2025 Flight Recorder Installation Survey on National-Registered Civil and Public Aircraft

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1. Background Introduction

Taiwan Transportation Safety Board (TTSB) carries out routine flight recorder installation survey on national-registered civil and public aircraft. Every year official document of flight recorder installation survey form is sent to operators and government organizations. This survey is to collect model and brand of the aircraft installation of cockpit voice recorders (CVR), flight data recorders (FDR), flight data acquisition units (FDAU), quick access recorders (QAR), and lightweight flight recorders (LWR) at various national-registered operators. The findings have been the reference to establish flight recorder readout capability in the Research and Engineering Division in order to enhance the readout efficiency during the occurrence investigations.

ICAO Annex 6 has regulated on installation standard and recommendation, that depends on aircraft category (fixed-wing or helicopter), operation type (commercial air transport or general aviation), issue date of the aircraft type certificates, Maximum Take-Off Weight (MTOW), and propulsion type to distinguish installation necessity and specification requirement.

In Chapter 2 (for civil aviation) and Chapter 3 (for general aviation) of Regulations Governing Aircraft Flight Operations, both require the operators in Taiwan for flight recorders installation onboard their aircraft and minimum recording time and parameters stated in ICAO Annex 6 are adopted by CAA Taiwan in the national regulation. However, an aircraft may be exempted from this requirement upon CAA Taiwan authorization, when its manufacturer does not provide any technical service for modification, and the operator cannot obtain STC issued by Taiwan CAA, FAA, EASA or civil aviation authority from the original design country for technical modifications, or certified free balloons.

The adopted ICAO regulations by CAA Taiwan are as follows:

1.No.1-1C: The Requirements of Flight Recorders for Civil Air Transport Operations

2.No.1-2C: The Requirements of Flight Recorders for General Aviation and Supplemental Operations

Public and military aircraft which are not governed by civil aviation regulations do not have relevant legal sources for the installation of flight recorders. However, public helicopters (UH-60M) and second-generation fighters (F-16/M-2000/IDF) are equipped with military flight recorders. In addition, AS365 helicopters (except N1 model) have equipped lightweight

flight recorders.

2. The specific accomplished tasks

This survey included twenty-three operators - China Airlines, EVA Airways, UNI Airways, Mandarin Airlines, Tigerair Taiwan, Starlux Airlines, Aerospace Industrial Development Corporation, Daily Air, Emerald Pacific Airlines, Win Air Business Jet, Executive Aviation Taiwan Corp., Strong Aviation, RealWorld Aviation, Ginger Aviation , APEX Flight Academy, Heli Service Taiwan Co., Ltd., MetaStar-Airlines, Skyrainbow Airlines and Lu-Shi Management Consultant Co. Ltd., Skyvision Aviation Corp., and three government agencies - National Airborne Service Corps., Civil Aeronautics Administration, Taitung County Government and Department of Information and Tourism.

The list of accomplished tasks that collected by operators which are:

1. The models and the manufacturers of the flight recorders installed.
2. The formats of the flight data readout database.
3. The models and the manufacturers of FDAU.
4. The establishment of FOQA system.

3. Findings

Based on the responses from all these agencies, TTSB can analyze the laboratory readout capability of the flight recorders which installed in civil aviation and public aircraft, and also QAR, portable GPS devices and lightweight flight recorders in public aircraft and general aviation aircraft.

16 EA (each) aircraft (15 EA fixed-wing and 1 helicopter) are newly operated this year and their flight recorder models introduced are shown in the table 1. There is a total of 310 EA aircraft, including 279 EA fixed-wing and 31 EA rotary-wing (helicopters). Out of these, 286 EA are civil aircraft (278 EA fixed-wing and 8 EA helicopters) and 24 EA are public aircraft (1 EA fixed-wing and 23 EA helicopters). In addition, 27 EA legally certified free balloons are included.

Table 1 List of newly operated and their flight recorder models

Operator	Aircraft type	Recorder category	Manufacturer	Model/Serial number
China Airlines	B777F	CVDR	L3	SRVIVR25/ 7100-1000-70
	A321-271N	CVDR	L3	SRVIVR25/7100-0200-00
Starlux Airlines	A350-900	CVDR	L3	SRVIVR25/7100-1900-31
	A330-941	CVDR	L3	SRVIVR25/7100-1000-30
Win Air Business Jet	Gulfstream 550	CVFDR	Universal	CVR120/1606-01-00

The fixed-wing aircraft of Starlux Airlines and China Airlines are equipped with L3 CVDR recorders combined cockpit voice and flight data recording functions and having well exceed 25 hours of voice recording length on their four audio channels. The findings from statistics is shown as follows.

