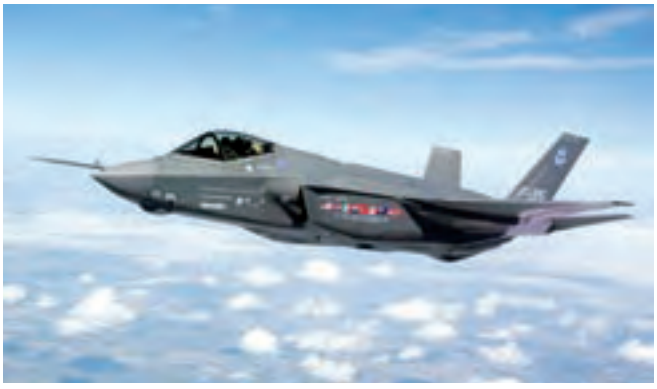
Section 5

Acquisition of Next-generation Fighter Aircraft

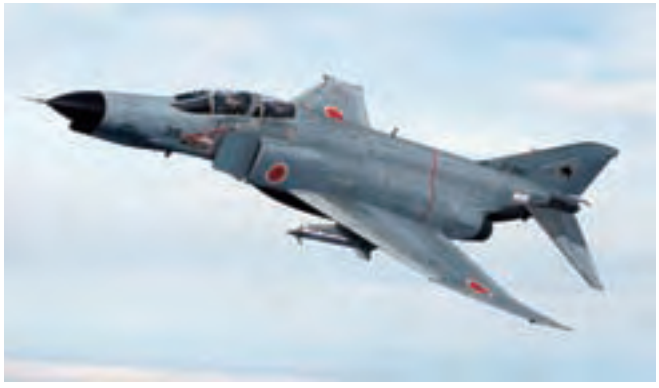
In the new fighter selection, the Ministry of Defense assessed the proposals fairly and rigorously, according to the predetermined evaluation criteria. Finally, a comprehensive evaluation was carried out regarding four elements - performance, costs, Japanese industrial participation, and logistics support - and on December 19, 2011, the Ministry of Defense selected F-35A as the new fighter and decided to procure 42 aircrafts. On December 20th, the Security Council of Japan decided that, "42 F-35A aircraft shall be procured from FY2012 as the new fighter, in order to supplement deficiencies resulting from aging of the currently used fighters of the Air Self-Defense Force and facilitate their modernization. In addition, except some initially imported aircrafts, Japanese industries shall participate in their manufacturing and the annual procurement in each fiscal year shall be made with the recognition of the economic and fiscal situation, seeking to harmonize this with the various other policies being implemented by the Government." This decision was approved by the Cabinet on the same day and 4 aircrafts are procured in FY2012, based on this policy.

On June 29, 2012, the Ministry of Defense signed the Letter of Offer and Acceptance (LOA)[1] in order to procure these 4 aircrafts using the Foreign Military Sales (FMS) provided by the U.S. Government.

This section explains the process of F-X selection by the Ministry of Defense.



Next-generation fighter (F-35A)



F-4 fighter

1 Necessity of the Introduction of Next-generation Fighter Aircraft

According to the 2010 National Defense Program Guidelines, the Air Self-Defense Force fighter units should consist of 12 fighter squadrons with approximately 260 fighter aircraft, and that the force currently consists of 12 fighter squadrons, with approximately 260 fighters: 2 F-4 fighter squadrons, 7 F-15 fighter squadrons and 3 F-2 fighter squadrons.

Given that F-4 fighters are already decreasing in number, it is necessary to make a start on acquiring the new fighter aircraft as quickly as possible. Furthermore, it will become increasingly important to improve the comprehensive air defense capability through introducing new fighter with high performance, in which fighter aircraft and their support functions act in an integrated manner, due to the modernization of military capability in regions surrounding Japan, so in order to enable the Air Defense Force to maintain 12 squadrons and 260 fighter aircrafts.

In light of this situation, the 2011 Mid-Term Defense Program stipulated that "New fighter aircraft shall be put in place as successors to the currently-active fighters (F-4)".

1 The Letter of Offer and Acceptance is a document signed by the representatives of both the Japanese and U.S. Governments for each sale (the Japanese representative is the official for Treasury obligation such as the Director General of the Equipment Procurement and Construction Office). Through this process, the FMS is issued. The LOA describes such details as procurement items which both governments agreed on, their prices, and scheduled delivery time.

