AIR TRAFFIC DELAYS AND RUNWAY CAPACITY: WHAT'S THE GAME PLAN AND WHO'S KEEPING SCORE?

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The cost of delay in the ATC system is already totally out of hand. In 1982 a 23-man Industry Task Force said: "If nothing is done to improve airside thruput capacity, by 1991 we could see the cost of delay at our impacted airports reaching as high as 2.7 billion dollars a year." There are programs now being studied to meet this very real challenge, but they are moving at a snail's pace.

There is little push for more runways, and, if we had more runways at certain airports a very real question exists: "Could the present ATC environment handle the traffic?"

Traffic is increasing at a yearly rate of almost 5%. American Airlines has 320 airplanes today and expects to have 530 airplanes by 1991.

As traffic hits saturation at major terminals, delay grows exponentially from that point on. An FAA Staff Study, Report No. RD-67-70, dated November, 1967, said: "An increase of 10% in demand would result in a 60% increase in delay. A 20% increase in demand would see a 200% increase in delay."

There is sharply increased pressure to use close parallel and interactive runways to increase airport capacity, AND THIS IS -

THREATENING TO MAKE ONE OF OUR WORST, UNSOLVED SAFETY PROBLEMS A LOT WORSE. We are increasingly vulnerable to another Tenerife. It came within 50 feet of happening between 2 DC-10's at MSP!!!

SO, HERE'S THE QUESTION -

Can we apply automation in terminal areas to:

A) Make better use of available runways?

B) Reduce controller workload?

C) Increase safety?

ANSWER: YES, indeed we can.

QUESTION: Is there any effective program now being aimed at bringing this about?

ANSWER: In this country: NO. There is no active program at this time. In Germany there is a program soon to be turned on at Frankfurt. It has been tried by 30 controllers in simulation. They expect

to increase the flow of traffic on and off the runways, while decreasing control workload and increasing SAFETY.

QUESTION: You might ask then: Why did I say that we could have such a program here?

ANSWER: The answer is simple. We had such a system in operation here on a trial basis 20 years ago. This was a computer ordered final spacing system applied to the approach control operation. This system was run in simulation at the Experimental Center at Atlantic City. It was then taken to JFK for extensive live trials, using rush hour traffic, in both IFR and VFR weather.

These trials proved that an aircraft could be brought over the end of the runway within plus or minus 11 seconds. This 11 second figure is still gospel in the literature today. The best controllers could not achieve better than plus or minus 28 seconds on average. The difference between those two numbers is worth an increase of 20% in the landing rate - using fewer control orders than the controller uses in the manual system.

QUESTION: At this point you should ask me: Is all this documented?

ANSWER: Yes it is. It is thoroughly documented. There are three reports of the NAFEC simulation plus the live trials at JFK in 1964 and again in 1967. These reports (the report of Project No. 101-25X, dated September 1963, and Part B of the same Project, dated July 1964 and the Final Report on Project No. 150-514-03X, dated August 1968) indicate that this was clearly a successful program.

In addition, there is the FAA Staff Study referred to above. This Staff Study came out on the heels of the successful live trials at JFK in 1967. One of the major conclusions of this Staff Study was this: "By far the greatest benefits...are achieved by automation of the Final Spacing Function. Benefit/cost ratios of several hundred to more than 1000 are achieved by these alternatives."

In March of 1975, the MITRE Corporation published "A Proposed Metering and Spacing System for Denver," MITRE Report, MTR-6865). This document says in its summary: "The results indicate that the use of the proposed procedures (MITRE's recommended procedures), as compared to an automated version of the current procedures, could provide an increase of up to 20% in IFR capacity on runway 26L."

Another cost/benefit study (FAA-AVP 75-3, September 1975) said: "The delay reduction benefits are due entirely to the M&S (computer ordered sequencing and final spacing) capability, and represent the major source of all ARTS III enhancement benefits."

