a decision in the spring of 2009. On the basis hereof, the Folketing will decide whether or not the Defence should procure new combat aircraft and, in the affirmative, which manufacturer the Defence should then

open contract negotiations with. The decision will be made in connection with the political negotiations about a future defence agreement. If the Defence is given the go-ahead, the Folketing has to make a final decision when the outcome of the Defence's negotiations with the preferred manufacturer is known – expectedly in 2012.

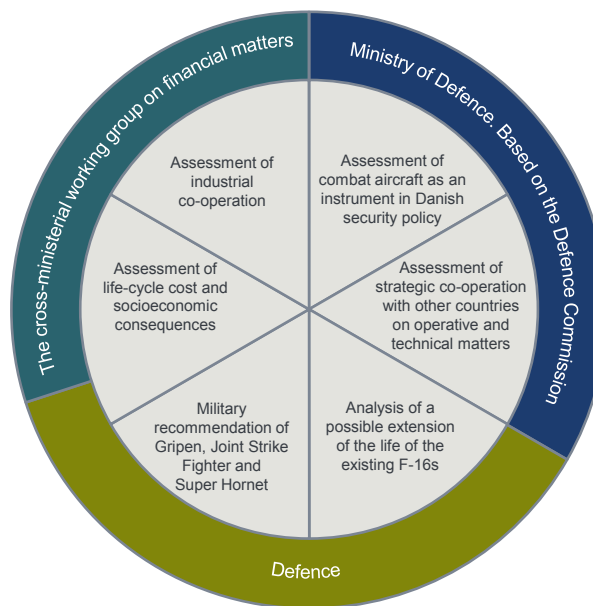
The basis for a decision will also include an analysis of the possibility to extend the life of the existing F-16s which would postpone the replacement of the F-16 fleet by up to six years.

The Defence Commission is expected to present its position on a possible replacement of the F-16 by the end of March 2009 – before the government presents its basis for a decision. The Commission is considering the possible replacement of the F-16 as part of its overall conclusions on the future development of the Defence. The Commission is expected to determine whether Denmark has a requirement for new combat aircraft, and which tasks such aircraft would be required to perform.

10. The Ministry of Defence is expected to prepare a basis for a decision comprising 6 parts. Figure 2 shows the expected content of the basis for a decision.

The Defence Commission of 2008
The Defence Commission was established in January 2008. The members of the Commission are politicians, experts and government officials. According to its terms of reference, the Commission has to consider the future development of the Defence. For instance, the Commission has to consider the possible replacement of the Defence's current F-16 aircraft.

Figure 2. Outline of the basis for a decision and the involved government institutions



Source: Rigsrevisionen's representation of the basis for a decision based on accounts given by the Ministry of Defence.

The figure shows that several government institutions are involved in the elaboration of the basis for a decision.

The Ministry of Defence is going to assess both strategic issues and issues related to security policy. *Security policy issues* comprise an assessment of the combat aircraft as an instrument in Danish security policy. *Strategic issues* include an assessment of Denmark's future possibilities of co-operating with other countries about new combat aircraft. The Ministry expects to base these assessments on the work done by the Defence Commission.

The Defence is heading the Danish combat aircraft competition and will provide its *military recommendation* as to which combat aircraft, the Defence considers to be the best replacement for the F-16 aircraft. The recommendation will conclude in a prioritised ranking of the

three candidates and constitutes an independent part of the basis for a decision. The Defence is also analysing the possibility of *extending the life span* of the current F-16s.

To prepare the financial part, the government has established a cross-ministerial working group. The working group began its work in 2008 and is going to assess the *total life-cycle cost* and the *socioeconomic consequences* of procuring the combat aircraft and of extending the life of the F-16s. Besides the Ministry of Defence and the Defence, also the Ministry of Foreign Affairs and the Ministry of Economic and Business Affairs, represented by the Danish Enterprise and Construction Authority, participate in the work. The Defence's work with the military recommendation provides the basis for the work done in the working group. The Defence is estimating the life-cycle cost, but the working group provides input on how to handle, for instance risks and uncertainties. Thereby the analyses of the financial part of the procurement are both part of the military recommendation and constitute an independent part of the basis for a decision. The cross-ministerial working group will also assess the *industrial co-operation* related to the procurement of new combat aircraft and a possible extension of the life of the F-16s.

Terms of reference for the cross-ministerial working group

The purpose of the working group is to establish as adequate a financial basis as possible which will be incorporated in the basis for a decision to procure new combat aircraft.

11. At its meeting on 13 September 2007, the Public Accounts Committee requested Rigsrevisionen to consider how an examination of the potential acquisition of new combat aircraft could be organised. The Auditor General described the process in a memorandum dated 2 November 2007. Subsequently, at its meeting on 28 November 2007, the Public Accounts Committee asked Rigsrevisionen to submit a report.

Rigsrevisionen has been following the preparations of the basis for a decision since November 2008. Rigsrevisionen has in particular focused on the Defence's work with the military recommendation and the work performed by the cross-ministerial working group on financial matters.

B. The scope of Rigsrevisionen's audit

12. Normally, Rigsrevisionen's audits are conducted after a political decision has been made and implemented, and the purpose of the study performed by Rigsrevisionen is then to assess whether the objectives of a certain activity have been achieved in an efficient manner – a "value for money" study. In this case, however, no decision to acquire combat aircraft has yet been made, and Rigsrevisionen has therefore to some extent become part of the process preceding the political decision. It has been essential for Rigsrevisionen to safeguard its independent position, but also contribute to qualify the basis for a decision has been essential for Rigsrevisionen. Out of consideration for its independence of political deliberations, Rigsrevisionen has decided to publish its findings in this report before the process has been completed, i.e. before the Defence Commission has finalised its conclusions.

Overall, Rigsrevisionen has taken the position that the Defence should know the extent to which the procurement of new combat aircraft will burden the budgets both in relation to the procurement itself, but also in relation to the cost of operating and modernizing the aircraft over their life span. This should be the starting point because the Defence, after the procurement of the F-16s, had problems funding other procurements for a decade. This approach is also considered good practice in countries which Denmark normally compares itself to, although such calculations are performed very differently which makes it difficult to make comparisons between countries. Rigsrevisionen notes that governments are often reluctant to share information owing to commercial and political considerations and therefore the analyses performed by the Defence have to stand alone to some extent.

Naturally, Rigsrevisionen has also followed the public debate and some of the issues addressed in the report – which would in any circumstance be considered relevant – originate partly from the public debate. The Defence's assessment of alternatives to buying new combat aircraft and extending the life span of the F-16s falls in this category.

Rigsrevisionen is also of the opinion that the Defence should ensure the transparency of its recommendation as to which combat aircraft it considers to be the best candidate, in terms of tasks to be performed and the financial aspect. This is not an easy task for the Defence as the subject matter is not immediately understandable to a layman and moreover the Defence's recommendation will be widely based on estimates

13. The procurement of new combat aircraft can become the largest single investment made by the Defence ever and it will have considerable impact on the activities of the Defence for many years ahead. The investment will span 30 years and the total cost will probably swallow up a considerable part of the future defence budgets, depending on the number of aircraft to be acquired by the Defence and the size of future budgets.

Investments of this magnitude involve considerable uncertainties. No matter how the responsible authority proposes to handle these uncertainties in the basis for a decision, the time frame and scope of the investment will involve considerable uncertainty. And it will be impossible to uncover and predict the full consequences of these uncertainties. It is therefore essential, that the Ministry of Defence applies a so-called intelligent risk management strategy to ensure that risks are being evaluated continuously and project management is being adjusted should new risks arise. Future negotiations with a preferred manufacturer should contribute to minimise existing uncertainties and risks in the period leading to a final decision by the Folketing in 2012.

14. An evaluation of military equipment, like combat aircraft, is extensive and involves, for instance an evaluation of the technical and operative capabilities of the aircraft, e.g. the ability of the aircraft to perform and survive military operations. In the early phases of the study, Rigsrevisionen recommended that the Ministry of Defence should subject the entire process to external quality assurance, as Rigsrevisionen would otherwise be compelled to hire external assistance. The Ministry of Defence has subjected the entire basis for a decision to quality assurance by external consultants. The external quality assurance is very extensive and encompasses all parts of the basis for a decision. The quality assurance activities were initiated in the fall of 2008 and will continue until the basis for a decision is presented. Rigsrevisionen has in a number of cases abstained from assessing issues that are being dealt with in the external quality assurance. The results of the external quality assurance were not known to Rigsrevisionen when this report was concluded.

C. Purpose, delimitation and method

15. The purpose of this report is to evaluate the work performed so far by the Ministry of Defence and the Defence with respect to the elaboration of a basis for a decision. The report considers the following three questions:

- How does the Defence determine its requirement for potential new combat aircraft?
- How does the Defence evaluate the combat aircraft candidates?
- How does the Defence estimate the cost of new combat aircraft?

The first question concerns how the Defence can perform its duties if F-16 is phased out by 2020. The two last questions are closely related to the Defence's evaluation of the three combat aircraft candidates that are competing to replace F-16.

16. Rigsrevisionen has had unlimited access to documents and materiel from the Ministry of Defence and the Defence, but has not included military and commercially confidential information in the report. The financial aspect has been included in Rigsrevisionen's review, and Rigsrevisionen has continuously discussed the actual calculations of the life-cycle cost of the combat aircraft with the Ministry and the Defence. To safeguard the Defence's negotiating position, the Ministry of Defence found that actual figures should be left out of Rigsrevisionen's report. Rigsrevisionen has therefore in agreement with the Ministry refrained from publication of data on the cost of new combat aircraft.

The external quality assurance of the basis for a decision comprises the Ministry of Defence's strategy for the procurement and possible subsequent contract negotiations. The assurance also includes the organisation and the resources committed to the project. Furthermore, the consultants will assess the military recommendation and the basis for the financial calculations. Finally, the Defence's risk management of the entire project is being assessed.

Because of the timing of the report, the Ministry and the Defence had not completed their work when this report was concluded. Rigsrevisionen has only received parts of the basis for a decision in draft versions. Data and other information about the aircraft candidates may therefore be subject to change. Appendix 1 [not available in English] contains an overview of Rigsrevisionen's insight into the basis for a decision at the time when this report was submitted.

