

**Cooperative Problem-Solving in the Interactions
of Airline Dispatchers with ATCSCC**

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Executive Summary

This report summarizes the results of a focus group held to explore interactions between airline Operations Control Centers and ATCSCC, the FAA Air Traffic Control Systems Command Center. The purpose was twofold:

1. To understand the factors contributing to successful cooperation between the airlines and ATCSCC;
2. To identify areas for potential improvements and research activities.

As one of the participants put it, to improve the aviation system:

"We've got to find a way to make the system work more effectively with the people who are in it, with their strengths and their imperfections."

System performance may be improved by revising procedures, by providing training, and by developing technologies that enhance cooperative problem solving.

Method

The focus group, which met for one day in Washington, DC, consisted of the following participants: eight airline dispatchers and two Air Traffic Coordinators from seven airlines, two experienced staff members from ATCSCC, and one airline captain. Also present as observers were eight FAA (Federal Aviation Administration) staff members from the Research and Development Service (ARD), Flight Standards (AFS), and the Operations Research Service (AOR), plus two MITRE staff members. The meeting was moderated by three researchers, assisted by three graduate students. Nine specific questions about current operations and areas for improvement were posed to the group. All proceedings were tape recorded and reviewed by participants prior to distribution.

Findings

Successful Airline-ATCSCC Interactions

Successful interactions between the airlines and ATCSCC have resulted in substantial fuel savings through approval of non-preferred routes as exceptions to the preferred-routing system. Several factors appear to have contributed to the success of this program.

1. Development of a shared understanding of the goals, problems, constraints and potential solutions by both parties. Shared understandings in turn seem to depend on some specialization of roles within ATCSCC and the airlines for dealing with the NRP (National Route Plan) system; on the use of the telephone to discuss requests and provide rationales and explanations; and on shared knowledge about system constraints.

2. Distribution of responsibilities and knowledge. Decisions involve input from several parties within the airlines and ATCSCC who have distinct knowledge and perspectives. This collaboration increases the likelihood that good decisions will be reached and poor ones detected.
3. Process control and feedback. Mechanisms are in place to detect inappropriate decisions (e.g., unjustified route rejections) and to make the system more efficient (e.g. identification of new automatic routes). Immediate feedback seems to be an important ingredient in bringing about changes.
4. Staff selection and communications channels. Interactions with the ATCSCC are more effective when they are managed by an airline dispatcher assigned to the role of ATC coordinator, if this person has a thorough knowledge both of dispatching and of the ATC system, and thus understands both perspectives and constraints. Funneling most communications between airlines and ATCSCC through such a person increases transaction efficiency and promotes good working relationships.

Short Term Enhancements to System Efficiency

System efficiency could be improved to some degree by adoption of certain procedures, with minor investments in technology or training.

1. Improve communication of ATCSCC policies and practices to the airlines, especially to ATC coordinators.
2. Eliminate ATC practices that lead to the generation of flight plans in conflict with FAA regulations.
3. Improve the consistency with which FAA policies and practices are implemented to enhance predictability and planning on the part of the airline dispatchers.
4. Clearly assign roles within airline operations centers for interacting with ATCSCC and encourage consistency in these interactions.
5. Update training requirements for Dispatchers under FAR Part 65 to reflect current technologies, aircraft, airports, procedures, and conditions, and improve the training of ATCSCC staff regarding the responsibilities and capabilities of airline Dispatchers.
6. Reduce the response time for feedback to airline requests to ATCSCC for non-preferred routings.

Longer-Term Research Issues

Several issues arose that will require more extensive investigation.

1. Should the route generation process be changed, and if so, how? What would be the implications for safety, economy, and for organizational roles and responsibilities?
2. How could information be distributed in a more timely and efficient manner, both between ATCSCC and the airlines and within the airlines? This reflects the need for real-time information about delays, acceptance rates, runway closures, weather, etc.
3. What kind of computer support or display tools would make communication and distributed problem solving more efficient?
4. What kinds of changes in resource allocation would improve efficiency (similar to the slot-swap program)?

Conclusion

The purpose of the focus group was to cast a wide net in order to identify and understand areas of success and areas for improvement in the interactions of ATCSCC specialists and airline dispatchers. The results provided insights on a broad spectrum of issues. Possible short-term enhancements and issues requiring longer term study were identified. Some caution should be exerted in interpreting these results, however, since they are based on a single seven-hour meeting.

While areas for improvement were identified, it was clear from the meeting that interactions between ATCSCC and the airlines have improved dramatically in recent years. These successful changes have resulted from efforts to encourage cooperation among the parties, allowing them to work together to develop solutions that increase safety, reduce costs and improve efficiency.

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I. Introduction

A seven hour meeting was held to begin explore issues concerning the interactions between airline operations control (AOC) staff and ATCSCC (Air Traffic Control Systems Command Center) staff. This meeting was organized with three goals in mind:

1. To gain insights into the nature of the distributed and cooperative problem-solving activities that arise in the interactions of the airlines with ATCSCC;
2. To identify the successful aspects of these interactions and to better understand the nature of underlying factors contributing to such successes;
3. To identify areas for potential improvement. These areas fall into two categories:
 - a. concerns where solutions can easily be identified and implemented;
 - b. concerns where additional research is needed to better understand the problem, to identify potential solutions and to evaluate these alternative solutions.

I.A. Participants

Two ATC Coordinators and eight Dispatchers from 7 airlines attended the focus group. To provide an additional perspective, one airline Captain also attended. Two experienced staff members from ATCSCC represented Central Flow Control.

Dispatchers are employees of their respective airlines, and work at the operations control centers for those airlines. Under FAR 121, a Dispatcher (along with the pilot in command) is jointly responsible "for the preflight planning, delay and dispatch release of a flight". The Dispatcher is also responsible for:

- "(1). Monitoring the progress of each flight;
- (2). Issuing necessary information for the safety of the flight; and
- (3). Canceling or redispatching a flight if in his opinion or the opinion of the pilot in command, the flight cannot operate or continue to operate safely as planned or released."

From the airline's perspective the Dispatcher is also concerned with factors such cost, timeliness and passenger comfort.

ATC Coordinators are also airline employees who work at their airline operations control centers. They are typically experienced Dispatchers who work in a special role as liaisons to ATCSCC and the Enroute Centers. Thus, they engage in discussions with specialists within the ATM system and with the Dispatchers responsible for particular flights.

ATCSCC is the strategic planning organization for the ATM system, dealing with the airline operations control staff (often through the airline's ATC coordinator) and with the Enroute Centers to plan daily traffic (including replanning flights to deal with weather, airport problems, etc.) ATCSCC has a number of specialist positions for dealing with specific components of this strategic planning, including a position to deal with airline requests for route changes for particular flights.

In addition, eight FAA staff members from the Research and Development Service (ARD), Flight Standards (AFS) and the Operations Research Service (AOR), along with two MITRE staff members observed the session, occasionally providing needed information or raising questions to be addressed.

I.B. Methods

Three researchers moderated the discussions, with assistance from three graduate students. All discussions were tape recorded.

Based on these tapes, an initial summary was produced, which was distributed to the participants present at the focus group. These participants were allowed to edit the summary to remove any material that they might consider confidential and to clarify any points that needed further explanation. Only after such a review was the summary released for general distribution.

