# CHAPTER 3

## Fire Services Department
## Government Logistics Department
## Electrical and Mechanical Services Department
## Marine Department

## Procurement and maintenance of fire services equipment

**Audit Commission**
**Hong Kong**
**28 October 2016**

*This audit review was carried out under a set of guidelines tabled in the Provisional Legislative Council by the Chairman of the Public Accounts Committee on 11 February 1998. The guidelines were agreed between the Public Accounts Committee and the Director of Audit and accepted by the Government of the Hong Kong Special Administrative Region.*

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# PROCUREMENT AND MAINTENANCE OF FIRE SERVICES EQUIPMENT

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# PROCUREMENT AND MAINTENANCE OF FIRE SERVICES EQUIPMENT

# Executive Summary

1. The Fire Services Department (FSD) is responsible for fire-fighting and rescue on land and at sea, and providing emergency ambulance service for sick and injured persons under the Fire Services Ordinance (Cap. 95). Its fire services equipment (FSE), including communications systems, fire appliances and support vehicles, fire-fighting and rescue vessels and other fire services support equipment, is critical for delivering its core services and instrumental to the safe and efficient operations of frontline officers. In 2015-16, the FSD incurred $482.7 million and $127.1 million on the procurement and the maintenance of major FSE items respectively. The Audit Commission (Audit) has recently conducted a review to examine the FSD's work on the procurement and maintenance of FSE with a view to identifying areas for improvement.

## Communications systems

2. ***Two communications systems.*** The FSD has adopted a sophisticated telecommunication and computer integrated mobilising system, known as the Third Generation Mobilising System (TGMS) to enhance the identification, location and mobilisation of fire-fighting and ambulance resources with a view to meeting the targets of graded response time. The FSD has also installed a radio communications system, namely the Digital Trunked Radio System (DTRS), to provide effective and efficient radio communications at incident scenes (para. 1.8).

### *TGMS*

3. ***Delay in commissioning of the TGMS.*** In May 2000, the Finance Committee (FC) of the Legislative Council approved funding of $718.6 million for the FSD to procure the TGMS for replacing the Second Generation Mobilising System (SGMS) in 2003. As of April 2016, $708.2 million of the approved funding had been spent. In March 2001, a contract (Contract A) for the procurement, installation and maintenance of the TGMS was awarded to Contractor A. Owing to

various reasons including slippage in building works and changes of user requirements, there were delays in completing certain milestones of Contract A. As the SGMS contractor indicated that it could no longer provide the maintenance services, the TGMS was commissioned in March 2005, i.e. 25 months before the completion of the System Acceptance Tests (SATs) in April 2007 (paras. 2.3 and 2.6 to 2.8), which had led to the following problems:

(a) ***Targets of graded response time not met in the first year.*** Due to technical issues on the system side and teething problems for the frontline staff to adapt to the operation of the new system in the first year, the graded response times were only met in 89.2% of the fire calls and 89.6% of the emergency ambulance calls in 2005-06, i.e. below the target of 92.5% (para. 2.8(a)); and

(b) ***Payment for live operation support of the TGMS before completion of the SATs.*** Contractor A had to support the live operation of the TGMS for 25 months before completion of the SATs, which was outside the scope of Contract A. The FSD had neither sought the approval for a contract variation nor agreed with Contractor A on whether and how the live operation support service fee should be paid before commencing the service. In the event, Contractor A was paid $53.6 million for providing the live operation support services (para. 2.8(b)).

To prevent recurrence of similar problems, the FSD needs to take measures to tackle the root causes of contract delays and observe the laid-down requirements in procuring services outside the scope of a contract (para. 2.9).

4. ***Operational issues.*** The TGMS has a design serviceable life of 10 years and extendable to 15 years (para. 2.4). Audit examination has revealed the following operational issues after commissioning the TGMS in 2005:

(a) ***Additional costs for monitoring the finalisation of outstanding contractual work.*** According to the funding paper of May 2000, an estimated $13 million of the approved funding was for engaging the Government's trading funds to provide professional advice on the design, implementation and commissioning of the TGMS. Up to April 2016, $81.2 million had been spent on engaging the trading fund services, of which $35.9 million was for engaging the Electrical and Mechanical Services Trading Fund (EMSTF) in providing professional services for

enhancing the TGMS and monitoring Contractor A's finalisation of outstanding contractual work from May 2007 onwards. Audit found that upon the completion of the SATs in April 2007, it had taken 4 years for the FSD and Contractor A to agree on the arrangements for handling the outstanding contractual work in March 2011. Afterwards, Contractor A spent some 4 years to complete all the outstanding contractual work in August 2015. In Audit's view, the FSD needs to take measures to ensure that outstanding contractual matters are dealt with expeditiously in similar projects in future to minimise professional service cost on contract management (para. 2.10); and

(b) ***Delay in installation of TGMS equipment on new vehicles.*** Under Contract A, Contractor A was required to supply and install up to 763 sets of TGMS equipment on fire appliances, ambulances and vessels but there was no contract provision to cater for additional sets of TGMS equipment required by the FSD after September 2004 or for the relocation of TGMS equipment from the replaced vehicles to the new ones. As a result, the FSD had to procure such services from Contractor A for new vehicles. In two cases during the period October 2013 to January 2016, the FSD and the Government Logistics Department (GLD) took a long time to complete the procurement process, resulting in delays of about 7 months in installation of TGMS equipment on 25 new ambulances and 14 new fire appliances (para. 2.11).

5. ***Maintenance issues.*** According to Contract A, Contractor A was required to provide one-year warranty and a nine-year post-warranty maintenance service (para. 2.6). Audit has found the following areas for improvement:

(a) ***Target maintenance response time and turnaround time not met.*** Contract A has set a target response time (i.e. time required for arrival on scene after a system incident is reported) and a target turnaround time (i.e. time required to rectify a breakdown after arrival on scene) for corrective maintenance of TGMS equipment. In 2015-16, for the maintenance of a sub-system of the TGMS: (i) the 2-hour response time target was not met in 423 (43%) of 985 cases; and (ii) the target of 6-hour turnaround time for critical faults was also not met in 248 (30%) of 814 cases (para. 2.12); and

(b) ***Lack of competitive bidding for extended maintenance services.*** While the TGMS has a design serviceable life of 10 years and extendable to 15 years, Contract A has only required a nine-year post-warranty maintenance service. When the FSD decided in February 2015 to extend the use of the TGMS for five years from April 2017 to April 2022, the maintenance service under Contract A had to be extended by means of a contract variation. The GLD's and the FSD's efforts to negotiate a reduced fee with Contractor A were not successful. In view of the significant cost of the extended maintenance services ($58.5 million a year), the FSD needs to take measures in the future to acquire any extended maintenance services for procurement projects with an extendable design serviceable life through competitive bidding as far as practicable (para. 2.14).

6. ***Other enhancements for planning the next generation of the mobilising system.*** In 2014, the FSD commissioned a consultancy study to prepare for the replacement/upgrade of the TGMS (para. 2.16). The following enhancements need to be considered in planning for the next generation of the mobilising system:

(a) ***Need to provide mobile phone location identification function.*** Over the years, the subscribed mobile phone numbers had increased by 104% from 8.2 million in 2004-05 to 16.7 million in 2015-16. The percentage of emergency calls from mobile phone users had also increased from 30% in 2001-02 to 44% in 2015-16. With the advancement in information and communications technology (e.g. location services in smartphones) in recent years, the FSD needs to explore the technical feasibility of providing mobile phone location identification function in the next generation of the mobilising system to facilitate speedy and accurate identification of incident addresses reported by mobile phone callers (para. 2.17); and

(b) ***Need to set a target time for answering emergency calls.*** The FSD had not set any target time for answering emergency calls. Audit analysis revealed that: (a) of the 864,426 emergency calls which were responded to in 2015-16, the waiting times for 288,002 (33%) calls were 10 seconds or more; and (b) of the 288,002 calls, the waiting times of 8,747 (3%) calls were 60 seconds or more. As the time taken to answer emergency calls also affects the timeliness of despatch of emergency resources, the FSD needs to consider setting a target time for answering emergency calls in the design of the next generation of the mobilising system (para. 2.18).

### *DTRS*

7. In December 2012, the FSD engaged the EMSTF to provide post-warranty maintenance services for the DTRS under a Service Level Agreement (SLA) (para. 2.24).

8. ***Preventive maintenance.*** Under the SLA, the EMSTF was required to provide preventive maintenance on a half-yearly basis. For 2015-16, of 1,055 fire appliances, support vehicles, ambulances and vessels under preventive maintenance, the DTRS terminal equipment installed in 433 (41%) vehicles/vessels received only one round of preventive maintenance services and that installed in 312 (30%) vehicles/vessels missed all two rounds of preventive maintenance services (paras. 2.25 and 2.26).

9. ***Corrective maintenance.*** For 2015-16, the actual compliance level for the response time to corrective maintenance for DTRS infrastructure equipment was 78%, i.e. below the SLA requirement of 90% or above (para. 2.28).

## Fire appliances and support vehicles

10. As at 1 May 2016, the FSD had a fleet of 434 fire appliances and 186 support vehicles. The FSD's Workshops and Transport Division is responsible for maintaining 415 fire appliances and 11 support vehicles while the EMSTF is responsible for maintaining the remaining 19 fire appliances and 175 support vehicles (para. 1.9).

11. ***Availability of fire appliances and support vehicles.*** The FSD has to ensure that its fire appliances and support vehicles are in an immediate state of readiness to respond to emergency calls at all times. For the fire appliances and support vehicles under the Workshops and Transport Division's maintenance, the FSD has set a target availability rate of 90%. Audit's examination revealed that the Division could not meet the target availability rate from 2013-14 to 2015-16. Since the Division had taken remedial measures to address the issue, the vehicle availability rate for August 2016 had increased to 89.5%, i.e. still slightly below the target of 90% (paras. 3.2 and 3.5 to 3.7).

12. ***Termination of five fire-appliance procurement contracts.*** Between 2007 and 2009, the FSD obtained funding of $175.9 million under the capital account of the General Revenue Account for procuring 37 fire appliances with target commissioning dates from May 2010 to January 2012. Between May 2008 and January 2010, the GLD on behalf of the FSD entered into five contracts with two contractors for procuring the 37 fire appliances at a total contract sum of $136.4 million. However, all the five contracts were terminated by the Government between September 2011 and December 2012. Audit was concerned that this might render the cost and time spent on procuring the 37 fire appliances nugatory. In particular, the FSD paid a total of $66 million under three of the five contracts but according to the Department of Justice, a counterclaim had been filed against the contractor to recover those costs, which is in the legal proceedings pending trial. Between January 2012 and March 2014, five new contracts were awarded to procure replacement fire appliances which were eventually put into operation between April 2014 and June 2016, some four years later than the original target commissioning dates from May 2010 to January 2012 (para. 3.11).

13. ***Scheduled maintenance.*** All the FSD's vehicles are subject to scheduled maintenance which is preventive in nature. The aim is to minimise the number of vehicle breakdowns during fire-fighting and rescue operations (para. 3.21). Audit has found the following areas for improvement:

(a) ***Scheduled maintenance carried out by the FSD.*** From July 2015 to June 2016, 86 (20%) of the 426 FSD maintained vehicles had not undergone all stipulated rounds of scheduled maintenance. Besides, there were delays in carrying out 359 rounds of scheduled maintenance for 222 vehicles (35% of 1,022 rounds for the 426 vehicles) (para. 3.22); and

(b) ***Scheduled maintenance carried out by the EMSTF.*** From April 2015 to March 2016, out of the 194 vehicles maintained by the EMSTF, 10 (5%) vehicles had missed all scheduled maintenance while another 23 (12%) vehicles each missed one round of the scheduled maintenance (para. 3.24).

## Fire-fighting and rescue vessels

14. As of July 2016, the FSD operated a fleet of 21 vessels to provide fire-fighting and rescue services within Hong Kong waters. Of the 21 vessels, 14 (67%) had exceeded their designed serviceable lives by 0.7 to 11 years (paras. 4.2 and 4.4).

15. ***Delay in implementing the replacement projects for a fireboat and two speedboats.*** In June 2012, the FC approved funding of $85 million for the FSD to replace a fireboat (FB 7) which had been in service for over 20 years. In May 2013, the FSD also obtained funding of $16 million for replacing two speedboats which had been in service since June 1999 and with maximum speed reduced by 25% from 40 to 30 knots. The FSD sought the assistance of the Marine Department (MD), i.e. the designated endorsement authority and agent for procurement of government vessels, in implementing the two replacement projects. However, the procurement progress had been slow, mainly due to the need to review the vessel procurement procedures and the shortage of experienced staff in the MD. The MD estimated that the two new speedboats would be delivered by July 2018, more than three years later than the target commissioning date of April 2015 and that the new FB 7 would be delivered by August 2019, more than four years later than the target commissioning date of December 2014. As a result of the delays, the total financial commitments of the FB 7 and speedboat replacement projects had increased by $13.3 million (16%) to $98.3 million and by $16 million (100%) to $32 million respectively (paras. 4.5, 4.8 to 4.10, 4.12 and 4.13).

16. ***Need to take measures to ensure the timely implementation of the 10-year vessel replacement/procurement plan.*** Apart from ongoing replacement projects for the FB 7 and the two speedboats, in 2015, the FSD had drawn up a 10-year procurement plan for replacing another 11 old vessels. The FSD had also planned to procure one new fireboat and one new fast rescue vessel for commissioning in 2018. Given that a total of 13 fire-fighting and rescue vessels are to be replaced/procured in the coming years, the FSD needs to ascertain from the MD whether it is able to cope with the FSD's 10-year vessel replacement/procurement plan in a timely manner (para. 4.14).

## Other fire services support equipment

17. ***Asset Management and Maintenance System (AMMS).*** To improve the efficiency and effectiveness of the FSD's management of some 19,000 types of operating assets, in April 2012, the FC approved funding of $49.8 million for the FSD to develop an integrated computer system, i.e. the AMMS. According to the funding paper of April 2012, the AMMS would provide major functions on inventory control, repair and maintenance management, and business intelligence analysis for enhancing the FSD's procurement and asset management work. However, up to July 2016 (over one year after the rollout of the AMMS in February 2015), some of these major functions could only be provided in the testing environment pending further fine-tuning before they could be put into actual use (paras. 5.2, 5.3 and 5.5).

18. ***Fire-fighting protective suits.*** In May 2010, the GLD on behalf of the FSD awarded a contract for the supply of 13,000 sets of fire-fighting protective suits at a cost of $81 million which included an option of requiring the contractor (Contractor E) to provide a comprehensive managed care and maintenance services (CMCMS) of the suits. From October 2010 to March 2013, the FSD obtained the approvals from the Financial Services and the Treasury Bureau (FSTB)/GLD Tender Board for making three contract variations totalling $50.1 million for Contractor E to provide the CMCMS from April 2011 to March 2017. In August 2016, after considering the FSTB's and the Security Bureau's advice on the tendering mode, the FSD adopted open tendering for the provision of the CMCMS for the fire-fighting protective suits from April 2017 to March 2022. The FSD needs to explore new service providers and bring in competitive tendering as far as possible for the procurement and maintenance of its other fire services support equipment in future (paras. 5.9, 5.11 and 5.12).

19. ***Specialised fire services support equipment.*** The Workshops and Transport Division is responsible for maintaining 56 types of electrical/mechanical specialised fire services support equipment (such as light portable pumps). Of the 1,647 rounds of preventive maintenance completed from June 2015 to May 2016, there were delays in carrying out 259 (15.7%) rounds of maintenance. The FSD needs to step up monitoring of the preventive maintenance for specialised equipment to ensure that it is carried out in a timely manner to prevent equipment failures before they occur or develop into major defects (paras. 5.15, 5.17 and 5.18).

## Audit recommendations

20. **Audit recommendations are made in the respective sections of this Audit Report. Only the key ones are highlighted in this Executive Summary. Audit has *recommended* that the Director of Fire Services should:**

*Communications systems*

(a) **seek prior approval from the appropriate authority when services outside the scope of a contract are required and take measures to negotiate the best or most favourable terms for the services (para. 2.19(a));**

(b) **improve the preparation of user requirements to minimise subsequent changes after the award of contract and closely liaise with the works agents to sort out any unresolved issue of the installation site at the earliest opportunity in future procurement projects (para. 2.19(b));**

(c) **take measures to ensure that any outstanding contractual matters are dealt with expeditiously in similar projects in future to minimise professional service cost on contract management (para. 2.19(c));**

(d) **take measures to ensure that the procurement of additional TGMS equipment for installation on new emergency vehicles is carried out in a timely manner (para. 2.19(d));**

(e) **require Contractor A to strengthen its maintenance services with a view to meeting the contract stipulated response time and turnaround time targets (para. 2.19(f));**

(f) **for procurement projects with an extendable design serviceable life, take measures to acquire any extended maintenance services through competitive bidding as far as practicable (para. 2.19(h));**

(g) **explore the technical feasibility of providing mobile phone location identification function in the next generation of the mobilising system (para. 2.19(j));**

(h) **consider setting a target time for answering emergency calls in the design of the next generation of the mobilising system (para. 2.19(k));**

(i) **closely monitor the compliance by the EMSTF with the service requirements stipulated in the SLA (para. 2.29(a));**

*Fire appliances and support vehicles*

(j) **closely monitor the effectiveness of the Workshops and Transport Division's remedial measures in attaining the 90% target availability rate of the fire appliances and support vehicles (para. 3.9);**

(k) **step up monitoring of the compliance with the scheduled maintenance requirements to ensure that the fire appliances and support vehicles receive proper maintenance in a timely manner (para. 3.27(a));**

*Fire-fighting and rescue vessels*

(l) **closely monitor the progress of the replacement projects for FB 7 and the two speedboats to guard against further slippage (para. 4.15(b));**

(m) **ascertain from the MD whether it is able to cope with the FSD's 10-year vessel replacement/procurement plan in a timely manner (para. 4.15(c));**

*Other fire services support equipment*

(n) **expedite the fine-tuning of the outstanding functions in the AMMS and put them into use as soon as possible (para. 5.7(a));**

(o) **explore new service providers and bring in competitive tendering as far as possible for the supply and maintenance of other fire services support equipment in future (para. 5.13); and**

(p) **step up monitoring of the preventive maintenance for specialised equipment to ensure that it is carried out in a timely manner (para. 5.19(a)).**

## Response from the Government

21. The Government agrees with the audit recommendations.

# PART 1: INTRODUCTION

1.1 This PART describes the background to the audit and outlines the audit objectives and scope.

## *Background*

1.2 The Fire Services Department (FSD) is responsible for fire-fighting and rescue on land and at sea, and providing emergency ambulance service for sick and injured persons under the Fire Services Ordinance (Cap. 95). Under the policy directives of the Security Bureau (SB) and headed by the Director of Fire Services, the FSD is organised into seven Commands and one Administration Division. Among the seven Commands, three Operational Commands (Note 1) provide fire-fighting and rescue services while the Ambulance Command provides emergency ambulance services. An extract of the organisation chart of the FSD is at Appendix A. As at 30 June 2016, the FSD had a strength of 10,114 staff, comprising 9,418 disciplined staff and 696 civilian staff.