3.1 Findings from statistics related to civil operators

1. Figure 1 shows the statistics of the civil aircraft:
   - ◆ The proportion of the civil aircraft equipped CVR and FDR is 95.1% and 94.1% respectively;
   - ◆ The numbers of the civil aircraft equipped with 30-min CVR, 120-min CVR and 25 hours CVR are 1, 202 and 69, respectively.
2. Figure 2 shows the statistics of civil fixed-wing aircraft:
   - ◆ The proportion of the civil fixed-wing aircraft equipped with CVR and FDR is 96.0% and 95.7% respectively;
   - ◆ The numbers of the civil aircraft equipped with 30-min CVR, 120-min CVR and 25 hours CVR are 1, 198 and 68, respectively.
3. The statistics of civil helicopters listed as below:
   - ◆ There are eight civil helicopters, of which five are equipped with CVR and three equipped with FDR. The proportion of the civil helicopters installed with CVR and FDR are 62.5% and 37.5% respectively.
   - ◆ The numbers of the civil aircraft equipped with 120-min CVR and 25 hours CVR are 4, and 1, respectively.
4. The proportion of the civil fixed-wing aircraft with the FDR readout database in hard

copies and electronic copies are 38.3% and 91.7% respectively.

5. The proportion of verified FDR readout database for the civil fixed-wing aircraft is 100%.

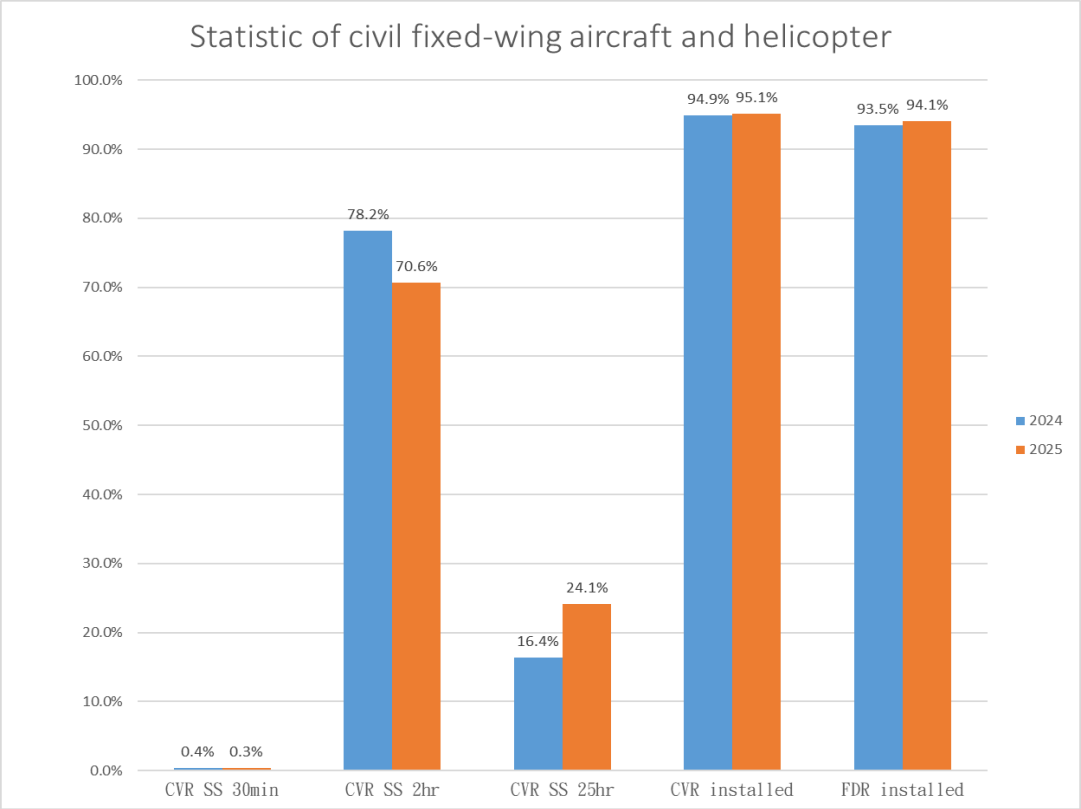

Figure 1 Statistic of civil fixed-wing aircraft and helicopter

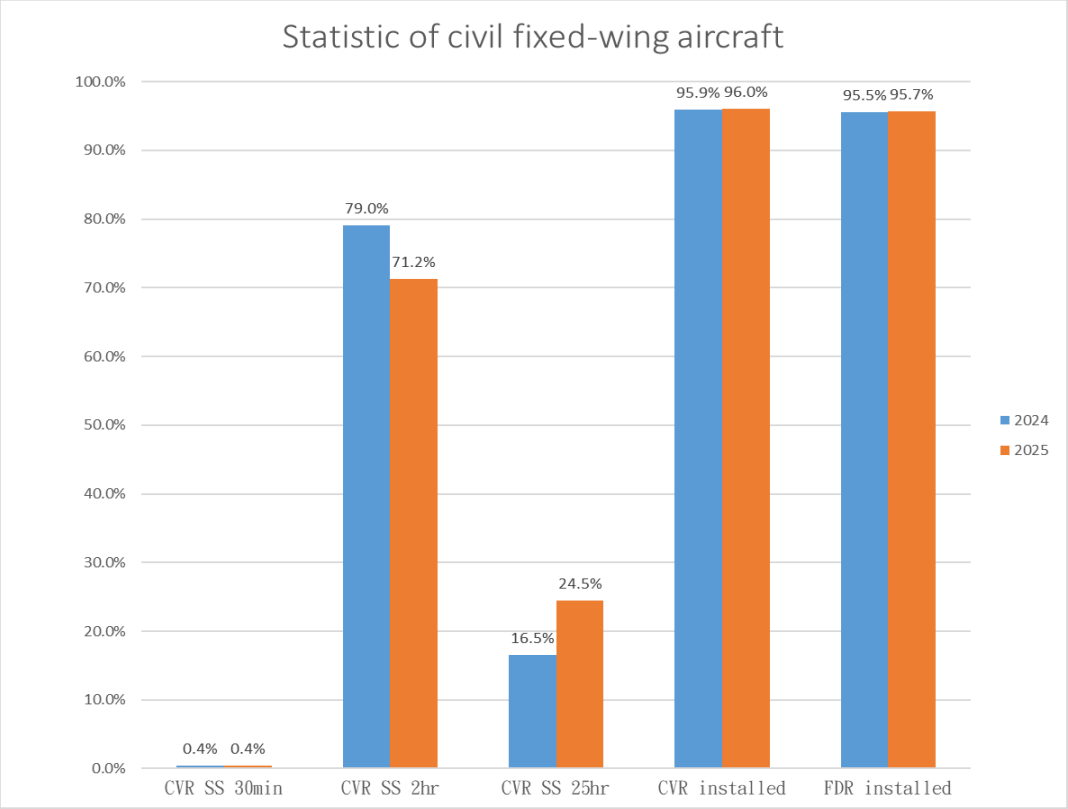

Figure 2 Statistic of civil fixed-wing aircraft

3.2 Findings from statistics related to public aircraft:

1. Of all 24 EA public aircraft (consisting of one fixed-wing BEECH-200, nine AS-365, and fourteen UH-60M), all (14 EA) of UH-60M helicopters is equipped with mil-spec flight recorder (the proportion is 58.3%) and the remainder has portable GPS, which is 41.7%.
2. The capabilities at TTSB LAB for the surveyed flight recorders equipped on the public aircraft have reached 100%.

3.3 Findings from statistics related to free balloon installed with portable GPS:

1. All 27 registered free balloons in Taiwan have data recording devices installed. The Taitung County Government owns 14 EA, Skyrainbow Airlines owns 10 EA, Lu-Shi Management Consultant Co. Ltd. owns 3 EA.
2. The readout capability at TTSB LAB for the surveyed portable GPS is 100%.

3.4 Findings from FOQA statistics related to civil operators:

As per "Regulations Governing Aircraft Flight Operations - Article 9", by Taiwan CAA:

From 1 January 2009, an operator shall establish and implement a safety management system acceptable to the CAA which, as a minimum:

1. Identifies safety hazards;

2. Ensures that remedial action necessary to maintain an acceptable level of safety is implemented;

3. Provides continuing monitoring (auditing) and regular assessment of the safety level achieved; and

4. Aims to make continuous improvement to the overall level of safety.

The safety management system as set out in the preceding paragraph shall clearly define lines of safety accountability throughout the operator's organization, including a direct accountability for safety on the management level, and comply with attachment 1.