Several general questions were posed by the moderators to stimulate and focus discussions:

1. How successful is the NRP (National Route Plan) program for different airlines? Are there areas for improvement?
2. What are the most effective and efficient ways for Dispatchers and ATCSCC staff to interact?
3. What are the functions of an ATC Coordinator?
4. Would standardization across airlines help to improve interactions between ATCSCC and the airlines?
5. Are there different situations that call for different forms of interaction?
6. How successful is the process for swapping slots? Are there other areas for improvement? Are there areas (such as rationing resources like departure gates or routes) where similar procedures could be used effectively?
7. What are examples of the most significant problems that currently arise in ATCSCC interactions with the airlines? What are potential solutions to these problems? What are the most effective ways to initiate such changes?
8. In the upcoming rewrite of FAR 65, what training should be included for

Dispatchers

regarding interactions with ATCSCC?

9. What training/knowledge would Dispatchers and ATC Coordinators like ATCSCC staff to have?

II. Successful Airline-ATCSCC Interactions

The key insight that this focus group pointed toward was that, in the evolution of ATCSCC and its interactions with airline staff, certain new procedures have been developed and integrated in such a way as to encourage collaboration and cooperation between FAA staff and airline staff. The goal in adopting these procedures has been to improve the efficiency and timeliness of flights, while maintaining or improving safety, thus resulting in lower costs and better service for passengers and cargo delivery. The factors influencing the effectiveness of these new procedures, though, appear to be fairly complex.

As a case study of such an evolutionary process, the discussion of the focus group delved into the procedures for requesting and approving non-preferred routes. The evidence that this evolution was successful is quite strong:

1. One airline reported that in 1992 they requested 7,659 non-preferred routes, of which 59% were approved, saving them 5,582,208 lbs. of fuel. In 1993 they requested 15,279 non-preferred routes, getting approval for 75%, and saving 13,396,510 lbs. of fuel;
2. A second airline reported that they saved \$4.3 million in fuel costs in one year because of the non-preferred route approval system provided by ATCSCC ("Last year the non-prefs saved our airline \$4.3 million. Our upper management finally came back and said: How can 2 guys in the Dispatch Office be saving this much money? You either go out and prove or disprove. We proved it and they told us to hire another ATC man.");
3. ATCSCC reported the following statistics on requests for non-preferred routes for all airlines.:

	<u>Jan. 1993</u>	<u>Jan 1994</u>
Requests (for the Month)	3514	4722
Approval Percentage	69.55%	68%

The question, then, is:

What factors have contributed to the success of the new procedures for approving non-preferred routes?

Below, we begin to hypothesize answers to this question. Further research is required to substantiate some of these hypotheses.

II. A. Requesting Non-Preferred Routes

As part of the National Route Program (NRP), many commercial airline flights (those city pairs that have FAA preferential routes established) are assigned a preferred route by ATCSCC. Individual airlines can, however, request alternatives to these routes. These requests can be for reasons of weather avoidance or efficiency (reducing costs or improving arrival times). Requests for weather avoidance are given priority, since some alternative plan must be approved (although this alternative could be delaying the flight or landing at an alternative destination). Requests based on efficiency may be denied for a variety of reasons.

Requests for non-preferred routes must be submitted to ATCSCC via teletype. The ATCSCC staff member responsible for such requests then contacts the necessary Enroute Centers by phone to see whether they can accommodate the request. (Some requests, or portions of requests, may match a list of non-pref routes that can be automatically approved without contacting the affected Center.) If a request for a segment of a route is denied by a Center, that Center may suggest an alternative.

Once all of the affected Centers have been contacted, the ATCSCC staff member informs the ATC Coordinator or Chief Dispatcher at the airline (or an individual Dispatcher at some airlines) that made the request, communicating by phone or teletype regarding its approval, proposed modification or disapproval. The reasons behind a proposed modification or disapproval may also be given. Finally, the relevant Dispatcher at the airline must concur with the ATC Coordinator that the approved route is viable.

II.B. Factors Underlying the Success of the Non-Preferred Route Program

As the numbers presented earlier indicate, the non-pref program has been quite successful. Interestingly, this success has been achieved even though the technologies used for this particular program have for the most part been rather "unsophisticated" technologically. This raises an interesting question:

What factors have contributed to the success of this program?

The answers may provide useful guidance for future changes in procedures, policies and introductions of technological support. Below, we outline four factors that seem to have contributed:

1. Developing a shared understanding of goals, problems, constraints and solutions;
2. Distributing responsibilities to a number of different individuals;
3. Incorporating feedback and process control loops into the system; and
4. Selection of staff.

Shared Understanding

In order to work efficiently and effectively as a team, it is important for various team members to share goals and to understand what their fellow team members are trying to do, how they are doing it, and why they have arrived at particular conclusions. This need for understanding applies both at a general level, and at the level of a particular decision.

Although there is room for improvement (to be discussed later), the success in shared understanding that has been achieved thus far appears to be due to several things:

- a. Task allocation - assigning an ATCSCC staff member the task of approving or disapproving routes as his or her sole responsibility on a shift is likely to encourage that individual to adopt as a personal goal finding ways to get non-pref routes approved (rather than simply following some rote procedure to decide whether a route can be approved). In addition, because this person is focusing on this one task, he or she is more likely to develop an understanding of the motivations and behaviors of the ATC Coordinators or Dispatchers making requests.

Similarly, assigning ATC Coordinators the task of interacting with ATCSCC makes it more likely that these individuals will develop an understanding of the procedures and constraints that the ATCSCC specialist must deal with. Equally important, because a relatively small number of individuals is involved in direct communications (at ATCSCC and the airlines), the individuals are more likely to develop an understanding of each other and a sense of shared goals;

- b. Communication channels - although decisions about non-pref route requests are sometimes sent back to an airline by teletype, much of the communication is via telephone. This allows for much richer interactions, increasing the likelihood that a shared understanding of the process will develop. It also makes it more likely that personal ties will develop, enhancing cooperation;
- c. Distribution of knowledge - to work as an effective team, certain knowledge must be shared. Otherwise, unnecessary questions are asked and more detailed

explanations are required. A good example of this is the behavior of ATC Coordinators in generating non-pref requests. Because communications involve discussions of why requests have been rejected, the ATC Coordinators begin to learn what routes are viable as requests. They therefore begin to limit their requests appropriately. This process was commented on by one of the ATC Coordinators:

"When we started this, even Central Flow didn't know where all the choke points were. But as we pressed the system and said 'now we want to fly over here', we'd call the Albuquerque Center and they'd say: 'Well, you can't go eastbound over St. John at 4 o'clock in the afternoon'. Well, that was tribal knowledge in the Albuquerque Center. The tribe expanded to include Central Flow; Central Flow expanded the knowledge to the airlines and we began to build better routes. So rather than having to fly a 2000 mile route because it didn't work at one point, we began juggling around and making routes that were smarter.

Also, originally we'd call and they'd say no. But then it became: 'Well, if you would just do this, if you'd just make this minor adjustment in your flight plan, we could probably do this.' It became a much more collaborative effort."

- d. Requiring explanations - phone communication makes it easy to request and receive explanations. Such explanations serve three purposes. First, they help to develop the shared understanding of problems and constraints. Second, they help control the process, since decisions that lack support are discouraged or can be detected. (This second purpose is discussed in more detail later.) Third, they encourage collaborative problem-solving, since once both parties understand the problem, they can work together to consider other solutions.

Distribution of Responsibilities.

A second factor contributing to this successful collaboration appears to involve the distribution of tasks. Four groups of individuals are directly involved in selecting non-pref routes: staff at the Enroute Centers, the non-pref route specialist on duty at ATCSCC, ATC Coordinators at the airlines and Dispatchers at the airlines. Other groups, such as staff meteorologists at the airlines and at ATCSCC, also provide input to these decisions.