## *Fire and emergency ambulance services*

1.3 The mission of the FSD is to protect life and property of Hong Kong citizens from fire or other calamities. Upon receipt of fire calls, ambulance calls and special service calls (Note 2), the FSD will mobilise its fire-fighting and rescue resources to the incident scenes to take appropriate actions. Time is of the essence. The FSD's graded response times for building fire calls are six minutes for built-up areas and nine to 23 minutes for areas of

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**Note 1:** *They are the Hong Kong Command (including the Marine and Offshore Islands Division), the Kowloon Command and the New Territories Command (including the Airport Fire Contingent which is located at the Hong Kong International Airport).*

**Note 2:** *Special service calls cover a wide range of incidents including traffic and industrial accidents, landslides, flooding, house collapse, malfunctioning of lifts, immersion and ship collision.*

more dispersed risk/isolated developments. For emergency ambulance services, the target on-scene response time is 12 minutes (Note 3). According to its Controlling Officer's Report, the FSD aims to achieve its targets of graded response time:

(a) in 92.5% of building fire calls in built-up areas;

(b) in 94.5% of building fire calls for areas of more dispersed risk/isolated developments; and

(c) in 92.5% of emergency ambulance calls.

For attendance to fire calls, the FSD will generally classify the fire incidents into five categories, from No. 1 alarm escalating to No. 5 alarm, according to their severity. Additional fire appliances, equipment and personnel will be despatched to the fire scenes of higher alarm incidents.

1.4 From 2011 to 2015, the total number of call cases had increased by 9% from 752,564 to 818,066 (see Table 1). The FSD had achieved its targets of graded response time for both fire and emergency ambulance calls (ranging from 93.2% to 95% of the calls).

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**Note 3:** *The response time is counted from the time when the location of an incident has been established. There are no graded response time targets for special service calls and for fire-fighting and rescue services provided by the FSD's vessels (see para. 4.3(b)).*

**Table 1**

**Number of call cases**
**(2011 to 2015)**

| Type of call cases | Number of calls | | | | | Percentage increase/ (decrease) from 2011 to 2015 |
|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | |
| Fire calls (Note 1) | | | | | | |
| — real fire incidents | 7,355 | 6,182 | 6,209 | 6,364 | 6,330 | (14%) |
| — false/ unwanted alarms | 26,833 | 31,456 | 30,564 | 29,971 | 27,990 | 4% |
| Emergency ambulance calls | 646,996 | 683,921 | 675,424 | 699,427 | 710,041 | 10% |
| Emergency ambulance calls attended by first responders (Note 2) | 44,221 | 46,972 | 42,047 | 44,676 | 40,022 | (9%) |
| Special service calls (Note 3) | 27,159 | 30,191 | 31,115 | 33,420 | 33,683 | 24% |
| Overall | 752,564 | 798,722 | 785,359 | 813,858 | 818,066 | 9% |

*Source: FSD records*

*Note 1: The fire calls included false/unwanted alarms due to faulty alarm system or humid weather.*

*Note 2: First responders are frontline fire personnel specially trained in advanced ambulance aid and qualified to operate defibrillators. They provide prompt basic life support to patients before the arrival of ambulances to increase their survival rate.*

*Note 3: The increase in number of special service calls was mainly due to increase in cases of people trapped in lifts and cases of incidents reported by the public with good intent (e.g. suspected gas leakage) but subsequently confirmed by the FSD as unfounded.*

## *Fire services equipment*

1.5 The FSD has altogether 81 fire stations, 39 ambulance depots and six fireboat stations, which are strategically located in different areas of Hong Kong to provide fire-fighting, rescue and emergency services for the public. The FSD's fire services equipment (FSE), including communications systems, fire appliances and support vehicles, fire-fighting and rescue vessels, and other fire services support equipment (see paras. 1.8 to 1.11), is critical for delivering its core services and instrumental to the safe and efficient operations of frontline officers.

1.6 The FSD's capital and recurrent expenses on procuring, replacing and maintaining its FSE are the largest expenditure area after personal emolument. In 2015-16, the FSD incurred $482.7 million under the General Revenue Account/Capital Works Reserve Fund (CWRF) on the procurement of major FSE items. Table 2 shows the expenditure in the past five financial years. In 2015-16, the FSD also incurred $127.1 million under the General Revenue Account on the maintenance of major FSE items (Note 4), comprising:

(a) $71.6 million on maintaining the communications systems;

(b) $47.9 million on maintaining fire appliances and support vehicles; and

(c) $7.6 million on maintaining fire-fighting and rescue vessels (Note 5).

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**Note 4:** *Other fire services support equipment is maintained by the FSD's Workshops and Transport Division or its maintenance contractors. There is no costing information on the maintenance of such equipment.*

**Note 5:** *In 2015-16, the Marine Department had also incurred $15.7 million under its departmental account for maintaining the FSD's vessels (see Note 13 to para. 1.10).*

**Table 2**

**Expenditure on procurement of FSE**
**(2011-12 to 2015-16)**

| Type | Expenditure | | | | |
|---|---|---|---|---|---|
| | **2011-12** | **2012-13** | **2013-14** | **2014-15** | **2015-16** |
| | **($ million)** | | | | |
| Fire appliances and support vehicles | 98.3 | 77.0 | 48.0 | 43.3 | 249.3 (Note) |
| Ambulances | 83.8 | 81.8 | 81.9 | 68.9 | 99.3 |
| Fire-fighting and rescue vessels | 2.1 | — | 8.2 | 1.5 | 0.1 |
| Communications systems and information technology (IT) equipment | 97.6 | 97.4 | 38.3 | 32.7 | 26.2 |
| Other fire services support equipment | 56.7 | 68.6 | 88.6 | 120.6 | 107.8 |
| Total | 338.5 | 324.8 | 265.0 | 267.0 | 482.7 |

*Source: FSD records*

*Note: The increase in expenditure in 2015-16 is mainly due to procurement of: (a) 13 hydraulic platforms ($61.5 million); (b) 7 turntable ladders ($50.4 million); (c) 13 light pumping appliances ($35.5 million); (d) 8 major pumps ($30.8 million); (e) 2 rail road fire appliances ($23.7 million); (f) 7 major rescue units ($11.5 million); (g) 6 light rescue units ($9 million); and (h) 1 aerial ladder platform ($8.4 million).*

1.7 ***Procurement and maintenance.*** The FSD's procurement function is centrally carried out by the Procurement and Logistics (P&L) Group (Note 6) of the Fire Services Headquarters Command. Its vision of procurement is "Getting the right equipment at the right time and right cost". Its procurement strategy is to achieve the best value for money while maintaining open and fair competition on purchases in accordance with the Stores and Procurement Regulations (SPRs) and the relevant guidelines issued by the Financial Services and the Treasury Bureau (FSTB). The procurement process mainly comprises three stages:

(a) ***Planning.*** The P&L Group collects initial requirements from users (including feedbacks from staff consultations), carries out preliminary studies and market research to identify suitable products and potential suppliers, and secures funding from either the FSD's budget in the General Revenue Account or as an expenditure item under the CWRF;

(b) ***Tendering.*** The P&L Group, with the assistance of the Government Logistics Department (GLD — Note 7), prepares technical specifications and quotation/tender documents and invites quotations/tenders after confirmation of user requirements and obtaining approvals from appropriate authorities. Tender assessment panels will then be set up to examine the tender submissions and make recommendations for awarding contracts to the suppliers; and

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**Note 6:** *The P&L Group was established in April 2011 after completion of the Management Study on Procurement and Related Management Issues by the Efficiency Unit in December 2010. Headed by a Senior Divisional Officer and supported by disciplined staff and supplies grade staff seconded from the Government Logistics Department, the P&L Group is responsible for planning, organising and implementing the FSD's centre-led procurement strategy. It also develops guidelines on procurement and logistics matters, monitors expenditure on stores and equipment, and operates six departmental storehouses to cope with the operational requirements. Before the establishment of the P&L Group, the FSD's procurement function was mainly carried out by supplies grade officers of the Logistics Unit of the Safety and Logistics Group under the Headquarters Command.*

**Note 7:** *The GLD is the Government's central procurement agent. It provides bureaux/departments with procurement and supplies services including: (a) arranging issue of tenders exceeding departmental direct purchase authority and award of contracts on behalf of bureaux/departments; (b) providing advice on tendering and quotation procedures; and (c) providing advice on contract administration and monitoring.*

(c) ***Delivery.*** After award of contracts, the P&L Group will monitor the suppliers for delivery and installation of FSE, arrange product acceptance tests and distribute the FSE to users.

The various types of FSE are maintained by the FSD, the Marine Department (MD) or through the FSD's contractors to ensure their reliability and safety use. The FSD uses an integrated computer system, namely the Asset Management and Maintenance System (AMMS — Note 8), to help manage, procure and maintain its FSE.

1.8 ***Communications systems.*** The Fire Services Communication Centre (FSCC) of the FSD is responsible for mobilising all fire-fighting and ambulance resources. It also acts as a coordinator for government departments and public utilities during major incidents. According to the FSD, the Centre has adopted a sophisticated telecommunication and computer integrated mobilising system, known as the Third Generation Mobilising System (TGMS — Note 9) to enhance the identification, location and mobilisation of fire-fighting and ambulance resources with a view to meeting the targets of graded response time. The TGMS, which is linked to all fire stations, ambulance depots and fireboat stations, facilitates information exchange by means of graphics and text transmission through a wireless digital network. The FSD has also installed a radio communications system, namely the Digital Trunked Radio System (DTRS — Note 10), to provide effective and efficient radio communications at incident scenes. While the TGMS is maintained

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**Note 8:** *In April 2012, the Finance Committee of the Legislative Council approved funding of $49.8 million under Head 710 of the CWRF for the procurement of the AMMS. As of July 2016, the accumulated expenditure on the AMMS was $31.5 million.*

**Note 9:** *In May 2000, the Finance Committee approved funding of $718.6 million under Head 708 of the CWRF for the procurement of the TGMS. As of April 2016, $708.2 million had been spent.*

**Note 10:** *In May 2009, the Finance Committee approved funding of $178.3 million under Head 708 of the CWRF for the procurement of the DTRS. As of July 2016, $135.1 million had been spent.*

by a private contractor, the DTRS is maintained by the Electrical and Mechanical Services Trading Fund (EMSTF — Note 11) of the Electrical and Mechanical Services Department (EMSD).

1.9 ***Fire appliances and support vehicles.*** As at 1 May 2016, the FSD had a fleet of 434 fire appliances and 186 support vehicles (e.g. staff cars, vans and lorries). The 434 fire appliance fleet comprised 274 frontline fire appliances (such as hydraulic platforms, rescue units, major pumps and turntable ladders — see Photograph 1) and 160 other fire appliances (e.g. mobile command units). The FSD's Workshops and Transport Division (Note 12) is responsible for maintaining 415 fire appliances and 11 support vehicles while the EMSTF is responsible for maintaining the remaining 19 fire appliances (17 of which are specialised fire appliances of the Airport Fire Contingent at the Hong Kong International Airport at Chek Lap Kok — hereinafter referred to as the Airport) and 175 support vehicles (see Appendix B).

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**Note 11:** *The EMSTF is the trading arm of the Electrical and Mechanical Services Department which provides electrical and mechanical services to government bureaux/departments.*

**Note 12:** *Headed by a Senior Electrical and Mechanical Engineer, the Workshops and Transport Division is responsible for all engineering matters (e.g. design, testing, inspections and maintenance) relating to fire appliances and fire services support equipment.*

**Photograph 1**

**Frontline fire appliances**

**(a) Hydraulic platform**

**(b) Rescue unit**


**(c) Major pump**


**(d) Turntable ladder**

*Source:* *FSD records*

*Remarks:* *Frontline fire appliances are the first batch of fire-fighting vehicles deployed to respond to a fire call.*

1.10 ***Fire-fighting and rescue vessels.*** As of July 2016, the FSD operated a fleet of 21 vessels to provide fire-fighting and rescue services within Hong Kong waters. Of the 21 vessels, 10 were acquired and owned by the Airport Authority Hong Kong (AA — Note 13) and they are berthed at the Airport to

**Note 13:** *The Marine Department is responsible for the maintenance of the 11 FSD vessels while the AA's contractor is responsible for the maintenance of the AA's 10 vessels. While the FSD reimburses the AA its maintenance cost of the 10 vessels, the FSD and hence Audit did not have access to the AA contractor's maintenance records. According to the FSD, it will be responsible for the replacement of the 10 vessels and the MD will then be responsible for the maintenance of the replacement vessels. As such, this audit review focused on the procurement of the fire-fighting and rescue vessels by the FSD.*

provide emergency services (Note 14). The FSD takes into consideration the overall risk assessment of different regions (such as the distribution of vessels, utilisation of shipping channels, existence of high risk facilities on the sea and along the coastline) in deciding the berthing locations of its fire vessels. According to the SPRs, the MD is the designated endorsement authority and agent for procurement of government vessels. A total commitment of $295.3 million had been created from 2012-13 to 2015-16 for the FSD to procure vessels (Note 15), but up to 2015-16, no payment had been made.

1.11 ***Other fire services support equipment.*** The fire-fighting and rescue work of the FSD requires major FSE and other support equipment such as light portable pumps, positive pressure blowers, portable electricity generators and personal protective equipment (e.g. protective suits, helmets and gloves). As of July 2016, there were some 19,000 types of operating assets in the FSD either maintained by the Workshops and Transport Division or its maintenance contractors.

## Audit reviews

1.12 In 2004, the Audit Commission (Audit) conducted a review of "Management and maintenance of fire-fighting and rescue vehicles" covering the maintenance services provided by the FSD's workshops and the EMSTF, and the management of the stocks of spare parts and traffic accidents involving the fire-fighting and rescue vehicles. The results were reported in Chapter 6 of the Director of Audit's Report No. 42 of March 2004. In 2008, Audit conducted another review of "Emergency ambulance service" covering the procurement, replacement and maintenance of ambulances, the results of which were reported in Chapter 4 of the Director of Audit's Report No. 51 of October 2008. In May 2016,

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**Note 14:** *The 10 vessels berthed at the Airport provide search and rescue service in accordance with the standards and recommended practices of the International Civil Aviation Organisation.*

**Note 15:** *The total commitment comprised: (a) $85 million and $13.3 million created in 2012-13 and 2015-16 respectively for the replacement of Fireboat No. 7 (see para. 4.5); (b) two commitments of $16 million each created in 2013-14 and 2015-16 for the replacement of two diving support speedboats; and (c) $125 million and $40 million created in 2015-16 for the acquisition of a new fireboat and a new rescue vessel respectively.*

Audit commenced a review to examine the FSD's work on the procurement and maintenance of FSE (Note 16), focusing on:

(a) communications systems (PART 2);

(b) fire appliances and support vehicles (PART 3);

(c) fire-fighting and rescue vessels (PART 4); and

(d) other fire services support equipment (PART 5).

Audit has found room for improvement in the above areas and has made a number of recommendations to address the issues.

## General response from the Government

1.13 The Director of Fire Services generally agrees with the audit recommendations.

1.14 The Secretary for Security welcomes the audit recommendations. He has said that the FSD will, in consultation and collaboration with the relevant departments, follow up on the recommendations, and the SB will monitor the progress of the follow-up actions and ensure that the recommendations are implemented as far as possible in a timely manner.

## Acknowledgement

1.15 Audit would like to acknowledge with gratitude the assistance and full cooperation of the staff of the FSD, the EMSD, the GLD and the MD during the course of the audit review.

**Note 16:** *This audit review has not covered the ambulance fleet, except in so far as the TGMS and the DTRS equipment installed in them is concerned.*

# PART 2: COMMUNICATIONS SYSTEMS

2.1 This PART examines the procurement and maintenance of the following two communications systems:

(a) Third Generation Mobilising System (paras. 2.2 to 2.21); and

(b) Digital Trunked Radio System (paras. 2.22 to 2.32).

## Third Generation Mobilising System

2.2 The TGMS is a mission-critical system for the mobilisation of the FSD's fire-fighting and rescue resources to the incident scenes. The TGMS, comprising 21 sub-systems, provides a command and control system for the efficient deployment of fire and ambulance resources to scenes of emergencies by enhancing the identification, location and mobilisation of resources. It has been put into use since 2005 to replace the Second Generation Mobilising System (SGMS) which was commissioned in 1991. According to the FSD's consultancy study of 1999, the SGMS would reach the end of its serviceable life in 2003 and its capacity would not be able to cope with the growth in emergency call volume.

2.3 In May 2000, the SB obtained funding approval of $718.6 million from the Finance Committee (FC) of the Legislative Council for procuring the TGMS. The approved funding of $718.6 million comprised: (a) $631.9 million for the procurement and installation of the TGMS; (b) $35.6 million for the construction and related building services works; (c) $13 million for engaging trading fund services; (d) $27.6 million for the hiring of staff and services for project implementation; and (e) $10.5 million for contingency (Note 17). According to the funding paper, the TGMS would:

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**Note 17:** *Up to April 2016, the actual expenditure amounted to $708.2 million, which comprised: (a) $563.1 million for the procurement and installation of the TGMS; (b) $81.2 million for engaging trading fund services (see para. 2.10); (c) $42.8 million for the construction and related building services works; and (d) $21.1 million for the hiring of staff and services by the FSD and other departments for project planning and implementation.*

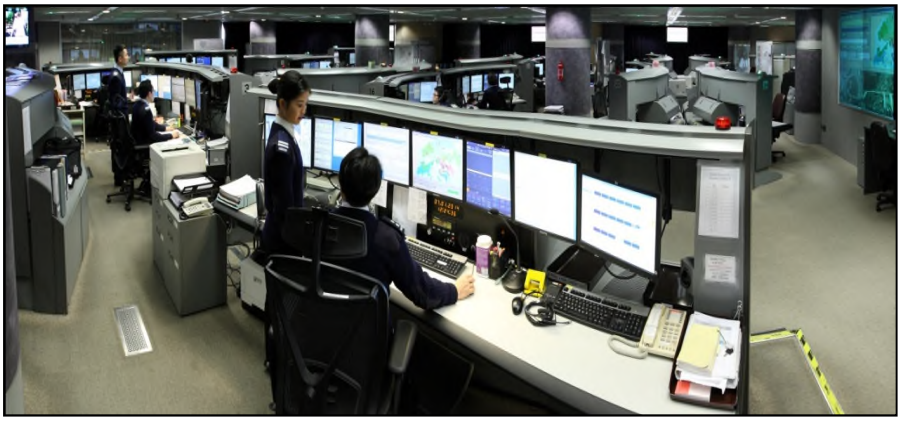
(a) replace the SGMS in 2003;

(b) provide a larger design capacity to handle fire and ambulance calls, enhancement in various mobilising activities and resource identification, and flexibility for upgrading to cope with growth in emergency call volume; and

(c) comprise a number of sub-systems (see Appendix C for details of the major sub-systems) and TGMS equipment (e.g. console workstations and mobile data terminals) would be installed in the FSCC (see Photograph 2), fire stations, fireboat stations, ambulance depots, fire appliances and ambulances (see Photograph 3), vessels and base stations in remote sites (e.g. tunnels and hilltops).

