

## Effects on the network of extra standby aircraft & B737 MAX grounding

The Boeing 737 MAX aircraft has been grounded since mid-March and it is difficult to anticipate how long this will last. After seven months, the impact of the grounding, both operationally and financially, is significant for many in the aviation industry.

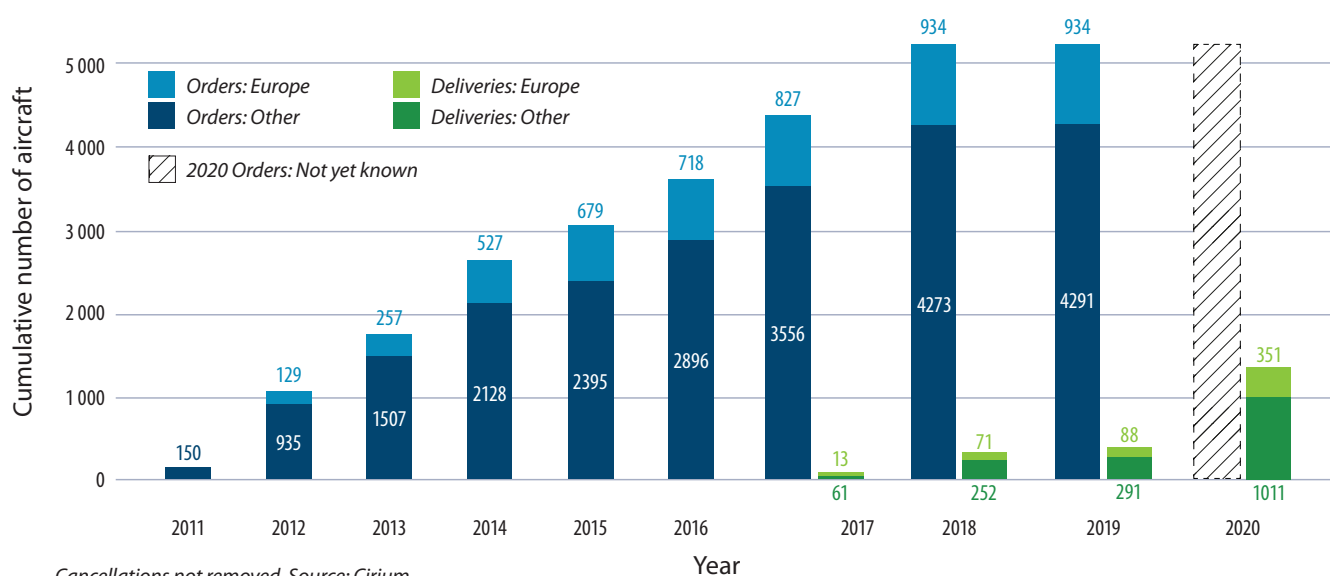
Our analysis suggests that, after a very brief spike in cancellations, airlines managed to find alternative aircraft to provide 85% of the flights that were originally planned in Europe. That remaining 15% gap, however, amounts to nearly 0.2 percentage points lost from Europe-wide flight growth. Growth of flights in Europe was weak this summer, just 0.4% in August, for example. If the MAX had been flying, this would have been nearer 0.6% growth instead.

A resumption of flights in 2019 is looking unlikely. As more deliveries are postponed, the effect of the grounding will increase and December growth could be reduced by 0.3-0.4 percentage points. On the flip side, a resumption of flights should lead to a small boost in growth, although it is likely to

take a while for airlines fully to adjust, so the effect will not be instantaneous.

For comparison, we also looked at how airlines adapted their plans for summer 2019, in response to high air traffic delays in 2018 and forecasts of similar in 2019. A number invested heavily in 'hot stand-by' capacity: extra idle time for specific aircraft in their planning. Some of this buffer is always included in plans. We estimate that the additional buffer took perhaps 0.4% off flight growth, so about 3 times the size of the effect of the 737 MAX grounding. As with the grounding, we would expect summer 2020 to see a smaller 'hot stand-by' effect, if the delay situation gradually improves.

FIGURE 1. DELIVERIES AND ORDERS FOR BOEING 737 MAX



## The 737 MAX

The Boeing 737 MAX 8 is a narrowbody short- to medium-range airliner with a range up to 3,550 nautical miles. The first commercial flight took place in May 2017. The aircraft uses 20% less fuel than the legacy B737-800, which it is intended to replace.