As discussed above, the structure of the communication links among these groups affects the development of shared knowledge and a sense of teamwork. In addition, because each individual has a different set of primary goals and responsibilities, and makes use of different sources of data, the system provides checks against bad decisions. The Dispatcher in charge of a flight, for example, may point out to the ATC Coordinator that the approved non-pref is questionable in terms of weather. Similarly, the ATC Coordinator may point out that a route

proposed by ATCSCC is impossible because of fuel constraints. Thus, because tasks, information and workload are distributed (with some redundancy), it is more likely that good solutions will be discussed, and that poor solutions will be detected.

Process Control and Feedback.

There are several ways in which data or input are used to improve performance.

Unjustified Route Rejections. Both the airlines and ATCSCC feel that there are times when an Enroute Center specialist will reject a route without adequate justification. It was pointed out, however, that the airlines need to understand possible reasons why a Center specialist might reject a route, such as concern over workload, or the need for a particular individual to be cautious. ("If there's an error, less than standard separation, then for the next week or the next month, no matter what you request [from that Center specialist], it's 'No'.") While understanding such concerns by Center personnel, ATCSCC does monitor for unjustified rejections of requests. To reduce such problems, ATCSCC will:

"constantly talk [with that Center] to try to find periods of time when they can be more flexible."

As part of this process, ATCSCC will:

"through observation of their operations, check the number of times they say no along a particular route of flight...[and take] pictures [of the ASD] at the time that the requested flight would have come through there. We're taking pictures to guarantee that they're not blowing smoke, and we will forward these pictures back to the facilities manager and say: This is consistently happening. Please tell us why. We don't see it here."

Requests for New Automatic Route Requests. A second example of feedback within the system involves the identification of non-preferred routes that can be automatically approved upon request:

"The NRP has been expanded 4 times. They're still looking to expand them. How are they picked? The airlines gave a list of like 250 or so. The airlines were requested to submit a list through the ATA and to prioritize them. The ATA looked at how many times a given city pair was submitted and reprioritized them."

Thus, ATCSCC periodically asks the airlines, through the ATA, to submit a list of routes that they would like added to this set of automatic approvals. The airlines submit their preferences to the ATA, which develops a combined set to submit to ATCSCC. ATCSCC then evaluates this set and selects those requests that are feasible for inclusion on the list of automatic approvals. This feedback process provides the airlines and ATCSCC with a mechanism to more efficiently get approval of routes that are both safe and efficient.

Direct Immediate Feedback. The above two examples of feedback processes involve delayed feedback. Perhaps the most important form of feedback, whether between an ATCSCC specialist and an ATC Coordinator or between an ATCSCC specialist and an Enroute Center specialist, though, occurs by talking on the phone about an immediate concern:

"A phone call is more valuable because you exchange ideas...It's interactive."

Such interactions help tune the process, identifying problems and promoting change. As one ATCSCC specialist put it:

"As long as you [the airlines] keep making the demands that you're making, you're going to force me to reevaluate the way I do business."

Staff Selection and Communication Channels

The creation of the ATC Coordinator position at many airlines to handle interactions with Central Flow Control has been mentioned several times already. One already discussed benefit of having an ATC Coordinator is the ability of such a specialist to better understand the goals, problems and constraints of the staff with whom the airlines deal at Central Flow. The importance of such understanding was highlighted by two comments:

ATC Coordinator: "When you're making these phone calls it's sometimes a bad day. They don't want to have a phone call where the first 5 minutes is an education process and then tell the Dispatcher why he can't have it this way."

ATC Coordinator: "The ATC guys [Coordinators] have got the ATC background to be able to discuss it [with Central Flow]."

The importance of developing and maintaining a friendly, cooperative working relationship was illustrated by several comments that highlight problems that may arise when there is no ATC Coordinator:

Chief Dispatcher: "Any time we've said, you go ahead and do it and let one of the Dispatchers call [ATCSCC directly], 9 times out of 10 we get a Dispatcher on the phone demanding: 'You [Central Flow] are going to do this. This is the way I'm going to do it and don't tell me I can't.' It does nothing but blow all of the rapport we've built between us and Central Flow because now everybody is mad."

An ATC Coordinator:

"I can't seem to get across to them [some of the Dispatchers] the last thing you want to do is get Cleveland Center mad at you, 'cause all they have to do is say no and you're stuck. So we try to limit it to the ATC Coordinator."

Thus, ATC Coordinators are selected based on their communication and interpersonal skills, as well as their knowledge of the ATC system. (These are currently subjective decisions by airline management.)

A second benefit in channeling communications with Central Flow through an ATC Coordinator is the increased likelihood that bonds will develop between ATC Coordinator and these ATCSCC specialists (because of the smaller number of people involved). Such ties are likely to encourage a greater willingness to cooperate and help each other out.

A third benefit from the use of ATC Coordinators is increased efficiency:

"What we did at our airline, and part of it was a complaint from System Command that they had 3 people calling about the same problem, that's why we decided to go through a focus [through an ATC Coordinator]. There's nothing wrong with a Dispatcher saying: I've got this problem, and if you're busy, if it's something you think he can handle, delegating the phone call to him. But then you know he's assigned and it's just 1 person making 1 contact on that 1 issue, instead of maybe 3 or 4 different people with flights through that area. It just didn't seem workable. They had a legitimate complaint there."

All three of these benefits, however, appear to be due not only to the creation of such a position to handle interactions with Central Flow, but also due to careful selection of the individuals to fill the position. Thus, several participants indicated that Dispatchers are not arbitrarily picked to become ATC Coordinators. In making this selection, the Dispatcher's personality, communications and negotiation skills, and understanding of the ATC system are all considered.

II. C. Evidence of Cooperation

The factors described above, dealing with the development of shared goals and knowledge, with the distribution of responsibilities, with mechanisms for feedback and process control, and with staff selection, appear to have engendered a cooperative system where ATCSCC specialists and airline staff actively work to help each other out:

"I think there was a paradigm shift at Central Flow, from Central Flow and the assorted Centers against the airlines, to the airlines and Central Flow trying to figure out what was the problem in the Centers. That was when it [the percentage of approved non-pref route requests] went up."

Similarly, the airline ATC Coordinators described how they would help out Central Flow when possible:

"If Central Flow is having a bad day, and we know when they're having a bad day, we'll raise our threshold on fuel or time savings for requesting a non-pref."

"We know when they're having a bad day with weather routes, so we'll back off."

Thus, this sense of increased cooperation between ATCSCC and the airlines was clearly one of the major themes that permeated the discussions. There were also, however, a number of specific areas where improvements could be made. Some of these are fairly straightforward concerns by either the airlines or ATCSCC staff. Others require more research to better understand the underlying problems and potential solutions.

III. Possible Enhancements and Research Issues

Some of the points that arose can be handled by simply communicating them to the relevant groups. Others can be considered short-run enhancements that require some development and evaluation of fairly obvious solutions. Still others call for more extensive research to better understand the nature of the problem and to explore alternative solutions. These classes of issues

are discussed in two sections below, focusing on short-run enhancements and longer-term research issues.

III. A Short-Run Enhancements

These issues deal with topics such as the need for better communication about policies and practices, the value of assigning personnel to specific responsibilities, and the need for improved education and training.

Communication About Policies and Procedures.