The audit covers the period from the end of the 1990s until March 2009. The Defence began to consider a replacement of the F-16s in the late 1990s. Rigsrevisionen has gathered the information during the period November 2007 until mid March 2009. Rigsrevisionen has made an effort to follow the developments in the basis for a decision up to the point of submission of the report, but editing was closed in the beginning of March.

Rigsrevisionen's activities to gather information for the study have included interviews and meetings with, for instance the Ministry of Defence, the New Combat Aircraft Project Office under Defence Command Denmark, the Tactical Air Command, the Danish Defence Acquisition and Logistics Organisation, the Ministry of Finance and the Danish Enterprise and Construction Authority. Furthermore, Rigsrevisionen has followed the work in the cross-ministerial working group on financial matters.

17. Rigsrevisionen has visited Boeing, Lockheed Martin and Saab in 2008. The purpose of the visits was to gather information about the combat aircraft. Furthermore, Rigsrevisionen has conducted meetings with the American, the Dutch and the Norwegian supreme audit institutions to exchange information. For instance, both the American and the Dutch supreme audit institutions have reviewed the Joint Strike Fighter programme. Finally Rigsrevisionen has conducted meetings with the Dutch Ministry of Economic Affairs and Ministry of Defence, the Norwegian Ministry of Finance and Ministry of Defence as well as the American Department of Defence. The purpose of these meetings has among other things been to gather information about similar defence acquisition processes in these countries.

18. The report has been presented in draft to the Ministry of Finance, the Ministry of Defence and the Ministry of Economic and Business Affairs, and their comments have been incorporated.

III. Future potential need for new combat aircraft

MAIN CONCLUSION

The basis for a decision has until now been prepared without a political decision on the tasks which combat aircraft would be required to perform in the future. The Defence has evaluated the requirement for new combat aircraft based on the same level of tasks currently performed by the F-16. The Ministry of Defence has stated that it will adjust the basis for a decision after the Defence Commission has finished its evaluation of the requirement. The basis for a decision is currently focused on an evaluation of the three combat aircraft competing to replace the F-16 fleet. The basis for a decision will include one proposal for an extension of the life span of the F-16 for a shorter period of time, but for the time being any other analyses regarding the continued use of F-16 are not being conducted.

19. Before a decision regarding the potential acquisition of new combat aircraft can be made, a position needs to be taken on the need for new combat aircraft and the tasks they are to perform. Rigsrevisionen has therefore examined how the Defence estimates the future requirement for new combat aircraft. Investing in new combat aircraft also means rejecting alternative solutions. Accordingly, Rigsrevisionen has also examined the extent to which other solutions form part of the basis for a decision.

For the purpose of its evaluation, Rigsrevisionen has examined how the Defence assesses:

- the future tasks to be performed by new combat aircraft
- alternative decision options.

A. The Defence's assessment of future tasks to be performed by new combat aircraft

20. A political mandate regarding the future requirement for combat aircraft and the tasks they are to perform is not expected to be available until the Defence Commission has submitted its report and the subsequent political negotiations have been concluded. Thus, for several years, the Defence has been preparing a basis for recommending a replacement for the F-16 without having a political indication of the intended use of the new aircraft.

The Ministry of Defence has stated that the intention is for the Defence Commission to clarify the future requirement for combat aircraft. The Defence Commission will identify the future tasks to be performed by the Defence and whether combat aircraft constitute a relevant future Danish Defence capability. The Defence Commission is expected to publish its report by the end of March 2009 before a basis for a decision has been made regarding the possible acquisition of new combat aircraft. The Ministry of Defence has stated that prior to submitting

the basis for a decision, it will adapt the basis to the Defence Commission's assessment of the future need for combat aircraft.

21. So far, the Defence has assumed that the same level of tasks currently performed by the F-16 is to be maintained in terms of both scope and content. However, the Defence is also conducting its aircraft evaluation on the basis of new tasks, that is, intelligence and surveillance, which the advent of improved sensors enables new combat aircraft to perform.

The military recommendation will include an assessment not only of the capabilities required of new combat aircraft but also of the number of combat aircraft needed to perform the tasks. The Defence will assess how well the individual combat aircraft candidates perform the tasks – are they better than the F-16 and if so, how much better. The Defence will also assess the number of each candidate combat aircraft that will be needed to perform the tasks, that is, are more or fewer combat aircraft required to perform the same level of tasks as performed by the F-16s and how many.

If the Defence Commission's report recommends a different task level for a future combat aircraft capability, the Defence may have to adapt its military recommendation before submitting the basis for a decision. Other capabilities will be required, for example, if combat aircraft are to be used in high-intensive international operations and not exclusively for the enforcement of national sovereignty in air policing operations. A change in task level will impact on the assessment of the need for new combat aircraft and the relevant solution options available for fulfilling this need. The Defence Commission recommendations and the political debate in the wake of the Commission report may therefore influence several elements of the basis for a decision.

22. The current F-16 tasks are air policing, reconnaissance alert and contributions to NATO, including participation in international operations. In addition, aircraft are used for training and education, which are prerequisites for the performance of the other tasks.

The existing defence agreement describes the tasks of the F-16 as the number of combat aircraft that must be ready for deployment at any given time. This is termed the level of ambition. The level of ambition for the Defence's international operations is for eight combat aircraft to be deployed every three years for six months followed by eight combat aircraft for a further six months. Participation in international operations may, eg, take place within the auspices of NATO. The level of ambition for national aircraft tasks is to have two F-16s on permanent standby for air policing operations and one for reconnaissance. The Defence is able to both increase and reduce the number of tasks relative to the levels of ambition described by deploying fewer or more aircraft if desired politically. However, this will have consequences for Defence planning and resource application.

Statistics on the Defence's use of F-16s for international operations show that F-16s were deployed for international operations five times during the period 1997-2009. Overall, this corresponds to the defence agreement target for the frequency of the Defence's deployment of combat aircraft for international operations. However, only once during this period did the number of aircraft deployed match the stipulated level of ambition. The existing use of the F-16 is described in Appendix 2.

The Defence's assessment of future combat aircraft tasks is based on the existing level of ambition and not on the actual use of the F-16.

Assessment

23. As the future tasks of the combat aircraft are not politically determined, the Defence's work is based on the assumption that the tasks which are currently performed by the F-16 are to be performed at the same level in the future.

NATO contributions
The Defence's F-16s carry out operations under NATO. This entails:

Contributing eight F-16s on high readiness and eight on lower readiness for NATO's High Readiness Forces, i.e. forces on high alert for deployment in first-time interventions.

Periodically contributing up to six aircraft for NATO's Response Force, i.e. a fast and flexible rapid response force with contributions from all forces.

Contributing two aircraft for NATO's Quick Reaction Alert – an air policing mission over NATO territory. Air policing operations are primarily performed over Danish territory, but may also be performed over other NATO territory.

24. Rigsrevisionen finds that the basis for a decision should be based on an agreement on the future tasks for combat aircraft. As an example, other capabilities will probably be required if combat aircraft are to be used in high-intensive international operations and not only for the enforcement of national sovereignty.

25. The Defence Commission's report and subsequent political negotiations may result in further adjustments of the basis for a decision. As a first step, the Ministry of Defence will adjust the basis for a decision in accordance with the Commission's evaluation of the future requirement for combat aircraft.

B. Alternative decision options

26. Rigsrevisionen has examined whether the Defence has analysed available decision options in its preparation of a basis for a decision regarding the acquisition of new combat aircraft.

27. In 2005 and 2006, the Defence prepared a number of reports about future combat aircraft. In these reports, the Defence considered the future requirement for combat aircraft and the air force's total airborne capability requirement. The basis of these reports was the task level set out in the existing defence agreement. At this early stage the Defence had already concluded that there was a need for new combat aircraft.

28. The Defence Commission is expected to broadly consider the issue of new combat aircraft in the context of the tasks and capabilities of the three Defence forces (the air force, the army and the navy). The Commission will assess the types of airborne capabilities that must be available to the Defence and consider the Defence's capabilities in the light of the international demand for international task performance. The Defence Commission's report and subsequent political negotiations may cause the Defence to conduct further analyses.

In 2008, for the use of the Defence Commission's secretariat, the Defence prepared a number of brief memoranda on the Defence's analyses of the need for combat aircraft and the alternatives to an acquisition. The Defence is, eg, assessing the consequences of not acquiring combat aircraft, for example by purchasing other weapon systems such as unmanned combat aircraft, combat helicopters and air defence systems. The Defence is also considering the possibility of leasing rather than buying combat aircraft. The Defence expects the contents of these memoranda to form part of the negotiations for a coming defence agreement.

The memoranda to the Defence Commission secretariat assume that the Defence's existing task level will be maintained. The analyses are therefore mainly limited to identifying the consequences of choosing alternative ways of handling these tasks. The Ministry of Defence concludes that no genuine alternative exists for carrying out the tasks performed by combat aircraft. The Ministry finds that other options will therefore be capabilities that handle only some of the tasks performed by combat aircraft and/or handle tasks other than those performed by combat aircraft. According to the Ministry of Defence, an assessment of these broad options does not fall within the framework of the basis for a decision regarding combat aircraft but does form part of the Defence Commission's work and the negotiations for a coming defence agreement.

29. The basis for a decision to acquire new combat aircraft includes evaluating the three candidates for replacing the F-16. At present, the basis for a decision also includes an analysis of one alternative solution, i.e. a short extension of the life span of the F-16 followed by new combat aircraft.

The Ministry of Defence currently finds that a long-term continuation of the existing F-16 structure does not constitute a genuine alternative to the acquisition of new combat aircraft. Rigsrevisionen finds that an adequate basis for a decision should cover all relevant decision

Defence studies of military capabilities to replace the F-16

In 2005, the Tactical Air Command prepared a 'Part-study regarding the combat aircraft for the future' (in Danish). The study analyses the requirements for future combat aircraft and the type of combat aircraft to be selected to replace the F-16. The part-study was revised in 2006.

In 2006, Defence Command Denmark prepared a 'Memorandum on the requirement for future airborne capabilities' (in Danish). The memorandum provides a detailed analysis of the types of airborne capabilities that should be acquired for the air force to replace the F-16.

options in relation to buying new combat aircraft and continuing the existing structure. The analyses of different decision options may be of varying nature and depth since all alternatives cannot be expected to be equally relevant.

