Flight Operational Quality Assurance (FOQA) introduction of China Civil Aviation

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Background

- Challenges facing flight standard supervision
- Thoughts on flight standard supervision
1. Challenges facing flight standard supervision

- Industry development trend
  - number of airlines
    - By the end of June 2011, there are 52 transport airlines in China
    - the number is increasing every year
  - number of aircraft in transport airlines
    - By the end of 2011, the total number of transport aircraft reached 1810
  - Other data
    - In 2011, the total transport turnover in the industry was 57.74 billion ton kilometers
    - The total turnover has been growing at an average rate of 15.6% during “the 11th five year plan period”
  - The fact is undisputable that China has become the second largest aviation country.
1. Challenges facing flight standard supervision

- One challenge: supervision resources cannot match the industry development speed
- Increase of workload
  - Increase of operations: number of airlines, fleet scale, total operation time;
- More complicated work

Diversity of airline operation (supervision issues even more complicated), including corporate structure (merger, alliance, foreign employees etc.), route structure, new technology application (EFB/RNP/ADSB/HUD); changes brought by regulations revision, such as ICAO English test, SMS implementation, cabin crew type restriction, new ETOPS policy, Advanced Qualification Program (AQP), Flight Operational Quality Assurance (FOQA), Fatigue Risk Management etc.
2. Thoughts on flight standard supervision work

- improvement of supervision methods
- increase of supervision efficiency
Risk management via systematic safety process model to move forward the safety threshold. Driven by hazards identification, set up a long-term mechanism of safety management with risk management as the core.
Optimize current flight operation supervision process, set up a closed-loop supervision & management process which prioritizes risk and improves itself consistently.

Involve sound planning, deployment, check, analysis, timely feedback, then follow up and correct. To take leadership and initiative in securing continuous safety via collective wisdom.
Supervision Method Improvement:

Safety protection side

- CAAC safety supervision and management (FSOP)
- Airlines’ safety management (SMS)

Operation side

- Change into Health care doctor
- Airlines’ operation

Set up an all-directional safety management system

Supervision Method Improvement:

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Change into

Health care doctor

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Set up an all-directional safety management system
Supporting risk management and safety decision-making via data collected by FSOP as major information and FOQA data as supplementary.
Improving supervision efficiency:

- Ease safety management pressure brought up by industry development
- Unify the certification and inspection standards for flight standard supervision

In line with the spirit of system safety, which puts risk evaluation and process control as the core, safety performance analysis could be conducted based on the data collected via "systematic supervision objective, dynamic supervision plan, standardized supervision process" as well as closed-loop management process. Together with other data, this approach could be used to evaluate the hazards identified in airlines’ design and operation and take corresponding control measures to make sure that supervision work is fair, justice, open and trustworthy.
CAAC safety supervision and management (FSOP)

Airlines’ safety management (SMS)

SMS & FSOP

Operation side

Safety protection side

CAAC supervision

Internal monitoring

control

Process measurement

rights

procedure

interface

responsibility

CAAC supervision and management (FSOP)

Airlines’ operation
The method for finishing a process, and to be documented. Check and limits designed to ensure the expected results, and have them be part of the process. Used to validate a process, so as to find out problems or potential ones for correction.

To ensure the expected results, interaction between processes must be managed.

Only the specified person could define the procedure and approve the modification. He/she should be identifiable, and holds relevant qualification and knowledge.

One specified person should take responsibility for the process quality. He/she should be identifiable, and holds relevant qualification and knowledge.
Functions of SMS & FSOP

- Air carrier, instead of CAAC, is responsible for delivering safe product;
- CAAC is not the quality controller or assessor for the air carriers;
- These are the function of SMS.
### Review of Flight Operation Quality Assurance of China’s Civil Aviation

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>• Start basic research</td>
</tr>
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</table>
| 1997 | • Launch QAR engineering  
• On Sept.17, CAAC issued the airworthiness guidance *Regulations on Quick Access Recorder (QAR) Installation* |
| 2000 | • On Dec.15, CAAC issued *Regulations on Flight Operation Quality Assurance Management* |
| 2007 | • On Mar.19, CAAC issued Aviation Safety Guidance - guidance about implementing ‘Flight Quality Supervision Criteria of Boeing and Airbus aircraft’ |
| 2010 | • On Jan.4, CAAC issued China’s civil aviation regulation *Approval Rules on Operation Qualification of Large Aircraft Public Air Transport Carrier (CCAR-121-R4)* |
| 2012 | • On Feb.15, CAAC *issued Implementation and Management of Flight Operation Quality Assurance (FOQA) advisory circular* |
Review of Flight Operation Quality Assurance of China’s Civil Aviation