A number of times, airline ATC Coordinators raised concerns that, to their surprise, had already been dealt with by ATCSCC. This suggests a need for providing some communication channel through which ATC Coordinators can easily raise questions and get answers about policies and practices. It may be that existing channels (such as a contact person) simply need to be publicized, or it may be that means for direct contact (rather than through extended formal channels) need to be improved.

One example was ignorance by an ATC Coordinator about whether he could submit several alternatives:

"Suppose I have 3 or 4 routes to submit and all of them save money except the preferred route. If I submit all those routes and list them 1 2 3 4, do you have any way of using that info?"

A Central Flow participant indicated this was possible:

"My suggestion is that you should do 2."

This problem with communication about policies and practices, and about ongoing projects to improve things, was further emphasized by another Dispatcher who commented that he had written a letter eight months earlier to ATCSCC saying:

"Gee, I think you're doing a great job on these weather routes...Here's my suggestion. I never got an answer. I mailed it again 3 months later and I'm still waiting for an answer."

Another Chief Dispatcher then commented on this same issue:

"I had a meeting with [them] probably about 3 months after you did that, face to face, and basically told them the same thing, that under the procedures that were followed last summer for severe weather routing, our airline cannot operate again this summer. So I said, we've got all winter to sit down and talk this out. We need better coordination

between Washington and the Dispatchers on picking severe weather routes before the airplanes leave the ground so that we can plan for their fuel."

A participant from Central Flow indicated that they had listened to these inputs:

"We're working on an order right now based on that information, for 5-6 hours in advance coordination. We'll put out an advisory at least 4 hours in advance and you'll get weather updates every hour...We are taking steps."

Thus, this discussion revealed that the problem wasn't that Central Flow was ignoring such input, it was that Central Flow wasn't providing the airlines with timely feedback about how they were dealing with such concerns. Minimally, such a lack of timely feedback can create uncertainties and bad feelings between ATCSCC and the airlines (i.e., it is poor public relations). Equally important, it meant that potentially valuable airline input wasn't being

requested by Systems Command Center as early in the planning process as it might be (since in those earlier stages, the airlines weren't even aware that changes were being planned).

A third example illustrated the need for a better communication channel for ATC Coordinators to inquire about policies that have to do with holding:

"In some instances I think that perhaps they [Central Flow] should just let the airline decide if we want to go someplace and hold. Their business is to keep airplanes from running into each other in the sky. I should have the option of, if I want to go over there to hold to get in. I should have that option. If I feel the RVR is going to come up and me and the Captain feel it's a safe operation, we've got plenty of holding fuel, we've got a good alternate, if we want to go there and hold and take that chance, we should have the opportunity to do that."

As with the previous two examples, the actual problem was a lack of awareness about Central Flow policies:

Central Flow Participant: "You can request that any time."

Airline ATC Coordinator "You can?"

Central Flow Participant: "You can request that and let him go up there and take that chance."

Airline ATC Coordinator: "I wasn't aware of that."

Another airline ATC Coordinator: "I wasn't either. What's your home phone number. Yea, we'll ask for [you]!"

Practices Inconsistent with FAA Policies.

There was one point about which the Dispatchers and ATC Coordinators vehemently expressed concern: The ATC system can ask Dispatchers to file flight plans which cannot be followed due to weather or other problems.

"You cannot tell people to file a flight plan that legally the Dispatcher must brief the pilot he cannot take - even if he gives him 2 flight plans and he says: "This is the one I filed for you but this is the one you should fly.' It puts us in a very difficult situation."

Thus, the problem arises when ATC staff ask Dispatchers to file a flight plan that either cannot be followed (because of bad weather, for instance) or that may become unavailable (because of missile tests, for example). The ATC specialist apparently assumes that an alternative path will be selected once the aircraft is airborne. The Dispatcher, however, is

forbidden by FAR 121 from releasing such a flight since its flight plan is known to be infeasible.

The Dispatchers did note, though, that:

"Central Flow has been very helpful in trying to change the mindset of the Centers who are saying: 'Well, just file the pref and we'll take care of it after you're in the air'.

Nevertheless, the airline representatives view it as a very serious continuing problem:

"What drives us absolutely nuts is when, I use my fun example, a pref route from Tampa to DFW, with J58 over New Orleans. The Dispatcher files a request and wants to go up the west coast in Florida to Montgomery, pick up J4...This is because there are 86000 foot thunderstorms at New Orleans, the National Guard has been called out, they are removing people from the city to high ground. You send in a request. The answer comes back: Denied. In this case I said: 'Specialist, we can't deny it. We're not going to file J58.' I then asked: 'Who denied it?' ATCSCC responded: 'Jacksonville Center'. I pointed out: 'There are no thunderstorms in Jacksonville Center. What's the problem? Let's get Jacksonville Center on the Line.' Jacksonville Center gets on the line and I say to him: 'How are we going from Tampa to DFW? Oh, we're going up the west coast of Florida to Montgomery, J4 over to DFW.' I'm saying to myself: 'This sounds vaguely familiar.' Why were we turned down? Jacksonville Center's response is: 'We always turn down nonpreferred requests when we're busy.' This has got to change."

Dispatcher: "We have a similar situation when there's going to be a missile shot and they tell you that in the event that the shot is going to go off, we're going to route you the inland routing, or the offshore routing or whatever it is, but don't change your system. We'll reroute you as we have to. That's fine for you guys, but it doesn't work for us for the same reasons. We plan our fuel calculations based on the original routing and you send us off later in a different direction. Then we don't get to our destinations with the proper amount of fuel, to say nothing of the possible inconvenience of people who are gonna be late for connections or whatever.

An ATC Coordinator: "The other example we get, and really I have no idea why, I don't understand it, we will get an advisory out from Washington saying: 'We are rerouting traffic this way but don't file it. File the preferred route.' That's the same as when there's a missile shot. I figure: What do you mean? If you're rerouting traffic, why can't I file a flight plan where you're rerouting the traffic? I can't put it on the preferred route because the preferred route takes you right through the thunderstorm activity and yet you're telling me all the traffic is being rerouted this way. Yet if I go to file it that way you'll turn it down."

A Dispatcher: "The missile shot one is serious, but doesn't concern me as bad as the weather one, where one part of the FAA [the ATC system] is telling me to do something that another part of the FAA says violate regulations [FAR 121]. That's very discouraging."

At first glance this seems like a straightforward training or policy problem involving the Enroute Centers directly, as well as the Central Flow staff who are the intermediaries for route requests. Other comments, however, suggest that it is really a symptom of some deeper problems that merit study. These deeper problems may involve inadequate procedures and workload concerns (as with the earlier example where a Center's response was: "We always turn down nonpreferred routes when we're busy.")

These deeper problems may also, however, involve attitudes, perceptions and personalities, as commented on by one Chief Dispatcher:

"On a very broad basis I think perhaps that the people at Central Flow and the Centers [Central Flow and the Enroute Centers] don't recognize that flight Dispatchers are very well trained professionals, that they are familiar with the field of aviation and with the language of aviation. I've had several experiences where I've called Centers or Central Flow or various traffic management offices around the country, and talking also to people at the tower. Maybe I don't introduce myself clearly, that I am an airline employee, number one, and that I do work in flight operations, but they talk to you as if they're talking to somebody that was out on the street that doesn't know anything about aviation. By and large they're not familiar with who they're talking to."

As another example of friction, a Dispatcher noted:

"Unless you come right out and tell them [staff at Enroute Centers] that there's a big saving, that if they go this way it's x number of extra miles, they don't care. [To them] it's one more airplane. Tunnel vision."

