CURRENT SITUATION OF AVIATION SAFETY INFORMATION EXCHANGE SYSTEMS IN JAPAN

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Abstract

In 1998, the Japanese committee on Global Aviation Information Network was formed in the Association of Air Transport Engineering & Research (ATEC) at the request of Japan Civil Aviation Bureau to promote and facilitate the collection and sharing of safety information. The concept is to improve aviation safety through more proactive use of accident and incident data. [1]

Committee members include Japan Aerospace Exploration Agency, All Japan Air Transport and Service Association, Japan Airlines International, All Nippon Airways, Japan Airlines Domestic and other aviation related organizations.

The effectiveness to use accident and incident data is explained in the Accident Prevention Manual issued in 1984 by ICAO. New Chapter 8 of Annex 13, which became applicable on 1st November 2001, addresses incident reporting system, database systems, the analysis of safety data, and the exchange of safety information by more proactive and risk analysis based approaches.

This paper describes existing airlines (internal use) and government information collecting systems in Japan and necessary areas to be improved in the light of new Annex 13. In particular, as new Annex 13 recommends a prompt exchange of information, following two data exchange systems were described in detail.

So-called data exchange system among member airlines was first introduced in Japan when ATMS (Aircraft Trouble-report Management System) started its operation in 1992. This system is a kind of mandatory incident reporting system operated by ATEC and has currently 10 member airlines and accumulated more than 14,000 data.

As a voluntary incident reporting system, ASI-NET (Aviation Safety Information-Network) started its operation in 1999 and has currently 17 member airlines.

In addition to these two systems, Japan Confidential Aviation Incident Report System (JCAIR) by ATC started its trial operation in late 2003 and also, collection of safety information on small aircraft has just started its operation.

Lastly, necessary frameworks to extend the data exchange globally and impediments to collect information and the countermeasures were discussed briefly.

1 Needs for Proactive Accident Prevention

Fatal accident rates of Commercial Jet Fleet worldwide remain fairly constant in these two decades shown as below (Boeing Data).[2]

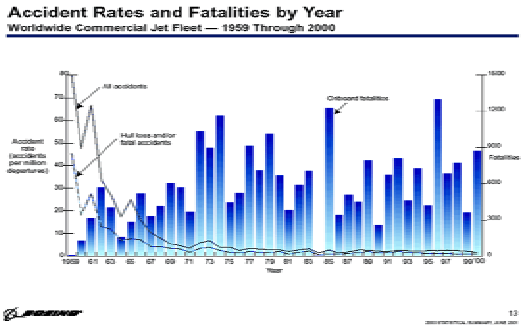

Fig. 1 Fatal Accident Rates by Year

The fatal accident rate is the number of fatal accidents per million flights. The rate for commercial operations was 1.28 in the year

1980 and 0.97 in the year 2000, which is about 25% reduction.

On the other hand, the number of flights in all commercially operated aircraft with takeoff weight of 5700kg or heavier worldwide [3] was about 18 million in the year 1980 and 35 million in the year 2000, which is nearly doubled. As this growth rate is expected to continue, safety analysts are forecasting a significant increase in the number of catastrophic accidents, if current accidents rate could not be reduced.

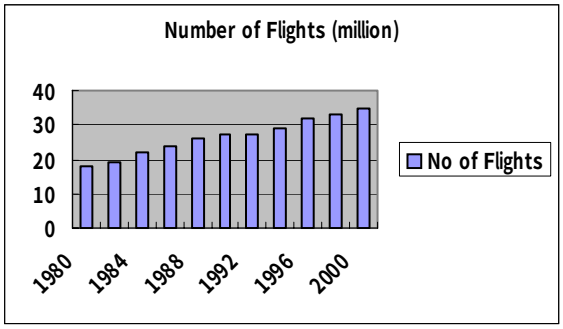

Fig. 2 Number of Flights by Year

In summary, comparison between 1980 and 2000 are;

Fatal accident rate	25% reduction
Number of Flights	doubled

This means that the number of fatal accidents in the world has increased 50%.

Let's look at the situation in Japan. As the Fig.3 below shows, the number of air passengers in Japanese domestic routes in 1980 was 40 million and in 2000, 20 years later, domestic passengers grew to 92 million, more than doubled. This growth rate is expected to continue and the number of domestic passenger is expected to double over the next two decades the same as worldwide growth.

