

and for which some determination of the compatibility issue can be made. The decision can be made in any of a number of ways, including:

- experience,
- data from data banks,
- cost information,
- standards and criteria,
- forecasts,
- analytical techniques, and
- other.

A second group of interactions is simultaneously formed which consists of two major elements: first, those interactions for which data may exist, but for which only the gathering of these data is needed to reach a conclusion; and second, those interactions for which there is not sufficient information available to draw any conclusions.

The method then proceeds as follows:

1. Evaluate all of the interactions for which the influence is known. If the issue can be satisfactorily handled, continue to step 2. If not, draw whatever conclusions that are estimated, make recommendations, and communicate the results to all interested parties.
2. Identify and collect any data needed for those interactions identified as important, and for which only a lack of known data prevents a decision from being drawn. If the issue can then be satisfactorily handled, continue to step 3. If not, draw any conclusions that are possible, make recommendations, and communicate the results to all interested parties.
3. Conduct any research that is needed to allow a resolution of the issue. After the research has been conducted, provide the channels necessary to transfer the results to the accepted body of knowledge so that the interaction can be added to those that are known. Execute step 1 for this interaction. Continue this process until all unknown interactions have been moved into the known area, or until all interactions of primary importance have been exhausted.
4. Make conclusions, recommendations, and communicate the results to all interested parties.

It should be noted that in any real problem the analyst must stop at some point, exhausting the resources of either time or money in the study of the issue at hand. It is thus vital at the start of this process to include an interdisciplinary team to reduce the number of interactions that must be examined to a manageable number. As the methodology is used over time, more and more of the unknown interactions will become quantified, and through the use of modern digital computer techniques, automation will speed the process enormously.

To accomplish this process requires the ability to reference many types of data. Obviously, data on aircraft characteristics and operating scenarios are needed. Data on airport characteristics, air traffic control procedures, and individual community characteristics are also needed. The amount of data desirable is very large and beyond the ability to handle without resorting to automation. Some of these data already exist, while some are not available in any convenient accessible form. It will require a long time to acquire all of the data banks needed, but that task must be begun. In fact, at the present time there is no centrally located

facility through which one can get a comprehensive bibliography of all of the relevant information on any of the aircraft/airport compatibility issues. One of the findings of this Working Group is that the interdisciplinary nature of the problem makes the data far flung and not easily identifiable nor locatable. A centralized library source must be found.

Recommendations

The Working Group made several recommendations to provide guidance for the TRB Committee on Aircraft/Airport Compatibility. Each of these recommendations fills a need in terms of the methodology adopted by the Working Group as a model for solving current and future compatibility problems. Where possible, the Working Group has suggested who the sponsor should be, the time period involved, and a priority ranking.

1. Establish Bibliography

- Identify existing data sources, and
- Develop and maintain a comprehensive bibliography on:
 - Aircraft characteristics
 - Airport standards
 - Trends
 - Research results
 - Regulations
 - Papers
 - Etc.

Sponsor: Organization similar to the Air Transportation Research Information Service or by contract

Time period: One year minimum, probably longer

Priority: High

2. Generate Interactions List (or Matrix)

- Establish interdisciplinary team to generate interactions and determine severity level of each.

Sponsor: TRB Committee A3A16 Members

Time period: Establish Group - January 1982
Complete Task - January 1983

Priority: Moderate

3. Additional Data

- Identify need for additional data
- Generate data as needed

Sponsor: TRB Committee A3A16

Identification: by contract

Data collection: Industry/Government

Time period: Complete identification - must be coordinated with #1.

Priority: Moderate.

Group 2 - AIRCRAFT/AIRPORT COMPATIBILITY PROBLEMS AND SOLUTIONS: 1981-1990

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Introduction

The goal of the Working Group was to identify problems relating to aircraft and airport compatibility during the period from 1981 to 1990. Further, the group was to identify relevant issues and research and development programs essential for solving the problems identified.

Procedure

The members of the group separately identified potential problems of aircraft/airport compatibility for the time frame of concern. These were then shared within the group. Eliminating duplicates and combining related problems lead to the formation of a definitive list of 19 problems. This list was then prioritized by having each member select the five problems which in his opinion were of the highest priority, assigning 5 points to the first, 4 points to the second, etc. The scores of the twelve members were then combined, and the 19 problems were then ranked in accordance with the total score assigned by the group. Table 1 lists the problems in priority order with the combined scores included.

Time did not permit an in-depth examination of all of the 19 problems, and accordingly, the first six problems, representing about 73 percent of the total score, were discussed in more detail. This is not to imply that the remaining thirteen problems are not significant; indeed, they could be of serious concern to airports and airlines.

Results

The following is the consensus of the group concerning the first six problems listed in Table 1.

1. Problems associated with the introduction of new and recent aircraft into the airline system.

The issue is that the compatibility of aircraft and airports is not yet accurately and scientifically defined. When land becomes scarce, relatively simple solutions tend to disappear, and it becomes more critical to establish scientific approaches relating such things as wing span, fuselage length, tail height, aircraft operational characteristics, etc. with runway/taxiway clearances, runway/runway clearances, taxiway/taxiway clearances, etc.

Support is recommended for a research and development program to obtain the techniques, criteria, and data bases needed to relate aircraft physical and operating characteristics with airport airside geometrics. This is a large undertaking which will probably require the combined support both of industry and government.

The general discussion indicated that very few new airports will be developed and that

Table 1. Problems in Aircraft and Airport Compatibility - 1981 to 1990.