Following the Lion Air accident, and then the Ethiopian Airlines Flight ET302 accident on 10 March 2019, the European Union Aviation Safety Agency (EASA) published an airworthiness directive, suspending all flight operations of all Boeing Model 737-8 MAX and 737-9 MAX aircraft in Europe from 12 March 2019. The aircraft were grounded worldwide within a few days. At the time of writing, Boeing, the US FAA and other regulators are working to restore the aircraft to certified airworthiness, but no date for worldwide resumption of flights is fixed.

In the meantime, airlines have responded with a mix of delaying aircraft retirements, using alternative aircraft (often on short-term lease) or cancelling flights. In support of the autumn STATFOR forecast, this paper explores the impact of the MAX grounding on traffic volumes over the summer in Europe, and considers what the coming months might hold.

## MAX flights in Europe

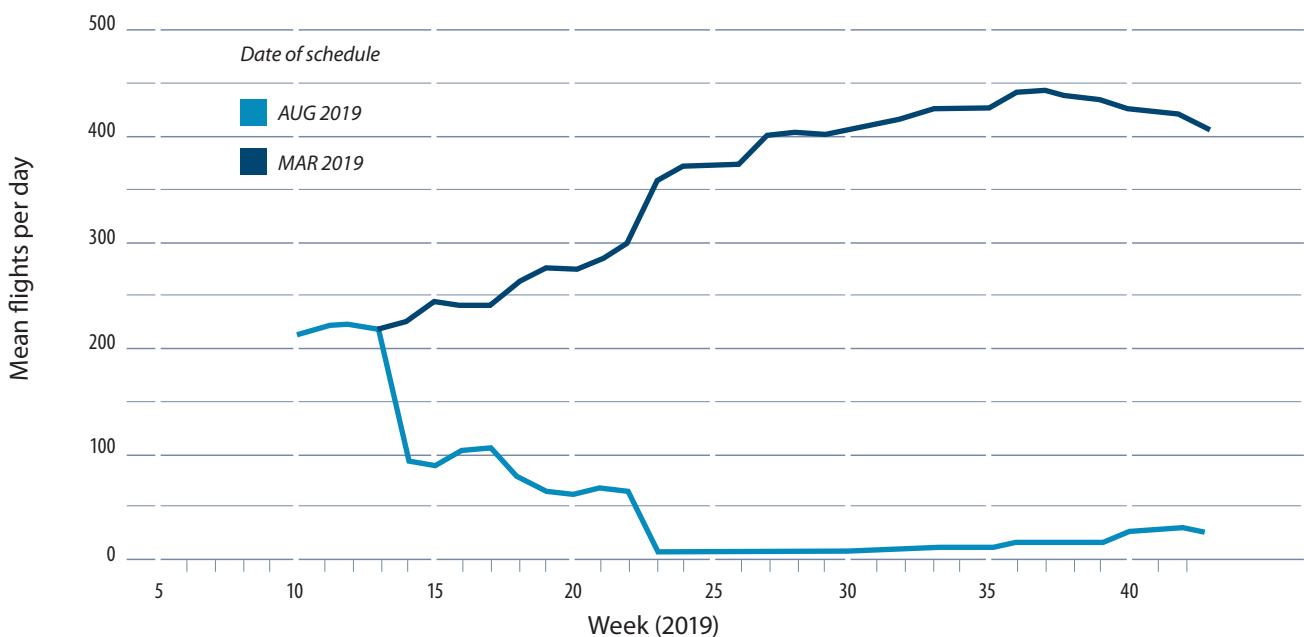
The most common aircraft in European skies is currently the legacy B737-800, used for more than 18% of the monthly flights in February 2019 (the last complete month before the MAX grounding), nearly 4,800 flights per day. It is, for example, the main aircraft of Ryanair, the busiest operator in Europe by flights. In the same month, the B737 MAX had a share of 0.7% of flights, corresponding to around 205 per day in Europe.

As a medium-range aircraft, those 205 flights in February included flights by European operators, with Norwegian Air and Turkish Airlines at the top of the list, but also flights by non-European operators to and from Europe, such as FlyDubai and Oman Air.

We have analysed the MAX grounding based on EUROCONTROL's PRISME Fleet data and flight data, and based on schedules and fleet data from Cirium.