Then there was the very large "New Engineering and Development Initiatives" study that included all branches of Government, the avionics industry and the user groups. This voluminous report

was put out in March of 1979. It includes the following recommendation: "That the development of M&S (computer ordered sequencing and final spacing) be pursued as a matter of priority, with the intent that it would be the basic component of the future terminal area air traffic control system."

Twelve of the 51 recommendations of this study refer to the desirability of developing a Metering and Spacing operation for the terminal area.

On page 110 of Volume I of this study we read: "The Topic Group believes that the program goals (for M&S in the terminal area) are achievable...The M&S system, in the operation of the Topic Group, is the critical sub-system in the total airport program to increase airport capacity.

QUESTION: The next question, then, should be obvious. What specific follow-up took place? What has actually happened in the 20 years since the JFK trials -- while all those favorable reports were being written and published? Did FAA follow up on those recommendations?

ANSWER: YES. FOR A WHILE THEY DID. Several millions of dollars were spent in contracts with UNIVAC to develop a system for a continuing service trial at Denver.

This system was debugged at NAFEC, and, just as it was ready to be turned on at Denver, the project was scrubbed. It was turned off for reasons that were not acceptable to the user community.

The reasons were:

A) It was argued the system had to be designed to insure that it would never vector flights into severe weather. This requirement totally ignored the fact that the controller could still vector a flight around the weather, or a pilot could take himself around the storm cells at any time. The spacing computer would simply keep track of where every aircraft was and continue to issue the best vector and speed orders given the actual situation at any given moment.

B) It was argued the system had to be deployable in the complex New York area, with all the second and third order problems solved, before it could be tried on a simple basis anywhere. Airports like BNA, CLT, MEM, RDU -- the New Hubs -- need it now!

C) They demanded a guarantee that the system would never fail. This was totally unrealistic. The beauty of the system was: that it could fail at any time without creating an unsafe condition.

Let's face it, all evidence points to the fact that the Denver project was stopped because it did not fit into FAA's new policy on how to manage traffic flow.

QUESTION: Then, am I saying that FAA's R&D policy changed?

ANSWER: YES, it certainly did. The first NAS plan (Brown Book) put out in December 1981 shows a radical change. This thick book talks extensively about Central Flow Control and Integrated Flow Management. This sentence on Page IV-3 puts the new philosophy in perspective: "In the long term, automation will be extended to create an Integrated Flow Management System which will maximize airport capacity, smooth traffic flow and reduce aviation fuel consumption."

One FAA planner said to us: "If we do the right thing in managing traffic flow into the terminal area, we won't have to do anything in the terminal area itself." That is disastrously wrong thinking.

In the 1981 NAS Plan a sop was still thrown to those who wanted computer ordered final spacing.

On Page IV-54 the 1981 NAS Plan indicates that "terminal computer enhancements" will include "metering and spacing," but points out that the requirements for the metering and spacing feature will be DEFINED in 1989!!! 22 years after the successful trials at JFK!!!

Today FAA's rejection of computer ordered sequencing and final spacing for the terminal area is complete.

The updated NAS Plan, published in April of 1985, has dropped any mention of ever using a computer to space flights more accurately on final approach.

This switch in FAA's philosophy for ATC in the future is beginning to make the airlines very nervous indeed. Airline managements are beginning to realize that the only way for FAA's Integrated Flow Management to work is for FAA to take over the airline's Dispatch prerogative.

QUESTION: This brings us back to the question we started with: "Why, after the successful trials at JFK in the 60's, and the large volume of favorable reports -- why has computer ordered final spacing been dropped from the NAS Plan? Why has this potential for increasing the safe use of our runways by 20%, or more -- why has this tremendously important way of reducing the threat of multibillion dollar delay costs been put into the discard?

ANSWER: It is perhaps an oversimplified answer, but three errors in judgment were the root cause of dropping computer-ordered final spacing from the NAS Plan.