Continuing the F-16 structure may hold other options than a short extension of the life span of the F-16, which is the alternative currently being considered by the Defence. Other options could be buying used or new F-16 aircraft, extending the period during which some or all F-16s are operational, effecting a phased acquisition of combat aircraft, or varying the transitional period between existing and any new combat aircraft.

Rigsrevisionen has not evaluated the relevance of such options. In preparing a basis for a decision, the Ministry of Defence has found that no alternatives to acquiring new combat aircraft exist if Denmark is to maintain combat aircraft capabilities in the long term. Accordingly, in its basis for a decision, the Ministry contemplates a prioritized ranking of three new combat aircraft and one further option so far, i.e. to temporarily extend the life span of the F-16 followed by new combat aircraft. The rejection of other options is not expected to be documented in the basis for a decision.

The Defence's current analysis of the potential for extending the life span of the F-16

30. Extending the life span of the F-16 can be considered a way of postponing a potential acquisition of new combat aircraft. A life-span extension constitutes an alternative in the basis for a decision on the condition that it is succeeded by the acquisition of new aircraft.

31. The Defence needs to establish the time at which the F-16 must be phased out in order to determine when an alternative will be needed. So far, the basis for a decision is founded on the Defence's existing plan to phase out the F-16, which assumes decommissioning the F-16 during the period 2016-2020. According to the Defence, an alternative will be required from approx. 2016 onwards.

The phase-out plan was drawn up in 2004, and the Defence has stated that it is being updated. The plan assumes that the Defence must be able to continue performing its existing tasks, that the F-16 is operational in the transitional period, and that new combat aircraft will gradually take over the tasks performed by the F-16.

32. For the purpose of the basis for a decision, the Defence is assessing the potential and consequences of extending the life span of the F-16 beyond 2020. A life-span extension means increasing the remaining life of the F-16 and decommissioning it later than currently planned by the Defence, thus increasing the number of flying hours beyond those planned so far. The options for extending the life span of the F-16 depend on technical, operational and financial factors, among others.

The remaining life of the F-16 is partly determined by the estimated number of flying hours that the individual aircraft can fly throughout its life span and the number of hours already flown. There are major individual differences in the life spans of the F-16s, partly because the aircraft originate from different production series and have been subjected to different updating procedures. Furthermore, the workload of each aircraft differs. For example, the Defence only deploys the newest and most recently updated aircraft for international operations, because these aircraft are the only ones that can carry the weapons and sensors required for participation in international operations. The remaining service life of the F-16 is explained in detail in Appendix 3.

33. For the purpose of the basis for a decision, the Defence will assess whether it is technically and financially advantageous to extend the life of the F-16 for a period of up to six years beyond 2020. The Defence will thus assess the performance of life-span extended F-16s (operational assessment), and the feasibility (technical assessment) and cost (financial assessment) of a life-span extension.

Updating the F-16

The Defence's F-16s are continuously updated through participation in the so-called "Mid-life Update" programme (MLU). So far, the F-16s have been updated four times (M1 to M4). A further two updates are underway (M5 and M6). In addition to the MLU programme, the Defence carries out structural improvements to the F-16s, including improvements to the main body of the aircraft. A wing update programme is planned for the period 2010-2013.

The Defence's provisional recommendation is not to extend the life of the F-16, because the operational value of an F-16 whose life has been extended beyond 2020 cannot be compared to the operational value of other countries' combat aircraft. Moreover, according to the Defence, substantial uncertainty attaches to the technical solution, and substantial financial uncertainty and risk attach to calculating the overall cost of a life-span extension, for example, the extent to which Denmark will be able to share updating expenses with other F-16 users.

34. Rigsrevisionen has not evaluated the Defence's recommendation regarding a life-span extension. The options for extending the life span of the F-16 will be considered by the cross-ministerial working group and subjected to external quality assurance as part of the overall basis for a decision.

35. The Ministry of Defence's current analysis of a possible life-span extension assumes that the Defence's current task level will be maintained. This means that for the moment, the Defence is exclusively analysing the consequences of using F-16s that have undergone life-span extension to continue performing the same tasks.

The Ministry of Defence has stated that the Defence will also assess how the F-16 can be used for a longer period of time without carrying out the structural updating implied by a life-span extension. This could be accomplished by reducing the number of flying hours. This constitutes an alternative to a life-span extension, whereby the planned number of flying hours of the F-16 would be maintained but spread over a longer period.

For the use of the cross-ministerial working group, the Defence will also calculate the financial consequences of extending the life of the existing aircraft and a of a reduced number of aircraft.

Assessment

36. The Ministry of Defence and the Defence's analyses of the requirement for combat aircraft have led the Ministry to propose a choice between three new combat aircraft. The basis for a decision will also – on the condition that new combat aircraft are acquired later – include an extension of the life span of the F-16 for a shorter period beyond 2020.

37. The analysis of the possibilities of extending the life span of the F-16 fleet is not yet complete. The Defence's work does not yet include an evaluation of the consequences of changing the tasks currently performed by the F-16. The Ministry will include an evaluation of how the life span of the F-16 fleet can be extended if the present number of flying hours is being reduced. The basis for a decision will not include other possibilities regarding a continuation of the F-16 structure like, for example acquisition of new or used F-16s or a phased acquisition of new combat aircraft.

38. The Ministry of Defence assesses that there is no alternative to the acquisition of new combat aircraft, if Denmark is to maintain a combat aircraft capability in the long term. The basis for a decision is not expected to include the analyses upon which this assessment is based.

IV. The Defence's evaluation of the combat aircraft candidates

MAIN CONCLUSION

The Defence's military recommendation is designed to prioritise the three combat aircraft competitors. The Defence compares the significant characteristics of the candidates. However, the Defence has not determined in advance how excellent qualities in one area should be compared with less excellent qualities in another area in order to clarify how the Defence ranks the candidates. This makes the evaluation of the candidates less transparent.

39. Rigsrevisionen finds that the Defence's grounds for recommending one candidate rather than another should be as transparent as possible. Rigsrevisionen has therefore examined how the Defence evaluates the candidates for the purpose of the military recommendation.

To clarify the issue, Rigsrevisionen has examined:

- The framework of the Defence's military recommendation work
- The Defence's selection of candidate aircraft and evaluation model
- The Defence's verification of the information contained in the evaluation.

A. Framework of the Defence's military recommendation work

40. The Defence has been working on a basis for selecting an F-16 replacement for several years. Since 1997, the Defence has participated in the development of the Joint Strike Fighter and followed international developments in the combat aircraft field. Although the Danish combat aircraft competition opened in 2005, the Defence did not start working on the military recommendation on the basis of a specific commission from the Ministry of Defence until October 2006.

In its commission, the Ministry of Defence established a general framework for the military recommendation. The Ministry prescribed that the Defence should prepare an analysis of the need for combat aircraft, a description of the candidate aircraft and the evaluation model, as well as a comparison of the evaluation results in order to produce a military recommendation for a possible F-16 replacement.

The Ministry of Defence's commission and timeframe for the military recommendation have been continuously changed. The original January 2007 deadline has, eg, been postponed until after publication of the Defence Commission report. One reason for the postponement was to allow the Defence time to collect additional, updated information from the manufacturers to improve the evaluation basis.

The New Combat Aircraft Steering Committee

The Defence has organised the preparation of the military recommendation as a project organisation consisting of a project owner (Chief of Defence Staff), a steering committee (the New Combat Aircraft Steering Committee) and a project manager (the head of the New Combat Aircraft Project Office).

Information from manufacturers

The Defence formally initiated the combat aircraft competition in 2005 by requesting information about the aircraft from the manufacturers in a so-called 'Request for Information'. In 2007 the Defence issued a 'Supplementary Request for Information'. In 2008 the manufacturers were given yet another opportunity to supply information.

Evaluation model

The combat aircraft are evaluated on six parameters:

- survivability
- mission effectiveness
- purchase price
- operation and maintenance costs
- future-orientation
- project risk.

41. In April 2006 the Defence appointed the New Combat Aircraft Steering Committee, which coordinate the work of Defence authorities on the combat aircraft project.

In July 2007 the Defence established the New Combat Aircraft Project Office under Defence Command Denmark, the entity tasked with heading the competitive selection procedure for a replacement Danish combat aircraft and the preparation of the military recommendation. The work of the Project Office is subject to the approval of the appointed Steering Committee and senior Defence management.

The Defence has assigned personnel from Defence Command Denmark, the Danish Defence Acquisition and Logistics Organisation, and Tactical Air Command to the Project Office. Preparations for a possible F-16 replacement were formerly divided among these authorities. By establishing the New Combat Aircraft Project Office, the Defence separated the preparation of the military recommendation from its participation in the Joint Strike Fighter project. The two tasks were previously closely tied under the Defence organisation.

Assessment

42. The Defence has worked with the potential acquisition of new combat aircraft for several years, but the work did not assume its current shape until the most recent phases. The Defence did not separate the Danish participation in the Joint Strike Fighter programme from the combat aircraft evaluation until the autumn of 2007. Rigsrevisionen finds this separation satisfactory and considers it a necessary condition to ensure a fair competition on equal terms.

B. The Defence's selection of candidate aircraft and evaluation model

43. Following preliminary market surveys, in 2005 the Defence selected four manufacturers for the Danish combat aircraft competition. The Defence selected the candidate aircraft on the basis of a few, high-level requirements to ensure that the aircraft could be used in a NATO context over a 30-year period and would be affordable. The requirements are reproduced in Appendix 4.

The field of candidates has changed since 2005, with two manufacturers withdrawing from the competition. Dassault Aviation, which manufactures the French Rafale combat aircraft, withdrew after receiving the Defence's first request for information from the manufacturers in 2005, while the European consortium responsible for Eurofighter withdrew its candidacy when the Defence asked the manufacturers in the consortium to forward supplementary information in 2007. In 2008 Boeing's Super Hornet became the third candidate to enter the field. The development of the candidate field can be seen in Appendix 5.

44. The Defence is using a newly developed evaluation model for its work of recommending a replacement for the F-16. The Defence uses the model to compare significant characteristics of the Gripen, Joint Strike Fighter and Super Hornet.

First, the Defence assesses the operational effect of the candidate aircraft, that is, how well they perform. Second, Defence assesses the aircraft's life-cycle costs, which include procurement as well as operation and maintenance costs. Finally, the Defence assesses the potential for further developing the aircraft and the project risks of each candidate.