**Photograph 2**

**TGMS installed in the FSCC**



*Source: FSD records*

**Photograph 3**

**TGMS installed in FSD vehicles**

| (a) TGMS equipment installed in a fire appliance | (b) TGMS equipment installed in an ambulance |
|---|---|
|  |  |



*Source: FSD records*

2.4 In light of the delay in commissioning of the TGMS in 2005 instead of 2003, Audit conducted a review and the findings are set out in paragraphs 2.5 to 2.9. The TGMS has a design serviceable life of 10 years and extendable to 15 years. In 2015, the FSD decided to extend the use of the TGMS to April 2022 (Note 18). Audit also reviewed other operational and maintenance related issues after commissioning the TGMS and the findings are set out in paragraphs 2.10 to 2.15.

## *Delay in commissioning of the TGMS*

2.5 The FSD implemented the TGMS project through the following arrangements:

(a) letting out a contract (Contract A) for the design, supply, implementation, commissioning, maintenance and other related services for the TGMS;

**Note 18:** *In 2014, the FSD commissioned a consultancy study to prepare for the replacement/upgrade of the TGMS.*

(b) engaging the Architectural Services Department to carry out the construction and related building services works (e.g. fitting out works for the FSCC); and

(c) engaging trading fund services (e.g. the EMSTF) for providing professional advice on the design, implementation and commissioning of the TGMS and hiring of additional staff including those from other departments (e.g. the then Information Technology Services Department, now the Office of the Government Chief Information Officer) for the management, logistics and development support of the implementation of the TGMS.

2.6 In accordance with the SPRs, Contract A was procured by open tendering (Note 19). The tender documents were prepared by the FSD for vetting by the then Government Supplies Department (now the GLD — Note 20) and the Department of Justice (DoJ). A marking scheme was adopted in the tender evaluation process (Note 21). In March 2001, upon the advice of the Central Tender Board (CTB), the then Secretary for the Treasury (now the Secretary for Financial Services and the Treasury) approved the award of Contract A to Contractor A for:

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**Note 19:** *The SPRs provide that departments should as far as practicable adopt open tendering for invitation of tenders so as to promote fair, competitive and open bidding.*

**Note 20:** *The Government Supplies Department merged with the Government Land Transport Agency and the Printing Department to form the GLD in July 2003.*

**Note 21:** *The relative weightings for technical and price assessments were 60% and 40% respectively.*

(a) the procurement and installation of the TGMS cum one-year warranty at a contract sum of $443.2 million (Note 22); and

(b) a nine-year post-warranty maintenance service at a contract sum of $350.8 million (Note 23).

2.7 In the course of implementing Contract A, there were some delays in completing certain milestones. The delays (by a comparison of the scheduled and actual completion dates) and the underlying reasons are summarised in Table 3. According to the FSD, it encountered various challenges in implementing the TGMS (Note 24).

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**Note 22:** *Up to April 2016, $563.1 million was incurred for the procurement and installation of the TGMS (see Note 17 to para. 2.3), which comprised: (a) $451.3 million under Contract A and the related contract variations (see Note 27 to para. 2.11); (b) $53.6 million for settling an extra-contractual claim by Contractor A (see para. 2.8(b)); and (c) $58.2 million for other expenditures for the implementation of the TGMS project (e.g. miscellaneous upgrades and enhancements to the TGMS procured through tendering/quotations in accordance with the SPRs requirements).*

**Note 23:** *The annual post-warranty maintenance service cost might be adjusted after the first year in accordance with the Consumer Price Index (B) figures published by the Census and Statistics Department. The post-warranty maintenance service cost was recurrent in nature and funded under the FSD's annual provision in the General Revenue Account.*

**Note 24:** *According to the FSD, in order to develop an advanced mission-critical system to cope with the rapid development of Hong Kong, it had spent enormous efforts in overcoming the unforeseen obstacles arising from the tremendous changes to be incorporated into the TGMS under development as compared with the SGMS in terms of operational workflow requirements, system architectures and advancement in information and communications technology such as the introduction of the advanced geographical information system, wireless digital network and data transmission technology.*

**Table 3**

**Delays in completing some milestones under Contract A and the underlying reasons**

| Key milestone | Completion date | | Underlying reasons for the delays |
|---|---|---|---|
| | Scheduled | Actual | |
| Project initiation | Apr 2001 | Apr 2001 | N/A |
| Detailed system design | Jan 2002 | Oct 2002 | (i) change of design of the FSCC to cope with operational needs (in terms of workflow requirements, operational accuracy, efficiency and flexibility to handle disastrous situations) and slippage in the building works of the FSCC by the Architectural Services Department;<br><br>(ii) difficulties in deploying technical staff during the outbreak of Severe Acute Respiratory Syndrome;<br><br>(iii) changes of user requirements (e.g. change of software design to cope with the implementation of newly introduced services namely the First Responder and the Fire Motorcycle in 2003); and<br><br>(iv) extended SATs due to the need to align the test approaches and passing criteria of the SATs for some sub-systems with Contractor A. |
| Site preparation and building service works | Jan 2002 | Jul 2003 | |
| Programme development and system installation | Dec 2002 | Jun 2005 | |
| System rollout | Sep 2003 | Mar & Jun 2005 (Note 1) | |
| Completion of System Acceptance Tests (SATs) | Dec 2003 (Note 2) | Apr 2007 | |

*Source: FSD records*

*Note 1: The TGMS was commissioned in the New Territories Command in March 2005 and in the Hong Kong and Kowloon Commands in June 2005.*

*Note 2: According to Contract A, a series of SATs would be carried out from October 2002 to December 2003. The last SAT was a three-month live performance and system reliability test which would be carried out after the system rollout to monitor the system performance.*

2.8 As shown in Table 3 in paragraph 2.7, the TGMS was put into use in March 2005, i.e. 25 months before the completion of the SATs. This was because the SGMS contractor indicated that it could no longer provide maintenance services due to the shortage of spare parts for maintenance of the outdated hardware of the SGMS. The FSD was of the view that without a mobilising system in place, the FSD would be at the risk of being incapable of mobilising fire and ambulance resources effectively and efficiently. Therefore, there was an imminent need to roll out the TGMS in parallel with the ongoing SATs in March 2005 in order to avoid any interruption of the FSD's daily operation. However, the commissioning of the TGMS before the completion of the SATs had led to the following problems in the first two years of operations:

(a) ***Targets of graded response time not met in the first year.*** As the TGMS was commissioned phase by phase in March and June 2005 before the completion of the SATs in April 2007 (see Table 3), there were both technical issues on the system side and teething problems for the frontline staff to adapt to the operation of the new system in the first year. As a result, the graded response times were only met in 89.2% of the fire calls and 89.6% of the emergency ambulance calls in 2005-06, i.e. below the target of 92.5%; and

(b) ***Payment for live operation support of the TGMS before completion of the SATs.*** According to Contract A, the SATs were scheduled to be completed within 3 months after the system rollout and the one-year warranty should commence after completion of the SATs (which turned out to be in April 2007). As a result, Contractor A had to support the live operation of the TGMS for a period of 25 months (i.e. from March 2005 to April 2007) before the commencement of the warranty. While such additional service was outside the scope of Contract A, the FSD had neither sought the approval of the FSTB (i.e. the authority for approving variations to GLD contracts awarded on the advice of the CTB with the accumulated value of the variations exceeding $15 million) for a contract variation (contrary to the SPRs requirement) nor agreed with Contractor A on whether and how the live operation support service fee should be paid before commencing the service. According to the FSD, it had been the department's understanding at that time that the maintenance and support of the TGMS were covered in the terms of Contract A even though the SATs had yet to be completed. Therefore, it did not see the need for a variation of the contract. It was not until June 2006 when Contractor A submitted a claim for the live operation support services

provided since the system rollout that the FSD realised that the services fell outside the original contract scope, and hence approval was only sought for contract variation afterwards. In approving the settlement of the claim in February 2007, the FSTB commented that the case was far from satisfactory and reminded the FSD to seek prior approval from the relevant authority for any variation to the existing contract in accordance with the SPRs. In the event, Contractor A was paid $53.6 million for providing the live operation support services (Note 25).

2.9 The FSD needs to observe the SPRs requirements in procuring services outside the scope of a contract and take measures to protect the government interest in such situation. To prevent recurrence of similar problems, Audit considers that the FSD also needs to take measures to tackle the root causes of contract delays. For example, one of the causes of delay in Contract A was changes in user requirements (see item (iii) in Table 3 in para. 2.7). The FSD needs to improve the preparation of user requirements to minimise subsequent changes after the award of contract. As for the slippage in building works of the FSCC (see item (i) in Table 3), the FSD needs to closely liaise with the works agents (such as the Architectural Services Department) to sort out any unresolved issue of the installation site at the earliest opportunity.

## *Operational issues of the TGMS*

2.10 ***Additional costs for monitoring the finalisation of outstanding contractual work.*** According to the funding paper submitted by the SB to the FC in May 2000 (see para. 2.3), an estimated $13 million of the approved funding was for engaging the trading funds (i.e. the EMSTF and the then Office of the Telecommunications Authority Trading Fund, now the Office of the Communications Authority Trading Fund) to provide professional advice on the design, implementation and commissioning of the TGMS. Audit noted that up to April 2016, a total of $81.2 million had been spent on engaging the trading fund services, comprising:

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**Note 25:** *In accordance with the SPRs, the Permanent Secretary for Financial Services and the Treasury (Treasury) approved the extra-contractual settlement of the claim. The payment was made by three instalments during the period March 2007 to March 2011.*

(a) $33.4 million (i.e. $24.1 million for the EMSTF and $9.3 million for the then Office of the Telecommunications Authority Trading Fund) for paying the trading fund services from 2001 up to the full commissioning of the TGMS in June 2005;

(b) $11.9 million from July 2005 to April 2007 for engaging the EMSTF in providing professional advice and monitoring Contractor A's work for completing the SATs; and

(c) $35.9 million for engaging the EMSTF in providing professional services after the completion of the SATs for enhancing the TGMS and monitoring Contractor A's finalisation of outstanding contractual work from May 2007 onwards.

Audit found that upon the completion of the SATs in April 2007 (see Table 3 in para. 2.7), the FSD accepted the TGMS on the condition that outstanding contractual work items (e.g. outstanding system functions, training or documentation) were to be handled separately. It took 4 years for the FSD and Contractor A to agree on the arrangements for handling the outstanding contractual work items (Note 26). The agreed arrangements necessitated a variation to Contract A, which was approved by the GLD Tender Board in March 2011. Afterwards, Contractor A spent some 4 years to complete all the agreed outstanding contractual work in August 2015. In Audit's view, the FSD needs to take measures to ensure that outstanding contractual matters are dealt with expeditiously in similar projects in future to minimise professional service cost on contract management.

2.11 ***Delay in installation of TGMS equipment on new vehicles.*** Under Contract A, Contractor A was required to supply and install up to 763 sets of TGMS equipment on fire appliances, ambulances and vessels. However, there was no contract provision to cater for additional sets of TGMS equipment required by the FSD after September 2004 or for the relocation of TGMS equipment from replaced vehicles to new ones. As a result, the FSD engaged Contractor A to

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**Note 26:** *Of a total of 543 items of outstanding contractual work: (a) 343 items were no longer required and $14.3 million was deducted from the original contract sum of $443.2 million; and (b) for the remaining 200 items, contract payment of $8.3 million was withheld by the FSD and to be released to Contractor A on a quarterly basis based on the items of outstanding work completed.*

provide such services by quotations in case the estimated value of the services required did not exceed $1.43 million as stipulated in the SPRs. If the estimated value of required services exceeded $1.43 million, the FSD procured Contractor A's services by means of contract variations (Note 27) prior to 2014 and by means of single tendering since 2014. Audit's examination revealed that, in two cases, the procurement process took a long time to complete, resulting in a delay in installation of TGMS equipment on new vehicles, as follows:

(a) ***Delay in installing TGMS equipment for new ambulances.*** In September 2013, the FSD was informed that 25 new ambulances would be delivered in the third quarter of 2014 and the installation work of the TGMS equipment should be carried out by then. However, the procurement process took 13 months to complete, i.e. from October 2013 to November 2014 (see Appendix D). As a result, Contractor A carried out the installation work from December 2014 to February 2015, about 7 months after the delivery of the 25 ambulances from May to July 2014. In other words, the ambulances had, on average, been left idle for about 7 months; and

(b) ***Delay in installing TGMS equipment for new fire appliances.*** In April 2015, the FSD requested the issue of a single tender for the installation of TGMS equipment on 126 new emergency vehicles. In processing the FSD's single tender request, from April to November 2015, the GLD raised 12 rounds of questions on the tender terms and conditions for the FSD's clarification (Note 28 ). In

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**Note 27:** *Up to June 2016, 42 variation orders had been issued under Contract A. Among them, 30 (71%) did not affect the original contract sum of 443.2 million (e.g. staff replacement and change of sub-contractors). The remaining 12 (29%) variation orders increased the original contract sum by $35.1 million, which were partly funded by the TGMS project vote ($8.1 million) and other funding sources ($27 million). For example, the procurement of additional sets of TGMS equipment for installation on new emergency vehicles was funded by the capital account of the General Revenue Account. In view of the large number of contract variations, the GLD required the FSD to avoid as far as possible further contract variations in September 2013.*

**Note 28:** *According to the FSD, it had provided prompt responses for each round of questions received from the GLD and sent several reminders to the GLD to emphasise the urgent needs to put the new fire appliances into use.*

January 2016, the GLD Tender Board eventually approved the award of the contract. The installation work for 14 fire appliances with delivery dates from May to October 2015 was carried out from March to June 2016, i.e. they had, on average, been left idle for about 7 months.

In Audit's view, there is a need for the FSD and the GLD to take measures to ensure that the procurement of additional TGMS equipment for installation on new emergency vehicles is carried out in a timely manner to avoid similar delays. To streamline the arrangements of procuring additional equipment of the next generation of the mobilising system for installation on new emergency vehicles, the FSD needs to, in consultation with the GLD, explore the feasibility of including requirements in the tender for the supply and installation of necessary equipment on new vehicles and the relocation of the equipment from replaced vehicles to new ones throughout the contract period.

## *Maintenance issues of the TGMS*

2.12 ***Target maintenance response time and turnaround time not met.*** Contract A has set a target response time (i.e. time required for arrival on scene after a system incident is reported) and a target turnaround time (i.e. time required to rectify a breakdown after arrival on scene) for corrective maintenance of TGMS equipment installed in the FSCC, fire stations, fireboat stations, ambulance depots, fire appliances, ambulances, vessels and base stations in remote sites. Audit's examination revealed that the target response/turnaround times were not met in 2015-16, as follows:

(a) for the maintenance of the Automatic Vehicle Location System (a sub-system of the TGMS — see para. (c) at Appendix C), the 2-hour response time target was not met in 423 (43%) of 985 cases; and

(b) the target of 6-hour turnaround time for critical faults (e.g. inaccurate positioning of an emergency vehicle) was also not met in 248 (30%) of 814 cases.

In response to the above findings, the FSD informed Audit in September 2016 that since 2012-13, it had stepped up the mechanism to identify fault cases under the Automatic Vehicle Location System by using a separate computer programme to actively monitor the position of all emergency vehicles. Fault cases identified by

the computer programme were reported in bulk to Contractor A on a daily basis. Under the new mechanism, the total number of fault cases had increased by 152% from 496 in 2011-12 to 1,251 in 2015-16. As a result, Contractor A had encountered difficulties in meeting the target response time and turnaround time for the maintenance services. However, as timely repair of faulty equipment is essential to ensure the operational efficiency of the TGMS in mobilising the FSD's emergency resources, Audit considers that the FSD needs to require Contractor A to strengthen its maintenance services with a view to meeting the contract stipulated response time and turnaround time targets.

2.13 ***Delays in claiming damages in case of default by the contractor.*** According to Contract A, the FSD may claim damages on Contractor A in case of its failure in meeting the performance targets for the maintenance work (Note 29). Audit's examination revealed that there were delays in claiming damages from Contractor A. Up to July 2016, the FSD had only claimed damages for 2009 and the first half-year of 2010. Upon enquiry, the FSD informed Audit in September 2016 that:

(a) due to the complexities of the formulas used and the significant number of components in various sub-systems of the TGMS, the approach and details of the calculation were only agreed with Contractor A in 2014 after a tedious negotiation;

(b) based on the confirmed amount of damages claimed for 2009 and the first half-year of 2010, the FSD had made estimation on the damages for the years up to 2015-16 and deducted the estimated damages from the maintenance charges paid to Contractor A in August 2016; and

(c) pending finalisation of the actual loss suffered, the difference between the estimated damages and the actual damages would be settled through adjustments in the maintenance charges payable to Contractor A in the coming months.

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**Note 29:** *In case of default by Contractor A, it shall pay damages to the FSD on a half-yearly basis with computation methodologies stipulated in the addendum to Contract A, which was concluded in June 2010. For example, for every case of default which exceeded the 2-hour response time, Contractor A shall pay damages at 5% of the monthly maintenance cost of the equipment.*

In Audit's view, the contract right for claiming damages is not just a retributive measure but can also have a deterrent effect on contractors to prevent recurrence of the same unsatisfactory performance. The FSD needs to take measures to ensure that contract damages are claimed in a timely manner.

2.14 ***Lack of competitive bidding for extended maintenance services.*** While the TGMS tender document (which became the contract document upon award of contract) required the design serviceable life of the system to be 10 years and extendable to 15 years, the tenderers were only requested to bid for a nine-year post-warranty maintenance service. In response to Audit's enquiry on the reason for not requesting a bid for the service over the extendable serviceable life, the FSD said that, with the rapid change and development in information and communications technology, it was very difficult for the tenderers to accurately project the maintenance cost under the extensive use of the system over 10 years together with other inflation factors (see Note 23 to para. 2.6). In February 2015, the FSD decided to extend the system use for five years from April 2017 to April 2022 on the same terms and conditions at a mutually agreed maintenance charge in accordance with Contract A. After a lengthy discussion with all concerned parties, the FSD sought the FSTB's approval to extend the maintenance services by means of a contract variation in February 2016. In April 2016, in approving the contract variation, the FSTB requested the FSD and the GLD to negotiate a reduced fee with Contractor A but their efforts were not successful. In the event, the annual fee for the five-year extended maintenance services of $58.5 million (Note 30) was about 7.4% higher than the existing level in 2015, after discounting the estimated inflation of 4% each year in 2016 and 2017 (see para. 2.6). In view of the significant cost of the maintenance services, the FSD needs to take measures in the future to acquire any extended maintenance services for procurement projects with an extendable design serviceable life through competitive bidding as far as practicable.