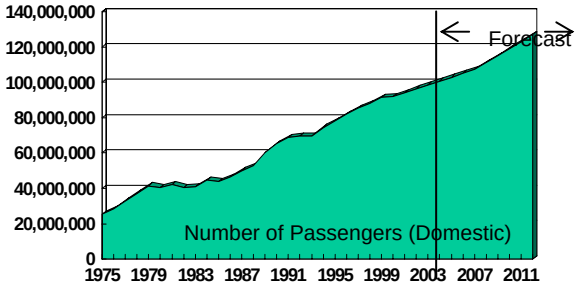

Fig.3 Number of Passengers (Domestic)

Although the same kind of fatal accidents rate data is not available for aircraft registered in Japan, Fig.4 shows the number of accidents for Large airplane (in excess of 60 seats or 25000 kg) , Small airplane, Helicopter, Glider and Airship registered in Japan by calendar year since 1976. The total accidents number by year shows decreasing gradually. The number was 40 in 1980 and 22 in 2000, which is a big decrease.

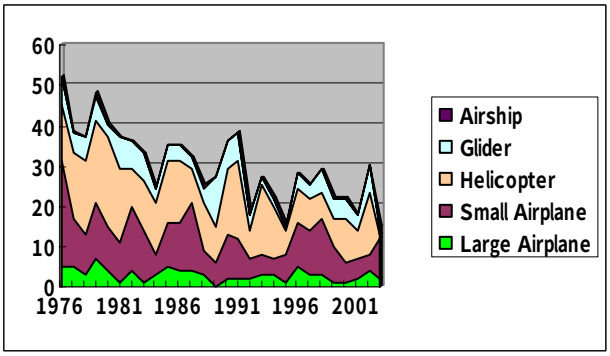

Fig.4 Number of Accidents by Year

As the absolute numbers of accidents by year for large airplanes are very small and have a large scatter, you can not tell much for large airplane. The 5 years average of the number of accidents for large airplane in 1980 was 3.6 and 2.2 in 2000. As the number of air passenger in Japan has doubled in these two decades, we can say that accidents rate of large airplane in Japan has decreased about 70% in these two decades, which is very good compared to the world average.

Fig.5 shows the cause of Accidents in Japan.

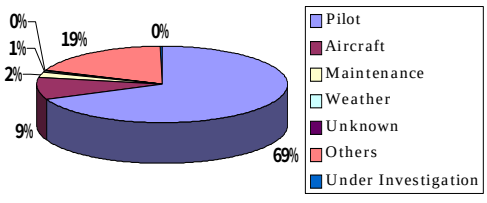

Fig.5 Cause of Accidents in Japan

As shown in Fig.5, the cause related to pilot occupies 69% and this is why human factors analysis is important to reduce the accidents. [4]

2 ICAO initiatives (New Annex13)

The effectiveness to use accident and incident data is explained in the ICAO Accident Prevention Manual [5] issued in 1984. New Chapter 8 of Annex 13, which became applicable on 1st November 2001, addresses incident reporting system, database systems, the analysis of safety data, and the exchange of safety information by more proactive and risk analysis based approaches.

Annex 13, Chapter 8 [6] states;
The objective of these specifications is to promote accident prevention by analysis of accident and incident data and by a prompt exchange of information.

Incident reporting systems
8.1 A State shall establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies.
8.2 **Recommendation.** - A State should establish a voluntary incident reporting system to facilitate the collection of information that may not be captured by a mandatory incident reporting system.
8.3 A voluntary incident reporting system shall be non-punitive and afford protection to the sources of the information.

Database systems
8.4 **Recommendation.** - A state should establish an accident and incident database to facilitate the effective analysis of information obtained, including that from its incident reporting systems.
8.5 **Recommendation.** - The database systems should use standardized formats to facilitate data exchange.

Analysis of data – Preventive actions
8.6 A state having established an accident and incident database and an incident reporting system shall analyze the information contained in its accident / incident reports and the database to determine any preventive actions required.
8.7 **Recommendation.** - If a State, in the analysis of information contained in its database, identifies safety matters considered to be of interest to other States, that State should forward such safety information to them as soon as possible.
8.8 **Recommendation.** - In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies. If safety recommendations are addressed to an organization in another State, they should also be transmitted to that State's investigation authority.