The Defence only uses some of the elements of the evaluation model to assess an extension of the life span of the F-16s. These elements relate to an assessment of the cost of operating the F-16 fleet and the risk associated with extending their life span.

45. In the first instance, the evaluation focuses on individually assessing the three candidate aircraft. The Defence has established criteria for assessing and grading the aircraft's capabilities in each area. Second, the candidates are ranked against each other. This process enables the Defence to propose a preferred supplier with whom it is recommended that

contract negotiations are primarily initiated. The ranking is based on a comparison of the candidates across all the parameters in the evaluation model.

The Defence has developed the evaluation model simultaneously with its candidate selection and evaluation. Rigsrevisionen has noted that the candidate evaluation criteria had not been established when the Defence received information from the manufacturers in 2005 and 2007, and that the Defence only later compiled the criteria and the basis for comparison against which the candidates are evaluated.

46. The F-16 combat fleet is used as a standard for comparing several of the evaluation model's parameters. However, Rigsrevisionen notes that the F-16 has not been described independently as a basis of comparison for the evaluation and that the Defence does not refer systematically to the F-16 fleet in the analyses. The Defence has stated that a detailed description of the F-16 is being prepared.

The Defence does not use the F-16 as a standard for comparing and evaluating the candidates' financial data, but compares the life-cycle costs of the candidates against each other. The Defence operates on the assumption that differences in candidate costs should result in different grades, and has thus continually adjusted the basis of comparison to reflect its current calculations.

The Defence does not define a basis of comparison for assessing the aircraft's project risk. The Defence works systematically to determine the extent of the risk associated with each candidate aircraft. For its risk analysis, the Defence is using a new project tool developed specifically for the combat aircraft project. This tool has to ensure that the Defence takes the aircraft's project risk into account when recommending a preferred manufacturer, and that the risks identified continue to be subject to risk management after the supplier has been chosen.

Rigsrevisionen has not assessed the quality of the risk analyses conducted, which are also subject to external quality assurance. Among other things, the external consultants assess whether the Defence's risk analyses are complete. According to Defence information, the consultants compare the combat aircraft project with three successful acquisitions by the British defence in order to assess whether the Danish Defence has taken the same types of risk into account.

47. In the military recommendation the candidates are ranked against each other according to an overall assessment across the parameters in the Defence's evaluation. Rigsrevisionen notes that the Defence has not in advance prescribed a weighting of the parameters; in other words, described how excellent qualities in one area (eg, operation and maintenance costs) can be compared with less excellent qualities in another (eg, project risk). It is therefore unclear which qualities the Defence will consider decisive in its prioritisation of the candidate aircraft. The Defence has stated that the parameters cannot be considered in isolation, and that the final ranking of the candidates should include an overall assessment of the candidates in all areas. The numerous individual parameter assessments would thus be weighed against each other. The approach selected thus makes high demands on the subsequent transparency of the Defence's grounds for its recommendation.

48. The Defence has not yet completed its evaluation work. Therefore Rigsrevisionen has only limited insight into the actual use of the evaluation model. The external quality assurance will also include an assessment of the Defence's evaluation.

Assessment

49. The Defence originally selected the candidates for the Danish combat aircraft competition on the basis of a few high-level requirements to ensure that the aircraft could be used in a NATO context over 30 years and would be affordable. The field of candidates was adjusted over time, mainly as a result of the manufacturers' indications as to whether they wished to participate in the competition or not.

Project risk

The Defence determines a combat aircraft's project risk by identifying risks in the areas included in the candidate comparison. The Defence assesses, for example, whether the aircraft perform as expected on delivery and at the expected price. This assessment may involve highly detailed and technical issues. The Defence also works with more general strategic risks on which it has no influence, eg, risks related to NATO regulations. Another example is the number of user countries, which is another important factor for the risk assessment.

50. The Defence compares the combat aircraft candidates in several areas, which, in addition to traditional military and technical capabilities, include project risk and life-cycle costs. This means that the Defence evaluates not only how well the aircraft perform, but also the risks related to the procurement and the cost of the aircraft. This is a significant improvement taking into consideration the Defence's experience with other major acquisitions.

51. Rigsrevisionen finds it relevant that the Defence intends to base its evaluation on a comparison with the F-16, as this will provide the Defence with a known, well-defined basis for the evaluation. Thereby the transparency of the assessment will be increased at a time when the future tasks of combat aircraft have not yet been determined.

52. The Defence is working systematically to identify the risks associated with each candidate. The purpose of the Defence's risk analyses is to identify and follow up on risk factors recognised during the project.

53. Rigsrevisionen finds that the Defence should have established in advance the parameters that will be decisive for the evaluation. The final ranking could be very sensitive to the qualities that the Defence considers to be the most important. For instance, it could be decisive for the ranking if price is valued over quality of task performance. In Rigsrevisionen's opinion, the transparency of the subsequent ranking is reduced because the Defence has not set these parameters in advance.

54. The Defence should seek to counter the problems related to the fact that the parameters have not been set for the evaluation in advance. In connection with the publication of the basis for a decision Rigsrevisionen recommends that the Ministry should prepare a clear and comprehensive description of the decisive factors for each candidate, and make it clear that the ranking of the candidates has also been subjected to external quality assurance.

C. The Defence's verification of the manufacturers' information

55. Because the Defence bases its evaluation largely on information from the manufacturers, the Defence must consider the reliability of this information.

In its first request for information in 2005, the Defence stipulated that the financial data should be 80% accurate. In its request for supplementary information two years later, the Defence expected manufacturers to be able to provide data with an accuracy higher than 80%. The Defence therefore asked the manufacturers to state an information reliability target. Box 1 shows the financial data reliability indicated by the individual manufacturers.

BOX 1. RELIABILITY OF THE FINANCIAL DATA OF THE AIRCRAFT

Lockheed Martin stated that the information about the Joint Strike Fighter was based on approximate data, which included a combination of historic data from other aircraft projects and actual production data from the Joint Strike Fighter. (The updated data provided to the Defence in August 2008 related to two completed aircraft and 19 in production.)

Boeing stated that the acquisition costs of the Super Hornet were known as this aircraft is fully developed, constructed and operational. The operation and maintenance costs for the Super Hornet are based on data from the operational activities of the US fleet and based on a high number of actual flying hours over a period of approximately nine years.

Saab stated that the operation and maintenance costs were based on data from the Swedish Air Force's Gripen fleet operations as well as information from the manufacturer. As Denmark is being offered a different Gripen version, the data are therefore approximate. The acquisition costs are quoted as budgeted prices. In December 2008, Saab announced that it was prepared to offer a fixed level of life-cycle cost. More detailed information about the price, scope and conditions of the offer has not been provided.

Source: The manufacturers' response to the Defence's requests for information in 2005, 2007 and 2008.

The Defence has not set any requirements for the reliability of the manufacturers' operational data, but uses methods such as test flights and flight simulations to verify this information.

Rigsrevisionen notes that the manufacturers have not indicated the degree of accuracy of the financial information, but have described the sources of the information.

56. The information collected by the Defence for the purpose of the evaluation is not binding. The Defence has stated that it has informed manufacturers that it will break off any future contract negotiations if it discovers significant discrepancies between the information currently used for the evaluation and a future basis for contract negotiations. A ceiling on the amount of deviation considered acceptable has yet to be set.

Rigsrevisionen has noted that the Defence has not analysed cost developments regarding the information already provided in order to assess the credibility of the manufacturers' statements. The Defence estimates that it would be most relevant and effective to analyse such developments during contract negotiations. During the evaluation, the Defence addresses this issue as part of the candidates' project risk analysis. The Defence has stated that in cases where it assesses that there is a risk of a cost being higher than originally stated by the manufacturers, this is considered a specific risk. The overall risk thus reflects the Defence's assessment of the reliability of the manufacturers' information.

57. Access to independent sources of information can give the Defence an opportunity to verify the manufacturers' information. The Defence has indicated that it uses F-16 fleet data as a standard for assessing the correctness of the manufacturers' information. Furthermore, the Defence has entered into agreements or been in dialogue with users of the candidate aircraft wherever possible. In addition, the Defence has been in regular contact with the defence ministries of other countries to collect and verify information on, eg, the candidate aircraft's life-cycle costs for use in the evaluation.

58. In the evaluation, the Defence has focused on ensuring the transparency and traceability of its methods for assessing and using the information about the candidates, an issue that is the subject of the external quality assurance. One way to create transparency in the use of information could be to initiate a consultation procedure involving the manufacturers prior to finalising the military recommendation. Together with the Legal Adviser to the Danish Government, the Defence is considering whether and how a consultation procedure could

Users of the candidate aircraft

No air forces are using the version of the Gripen being offered to Denmark, but other air forces, including the Swedish and Czech forces, use former versions of the aircraft.

No air forces use Joint Strike Fighter as it is newly developed, but the Danish Defence is discussing the financial data with the other partner countries in the Joint Strike Fighter programme.

The US air force uses Super Hornet, as does the Australian air force, which recently acquired the Super Hornet.

be practically implemented without publishing the precise basis for comparison and thus weakening the Defence's negotiating position.

Assessment

59. The information provided by the manufacturers is not binding. However, the Defence has set requirements for the reliability of financial information and is testing the information in various manners. Rigsrevisionen recommends that the Defence, during the process leading to the possible signing of a contract, should ensure that the information provided on financial matters was indeed reliable. The Defence has stated that this recommendation will be included in the strategy for possible future contract negotiations.

V. The Defence's cost estimates for new combat aircraft

MAIN CONCLUSION

A key point in the military recommendation is the calculation of the cost of acquiring and maintaining one of the three candidates, the so-called life-cycle cost. The Defence is facing considerable challenges in determining the life-cycle cost of the candidates, especially in relation to risk factors and uncertainties. Rigsrevisionen finds that the cross-ministerial working group's contribution to handling uncertainties and risks is a prerequisite for the elaboration of an adequate financial basis.

60. Rigsrevisionen finds that the basis for a decision should provide a complete picture of the expected costs, and that the financial basis should also reflect the principal risks and uncertainties of purchasing new combat aircraft for the Danish Defence. Rigsrevisionen has therefore examined the way in which the Defence estimates the cost of new combat aircraft.

To assess the issue, Rigsrevisionen has examined:

- The Defence's estimates of the life-cycle costs of combat aircraft
- Ways of comparing life-cycle cost levels
- Risk and uncertainty assessments
- Analysis of the socioeconomic consequences, with particular focus on industrial cooperation.