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**Note 30:** *In April 2016, the FSTB approved the contract variation on extending the maintenance services to April 2022 at an estimated cost of $390 million with an option of extending the services for two more years to April 2024 at an estimated cost of $156 million. The maintenance fee of $390 million for the five-year services included the cost of $97.5 million for upgrading the TGMS and procurement of spare parts, and the annual maintenance cost of $58.5 million. In justifying the contract variation request, the FSD informed the FSTB that the system upgrading was necessary after 10 years of use. According to the FSD, the cost of $97.5 million for upgrading the TGMS, which represented 22% of the original project cost of $443.2 million (see para. 2.6(a)), was accepted after considering details of the system upgrading proposals and carrying out detailed sub-systems comparison.*

2.15 ***Need to conduct a post-implementation review.*** As laid down in the best practice guide entitled "A User Guide to Post Implementation Reviews" issued by the Efficiency Unit in February 2009, conducting a post-implementation review is a good practice of modern day public sector management. It helps bureaux and departments evaluate whether a programme/project has achieved its intended objectives, review its performance and capture learning points to improve the delivery and outputs of future programmes/projects. The areas for improvement in implementing the TGMS found by Audit in the above paragraphs highlighted the importance of a post-implementation review. Audit considers that the FSD needs to conduct a post-implementation review of major procurement projects including the TGMS after completion of critical milestones.

## *Other enhancements for planning the next generation of the mobilising system*

2.16 In 2014, the FSD commissioned a consultancy study to prepare for the replacement/upgrade of the TGMS which would reach the end of its extended serviceable life by 2022 (see para. 2.4). Apart from the lessons highlighted in paragraphs 2.5 to 2.15, there are other enhancements that need to be considered in planning for the next generation of the mobilising system as set out in paragraphs 2.17 and 2.18.

2.17 ***Need to provide mobile phone location identification function.*** As revealed in the consultancy study of the TGMS in 1999 (see para. 2.2), the technology for mobile phone location identification was not mature at that time. Hence, the address identification function of the TGMS (see para. (b) at Appendix C) did not cater for mobile phone calls. Over the years, the subscribed mobile phone numbers had increased by 104% from 8.2 million in 2004-05 to 16.7 million in 2015-16. The percentage of emergency calls from mobile phone users had also increased from 30% in 2001-02 to 44% in 2015-16. With the advancement in information and communications technology (e.g. location services in smartphones) in recent years, the FSD needs to explore the technical feasibility of providing mobile phone location identification function in the next generation of the mobilising system to facilitate speedy and accurate identification of incident addresses reported by mobile phone callers.

2.18 ***Need to set a target time for answering emergency calls.*** The Telephone System of the TGMS was equipped with Computer Telephony Integration technology to facilitate automatic call distribution (see para. (b) at Appendix C) for telephone operators working in the FSCC to attend to emergency calls. According to the FSD's records, of the 864,426 emergency calls which were responded to in 2015-16, the waiting times for 288,002 (33%) calls were 10 seconds or more. Audit's further analysis of the 288,002 calls revealed that the waiting times of 8,747 (3%) were 60 seconds or more. Upon enquiry, in July and September 2016, the FSD informed Audit that:

(a) the Telephone System of the TGMS had fulfilled the contract specification that it should be properly designed so that no less than 98% of calls could get answered within the maximum acceptable waiting time of 10 seconds; and

(b) the present service level of answering emergency calls was not attributable to the equipment capacity nor the number of console workstations under the current provision. In fact, the service level mainly depended on the number of telephone operators working in the FSCC and their availability to answer the calls.

Audit noted that the FSD had not set any target time for answering emergency calls. Audit also noted that such performance target had been set for other government services (e.g. 9 seconds for 999 emergency calls set by the Hong Kong Police Force and 12 seconds for 1823 hotline set by the Efficiency Unit). As the time taken to answer emergency calls also affects the timeliness of despatch of emergency resources, the FSD needs to consider setting a target time for answering emergency calls in the design of the next generation of the mobilising system.

# Audit recommendations

2.19 **Audit has *recommended* that the Director of Fire Services should:**

***Delay in commissioning of the TGMS***

(a) **seek prior approval from the appropriate authority when services outside the scope of a contract are required and take measures to negotiate the best or most favourable terms for the services;**

(b) **improve the preparation of user requirements to minimise subsequent changes after the award of contract and closely liaise with the works agents to sort out any unresolved issue of the installation site at the earliest opportunity in future procurement projects;**

*Operational issues of the TGMS*

(c) **take measures to ensure that any outstanding contractual matters are dealt with expeditiously in similar projects in future to minimise professional service cost on contract management;**

(d) **in collaboration with the Director of Government Logistics, take measures to ensure that the procurement of additional TGMS equipment for installation on new emergency vehicles is carried out in a timely manner;**

(e) **in consultation with the Director of Government Logistics, explore the feasibility of including in the tender for the next generation of the mobilising system requirements for the supply and installation of necessary equipment on new vehicles and the relocation of the equipment from replaced vehicles to new ones throughout the contract period;**

*Maintenance issues of the TGMS*

(f) **require Contractor A to strengthen its maintenance services with a view to meeting the contract stipulated response time and turnaround time targets;**

(g) **take measures to ensure that contract damages are claimed in a timely manner in case of a contractor's default in meeting performance targets for maintenance work in accordance with the contract provisions in future;**

(h) **for procurement projects with an extendable design serviceable life, take measures to acquire any extended maintenance services through competitive bidding as far as practicable;**

(i) **conduct a post-implementation review of major procurement projects, including the TGMS, taking on board the audit observations and recommendations in this Audit Report;**

***Other enhancements for planning the next generation of the mobilising system***

(j) **explore the technical feasibility of providing mobile phone location identification function in the next generation of the mobilising system to facilitate speedy and accurate identification of incident addresses reported by mobile phone callers; and**

(k) **consider setting a target time for answering emergency calls in the design of the next generation of the mobilising system.**

## Response from the Government

2.20 The Director of Fire Services agrees with the audit recommendations. He has said that:

***Delay in commissioning of the TGMS***

(a) the FSD will improve the preparation of user requirements in formulating the tender for the next generation of the mobilising system by widely consulting the frontline members and respective stakeholders. The FSD will also closely liaise with the works agents on the site installation to avoid undue delay. The FSD will strengthen the monitoring of projects implementation in similar projects to complete all project works in accordance with contract specifications in a timely manner;

***Operational issues of the TGMS***

(b) the FSD will collaborate with the GLD, through periodical progress review and inter-departmental meetings, to ensure that the procurement of additional TGMS equipment for installation on new emergency vehicles is carried out in a timely manner;

(c) the FSD will, in consultation with the GLD, explore the feasibility of including in the tender for the next generation of the mobilising system the requirements for the supply and installation of necessary equipment on new vehicles and the relocation of the equipment from obsolete vehicles to new ones throughout the contract period;

***Maintenance issues of the TGMS***

(d) the FSD will instruct Contractor A to strengthen its maintenance services with a view to meeting the contract stipulated response time and turnaround time targets. On the other hand, all contract damages with Contractor A will be settled in the first quarter of 2017;

(e) for procurement projects with an extendable design serviceable life, the FSD will consult the GLD to acquire any extended maintenance services through competitive bidding as far as practicable;

(f) after the implementation of the TGMS, the FSD has kept under review its functionalities and operation to ensure that the mission-critical system meets its operational needs. While it may not be practicable for the FSD to follow the guidelines subsequently promulgated by the Efficiency Unit on conducting post-implementation review in full at this point in time, the FSD will conduct a review on major procurement projects after their implementation in the light of the experience gained from their procurement/implementation for the benefit of future projects. Having considered the long lapse of time from the commissioning of the TGMS, the FSD will take on board the audit observations and recommendations to conduct a post-implementation review for the TGMS as far as practicable;

***Other enhancements for planning the next generation of the mobilising system***

(g) the FSD will approach the mobile operators to explore the technical feasibility and consult the Office of the Communications Authority on the personal data privacy issue of providing mobile phone location identification function in the next generation of the mobilising system; and

(h) the FSD will also consider setting a target time for answering emergency calls in the design of the next generation of the mobilising system in accordance with the recommendation of the consultancy study for the replacement/upgrade of the TGMS.

2.21 The Director of Government Logistics accepts the audit recommendations in paragraph 2.19(d) and (e). She has said that the GLD:

(a) will provide assistance to the FSD to facilitate timely procurement of the FSD's stores and equipment; and

(b) will assist the FSD to work out the procurement approach for the new mobilising system where necessary.

## Digital Trunked Radio System

2.22 In 1997, the FSD used an analogue radio communications system to facilitate communications among frontline officers at the scene of incidents. According to a consultancy study conducted by the EMSD in July 2008, the system should be replaced by a new digital system, namely the DTRS (see para. 1.8), because the analogue system was approaching the end of its serviceable life. In May 2009, the SB obtained the FC's funding approval of $178 million for procuring the DTRS which would provide the following benefits:

(a) some 200 portable repeaters could be deployed flexibly inside buildings at the scene of incidents to enhance the reliability and coverage of indoor communications;

(b) the DTRS would offer improved voice quality and better protection against interference and interception; and

(c) the DTRS would make more efficient use of the radio spectrum, and had the capacity to provide more voice channels and increase the usable or effective airtime.

2.23 The EMSTF was appointed by the FSD as the management consultant of the DTRS project. After open tendering, the EMSTF, on behalf of the FSD, awarded:

(a) in March 2010 the DTRS infrastructure contract (Contract B) to Contractor B for setting up the radio infrastructure at a cost of $44 million; and

(b) in October 2010 the DTRS terminal contract (Contract C) to Contractor C for procuring terminal equipment (see Photograph 4) at a cost of $30 million.

**Photograph 4**

**DTRS terminal equipment installed in FSD's vehicles**

*Source: FSD records*

2.24 With the completion of the DTRS infrastructure and terminal equipment installation work, the DTRS was commissioned in February 2012 (Note 31). In December 2012, the FSD engaged the EMSTF to provide post-warranty

**Note 31:** *According to the funding paper, the DTRS would commission in July 2011. According to the FSD, the 7-month delay in commissioning of the DTRS was mainly due to inclement weather and the unavailability of two remote sites for the installation of DTRS infrastructure equipment.*

maintenance services for both the DTRS infrastructure and terminal equipment (Note 32) at an annual sum of $8.95 million for the first year. Provision of the maintenance services was incorporated into the then Service Level Agreement (SLA) with the EMSTF which covered the period from April 2006 to March 2016 (Note 33). While the EMSTF's maintenance team carried out maintenance of DTRS terminal equipment, the maintenance of DTRS infrastructure equipment was subcontracted to Contractor B (which provided the DTRS infrastructure). In 2015-16, the maintenance fee of the DTRS charged by the EMSTF amounted to $12 million.

## *Maintenance services falling short of SLA requirements*

2.25 Under the SLA, the EMSTF was required to provide maintenance for the DTRS infrastructure and terminal equipment, as follows:

(a) preventive maintenance would be provided on a half-yearly basis; and

(b) corrective maintenance would be provided to rectify a fault in accordance with the target fault response times and rectification times set for different types of faults (Note 34). The target compliance level was 90% or above in both response time and rectification time.

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**Note 32:** *According to Financial Circular No. 6/2001 (in force at that time), a Controlling Officer might use the in-house services provided by a trading fund if he was satisfied that, having regard to the circumstances of the case (such as special service requirements), inviting competitive bidding for the delivery of such services was not appropriate.*

**Note 33:** *According to the FSD, the SLA was extended for 5 years from April 2016 to March 2021.*

**Note 34:** *Under the SLA, there are a number of target response times and rectification times. For example, for faults relating to DTRS infrastructure equipment in the FSD's Headquarters Building, the maintenance staff are required to arrive on site within 1 hour and rectify the fault within 6 hours for major faults and 12 hours for minor faults.*

According to the FSD, it held regular meetings with the EMSTF to review the maintenance service level under the SLA. However, unlike Contract A of the TGMS (see para. 2.13), there was no provision for claiming damages in the SLA to address default in achieving the target compliance level by the EMSTF or Contractor B.

2.26 ***Preventive maintenance.*** Audit's examination of the preventive maintenance records of the EMSTF for 2015-16 revealed that, when the DTRS terminal equipment installed in a vehicle/vessel was not available for preventive maintenance (e.g. deployed to provide emergency services) in a scheduled visit by the EMSTF maintenance team, the team would not arrange for a supplementary maintenance. Audit's further analysis revealed that, of 1,055 fire appliances, support vehicles, ambulances and vessels under preventive maintenance in 2015-16, the DTRS terminal equipment installed in:

(a) 310 (29%) vehicles/vessels received all two rounds of preventive maintenance services;

(b) 433 (41%) vehicles/vessels received only one round of preventive maintenance services; and

(c) 312 (30%) vehicles/vessels missed all two rounds of preventive maintenance services.

2.27 Upon enquiry, the FSD and the EMSTF informed Audit in October 2016 that with effect from July 2016:

(a) in order to improve the service level of preventive maintenance of DTRS terminal equipment of vehicles/vessels in fire/fireboat stations and ambulance depots, a more detailed maintenance schedule would be sent to the FSD in advance for it to make available those stored terminal equipment for preventive maintenance services when the EMSTF teams visit the stations/depots. The stations/depots concerned would be informed of the maintenance scheduled and they could reschedule the maintenance with the EMSTF, if so required; and

(b) in case that the DTRS terminal equipment was unable to receive preventive maintenance due to operational commitment, the EMSTF maintenance team would provide an outstanding list to the FSD for subsequent despatch to the concerned fire/fireboat stations and ambulance depots. The EMSTF would follow up with the fire/fireboat stations and ambulance depots concerned to carry out the outstanding preventive maintenance.

In Audit's view, the FSD needs to closely monitor the effectiveness of the enhanced measures to ensure that the EMSTF's preventive maintenance services are effectively provided in accordance with the SLA requirements.

2.28 ***Corrective maintenance.*** According to the SLA, the target compliance level for response time of corrective maintenance for the DTRS was 90% or above (see para. 2.25(b)). According to the EMSTF's performance report for 2015-16 submitted to the FSD, the compliance level achieved was 100%. However, Audit's examination of the EMSTF's corrective maintenance records revealed that:

(a) for the DTRS infrastructure equipment maintained by the EMSTF sub-contractor (Contractor B), the actual compliance level was 78%, i.e. below the 90% SLA requirement. In response to Audit's enquiry, the EMSTF in August 2016 said that:

(i) the compliance level was incorrectly reported as 100% because Contractor B had wrongly reported the response time (Note 35) in the monthly reports submitted to the EMSTF;

(ii) in cases involving equipment located in the FSD's Headquarters Building, the EMSTF maintenance staff who stationed around-the-clock therein had provided the fault attendance services to the FSD so as to meet the target response time specified in the SLA. However, records were not always kept by the EMSTF in such cases;

**Note 35:** *Contractor B misinterpreted the response time as the time it picked up a call for assistance instead of the time of actual arrival on scene of incident.*

(iii) no complaint/enquiry was received from the FSD regarding the response time for the maintenance of the DTRS infrastructure equipment in the FSD's Headquarters Building in 2015-16; and

(iv) the actual compliance level could reach 93% taking into account the factors mentioned in (ii) and (iii); and

(b) for the DTRS terminal equipment maintained by the EMSTF maintenance team, Audit could not verify the reported 100% compliance rate because the team had not recorded essential information (such as the call receipt time and arrival time).

Upon enquiry, the FSD informed Audit in September 2016 that the EMSTF would review and closely monitor the service level of Contractor B for the DTRS maintenance to ensure that the actual service level would comply with the SLA requirements at all stages of maintenance work. Audit considers that the FSD should closely monitor the EMSTF's maintenance work to ensure that the agreed service requirements specified in the SLA are achieved and properly reported. To ensure the delivery of quality maintenance services, the FSD also needs to consider introducing provisions for claiming damages in future SLAs to guard against any non-compliance with the stipulated maintenance requirements by the EMSTF (see para. 2.25).

## Audit recommendations

2.29 **Audit has *recommended* that the Director of Fire Services should:**

(a) **closely monitor the compliance by the EMSTF with the service requirements stipulated in the SLA to ensure that:**

(i) **preventive maintenance services for the DTRS terminal equipment are effectively provided in accordance with the SLA requirements;**

(ii) **corrective maintenance services are provided in a timely manner; and**

(iii) **the actual service level of corrective maintenance services is accurately reported and properly documented; and**

(b) **consider introducing provisions for claiming damages in future SLAs to guard against any non-compliance with the stipulated maintenance requirements by the EMSTF.**

2.30 **Audit has also *recommended* that the Director of Electrical and Mechanical Services should take measures to ensure that:**

(a) **the maintenance work of the DTRS terminal equipment complies with the service requirements as stipulated in the SLA; and**

(b) **proper records are kept by the EMSTF maintenance team for corrective maintenance provided for the DTRS.**

## Response from the Government

2.31 The Director of Fire Services agrees with the audit recommendations in paragraph 2.29. He has said that, in addition to the improvement measures mentioned in paragraph 2.27:

(a) the FSD has asked the EMSTF to submit maintenance records in a timely and accurate manner for the FSD's monitoring of the maintenance services; and

(b) the FSD will approach the EMSTF to explore the feasibility of introducing provisions for claiming damages in future SLAs to guard against any non-compliance with the stipulated maintenance requirements by the EMSTF.

2.32 The Director of Electrical and Mechanical Services agrees with the audit recommendations in paragraph 2.30. He has said that, in addition to the improvement measures mentioned in paragraph 2.27:

(a) Contractor B has been instructed to correctly input data on the fault receiving time, the appointment time, the fault attendance time, and the fault completion time for proper calculation of the fault response time and fault rectification time; and

(b) EMSTF staff have been reminded to accurately record similar data in the corrective maintenance job cards for proper calculation of the fault response time and fault rectification time.

# PART 3: FIRE APPLIANCES AND SUPPORT VEHICLES

3.1 This PART examines the procurement and maintenance of fire appliances and support vehicles, focusing on:

(a) availability of fire appliances and support vehicles (paras. 3.2 to 3.10);

(b) termination of five fire-appliance procurement contracts (paras. 3.11 to 3.12);

(c) replacement of diesel vehicles not meeting European emission standard IV (hereinafter referred to as pre-Euro IV diesel vehicles — paras. 3.13 to 3.19);

(d) scheduled maintenance (paras. 3.20 to 3.29); and

(e) dormant stocks of vehicle spare parts (paras. 3.30 to 3.36).

