FEATURE STORY

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Fill a plane: How hard can it be?

The quickest method is 4 to 10 times faster than the slowest.
For airlines, there is a fortune to be saved by getting the aircraft filled in a hurry. But will passengers be treated like cattle? An Australian engineer claims to have found an inexpensive solution that satisfies everyone, but airlines haven't taken up his "magic carpet".

As passengers you know only too well:
Departures are already late, you have an appointment on arrival or must connect to another plane. Finally, they announce boarding, you get your ticket checked then rush forward - only to join a long queue of people waiting to get onto the plane.

And when you finally reach the cabin, to your boundless irritation, passengers are blocking the aisle, putting coats, handbags, computer, etc. up into the overhead lockers. Why don't they step aside into the seat row, wait for people to pass, then stow their baggage?

Nuclear physicist on the task
Such thoughts also occurred to nuclear physicist Jason Steffen when he was boarding a flight from Seattle, leading him to find out whether there was a faster way to fill a plane. Airlines have had decades to optimize this non-negligible part of their overall performance. Indeed, there are millions upon millions of dollars to be saved if they can at least get planes away on time, so they don't lose their place in the runway queue.

Even winning just five minutes on each flight is pure gold for shareholders. Faster turn-around (time from an aircraft landing to taking off again, Ed.) means better use of aircraft and hence fewer aircraft are needed.

And for passengers, getting aircraft off on time is important for mental health. In one survey 30 percent of passengers stated that, "Delayed flights made their blood boil". But for decades now boarding time has just been getting longer and longer.

Very simple, or ...?
It was soon apparent that to fill a plane as quick as possible – however trivial the task may seem – is almost on a par with space exploration. Maybe, maybe not, but more about that later.

Jason Steffen created his own computer program, where he could test different methods of boarding. He presumed that the slowest way might be to fill the plane backwards from the first row, because passengers would always block each other. The time spent by this manoeuvre was his starting point. Common sense says that if one chooses the opposite approach of the worst, you probably get the best, so he tried boarding the plane from back to front, - the method used by most airlines

Most common - but inferior
He presumed that back-to-front boarding would be several times faster, but to his surprise, it was only slightly faster - and even more interestingly – was the second-worst of all boarding methods. For example it is faster just to let the passengers go on board in random order.

Initially, he believed there were errors in the computer system, but when that was excluded, he became seriously interested in solving "the problem".

Monte Carlo simulation
In further work he used, among other things, the tool familiar to physicists, the Monte Carlo simulation (how atoms and molecules to organize themselves). The Monte Carlo method is not a theory but a purely practical implementation of an exercise which involves running the experiment over and over again. In this situation it simulated passengers with allocated seats.

The big time-consumer
It soon became clear to Jason Steffen that the biggest problem is the time passengers spend on putting luggage into the overheads lockers, causing others to wait until they themselves can do likewise. Hence, it is necessary for passengers to be scattered as much as possible, to provide room for each person.

True, back-to-front boarding minimises blocking of the aisle. But, on the other hand, the passengers who have just boarded are clumped together beside their rows, and waste much time getting in each other's way. Meanwhile, the rest of the aircraft is empty instead of being used by other passengers to remove overcoats, jackets, rummage in their bags, look around, close bags, stow them in overhead lockers and sit down.

Four times faster
The American physicist discovered - by running different boarding methods again and again on the computer - that the optimum filling of a plane is 4 to 10 times faster than the slowest, depending on aircraft size. It does however require that every passenger has a specific place in the queue beforehand.

Boarding should begin at the rear of the aircraft, window seats first. At the same time there must be a vacant row between each passenger, so there is room to get to stow cabin baggage in the overhead locker.

A plane with 30 rows should therefore be filled as follows: 30A, 28A, 26A and so on, up to 2A. Next, 30F (window seat on the right side), 28F, 26F, etc., followed by 29A, 27A, and 25A. Then come the middle rows in the same sequence and finally, the aisle seats.