Figure 1 shows the current (October 2019) status: a freeze in aircraft deliveries in 2019 has created a bulge of 263 MAXes to be delivered in Europe in 2020, more than 20 per month.

FIGURE 2. EXPECTED MAX FLIGHTS IN EUROPE, THEN AND NOW



*“A bulge of 263 MAXes to be delivered in Europe in 2020”*

## The initial impact: operational cancellations

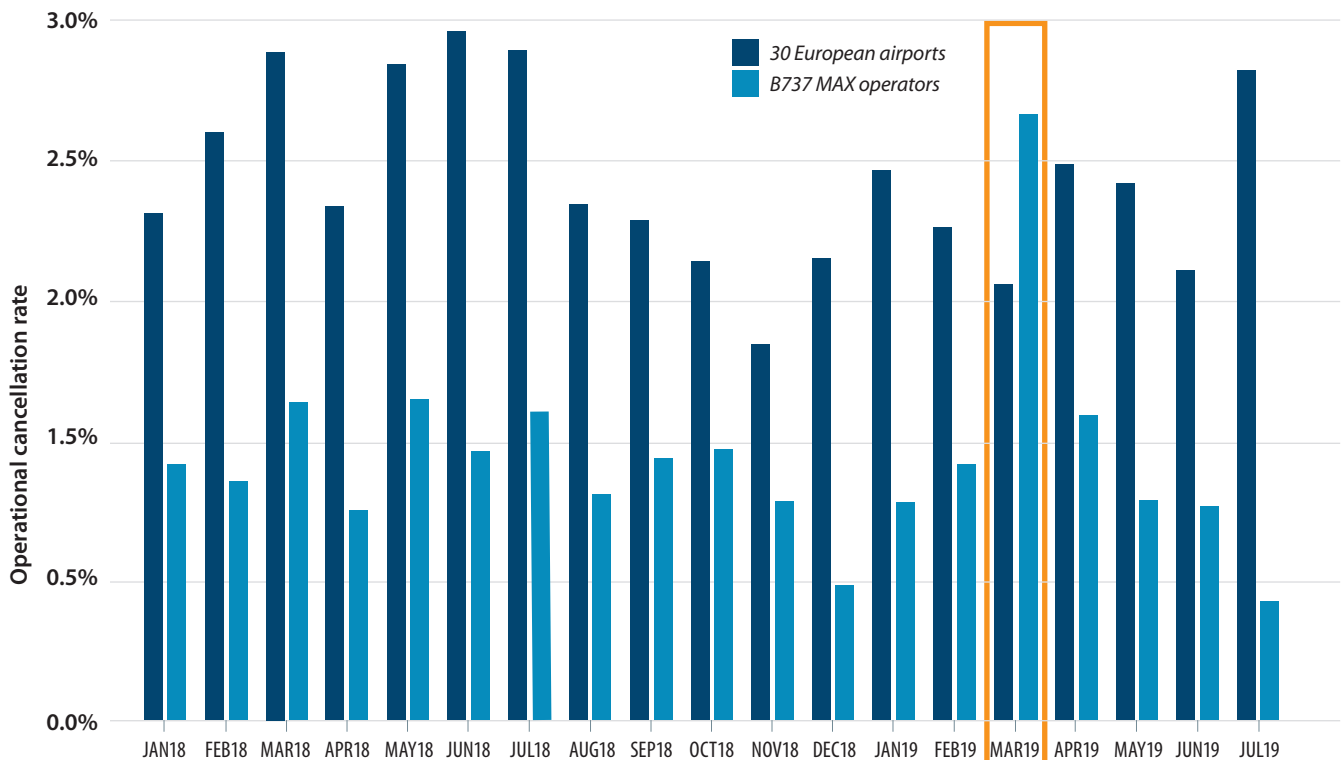
At the start of 2019, however, airlines were planning in anticipation of receiving deliveries of MAX already during summer 2019. This was reflected in the schedules published at the beginning of March 2019. Figure 2 shows that airlines had scheduled to double the daily MAX flights, from around 200/day to over 400/day by the end of the summer (dark blue line), as new aircraft came into service. It also shows how in August the published schedules reflected the grounding and, perhaps, some limited optimism about lifting the suspension later in the year, though it is difficult to separate this from 'noise' in the data.