2 Background of the Selection of the Model

In response to the Mid-Term Defense Program (FY2005-FY2009) stipulating that "New fighter aircraft shall be put in place as successors to the currently-active fighters (F-4)", work began in earnest in July 2005, aimed at the selection of the next-generation fighter aircraft.

Subsequently, F-22 (Lockheed Martin), F-35 (Lockheed Martin), F-15FX (Boeing), F/A-18E/F (Boeing), Eurofighter Typhoon (Eurofighter), and Dassault Rafale (Dassault Aviation) were selected as fighters that satisfied the four "capabilities required for next generation fighter aircraft". In order to obtain further detailed information concerning these six models, questionnaires were sent during the period to March 2006, to the governments of the countries where the foreign companies are based. Apart from F-22, regarding which no response was received, the replies concerning these models were all broadly received by July 2007. Moreover, oversea surveys were conducted in order to continue gathering the requisite information, but as the information gathering was not adequate in all cases, the acquisition of seven next-generation fighters was postponed, having initially been planned to take place during the period covered by the Mid-Term Defense Program (FY2005-FY2009).
(See Figure II-3-5-1)

Fig. II－3－5－1 Overview of New Fighter Aircraft under Survey

	F-22 (Raptor)	F-35 (Lightning II)	F-15FX	F/A-18 E/F(SuperHornet)	Eurofighter/ Typhoon	Dassault Rafale
Type						
Country of manufacture	U.S.A.	U.S.A. and others*	U.S.A.	U.S.A.	U.K./Germany/ Italy/Spain	France
Width Length Height	approx. 14m approx. 19m approx. 5m	approx. 11m approx. 16m approx. 4m	approx. 13m approx. 19m approx. 6m	approx. 14m approx. 18m approx. 5m	approx. 11m approx. 16m approx. 5m	approx. 11m approx. 15ma approx. 5m
Seat type	single and two-seater	single-seater	two-seater	single and two-seater	single and two-seater	single and two-seater
Thrust	35,000lb × 2	43,000lbs × 1	23,450lb × 2	22,000lb × 2	20,250lb × 2	16,400lb × 2
Velocity	M1.7 max.	M1.6 max.	M2.5 max.	M1.6 max.	M2.0 max.	M1.8 max.
Design	Lockheed Martin	Lockheed Martin	Boeing	Boeing	Eurofighter ・BAE System (United Kingdom) ・EADS Germany (Germany) ・Alenia (Italy) ・EADS CASA (Spain)	Dassault Aviation
Status of deployment	deployed	development in progress	F-15Es are deployed (prototype of F-15FX)	deployed	deployed	deployed

Source : Jane's aircraft upgrades etc.
* Several countries participated in investment and development of F-35 (JSF).
Level 1 partner: United Kingdom
Level 2 partner: Italy and Netherlands
Level 3 partner: Turkey, Australia, Canada, Norway, and Denmark

Subsequently, as well as striving to gather information by such means as conducting oversea studies in February and March 2010 in Australia, Norway, the UK and Italy, due to these countries being involved in the joint development or operation of the aircraft surveyed, the Ministry of Defense started to obtain necessary advice in January 2011 from domestic companies with technology and knowledge to manufacture fighter aircraft. As it was deemed that these endeavors had yielded the information required to issue a request for proposals and that it was necessary to acquire new fighters as quickly as possible, given the decreasing number of F-4 fighters, a request for proposals was issued on April 13, 2011, in order to seek a budget allocation for expenses associated with the acquisition of the next generation fighter aircraft in the budget for FY2012.

On September 26, 2011, which was the deadline for the submission of proposals, proposals were submitted by the U.S. Government, which proposed F/A-18E and F-35A, and the British Government, which proposed the Typhoon; these proposals were then analyzed and evaluated using a three-stage evaluation method, in accordance with the predetermined evaluation criteria.