Exchange of safety information
8.9 **Recommendation -** States should promote the establishment of safety information sharing networks among all users of the aviation system and should facilitate the free exchange of information on actual and potential safety deficiencies.

3 Japanese Airlines internal safety reporting

Recognizing the importance of incidents reporting system, Japanese airlines have following in-house reporting systems;

1) Captain reports
2) Daily Flight Operation Monitoring
3) Safety Report
4) LOSA (Line Operations Safety Audit)

As each airline has basically same but slightly different system, a typical Japanese airline's case based on JAL [7] is explained in a little bit more detail.

1) Captain Report
- Reporting Criteria
  -Accidents, Serious Incidents
  -Occurrences defined by regulation
  -Discretionary Items
- Effective for the collection of major and some minor events
- Approximately 400 reports per year
- Reviewed by Flight Operations Department Meeting

2) Daily Flight Operation Monitoring (DFOM)

・Almost equivalent to FOQA.
・General concept and policy
Crew will utilize DFOM data for the improvement of their ability by reviewing their own flight data and sharing edited data among crew
・Operations Manual states their non-punitive policy as;
"The exception report shall not be used for the purpose such as personnel evaluation or disciplinary actions"
・Main features
-Airborne printers
-Information feed back to all crew
-Anonymity policy
・Fleet Status (JALI)

747-400	:	42/42 (100%)
767-200/300	:	30/30 (100%)
777-200/300	:	15/15 (100%)
MD-11	:	3/3 (100%)
747-100/200/300	:	37/39 (95%)
DC-10-40	:	7/13 (54%)
737-400	:	21/23 (91%)

Monitor : 15,100 Legs/Month
93% of All Flight

3) Safety Reporting System
・Purpose of the report explicitly stated in Operations Manual as;
"The SRS is a voluntary incident reporting system and has the purpose of accident prevention and contribution to operational safety. Typical experiences including those possessing latent incident factors are reported voluntarily by operations personnel…"
・Non- punitive feature
The trust of employees in the reporting program is fundamental to the quality, accuracy and substance of data submitted. If hazard and incident data are collected in a corporate atmosphere where employees feel free to openly share safety information, the data will contain much useful detail.
・Anonymity
・Safety Report Committee
-Gives technical considerations
-Appointed by General Manager, Operations
・Feed back
-Disseminates the information to all crew and safety related personnel
-Leaflet or Flight Safety Magazine
-Reporting to Operation Safety Committee
-Reporting channel to ASI-NET

4) LOSA
LOSA is still under evaluation in Japan. Some trial operation was made for evaluation.

Flight operations monitoring concept is very effective as a measure of preventing accidents for airlines as explained by Airbus [8] at the GAIN Asia Pacific Regional Conference held in Tokyo. Flight operations monitoring concept consists of three tools for detection of deviations, which are Flight Data Monitoring (equivalent to DFOM), Crew observation (LOSA) and Flight Crew Reporting. Deviations are analyzed and action plans for remedial measures are launched. By performing these cycles, airlines can prevent future accidents. Japanese airlines also follow this concept.

Flight Operations Monitoring concept

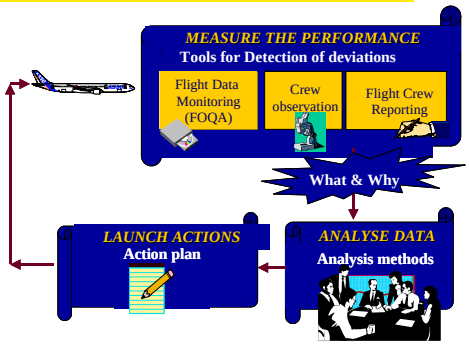

Fig. 6 Flight Operation Monitoring Concept

As Japanese incidents reports are written in Japanese, automatic translation tool is necessary to be developed in order to exchange information with the world outside Japan.