## Availability of fire appliances and support vehicles

3.2 The FSD has to ensure that its fire appliances and support vehicles are in an immediate state of readiness to respond to emergency calls at all times. As of May 2016, the FSD had a fleet of 620 fire appliances and support vehicles, comprising 434 fire appliances and 186 support vehicles (see para. 1.9). Their expected serviceable lives (Note 36), which were assessed by the engineers in the EMSTF/Workshops and Transport Division (see para. 1.9), ranged from 5 to 15 years (see Table 4). Of these 620 vehicles, 565 (91%) were serviceable vehicles and 55 (9%) were supernumerary vehicles which were replaced old vehicles but retained for either training or reserve purposes (i.e. for temporary deployment to different fire stations when their serviceable vehicles were under maintenance).

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**Note 36:** *According to the FSD, expected serviceable life is one of the factors to be considered when deciding whether a vehicle has to be replaced (see para. 3.3 for details).*

According to the FSD, these supernumerary vehicles are essential to the effective operation in terms of maintaining the availability of the vehicle fleet and meeting training requirement (Note 37).

**Table 4**

**Expected serviceable lives of fire appliances and support vehicles (1 May 2016)**

| Vehicle type | Number of vehicles | | Expected serviceable life (Year) |
|---|---|---|---|
| | Serviceable | Supernumerary | |
| Frontline fire appliances | 241 | 33 | 10 — 15 |
| Other fire appliances | 147 | 13 | 6 — 15 |
| Sub-total | 388 | 46 | — |
| Support vehicles | 177 | 9 | 5 — 9 |
| Total | 565 | 55 | — |

*Source: FSD records*

3.3 ***Vehicle procurement strategy.*** Since 2011, the FSD has prepared its annual Departmental Procurement Strategy. The document covers topics such as the FSD's procurement strategy, an action plan for the procurement of the FSE in the coming year, a 10-year procurement plan for its FSE and a performance review of the achievement of the action plan of the preceding year. When devising the procurement plans of its fire appliances, the FSD takes into consideration factors such as: types, functions and serviceable lives of its fire appliances; maintenance and replacement costs; technical advice given by the Workshops and Transport

**Note 37:** *The FSD had not set a ratio for the number of supernumerary vehicles against its serviceable vehicles. According to the FSD, in deciding the number of supernumerary vehicles to be kept, it would take into consideration factors such as the fleet condition, operational requirements and capacity of maintenance teams in the workshops. The number of supernumerary vehicles increased by 10 (22%) from 45 in March 2011 to 55 in May 2016.*

Division and the EMSTF; breakdown and fault rates of its fire appliances and availability of spare parts. According to the FSD, usually, the condition of a vehicle would be critically and regularly reviewed according to the above factors when the vehicle approaches the end of its expected serviceable life. The FSD will then determine if it is fit for the vehicle to continue its service or a planned replacement is needed. According to the 2015 Departmental Procurement Strategy, the FSD adopted the following principles in devising the 10-year procurement plan of its fire appliances:

(a) replacing diesel vehicles of 15 years old;

(b) replacing vehicles reaching the end of their serviceable lives as far as possible, with due consideration of the conditions of individual vehicles;

(c) evening out the expenditure for procuring new fire appliances as far as practicable (subject to its plan to phase out pre-Euro, and Euro I to Euro III diesel vehicles by December 2019 — see paras. 3.13 and 3.14); and

(d) giving priority to procuring frontline fire appliances (see para. 1.9).

3.4 ***Vehicle age profile.*** To ascertain the age profile of the FSD's vehicle fleet, Audit performed an ageing analysis of the 620 fire appliances and support vehicles. As at 1 May 2016, of the FSD's 620 vehicles, 246 (40%) vehicles (comprising 191 serviceable fire appliances and support vehicles and 55 supernumerary vehicles — Note 38) had exceeded their expected serviceable lives (averaging 4 years — see Appendix E). Audit noted that:

(a) of the 388 serviceable fire appliances (see Table 4 in para. 3.2), 114 (29%) had, on average, exceeded their expected serviceable lives by 4.5 years;

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**Note 38:** *According to the FSD, it will carefully assess the reliability, roadworthiness and operational suitability of those replaced vehicles before they are arranged to become supernumerary vehicles. These supernumerary vehicles will undergo the same level of scheduled maintenance (see paras. 3.20 and 3.21) as other vehicles of the fleet so as to ensure that such arrangement provides good value for money.*

(b) of the 177 serviceable support vehicles (see Table 4), 43 (24%) had, on average, exceeded their expected serviceable lives by 2.5 years; and

(c) of the total 55 supernumerary vehicles (see Table 4), 37 (67%) had, on average, exceeded their expected serviceable lives by 7.7 years.

## *Availability rate of fire appliances and support vehicles*

3.5 ***Target availability rates.*** For the 415 fire appliances and 11 support vehicles maintained by the FSD's Workshops and Transport Division (see Appendix B), the FSD has set a target availability rate (Note 39) of 90%. For the 19 fire appliances and 175 support vehicles under the EMSTF's maintenance (see Appendix B), the FSD has stipulated in the SLA a target availability rate of 92%. According to the SLA, the 92% availability rate only accounts for downtime due to normal maintenance work. Downtime caused by factors not controlled by the EMSTF (e.g. repair of damages caused by car accident) is excluded from the computation. However, for calculating the availability rate of vehicles under the Workshops and Transport Division's maintenance, all downtime will be taken into account.

3.6 ***Actual availability rates.*** While the EMSTF achieved the target availability rates for the last three years 2013-14 to 2015-16 (i.e. the actual availability rates were 95.4%, 95.8% and 96.8% respectively), the Workshops and Transport Division could not achieve the target availability rate in the corresponding period. As indicated in Table 5, the actual availability rates decreased from 88.6% in 2013-14 to 84.9% in 2015-16.

**Note 39:** *Availability rate of a vehicle is calculated by dividing the number of hours that the vehicle is available for operation against the total number of hours in a month.*

**Table 5**

**Availability rate of fire appliances and support vehicles maintained by the Workshops and Transport Division (2013-14 to 2015-16)**

| Workshop | Availability rate | | |
|---|---|---|---|
| | 2013-14 | 2014-15 | 2015-16 |
| Hong Kong Workshop | 89.2% | 88.4% | 88.3% |
| Kowloon Workshop | 88.6% | 89.3% | 85.5% |
| New Territories Workshop | 88.1% | 88.2% | 81.9% |
| Overall (Note) | 88.6% | 88.6% | 84.9% |

*Source: FSD records*

*Note: Overall availability rates were weighted average figures.*

3.7 Upon Audit's enquiry on the non-achievement of the target availability rates in the three years 2013-14 to 2015-16, the Workshops and Transport Division informed Audit in June and August to October 2016 that:

(a) the workload of the Division's workshop staff had increased by 22% since 2004, partly attributed to the increase in number of fire appliances, fire-fighting equipment and supernumerary vehicles (see Note 37 to para. 3.2). In addition, traffic accidents involving FSD vehicles (Note 40) and ad hoc jobs (e.g. modification of vehicles to house fire-fighting equipment to suit operational needs) throughout the years resulted in additional maintenance time and hence affected the availability rates. Moreover, the workforce size had decreased by 11% from 137 in 2004 to 122 in 2016;

**Note 40:** *The numbers of traffic accidents involving fire appliances and support vehicles of the FSD were 136, 134 and 156 in 2013, 2014 and 2015 respectively.*

(b) the Division had taken the following remedial measures to improve the availability rates of vehicles:

(i) outsourcing some repair works (e.g. tyres and air-conditioners) to maintenance contractors to reduce the downtime;

(ii) using state-of-the-art technology to improve the maintenance effectiveness (e.g. using better type of engine lubrication oil and gearbox hydraulic oil); and

(iii) according priority to vehicles with greater maintenance need (e.g. in case of significant delays in scheduled maintenance, the workshops would defer the scheduled maintenance of recently acquired vehicles for one to two months so that older ones could undergo scheduled maintenance first);

(c) the Division believed that the operation of the FSD had not been affected after the implementation of the remedial measures in (b) above. Notwithstanding this, the FSD would continue to review the number of supernumerary vehicles required as operational reserves (see para. 3.2) and the number of maintenance staff required. Subject to the result of the review, the FSD would bid funds to procure extra vehicles to serve as operational reserves and recruit extra maintenance staff if necessary; and

(d) due to input errors, the 2015-16 availability rate as indicated in the report generated by the AMMS (see para. 1.7) might have been affected and become inaccurate. While it was not practicable to recalculate the availability rate for 2015-16, the availability rate for August 2016 was 89.5% after the input errors had been rectified.

3.8 Audit noted the Workshops and Transport Division's efforts to improve the availability rate. However, given that the target availability rate was consistently not met from 2013-14 to 2015-16, the FSD needs to closely monitor the effectiveness of the Division's remedial measures in addressing the issue and take further measures where necessary.

## Audit recommendation

3.9 **Audit has *recommended* that the Director of Fire Services should closely monitor the effectiveness of the Workshops and Transport Division's remedial measures in attaining the 90% target availability rate of the fire appliances and support vehicles, and take further measures where necessary.**

## Response from the Government

3.10 The Director of Fire Services agrees with the audit recommendation. He has said that:

(a) the FSD will take necessary measures to attain the 90% target availability rate of the fire appliances and support vehicles; and

(b) among the 114 vehicles which had exceeded their expected serviceable lives as at 1 May 2016 (see para. 3.4(a)), the oldest 18 vehicles were originally planned for replacement but affected by unexpected contract disputes (see paras. 3.11 and 3.12). While ensuring that these vehicles were suitable for extending their serviceable lives, the FSD had expedited the re-tender exercises. In fact, all these 18 vehicles had been replaced or condemned as at July 2016. Excluding these 18 oldest vehicles, the remaining 96 vehicles are working in their extended serviceable lives of 7 years or less.

## Termination of five fire-appliance procurement contracts

3.11 Between 2007 and 2009, the FSD obtained funding of $175.9 million under the capital account of the General Revenue Account for procuring 37 fire appliances with target commissioning dates from May 2010 to January 2012. Between May 2008 and January 2010, the GLD on behalf of the FSD entered into five contracts with two contractors for procuring the 37 fire appliances at a total contract sum of $136.4 million. However, all the five contracts were terminated by the Government between September 2011 and December 2012. Audit was concerned that this might render the cost and time spent on procuring the 37 fire appliances nugatory. In particular, the FSD paid a total of $66 million under three of the five contracts but according to the DoJ, a counterclaim had been filed against

the contractor to recover those costs, which is in the legal proceedings pending trial (Note 41). Between January 2012 and March 2014, five new contracts were awarded to procure replacement fire appliances which were eventually put into operation between April 2014 and June 2016, some four years later than the original target commissioning dates from May 2010 to January 2012.

3.12 In light of the DoJ's advice that there are pending or potential legal proceedings under the five contracts, in order not to prejudice any pending or potential court proceedings, Audit will not make any comment in relation thereto in this Audit Report.

## Replacement of pre-Euro IV diesel vehicles

3.13 Under the Air Pollution Control (Vehicle Design Standards) (Emission) Regulations (Cap. 311J), since April 1995, vehicles seeking first registration in Hong Kong have been required to meet the related European (Euro) emission standards. Since the introduction of Euro emission standards in 1993 in Europe, there have been six Euro emission standards, namely Euro I, Euro II, Euro III, Euro IV, Euro V and Euro VI. The standards are progressively becoming more stringent from Euro I to Euro VI. Vehicles registered before April 1995 are classified as pre-Euro vehicles. In general, diesel vehicles registered in early years are more polluting than those registered in later years.

3.14 In his 2013 Policy Address, the Chief Executive of the Hong Kong Special Administrative Region said that in order to reduce roadside air pollution in Hong Kong, the Government had proposed financial subsidies for vehicle owners to phase out their pre-Euro IV diesel commercial vehicles. In line with the Government's environmental policy, the FSD stated:

**Note 41:** *In February 2012, the contractor of the first three contracts filed a Statement of Claim to the High Court against the Government. Thereafter, the Government had filed a Defence and Counterclaim. According to the DoJ, there might be potential court proceedings for the remaining two contracts.*

(a) in its 2013 Departmental Procurement Strategy that it would study the feasibility of using electric vehicles as fire appliances and include the replacement of its pre-Euro IV diesel fire appliances in its vehicle procurement plan. The vehicle procurement plan in the 2013 Departmental Procurement Strategy also specified that the FSD would phase out its pre-Euro to Euro II and Euro III diesel vehicles by January 2017 and January 2019 respectively (Note 42);

(b) in its 2014 Departmental Procurement Strategy that it had earmarked funds for progressively phasing out its pre-Euro IV diesel fire appliances and specialised vehicles (e.g. canteen van, hose layer and mobile command unit) in order to support the Government's emission reduction initiatives. Notwithstanding that the FSD's fire appliances and specialised vehicles were not covered by the Government's replacement plan of diesel vehicles, the FSD still supported the phasing out of its pre-Euro to Euro II diesel vehicles by January 2017 and Euro III diesel vehicles by January 2019 (Note 43); and

(c) in its 2015 Departmental Procurement Strategy that it would defer the end date of replacing its pre-Euro IV diesel fire appliances and specialised vehicles to December 2019.

## *Slow progress in replacing pre-Euro IV diesel vehicles*

3.15 Audit noted that the progress of replacing the pre-Euro IV diesel fire appliances/specialised vehicles was slow as the target end dates of replacing such appliances/specialised vehicles had already been deferred by three years and one year respectively to December 2019 (see para. 3.14(b) and (c)). Audit further noted that as at 1 May 2016, the FSD still had a total of 250 pre-Euro IV diesel vehicles (see Table 6) in operation, comprising:

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**Note 42:** *The 2013 Departmental Procurement Strategy stated that 55 Euro II and 50 Euro III diesel vehicles should be replaced by January 2017 and January 2019 respectively.*

**Note 43:** *The 2014 Departmental Procurement Strategy stated that 50 Euro III diesel vehicles should be replaced by January 2019.*

(a) 206 serviceable fire appliances and support vehicles (representing 36% of its 565 serviceable fire-fighting and support vehicle fleet); and

(b) 44 supernumerary vehicles (representing 80% of its 55 supernumerary vehicles or 7% of the 620 fire-fighting and support vehicle fleet — see para. 3.4(c)).

**Table 6**

**Analysis of the FSD's diesel vehicles by Euro emission standards (1 May 2016)**

| | Pre-Euro (Number) | Euro I (Number) | Euro II (Number) | Euro III (Number) | Total (Number) |
|---|---|---|---|---|---|
| **Serviceable** | | | | | |
| Fire appliances | 1 | 17 | 98 | 88 | 204 |
| Support vehicles | 0 | 0 | 1 | 1 | 2 |
| Sub-total | 1 | 17 | 99 | 89 | 206 |
| **Supernumerary** | | | | | |
| Fire appliances | 9 | 12 | 20 | 1 | 42 |
| Support vehicles | 0 | 0 | 1 | 1 | 2 |
| Sub-total | 9 | 12 | 21 | 2 | 44 |
| Total | 10 | 29 | 120 | 91 | 250 |

*Source: Audit analysis of FSD records*

3.16 Audit's analysis revealed that, as at 1 May 2016, 133 of the 206 serviceable pre-Euro IV diesel vehicles had, on average, exceeded their serviceable lives by 3.8 years. Audit's examination of the progress of replacement of these 206 diesel vehicles revealed that as at 1 May 2016, replacement exercises for 163 (79%) vehicles were in progress but the replacement schedule of 43 (21%) vehicles was still under planning.

3.17 Given the procurement lead time of some 36 months (Note 44) for some vehicles (such as hydraulic platforms and major pumps) and that the replacement schedule of the 43 diesel vehicles was still under planning, there is a risk that the FSD could not meet the target replacement date of December 2019. To support the Government's emission reduction initiatives, the FSD needs to closely monitor the progress of replacing the 206 serviceable diesel vehicles and, in particular, expedite action on the 43 vehicles for which replacement schedule was still under planning.

## Audit recommendation

3.18 **Audit has *recommended* that the Director of Fire Services should closely monitor the progress of replacing 206 serviceable pre-Euro IV diesel vehicles and, in particular, expedite action on the 43 vehicles for which the replacement schedule was still under planning.**

## Response from the Government

3.19 The Director of Fire Services agrees with the audit recommendation. He has said that:

(a) although fire appliances are exempted from the government-wide replacement plan of pre-Euro IV diesel vehicles, the FSD supports the Government's emission reduction initiative and will revise the fire appliance replacement programme to this effect; and

(b) the FSD agrees to closely monitor the replacement progress of relevant fire appliances and support vehicles to meet the objective (see para. 3.14(c)).

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**Note 44:** *The procurement lead time was arrived at by counting from the start date of preparation of tender specifications to the target commissioning date as estimated by the FSD in its submission of the Department's draft estimates for 2014-15 and 2016-17.*

## Scheduled maintenance

3.20 The Workshops and Transport Division has a team of some 90 disciplined-grade workshop staff to carry out the maintenance work in its three workshops located on Hong Kong Island, in Kowloon and in the New Territories respectively. The FSD has also entered into an SLA with the EMSTF for maintaining the FSD's specialised fire appliances at the Airport and support vehicles (mainly staff cars and lorries). The number and types of vehicles maintained by the FSD and the EMSTF respectively as of May 2016 are shown at Appendix B.

### *Scheduled maintenance falling short of requirements*

3.21 All the FSD's vehicles are subject to scheduled maintenance which is preventive in nature. The services include replacing consumable items (e.g. lubrication oil and filter), and checking vehicle systems and moving parts (e.g. ladder). The aim is to minimise the number of vehicle breakdowns during fire-fighting and rescue operations (Note 45).

3.22 ***Scheduled maintenance carried out by the FSD.*** The Workshops and Transport Division is responsible for the maintenance of the FSD's 426 fire appliances and support vehicles (see Appendix B). According to the Division, in order to ensure that the fire appliances and support vehicles are well-maintained, the scheduled maintenance cycles are four months for frontline fire appliances (i.e. 3 rounds per annum), four to six months for other fire appliances (i.e. 2 to 3 rounds per annum) and six months for support vehicles (i.e. 2 rounds per annum). Audit reviewed the implementation of 1,022 rounds of scheduled maintenance of the 426 vehicles from July 2015 to June 2016. Audit found that 86 vehicles

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**Note 45:** *According to the FSD, during the period July 2015 to June 2016, there were 3,021 cases of breakdown maintenance involving the FSD's fire appliances and support vehicles. Among the 3,021 cases: (a) 479 (16%) were breakdowns of vehicles which were unable to be deployed to emergency operations; (b) 36 (1%) cases were vehicle breakdowns either on their way to the scenes of incidents or at the scenes of incidents; and (c) 2,506 (83%) were mainly minor breakdowns identified during inspections by staff at the fire stations. For the vehicles maintained by the EMSTF, there were 106 cases of vehicle breakdowns on the roadside which required the EMSTF's vehicle recovery service in the same period.*

(i.e. 75 frontline fire appliances and 11 other fire appliances and support vehicles), representing 20% of the 426 FSD maintained vehicles, had not undergone all stipulated rounds of scheduled maintenance in the period concerned (Note 46). Besides, as shown in Table 7, there were delays in carrying out 359 (35% of 1,022) rounds of scheduled maintenance for 222 vehicles. Of the 359 cases, 284 (79%) cases involved frontline fire appliances, 49 (14%) involved other fire appliances and 26 (7%) involved support vehicles.