The response of an ATCSCC participant to this concern was:

"I think that in the last 3 years, the education on both people's part, the users and the Centers, they're starting to see that and they're cooperating more, but it is personalities, believe me."

In terms of personalities, one Dispatcher commented:

"You can do your greatest work at this level, with the NRP (National Route Plan), and then you get that local controller that says: 'I am in charge. I've got it. You go when I say you go'. They blow your whole scenario, all the work that you've done. I think when you have a personality such that they want to be in control instead of being a team player, you lose the continuity of the whole concept."

It was pointed out by one of the ATCSCC representatives, though, that the actual situation is more complex than it might seem at face value:

"Sometimes it may not necessarily be wanting to flex your muscles, but it could be when they're faced with the choice of your profitability or [their own] job preservation, that's it. [For example, suppose] I'm a controller and I've been working 17 years and I've had two operational errors in the last 2 years and I don't know what they're going to do to me [if I make another error]. You want to go direct where? No. I don't know what's going to happen because it's 30 minutes away or an hour away, so right now the easiest thing is to say no... That fear is legitimate."

In short, the vehemence with which the airline participants expressed their concern about ATC practices that are inconsistent with FAA policies appears to both be a direct problem and also a symptom of a much deeper and complex set of concerns. Furthermore, these deeper concerns are by no means one-sided, dealing with issues of workload, mutual understanding and respect, and management practices, etc.

Consistency in Policies and Practices.

There appeared to be some concern by the airlines about consistency in the way Central Flow staff members dealt with situations. One such concern was uncertainty over whether a response to a request for a non-pref would be made via teletype or phone. (It was suggested: "A phone call is quicker. In some ways a phone call is better because when a guy says 'no' you can say: How come?")

Related to this issue was a concern that not all Central Flow and Center staff are as inclined to offer a reason for a denied request. As a partial solution to this concern, it was suggested that the ATC Coordinators be a little more assertive:

"I think anytime that anyone sends a request, when they're told no, don't accept no. Asking why is going to give you knowledge of where that sore spot is."

Since such assertiveness could affect the relationship between an ATC Coordinator and a particular ATCSCC specialist, though, it may be that other solutions (such as periodic encouragement from ATCSCC managers to routinely provide such information) may also be of value.

A third area of concern regarding consistency had to do with the approval of non-preferred routes by Centers:

"I can go for a whole week and ask for a route on a specific city pair and get it approved. Then you get a shift change at the Center. Nothing has changed. The weather is exactly the same and now it's disapproved."

Assignment of Roles.

As discussed earlier, a number of the airlines have structured their interactions with ATCSCC to occur through their ATC Coordinators (or Chief Dispatchers). This approach was viewed very favorably by both the airlines and ATCSCC. One concern, however, was the workload of this individual and his consequent ability to handle ATC functions. This problem, along with associated concerns, is illustrated in the following comments:

A Chief Dispatcher: "Speaking for our airline, our ATC Coordinator is a licensed Dispatcher. In fact, when he's not working ATC, on his off shift, he's a Dispatcher within the office. One of his duties under severe weather is for him to get a briefing from the meteorologist, when and where the weather is going to be, in what part of the country, and then go to that specific Dispatcher and discuss it with the Dispatcher, and get the Dispatcher's input on how he'd like to see the aircraft routed. He's also supposed to be the only contact between our airline and the ATC system."

Moderator: "Does that work?"

ATC Coordinator: "Works so far as far as we can get the cooperation from the other side to get the routes we want."

Another ATC Coordinator: "It works generally the same way with our airline. We have other responsibilities, including the National Route Plan, requesting nonpreferred. We are the liaison between any ATC function. We also have our ASD and monitor it and watch for holding patterns or whatever, from one of our hubs, and as soon as we see a hold, we start contacting people and try to find what is going on and pass that information on to our flights."

A Chief Dispatcher: "We work the substitution program at our airline. The ATC person is also a licensed Dispatcher and generally goes pretty senior, but he's not the only person that works with Central Flow Control or has access to them anyway. Anybody in the office can pick up the phone and call down to Washington or even the various Center TMUs. That might be something that should be addressed in our own house. I think it would be better if one person did it all. The ATC person at our airline is also working the shift at the same time that he's doing that. When we get terminal ground delay programs and things like that, it's just more than he can handle."

An ATC Coordinator: "At our airline, the ATC coordinator runs the swapping software, coordinates NRP, and is the liaison. Our only problem is, it's a good idea to have one point of contact, but when you've got programs running in Boston and LaGuardia, DFW and Chicago and severe weather in the Southeast, you're wiped out. You cease to be effective. I know it's a good thing to say you should go back and chat

with the Dispatchers and say what do you want to do, but you're a one-armed paper hanger under conditions like that."

Training and Certification.

Although the use of ATC Coordinators helps reduce problems, there was a general feeling that both Dispatchers and ATCSCC staff would benefit from a better understanding of each other. For Dispatchers, this is in part a result of the outdated FAR 65 (FAA regulations concerning the training and certification of Dispatchers):

"The last time FAR 65 was rewritten was 1964. There was no Central Flow then."

"I think it would be a great benefit to new Dispatchers to benefit from your knowledge of how your system [at ATCSCC] works, so that they don't have to make all the mistakes that they would make in a career."

Another Dispatcher: "You don't have to limit that to new Dispatchers. I have a lot of senior Dispatchers that I'd love to send to Cleveland Center to sit down and watch their ASD."

A Chief Dispatcher: "I went through both training processes [Dispatcher and ATC training]. I've done both and I'll tell you, *I've met people who are Dispatchers, I've worked with them. I've met people who are air traffic controllers, I've worked with them. Eight out of ten of these people haven't got a clue what the other guy's thinking about, or what he's basing his decision on.* I mean, when you see an air traffic controller saying: Well, slow this guy down, they have no idea what the backward effect of that is on the guy flying the airplane or the people planning the trip. The same thing with the Dispatcher saying: 'Well, I've only got 2 flights going to Chicago today, I don't see any big problem. Let's go.' He has no idea that the guy working the sectors along the way may have a totally different look at that."

There was, though, some disagreement on the extent and timing of training requirements for Dispatchers:

"Flight planning now includes consideration of the ATC system. If flight planning is a requirement for getting a Dispatcher's license, then you have to include knowledge of ATC system in the Dispatcher license."

"Maybe the ATC Coordinator should get an additional type of certification."

"I don't know if it [training about ATCSCC] should be prerequisite education or advanced training after certification."

In terms of training for ATC staff (and note that much of this discussion dealt with issues outside the realm of ATCSCC), one major concern expressed by the airlines was a lack of knowledge about the capabilities of different types of aircraft:

"Now and then we have incidents where ATC, somewhere along the chain of command, especially when someone establishes an airport arrival rate or something like that, it's based on, not a good understanding of the category minimums for a runway that might be closed. We had a perfect example about 2 weeks ago. They came out with a 5 hour ground delay program for all arrivals into Detroit for the rest of the day and there was a misunderstanding at that Center about certain lights being inoperable. But ATC, or whoever made the decision, didn't know that doesn't affect CAT-1 and that's our dilemma."

"It seems to us that the FAA makes a lot of generalized decisions about what airplanes can do based on general knowledge. I know Newark is an example [where unnecessary decisions are made about limiting runway use when there is] a 15 knot crosswind."

"Boston's another good one."