- Accepted by pilots and airlines as a proactive safety management measure
- Achieve a high supervision rate
- Remarkable effect of detecting and solving hidden issues
- Carry out supervision on specific items
- Greatly reduce accident and incident rate
Introduction of Flight Operation Quality Assurance Advisory Circular

1. Compilation reference and purpose

- CCAR - Part 121 Article 121.352
- Provide guidance for airlines to set up and implement FOQA procedure according to CAAC requirements;
- Used by CAAC when supervising and inspecting airlines” flight operation quality assurance works
Article 121.352 Quick Access Recorder or equivalent device
(a) Certificate holder should equip all operating aircraft with QAR or equivalent device which are approved by CAAC, and set up FOQA procedure as a part of safety management system.
(b) Certificate holder could sign contracts with another party who will conduct detailed FOQA work. But the conformity responsibility defined in Item (a) should be taken by the certificate holder.
(c) Certificate holder should regularly report its statistics and trend analysis report, gained through FOQA, to the local administrative department which’s responsible for certificate management. Whenever necessary, CAAC can check or analyze the raw data from QAR or equivalent device.
(d) FOQA procedure should be non-punitive and the protection procedure of data should be included in the FOQA procedure.
Introduction on FOQA AC

2. Compilation Process

- **2009-2010**
  - Data collection
  - Outline definition
  - First draft finished

- **2011**
  - Experts discussion
  - Asking for advice
  - Asking for Airbus advice

- **2012**
  - Final draft
  - Issuance
  - Communication and implementation
Introduction on FOQA AC

3. Content Structure
Main content consists of 11 chapters.
Basis and purpose, applicability, reference, definition, background, FOQA procedure, establishment and implementation of FOQA project, FOQA management, information sharing, appendixes, validation date

5 appendixes
• FOQA specification of Airbus and Boeing aircraft
• FOQA working checklist
• requirements on statistics, trend analysis and original data
• requirements on basic data of FOQA
• abbreviation
4. **Applicability**

- holders of CCAR-121 Operation Certificate
- operators of multi-engine turbojets with MTOW over 20000kg operating under CCAR-135.
5 Characteristics
5.1 Change of management responsibility

- CAAC FSD is in charge of managing FOQA policy of China’s civil aviation, formulating regulation and supervising guidance and coordination.
- CAAC regional FSD is in charge of monitoring the flight operation quality of certificate holders in that region.
- CAST, as a technical support to FOQA, is responsible for data collection, trend analysis, consulting and training of industrial FOQA.
5.2 Implementation phase has been added in
- Descriptions on the setting and implementing phases of FOQA projects have been added in.
- Various work during planning, implementing and continuous operation stages has been clarified.

5.3 Protection of data safety has been added in
- Creating protection measures to ensure safety of data and data source to avoid unauthorized disclosure, interpolation, misuse or destruction.

5.4 Information sharing has been added in
- encouraging FOQA information sharing among certificate holders
- Certificate holders should share information with CAAC when FOQA statistic analysis for the whole industry is carried out.
Introduction on FOQA AC

5.5 Detailed requirements

5.5.1 Requirement on equipment

- QAR or equivalent equipment should meet requirements of *Regulations on QAR Installation*(CAD1997-MULT-38)
- Requirements on recorded parameters and their attributes should not be lower than parameters recorded by FDR

5.5.2 Requirement on personnel

- The team should consist of a manager and personnel specializing respectively in system management, data process, data analysis, event analysis
- Cross-department job is acceptable.
5.5.3 Monitoring Requirements

Monitoring rate
- Aircraft monitoring rate 100%
- Flight leg monitoring rate no less than 85%

Monitoring items and standard
- Monitoring items no less than the items listed in Appendix 1
- Monitoring standard no lower than Appendix 1
5.5.3 Monitoring requirements

Data analysis

• Besides events detection, another requirement of daily data measurement (ROM) is added in
• Emphasize on the value of statistics and trend analysis
• Correlate event information with crew information during the event analysis
5.5.4 Requirements on Data Reporting

- Report monthly the statistics and trend analysis acquired through FOQA to the functional department of regional administration responsible for certification management.
- Each aircraft type’s monitoring rate, deviation occurrences and deviation rate.
- Overall trend analysis, study on typical deviation occurrences and safety recommendations etc.