1) It was decided that the computer could not be allowed to violate the three-mile minimum spacing on final approach -- this in spite of the fact that the JFK trials had been run -- and been run safely -- with a 60 second minimum, approximately the same minimum Controllers had been using since radar was first used in approach control.

You can go out to any busy airport in the rush hour and determine that the manual controller will have approximately 30% of his arrivals under the three-mile minimum on final approach. And this with no SAFETY problem. The 60 second minimum on final used in the JFK trials produced no SAFETY problem. YES, there is an FAA evaluation for 2.5 mile final approach spacing. But what are we evaluating? Reality!

So, one must ask: "Why is the computer forced to use a limitation that the human controller is not required to use?" Or I might add: "That pilots in fact use in visual conditions?"

2) The second mistake in judgment was this: "The FAA planners laid several additional requirements on the computer." The spacing computer, for example, was required to also INSURE that the 3 mile minimum was not violated in any part of the pattern. This had not been a problem in the JFK trials. In fact, with the intense workload of choosing the exact times for final vectors and speed reduction lifted from the controller he had more time to double check the safe separation.

3) But worst of all (and I believe this was the real problem), a small group of planners in FAA decided that flow management should start at the departure end of the operation -- the departure airport -- and work toward the receiving airport. This approach gave us the Central Flow Control Facility, with the concept of quotas and slots. A whole host of unanswerable questions are raised by this backward approach to flow management.

Without artificial restraints such as miles-in-trail, minutes-in-trail or specific traffic flow by number of aircraft in specified time blocks, flow control should naturally start at the receiving runways. Feedback from what is happening in approach control will logically modify the plans at each preceding stage of the operation -- back through the system until you finally may need to issue departure release times.

To try to do this job the other way round, makes the problem an order of magnitude more difficult. In fact, such a system must ultimately fail, because there will still be a long list of unanswerable questions.

For example:

A) How do you deal with requests for test flights, extra sections, an air taxi operation, or VFR "pop ups" at the edge of the terminal area? How do you fit these last minute requests in with the long-haul flights, with their prearranged "slots?"

B) How do you deal with the problem when the ceiling drops another 100 feet at ORD and three landing runways suddenly and unexpectedly become two landing runways? Or an increase

of another three knots of wind at LGA turns a two-runway operation into a one-way operation?

C) Or how do you deal with a morning fog that doesn't burn off when the planners said it should? And a number of flights, without "slots," suddenly need to divert to another impacted airport?

These are real world problems. The control of traffic flow into an impacted airport by the most sophisticated computation of Departure Release Times has no answer to these very real, daily problems.

What this all means is: You just cannot run flow control starting with Departure Release Times. The flow control problem begins with what is happening at the exit point of the runway, and flow restrictions should be applied, as required, in stages back through the system. The application of Departure Release Times should be applied only as a last resort.

QUESTION: Let me go back to basics for a moment and ask again: "Did computer-ordered final spacing really work at JFK in 1967?"

ANSWER: YES, it worked. We handled more traffic during those computer runs than JFK had ever seen before. And not once did any controller back away from using the computed vectors and speed orders during any test run. The system was not turned off once for saturation traffic or any other operational reason.

The controller was pitted against the computer at NAFEC in the early simulation trials. There was no way that even the sharpest controller could match the simple vector and speed orders that came from the computer.

YES, the JFK trials of computer ordered final spacing did, indeed, work. There is no reason at all why we could not use computer-ordered final spacing in terminal areas today.

You will realize, of course, that there was no automatic tracking in the radar in 1967. And I might add that controllers saw alpha numerics on a working scope for the first time in that JFK project.

And you will realize that the technology today is light years ahead of where we were in 1967.

Look now at some of the things that are being pushed as ways to increase thruput capacity at impacted airports.

QUESTION: We hear a lot today about the importance of making better use of closer parallel runways and converging and diverging and interactive runways to increase traffic flow at overloaded airports. Will this indeed increase the number of operations per hour at these impacted airports?