It takes time to find alternatives when a major aircraft type is grounded. So in mid-March operators briefly had to cancel flights. EUROCONTROL/CODA collects data on operational cancellations, direct from airlines and airports. These are cancellations on the day of intended operations, or very close. By contrast, removal of a flight from the published schedule might be called a 'commercial cancellation'.

CODA saw a spike in operational cancellations by MAX operators, on MAX airport-pairs, in March, as Figure 3 shows (for data at 30 major airports). The spike was 400 operational cancellations, over 2% of planned flights.

But this spike only lasted a month, then dropped again below the background rate of cancellations, to a similar rate seen in earlier months.

FIGURE 3. OPERATIONAL CANCELLATION RATES PEAKED IN MARCH FOR MAX OPERATORS



*“CODA saw a spike in operational cancellations by MAX operators, on MAX airport-pairs, in March”*

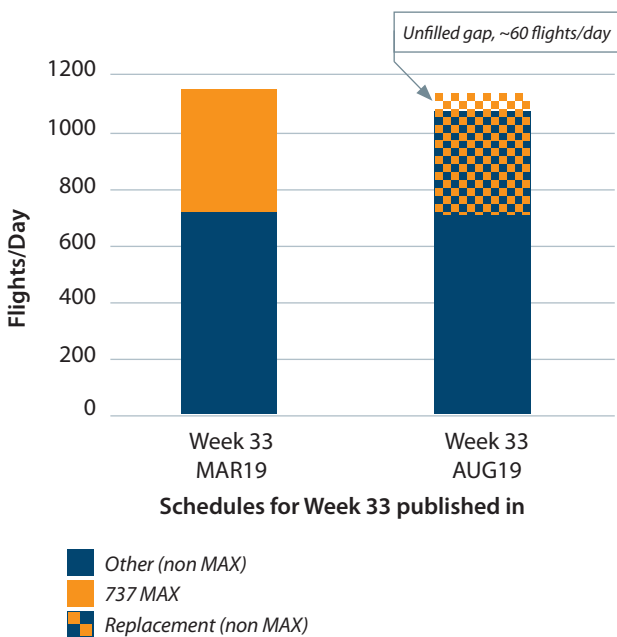
## Replacement programme

Cancellation is only a short-term solution. From April, airlines managed to deliver a portion of the originally-scheduled MAX flights using replacement aircraft. We estimated this portion by comparing the pre-grounding and more recent schedules, and actual flight data.

Between the March and August schedules, total scheduled frequency on airport pairs where the MAX had been expected fell by a fairly steady 50-60 flights per day in Europe. We identified cases where, to achieve this, airlines had increased non-MAX frequencies to fill in the gap left by MAX. There were also cases where non-MAX frequencies had been reduced, presumably for other market reasons, and where airlines had cancelled flights on non-MAX airport pairs, to free up capacity to use on MAX airport pairs. But these latter two were relatively rare.

Figure 4 shows the net result for a typical week in mid-August. Non-MAX aircraft have filled around 85% of the MAX gap, leaving a little over 60 flights/day fewer than originally planned.

FIGURE 4. TOTAL FLIGHTS WHERE MAX HAD BEEN PLANNED TO OPERATE, IN EUROPE.



This loss of flights, in effect, reduced overall growth in flights by around 0.15 percentage points. A small effect, although not insignificant compared to the actual growth in flights in August of 0.4%, compared to August 2018.

Analysis of worldwide schedule data shows the average for August was a slightly lower 80%, and the picture was more varied:

- In the US, airlines cancelled more and filled only around 76% of the gap left by MAX in August. In some cases this was by reducing frequency on double-daily, or higher frequency routes, such as Boston-Miami or Chicago-Seattle. As a result, some 60 flights/day were lost.
- Canada was expecting to be the second largest MAX market in summer 2019, and carriers there managed 85% replacement, leaving around 20 flights/day fewer in total.
- China had a similar rate of replacement to the US, losing some 20 flights/day.
- In India, only around 50% of the gap was filled, though this picture was distorted by the failure of Jet Airways.

## Contrast: hot stand-by

By way of contrast, we compare the scale of the 737 MAX grounding with the impact of airlines keeping aircraft in hot stand-by: the small margin that they keep of spare aircraft capacity to cope with issues which arise on a particular day. As with operational cancellations, there is a background level to hot stand-by. What is interesting here is any increase compared to the background (ie summer 2018) level.

