Measuring Aviation System Performance in China

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- Air Traffic Operation Performance Analysis and Optimization
  —— 《2014 Flight Operation Efficiency White Paper》
- Aviation Safety Data Statistics and Analysis
- Air Traffic System Simulation and Tools Development
- Controllers Education and Training
ATM Research Institute

ATFM Research Platform

Integrated Control Simulator

TWR  Radar  Non-Radar
1. Performance review in China

2. Performance frameworks

3. Measuring performance in China
1. Performance review in China

1.1 Data Collection

Half year in advance

<table>
<thead>
<tr>
<th>D-1 day</th>
<th>D day</th>
<th>D Day</th>
<th>D+1 Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20:00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flight Schedule

Next Day Flight Plan

Operation Day Flight Plan

Performance Plan

Dispatch Plan

FPL

ATC Clearance

Flow Control

Flight Track

Instructions

Departure

Landed

Statistic

Airline

Airport

Demand

Capacity

ATM

On month in advance

修改

机位

调整

修改

管制意图

流量控制

管制意图

管制意图

指令(控制意图，不修改今日动态)

动态电报

空管

ACA

RS

电话

修改
1. Performance review in China

1.2 Report to Headquarters

Diagram:
- CAAC
- NE Regional Branch
- NC Regional Branch
- EC Regional Branch
- Regional ATMB
- Provincial Aviation Safety Supervision Bureau
- Provincial/Local ATMB Branch
- Local Airlines
- Local Airports

Report flows from regional branches to CAAC and then to Center ATMB.
1. Performance review in China

1.3 Public Reports

- Monthly Statistics
- Monthly Analysis Report
- Yearly Report
- Yearly Airport Report
- 《Statistic Data on Aviation of China》

http://www.caac.gov.cn/
1. Performance review in China

1.4 Internal Reports

- Monthly Briefing Reports
- Monthly Operation Situation Analysis Reports
- Flight Delay Analysis Special report
- ……
1. Performance review in China

1.5 Internet/Intranet Resources

Globe Flight Schedule Management System

Flight Punctuality Statistic System

www.sked.cn

Air Traffic Information Platform

https://pro.chinaatm.com.cn

www.flightontime.cn
1. Performance review in China

1.6 Other Analysis

Focus on Flight Punctuality
Mainly used by Passengers

http://www.carnoc.com/

http://www.umetrip.com/

Airline Operation Analysis

Airport Operation KPI
1. Performance review in China
2. Performance frameworks
3. Measuring performance in China
2. Performance frameworks

2.1 CAAC Headquarter

- Air Transportation Turnover volume
- Passengers Transportation Volume
- Cargo Transportation Turnover Volume
- Passenger Load Factor
- Aircraft Utilization
- Number of accidents per million flight hours
- Flight Punctuality Rate
- Airport Movements
- ……
2. Performance frameworks

2.2 Target Performance in 2015

<table>
<thead>
<tr>
<th>类别</th>
<th>指标</th>
<th>2010年</th>
<th>2015年</th>
<th>年均增长</th>
</tr>
</thead>
<tbody>
<tr>
<td>业务规模</td>
<td>航空运输总周转量（亿吨公里）</td>
<td>538</td>
<td>990</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>旅客运输量（亿人）</td>
<td>2.68</td>
<td>4.5</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>货邮运输量（万吨）</td>
<td>563</td>
<td>900</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>通用航空生产作业（万小时）</td>
<td>14</td>
<td>30</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>客运周转量在综合交通中的比重（%）</td>
<td>14.5</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>发展质量</td>
<td>运输飞行百万小时重大事故率</td>
<td>[0.05]</td>
<td>&lt;[0.20]</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>航班正常率（%）</td>
<td>81.5</td>
<td>&gt;80</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>载运率（%）</td>
<td>71.6</td>
<td>&gt;70</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>运输飞机日利用率（小时/天）</td>
<td>9.4</td>
<td>≧9.6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>吨公里燃油消耗（公斤）</td>
<td>[0.306]</td>
<td>&lt;[0.294]</td>
<td>-</td>
</tr>
<tr>
<td>保障能力</td>
<td>保障起降架次（万）</td>
<td>605</td>
<td>1040</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>全国民用运输机场（个）</td>
<td>175</td>
<td>≧230</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>运输机队规模（架）</td>
<td>1597</td>
<td>2750</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>通用机队规模（架）</td>
<td>1010</td>
<td>&gt;2000</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>航油供应（万吨）</td>
<td>1600</td>
<td>2850</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>飞行员数量（万人）</td>
<td>2.4</td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>民航院校在校生（万人）</td>
<td>5.0</td>
<td>6.3</td>
<td>5%</td>
</tr>
</tbody>
</table>

注：带[ ]的数据为5年累计数。
2. Performance frameworks

2.3 Main Performance until 2013

- **Number of major accidents**

- **ATC Facilities (2.95 Billion, 10.5%)**

- **Investment**

- **Flight Punctuality (average 72.3%)**

- **Number of Airline Aircrafts**

- **Number of Airline Aircrafts**
2. Performance frameworks

2.4 Operation performance have been concerned

Especially Airports and Sectors’ Capacity
## 2. Performance frameworks

### 2.5 《Flight Operation Efficiency White Paper》

<table>
<thead>
<tr>
<th>Traffic Volume</th>
<th>Punctuality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual movements</td>
<td>Annual</td>
</tr>
<tr>
<td>Average day movements</td>
<td>Monthly</td>
</tr>
<tr>
<td>Area traffic volume</td>
<td>Airline</td>
</tr>
<tr>
<td>Fix points day traffic</td>
<td>Airport departure</td>
</tr>
<tr>
<td>Terminal area traffic</td>
<td>Departure delay distribution</td>
</tr>
<tr>
<td>Airport traffic</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight distance distribution</td>
</tr>
<tr>
<td>Passenger Load Factor</td>
</tr>
<tr>
<td>Aircraft Utilization</td>
</tr>
<tr>
<td>Airport pairs transmit time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost-Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>In flight fuel consumption</td>
</tr>
<tr>
<td>Temporary airways utilization</td>
</tr>
</tbody>
</table>
1. Performance review in China
2. Performance frameworks
3. Measuring performance in China
3. Measuring performance in China

Main works

- Standardization data resource
- Indicators definition
- Air-route Network evaluation
- Calculated ATFM delay
- Compare to others countries
- Performance based analysis and improvement
- ……
3. Measuring performance in China

3.1 Standardization data resource

Current Operation Systems → Centerlized Data Verification System → Standard Performance Database

- Data Set I: Flight Schedule/Plan Data
- Data Set II: Flow Control Data
- Data Set III: Flight Trajectory Data
- Data Set IV: Operation Performance Data
3. Measuring performance in China

3.2 Indicators definition

Follow new Regulations, such as departure time replace by off-block time in punctuality.

Increase new comparing indicators, such as volume/capacity, planned/actual, ……

Identify performance benchmarks, form different operation situations, different facilities.
3. Measuring performance in China

3.3 Air-route Network evaluation

- Network connection degree
- OD non-linear coefficient
- Air-route/airway density
3. Measuring performance in China

3.4 Calculated ATFM delay

Can we find methods to calculate delay? Or Identify benchmarks?
3. Measuring performance in China

3.5 Compare to others countries

Route Segment traffic volume

Flight distance

Efficiency, Cost-Benefit, ……
3. Measuring performance in China

3.6 Performance based analysis and improvement

Beijing Capital Airport Diverting Analysis

2013.7.21 heavy rain in Beijing

Diverting Delay, Flight Distance, Time to issue diverting instructions, ……
Thanks

Question?