REPORT OF THE FINDINGS OF THE WORKING GROUPS

This section presents the reports made by each of the working groups at the conclusion of the workshop. However before doing so, it may be advantageous to record the lists of tasks presented to each group prior to the meeting.

Group 1

1. Identify for use by the other groups all the categories of problems which can exist in compatibility between civil aircraft and the airport and its environs.
2. For each problem category, identify and assess as to adequacy, the methods and units of measure used to define compatibility.
3. Describe and assess existing and candidate techniques (including the kind and extent of data required as input) for identifying and analyzing potential problems in aircraft and airport compatibility.
4. Assess the need for a data bank for compatibility analysis, and if needed, outline recommendations regarding its scope, and how best to obtain, document and disseminate such data, plus identification of candidate organizations and sources of funds for data bank implementation and update.
5. Identify any critical technology needs associated with items 1-3 above, and where indicated, develop recommendations for specific research including a descriptive outline, estimated magnitude of resources involved, and time frame of activity.
6. Recommend future activities for the TRB Committee on Aircraft/Airport Compatibility in the area of methodology for identifying and addressing the problems of compatibility.

Groups 2, 3, and 4

1. Identify for Group 1 one or more compatibility problems foreseen in the decade being addressed by your group wherein present methods for defining compatibility are less than adequate.
2. Identify for Group 5 consideration, any particularly sticky institutional issue foreseen as hindering the implementation of candidate solutions to one or more of the significant compatibility problems of the decade being addressed by your group.
3. Describe and rank in importance the significant compatibility problems foreseen as likely to occur in the decade being addressed. For each problem, identify the fundamental issue or issues (e.g., land use, environment, economics) which makes it a problem.
4. For each of the significant problems, identify alternate candidate solutions and evaluate them from technical, economic and institutional considerations, insofar as possible in the time available.
5. Identify any new technology needed for the candidate solutions and assess the adequacy of R&D effort underway to provide the technology in a timely fashion. If there are glaring deficiencies, develop recommendations for specific new research including the descriptive outline and estimated magnitudes of resources required.
6. Recommend future activities for TRB Committee A3A16 in the area of compatibility problems and solutions.

Group 5

1. Identify, by analysis of several past histories, the major institutional issues that slowed or even halted the execution of various measures aimed at improving or fully achieving aircraft and airport compatibility in specific problem areas.
2. Identify, by case history analysis similar to (1), the various approaches or strategies used in the past that successfully coped with institutional issues which were present or arose during execution and successful completion of measures which enhanced compatibility.
3. Identify, including inputs for Groups 2, 3, and 4, institutional issues foreseen as possibly hindering implementation of various candidate solutions to present and future compatibility problems.
4. Develop strategies, based on the results of (1) and (2), deemed best for coping with the various institutional issues identified in (3), insofar as possible in the time available.
5. Identify any study or analysis efforts that appear warranted for improving the methodology for coping with institutional issues. Include descriptive outlines and estimates of the resources needed.
6. Recommend future activities for TRB Committee A3A16 in the area of coping with institutional issues.

Group 1 - METHODOLOGY FOR STIMULATING AIRPORT COMPATIBILITY

Participants

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Introduction

In examining the question of a methodology for stimulating aircraft/airport compatibility, the Working Group felt that it was necessary to start with a scoping of the group assignment. In general, it was felt that the issues to be addressed included:

- Approaches to problem solving
- Description of problem
- Tools available
- Sources of data
- Subsequent follow-up action.

A portion of the time was spent discussing typical problems, and defining the characteristics of the aircraft/airport type of problem. This enabled the group members to agree upon a general scope for deliberation. It is clear that in the

craft/airport arena there is a lengthy list of oblems or problem areas that one can study in pth. These range from a systematic approach to etermining runway friction without interfering ith aircraft operations, to developing a method for accurately accounting for the impact of a proposed change to an aircraft on the indirect operating costs (IOC) of a user airline. It became apparent that using a specific problem area to develop a methodology for attacking that problem and others would result in a solution plan which would be very difficult or impossible to follow in such a broad field containing such a plethora of problems. Thus, the group agreed that a more useful approach in the time available would be to look at the problems from a much broader perspective. The goal adopted was to develop a methodology outline which would allow solution to most of the problems currently existing, and also provide a framework for isolating and evaluating other issues of concern in the future.