3 Background of the Adoption of the New Procedure for Selecting Aircraft Models

Until now, when selecting fighters, the Japan Defense Agency (as it was known at the time) decided on a specific model based on information gathered from on-the-ground studies, rather than adopting as competitive, transparent model selection procedure as on this most recent occasion; after a decision was made by the Security Council of Japan and approved by the Cabinet, the Agency cooperated with the domestic company selected by the head of the Defense Agency (as it was known at the time) as the main domestic manufacturing company and embarked upon negotiations with overseas companies manufacturing the selected model and government institutions in the countries where those companies were located, concerning the specific conditions for the granting of licenses.

However, in light of the following developments in recent years:

- ○ The fact that more stringent standards regarding the transparency and fairness are required in government procurement;
- ○ The fact that there have been successful examples of obtaining better conditions through introducing the competitive procedure in the field of defense equipments, where there was a tendency towards monopoly or oligopoly;
- ○ The fact that it is becoming more difficult to obtain information concerning state-of-the-art equipment as the importance of advanced technologies in security are increasing, and the amount of information for selecting a model that can be obtained using conventional methods seems to be quite limited;
- ○ In light of the current status of the defense production and technology base, as well as the downward trend in defense budgets, it is necessary to focus not only on the performance of the fighter, but also on the degree to which domestic companies can be involved in the manufacture and repair of the fighter (participation by domestic companies) and the life-cycle costs, including the maintenance and running costs of the fighter,

on January 6, 2011, a directive entitled Concerning Model Selection Procedures for the Next Generation of Fighter Aircraft to be Directly Acquired by the Air Self-Defense Force was issued, in which it was stipulated that the Ministry would aim for the acquisition of the next generation fighter aircraft under more advantageous conditions, based on procedures with high levels of fairness and transparency.

4 Performances, etc. Required for the Next-generation Fighter Aircraft

1 Advanced Performance

As described above, since the military capacities in regions surrounding Japan are modernizing, it is becoming increasingly important to improve the comprehensive air defense capability, with fighter aircraft acting in an integrated fashion with their support functions; more specifically, the development of frameworks for air defense, etc. that can deal with the following situations is becoming a pressing issue:

- ○ The emergence of high-performance fighter aircraft with excellent stealth capability[1] and situational awareness (SA) capabilities[2];
- ○ Further increases in cruise missiles with excellent stealth capacity; and

1 Generic term for technologies or effects for preventing the aircraft being detected by enemy sensors

2 Generic term for technologies or effects thereof that improve the pilot's understanding of the tactical situation or reduce the burden on the pilot by merging data from various sensors (including those not mounted on the aircraft itself) and showing it on a single display

○ The development of network-centric-warfare, in which fighter aircraft, the Airborne Warning and Control System (AWACS), aerial refueling tankers, and surface-to-air missiles (SAM), etc. form part of an integrated system.

In other words, the new fighter aircraft needs to be able to effectively deal with high-performance fighters, as well as being equipped with sufficient performance to deal with cruise missiles and the ability to carry out its operations effectively in network-centric-warfare that has those functions as constituent elements. Moreover, with weapon systems becoming increasingly high-performance and expensive at present, all weapons are becoming increasingly multirole-focused (multifunctional), from the perspective of cost-effectiveness as well, and this trend is particularly pronounced in the field of fighter aircraft. Furthermore, in light of the fact that the security challenges and destabilizing factors surrounding Japan are becoming increasingly diverse, complex and multilayered, the new fighter aircraft are required to be multirole (multifunctional) aircraft equipped not only with air superiority combat ability, but also with the ability to carry out air interdiction[3] (air-to-ground attack capability), at least.

2 Efficient and Stable Logistics Support Arrangements

In order for fighter units to carry out their role effectively, it is extremely important to ensure that the unit as a whole is able to operate stably with a high level of operational availability, in addition to high functional aircrafts. At the same time, the cost of maintaining and operating fighters is on the increase, and in light of the current harsh fiscal situation, if this tendency accelerates further, it will become impossible to procure the components required to maintain and operate the aircraft, so it will be impossible to maintain the operational availability at the level required as a unit, even if the performance of the individual aircraft is excellent. By extension, one cannot deny the possibility that this will give rise to a situation in which they cannot fully carry out the duties expected of them as a fighter unit.

Consequently, in introducing the next generation fighter aircraft, it is essential to select a model that is highly reliable and easy to maintain, and which makes it possible to establish efficient, stable logistical support arrangements for a reasonable cost regarding all aspects of preparation, replenishment and technical support.