A. The Defence's estimates of the life-cycle costs of combat aircraft

61. Rigsrevisionen has examined the Defence's preliminary estimates of the life-cycle costs of the candidate aircraft. Life-cycle costs give a picture of the total costs associated with purchasing and operating combat aircraft until they are decommissioned. Rigsrevisionen has had ongoing discussions about the specific life-cycle cost estimates with the Ministry of Defence and the Defence, and has observed changes in the figures as the decision-making basis has developed.

The Defence estimates the cost of purchasing and using new combat aircraft over 30 years. This is a huge investment of several billion Danish kroner, with operation and maintenance costs estimated to account for about two-thirds of the total life-cycle cost. In agreement with the Ministry of Defence, the preliminary life-cycle cost figures have been omitted from this report to avoid jeopardising the Defence's negotiating position.

The Defence bases its life-cycle cost estimates on the number of new combat aircraft that it assesses will be needed to perform the same tasks as the present fleet of 48 F-16s.

Life-cycle costs comprise the purchase price and the continuous operating and development costs throughout the lifespan of the military equipment. The term thus denotes the total costs associated with an acquisition 'from cradle to grave'.

The Defence's guidelines for estimating life-cycle costs group the costs into three categories:

Acquisition

Acquisition costs are the unit price of the combat aircraft plus investment and facility construction costs.

Operation

Operation costs refer to the current costs of operating the combat aircraft.

Phase-out

Phase-out costs are the costs associated with discontinuing use of and decommissioning the aircraft.

62. The Defence has based its life-cycle cost estimates on guidelines issued by the Danish Defence Acquisition and Logistics Organisation. The guidelines contain general directions for the cost elements that must be included in order to calculate the cost of acquiring, operating and phasing out military equipment.

Drawn up in 2007, the guidelines are being used for the first time for this combat aircraft project. They can be used to estimate the life-cycle costs of all types of military equipment. This means that in order to provide a complete analysis, the specific calculations have to be extensively adjusted to the military equipment in question. A review of the Defence's work to date shows that the Defence to a large extent has had to give the guidelines more depth. This involved establishing a large number of assumptions and delimitations as well as designing underlying models, eg, to enable the Defence to estimate how many aircraft are needed for various levels of task performance.

63. The Defence's point of departure is that all costs related to new combat aircraft must be included in the estimates to the extent that the specific cost item has significant importance for the overall cost level. This includes both type-specific costs particular to an individual aircraft candidate and capability-specific costs resulting from the Danish Defence's possessing a combat aircraft capability.

The ongoing delimitations set by the Defence mean that some costs have been excluded from the estimate of life-cycle costs. Examples are costs related to phasing out the combat aircraft and some indirect case processing and staff training costs. The Defence has chosen to disregard these costs, assessing that their impact on the overall cost level is insignificant or highly uncertain. The external quality consultants will assess the scope of the costs included by the Defence in the calculations. Appendix 6 contains a review of some of the individual cost elements excluded by the Defence from the basis for a decision.

64. The number of aircraft to be acquired has major impact on the overall cost level. The Defence has collected information from the manufacturers based on the assumption that Denmark will purchase a total of 48 aircraft, but will calculate how many of each candidate will be needed to maintain the performance level of the present F-16 fleet. Defence analyses show, first, that a smaller number of aircraft than the current 48 F-16s will be needed to perform the same tasks, and second, that the number varies depending on the candidates. The difference in the number needed is due to the different capabilities of the aircraft and the different ways in which they perform tasks.

The Defence has designed a model for calculating the total number of aircraft needed, working on the assumption that the prescribed tasks determine the number of aircraft to be acquired. The connection between tasks and number of aircraft is based on a wide range of assumptions such as, eg, the NATO requirement for the number of hours pilots are expected to log per year and factors determining how many flying hours a combat aircraft can produce in its life span. The way in which the Defence establish these assumptions has a great impact on the number of aircraft needed. More detailed examples are presented in Box 2.

BOX 2. EXAMPLES OF ASSUMPTIONS IN THE DEFENCE'S MODEL FOR CALCULATING THE NUMBER OF AIRCRAFT NEEDED

Pilots' flying hours

Pilots must meet NATO's annual flying hour requirement in order to be deployed on international operations as part of a NATO contribution. The former NATO requirement was 180 hours, but the Defence has reported that this minimum has been dropped by 40 hours, which can be replaced by flight simulator hours. In its estimates of the number of new aircraft needed, the Defence has further reduced the flight hour level to 130 annual hours per pilot. The Defence also establishes assumptions for the number of pilots to be trained and retrained annually, and for the number of flying hours pilots must complete in order to achieve or maintain their pilot status.

Production of flying hours by combat aircraft

Many factors impact the number of flying hours that combat aircraft can produce, including aircraft life span, the number of daily and annual hours they can produce, and the amount of maintenance required. A key assumption in this connection is operational availability: the time for which aircraft are available and not undergoing maintenance or inspection. On the basis of US Defense figures and information provided by the manufacturers, the Danish Defence estimates that operational availability can be increased from the current level of approx. 50% for the F-16 to approx. 70-75% for a new combat aircraft.

Deployment period

The planning basis for deploying F-16s on international operations presupposes that an F-16 contribution can be made every three years for a maximum period of six months at a time. The Defence has maintained these assumptions in its model for calculating the number of aircraft needed.

Some of the factors included in estimating the number of aircraft needed vary from aircraft to aircraft, for which reason the estimates depend on the aircraft type as well as the fundamental assumptions. The complexity of the model is due to the numerous underlying conditions and assumptions.

65. The cross-ministerial working group will describe the financial implications of acquiring differing quantities of combat aircraft. The working group has decided to evaluate the implications of reducing, maintaining or increasing the current number of F-16 aircraft. The Ministry of Defence has stated that, at present, the working group expects to evaluate the cost of acquiring 24, 36, 48 and 60 new aircraft of each candidate.

The working group deals only with the financial aspects of changing the total number of combat aircraft. However, the Ministry of Defence has stated that the working group's report will also contain a description of which tasks each candidate aircraft can perform, based on each of the four fleet-size scenarios. The description will both cover differences between candidates when the same number of each candidate is purchased and illustrate differences in task performance with varying fleet sizes. The description is thus expected to indicate which types of task the Defence can perform with 24, 36, 48 and 60 models of a given candidate, but also the impact on task performance if the Defence purchased, for example, 48 models of one candidate compared with 48 of a different candidate. The Ministry of Defence has not yet determined what form the description of the relationship between total fleet size and task performance should take.

Assessment

66. The Defence estimates the cost of acquiring and using new combat aircraft over 30 years. This is a huge investment of several billion Danish kroner. Operation and maintenance costs are estimated to account for about two-thirds of the total life-cycle cost. In agreement with the Ministry of Defence, the preliminary life-cycle cost figures have been left out of this report to preserve the Defence's negotiating position.

67. The Defence's estimate of life-cycle cost is based on general guidelines that are being used for the first time on this project, and which the Defence has had to elaborate. Rigsrevisionen finds that the Defence has been targeted in its efforts to make that the financial information on the three candidates as complete as possible.

68. The number of aircraft to be acquired has considerable impact on the level of the life-cycle cost. The Defence's calculation of the required number of aircraft is based on several underlying assumptions. Rigsrevisionen finds that these assumptions should be subjected to a critical evaluation to ensure transparency and reduce the total number of aircraft, if possible.

69. The cross-ministerial working group will evaluate the financial implications of reducing, keeping the same number or increasing the number of aircraft in relation to the present F-16 capability. Rigsrevisionen agrees with this approach and recommends that the basis for a decision should include a clear description of the tasks that can be performed with a given number of aircraft.

B. Ways of comparing life-cycle cost levels

70. The Defence's estimates of the life-cycle costs of the combat aircraft are based on its own models and analytical work to date. It might be useful to verify the level of the Defence's estimates by comparing them with the Defence's own data and experience as well as those of international air forces.

71. Rigsrevisionen's examination has shown that the Defence has had ongoing contact with authorities in other countries, collecting and verifying information about the combat aircraft's life-cycle costs. The Defence and the cross-ministerial working group have, eg, contacted the ministries of defence in Norway, the Netherlands and the USA.

Considerable difficulties can arise when comparing information about the life-cycle costs of combat aircraft from the defence ministries of other countries. The reasons include different calculation methods, as well as political and commercial interests which may cause reluctance by defence ministries to exchange information.

72. The Ministry of Defence has reported that it is in close dialogue with the Norwegian Ministry of Defence, receiving information about Norwegian estimates of life-cycle costs.

In November 2008 the Norwegian government announced its decision to acquire the Joint Strike Fighter as a replacement for the Norwegian Defence's F-16 fleet. In this connection the Norwegian life-cycle cost figures for the Joint Strike Fighter were published. Adjusted for price levels, exchange rates and number of aircraft, the Norwegian figures are significantly higher than the preliminary Danish estimates that Rigsrevisionen has seen (see Box 3). The Norwegian and Danish figures are not directly comparable, and a comparison would be subject to significant uncertainties because of different assumptions. However, the difference between the Norwegian figures and the preliminary Danish figures shows that it might be relevant for the Defence to provide a general explanation of the differences between the Norwegian and Danish estimated life-cycle costs.

BOX 3. NORWEGIAN LIFE-CYCLE COST FIGURES

The Norwegian Ministry of Defence has estimated the life-cycle costs of 56 Joint Strike Fighter aircraft at approx. NOK 145 billion over a 30-year period (2008 prices). The Norwegian figures correspond to life-cycle costs amounting to DKK 123 billion for the Joint Strike Fighter (exchange rate as at 17 March 2009). Rigsrevisionen notes that the Norwegian estimates are significantly higher than the preliminary calculations carried out by the Danish Defence. Although the comparison takes price level, exchange rate and number of aircraft into account, it will be subject to major uncertainties due to the different assumptions. The comparison is based on preliminary Danish calculations for Joint Strike Fighter, which Rigsrevisionen has seen.

The Norwegian Ministry of Defence concludes that it was impossible to provide a complete cost overview for the Gripen, but that the costs identified were NOK 20-30 billion higher than for the Joint Strike Fighter.

Source: Norwegian Ministry of Defence: Extended acquisition strategy for project 7600 (in Norwegian), November 2008.