Conclusions

Before discussing the group's findings and recommendations, it is useful to enumerate some of the conclusions reached.

- A useful methodology has been outlined.
- Resolution of most problems requires a major interdisciplinary effort.
- There is no cohesive library of relevant documents to support the methodology.
- There are voids in the available data.
- The complexity and extent of the information needed for analysis suggests automated data processing techniques.

In the following sections, each of these areas will be discussed, followed by the recommendations of the group.

Methodology and Its Implementation

In discussing a methodology, the group came quickly to a consensus that the approach to the problem was not unique. Thus, the skeleton of a workable method was arrived at without any appreciable discussion. Most of the deliberations centered on shaping the generally agreed upon method into a framework for the aircraft/airport compatibility problems. The problems were viewed as having four major subelements, each having numerous subdivisions:

Aircraft
Airports
Airspace
Community

Although not meant to be all inclusive, each of these areas can be thought of as being subdivided into major elements as follows:

Aircraft
- Geometry
- Operating Characteristics
- Weight
- Propulsion System
- Avionics
- Service Requirements
- Aerodynamic Systems
- Environmental Characteristics (e.g. noise, pollution, blast, etc.)

Airports
- Layout (e.g. runways, taxiways, etc.)
- Setting (e.g. site, surroundings, access, etc.)
- Terminal Facilities (e.g. apron, gates, etc.)
- Service Facilities
- Navigational Aids (i.e. visual and electric landing aids)
- Environmental Controls
- Crash-Fire-Rescue
- Management

Airspace
- Navigation Facilities (e.g. ILS, MLS, etc.)
- ATC Procedures (e.g. metering, spacing, patterns, noise abatement, etc.)
- Obstacles
- Restrictions

Community
- Geometry (e.g. street layout, rivers, etc.)
- Demographics
- Obstacles
- Political Environment (e.g. curfews, noise, etc.)
- Planning (e.g. land use, zoning, etc.)

In discussing each of these areas it is important to note first, that these lists are not all inclusive, nor are they mutually exclusive. It is apparent that drawing sharp dividing lines between all of the divisions and elements is not possible. The items listed are given for reference only and a complete list for each category will have to be developed with much more extensive study than is possible at this workshop. Another important note is that the elements given must be broken down into many subdivisions, reflecting the component levels for each element. For example, within the category aircraft, and element, geometry, the subdivision into wing, body, tail, etc. must first be made, and then these further subdivided into span, chord, length, etc. When completed, a thorough taxonomy of all elements which enter the aircraft/airport compatibility problem will be available for analysts.

To describe the methodology briefly, an aircraft/airport compatibility issue drives the system. The first step is to take the issue at hand (e.g. to determine the effect of an increase in span on the ability to use the new vehicle in the current operating system, to analyze the optimum number of wheels for a new landing gear design, to determine the cost trade-off of an aircraft versus an airport modification to accomplish the same end, etc.), and scope it -- vis-a-vis the objective, the constraints, the environment, the user of the result, etc. Next, all of the interactions between each element in each category must be determined. It is anticipated that rather large and extensive interaction matrices will have to be developed to indicate all of the possible interactions both within each category (self interaction) and across categories (mutual interaction). Much of this work has been done, through the efforts at each of the major airframe manufacturers, who have been studying this problem for many years, and through the research being done at the University of Virginia. When all the interactions have been determined, they must be filtered or edited to eliminate any of the interactions that are either of secondary importance or in which the analyst has no interest. Each of the interactions which survive this screening process can then be divided into two groups. The first group contains those interactions for which the influence is known

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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