As another concrete example, two airline participants discussed:

"What's a wet runway? I consider a grooved runway [which is wet but without standing water] a dry runway. Chicago says if I've got water along the edge of the runway (the airplane will never touch it), it's a wet runway. You want to change something, that would help a hell of a lot. Get that changed."

The pilot present raised some caution in deciding such issues, though:

"Consider an aborted takeoff. You can take that fully loaded 727 taking off on Runway 4 at LaGuardia, dry conditions and either scenario, either engine failure prior to V1 or 2 blown tires on 1 side, and you got a similar condition. If it's a dry runway, everything normal, I'll get it stopped in the 750 feet to go. You make that runway wet, even though it's grooved, I'm doing 65 just prior to going swimming because they never certify with wet runways [although, a dispatcher pointed out, there is some padding of the standards in order to allow for wet runways]."

Timeliness of Responses.

One airline participant expressed a concern over the timeliness of responses:

"One of the problems we have is that individual requests can be made by sending a message out with the route request down to Central Flow and then we wait for a response. One of the problems is the time constraints. We can send our requests

maybe 5 hours ahead of time. A lot of times we don't get a response for a positive until maybe a half hour before departure time. At that point, we probably don't save the fuel. If we could get approvals on a more timely basis, we could set up a plan a lot more in advance and afford the airlines a lot more savings."

A second airline supported this concern:

"We experience the same thing with response time. We've had them go with no response. We've wound up having them stay on the preferred route."

While this is clearly in part a workload issue, the fact that airlines voiced it as a concern suggests a need to monitor response times, determining how significant the problem is and whether cost-effective solutions are available.

III. B. Longer-Term Research Issues

There were clearly other topics that arose that require more extensive investigation. These range from broad questions about approaches to air traffic management, to information exchange and dissemination, and to software design.

Restructuring the Route Generation Process.

Several of the airlines supported exploration of a radical change:

Managing air traffic by having the airlines first propose routes based on cost and efficiency concerns, and then having the ATC system identify and resolve conflicts that could result in safety problems.

The discussion around this raised issues about safety, organizational change and potential ways to explore possibilities:

Dispatcher: "Couldn't we create programs based on letting everybody do what the hell they want to do? If they just had a program that said: 'On a typical day, here's what everybody requested and wanted. Let's run a program and let them have it.' Let's see where the bottlenecks are. Let's see if we're putting too much restraints on it."

Central Flow Participant: "Still, with our mandate to guarantee safety, while trying to promote the commerce of the industry, I'm talking, not the FAA, I don't think we could guarantee your safety if we gave you that much flexibility. To go for a free for all - we're having a hard enough time just asking them [the Enroute Centers] to accept the experiment of limited airborne holding."

Dispatcher: "Yeah, we want to put safety at the head of the list, but do you feel like within the FAA and the Centers there is too much restriction? Do you feel like the safety level is too big?"

FAA Researcher: We could simulate your request and see what happens in terms of letting the airlines say: 'Here's what we'd like to do and seeing how ATC would respond to that.' We probably have tools to do this."

Information Dissemination.

There were also a number of less radical suggestions for improvement. Several of these dealt with the distribution of information between Central Flow and the airlines, and within an individual airline. The first concern had to do with teleconferences:

Central Flow Participant: "You should be on the other end of the line after these teleconferences. At the end of such a conference, we'll say: 'OK, do you have any questions? No, no questions. OK, here's our plan, this is what we're going to do. We'll give you an update in 7 hours. Bye.' As soon as we hang up, here's [the phone ringing]: This is so and so, and so I wanted to talk to you about...Come on, let's bring it up with everybody, so we can come up with, get all of the input that we need, because that problem may affect them [the other airlines] also."

Another problem with teleconferences is that, by their very nature, the information exchange occurs at a fixed point in time. Problems arise if some people aren't available or aren't included in the discussion:

"That's a problem with teleconferences. It's very nice that Central Flow should decide at 4:30 we're going to have a conference to discuss O'Hare arrival delays, but who knows what I'm going to be doing at 4:30."

"I had an incident with a manager sitting above me where I work and the analyst who works for the manager. They get a phone call from Central Flow saying that the Boston Center radar is out of service. The manager and the analyst talk about it and say: What do you think about it? Yeah, probably big delays in Boston. About half an hour later the Dispatcher working Boston comes running and screaming down the road saying: What happened?' The information never got to the person who needed it. The problem with verbal information is that it's accessible only to the person who heard it. Then the person who heard it has to take some action to get it to everyone."

In response to some of these issues, suggestions were made for disseminating information in a more timely and effective fashion. Some of these suggestions dealt with making information and data accessible on a more permanent basis, and some with distributing information that simply isn't shared right now. These are discussed below.

Shared Information.

One proposal to deal with the need for real-time information was to allow the air carriers to listen in on discussions at Centers:

"Talk about communication. One of the other proposals made at the meeting on Test Plan 92 [a proposal for improvements to the ATC system] was an open line concept, which would be basically a phone line that went from New York to LA and anybody, air carrier or Center, could link up to this phone line and the phone would be basically off the hook during the event so that we know exactly what was going on at the station that was impacted as it was happening so that we could react much faster. Because the complaint was, the station calls Central Flow, tells them what they're doing. Central Flow types a message and sends it through computer and what's happening? Well, that could take anywhere from 15 to 30 minutes. By the time the 30 minutes was up, the situation had changed again. Whereas with the open line concept, all you'd have to do is put a speaker on the line and when Central Flow and the facilities got together to discuss what was going on, at that time the airline would hear what was going on and have that information now. It has never really materialized. I know that the delay task force at Chicago did some pricing on it, and I think they came up with about \$6000 was the cost of a phone line to go from New York to California and then it was going to cost each carrier somewhere around \$150 to connect up to it. But it never materialized."

An alternative, or complementary, suggestion for providing access to real-time data involved the creation of a shared database:

"My boss will hate me for saying this, 'cause he loves telephone conferences. I think we have too many of them. The reason I say that is, the reason we have them is because operational information is not contained in a centralized database. If it was, there'd be a lot less talking. But since it isn't, it's the only way we can communicate. There is a whole lot of data that we all use differently, but it's the same data. We can figure out who creates the data. We could all contribute, and then everyone would access the same database. Then the only time you'd have to confer is when you could add something to the information. Quite often, I get on a telecon and I listen to it for 30 minutes and there's really no reason for me to be there. I'm not adding any value and I think a database would be in the long term the way to go. What I'm saying is that, if Chicago has several runways closed and the acceptance rate is 36 an hour, that's data that doesn't need to be in a teleconference. If we build the database correctly, we all see it at the same time and then we discuss what we need to discuss."

Another Dispatcher: "But how do you put in your database Chicago just closed 27 left to plow it. Somebody has to input the data into that database and if you've got a phone line sitting there or a phone off the hook and Howard just comes on and says we just closed 27 left for plowing, I know now. I don't have to wait for somebody to sit down input that data and then I don't have to go to another machine and pull that data up."

Response by ATC Coordinator: "Yeah, but you're on the phone when he says it, and then you say: 'What did he say?' Then you've missed it."

Response by Dispatcher: "No, because in my office, in our ATC Coordinator's, I have a specific phone. I can hear anything that's going on."

Another ATC Coordinator: "I think a database works much better because it also eliminates the possibility of the human factor having to pass it on to how many people. How many guys do you have to verbally brief, or how many guys do you have to yell across the room to and make sure they hear you at that moment, that the guy's not involved in doing something else that's more time critical. If there was something in a database that everybody could access when they needed to access it and see what the latest info was, it makes a lot more sense than if you're dependent on somebody hearing it and passing it along."