**Table 7**

**Delays in carrying out scheduled maintenance for fire appliances and support vehicles (July 2015 to June 2016)**

| Time elapsed between the scheduled and actual maintenance (Day) | Frontline fire appliances (Number of cases) | Other fire appliances (Number of cases) | Support vehicles (Number of cases) | Total (Number of cases) |
|---|---|---|---|---|
| <30 | 222 | 39 | 13 | 274 (76%) |
| 30 to <60 | 47 | 5 | 6 | 58 (16%) |
| 60 to <120 | 15 | 3 | 5 | 23 (7%) |
| 120 to <180 | – | 2 | 1 | 3 (1%) |
| 180 to <210 | – | – | 1 | 1 (0%) |
| Total | 284 | 49 | 26 | 359 (100%) |

*Source: Audit analysis of FSD records*

**Note 46:** *For the 75 frontline fire appliances, 72 and 3 appliances had missed 1 round and 2 rounds of scheduled maintenance respectively. For the 11 other fire appliances and support vehicles, they had each missed 1 to 2 rounds of scheduled maintenance.*

3.23 In response to Audit's findings in paragraph 3.22, in June and August 2016, the Workshops and Transport Division said that:

(a) there were cases where the workshops would defer the scheduled maintenance of recently acquired vehicles for one to two months so that older vehicles could undergo scheduled maintenance first, thus minimising the risk of vehicle breakdown. The daily checking of the fire appliances by the fire station staff could also identify defective components/functions on the appliances and they could call for the assistance of the workshop staff to carry out corrective maintenance; and

(b) all reserve vehicles were fully engaged at that time and hence, the vehicles concerned could not be released for maintenance. For vehicles which were overdue for maintenance for over two months, maintenance staff of the Division would visit the relevant fire stations to inspect the concerned vehicles.

3.24 ***Scheduled maintenance carried out by the EMSTF.*** According to the SLA, the EMSTF has to provide scheduled maintenance to the FSD's vehicles. The EMSTF follows the guideline in its work instruction when providing scheduled maintenance service, viz. ranging from 2 rounds (e.g. for cross country vehicles and medium trucks) to 6 rounds (e.g. for large motorcycles) per annum. The EMSTF will inform the FSD of the scheduled maintenance one month in advance of the scheduled date and for any vehicles which have missed the scheduled maintenance, send reminders (via e-mail) every two to three months to the FSD requesting their release for maintenance. However, Audit's analysis of the scheduled maintenance work carried out by the EMSTF from April 2015 to March 2016 revealed that some vehicles had not undergone all stipulated rounds of scheduled maintenance similar to those carried out by the Workshops and Transport Division as mentioned in paragraph 3.22. Of the 194 vehicles maintained by the EMSTF (see Appendix B):

(a) 10 (5%) vehicles had missed all scheduled maintenance; and

(b) the number of scheduled maintenance of 23 (12%) vehicles was less than the stipulated frequency (see Table 8).

**Table 8**

**Scheduled maintenance of support vehicles below the frequency stipulated in the EMSTF's work instruction (April 2015 to March 2016)**

| Vehicle type | Number of rounds of scheduled maintenance required per annum | Number of vehicles with missed scheduled maintenance in | | |
|---|---|---|---|---|
| | | All rounds | One round | Total |
| Light bus | 3 | – | 1 | 1 |
| Medium saloon car | 2 | 9 | 15 | 24 |
| Small saloon car | 2 | 1 | – | 1 |
| Medium van | 2 | – | 7 | 7 |
| | Total | 10 | 23 | 33 |

*Source: Audit analysis of EMSTF records*

3.25 In August 2016, the FSD informed Audit that the relevant vehicles could not be released to undergo scheduled maintenance by the EMSTF because all reserve vehicles were fully engaged at that time.

## *Need to step up monitoring of compliance with scheduled maintenance requirements*

3.26 According to the FSD, the cases of non-compliance with the scheduled maintenance requirements as stipulated by the Workshops and Transport Division and the EMSTF's work instruction were not brought to the attention of the senior management of the FSD. Audit considers that the FSD needs to step up monitoring of such non-compliance issues and take measures to ensure that all operational vehicles, in particular the frontline fire appliances, receive proper maintenance in a timely manner and are in good working order during emergency operations. The FSD should also explore with the EMSTF the feasibility of providing supplementary service to vehicles that have missed the maintenance on the scheduled dates

(e.g. sending EMSTF maintenance staff to inspect them at relevant fire stations similar to the arrangement made by the FSD's Workshops and Transport Division — see para. 3.23(b)).

## Audit recommendations

3.27 **Audit has *recommended* that the Director of Fire Services should:**

(a) **step up monitoring of the compliance with the scheduled maintenance requirements, including reporting to the FSD senior management of any non-compliance cases and taking measures to ensure that the fire appliances and support vehicles receive proper maintenance in a timely manner; and**

(b) **explore with the EMSTF the feasibility of providing supplementary service (e.g. inspection service at fire stations) to vehicles that have missed the maintenance on the scheduled dates.**

## Response from the Government

3.28 The Director of Fire Services agrees with the audit recommendations. He has said that the FSD will take necessary measures to ensure that its fire appliances and support vehicles undergo proper maintenance in a timely manner to maintain their effective working order.

3.29 The Director of Electrical and Mechanical Services agrees with the audit recommendation in paragraph 3.27(b). He has said that the EMSTF has coordinated with the FSD for the provision of a monthly outstanding report listing out those fire services vehicles with deferred preventive maintenance for further arrangement.

## Dormant stocks of vehicle spare parts

3.30 The Workshops and Transport Division is responsible for the maintenance of the FSD's 426 fire appliances and support vehicles (see Appendix B), which had expected serviceable lives ranging from six years (for mini passenger vans) to 15 years (for hydraulic platforms and aerial ladder platforms). It is the Division's practice to procure and keep adequate vehicle spare parts in order to provide efficient maintenance services over the vehicle serviceable lives. Table 9 shows the expenditure of the FSD on procuring vehicles spare parts in the past three financial years and the inventory value as at 31 March in each financial year.

**Table 9**

**Expenditure on vehicle spare parts and year-end inventory value (2013-14 to 2015-16)**

| Financial year | Expenditure ($ million) | Inventory value as at 31 March ($ million) |
|---|---|---|
| 2013-14 | 29.4 | 51.8 |
| 2014-15 | 39.6 | 53.6 |
| 2015-16 | 38.3 | 61.4 |
| Average | 35.8 | 55.6 |

*Source:* *FSD records*

*Remarks:* *The expenditure and inventory value figures included those for spare parts of other specialised fire services support equipment maintained by the Workshops and Transport Division (see para. 5.15). According to the FSD, there was no readily available breakdown of such records.*

3.31 According to the System Analysis and Design Report of the AMMS, for those spare part items without movement in or out of the storehouses of the Workshops and Transport Division in the preceding three years, the AMMS (see para. 1.7) will classify them as dormant spare parts. In June 2016, Audit requested the P&L Group to generate the dormant stock report as at June 2016 from the

AMMS. Although the inventory data of the three years preceding the rollout of the AMMS in February 2015 had been fully migrated to the AMMS, the P&L Group could not successfully generate a dormant stock report because of unresolved technical problem of the AMMS. As such, Audit carried out an ageing analysis of the dormant spare parts based on the P&L Group's latest available record as of March 2015. The results are shown in Table 10.

**Table 10**

**Ageing analysis of dormant stocks of vehicle spare parts**
**(March 2015)**

| Dormant period (Note) (Year) | Number of stock items (Number) | | Amount ($ million) | |
|---|---|---|---|---|
| **More than 3 years to 10 years** | | | | |
| >3 to 5 | 690 | | 4.46 | |
| >5 to 10 | 1,547 | | 6.83 | |
| Sub-total | 2,237 | | 11.29 | |
| **More than 10 years** | | | | |
| >10 to 15 | 2,107 | | 7.40 | |
| >15 to 20 | 1,599 | 1,949 | 6.93 | 7.93 |
| >20 to 25 | 328 | | 0.95 | |
| >25 | 22 | | 0.05 | |
| Sub-total | 4,056 | | 15.33 | |
| Total | 6,293 | | 26.62 | |

*Source: Audit analysis of FSD records*

*Note: The dormant period is counted from the date of last movement to the end of March 2015.*

3.32 Upon Audit's enquiry in August 2016 about the large number of dormant stock items, the FSD said that:

(a) serviceable lives of some of the vehicles could be longer than 15 years. The Workshops and Transport Division had to hold stocks of spare parts for the corresponding periods; and

(b) many spare parts could be commonly used for vehicles of different/new models under the same brand.

3.33 However, as indicated in Table 10 in paragraph 3.31, as of March 2015, 1,949 stock items of vehicle spare parts with a total value of $7.93 million had been kept for more than 15 years (see para. 3.2) without movement in the three storehouses of the Workshops and Transport Division. Audit noted that in February 2013 and July 2014, the FSD carried out two reviews of dormant/excessive spare parts (Note 47) and identified a total of 1,305 such items with an aggregate value of $1.7 million for disposal. In mid-July 2016 (during the course of this audit review), the FSD informed Audit that another review of the dormant/excessive vehicle spare parts had just started.

3.34 In light of the 1,305 items of dormant/excessive spare parts with an aggregate value of $1.7 million identified in the 2013 and 2014 reviews for disposal, the FSD needs to improve its inventory control to prevent accumulation of dormant/excessive spare parts. In this connection, Audit noted that the AMMS had a designed inventory control function to forecast spare parts demand based on factors such as past consumption rate, procurement lead time and life span of the spare parts. However, some features of the inventory control function (e.g. issuing notifications automatically to remind users to timely replenish an inventory item — see para. 5.5(a)) had not been put into use due to technical problem. Audit considers that the FSD needs to expedite action on resolving the technical problem of the AMMS so that it can properly perform its designed inventory control function.

**Note 47:** *An item is classified as excessive by the AMMS if its stock balance is greater than the average annual consumption of the past 36 months.*

## Audit recommendations

3.35 **Audit has *recommended* that the Director of Fire Services should:**

(a) **improve the inventory control of spare parts for vehicles to prevent accumulation of dormant/excessive stocks; and**

(b) **expedite action on resolving the technical problem of the AMMS so that it can properly perform its designed inventory control function.**

## Response from the Government

3.36 The Director of Fire Services agrees with the audit recommendations. He has said that:

(a) the July 2016 review (see para. 3.33) had been completed in one of the three spare parts stores. The review revealed that most of the vehicle spare parts held for 20 years or more should be maintained as they could be used for vehicles of different/new models under the same brand and the production of such spare parts might even have ceased for some time. The Workshops and Transport Division has regularly reviewed the lists of dormant spare parts having regard to the types of fire appliances and equipment in services. As the spare parts for the old model fire appliances and equipment can be out of production, maintaining such spare parts in stock is considered essential to support unforeseen repair operations. The FSD will arrange disposal of such spare parts when the fire appliances and equipment concerned are to be disposed of or when the conditions of the spare parts are no longer suitable for use; and

(b) as of October 2016, the AMMS dormant stock report (see para. 3.31) could be generated for reviewing the dormant stock and only the data for "last issue date" in the report was missing. However, it will not affect the review operations as "last issue date" is for reference only (which could be made available from other sources). Moreover, the function of issuing notifications automatically had not been put in use due to teething problem of the AMMS.

# PART 4: FIRE-FIGHTING AND RESCUE VESSELS

4.1 This PART examines the procurement of fire-fighting and rescue vessels.

## Vessel fleet

4.2 As of July 2016, the FSD operated a fleet of 21 fire-fighting and rescue vessels and 23 small boats (Note 48) to provide fire-fighting and rescue services within Hong Kong waters (see para. 1.10). The 21 fire-fighting and rescue vessels included:

(a) 11 vessels (eight fireboats, one diving support vessel and two diving support speedboats) operated by the Marine and Offshore Islands Division of the Hong Kong Command to provide fire-fighting and rescue services in different areas of Hong Kong waters. These vessels were strategically berthed at six fireboat stations, a diving base and the Airport; and

(b) 10 vessels (two command boats and eight speedboats berthed at the Airport) operated by the Airport Fire Contingent of the New Territories Command to provide fire-fighting and rescue services at the Airport (see Note 13 to para. 1.10).

4.3 According to the FSD:

(a) from time to time, the FSD assesses potential fire risks of different areas of waters and flexibly deploys its resources to strategic positions. In the event of incidents, the vessels will be strategically deployed to the incident scenes to provide fire-fighting and rescue services. The years of commissioning and designed maximum speeds of the 21 vessels, and their berthing places as of July 2016 are shown at Appendix F; and

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**Note 48:** *These 23 small boats are mainly dinghies, hovercrafts and inflatable boats.*

(b) vessels in marine areas are more widely spread and of higher mobility. Unlike the land areas, there is no risk category for the marine areas for regular specific risk assessments. In view of such practical difficulties, the FSD has not set any response times or performance pledges for services provided by its vessels in individual areas of waters. From 2011 to 2015, the FSD handled a total of 212 marine fire incidents (averaging 42 a year, of which 21 were related to vessel fires) and 1,089 marine rescue incidents (averaging 218 a year — Note 49).

4.4 The 21 fire-fighting and rescue vessels operated by the FSD can be categorised into three types with designed serviceable lives of 15 and 20 years. An ageing analysis of the 21 vessels shows that as of July 2016, their service years since commissioning ranged from 7.2 to 26 years (see Table 11). Of these 21 vessels, 14 (67%) (10 speedboats, 2 command boats and 2 fireboats) had exceeded their designed serviceable lives by 0.7 to 11 years (see Appendix G). According to the FSD, the vessels undergo dry-docking inspection, regular overhaul and scheduled maintenance services. With a view to ascertaining their seaworthiness and suitability for operational use, the MD will from time to time conduct condition surveys for the vessels after they reach their serviceable lives.

**Note 49:** *Marine rescue incidents included those relating to drowning, chemical spillage and ship incidents.*

**Table 11**

**Ageing analysis of 21 vessels**
**(31 July 2016)**

| Type of vessels | Designed serviceable life (Year) | Number of vessels | Service years since commissioning (Year) |
|---|---|---|---|
| Fibre-hulled speedboat | 15 | 10 | 17.1 to 19 (average: 18.3) |
| Aluminium-hulled fireboat, command boat and diving support vessel | 15 | 5 | 7.2 to 26 (average: 16.8) |
| Steel-hulled fireboat | 20 | 6 | 7.2 to 20.7 (average: 15) |

*Source: Audit analysis of FSD records*

## Replacement of vessels

4.5 According to the FSD, there are a number of factors to determine whether a vessel is due for replacement, including its designed serviceable life (see Table 11 in para. 4.4), breakdown frequency and maintenance history (i.e. downtime and maintenance costs). The FSD will also assess the operational requirements of marine services and replace the equipment in a vessel replacement exercise (e.g. expiry of serviceable life of fire pumps installed in the vessels). From 2006 to October 2016, the FSD initiated actions and sought the MD's assistance (Note 50) in replacing a fireboat (i.e. Fireboat No. 7 — FB 7) and two diving support speedboats (i.e. diving support speedboats Nos. 1 and 2). Photograph 5 shows the existing FB 7 and a diving support speedboat which are due for replacement.

**Note 50:** *The MD is the designated endorsement authority and agent for procurement of government vessels. It is responsible for approval of procurement proposals, concept design and preparation of technical specifications, tendering, and management of shipbuilding contracts for construction of vessels.*

**Photograph 5**

**FB 7 and a diving support speedboat**

| (a) FB 7 | (b) Diving support speedboat |
|---|---|
|  |  |

*Source: FSD records*

## *Delay in planning the replacement of FB 7*

4.6 FB 7 is an aluminium-hulled catamaran rescue boat which has been put into service since 1990. According to the FSD, it had been used to provide rescue services to the ex-Hong Kong International Airport at Kai Tak until its closure. With the MD's approval, it was modified and used by the FSD as maintenance reserve for fireboats in 1999. Before FB 7 reached the end of its designed serviceable life of 15 years in 2005, the MD conducted a condition survey and considered that FB 7 could remain in service for several more years. With the passage of time, the performance of FB 7 deteriorated (see para. 4.8(a) and (b)). In late 2009, the FSD initiated actions on procuring a new vessel to replace FB 7. After obtaining the MD's approval of the operational requirements of the new vessel in May 2010, the FSD revised the requirements and informed the MD in April 2011 that enhanced functions should be included in the new vessel in order to cope with the changing requirements for modern operational needs. After obtaining the MD's approval of the revised proposal in July 2011, the SB sought funding approval from the FC in May 2012. According to the 2012 funding paper, FB 7 was the FSD's only rescue boat designated for the purpose of mass rescue in marine areas other

than the Airport (Note 51). A chronology of key events from May 2009 to May 2012 is shown at Appendix H (see paras. 4.8 to 4.13 for developments after May 2012).

4.7 ***Need to improve the planning of operational requirements for vessel replacement projects.*** As indicated at Appendix H, after obtaining the MD's approval of replacing FB 7 in May 2010, the FSD revised the requirements of the new vessel in April 2011 to include the enhanced functions for modern operational needs. In the event, the MD's approval of the revised requirements was obtained in July 2011, i.e. an additional 14 months had been taken to finalise the operational requirements of FB 7 before seeking funding from the FC. Audit noted that some of the operational requirements of the new vessel prepared by the FSD in February 2010 were largely based on those of the existing FB 7 which was designed some 20 years ago, e.g. the proposed use of propeller and simple decontamination facilities. The proposed maximum speed requirement of 28.5 knots was only slightly above the 27.5 knots of the existing FB 7. It appeared that the FSD had not fully taken into consideration the operational requirements of the new vessel in light of the latest technology and operational environment until April 2011 when the FSD proposed various enhancements (see Appendix H), thus contributing to the 14-month delay in the planning process. To prevent recurrence of similar problems in vessel replacement projects, the FSD needs to improve its planning of operational requirements in future.

## *Delay in implementing the replacement projects for FB 7 and two speedboats*

4.8 ***Funding approval for FB 7.*** In June 2012, the SB obtained funding approval from the FC for replacing FB 7 at an estimated cost of $85 million. In the funding paper, the FC was informed that:

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**Note 51:** *With a large rescue capacity of 320 persons, FB 7 was mainly responsible for providing port safety and rescue services in Hong Kong waters in case of marine fire and sinking of a large vessel. It also served as a rescue boat and provided necessary on-site decontamination facilities in case of an incident involving a nuclear-powered vessel.*

(a) FB 7 had been in service for over 20 years. The performance of the fireboat had deteriorated with the annual maintenance downtime due to mechanical fault increasing by about 62% from 24 days in 2008 to 39 days in 2011;

(b) some components for the major parts such as engine and electricity generator of FB 7 had become obsolete and were no longer available in the market, making the maintenance of FB 7 increasingly difficult. The annual maintenance cost had increased from about $590,000 in 2008 to about $1,400,000 in 2011. The maintenance cost would continue to increase as the vessel aged further;

(c) the FSD planned to procure a new vessel with enhanced fire-fighting and rescue functions and installations to meet the operational requirements more effectively (see Appendix I for the specifications and major equipment of FB 7 and the new fireboat); and

(d) according to the FSD's plan, the target date of tender invitation would be February 2013 and the target commissioning date of FB 7 would be December 2014.

