It's the Structure: It's Always been the Structure

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What airlines/pilots want is simple. They want to take off when *they* want, fly the route that *they* choose, change that route as *they* require, navigate with the tools *they* select, land when *they* arrive and do this all without delays. What airlines/pilots want from the ATC system is to do the above without hitting another aircraft.

While this may seem simple, it is daunting from the perspective of the ATC system, but it should not be. Airspace congestion is largely a mythical issue that exists on a very busy computer screen in front of the controller. *There is plenty of airspace and runways.* The real problem lies with ATC's highly structured, manually based approach to separation, which is analogous to Henry Ford's first production line. Unfortunately for the consumer, while technology is leaping forward, inconceivably, ATC is planning to spend another 10 to 20 years building an complex network of even more highly organized structure.

In today's airspace we have restrictions and delays, the opposite of what everyone wants, primarily for one reason - ATC's current separation process. And ATC's ***manually run*** separation process requires one basic factor to allow it to work properly - structure. It is this ever-increasing structure that causes most of the restrictions and delays now so prevalent in the ATC system.

Yet, we have the ATC R&D branches and an entire aviation industry planning to spend billions on the avionics du jour (CPDLC, TCAS, ADS-B, GPS, etc.) which has nothing to do with giving the users what they want. This is not to say that these are not excellent technologies, but I defy anyone to find me an pilot/airline that is truly interested in spending $300,000 to install FMS and GPS systems for ATC purposes if they don't need to. Is there a better way? I believe there is.

Imagine the controller's job as manually guarding a room - four walls and no windows. Now imagine that there is only one door leading into the controller's room. For anyone to enter, they must knock and receive permission from the guard. So far not too difficult. Now add another door and a defined pathway between the two doors. Again, a manageable task. Add more doors and the controller needs more and more defined pathways between doors to keep things orderly, even without a single person in the room. Now add people entering and exiting the room and the defined doors and pathways (structure) are the only way for the controller to easily visualize the future path of each person in the room to identify where any conflicts will occur, keeping everyone safe. And to add to the difficulty of the problem, although every room adjoins 2 or more other rooms, each room operates mostly independently. People or aircraft, the process is the same. It's the structure that makes the controller's job (mentally visualizing the future path of each aircraft to identify potential conflicts) doable, but also makes the system inefficient.

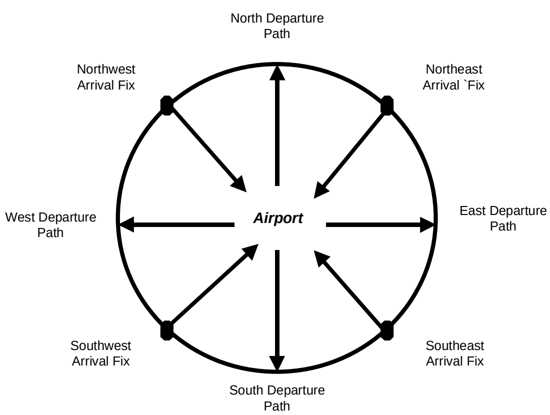
Further, the more structure a system has, as the workload on the operator increases, the more that it needs - ***structure begets structure***. But the door/pathway structure, now required in the ATC system, is predicated on a 40-year-old assumption that the controller must manually identify each conflict. Structure is both the strength and weakness of the present system. Its strength is that the structure is the only way the controller can assure safety within the current manual, God's eye view system. Its weakness is that until the structure is removed, inefficiencies can only get worse.

A complicating factor in the ATC problem is the two types of separation necessary - tactical and strategic. Tactical separation is the controller's core job. The controller must mentally calculate whether any aircraft in their room will conflict with any other aircraft 30 to 80 miles into the future and if they do, alter one aircraft's path. Strategic separation is what the controllers do (distance-based linearization of the aircraft flow) as too many aircraft converge at an airport. As the traffic load increases, the length of the conga line (i.e., delays) increases dramatically.

Remember all of ATC's finger pointing in 1999 stating that 75% of the delays were caused by weather? Well, this is not the whole truth. You see, all arriving aircraft into a large hub airport (i.e., Chicago, Dallas, Atlanta, etc.) must enter via a well-structured route that flies over specific geographic points separated by approximately 90 degrees. And if nature adds a 20-mile line of thunderstorms over one of the structured arrival fixes - the flow of traffic stops. Can the aircraft easily fly around the weather - of course? Will the ***structure*** in the ATC system allow it - no way? To fly around the weather, the aircraft could ***potentially*** conflict with the departing aircraft which the structure dictates must climb out from the airport between the arrival fixes.

None of the current R&D ATC modernization efforts, like its latest magic bullet - CPDLC, allow removal of any structure, a very important point. The same for GPS, ADS-B and a host of other current ATC modernization programs. These programs simply allow the controller to do a better job within the structure and will have little effect on delays or safety in the face of ever-increasing traffic. Add in ATC's excessively long program lead times and we assure little will change. Absence a recession to limit traffic, these programs cannot even assure that controller workload levels will remain in the safe range.

Aircraft Arrival/Departure Flows



There are only two things required to begin the process of removing the layers of structure - time-based flow management and a computerized conflict probe.

The first critical part of the solution is airline driven time-based flow management to the airports. This was the basis of the successful Berlin Airlift over 50 years ago, yet we ignore these lessons from history. Instead of linearizing the traffic flow 100s of miles from the merge point, assign the aircraft a specific time to cross the merge point. Let the pilots do their job - navigate (in all 4 dimensions); let the controllers do their job - separate.

The second part of the solution is a computerized conflict probe that looks at much larger sections of 4-dimensional airspace than the controller's room, which will relieve the difficult controller of the task of identifying conflicts. This tool can easily answer the question so difficult to answer in the current system - will two aircraft hit each other? This simple question lies at the heart of any separation process, but today can't be answered by the controllers outside of their individual rooms. A pilot is denied a direct routing - why? The cause is the structure given the controller's inability to determine if the aircraft will conflict with another aircraft. The fact that there may not even be an aircraft on the pilot's requested flight path is immaterial.

Although the controllers would still monitor their individual rooms and pilots would still file flight plans (their choice, not ATC's), the use of the conflict probe allows controller to manage separation, not airspace.

Slowly, the sector to sector and center to center restrictions (structure) now required to assure the aircraft enters through the right door can be peeled away. Rather than building structure to limit conflicts, or put the conflicts all in the same place so the controller knows where to look, the controller could safely allow more random paths. This is based on the controller's knowledge that the aircraft is conflict free 15 minutes into the future, regardless of whether their attention is momentarily diverted.

The following represents the steps necessary to rapidly and inexpensively prevent delays, congestion and excess CO_2. This solution overlays the current ATC system in such that the highly structured airspace system can be slowly peeled back.

1. Assign a VP - Production at each airline (3 months), with cross departmental authority to put the passenger where they were promised, when they were promised
2. Install a computerized conflict probe-based backup system (2 to 3 workstations per center) using existing technology. This will drastically increase system safety, integrity and significantly reduce operational errors. (6 to 12 months, $20 million)
3. Implement airline/operator managed time-based sequencing to the arrival corner posts. (6 to 12 months)
4. Expand the conflict probe-based backup system to a complete, fully operational ATC system. (24 to 36 months, $300 million)
5. Begin removing structure while replacing the old ATC system with a new backup system and start all over on a 5-year cycle.

Solve the right problem,
Keep the solution simple.

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