ANSWER: YES. In the manual system, in VFR conditions, traffic flow will be increased -- if you are willing to accept a reduction in the SAFETY of operations on interactive converging runways.

But, I would like to point out that the problem of coordinating movements on interactive runways cries out for computer-ordered final spacing. A computer can look at the times that two aircraft will arrive at the intersecting point and adjust this timing to keep it safe. This sort of thing is extremely difficult for the manual controller to do. The manual controller will be forced to put a lot of extra cushion into his operation to keep it safe at all. Is it logical to suppose that verbal separation..."cleared to land hold short of taxiway alpha"...can be relied upon without additional safety factors.

QUESTION: So, what kind of increased rate could we expect on close parallel runways with help of a final spacing computer?

ANSWER: Very good question. If you mix departures and arrivals on each of two close parallel runways, the computer can stagger the arrivals, providing lateral as well as longitudinal spacing. This will give you an increase of something between 5% and 30% more capacity in the use of those two runways. Recent FAA R&D statistics indicate that a 5% capacity increase can reduce delay costs about 25%. Remember 11 airports have existing parallel runways spaced between 2500 and 4300 feet. But, even more importantly you would then be running operations at a higher rate than can be achieved in VFR on those runways. Concern about the possible "Blunder" factor, however, is real. One of the early hang-ups in the exploratory process of reduced independent simultaneous parallel runway use separation is the development of a suitable device to detect and alert Air Traffic Control of an aircraft deviation from the ILS/MLS runway centerline. The best intelligence in both Government and Industry estimate that the specifications, development, installation and testing for this device is at least four to five years down the road. Remember this would only be the first step on the long road toward a reduction in separation standards. Accepting that this timetable is valid for the development of the localizer excursion device, I would suggest that with present standards an evaluation of adherence to localizer centerline should be conducted with the requirement that aircraft autopilot ILS approach couplers must be used. Are we so blinded by new and future technologies that we cannot see the value of requiring the use of equipment already installed. Certainly 99% of all aircraft landing at major United States airports have auto-pilot ILS approach couplers. The required use of the airborne coupler will also reveal both airborne and ground deficiencies.

When the day comes that we can run airport ATC 98% the time at the same acceptance rates, we will have eliminated a large part of the confusion we sometimes experience today; and, there is no way we can do this until we put a computer to work to space flights properly on final approach.

QUESTION: What about the curved approaches of the MLS landing system? There are some who think this capability will increase operations rates on critical runways.

ANSWER: This is another case that cries out for computer-ordered final spacing. A computer can fit the aircraft on an MLS track behind, or ahead of, a 747 on a long straight approach. The manual controller certainly cannot do this. I think it should be clear to any carefully thinking student of this problem that the full advantage of the MLS capability will not be realized until we have computer-ordered final spacing.

I would like to add this final note: I find it incredible that we have not developed a method for determining how much runway time is wasted at our impacted airports. Neither do we have the hard data to tell us how much delay we are really experiencing, and what this delay is chargeable to.

For example: A MITRE study of a traffic sample at Atlanta (Report No. FAA-EM-79-23) indicated that excessive flow metering, and failure to distribute the load on the two runways properly, accounted for three out of every four minutes of delay observed.

I have an uneasy suspicion that much of the delay we are experiencing is chargeable to a flow management system that starts at the wrong end of the problem.

But we really don't know. All the hard data needed to answer this question exists today in a combination of the ATC computers and the airline computers. We need to pull this data out and have a hard look at it. I think we might learn some shocking things.

Maximum utilization must be derived from both arrival and departure runways. Do we know if we are getting maximum arrival and departure rates from these runways? The answer is NO! No -- simply because we have no organized system at all our major airports to catalog runway use by aircraft identification, type, runway used, etc. in minutes and seconds. This accountability is needed now and should be the combined effort of the airlines, FAA and airport operators.

The bottom line and objective must be to achieve absolute maximum runway utilization. When confidence exists that absolute runway rates are being achieved, then and only then should legitimate traffic restrictions be imposed.