73. As part of the work in the cross-ministerial working group, the Defence is to calculate the operation and maintenance costs of the present F-16 fleet. The calculations are not yet complete, but preliminary figures show that the annual cost of operating the F-16 fleet amounts to roughly DKK 1 billion (2008 prices). A comparison of the expected operation costs of the candidates and the current operation costs of the F-16 may indicate whether the Danish Defence's annual operating costs for combat aircraft will change.

The Ministry of Defence has stated that only a limited comparison of the operating costs of F-16 and new combat aircraft is possible, one reason being that the extent of the ongoing updating costs included in the calculations varies.

The life-cycle cost level may have an impact on the existing defence budget and its flexibility. For example, during a given ten-year period, the acquisition of F-16s made it difficult for the Defence to afford other acquisitions. On the basis of the available data, Rigsrevisionen has noted that no analysis has been made of the impact that a possible acquisition of combat aircraft would have on defence budget flexibility, and thus on the Defence's other activities and acquisitions.

Assessment

74. The figures for the life-cycle costs of the Joint Strike Fighter presented by the Norwegian Ministry of Defence are at a significantly higher level than the Danish Defence's current estimates. Rigsrevisionen finds that the Ministry of Defence should be able to explain the differences at an aggregate level. Rigsrevisionen recognises the difficulty of procuring comparable figures at a detailed level.

75. The Defence intends to calculate the operation and maintenance cost of the present F-16 fleet. Rigsrevisionen finds this relevant to enable comparisons between the operating cost of the candidates and the F-16. It would also provide a good basis for determining the extent to which acquisition and operational costs can be financed within the existing budgets, and what the impact will be on other Defence acquisitions and activities.

Risk is the term denoting the possibility of an unfavourable occurrence.

Uncertainty denotes the degree of uncertainty with which a given event will occur. The term is used to describe the probability of a certain cost ceiling being exceeded.

C. Risk and uncertainty assessments

76. The terms risk and uncertainty refer to the fact that the Defence's estimates are a prediction of future life-cycle costs, and there is always a possibility that the actual costs will deviate from the prediction. An assessment of the extent of these risks and uncertainties thus forms a core element of the decision-making basis.

77. The assessment of life-cycle costs is the result of the joint efforts of the Defence and the cross-ministerial working group. The working group assesses, eg, the life-cycle costs and determines the key assumptions and uncertainties to be included in the estimates. The working group's tasks are outlined in Box 4.

BOX 4. THE TASKS OF THE CROSS-MINISTERIAL WORKING GROUP

The working group is tasked with estimating the expected **total cost** of new combat aircraft. The working group is expected to calculate the costs of acquiring 24, 36, 48 and 60 air craft of each candidate. The group will also define the aircraft training and maintenance concepts to be used for the subsequent estimates. Both concepts will be important for determining the total number of aircraft the Defence will have to buy to perform the given tasks.

The working group will establish a series of **assumptions** for estimating the total costs such as exchange rates, fuel prices, real growth and inflation. Another assumption is the expected number of user countries, which will influence how development costs are distributed and the extent to which maintenance and weapon integration costs can be shared among several countries.

The working group will establish a model for handling the risks and uncertainties associated with estimating the total costs, eg, the risks related to the financial information provided by the manufacturers. The model is based on information from the Defence about such factors as the financial consequences of the individual uncertainties and risks and the probability of their occurrence.

The working group's assessment of the **socioeconomic consequences** of the acquisition covers the scope and nature of industrial cooperation, including the possibilities for knowledge transfer, employment and industrial development.

78. The work of the working group is based on the Defence's work, but the working group has the particular task of establishing a framework that the Defence can use to handle risks and uncertainties.

Under the auspices of the cross-ministerial working group, the Ministry of Finance will assist with the assessment the risks and uncertainties on the basis of the Defence's information. The Ministry of Finance has asked an external consultancy firm to design a model for how the working group and the Defence can handle the uncertainties and risks associated with life-cycle costs. This will be done independently of the general quality assurance project initiated by the Ministry of Defence. The model is based on information from the Defence about such factors as the financial consequences of the individual uncertainties and risks and the probability of their occurrence. The work has not yet been completed, and Rigsrevisionen has not yet seen the results.

Risk assessments

79. The Defence conducts ongoing risk assessments of the individual elements included in the estimate of the combat aircraft's life-cycle costs.

When addressing risks, the Defence distinguishes between risks whose costs can be estimated and those that cannot. The Defence has stated that a calculation of life-cycle costs will include risks whose expected cost can be estimated. If the cost of the risk cannot be estimated, the risks will not be included in the calculation but in an assessment of the

candidate's project risks. The external quality assurance will assess both cost-estimated and non-cost-estimated risks.

Cost-estimating risks is a way of ensuring that the life-cycle costs reflect the expected risks. Underestimating the costs of risks may make the actual life-cycle costs higher than originally estimated.

The Defence will continue with the risk analysis, also after the conclusion of the evaluation work, and expects to cost-estimate more risks on an ongoing basis as the basis for a decision evolves. The military recommendation will therefore present a snapshot of the Defence's risk assessment.

The Defence has furthermore explained that, on the basis of the Ministry of Finance's assistance, the Defence will organise its risk analysis to provide for additional analyses of the principal risks estimated to have the greatest impact on life-cycle costs.

Uncertainty assessments

80. The cross-ministerial working group will estimate how sensitive life-cycle costs are to changes in areas associated with major uncertainty. This estimate will be based on the model for handling uncertainties and risks that the Ministry of Finance is responsible for having prepared.

Based on this model the working group is expected to present a proposal demonstrating the likelihood that the life-cycle costs will correspond to the Defence's estimate. The Ministry of Finance has reported that the working group is expected to present a range of probable outcomes of the calculated life-cycle costs. The working group is also expected to be able to give an idea of which costs and risks will have the greatest impact on life-cycle costs. In the light of earlier work, the Defence has reported that exchange rate risk is probably an area in which life-cycle costs will be most sensitive to changes.

So far, the Defence has carried out a few preliminary analyses of how sensitive life-cycle costs are to fluctuations in exchange rates, fuel prices, real wages and the effect of the maintenance concepts. The analyses illustrate how changes affect not only total life-cycle costs for each of the candidates, but also the relationship between the candidates. The Defence has stated that these analyses will be organised in accordance with the working group's assessments.

81. The Norwegian model for handling sensitivity analyses is described in Box 5. It shows, for example, that the Norwegian life-cycle cost estimates contain an evaluation of the probability that life-cycle costs will end up at a certain level. It also shows that the Norwegian model has been used to identify areas in which life-cycle costs are particularly sensitive to changes.

BOX 5. NORWEGIAN ESTIMATES OF THE SENSITIVITY OF LIFE-CYCLE COSTS

The estimated life-cycle costs for the Norwegian Joint Strike Fighter acquisition project amount to approx. NOK 145 billion (2008 prices). The Norwegian figures have an uncertainty margin of NOK 40 million (2008 prices). The margin shows that the life-cycle costs have a 15% probability of not exceeding approx. NOK 125 billion and an 85% probability of not exceeding approx. NOK 165 billion.

The Norwegian Ministry of Defence has used the sensitivity analyses to identify factors with the greatest impact on the life-cycle costs of the Joint Strike Fighter. Life-cycle costs are particularly sensitive to uncertainties related to patterns of aircraft use, exchange rate risk on acquisition and the consequences of an operational partnership with other countries. Together, these three factors account for over 60% of the uncertainty margin of the life-cycle costs. In addition to the exchange rate risk, weapon investment and real growth are other major explanatory factors for the uncertainty margin associated with aircraft acquisition. In addition to the question of an operational partnership with other countries, the uncertainty margin related to operations can also be explained by fuel price developments.

Source: Norwegian Ministry of Defence: External Quality Assurance QA2 of extended acquisition strategy for project 7600 Future Air Craft Capacity (in Norwegian), 14 November 2008.

Currency hedging

Currency hedging is a mechanism for protecting the exchange rate against foreign currency fluctuations. This may be relevant in a situation in which a country has to pay for combat aircraft in a foreign currency and wishes to protect itself against exchange rate fluctuations in the period from the decision is made to the date of payment.

82. So far, the Defence's estimation of life-cycle costs has been based on exchange rate, fuel price and real wage levels fixed by the Defence. The levels have not been based on independent sources.

The Defence has stated that it will address exchange rates, fuel prices and real wages in accordance with the assessments made by the Ministry of Finance under the auspices of the cross-ministerial working group. The Ministry of Finance will establish the assumptions for calculating exchange rate risk, real wage growth, fuel prices and inflation. The Ministry will furthermore describe the options for currency hedging. The purpose of currency hedging is to protect the exchange rate against foreign currency fluctuations. Rigsrevisionen has not yet seen the results of this work.

Assessment

83. The life-cycle cost of the candidates calculated by the Defence includes risks, their probability of occurring and the financial consequences related to the occurrence of each individual risk. This is done to ensure that the life-cycle cost reflects the risks associated with each of the candidates. Rigsrevisionen recommends that the Defence should estimate the cost of all significant risks and include it in the life-cycle cost. The external quality assurance will address this part of the Defence's calculations.

84. The cross-ministerial working group is determining how the basis for a decision should handle uncertainties and risks. This work is a prerequisite for the preparation of a financial basis that is as complete as possible. The work is not finished yet.

85. The working group will also estimate how sensitive life-cycle cost are to changes in areas characterised by major uncertainty, such as exchange rates and the price of fuel. Rigsrevisionen finds that the analyses should also disclose how cost fluctuations will affect the comparison of the candidates.

86. The Defence's estimation of life-cycle cost has so far been based on the unit costs for currency rates, fuel and real wages fixed by the Defence. The Ministry of Finance will determine the rates in the cross-ministerial working group. Rigsrevisionen agrees with this approach.

D. Socioeconomic consequences

87. The cross-ministerial working group is to assess the socioeconomic consequences of the Defence either acquiring new combat aircraft or extending the life of the F-16 combat air fleet. Under the auspices of the working group, the Danish Enterprise and Construction Authority will produce an analytical model for assessing the socioeconomic consequences. The model has not yet been determined, and the Enterprise and Construction Authority's assessments are preliminary. The analytical work is expected to include the industrial cooperation between Danish industry and a possible future supplier. The Authority also expects to assess possible effects in the form of knowledge transfer to Danish companies, business development and employment.