4.9 ***Funding approval for two speedboats.*** As mentioned in paragraph 4.5, the FSD also initiated actions on replacing two diving support speedboats after the MD's condition assessment in May 2011 revealed their deteriorated performance (e.g. their maximum speed had been reduced by 25% from 40 to 30 knots). The two speedboats with a designed life expectancy of 15 years had been put into service since June 1999. In March 2012, the FSD submitted to the MD a proposal for replacing the two diving support speedboats together with the operational requirements of the proposed new vessels. After obtaining the MD's approval in December 2012, the FSD in May 2013 obtained funding of $16 million for replacing the two speedboats under the capital account of the General Revenue Account. The tender invitation date and the vessel commissioning date were scheduled for September 2013 and April 2015 respectively.

4.10 ***Delay in design and tender preparation by the MD.*** The MD is responsible for procurement of new vessels for the use of government departments. The work includes concept design, preparing technical specifications and drafting tender document with specifications (Note 52). Shortly after obtaining funding approvals for replacing FB 7 in June 2012 and the two speedboats in May 2013, the FSD noted that the procurement progress had been slow, mainly because of the need to review the vessel procurement procedures and the shortage of experienced staff in the MD to proceed with the pre-tendering work. Despite the FSD's repeated requests to expedite the procurement process, the MD had difficulties in doing so, because there were a number of government vessel procurement projects in the pipeline.

4.11 ***Interim measures.*** In light of the delays in the procurement of the new vessels, the FSD/MD took the following interim measures:

(a) replacing one engine of FB 7 by a second-hand one at $0.8 million in September 2013; and

(b) replacing the hull and engine of one speedboat at $1.6 million in February 2015 to ensure that the aged vessel would continue to function properly. The FSD also planned to complete similar upgrading works at an estimated cost of $2.2 million for the other speedboat in late 2016.

Since 2013, the MD had also taken actions on outsourcing some of its pre-tender work (Note 53) and project management work to external consultants. A chronology of key events from June 2013 to October 2016 is at Appendix J.

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**Note 52:** *Subsequent work includes invitation and evaluation of tenders, awarding contracts, approving design and monitoring the construction process, accepting vessels upon delivery, and providing support and professional advice to users during the warranty period.*

**Note 53:** *The outsourcing work included conducting market research on estimated costs of vessels, carrying out feasibility study on the design of vessels, carrying out research of suitability of functions to be incorporated in vessels, and preparing conceptual design and technical specifications for construction of vessels for incorporation in the tender document.*

### *Need to closely monitor the progress of the replacement projects for FB 7 and two speedboats*

4.12 According to the funding submissions, the new FB 7 was targeted for commissioning in December 2014 while the two new speedboats were targeted for commissioning in April 2015 (see paras. 4.8(d) and 4.9). However, tenders for the two new speedboats and the new FB 7 were invited in September and October 2016 respectively (see Appendix J), some 3 years later than the targeted dates of February and September 2013 (see paras. 4.8(d) and 4.9). The MD estimated that the two speedboats and the new FB 7 would be delivered by July 2018 (i.e. more than three years later than the target commissioning date of April 2015) and August 2019 (i.e. more than four years later than the target commissioning date of December 2014) respectively.

4.13 As a result of the delays, the total financial commitment of the FB 7 replacement project had increased by $13.3 million (16%) from $85 million to $98.3 million while the maintenance cost of the existing FB 7 had increased by 69% from $1.3 million in 2014-15 (the planned year of replacement) to $2.2 million in 2015-16. From the operational point of view, the situation was also unsatisfactory as the expected benefits of a new FB 7 with enhanced fire-fighting and rescue functions (see Appendix I) could not be realised earlier. As for the speedboat replacement project, the total financial commitment had increased by 100% from $16 million to $32 million to make allowance for the rising cost. Moreover, the objective of speedier arrival at incident scenes by the new speedboats with maximum speed of 40 knots also could not be realised as scheduled. In Audit's view, the MD as the government vessel procurement agent needs to take measures to ensure that the FSD's vessel replacement/procurement projects are implemented in a timely manner. The FSD also needs to closely monitor the progress of the two replacement projects to guard against further slippage.

### *Need to take measures to ensure the timely implementation of the 10-year vessel replacement/procurement plan*

4.14 Apart from FB 7 and the two speedboats with ongoing replacement projects, another 11 vessels had exceeded their designed serviceable lives (of 15 to 20 years) by 0.7 to 4 years as of July 2016. In 2015, the FSD had drawn up a 10-year procurement plan for replacing the 11 old vessels. In December 2015, the SB informed the Panel on Security that the FSD had planned to procure one new fireboat and one new fast rescue vessel for commissioning in 2018 at estimated costs of $125 million and $40 million respectively (Note 54) to enhance its fire-fighting and rescue capability in the eastern waters of Hong Kong (Note 55). Given that a total of 13 fire-fighting and rescue vessels are to be replaced/procured in the coming years, the FSD needs to ascertain from the MD whether it is able to cope with the FSD's 10-year vessel replacement/procurement plan in a timely manner and where necessary, develop a contingency plan, including seeking the MD's assistance to outsource the procurement work to external consultants.

## Audit recommendations

4.15 **Audit has *recommended* that the Director of Fire Services should:**

(a) **improve the planning of the operational requirements for the FSD's vessel replacement/procurement projects;**

(b) **closely monitor the progress of the replacement projects for FB 7 and the two speedboats to guard against further slippage; and**

(c) **ascertain from the MD whether it is able to cope with the FSD's 10-year vessel replacement/procurement plan in a timely manner and where necessary, develop a contingency plan.**

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**Note 54:** *Up to August 2016, the procurement proposals of the two new vessels had not yet been submitted to the MD for its approval.*

**Note 55:** *The eastern waters of Hong Kong include the waters in Sai Kung, east Lei Yue Mun, Tolo Harbour/Tai Po, and northeast and southeast Hong Kong.*

4.16 **Audit has also *recommended* that the Director of Marine should take measures to ensure that the FSD's vessel replacement/procurement projects are implemented in a timely manner.**

## Response from the Government

4.17 The Director of Fire Services agrees with the audit recommendations in paragraph 4.15. He has said that:

(a) the FSD will keep up-to-date knowledge on fire-fighting and rescue vessels and, where appropriate, introduce such knowledge during the planning stage of the operational requirements for the upcoming vessel replacement/procurement projects; and

(b) the FSD has been in close liaison with the MD on the progress of the replacement of FB 7 and the other two speedboats.

4.18 The Director of Marine agrees with the audit recommendation in paragraph 4.16.

# PART 5: OTHER FIRE SERVICES SUPPORT EQUIPMENT

5.1 This PART examines the management of other fire services support equipment and their maintenance, focusing on:

(a) Asset Management and Maintenance System (paras. 5.2 to 5.8);

(b) fire-fighting protective suits (paras. 5.9 to 5.14); and

(c) specialised fire services support equipment (paras. 5.15 to 5.20).

## Asset Management and Maintenance System

5.2 The FSD has some 19,000 types of operating assets, including major FSE and other support equipment such as light portable pumps, positive pressure blowers, portable electricity generators and personal protective equipment (e.g. protective suits, helmets and gloves). To improve the efficiency and effectiveness of the FSD's asset management, in April 2012, the SB obtained funding approval of $49.8 million from the FC for the FSD to develop an integrated computer system known as the AMMS to help manage, procure and maintain the FSE (see para. 1.7). With the assistance of the GLD, the FSD prepared the tender document for the procurement contract. In March 2013, the GLD awarded the AMMS contract (Contract D) to Contractor D at a sum of $86.8 million for:

(a) the procurement and installation of the AMMS cum one-year warranty at $38.7 million; and

(b) nine-year post-warranty system support and maintenance services at $48.1 million.

5.3 In February 2015, the AMMS was rolled out notwithstanding that two key milestones, viz. IT security risk assessments and completion of SATs, were not fully completed as specified in Contract D (see Table 12).

**Table 12**

**Completion of key milestones under Contract D**
**(July 2016)**

| Key milestone | Completion date | |
|---|---|---|
| | Scheduled | Actual |
| Project initiation | Apr 2013 | Mar 2013 |
| System analysis and design | Sep 2013 | Sep 2013 |
| System development | Jul 2014 | Aug 2014 |
| Data conversion | Nov 2014 | Sep 2014 |
| IT security risk assessments | Nov 2014 | Mar 2016 (Note 2) |
| Completion of SATs (Note 1) | Nov 2014 | Apr 2016 (Note 2) |
| System rollout | Feb 2015 | Feb 2015 |
| System nursing | Aug 2015 | Aug 2015 |

*Source: FSD records*

*Note 1: The six SATs were Function Tests, System Integration Tests, Load Tests, Resilience Tests, Reliability Tests and Disaster Recovery Drill Tests. Upon the system rollout in February 2015, only the Disaster Recovery Drill Tests were not yet completed.*

*Note 2: The delay was due to the closing down of the disaster recovery site at the then Fire Services Training School (see para. 5.4(b) and (c)).*

5.4 According to the FSD, the AMMS was rolled out in February 2015 notwithstanding that two key milestones were not fully completed because:

(a) the data conversion process (e.g. conversion of inventory balance data from source documents such as paper and old computer records) was completed well before the system rollout. Postponement of system rollout would call for enormous efforts in checking the correctness and handling data discrepancies (i.e. necessitating an additional round of data conversion);

(b) one aspect of the IT security risk assessments was the physical security of system servers, which could only be assessed upon commissioning of the new Fire and Ambulance Services Academy at Tseung Kwan O in 2016 to replace the Fire Services Training School at Pat Heung. As the other issues pertaining to the IT security risk assessments had been remedied, there was no concern to allow the rollout of the system; and

(c) likewise, the Disaster Recovery Drill Tests (see Note 1 to Table 12 in para. 5.3) were outstanding in February 2015 owing to the relocation of the Fire Services Training School at Pat Heung to the Fire and Ambulance Services Academy at Tseung Kwan O. As the Disaster Recovery facilities had already been in place and fully functional (though the tests in accordance with contract requirement were not yet completed) before the system rollout in February 2015, it was considered that the normal operation of the AMMS would not be affected by allowing the outstanding test to be carried out later.

## *Some functions of the AMMS not yet put into use*

5.5 In the funding paper of April 2012, the FC was informed that the AMMS would provide an integrated database to centrally record all asset-related data of the FSD with major functions on inventory control, repair and maintenance management, and business intelligence analysis for enhancing the FSD's procurement and asset management work. Audit's examination of the system design documents and management reports generated by the AMMS revealed that up to July 2016, some of the functions of the AMMS mentioned in FC paper could only be provided in the testing environment pending further fine-tuning before they could be put into actual use, as follows:

(a) ***Inventory control.*** According to the FC paper, the AMMS would forecast materials demand based on various factors (such as past consumption rate, procurement lead time and life span of products) and issue reminders to users to make timely replenishment. It would also support the use of barcode identification technology to facilitate the monitoring of materials distribution and consumption. However, as of July 2016, the function of issuing notifications automatically to remind

users to timely replenish an inventory item if it fell below the pre-defined safety stock level or before its expiry date was still under testing. Besides, the pilot use of barcode and radio frequency identification technology was still on trial in one equipment storehouse of the FSD;

(b) ***Repair and maintenance management.*** According to the FC paper, the AMMS would formulate scheduled maintenance programme for the FSD's vehicles (mainly fire appliances), taking into account the number of maintenance staff and their workload, and pre-defined maintenance criteria such as the mileage and age of a vehicle, the availability of spare parts and supply of maintenance reserve. However, up to July 2016, the function of formulating preventive maintenance programme for the FSD's fire appliances still required fine-tuning before it could be put into actual use; and

(c) ***Business intelligence analysis.*** According to the FC paper, the AMMS would provide analytical and reporting tools for more effective management and maintenance of assets. Audit's examination revealed that some of the AMMS reports generated for business intelligence analysis required further fine-tuning before they could be put into use, such as the dormant stock report of vehicle spare parts (see para. 3.31).

5.6 In Audit's view, the FSD needs to expedite the fine-tuning of the outstanding functions with a view to putting them into use as soon as possible. Moreover, in light of various problems encountered in implementing the AMMS (see paras. 5.3 to 5.5), Audit considers that the FSD also needs to conduct a post-implementation review to evaluate its effectiveness and consolidate lessons to be learnt for similar IT systems in future.

## Audit recommendations

5.7 **Audit has *recommended* that the Director of Fire Services should:**

(a) **expedite the fine-tuning of the outstanding functions in the AMMS mentioned in paragraph 5.5 and put them into use as soon as possible; and**

(b) **conduct a post-implementation review of the AMMS to evaluate its effectiveness and consolidate lessons to be learnt for similar IT systems in future.**

## Response from the Government

5.8 The Director of Fire Services agrees with the audit recommendations. He has said that:

(a) apart from the dormant stock report mentioned in paragraph 3.36(b), and the use of radio frequency identification technology (see para. 5.5(a)) which has not been implemented in some storehouses, other outstanding functions in the AMMS mentioned in paragraph 5.5 have been put into use since September 2016; and

(b) the FSD will conduct a post-implementation review of the AMMS to evaluate its effectiveness, and the lessons learnt will facilitate the implementation of similar IT systems in future.

## Fire-fighting protective suits

5.9 In May 2010, the GLD awarded Contract E to Contractor E for supplying the FSD 13,000 sets of fire-fighting protective suits at a cost of $81 million with an option of requiring the Contractor to provide a comprehensive managed care and maintenance service (CMCMS — Note 56) of the suits for five years after the 12-month warranty. In view of the long shelf life of the suits (not less than ten years if properly maintained), after awarding Contract E in May 2010 (Note 57),

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**Note 56:** *The CMCMS of fire-fighting protective suits included: (a) inspection service (at least twice a year); (b) laundry and repair/replacement of components; (c) picking-up and delivery services to and from stations according to a monthly schedule; and (d) guaranteed turnaround time for laundry and/or repair services. The CMCMS was only an optional item in the tender document (of Contract E) in order to attract more competitors to submit tenders.*

**Note 57:** *As the 12-month warranty did not cover all the services under the CMCMS, the FSD spent $6 million under the first contract variation to top up the maintenance services to the CMCMS level during the warranty period.*

the FSD obtained approvals from the FSTB/GLD Tender Board to make three contract variations (Note 58) from October 2010 to March 2013 amounting to $50.1 million for Contractor E to provide the CMCMS from April 2011 to March 2017.

### *Need to bring in competitive tendering in procurement and acquiring maintenance service*

5.10 The justifications provided by the FSD in the three contract variations for engaging Contractor E to provide the CMCMS of the fire-fighting protective suits were that:

(a) the CMCMS of the protective suits was essential for meeting the operational and safety requirements of the FSD; and

(b) pursuant to an international standard in the industry, the service should be performed by an independent service provider authorised by the manufacturer. Contractor E was the only authorised service provider.

5.11 In August 2016, after considering the FSTB's and the SB's advice on the tendering mode, the FSD adopted open tendering for the provision of the CMCMS for the fire-fighting protective suits from April 2017 to March 2022. As at October 2016, the tender evaluation was in progress.

5.12 While the FSD had brought in competitive tendering for the CMCMS for its fire-fighting protective suits, Audit considers that the FSD should also explore new service providers and bring in competitive tendering as far as possible for the procurement and maintenance of its other fire services support equipment in future.

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**Note 58:** *As the provision of the CMCMS was an optional item (to attract more competitors to submit tenders (see Note 56 to para. 5.9)), which had not been evaluated in the tender evaluation process, three contract variations were made in 2010, 2012 and 2013 respectively to procure the service.*

## Audit recommendation

5.13 **Audit has *recommended* that the Director of Fire Services should explore new service providers and bring in competitive tendering as far as possible for the supply and maintenance of other fire services support equipment in future.**

## Response from the Government

5.14 The Director of Fire Services agrees with the audit recommendation. He has said that the FSD will continue to explore new service providers and bring in competitive tendering for the supply and maintenance of other fire services support equipment.

## Specialised fire services support equipment

5.15 The Workshops and Transport Division is responsible for maintaining 56 types (913 items) of electrical/mechanical specialised fire services support equipment such as light portable pumps, positive pressure blowers and portable electricity generators (see examples in Photograph 6). The Division draws up annual maintenance schedule of the equipment for different fire stations. Based on the annual maintenance schedule, the station officers-in-charge will deliver the equipment to the designated workshops for carrying out preventive maintenance on the scheduled dates.

**Photograph 6**

**Light portable pump and positive pressure blower**

| (a) Light portable pump | (b) Positive pressure blower |
|---|---|
|  |  |

*Source: FSD records*

## *Need to carry out preventive maintenance of specialised equipment in a timely manner*

5.16 The purpose of providing preventive maintenance for specialised equipment is to repair/replace defective components in a timely manner so that the equipment is always available for use in emergency operations. Depending on factors such as nature, usage and vulnerability of a piece of equipment and suppliers' recommendations, the maintenance cycle of equipment varies from once a year (e.g. for folding ladder of a fire appliance) to three rounds a year (e.g. for light portable pumps). According to the Workshops and Transport Division, the annual maintenance schedule is posted on the FSD's intranet and the AMMS will generate and issue notifications to the concerned holders of the equipment one week before the scheduled date to facilitate them to make appropriate arrangements for releasing the equipment for preventive maintenance.

5.17 To ascertain whether the specialised equipment had been delivered for preventive maintenance on schedule, Audit compared, for the period June 2015 to May 2016, the scheduled maintenance dates of the 913 items (1,647 rounds of maintenance in total) against the receipt dates of the equipment by the workshops. Audit found that, of the 1,647 rounds of preventive maintenance completed, 1,388 rounds (84.3%) were carried out according to the annual maintenance schedule. For the remaining 259 rounds, Audit found that:

(a) 226 rounds (13.7% of 1,647) of maintenance for 161 items of equipment were carried out within 29 days after the scheduled dates;

(b) 28 rounds (1.7% of 1,647) of maintenance for 26 items were carried out 30 to less than 60 days after the scheduled dates; and

(c) 5 rounds (0.3% of 1,647) of maintenance for 5 items were carried out 60 to 360 days after the scheduled dates (Note 59).