... but difficult to implement
There are at least two problems with this solution: Many travel with another person, and want to go on board together. Moreover, it also requires staff to organize the queue before boarding.
Steffen therefore propose a modified solution in which a row (three seats) boards at the same time, and otherwise follow the same system as before, ie. 30ABC, 28ABC, 26ABC, etc. It takes twice as long as the optimal method, but is twice as fast as back to front boarding.

Spread the passengers
Menken van den Brielle at Arizona State University is another researcher who has been tackling the problem: "How to fill a plane with 150 passengers in less than 15 minutes?" He dealt with particular combinations, so the specific task of filling planes as quick as possible was not so daunting.
Menken van den Brielle's study on behalf of the former airline, America West, is among the most thorough in the area. He devised computer simulations based on field studies at Los Angeles International Airport, where he filmed real passengers.

The answer clearly showed that the aircraft filled more quickly if passengers board in small groups in a logical order, spread out as much as possible on the plane. But people are not cattle, they will not follow rigid rules (particularly when they may not understand, especially nervous passengers who may have behaviour patterns that are at odds with a regimented boarding system. Some will want to be first aboard, others will wait until the last moment, and what about those who always comes rushing at the last minute?

The magic carpet
So now the Australian Rob Wallace and his "magic carpet" enters the scene. The engineer - and now boarding analyst - believes that giving passengers the opportunity to organize themselves prior to boarding will beat any imposed system.
The key to a successful boarding system is, according to him, allowing the passengers to go on board when it suits them, but in a logical order in relation to their place in the plane.
He has invented a large mat or a "magic carpet" which is adaptable to different aircraft types.

How it works
The carpet is in principle a mini version of the aircraft cabin plan, with small numbered squares, each representing a seat. When a passenger wants to go on board, he places himself onto his numbered place on the carpet. If others have already taken their places, there may not be room for him to stand on his numbered place. Then he must stand aside and wait a minute or two, until the current group of passengers proceed on board, and the carpet is "open" again for new passengers.

Common sense is encouraged
To encourage filling window seats first, these spaces are larger. Passengers in these seats have a better chance of taking their place on the carpet and thus are able to board sooner. Aisle seat places are quite small, as these seats ideally should be filled last.

"The magic carpet" is not just a cheap solution. It also discourages pushing and bickering, because the aisle of the plane is always free. It is flexible in the way that families and couples can be together, and it takes into account "early" and "late" passengers, points out Rob Wallace.

Difficult to penetrate
To Stiftstidende he says, " The problem of slow boarding is far greater than most realize. I have studied all boarding systems, and in most cases the" magic carpet" could halve boarding time. But for an individual in Australia it is very difficult to get attention from airline managements. This is regrettable because it is both to their own and the passengers advantage. It is not expensive to implement, and nothing can go wrong."

Even you can do something
Regardless of the boarding system the big time-consumer is the amount of hand luggage that passengers carry into the cabin, so you can do your part to get the plane away on time.

One last tip or two: When boarding, the aisle is not the place to begin to greet friends and small-talk about the purpose of the trip. And if the cabin baggage is so heavy that you need help to put it in the overhead locker, it should surely have been checked in as ordinary baggage.

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How different airlines board

On scheduled flights, passengers in business class and first class usually go on board whenever they wish, while passengers who need help, including families with children, are also first to their seats.
On charter flights, families with children are often first on board, after which the "ordinary" boarding begins.

Thomas Cook Airlines (Spies and others): Back to front.

Tui Nordic (Star Tour): Back to front.

SAS: Back to front, combined with passengers (for example) having loyalty cards, who can board whenever they want.

Cimber Air: Three boarding systems, depending on aircraft type: Back to front, front to rear, front and back simultaneously with two entrances.

Thai Airways: (Boeing 747 with two median aisles) Back to front, but passengers further back in the plane can always go with those that are "called". In economy class, the following seats are called in series: 53-71, 43-71, 31-71.

British Airways: Back to front.

Singapore Airlines: Back to front.

Air France KLM: Back to front.

United Airlines: From the outside in (window seats, centre seats, aisle seats)

America West: Reverse pyramid.

U.S. Airways: Window Seats only

Source: The companies themselves and Rob Wallace