3 Ensuring Participation of Japanese Industries

As set forth in the interim summary published by the Panel on Approaches to the Production Technology Base for Fighter Aircraft[4] in December 2009, in order to ensure the future safety of the fighter aircraft operated by the Air Self-Defense Force, while maintaining a high level of operational availability and implementing capacity improvements appropriate to operation by Japan, it is important to maintain and cultivate the defense indigenous capability. Accordingly, the participation of domestic companies in the manufacturer and repair, etc. of the next generation of fighter aircraft must be secured and it must be possible for domestic companies to provide timely and appropriate maintenance and operational support.

4 Consideration for Life-cycle Costs

As described above, it is necessary to take into consideration not only the procurement cost of the aircraft (unit price of the aircraft × number of aircraft due to be acquired), but also the life-cycle cost, including the cost of maintenance and operation after introduction, which could be several times higher than procurement cost itself.

5 Evaluation Method

In order to achieve the objective of the most recent model selection, namely acquiring fighter aircraft based on the most desirable conditions for the Ministry of Defense by bringing the principle of competition into play, it is essential to ensure fairness and transparency in the specific content of the selection procedures. As well as providing an outline of the evaluation method on the request for proposals, transparency was guaranteed by sharing details of the questions and answers relating to the request for proposals with all of those planning to submit proposals. Fairness was guaranteed by sealing it in an envelope before the eyes of those planning to submit proposals based on the evaluation criteria previously determined by the Minister of Defense on April 1, 2011, and by assessing the proposals impartially, in accordance with those evaluation criteria.

The method used to assess the proposals consists of three stages; an outline of these is provided in Figure II-3-5-2.

3 This refers to a strategy to diminish the capabilities of an invading force. This is conducted mainly by fighter aircraft, which, in a marine environment, aim to destroy invading troops by attacking vessels (marine attack), and against a force already landed, attack targets such as the enemy's logistic routes, material stock, and main traffic routes.

