systems seem less than reliable or are very uneconomical. The feeling was that vortex solutions probably lie in aircraft design, but this will not result in operational vehicles until the late 1990's.

Recommendations

As a result of the discussions summarized in the preceeding section, the group agreed upon recommendations for research and development activity or other actions currently needed in most of the areas. These are listed below in no particular order of priority.

Aviation System Concept
Develop system concept model to examine aircraft mix, routes, ATC concepts, navigation systems, airport activity (both volume and type).

ATC Procedures
Conduct major review of NAS and TERPS procedures to improve capacity by rapid use of new technology.

Develop aircraft flow management criteria for implementation of an automated system using 4-D navigation.

Approach Guidance
Speed up implementation of MLS technology at airports to allow an increase in capacity with improved safety and reduced noise.

Airport Design Standards
Update design standards or guidelines to improve airport safety while allowing operation of aircraft with increased gross weight, wing span, and fuselage size/length.

Noise
Develop new aircraft/airport noise standards for 1990 and the technology to achieve these standards, giving attention to areas such as:

- source reduction
- operational procedures
- land use planning
- approach fan noise
- aerodynamic noise
- auxiliary power unit noise.

Pavement
Develop technology to increase pavement lifetime, surface durability, and provide better surface roughness characteristics.

Develop new de-icing technology which avoids the great problems inherent in the current method of using salt.

Aircraft Control
Provide operational and certification criteria to use integrated flight and propulsion controls to allow 4-D flight path control.

Aircraft Certification
Improved techniques are required to permit rapid introduction of new concepts and methods in the design and operation of new and retrofitted aircraft of all sizes and types.

Airport Ground Guidance
An improved system for the guidance and control of aircraft on airport surfaces is required.

Airport Capacity - Wake Vortices
Develop technology to prevent/reduce the formation of wake vorticies.

Develop an operationally feasible system to locate the wake vortex pattern near airports.

Develop operational techniques to reduce effects of wake vorticies on aircraft.

Group 4 - AIRCRAFT/AIRPORT COMPATIBILITY PROBLEMS AND SOLUTIONS: 2001-2010.

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Scenario for the Time Frame 2001-2010

It became apparent early in the discussion that the group needed to concern itself first with a future scenario and associated fundamental assumptions. The feeling was that this was a necessary step to take before any part of the group assignment could be successfully addressed. As it turned out, much time was spent on scoping this task. There was concern among some that it was necessary to look beyond current compatibility problems. The consensus was that a realistic future view must include solutions to today's problems.

However, structuring and setting a futures scenario would have to be made in light of some basic assumptions. It was agreed by all that days could be spent developing a variety of scenarios which might include the necessary numbers needed to identify detailed problems and solutions. Therefore, it was agreed that a more broad, simplistic approach was necessary. This approach would include the following assumptions.

First, that Group 2 and 3 (1981-1990, 1991-2000 time frames) will insure that the air transportation system survives the major transitory changes brought about by:

- Deregulation
- Economic fluctuations
- Defederalization
- ATC rebuilding
- Energy short-falls

Second, the future view must reflect an evolutionary process versus a revolutionary process. To clarify this point it was suggested that a revolutionary process be defined as being similar to that which occurred when the piston-props were phased out and the jet transports were phased in during the 1960's. It was generally agreed that an evolutionary process is much more likely to occur to the year 2010 than a revolutionary one.

Figure 1. Preferred air transportation system - Years 2001-2010.

PREFERRED AIR TRANSPORTATION SYSTEM

Years 2001 - 2010

Scenario		
	'Socio-Econ.	Slow, but steady standard of living growth
	'Demand	Accept a 4-fold increase by 2010
	'Aircraft	Accept aircraft from small GA to largest transports
	'Airport	Pretty much in place, plus new relievers
	'ATC	More automated, flexible, safer
	'Environment	Noise - still a problem but better Emissions - under control
	'Energy	Avialable without any significant quantum jumps

Essentially unconstrained traffic growth

From these discussions the structure of the future scenario was developed. Seven characteristics were chosen to describe the 2001-2010 scenario. These are given along with their respective descriptors in Figure 1. It is interesting to note that the final group scenario reflected a "preferred" air transportation system by 2010 which in turn reflected a modest but steady growth in the standard of living and energy availability without any significant quantitative jumps. It was hard to determine if this reflected the group's optimism or pessimism about the future.