The Ministry of Defence has stated that the socioeconomic analysis will be limited to the earnings aspect of a possible investment. Consequential expenses such as environmental and noise nuisance will be analysed later, but before the Folketing makes a final decision.

88. Danish companies will partner with the manufacturers if new combat aircraft are acquired or if the F-16 fleet undergoes life extension. The Enterprise and Construction Authority's analysis will centre on the fact that the conditions for potential industrial cooperation between manufacturers and Danish industry will differ. Unless Denmark withdraws from the programme, a Joint Strike Fighter acquisition will be exempt from the ordinary rules for industrial participation regarding the acquisition of defence equipment (offset obligation). The offset obligation applies to the other candidate aircraft and to an extension of the life of the F-16 fleet. The Enterprise and Construction Authority estimates that the different conditions may have implications for both the scope and the content of a possible industrial cooperation.

If Denmark decides to acquire the Gripen or Super Hornet or to extend the life of the F-16, under the present Danish rules, the manufacturer would be under an obligation to place orders or establish industrial cooperation with Danish companies corresponding to the value of the entire acquisition and the further acquisition of equipment for the fleet (eg, updates). Danish industry would participate in the Joint Strike Fighter programme in competition with the national industries of the other partner countries. Thus, Danish companies are not guaranteed to win orders equivalent to Denmark's equipment costs of participating in the Joint Strike Fighter programme. Conversely, the cost of an industrial cooperation might exceed the Danish costs associated with programme participation. Similarly, the costs of an industrial cooperation regarding the Gripen and Super Hornet might exceed the statutory requirement. Both manufacturers have declared that the costs of a future industrial cooperation will go beyond the statutory requirement. The Enterprise and Construction Authority has stated that the calculations will be based on the statutory 100% offset obligation, but that the Authority will also explain the manufacturers' other plans for cooperation.

The ordinary rules for industrial cooperation and the provisions of the Joint Strike Fighter programme differ in several other areas. For instance, there are different definitions for the types of delivery that a possible cooperation will comprise. The ordinary set of rules also embraces options for manufacturers to reduce the offset obligation to a lower amount, for example, by quickly fulfilling their obligation or by contributing to research and development as well as the transfer of technology to Danish enterprises. The Joint Strike Fighter programme does not incorporate these mechanisms.

89. The Enterprise and Construction Authority will also consider the manufacturers' former cooperation with Danish enterprises on other acquisition projects. The analysis will be conducted to evaluate any uncertainties associated with a future collaboration and to paint a picture of the companies with which a manufacturer could be expected to cooperate.

Industrial cooperation and offset

International companies that supply defence equipment or services to the Danish Defence are required to make an agreement with the Danish Enterprise and Construction Authority before they can sign a contract with the Defence. The agreement commits international suppliers to placing defence-related orders for an amount corresponding to that of the supplier's contract with the Defence with Danish companies.

Exemption from the offset obligation

In 2007, in connection with Denmark's continued participation in the Joint Strike Fighter programme, the Minister for Economic and Business Affairs waived the offset obligation for current and potential future projects related to the programme.

Appropriation of funds for the Joint Strike Fighter programme

The Folketing's Finance Committee has appropriated approx. DKK 2.7 billion to Denmark's participation in the Joint Strike Fighter programme. Contributions to the programme cover the period 1997-2051. Danish industry has committed itself to contributing up to approx. DKK 170 million to the aircraft's development phase.

The Enterprise and Construction Authority is already monitoring the orders received by Danish companies as a result of Denmark's participation in the development of the Joint Strike Fighter. The Authority has calculated that the current volume of orders accounts for approx. two-thirds of the Danish contribution to the programme. Extrapolating the order intake to 2012, the Authority assesses that Danish participation will continue to be considerably lower than the level of the Danish contribution. In this context, the Authority's projection is based on the assumption that Danish enterprises will not win further business areas. This is an early assessment, and the order intake was measured at a time when Denmark had not committed itself to purchasing the Joint Strike Fighter.

90. Rigsrevisionen observes that the Enterprise and Construction Authority has provisionally pinpointed uncertainties related to the future Danish industrial cooperation on the acquisition of new combat aircraft or the extension of the life of the F-16 fleet. As the analytical process has not yet been concluded, Rigsrevisionen cannot describe other uncertainties that it will cover. These could for example be uncertainties related to the ability of Danish companies to fulfil orders of the size in question and their technological capabilities in connection with the acquisition project. The Enterprise and Construction Authority has stated that it is considering how to organise the analysis of uncertainties.

Assessment

91. Should the Folketing decide to acquire the Gripen or Super Hornet, or extend the life span of the F-16, then the respective manufacturer will – in accordance with current Danish regulations – be under an obligation to place orders with or establish an industrial cooperation with Danish firms. The industrial cooperation related to the Joint Strike Fighter is exempt from these regulations. The evaluation of the candidates should reflect the unequal terms.

92. Rigsrevisionen finds that the analysis of the socioeconomic consequences of acquiring new combat aircraft should include an evaluation of key uncertainties. The Danish Enterprise and Construction Authority has provisionally pinpointed uncertainties related to the future Danish industrial cooperation. It is essential that uncertainties are addressed during the process and future potential contract negotiations.

Rigsrevisionen, 18 March 2009

Henrik Otbo

/Bjørn Olsen

Appendix 1. Status of Rigsrevisionen's insight into the basis for a decision

As Rigsrevisionen submitted its report before the Ministry of Defence and the Defence had concluded their work on the basis for a decision, Rigsrevisionen only had insight into parts of the basis at the time of submission:

Elements of the basis for a decision that Rigsrevisionen has not seen

The military recommendation

The recommendation will consist of a memorandum package that is not expected to be compiled until the bulk of the Defence's analytical work has been concluded. Rigsrevisionen has primarily seen the background material to the memorandum package. Rigsrevisionen has not seen:

- The final estimated life-cycle costs for the Gripen, Joint Strike Fighter and Super Hornet and for the life extension of the F-16. Rigsrevisionen has not seen the financial background memorandum for the Super Hornet.
- A description of the F-16 combat aircraft as a basis for comparison with the three combat aircraft.
- The Defence's ranking of the candidates.

Report from the cross-ministerial working group

The report has not yet been finalised. Rigsrevisionen has seen preliminary drafts of chapter sections. Examples of elements that Rigsrevisionen has not seen include:

- The model for handling risks and uncertainties that the Ministry of Finance has requested an external consulting company to design, as well as the final results of the model, including the estimated life-cycle costs for the candidates and the life extension of the F-16 that the Defence is compiling on the basis of the model.
- The final assumptions for the exchange rate, real growth, inflation and fuel cost estimates.
- Estimated total operating costs of the present F-16 combat air fleet.
- Estimated socioeconomic consequences of a possible acquisition of combat aircraft or life extension of the F-16. Rigsrevisionen has seen the draft model to be used to carry out calculations.

The Ministry of Defence's assessment of security policy and strategic issues

The reviews are not expected to be completed until after the publication of the Defence Commission's report. However, Rigsrevisionen has seen a preliminary draft of the security policy assessment.

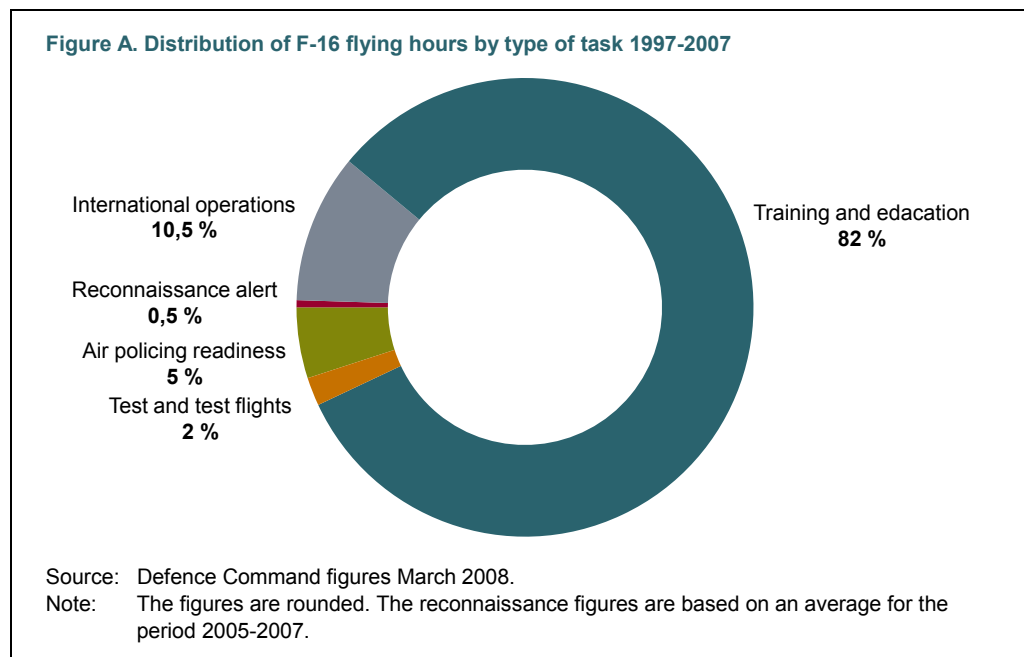
Results of the external quality assurance of the overall basis for a decision

Rigsrevisionen has received the contract and terms of reference for the external quality assurance, but beyond this has not seen the results of the work.

Appendix 2. Use of the F-16 fleet to date

The Defence has a fleet of 62 F-16 aircraft. According to the defence agreement, the Defence has the finances to deploy 48 aircraft on national and international missions. Not all 48 aircraft are directly involved in task performance as, at any point in time, some will be undergoing maintenance or inspection. In 2008, 24 aircraft in average were available for daily task performance.

In the period 1997-2007, the F-16 combat fleet logged approx. 88,000 flying hours, corresponding to an annual average of 8,000 flying hours per aircraft. Figure A shows the distribution of flying hours by type of task.



The figure shows that, in the period 1997-2007 the Defence's F-16 fleet was used for air policing 5% of the time, and was used for reconnaissance alert for 0.5% and international operations for 10.5% of the time. Most of the flying hours, approx. 82%, were used for training and education, prerequisites for maintaining national defence readiness and participating in international operations. Test and test flights accounted for approx. 2%.