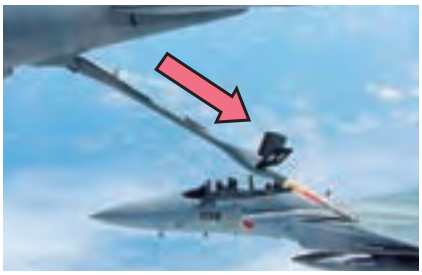
4 See Part III, Chapter 4, Section 1

Fig. Ⅱ－3－5－2 Proposal Appraisal Method

First-stage Appraisal	The proposals were evaluated according to whether or not they satisfied the minimum requirements (essential requirements) in regard to performance, logistical support, the delivery and training plan, and participation by domestic companies; those proposals that did not satisfy the essential requirements were excluded from consideration. The following provides further detail regarding this process. (1) Performance Appraisal of this criterion focused on such matters as whether the proposed model could achieve set speeds and ranges, whether it had the specified radar detection capability, whether it had certain sensors other than fire control radar, and whether it had the specified electronic warfare equipment. (2) Logistical support Appraisal of this criterion focused on such matters as whether stable maintenance support, logistics support (securing components), and technical support could be ensured throughout the operating life of the nextgeneration fighter. (3) Delivery and training plan Appraisal of this criterion focused on whether or not it was possible to deliver the airframes according to the schedule specified by the Ministry of Defense and whether training of pilots, etc. could be provided. (4) Participation by domestic companies Appraisal of this criterion focused on such matters as whether or not it was possible to carry out FACO (Final Assembly and Check Out) within Japan.
Second-stage Appraisal	It was decided that, in the event that more than one proposal passed the first-stage appraisal, a second-stage appraisal would be carried out, in which the proposals would undergo a comprehensive evaluation of four elements (performance, cost, participation by domestic companies, and logistical support), and the proposal that received the highest overall score based on the total score for those four elements would be adopted. The maximum score for all four elements combined was set at 100 points, with 50 points being allocated to the performance section, and 22.5 points each to the cost and participation by domestic companies sections, in light of their respective importance. With regard to logistical support, although establishing stable, efficient logistical support arrangements is extremely important, the majority of the aspects to be evaluated in relation to this would already have been appraised in the first-stage appraisal, so only 5 points were allocated to this section. The appraisal methods for each element were as follows. (1) Performance As well as evaluating aircraft performance, fire control capability, electronic warfare capability, stealth target detection capability, and air interdiction capability (air-to-ground attack capability, etc.), among other aspects, simulations using mathematical analysis (OR) were used to judge overall air defense capability. ① Appraisal of each aspect " Flight performance and stealth capacity were among the aspects examined to appraise aircraft performance. " With regard to fire control capability, functions such as the target processing capability of fire control radar and the simultaneous control ability of missiles were assessed. " With regard to electronic warfare capability, the capabilities of various instruments relating to electronic warfare were assessed. " With regard to stealth target detection capability, functions such as IRST (Infrared Search and Track) performance and situational awareness (SA) capability were assessed. " With regard to air interdiction capability (air-to-ground attack capability, etc.), functions such as displaying the range within which the aircraft has the potential to suffer a surface-to-air missile (SAM) attack and the number of precision-guided munitions with which it can be equipped were assessed. " In addition, the appraisal also examined whether or not the aerial refueling system conformed with the air-to-air refueling system employed by the ASDF, which uses a flying boom. ② Appraisal of overall air defense capability "OR was used to assess the degree to which the proposed model could exercise its full capabilities in the Japanese security environment, if combined with Japanese equipment systems. (2) Cost In order to assess the life-cycle costs of the aircraft under a fixed set of conditions, the Ministry sought proposals that covered not simply the cost of acquiring the aircraft airframe itself, but also initial costs in the form of the cost of acquiring the jigs and tools required to carry out FACO within Japan, and the cost of carrying out the initial education and training, as well as fuel expenses required over the next 20 years, the cost of acquiring support equipment and spare engines, and the cost of repairs and technical support. (3) Participation by Domestic Companies ① Degree of participation by domestic companies in manufacture and repair, etc. " With regard to proposals involving components in whose manufacture and repair Japanese companies could participate, the degree of participation was assessed from such perspectives as effective operational support for fighter aircraft (including ensuring safety, achieving a high level of operational availability, and increasing capabilities tailored to operations in Japan) and feasibility in terms of cost. In particular, proposals for components that kept the costs within certain set limits were assigned a high score. " Proposals involving components that did not keep costs within the set limits were still assigned a certain score, as they could still become the first step toward the future expansion of participation by Japanese companies in manufacturing and repair, etc. ② Degree of technology disclosure " In order to enable domestic companies to participate in manufacturing and repair, etc. and implement effective operational support for fighter aircraft, it is necessary not simply to acquire technical data relating to FACO, but also the data that served as reference materials during technological development, so the degree of disclosure of such reference data, etc. was assessed. " In order to prepare for the possibility of fitting the aircraft with domestically-produced missiles in the future, the proposals were assessed on the basis of whether or not the technical information required for refurbishment with such Japanesemanufactured missiles was disclosed. (4) Logistical Support As well as standard indicators for comparing reliability and maintainability in the form of Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTR), the appraisal assessed the proposals on the basis of matters relating to the specific functions of the sites of failures, and proposals for new logistical support arrangements that would lead to costs associated with maintenance and operation being curbed in the future.
Third-stage Appraisal	In the event that multiple proposals attained the same score in the second-stage appraisal, the proposal with the best score in the costs section of the second-stage appraisal (i.e. the one with the lowest cost) was to be adopted.

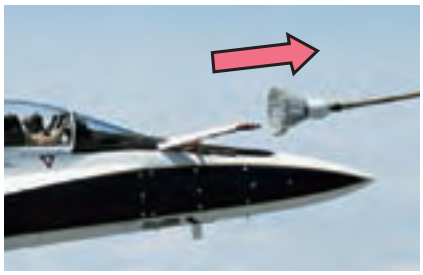
Fig. II－3－5－3 Aerial Refueling Methods

Flying boom system



○ This system is adopted by the ASDF.
○ The refueling aircraft operates its fueling pipe and inserts it into the fighter aircraft's opening to the fuel tank.

Probe-and-drogue system



○ The fighter aircraft inserts its fueling pipe into the refueling aircraft's probe.

6 Evaluation Results

1 First-stage Evaluation

All three proposals fulfilled all mandatory requirements.