Institutional Issues

Since Groups 1 and 5 needed an early input, consideration of methodology and institutional issues were addressed next. Actually, the sequence of activity here became beneficial to the group because in the scenario dialogue process, a number of concerns were expressed by the participants which led to an interesting discussion about institutional issues. An underlying feeling within the group was that in order for the preferred scenario to become more probable, there is a need to remove a number of institutional constraints. One central need is that long-range planning must be conducted in an environment that is free from the 2-4 year political change in direction. Considerable concern was expressed at this point that without long-range planning and funding, the current defederalization of major airports, for instance, may have a negative impact on both compatibility problems and their solutions by 2010. There was general agreement that there will likely be a need to have some organization, perhaps quasi-public or a free enterprise corporation, with the responsibility, authority and funding for long-range air transportation planning, coordination and implementation. This would include funding for airports as well as airways facilities development. In addition, concern was expressed over union acceptance of high technology automation. This automation is very likely to be both in ATC and cockpit by 2001. Thus, the overall concern is that a number of public and private institutional issues must be addressed in the near future because these issues will impact our ability to cope with and solve many third decade compatibility problems.

Methodology

Methodology issues developed along three lines. First, there is a need for better analysis methodology. In addition, there is a need for a standard accounting system to measure the impact of aircraft design on airport costs and airport design on aircraft costs. Second, a concern was expressed about the continuation of airline data collection for compenhensive system tradeoff analysis after CAB sunset. There is evidence that good methodology is forthcoming but without a continuation of consistant information; obtaining the required input data may be extremely difficult -- particularly for long-range analysis. Third, there was a concern that airport/aircraft methodology, usage and interpretation required experienced personnel and expertise across broad disciplines. What are these required levels of sophistication and knowledge and what disciplines?

Discussion

Using the previous material as background, the challenge was to expand on some of the necessary conditions required at the aircraft/airport interface to meet the agreed upon scenario. A number of key relationships and associated impacts were identified. With four-fold increase in air service demand likely by 2010 and with the airport system being pretty much in place, it became apparent to the group that many more major airports will become congested, even given that there will be capacity "fixes" during the first and second decades. In addition to the projected larger aircraft in the system by that time, the growth in commuter traffic, RTOL, VTOL and general aviation aircraft will require a significantly better airways and airport system by 2010. Thus, the group identified, after some lengthy but informative discussion, four necessary conditions for the 2001-2010 time frame. First, maximum utilization of the airspace is essential. If the traffic flow system between the airports cannot handle the expected volume then the congestion problem at the airports is not likely to happen. Neither will supply meet demand at a desired point. Second, maximum utilizaiton of existing airports is essential. Airport capacity must be balanced with the more automated, flexible airways system of the future. Third, there must be an increase in the development and utilization of additional airports, particularly reliever airports. And fourth, ground side passenger handling and access systems must be of significantly greater capacity: particularly surface transportation.

Since the group was primarily interested in the airport/aircraft interface, much discussion was centered around identifying some key elements necessary to achieve maximum utilization of existing airports. Through these discussions seven elements were identified:

- Minimum separation of arrivals
- Optimum runway and taxiway configuration

- Maximum gate utilization
- Coordinated servicing of aircraft
- Streamlined passenger/baggage handling
- Standardized and updated airport emergency procedure, standards and equipment
- Environmental compatibility solutions

These have been summarized in Figures 2 through 5 and are stated as objectives with their associated research and development activities.

Figure 2. Minimum separation of arrivals and departures.

MINIMUM SEPARATION OF ARRIVALS AND DEPARTURES

OBJECTIVE	R & D
-Wake Vortex Solutions	-Alleviation - Aircraft Design Methods (NASA/FAA/Industry)
	-Avoidance - Operational Solutions (FAA/NASA/Industry) -Sensors -Flight path profiles & tracks -Ground Alleviation methods
-Improved Cockpit Displays	-CDTI, DABS, TCAS, Printout in the cockpit Human Factors, Communication (FAA/NASA/Industry)
-Accurate, Timely Weather Information	-Enroute & terminal area, along flight paths, in aircraft and on the ground
-Improved Navigations & Guidance	-MLS, IFR procedures for various A/C types and technology levels

Figure 3. Optimized runway and taxiway configuration.

OPTIMIZED RUNWAY AND TAXIWAY CONFIGURATIONS

OBJECTIVE	R & D
-Improved runway and taxiway layouts	-Traffic simulation of alternative HUB airport configurations
-Separate runways for GA and Commuters	-Configuration studies, procedure development, simulations, cost/benefit studies

STANDARDIZED AIRPORT EMERGENCY PROCEDURES, STANDARDS, AND EQUIPMENT

-Develop crash fire & rescue procedures, standards, and equipment for projected requirements.	-Studies of equipment requirements for various A/C accident situations. Size of operation.

Figure 4. Maximum gate utilization.