One of Japanese airlines once introduced BASIS [9], which is a commercially available system, developed by British Airways but they

do not use it now because they have to use English to report incidents. BASIS is a widely used system in the world and several BASIS Modules are now available for a broad spectrum of activities relevant to accident prevention including to:

a) Process incident reports from
   1) Flight crews;
   2) Cabin safety personnel;
   3) Aircraft mechanics;
   4) Ground Handling personnel;
b) Store and analyze details from safety audits
c) Investigate maintenance errors
d) Proactively determine potential Human Factors causal factors.

If the airline continued to use it, they could enjoy the broad spectrum of activities described above. Other Japanese airlines are also encouraged to introduce a system like BASIS, so that they can have a single database system which covers reports from Flight crews, Cabin safety personnel, Aircraft mechanics, and Ground handling personnel with analytical capability.

4 Aviation Safety information collected by JCAB [10]

1) Information reported by operators
   (Mandatory for Operator)
   -Accidents
   -Serious Incidents

Outline of Civil Aeronautical Law
Article 76: The PIC shall, in the event of any of the following accidents, report to the Minister
(1) Crash, collision or fire of aircraft
(2) Injury to or death of any person, or damage to or destruction of, any object caused by aircraft
(3) Death or disappearance of any person on board
(4) Collision with other aircraft
(5) Other accidents: Major damage to aircraft in operation

Article 76-2: The PIC shall, when he has recognized during flight that there was the danger of collision or near-midair collision with another aircraft, or in the event of serious incidents, report to the Minister.

These accidents & serious incidents are investigated by Aircraft and Railway Accidents Investigation Commission and the investigation reports are available to public by their website;
http://www.mlit.go.jp/araic/index.html
Also these accidents and serious incidents are reported to ICAO ADREP system for the worldwide exchange of information.

2) Information collected by Airport Office
   (Not mandatory for Operator)
Flight Irregularities
・ Flight irregularity is an operation which categorized as follows;
  -Changing destination after take-off
  -Diversion to the origin airport
  -Requesting ATC priority
  -Contacting with other aircraft or object
  -Operations which needs close of runway
Flight irregularities are available to public through Civil Aviation Bureau website;
http://www.mlit.go.jp/koku/cabsafe/irregular.htm

3) Information reported by operator
   (Maintenance)
-Faults, Malfunctions and Defects on Aircraft
(This item is described in the next chapter.)

5 Exchange of Safety Information

1) ATMS (Aircraft Trouble-report Management System)
So-called data exchange system among member airlines was first introduced in Japan when ATMS started its operation in 1992. This system is a kind of mandatory incident reporting system operated by ATEC and has currently 10 member airlines and accumulated more than 14,000 data.
This program is based on a circular No.6-001 issued by Airworthiness Division of JCAB and to comply with ICAO Annex 8 Part Ⅱ, paragraph 4.2.5.

Paragraph 4.2.5 states " The state of registry shall ensure that in respect of aircraft of over 5700kg maximum certificated take-off mass, there exists a system whereby information on faults, malfunctions, defects and other occurrences which cause or might cause adverse effects on the continuing airworthiness of the aircraft is transmitted to the organization responsible for the type design of that aircraft."

In 2003, around 1500 discrepancies were reported to JCAB through ATEC server by Japanese airlines and the data are shared among member airlines. ATEC issues a statistical analysis report in its annual report for dissemination to aviation related communities. These statistics include classification of discrepancy reports by;

- Specified categories (Fire, In Flight Shut Down, Door Warning, etc)
- Parts of airplane (Structure, Engine, Electrical, etc)
- Flight Irregularities (Air Turn Back, RTO, Diversion, etc)
- Phase of the occurrence (In operation, In line maintenance, etc)
- ATA Specification Number

The system has a capability to make statistical analysis of the date stored. For example, Fig.7 shows the number of flight irregularities like air turn back, rejected take off, diversions reported during year 1999 through 2003.

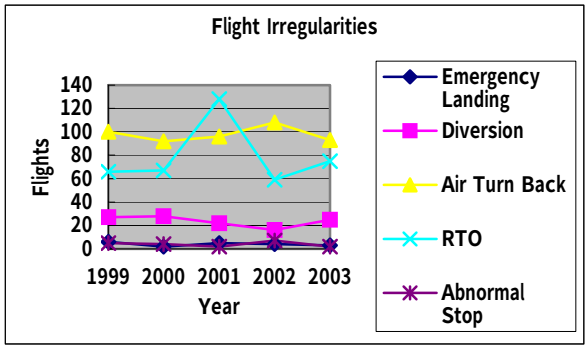

Fig.7 Flight Irregularities

Rejected Take Off occurred 395 cases in these 5 years.