Another Dispatcher: "I like both those ideas."

A Dispatcher: "I have no problem with the database. I think the database is probably a good idea 'cause like you say there's retention there. My only problem with databases is timeliness."

Increased Data Exchange. In addition to discussing how to disseminate information, there were general comments about the potential to exchange new types of data and information. One important example of the potential value of increased information exchange is particular data that the airlines have that would help in planning by ATCSCC. As one Central Flow participant put it:

"With your participation in ground delay programs, you'd probably see at least a 30-40% across the board reduction in your delays if we had real time data from you."

A Dispatcher supported this idea:

"I really feel it's to the advantage of both the airlines and the FAA if the FAA is working off a real time database and not working off the OAG. Many times we've had instances where there's been a ground delay program on a station, and we have sent all our cancellations in, and the program is still there and it still holds. It's still based on [the assumption of] a full [arrival rate], everybody showing up, and we've wiped out half of our operation."

Similarly, participants indicated that ATCSCC and the Enroute Centers have data that the airlines would find helpful:

"What we'd like to get back is capacity rates, what you expect the next hour to be like, how many actually landed the hour before, so we have some sense of what's going on."

"It seems to me that we never know what the Centers are doing. There's no communication between the Centers and the airlines. They should just send out a simple message [through ATCSCC] saying: 'OK, New York Center - we're now keeping the flight plans for 5 hours.' That way we would know that we didn't have to go back in and refile. If the Centers would simply tell us, it would save us a lot of work."

"There's a lot of weather information available on ATIS. We would love to see digital ATIS, so that when ATIS information is put into the system it's available to everybody at the same time. What runway is in use, if there's breaking action, if there's holding."

Another example where data exchange could help is with EFCs (Expect Further Clearance):

"A typical situation for us...these pilots will be coming up there and they've already experienced an hour and a half gate hold from their originating station. They'll get up there and they'll get an EFC of an hour and a half, and most airlines don't run around with that kind of holding fuel. The pilot, he's already aggravated because he's already an hour and a half late, the passengers are ticked off 'cause [they think] it's the airline's fault, so he diverts. Then [later] we realize it wasn't really going to be an hour and a half. It was only going to be 30 minutes. That's what actually happened. That's a rule that needs to be changed."

Central Flow Participant: "There's really no way for us to get around it. What we are trying to teach is to, I may start out with 30 minutes, that way I can still devote some attention to the airplanes that aren't holding. But as soon as you find out what the reason is, now you can come back and give the pilots a realistic assessment of why this is going on."

Dispatcher: "There is a way around it, and that way is the role of Dispatcher. I understand when the controller gives an EFC, it's because he must allow a buffer so he can clear the traffic out in front of the guy in case of radio failure. But if we could develop a system where the traffic control unit relays to the airlines that average hold is 30 minute, then when the pilot calls in and says my EFC is an hour and 30 minutes, the Dispatcher can say: 'Yes, I understand that and he has to give that to you. But we're telling you that the stack value is 15 airplanes in the stack and the average delay is 30 minutes.'"

Central Flow Participant: "Our advisories come out to tell you that as soon as we can find out what the real delay is."

Dispatcher: "You hit a real problem there, it's not an automated system. We need to automate that part of the system more. When airplanes begin to hold."

Dispatcher: "We have an internal program that does that, so the Dispatcher has that information available to him."

Dispatcher: "I think it's a two-fold problem. First of all, you've got an education problem for the pilot, exactly what an EFC is. If you're given an hour and a half EFC, you're not going to hold the hour and a half [i.e., the EFC is not an accurate indication of how long the hold will be]. The other thing is to get a hold of, the first thing our pilot will do given an EFC, is call the Dispatcher [as the Dispatcher may have better information]. The Dispatcher pulls up this display and says: Yeah, they give you an hour and a half, but our last 4 flights it only took 20 minutes."

Dispatcher: "That's good if the hold is at your hub, because you've got enough aircraft to have a metric there. But if we're going into Minneapolis, we have 3 flights a day. We can't detect that because our last flight got in 2 hours ago."

Current Computer Support.

The previous two subsections focused on problems with information dissemination. Additional problems arise because of inadequate or poorly designed tools for making use of available information. One example of this that was discussed at the meeting was the process for approving requests from the airlines for non-preferred routes (this general process was outlined in section II.A.). The discussion indicated that this inadequate computer support sometimes slowed the process and put extra burden on ATCSCC staff:

Dispatcher: "It's pretty much a manual process [communication of ATCSCC with the Enroute Centers to get approval for a non-preferred route]. You send them [ATCSCC] a message and they pick up the phones and call the Centers and they ask the Centers if they'll approve it. It's a time consuming method."

This lack of computer support also adds extra burden to the training and performance of ATCSCC staff:

Central Flow Participant: "We have a lot of new people who don't look at it [the requested flight plan for a non-preferred route] and say: "This is the only part that you've got to approve.' Now you've got seven Centers involved and you only needed to call one."

User Friendly Software.

A related problem regarding current computer support dealt with interface design. For a variety of reasons, including the problems in coordinating software design between the FAA and the airlines that are mentioned below, some of the software used at the airlines to interact with Central Flow is cumbersome:

Dispatcher: "I would like to see it more flexible I guess. One of the problems of working with computers is that they're not very forgiving of minor errors. A minor typographical error in one of these delay programs and you've blown the whole thing out of the water, and you've got to go back to square one and start all over again."

The discussion further indicated that such problems are in part due to a lack of coordination between the FAA and the airlines when designing software:

Dispatcher: "Our software is more convoluted than it has to be because of the construction of the software that was designed for Central Flow. I think, had we designed this together, we would have come up with a much better, faster, slicker, easily repairable, error tolerant type of system. What I would like to see is more cooperative software design between the airlines and in this case Central Flow."

Such difficulties in the use of software clearly affect efficiency. Furthermore, it is possible that safety concerns could also arise as a result of such software usability problems.

Advanced Computer Support Tools.

The discussions about computer support went beyond concerns about information exchange and about interface design. A number of proposals were also discussed for introducing intelligent decision aids and advanced graphics displays.

Minor Route Adjustments. One Dispatcher noted that non-preferred route requests are sometimes rejected or delayed because one fix didn't work. He suggested:

"If you had an automated route request, they could flag the fix that's the problem, and maybe have an automated fix replacement or route replacement for that small segment."

Continuing with this idea, the Dispatcher indicated:

"A phone call's time consuming. A picture is worth a thousand words. If they could transmit that to the airline saying: 'Here's the problem; here's the possible solution, and let's take a look at what we have, what that saves and see if it's workable'."

This suggestion involves several components. First, route requests would be displayed on a computer screen where fixes or route segments that were unavailable could be marked by an

ATCSCC staff member (or marked by the responsible Center and transmitted to ATCSCC). Second, possible route adjustments around that fix would be identified by the computer. (Alternatively, such deviations could be identified and marked on the computer by Center or ATCSCC staff.) Third, these results would be transmitted to the ATC Coordinator for display and consideration. In this way, the ATC Coordinator, ATCSCC specialist and Center specialist could all look at the same display while talking to each other if further discussion was required.

This general approach is compatible with current practice:

"That's usually what happens when they call. We'll submit a route and they'll call back and say: 'It's ok, but instead of going this way, you need to change it just this way.' Then we'll rebuild the route and submit it again and file it."