MAXIMUM GATE UTILIZATION

OBJECTIVES	R & D
-Sharing of airline gates	-Feasibility studies of alternative passenger loading and unloading systems
-Use of transportation vehicles from a/c to terminal	-Studies of multi-layer terminal operations. Arrivals on one level departures on the other

COORDINATED SERVICING OF AIRCRAFT

-Centralization of a/c servicing equipment and personnel	-Standardization studies of a/c servicing requirements

STREAMLINED PASSENGER HANDLING

-Consistent passenger check-in procedures	-Standardization studies of passenger check-in requirements
-Off-site check-in	-Automation methods

Figure 5. Environmental compatibility solutions.

ENVIRONMENTAL COMPATIBILITY SOLUTIONS

OBJECTIVE	R & D
-Land use planning	-Investigate conversion methods and insulated structures
-Retirement of old, noisy 727's, DC 9's, 737's	-Develop alternative incentives, noise tax in landing fees, etc.
-Quieter operational procedures	-Develop technizues to encourage the use of decel approaches and high glide scopes

General Comments

It can be seen that a number of pressing research and development activities were identified by the group. Many of these recommendations require the cooperative efforts of many organizations, associations and agencies, as well as industry participation. This being the case, the group recommended that TRB Committee A3A16 take the initiative to transmit these research recommendations and others developed at the workshop to the various organizations that are active in this field.

As an example it was suggested that it would be essential to have in place by the year 2000 the necessary standards, operating procedures and facilities to accommodate aircraft at present and projected congested hub airports at a level to meet demand. Specifically, the following items should receive high priority:

Independent IFR landing systems and procedures to:
a. Reduce centerline parallel runways (4300')
b. Separate short runways for GA/Commuters
c. Converging runways
d. Triple runways
e. Closely spaced parallels (to 1000')
f. Other strategies including staggered thresholds and variable glide slopes to 6°.

Also enroute and terminal area automation should be pursued as quickly as possible so that significant aircraft and airspace system productivity gains can be realized by the third decade, if not sooner. And finally, an overall system such as an Integrated Flow Management System should be implemented as quickly as is feasible at the national, enroute and terminal levels.

The workshop group concluded its deliberation with the overwhelming concern that much work is required to meet the challenges of the 2000's. Much will depend on what we do in the last two decades of the 1900's. The key will be careful, but innovative planning, reduction of instutional constraints, rapid integration of high technology and a "can do" attitude on the part of everyone in the air transportation business.

Group 5 - INSTITUTIONAL ISSUES IMPACTING AIRCRAFT/ AIRPORT COMPATIBILITY

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Procedures

The group adopted the following procedure for addressing its assignment within the short time allotted. First, an hour or so was spent in a synthesis mode, with the group essentially "brainstorming" to identify all the factors which might be anticipated to impact the problems of aircraft/airport compatibility. At this stage no effort was made to reject any suggestions, nor was there any attempt to justify the topic as an institutional issue. The main objective was to get as many thoughts as possible before the group.

The second stage was that of review. The brainstorming list was reconsidered carefully, and decisions were made about the appropriateness of keeping the thought, combining it with another, expanding it, or dividing it into two or more components. Also, at this point inputs from the other groups were incorporated into the lists and subjected to the same examination.

Stage three was a classification phase. The items which survived the review of stage two were subjected to further scrutiny from the viewpoint of grouping them under collective headings which represent major institutional issues of concern to aircraft/airport compatibility. At this point, although the final output of the group was beginning to take shape, it was still organized in outline form.

Next, each major topic from step three was discussed more thoroughly by the group. In some instances it was felt that the outline form was sufficient to define the problem. For other areas it was judged that further elaboration or comment might be helpful to others when considering the conclusions and the recommendations of the group. In these latter instances, small subcommittees were formed to prepare a brief position statement for each such issue.

Finally, the group addressed the task of distilling its work into a series of recommendations for study, research and development or other actions.

The remaining sections of this report are concerned with the final three stages of this procedure. The third section contains the classified outline of institutional problem areas. The fourth section presents the brief position statements to clarify some of the problem areas, and the final recommendations of the group are listed in the last section.

Problem Area Outline

Under each problem area, various descriptors or phrases are used to identify specific component problems. Neither the areas nor the components are listed in any order of importance.

Lack of Funds for Airport Research
- ways to reduce pavement costs
- lighting
- runway/taxiway layout
- minimize downtime
- improved operations at reduced visibility

Noise
- future regulatory levels
- the effect of noise in limiting capacity
- credibility
- descriptors
- curfews versus soundproofing
- land use
- special procedures
- preferential runways
- mechanisms for community relations