Fig.8 shows the classification by causes of these Rejected Take Offs. Classification is made actually by ATA specification but for the reader's convenience the charts below shows by typical causes.

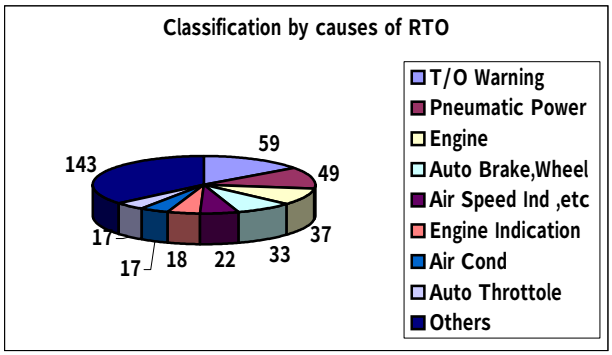

Fig.8 Classification of RTO by causes

2) ASI-NET

As a voluntary incident reporting system, ASI-NET (Aviation Safety Information-Network) started its operation in late 1999 and has currently 17 member airlines. [11]

The system collects voluntary information submitted by member airlines. Fig.9 shows the number of voluntary information together with the number of human factors related Captain reports submitted to the system for sharing with other airline members.[12]

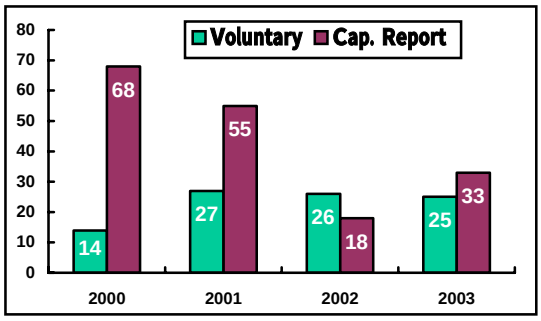

Fig. 9 Number of Voluntary Information

The number of reports seems very few compared to well-established systems like ASRS (Aviation Safety Reporting System) or CHIRP (UK confidential reporting program). ASRS collects more than 30 thousand reports a year and CHIRP collects about 360 reports a year.

Making safety recommendations based on the findings from collected information, to the parties concerned is one of the objectives of ASI-NET.

First safety recommendation was issued to airlines and JCAB in July, 2001, which promotes positive exchange of turbulence information between pilots and ATC controllers.

Second safety recommendation was issued to JCAB in June, 2003 on the reduction of TCAS RA between VFR and aircraft in terminal area.[13]

3) Japan Confidential Aviation Incident Report System (JCAIR) by ATC

New confidential incident reporting system by ATC started its trial operation in November 2003 and analysis of the data collected and dissemination of safety information is planned in 2004.

Original system began its operation in 1980 and the system was redesigned by the recommendation of ARAIC on the accident of JAL Flight 907 in 2002 to enhance the safety reporting function and to utilize TCAS RA reporting system.

4) Small aircraft version of ASI-NET

As Figure 4 shows, number of accidents of small aircraft in Japan has not decreased in these 10 years and occupies large portion of total number of accidents in Japan. So, small aircraft version of ASI-NET was established and just started its operation in April 2004. Contribution to aviation safety is expected.

6. Areas to be improved in the light of new ICAO Annex13

Accidents and serious incidents are thoroughly reviewed in Japan by ARAIC and from these investigations a great deal is learned about systematic deficiencies and contributions to future accident prevention are great.

However, fortunately accidents and serious incidents are rare events and for more proactive accident prevention, we need to have incidents reporting as the rate of occurrence of incidents is significantly greater than the accident rate for comparable types of occurrence and many hazards exist long before an actual occurrence.