Real Time Data on Choke Points. Through trial and error, ATC Coordinators begin to learn some of the choke points from Central Flow:

"Let me give you an example: Rosewood. That is 90% of the time a red sector. You file anything Jet 29 or anything that's going over Rosewood, they're not going to approve it. Forget it."

One interesting question is: How can we enhance this sharing of knowledge about choke points?

This question become even more important when the choke points change over time:

"Fort Worth has them too. Certain times of the day you can't go over certain fixes. That also changes, sometimes on a day to day basis. Sometimes you can do it on a Sunday and you can't do it on a Monday."

The significance of this need for information was highlighted by an example:

"Last Monday we submitted 7 requests on 1 flight before we could finally get a route."

Computer supported communication of choke points was suggested as a solution:

"One thing that would aid us would be to give us the current ASD data, and give the airlines the ability to project where the red sectors are going to be and when they're going to be. That is, give us the ability to go out and plan to keep that sector from going red by what we do. If we had the ability to see that Rosewood is going to be red at this particular time then we aren't going to bother to ask you for that, which will cut down on the number of routes you'll have to revise. I'd be making the choices about

which planes I'd be doing it with and also which way I want to go. How do we do the collaboration, that's the tricky part. The procedures, policies and the applications."

Control of Resource Allocation.

A final (and somewhat unrelated but still important) topic arose during the discussion of the slot-swap program at ATCSCC. This discussion highlighted the fact that many of the decisions made by ATCSCC staff have to do with allocating resources, including routes and arrival times. Issues regarding route allocation were discussed in detail earlier. Regarding arrival times or slots, the airlines viewed the slot-swap program (a method for allocating resources) favorably, particularly with the soon to be initiated multiple substitution program:

"[Swapping] it's cool. It's like NRP in that it's easily measurable and it's a major cost savings. It allows the airline to superimpose its business conditions on the ATC constraint."

"I agree. I think it's one of the best things going. It allows us to make the decision on what flights use what slots."

"As far as the slot swap program, I think it's the best thing that ever happened to the airlines. It gives us much better service to our passengers."

The discussion pointed out, however, other limited resources that are not as well controlled. One example that arose is:

"Outbound deicing slots. The chaos that occurs when we go into outbound deicing at a major airport. I mean, it is so totally chaotic because there is no control. I mean: 'How many? Where does he go? I don't know. 50%. What time? 50% of what? I don't know.' So we wind up at DFW and O'Hare, when we have freezing precipitation, we just cancel half the flights because that's the only way we have control."

IV. Summary

The previous sections discussed a number of concerns regarding the interactions of airline Dispatchers with ATCSCC. These concerns included problems with education, information exchange, policies and practices, work assignments and computer support. The focus group also identified a number of areas for improving the efficiency and effectiveness of activities at the airlines and ATCSCC. The specific issues brought up are summarized below.

IV. A. Airline-ATCSCC Interactions

Both airline and ATCSCC representatives indicated that very effective changes have been occurring in these interactions to help improve the efficiency of air travel and reduce airline costs while maintaining or increasing safety. Programs involving requests for non-preferred routes and slot-swapping were highlighted as examples of this.

Several factors were identified as contributors to these changes, with a major emphasis on an increased sense of cooperation between airline Dispatchers and ATCSCC. These factors included the development of shared goals and knowledge, the distribution of responsibilities, the incorporation of mechanisms for feedback and process control, and staff selection.

The usefulness of these observations lies in the possibility of modeling other potential changes in the air traffic management system on this successful approach to engender cooperative problem solving. Such potential changes include other areas of interaction between the airlines and ATCSCC, the airlines and Enroute Centers, and interactions between ATCSCC and Enroute Centers.

IV. B. Possible Enhancements and Research Issues

In addition to helping to build a descriptive model of the factors supporting cooperative problem-solving between ATCSCC and Dispatchers, the focus group served to identify a number of areas where fairly straightforward improvements could be made, as well as several areas where further research is needed to better understand the problem and potential solutions:

Short Run Enhancements

1. Improve avenues for providing direct answers to ATC Coordinators about questions on ATCSCC policies and capabilities. (In a number of cases, ATC Coordinators were surprised to learn of certain ATCSCC capabilities or policies);
2. Determine why Centers continue to sometimes advise airline ATC Coordinators (often through ATCSCC) to file routes in conflict with FAR 121. Then find appropriate remedies for this problem;
3. Collect data as part of a process control effort to determine how significant airlines' concerns are over slow response times. Use these data to determine whether there are cost-effective solutions (which could involve increased staffing or technological support);

4. Inform those airlines that don't currently communicate with ATCSCC through airline ATC Coordinators about the advantages of doing so;

Research Issues

5. Explore ways to help airline ATC Coordinators deal with the excessive workload demands that arise during periods with widespread weather problems, etc.;
6. Identify other areas where limited resources must be allocated (such as deicing slots) and consider implementing solutions analogous to the successful slot-swapping program;
7. Identify areas where the training of Dispatchers could be improved regarding ATC functions. Use formal mechanisms (such as the rewrite of FAR 65), as well as informal approaches, to implement such improvements in training;
8. Identify areas for improving the training of ATCSCC staff about the activities of Dispatchers;
9. Experiment (using simulations) with the concept of radically changing the process of managing air traffic by letting the airlines first propose routes and then having ATC identify and resolve conflicts;
10. Develop approaches to support cooperative software design between the FAA and the airlines;
11. Identify human factors problems in the design of software used to support interactions between ATCSCC and the airlines;
12. Identify classes of real-time data that could be fruitfully shared by the airlines and ATCSCC;
13. Improve the timeliness and adequacy of communication between ATCSCC and the airlines, and within airline Operation Control Centers by:
 - a. exploring an open-line concept to let Dispatchers listen in on activities at Centers;
 - b. creating a shared real-time database that all of the airlines and ATCSCC would have access to and could contribute to;
14. Provide improved computer support to display bottlenecks and to suggest route replacements to avoid such bottlenecks;

15. Develop tools to support cooperative work by allowing ATCSCC, Enroute Center and airline staff to view common displays during discussions;
16. Evaluate the possibility of allowing representatives from the air carriers [i.e., experienced Dispatchers] to be stationed at ATCSCC in order to enhance coordination among the airlines and between the airlines and ATCSCC staff, providing a "user representative" on site at ATCSCC.)

Some of these concerns are related to ongoing projects at the FAA, MITRE, and NASA. In those cases, discussions should be held with those research and development groups to fully communicate the findings of this focus group. Other concerns raise new issues that merit consideration. Discussions need to be held to set priorities and to develop a plan for further research. Finally, some of these concerns are fairly straightforward, and simply need to be communicated to the appropriate parties.

IV. C. Conclusions

The purpose of this focus group was to cast a wide net in order to identify and understand areas of success and areas for improvements in the interactions of ATCSCC specialists and airline Dispatchers. The results provide insights on a broad spectrum of issues. Some of these suggest possible short-run enhancements; others identify areas that merit additional study. Some caution should be applied, however, in interpreting these results, since they are based on a single seven hour meeting.

Finally, it is important to maintain a proper perspective when reviewing the issues raised. It was clearly the view of both the airline and ATCSCC participants that, although there are areas for improvement:

1. Changes in the interactions of ATCSCC with the airlines have shown major improvements in recent years;
2. These successful changes have resulted from efforts to encourage cooperation between ATCSCC specialists and Dispatchers, allowing them to work together to develop solutions that increase safety, reduce costs and improve efficiency. Thus, the methods underlying these successful changes should provide a model for initiating improvements in other areas.

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