An operator of an aircraft of a maximum certificated take-off mass in excess of 27,000 kg shall establish and maintain a flight data analysis programme as part of the safety management system in paragraph 1 above.

The flight data analysis programme as set out in the preceding paragraph shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

Six national-registered operators have established flight data monitoring programs for daily operation and total fleet size is 246 aircraft, among those 166 EA are equipped with QAR. Statistics of FOQA systems using by national-registered operators are listed as table 2.

Table 2 Statistics of FOQA systems of domestic operators

Operator	FOQA Maker	FOQA System	FDM	Animation
China Airlines	Aerobytes	Aerobytes FDM	Y	Y
EVA Airways	Aerobytes	Aerobytes FDM	Y	Y
Mandarin Airlines	Aerobytes	Aerobytes FDM	Y	Y
UNI Airways	Aerobytes	Aerobytes FDM	Y	Y
Tigerair Taiwan	Teledyne	AirFASE	Y	Y
Starlux Airlines	Teledyne	AirFASE	Y	Y

4. Conclusions

One of the goals the TTSB Research and Engineering Division trying to pursue is to reach 100% capability of flight recorder readout for national-registered civil and public aircraft. To accomplish this, the Division carries out national-registered aircraft flight recorder installation survey every year. The proportion of exceedance 120 minutes CVR installation has increased accordingly, and has achieved around 95% over the past 3 years. (95.2% in 2023, 95.5% in 2024 and 95.7% in 2025).

According to ICAO Annex 6 regulations, starting January 2022, all new-built fix-wing commercial aircraft whose Maximum Take-Off Weigh over 27,000 kg shall be equipped with 25 hours CVR. As per “No.1-1C: The Requirements of Flight Recorders for Civil Air Transport Operations”, by Taiwan CAA:

From 1 January 2022, an aircraft shall equip cockpit voice recorder that record at least 25 hours, thus stated in ICAO Annex 6 Part I 6.3.2.3.2. However, if operators may be exempted from this requirement shall provide explanation and submit relevant certified documentation approvable to the CAA, thus installation may be extended one year.

This year, China Airlines, EVA Airways, Starlux Airlines and Tigerair Taiwan have 68 EA aircraft equipped with 25 hours CVR, the proportion is 24.5%. Due to old avionics and related regulation limitations, the helicopters maintained low recorder installation rate in the past. However, with the introduction of new aircraft into the fleet, the proportion of CVR installation is 61.3%, in the meantime the proportion of FDR installation is gradually increased to 54.8% as well. For those helicopters still not equipped with flight recorders, TTSB will keep encouraging operators and relevant organizations to evaluate LWR

installation and flight data applications, so as to improve the flight safety. Due to the manufacturer does not provide any technical service for modification, two helicopters are only equipped with portable GPS and seven are equipped with lightweight recorders.

The readout capabilities at TTSB LAB for the surveyed CVR, FDR, portable GPS and LWR both in civil and public aircraft have all reached 100%. Heli Service Taiwan Co. has a newly helicopter (AW169) equipped with 25 hours EAFR system flight recorder (Fortress recorder) since 2024, and TTSB now possess the download and the readout software of such flight recorder.

5. Conclusion and suggestions

To conclude, the following suggestion is made:

1. Keeping establishing readout capability for newly flight data recorder.
2. With the recent FAA Reauthorization Act addressing 25-Hours Cockpit Voice Recorder (CVR) requirements that cover aircraft operated by air carriers under Part 121 (commercial) and type-certificated with a passenger seating capacity of 30 or more, or an all-cargo or combi derivative of such an aircraft, will be proposed equipped with 25- Hours Cockpit Voice Recorder within required time period. TTSB will be coordinated with Taiwan CAA, to promote modification of civil aircraft to be equipped with such recorder, in order to enhance safety management.
3. To enhance the efficiency of investigation operations, it is necessary to actively develop automatic speech-to-text transcription technology to meet the demand for transcribing 25-hour voice recordings.
4. Attend international training programs to improve flight data mining, dynamic image analysis, and big data applications in aviation, and keep establishing readout capability for damaged avionic devices and developing a dynamic database system to manage the aircraft flight parameters.
5. Convene Asia-Pacific Region investigation technical meeting to keep building up the capacity of TTSB engineering analysis. Invite JTSB (Japan), TSIB (Singapore), ARAIB (Korea) and nearby countries together to hold the technical seminar and practical training.