5.18 Audit noted that there were cases where the equipment had been deployed to emergency operations on the scheduled date of maintenance. As for those cases with preventive maintenance conducted more than 30 days after the scheduled dates, the officers-in-charge informed Audit that the reasons included "oversight" and "mistaken that the equipment had already been sent to the workshops". In this connection, Audit noted that the Workshops and Transport Division did not issue reminders to the concerned officers-in-charge despite that the original scheduled maintenance had been missed. Audit considers that the FSD needs to step up monitoring of the preventive maintenance for specialised equipment to ensure that it is carried out in a timely manner to prevent equipment failures before they occur or develop into major defects. The Workshops and Transport Division needs to make use of the AMMS to send reminders to the officers-in-charge requiring them to arrange preventive maintenance of specialised equipment once the scheduled maintenance is missed.

## Audit recommendations

5.19 **Audit has *recommended* that the Director of Fire Services should:**

(a) **step up monitoring of the preventive maintenance for specialised equipment to ensure that it is carried out in a timely manner; and**

(b) **make use of the AMMS to send reminders to the officers-in-charge requiring them to arrange preventive maintenance of specialised equipment once the scheduled maintenance is missed.**

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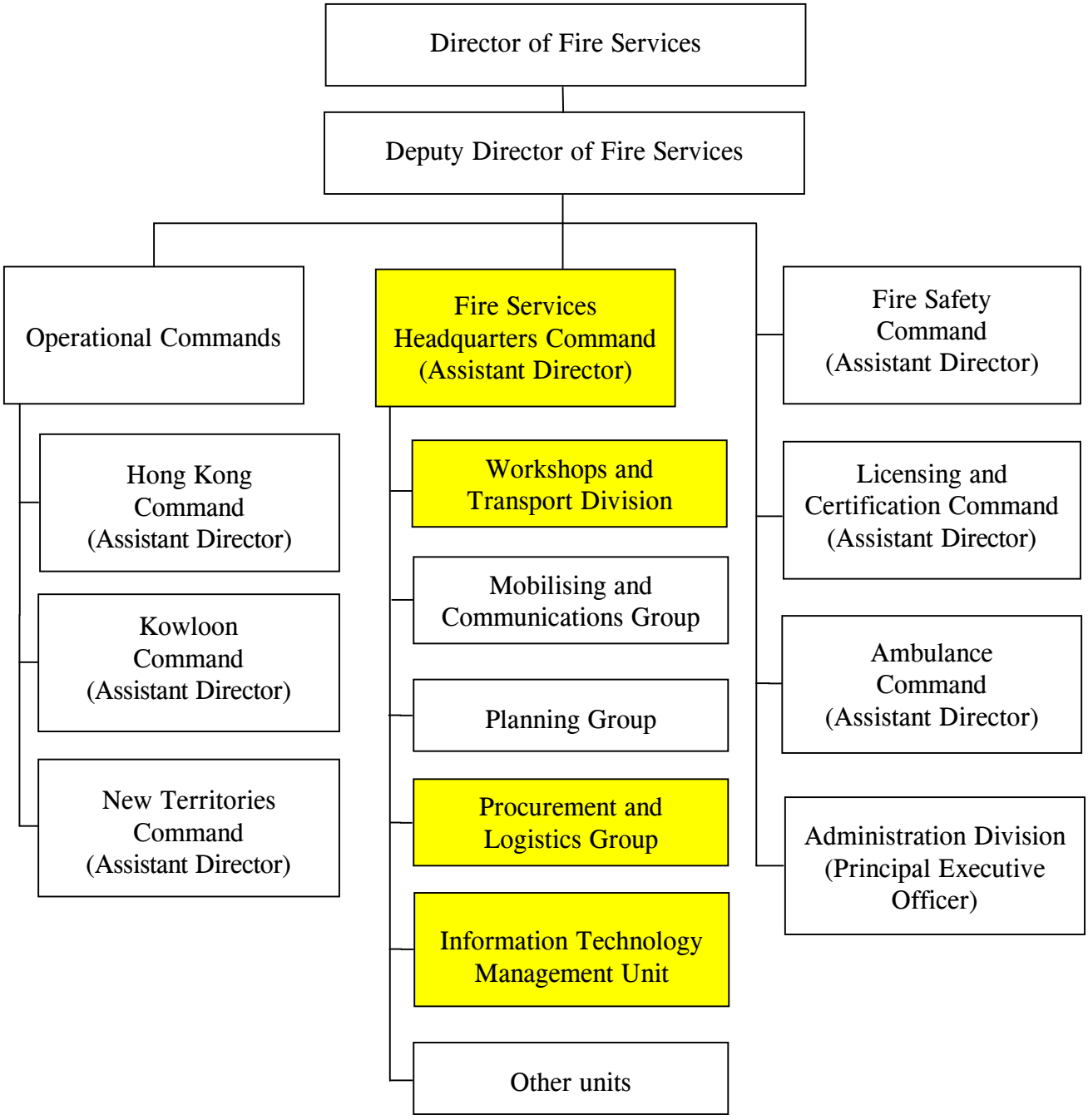
**Note 59:** *The equipment included folding ladders, slim jet foam and water monitors.*

## Response from the Government

5.20 The Director of Fire Services agrees with the audit recommendations. He has said that in October 2016, the FSD fine-tuned the system logic to provide a preventive maintenance schedule for specialised equipment to ensure its timely maintenance, including using the AMMS to send reminders to inventory holders for making necessary arrangement.

**Appendix A**
(para. 1.2 refers)

## Fire Services Department: Organisation chart (extract) (30 June 2016)




Legend: Divisions/Offices covered in this Audit Report

*Source: FSD records*

**Appendix B**
(paras. 1.9, 3.5, 3.20, 3.22, 3.24 and 3.30 refer)

## Fire-fighting and support vehicles maintained by the FSD and the EMSTF (1 May 2016)

| Type of vehicle | Maintained by EMSTF (a) (Number) | Maintained by FSD (b) (Number) | Total (c) = (a) + (b) (Number) |
|---|---|---|---|
| Frontline fire appliances (Note 1) | | 274 | 274 |
| Other fire appliances | 19 | 141 | 160 |
| Light pumping appliances | | 19 | |
| Hose layers | | 11 | |
| Reserve heavy pumps | | 9 | |
| Lighting tenders | | 8 | |
| Mini equipment carriers | | 6 | |
| Rescue tenders | | 6 | |
| Fire motorcycles | | 6 | |
| Specialised fire appliances at the Airport (Note 2) | 17 | | |
| Others (Note 3) | 2 | 76 | |
| Support vehicles (Note 4) | 175 | 11 | 186 |
| Total | 194 | 426 | 620 |

*Source: FSD records*

*Note 1: This category includes mainly hydraulic platforms, rescue units, major pumps and turntable ladders. They are the first batch of fire-fighting vehicles deployed to respond to a fire call.*

*Note 2: This category includes mainly crash fire tenders, hose foam carriers, rapid intervention vehicles and jackless snorkel.*

*Note 3: These include mainly foam tenders, diving tender and mobile command units.*

*Note 4: These include mainly the general purpose lorries, staff cars and multi-purpose vans.*

**Appendix C**
(paras. 2.3(c), 2.12(a), 2.17 and 2.18 refer)

## Major sub-systems of the TGMS

According to the funding paper of May 2000, the TGMS included the following major sub-systems:

(a) ***Computerised Mobilising System.*** It would be a high-power system built on an open platform with multi-tasking functionality to cope with the projected workload during the lifespan of the TGMS;

(b) ***Telephone System.*** The system with Computer Telephony Integration technology would facilitate automatic call distribution. Through the Calling Line Identification System, address information of the caller using lined telephone network could be readily retrieved to help speedy identification of incident address;

(c) ***Automatic Vehicle Location System.*** It would provide accurate location data of all FSD mobile resources, such as vehicles and fireboats, automatically;

(d) ***Geographic Information System.*** The system would indicate on a digitised map the nearest available fire and ambulance resources to the reported address of incident for efficient mobilisation. If needed, it would also indicate the shortest route to the incident. Furthermore, it would provide other useful information, such as location of hydrants, gas pipe layouts, building information and vehicular access to facilitate fire-fighting and rescue operations;

(e) ***Wireless Digital Network.*** This network would provide effective data and image transmission for equipment and terminals installed in emergency vehicles;

(f) ***Mobile Data Terminals.*** The terminals would be installed in fire appliances, ambulances and support vehicles to receive and despatch incident information through the wireless digital network; and

(g) ***Information Management System.*** It would integrate with all systems for records logging, analysis and resource management.

*Source: FSD records*

**Appendix D**
(para. 2.11(a) refers)

## Chronology of key events for procurement of TGMS equipment for 25 new ambulances (October 2013 to November 2014)

| Date | Event |
|---|---|
| October 2013 | The FSD consulted the GLD on the way to handle the procurement of the TGMS equipment for the 25 new ambulances. |
| November 2013 | The GLD advised the FSD to explore the possibility of acquiring the equipment through open tendering and that contract variation/single tender could be considered only with full and convincing justifications. |
| November 2013 to February 2014 | The FSD proceeded with the internal clearance and went through several rounds of price confirmation and negotiation with Contractor A. |
| March 2014 | The FSD submitted a contract variation request to the GLD. |
| March to June 2014 | The GLD processed the contract variation request, including seeking the advice from the DoJ and considered whether the issue of a single tender with appropriate contract conditions being included might be more appropriate. |
| June 2014 | The GLD advised the FSD to procure the installation service through single tendering instead of contract variation. |
| June 2014 | The FSD submitted the single tender request to the GLD in June 2014. |
| November 2014 | The GLD Tender Board approved the award of contract. |

*Source: FSD records*

**Appendix E**
(para. 3.4 refers)

## Ageing analysis of 246 fire appliances and support vehicles (1 May 2016)

| Service year beyond expected serviceable life (Year) | Number of vehicles | | | |
|---|---|---|---|---|
| | **Frontline fire appliances** | **Other fire appliances** | **Support vehicles** | **Total** |
| **Serviceable vehicles** | | | | |
| < 1 | 18 | 5 | 11 | 34 |
| 1 to < 5 | 39 | 47 | 42 | 128 |
| 5 to < 10 | 5 | 22 | 1 | 28 |
| 10 to 11 | 0 | 1 | 0 | 1 |
| Sub-total | 62 | 75 | 54 | 191 |
| **Supernumerary vehicles** | | | | |
| < 1 | 0 | 0 | 0 | 0 |
| 1 to < 5 | 14 | 2 | 2 | 18 |
| 5 to < 10 | 16 | 8 | 7 | 31 |
| 10 to 13 | 3 | 3 | 0 | 6 |
| Sub-total | 33 | 13 | 9 | 55 |
| Total | 95 | 88 | 63 | 246 |

*Source:* *Audit analysis of FSD records*

*Remarks:* 1. *Total numbers of fire appliances and support vehicles which had exceeded their expected serviceable lives by 1 year to 11 years were 114 and 43 respectively.*

2. *Total number of supernumerary vehicles which had exceeded their expected serviceable lives by 5 to 13 years was 37.*

**Appendix F**
(para. 4.3(a) refers)

## Years of commissioning, designed maximum speeds and berthing places of fire-fighting and rescue vessels (31 July 2016)

| Vessel | Year of commissioning | Designed maximum speed (Knot) | Berthing place |
|---|---|---|---|
| **Marine and Offshore Islands Division of the Hong Kong Command** | | | |
| Fireboat No. 1 | 2002 | 15 | Central Fireboat Station |
| Fireboat No. 2 | 1995 | 15 | North Point Fireboat Station |
| Fireboat No. 3 | 1998 | 20 | Cheung Chau Fireboat Station |
| Fireboat No. 4 | 2009 | 22 | Aberdeen Fireboat Station |
| Fireboat No. 5 | 1997 | 15 | Tuen Mun Fireboat Station |
| Fireboat No. 6 | 2005 | 15 | Tsing Yi Fireboat Station |
| Fireboat No. 7 | 1990 | 27.5 | Airport |
| Fireboat No. 8 | 2009 | 28 | North Point Fireboat Station |
| Diving support vessel | 2003 | 22 | Ngong Shuen Chau Diving Base |
| Diving support speedboats Nos. 1 and 2 | 1999 | 35 | Ngong Shuen Chau Diving Base and the Airport |
| **Airport Fire Contingent of the New Territories Command** | | | |
| Command Boats Nos. 1 and 2 | 1997 | 28 | Airport |
| Eight speedboats | 1997 & 1998 | 35 | Airport |

*Source: FSD records*

**Appendix G**
(para. 4.4 refers)

## 14 vessels exceeding designed serviceable lives (31 July 2016)

| Type of vessels | Number of vessels | Number of years exceeding designed serviceable lives |
|---|---|---|
| Fibre-hulled speedboat | 10 | 2.1 to 4 |
| Aluminium-hulled command boat | 2 | 3.5 and 3.6 |
| Aluminium-hulled fireboat | 1 | 11 |
| Steel-hulled fireboat | 1 | 0.7 |

*Source: Audit analysis of FSD records*

**Appendix H**
(paras. 4.6 and 4.7 refer)

## Chronology of key events for planning the replacement of FB 7 (May 2009 to May 2012)

| Date | Event |
|---|---|
| May 2009 | The FSD requested the MD to conduct a condition assessment of FB 7. |
| October 2009 | The MD found in a sea trial that the maximum speed of FB 7 had been reduced by 16% from 27.5 to 23 knots. |
| December 2009 | The MD advised the FSD to consider replacing FB 7 as soon as possible given that the maintenance cost of FB 7 had been consistently high and both the downtime and maintenance cost were expected to further increase. |
| February 2010 | The FSD submitted to the MD a proposal for replacing FB 7 together with the operational requirements of the proposed new vessel. |
| May 2010 | The MD approved the FSD's proposal for procuring a new vessel at an estimated cost of $27 million. |
| April 2011 | Subsequent to the 2011 Fukushima earthquake, the FSD informed the MD that the operational requirements of the new vessel should be revised to include enhanced functions: (a) increasing the maximum speed from the originally proposed 28.5 to 35 knots to enable speedier arrival at incident scenes; (b) using the water jet propulsion system instead of the originally proposed propeller; and (c) installing equipment to cater for chemical, biological, radiological and nuclear incidents instead of the simple decontamination facilities. |
| July 2011 | The MD approved the revised proposal of procuring a new vessel with enhanced functions at an estimated cost of $85 million. |
| May 2012 | The SB submitted a paper to the FC seeking its funding approval of $85 million for procuring the new vessel. |

*Source: FSD records*

**Appendix I**
(paras. 4.8(c) and 4.13 refer)

## Specifications and major equipment of FB 7 and the new fireboat

| Item | Description | FB 7 | New fireboat |
|---|---|---|---|
| **Specifications** | | | |
| 1. | Length | 23 metres | Not more than 30 metres |
| 2. | Breadth | 10 metres | About 10 metres |
| 3. | Engine | Two sets of 410-kilowatt diesel engines | Two sets of 2,200-kilowatt diesel engines |
| 4. | Speed | 27.5 knots | 35 knots |
| 5. | Electricity generator | One set | Two sets |
| 6. | Type of propulsion system | Propeller | Waterjet |
| **Major equipment** | | | |
| 7. | Rescue capacity (by means of life rafts) | 320 persons | 420 persons |
| 8. | Installation and provision of equipment for handling chemical, biochemical and radiological related incidents | Only simple decontamination facilities | Air filtration system and radiation monitoring equipment<br>Wheelhouse/cabin will have pressurisation system and with enhanced decontamination facilities |
| 9. | Small boat (facilitating operation in shallow waters) | Nil | One unit (a rigid hull inflatable boat of about 6 metres long) |
| 10. | Sonar | Nil | Equipped |
| 11. | Night vision telescope | Nil | Equipped |
| 12. | Fire pump | Driven by the power of fireboat engine | Driven by the power of an independent engine |

*Source:* *FSD records*

*Remarks:* *In August 2016, the FSD and the MD confirmed the following specification changes under the approved funding:*

*(a) the length of the vessel would be 33 to 35 metres (see item 1);*

*(b) four sets of propulsion engine (see item 3) would be installed to meet the maximum speed of 35 knots; and*

*(c) fire pump would be driven by the propulsion engine (see item 12).*

**Appendix J**
(paras. 4.11 and 4.12 refer)

## Chronology of key events for implementing the two vessel replacement projects (June 2013 to October 2016)

| Date | Event |
|---|---|
| June 2013 | The MD informed the FSD that due to a shortage of experienced staff (only two surveyors and five inspectors available for managing three vessel procurement projects at the same time) and the need to review the vessel procurement procedures, committed tendering schedules could not be followed. According to the funding approval dates and based on the manpower of the MD, the revised tentative dates for tender invitation for the new FB 7 and the two new speedboats were December 2017 and December 2019 respectively (instead of February 2013 and September 2013 — see paras. 4.8(d) and 4.9). |
| August 2013 | The MD informed the FSD that, to speed up clearing the backlog, the MD had considered employing Surveyors of Ships and outsourcing the pre-tender work and project management work to external consultants. After the employment of new surveyors and consultants, the FSD's vessel procurement projects would be handled earlier. |
| February 2014 | The MD informed the FSD that tender invitation of the new FB 7 would be conducted in July 2015 and the fireboat would be commissioned in August 2017. |
| April 2014 | The MD informed the FSD that tender invitation of the two new speedboats would be conducted in August 2015 and the speedboats would be delivered in February 2017. |
| March 2015 | The MD informed the FSD that the procurement of the new FB 7 and two speedboats was halted due to insufficient manpower with relevant experience and accumulation of a backlog of approved projects. The FSD appealed to the MD to accord priority to recommencing the new FB 7 project. |
| June 2015 | The MD resumed the tender preparation work for the new FB 7. |
| May 2016 | The MD requested the FSD to comment on the tender document for procurement of the new FB 7. |
| September and October 2016 | Tender notice for the procurement of the two speedboats was gazetted in September 2016 and that for FB 7 was gazetted in October 2016. |

*Source: FSD records*

# Acronyms and abbreviations

| | |
|---|---|
| AA | Airport Authority Hong Kong |
| Airport | Hong Kong International Airport |
| AMMS | Asset Management and Maintenance System |
| Audit | Audit Commission |
| CMCMS | Comprehensive managed care and maintenance service |
| CTB | Central Tender Board |
| CWRF | Capital Works Reserve Fund |
| DoJ | Department of Justice |
| DTRS | Digital Trunked Radio System |
| EMSD | Electrical and Mechanical Services Department |
| EMSTF | Electrical and Mechanical Services Trading Fund |
| Euro | European |
| FB 7 | Fireboat No. 7 |
| FC | Finance Committee |
| FSCC | Fire Services Communication Centre |
| FSD | Fire Services Department |
| FSE | Fire services equipment |
| FSTB | Financial Services and the Treasury Bureau |
| GLD | Government Logistics Department |
| IT | Information technology |
| MD | Marine Department |
| P&L | Procurement and Logistics |
| SAT | System Acceptance Test |
| SB | Security Bureau |
| SGMS | Second Generation Mobilising System |
| SLA | Service Level Agreement |
| SPRs | Stores and Procurement Regulations |
| TGMS | Third Generation Mobilising System |