Rank	Problem	Score
1.	Impact of recent and new aircraft	34
2.	Noise impact reduction	31
3.	Pavement design and maintenance	24
4.	Air carrier/commuter/general aviation integration	19
5.	Integration of CTOL/STOL/VTOL	12
6.	Systems approach to increase reliability of airport lighting and navigational aids	11
7.	Define compatibility	7
8.	Legal and regulatory environmental constraints	7
9.	Forecasting aviation demand under changing conditions	7
10.	International facilitation	6
11.	Problems of joint use airports	4
12.	Continuation of surge loading problem	4
13.	Ground access	4
14.	Passenger service improvement and reliability	3
15.	Greater efforts in F & E programs	3
16.	More carry-on baggage space	2
17.	Inadequate funding of STOL research in U.S.	1
18.	Unloading of cargo at passenger terminals	1
19.	Impact of multiple fuels	0

expanding most existing airports will be very difficult if not impossible. Thus, the problem is most significant and of high priority.

2. Problems associated with noise impact reduction.

It is recognized that significant reductions of noise impact by improvements in the aircraft, by changes in operational procedures, and by land use changes will become increasingly difficult in the future. Thus, the issue that evolved from an extensive discussion was that the problem was becoming less technical in nature and was becoming more and more a problem of public relations or community relations, where human factors and psychology become more dominant in achieving proper solutions.

The group could not reach agreement that improved measurement of noise impact was required. Some felt that existing procedures were adequate. However, the group was of the opinion that the problem remains a very important one and that more time than was available during this workshop was required to establish a proper research and development program. It is therefore recommended that a sub-committee of the TRB Aircraft/Airport Compatibility Committee be established to pursue this issue.

3. Problems associated with pavement design and maintenance.

The group recognized a need for pavements design with full consideration for life cycle costs and the impact on operations of shutdowns caused by pavement failures and rebuilding. Increased priority should be given to the funding of research and development to study:

- a. The history of airport pavements from design to the present with details of their environmental and operational exposure, and the history of their condition and repair over their lifetime.
 - b. The use of overall weight of the aircraft as well as its gear and wheel loads in pavement design criteria, as some are now doing in Europe. Part of the concern is with the pavement subgrade.
 - c. The interaction of the pavement and the aircraft as a result of pavement roughness.
 - d. Roll over load stresses in comparison to static load stresses where pavement discontinuities exist.
 - e. Load transfer between pavement slabs.
4. Problems associated with the integration of air carrier/commuter/general aviation into an airport and its local airspace.

The group recognized a concern for the effects of mixing various aircraft types and services upon safety, airport systems capacity, passenger convenience, interlining, cost, terminal space, etc. A number of possibilities were discussed as appropriate for further consideration of this problem; among them are:

- a. The construction of special facilities on air carrier airports for commuters and general aviation.
- b. The promotion of intersection take-offs for small aircraft.
- c. The construction of runway turn-offs suitable for small aircraft.
- d. Where possible, commuters should be permitted to operate to and from main terminals; where not possible, convenient ground transportation should be provided to the main terminals.
- e. The promotion of the preservation and improvement of small airports (relievers), both private and public, and the encouragement of their use by general aviation.

The group proposes studies to determine the location of commuter and general aviation facilities on air carrier airports so as not to impact seriously on air carrier operations, but at the same time to enhance passenger convenience. Studies are also proposed concerning the advantages of introducing by-pass taxiways for departing aircraft which are delayed by enroute or destination problems, and additional pavements for arriving aircraft which are delayed by the lack of available gates.

5. Problems associated with the integration of CTOL/STOL/VTOL aircraft into an airport and its local airspace.

A major concern was expressed for safety and efficiency in mixing these types of aircraft, and the following problem areas were considered as appropriate for further study:

- a. The use of separate airspace to increase system capacity in recognition of the different aircraft characteristics.
- b. An apparent lack of familiarity in handling STOL and VTOL aircraft and the need to train controllers to recognize and handle the differences.
- c. The difficulty of building and maintaining heliports in major urban areas because of land use and associated high value of the land.

The FAA Helicopter Research Program Plan was an important effort toward resolving these problem areas.

6. Problems associated with the reliability of airport lighting and navigational aids.

A concern was expressed for the effects of the failure of visual and navigational aids at airports. Primary concern is with safety. In addition, such failures can not only shut down runways, and thereby affect the capacity of discrete airports, but they can thereby affect capacity of major portions of the entire aviation system as well. A number of thoughts were expressed relating to the possibility of increasing the reliability of such systems. These were the redundancy of components and systems; interleaving of circuits; back-up regulators; solid state equipment; stand-by equipment; and the development of navigational aids which are easier to site, resulting in minimum restricted areas, unaffected by large aircraft, and having minimized reflections from structures, etc.

It is proposed that a research and development program be funded to address this problem and its potential solutions.

General Observations

This group recommends that the TRB Aircraft/Airport Compatibility Committee closely follow the FAA research and development efforts in order to be prepared to comment on the program design and draft reports if requested to do so.

The importance of allocating a fair share of the research and development budget to airport related improvements is emphasized.

Indirect operating costs in airline operations are now about equal to direct operating costs. Thus, it is suggested that a study is needed to examine means for reducing and controlling the indirect operating costs.

Problems in Methodology (referred to Group 1)

1. The development of a universal runway friction measuring system that does not interfere with flight operations.
2. The development of a usable standard for evaluating helicopter noise.

Institutional Issues (referred to Group 5)

1. Streamline project procedural steps from concept to completion.
2. Concern over any possibility of the transfer of regulations and standards from the federal level to the separate states.
3. The implications of deregulation on U.S. relations with ICAO and foreign nations and operators, especially concern over the possibility of 50 Departments of Transportation having separate sets of regulations and standards.
4. Concern for consistent interpretation of regulations by and within federal agencies.
5. The lack of a single international forum for the exchange and sharing of R & D results.
6. Problems of joint use of airports by military and civilian occupants.