2 Second-stage Evaluation

a) Performance

F-35A received the best evaluation, having obtained the highest score in the simulation using mathematical analysis (Operations Research (OR)), as well as obtaining a good balance of high scores in regard to aircraft performance, fire control capability, electronic warfare capability, stealth target detection capability, and air interdiction capability (air-to-ground attack capability, etc.) and all other evaluation criteria.

b) Cost

The cost items that are most likely to mount up are the cost of purchasing the aircraft and the fuel expenses. Among these items, F/A-18E received the highest evaluation regarding the aircraft purchase cost (i.e. the cheapest), while the Typhoon received the highest appraisal in regard to fuel expenses (i.e. the lowest). However, in the overall appraisal of costs, F-35A was the runner-up in terms of both aircraft purchase cost and fuel expenses; moreover, as it uses the same aerial refueling system as the Air Self-Defense Force are currently using, there were no additional renovation expenses, so it received the highest score overall. There was only a narrow margin between F-35A and the runner-up model.

c) Japanese industries' participation

A large number of proposals were made regarding F/A-18E and Typhoon, for components in whose manufacture domestic companies could participate. In the case of Typhoon, few of these proposals were within the scope of the prescribed cost bracket, so it was unable to secure the highest score in the evaluation of whether it fell within the appropriate cost bracket, but as there was a high level of participation permitted in the manufacture of the various components etc., as well as a high level of technology disclosure, it secured the highest score in the overall appraisal of participation by domestic companies.

d) Logistical Support

This was the evaluation criterion where there was the greatest competition between the three models; F-35A gained the highest score, due to its ability to identify failure sites on the aircraft in greater detail and the function to indicate the expected time to replace components. As a means of curbing maintenance and operation costs, all three models proposed to use a new contract system called performance-based logistics (PBL), under which remuneration is provided according to the achievement of maintenance outcomes, so all three scored the same for this criterion.

e) Overall Score

As a result of adding up the appraisal scores of each model in regard to the aforementioned appraisal elements, F-35A scored the highest.

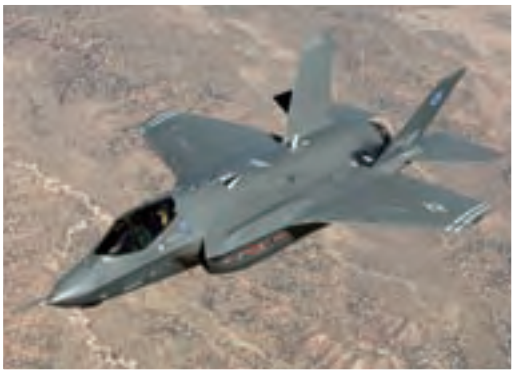
3 Conclusion

As only one model acquired the highest score in the second-stage appraisal, the third-stage appraisal was not carried out and F-35A, which obtained the highest score, was selected as the next-generation fighter aircraft to replace the F-4.

Questions Concerning the F-35A

Question 1 What are the features of the F-35A fighter ?

The F-35A fighter has the following characteristics:



F-35A fighter

(1) Its advanced stealth performance makes it difficult for enemy sensors to detect it, giving it an advantage in combat.

(2) Its diverse range of sensors give it the ability to gather the intelligence required for combat.

(3) It has superb networking capacity, so it is able to share the intelligence required for combat with other friendly fighter aircraft and ground troops.

(4) Data from a diverse range of sensors (including those other than the sensors mounted on the aircraft itself) are analyzed and merged for projection onto a single display, enabling the pilot to gain a comprehensive understanding of the combat situation.

Question 2 Which countries other than Japan use F-35 fighter ?

The full-scale joint development of F-35 fighter began in the autumn of 2001 by nine countries - the U.S., the U.K., Italy, Netherlands, Turkey, Canada, Australia, Denmark, and Norway. In addition to these nine countries, Israel has also decided to introduce it.

The USA plans to procure the following:

(1) CTOL*1 (type A) for the US Air Force

(2) STOVL*2 (type B) for the US Marine Corps

(3) CV*3 (type C) for the US Navy

*1: Conventional Take-Off and Landing
*2: Short Take-Off and Vertical Landing
*3: Carrier Variant

F-35B fighter

F-35C fighter