Appendix 3 and 4
Introduction on FOQA AC

5.5.5 No Punitiveness

Any independent individual deviation occurrence shall not be regarded as the restriction on the technical upgrade of personal type transition or promotion etc.. Nor quick access recorder (QAR) shall be taken as the information sources for punishment.
FOQA Example

As one of hazard identification tools, FOQA is an integral part of safety management system. **Flight quality network query system:**

- Integrate and match the SOC info and FOQA info stored in different working stations into one centralized data pool;
- Pilots can use the network access system to check deviation occurrences, record parameter engineering value and related personal statistic information;
- Provide the safety management department with different levels of comprehensive statistic analysis from different dimensions (aircraft type, fleet, department, event classification, date etc.)
- So far it is the main data sources of Air China flight safety system.
website version of engineering value browsed via FOQA software
- Accessible with several browsers such as IE/Google Chrome
- Tables and figures display engineering value
- Randomly adjust the parameter display sequence
- Computation and display of non-recorded parameters
- Browser engineering value by legs
- Browser engineering value by events (set the occurring time)
- QAR data interception technology
- Decoding database query and local storage
- Parameter profile editor, adding/deleting profiles or parameters
- parameter profile batch processing import
- Export coded parameter data to csv files
- Decoding capability of 28 configurations such as B737/B747/B757/B767/B777/A319/A320/A321/A330/A340
- Compatible with AGS / FLIDRAS / AirFASE decoding parameter pool
CAST has developed a web-based engine condition monitoring system based on AGS system for CSN Xinjiang Branch. During the past 4 years, 6573 engine abnormal events were detected in total and over 100 of those events were considered as severe engine failures after further investigation and confirmation.

FOQA Example

<table>
<thead>
<tr>
<th>Condition exceedence</th>
<th>2008/8-2008/12</th>
<th>2009/1-2009/12</th>
<th>2010/1-2010/12</th>
<th>2011/1-2011/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATR</td>
<td>161</td>
<td>1086</td>
<td>653</td>
<td>252</td>
</tr>
<tr>
<td>737</td>
<td>6</td>
<td>258</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>757</td>
<td>767</td>
<td>508</td>
<td>1194</td>
<td>1628</td>
</tr>
<tr>
<td>Total</td>
<td>934</td>
<td>1852</td>
<td>1880</td>
<td>1907</td>
</tr>
</tbody>
</table>
 FOQA Example

Engine related parameters e.g. Max/min VIB, OIP, EGT, etc of different flight phases

- upload relevant sample parameters to web data server;
- Mechanics predefine the monitoring logic and thresholds to timely monitor any over-limit event concerning engine health.
“China Civil Aviation FOQA” Blueprint

1. Problems

• The analysis data of QAR obtained by CAAC is usually outdated, which significantly prevents CAAC from fully understanding the overall flight safety status of China civil aviation at the first time and making the right decision.

• Each airlines has no access to the flight safety information of other airlines, which would prevent them from taking timely measures to solve the safety concerns faced by other airlines on the same aircraft type, same airport and same route.

Set up China civil aviation FOQA system
“China Civil Aviation FOQA” Blueprint

2. System Solution

(1) Aircraft modified with WQAR

- 570 aircraft embodied already;
- For the remaining aircraft, airlines are encouraged to update their QAR with WQAR on all aircraft under a dedicated subsidiary policy.
- CAAC will provide some subsidies in proportion.
“China Civil Aviation FOQA” Blueprint

2. Solution

（2）Set Ground Support and Service Station

• Set up CAAC ground support and service station;
• Automatically collect the flight data of all aircraft installed with WQAR in China civil aviation industry.
• Launch overall monitoring on the flight safety of civil aviation transport;
• Realize the information sharing among information monitoring industry and improve overall flight quality assurance.
“China Civil Aviation FOQA” Blueprint
Thank you!