In the period 1997 - March 2009, Danish F-16 aircraft have been deployed on international operations five times:

- Operation Allied Force and Balkan Air Operations (1998/1999), a contingent of six F-16s, which was, however, increased to eight for a period. The aircraft were deployed on two different international operations.
- Operation Enduring Freedom in Afghanistan (2002/2003), a contingent of six F-16s.
- Baltic Air Policing (2004), a contingent of four F-16s.
- Baltic Air Policing (2009), a contingent of four F-16s.
- Iceland Air Policing (2009), a contingent of four F-16s.

'Air policing' covers aircraft on standby to guard the airspace of NATO countries that do not have the resources to perform the task themselves.

On average, the F-16 aircraft were deployed every third year during the period. Overall, this equates to the current defence agreement's level of ambition for combat aircraft deployment on international operations. The defence agreement stipulates that the Defence must be

able to deploy eight combat aircraft on international operations for six months every three years, followed by a further eight combat aircraft for six months.

The statistics also show that, for a limited period, the number of aircraft deployed only matched the level of ambition on one occasion. However, as well as the number of aircraft mentioned, the Defence has also deployed an additional number of standby aircraft. This was done to ensure that the Defence could meet the NATO requirement regarding the length of time for which deployed aircraft must be available for task performance. The Defence has stated that it will not follow this practice in the future, and that the actual number of aircraft deployed to date has been higher than the number that will be deployed in the future.

Appendix 3. Remaining life span of the F-16 fleet

The life of a combat aircraft describes the total number of hours that the aircraft can produce or fly from the time of delivery until it is decommissioned. The Defence reports that the total life span for the current fleet of 62 F-16s is 379,000 hours, an estimate based on the Defence's assessment of the aircraft's structural life span. The Defence estimates that the total remaining life span of the F-16 fleet is about 136,700 flying hours. Of these, Defence plans to use approx. 122,000 hours until 2020. The remaining life span of approx. 136,700 flying hours corresponds to approx. 36% of the total life span.

The length of the fleet's remaining life is determined, for one thing, by the number of flying hours each aircraft is expected to produce in its lifetime and the number already flown. The aircraft vary greatly in their individual life spans. This is partly because the Defence's F-16 fleet is made up of aircraft from different production series and partly because the aircraft have undergone different updates, as illustrated in Figure B.

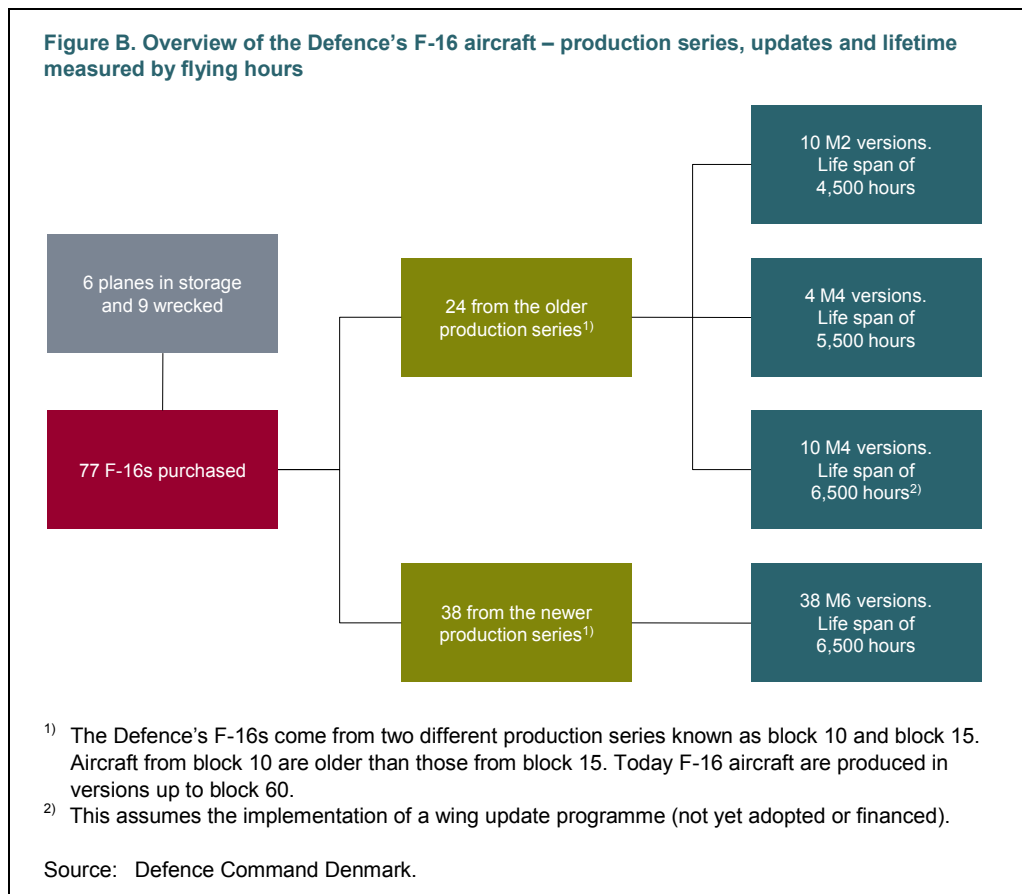


Figure B illustrates that the Defence has received aircraft from two different production series, which essentially have different lifetimes. The figure also shows that the Defence's F-16s will have to undergo various updates, another important factor for the overall life span of the aircraft.

The Defence's F-16 fleet is modernised on an ongoing basis. The Danish F-16s are updated via the 'Mid-life Update' programme (MLU) in order to extend their lifetime and operational usefulness. The MLU programme comprises several programmes. To date the Danish F-16s have undergone four such programmes (M1 to M4). M5 is being prepared, and M6 is planned but has not yet been implemented. The updates do not apply to all the Defence's F-16 aircraft; for example, only 38 will be updated to M5 and M6.

The Defence has stated that F-16 aircraft that have undergone the updates mentioned above will be used until 2020. According to the Defence, any deployment beyond this date will require further updating.

Appendix 4. The Defence's requirements for future combat aircraft

The Defence's requirements for a future combat aircraft are outlined in a report, 'A part-study regarding combat aircraft for the future', from November 2005 (in Danish, first revised edition, January 2006). The report was prepared by the Danish Tactical Air Command.

Aircraft that meet the requirements are:

- Broadly deployable – the aircraft must be a multi-role combat aircraft capable of multiple tasks in national and international contexts.
- Compatible – the aircraft must be deployable in a NATO context and thus able to operate with other NATO capabilities.
- Survivable – the aircraft must have sufficient self-defence capability.
- Network-based – the aircraft must be capable of operating in a network with other platforms and capabilities.
- Penetrative – the aircraft must be capable of participating in the first wave of offensive air operations and getting past the enemy's air defence relatively unobserved to deliver precision weapons at an early stage in the conflict.
- Enduring – the aircraft must be capable of providing long-term support to complex ground force operations, eg, in stabilisation operations.
- Available – the aircraft must be capable of taking over the tasks carried out by F-16 aircraft before the F-16 is phased out.
- Prevalent – the aircraft must be produced and deployed in large numbers.
- Economical – it must be possible to operate the aircraft within the scope of the current combat aircraft capability.

Appendix 5. Developments in the candidate field 1997-2008

Possible replacements for the F-16 mentioned by the Defence Commission of 1997		The Defence's first request for information from the manufacturers (2005)		The Defence's supplementary request for information from the manufacturers (2007)		Final field of candidates (august 2008)
Name of combat aircraft	Supplier (country)	Sent August 2005	Response November 2005	Sent June 2007	Response November 2007	
EF-2000 Typhoon (Eurofighter)	EADS (UK, Italy, Germany and Spain)	•	•	•		
F/A-18E/F Super Hornet	Boeing (USA)					•
F-35 Lightning II Joint Strike Fighter	Lockheed Martin (USA)	•	•	•	•	•
Gripen Next Generation	Saab (Sweden)	•	•	•	•	•
Rafale	Dassault Aviation (France)	•				

Appendix 6. Review of selected excluded cost elements

This appendix reviews selected individual cost elements omitted by the Defence from its estimate of the life-cycle costs of the combat aircraft candidates.

The Defence has regularly conducted a number of delimitations, which means that some costs have not been included in the estimated life-cycle costs. Examples of such costs are some indirect case-processing costs, phase-out costs related to a new combat aircraft, and some training expenses. These are reviewed below. In the first instance, the Defence's omission of certain costs has consequences for the level of life-cycle costs. Neither can it be ruled out that the omission of certain costs will affect the comparison of candidates to some degree.

The Defence has made a number of selective decisions regarding the *case-processing costs* of the combat aircraft project.

Project costs related to acquiring new combat aircraft have been included starting as of 2009. These costs include the work of the New Combat Aircraft Project Office and the future work of the Danish Defence Acquisition and Logistics Organisation in connection with the commissioning of a possible new acquisition. The Defence has not included the costs to date of running the combat aircraft competition, which are estimated to amount to approx. DKK 40 million (current prices).

Operating new combat aircraft will also entail case-processing costs. For example, the Defence has included the operating costs of Skrydstrup airbase, but not the management and administration costs of defence authorities, such as the Danish Defence Personnel Organisation and the Defence Staff, that handle cross-disciplinary tasks.

The Defence has not included *costs associated with phasing out* a new combat aircraft. The Defence has explained that this is due to the high degree of uncertainty of assessing and estimating the earnings and expenses related to phasing out a new combat aircraft in 2050. However, the Defence has stated that it is considering whether the phase-out costs should be treated as a potential risk that will impact life-cycle costs.

The Defence has not included the *costs of the Defence's basic training programmes* for officers, sergeants, flight engineers and so on. Type-specific training programmes for combat pilots and technicians have been included. Basic training programmes are the training courses that all Defence pilots have to take independent of aircraft type. Type-specific training programmes are the training courses required for pilots of certain aircraft, eg, the F-16.

The Defence has calculated that the cost of basic programmes for training officers to become combat pilots will amount to approx. DKK 1.6 billion over 30 years (2004 and 2008 price levels). The calculation is based on the costs of basic training for six combat pilots a year. The Defence has not calculated similar figures for basic training for sergeants and flight engineers. The Defence assesses that the majority of its basic training expenses relate to training officers to become combat pilots.