New ICAO Annex 13 requires [14]:

> That States establish **a mandatory incident reporting system** to facilitate collection of information on actual or potential safety deficiencies. In addition States are encouraged to establish **a voluntary reporting program** adjusting their laws, regulations and policies so that the voluntary program:
>
> a) Facilitates the collection of information that may not be captured by a mandatory incident reporting system
> b) Is **non-punitive**
> c) Affords protection to the source of the information

As explained in a previous page, Japan has already:

1) Mandatory incident reporting system
   - Accidents
   - Serious Incidents
   - ATMS
   - Flight irregularities
2) Voluntary incident reporting system
   - ASI-NET
   - JCAIR

The reports are de-identified and non-punitive policy was issued by JCAB.

Annex13 also requires;

> That States establish **an accident and incident database** to facilitate the effective analysis of safety information, including that from its incident reporting systems. The database systems should use **standardized formats** to facilitate data exchange, and States are encouraged to foster regional arrangements, as appropriate.

Japanese systems are operated separately, and so they don't use standardized formats. Integration of systems is necessary like ECCAIRS in EU to facilitate the effective analysis of safety information.[15]

Annex13 also requires;

> Recognizing the linkages between accident prevention and sound safety analysis, ICAO promotes accident prevention by **the analysis of accident and incident data** and by the prompt exchange of safety information. Having established an accident and incident database and an incident reporting systems, States are required to **analyze** the information contained in their accident/incident reports and their database to determine any **preventive actions** required. ICAO also recognizes the value of safety studies in recommending needed changes for accident prevention.

Preventing accidents requires the initial hazard identification, followed by the collaborate effort of risk management [16]. This function seems to be lacking in Japanese incident reporting systems. Almost no risk analysis is made after collecting safety data. During the risk assessment phase, the data are analyzed, the probability and severity of risks evaluated, and the degree of acceptability of the risks determined. To perform this kind of assessment, there need to be a group of specialists assigned in Japan as in the United States or Europe. [17]

Annex13 also requires;

> ICAO places particular attention on **the exchange of safety information** in the interests of accident prevention. States that have identified safety matters from their database considered to be of interest to other States should forward that information to them as quickly as possible. Further more, States are encouraged to promote the establishment of **safety information networks among all users of the aviation systems and should facilitate the free exchange of information on actual and potential safety deficiencies.**

This part is put into the Annex as the result of GAIN efforts. The objective of GAIN activities is written here. Japanese committee on GAIN is also promoting this concept.

7. Impediments against information collection

Properly collected and analyzed, safety information can be powerful safety tool. However, it can cause harm if used improperly. Four areas in which the information can be misused are [18];

a) Job sanctions by employers and / or enforcement action by government regulators based upon this information
b) Public disclosure of the information
c) Criminal sanctions based upon the information
d) Misuse of the information in civil litigation

And these areas are considered as impediments against information collection.

Regarding voluntary safety reporting or flight data monitoring, there seems to be no job sanctions in Japan. This is because airline managements understand the importance of safety reporting to prevent accidents. In their Operations Manual, non-punitive policy is stated clearly.

Also enforcement action by government regulators based on the information reported is not a problem in Japan. ASI-NET data are de-identified and government officials can not access the data. In addition, a policy statement by Director General-Engineering Department of JCAB was issued in June, 2003 to clarify their intention not to use such data for enforcement action.

Criminal sanctions based upon the information may be the biggest concern for Japanese Pilots and this is the reason why reports are so few. Police investigation sometimes begins in parallel with accident investigation. And although the purpose of accident investigation is clearly stated as accident prevention, the results of accident investigation can be reached freely by anybody including police and are sometimes used for criminalization in Japan. This culture in Japan that criminalization is considered to be effective

for preventing accident reoccurrence seems to prevent free flow of safety information collection.

Like many other countries, criminal law and practice sometimes overrides air safety and International Treaty obligations, in this case the International Civil Aviation Organization.

We think that safety culture, which is well balanced between

Compensation for victims of accidents
and
Protection of professionals involved in accidents except in case of gross negligence and willful misconduct

is necessary to root in Japan.

In Japan there is a maxim to say, ”*korobanu saki no tsue”*, which means a stick for precaution before you tumble. This represents that a good proactive culture exists in Japan, so Japan used to be called ”the safest country”. We need to keep this culture and to be proactive to prevent accidents.

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