In planning for summer 2019, a number of airlines responded to the critical delays in summer 2018, and the warnings of more to come in 2019 by increasing their investment in hot stand-by. ('Investment' because not using an aircraft has an opportunity cost in revenue forgone.)

Hot stand-by does not mean a single aircraft parked all day: often it means a few more idle moments during the day for a larger number of aircraft, increasing the general buffer.

*“Non-MAX aircraft have filled around 85% of the MAX gap”*

Nor does it mean that, at the end of even a 'normal' day, none of that spare capacity will have been used. Instead it becomes part of the toolkit that an operations manager will use to optimise performance, for example swapping in a stand-by aircraft for a moderately-late inbound aircraft to reduce first-rotation delay, knowing that this will pay dividends for the rest of the day as well as improve passenger connections.

This use of the spare capacity doesn't get around the fact that the airline has sold seats on fewer flights; total utilisation is still reduced. But the difference between plan and what happens on the day makes it difficult to measure the increase in hot stand-by from flight data. We made a detailed analysis at the level of tail number to look for differences in utilisation (flights per day) between summer 2018 and summer 2019 for a major airline. We allowed for the general increase in average hours per flight, as part of the gradual shift to longer-distance flying, and an overall increase in total capacity. Even so, there was an identifiable group of aircraft flying fewer flights over the summer months, and fewer hours. This amounted to 1-2% of capacity foregone.

At the same time, by looking at the flight planning process, we could identify a similar rate of late swaps of aircraft. This suggests how much of what had been planned as spare capacity was being used.

Our discussions with airlines suggest that it is some, but by no means many, that were able to extend their stand-by plans specifically in anticipation of high delay in summer 2019. We therefore make the conservative estimate that the single airline example (1-2%) generalises to around 0.4% of flights overall that were affected.

Thus, airlines' anticipation of high ATM delays in summer 2019 is about 3 times the size of the effect of the 737 MAX grounding, over the same period.

## Contrast: airline failures

Autumn is a difficult time for cash flow for airlines, and thus a peak time for airlines to fail. 2019 has been no different, and we have recently lost Thomas Cook UK, Adria, Aigle Azur and XL Airways. Travel has been disrupted and jobs lost. The network has also lost the approximately 300 flights per day that these airlines carried in August. That is around 1% of European flights, although on some routes other airlines have been quick to step into the gap.

## Looking ahead

Deliveries of 737 MAX in Europe had been due to accelerate from November onwards, though now Q1 2020 looks more likely for a return to service at best.

To estimate the impact of this further delay, we combined the delivery expectations with an expected number of rotations per day, and a proportion of MAX gap filled. Before March, a typical operator was flying its MAXes 3-4 times per day. In the schedule, it looks like around 4 is a reasonable average: with usage on longer legs of 3-4 hours, high-frequency rotations of 6 or 8 per day are at the top end of the distribution, and do not represent the 'average'. For estimates of airlines' success in filling the gap left by the MAX, the starting point is the 85% mentioned earlier for August 2019.

Three factors move this pointer: as the number of 737 MAX not delivered increases, the demand for replacements increases, so it becomes more difficult to find lessors with spare aircraft that are a good fit; but secondly with a seasonal dip in traffic that should moderate that. A third factor, the ability to delay retirements, might get marginally worse as expensive major checks loom closer. Combining these and from existing announcements and news, we assess the MAX gap will widen, as the first factor dominates.

On this assessment, we estimate the reduction of growth could be 0.3-0.4 percentage points by the end of the year if there is no resumption by then, as now seems likely. This extends to 0.6-0.9 percentage points by Easter in a worst-case scenario of a very late

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## Summary

resumption of flights. On the flip side, after resumption of flights, growth should see a corresponding small boost, although it is likely to take a while for airlines fully to adjust so the effect will not be instantaneous.

By summer 2020, if deliveries resume and if ATC capacity delays begin to decline, we expect that the dampening effect on flight growth will diminish.

1	400 flights/day had been scheduled with Boeing 737 MAX for summer 2019 in Europe.
2	Airlines managed to find substitutes for 85% of these, meaning just 0.1%-0.2% reduction in Europe-wide flight growth in summer 2019.
3	By contrast, airlines' additional investment in hot stand-by aircraft for summer 2019, in response to high levels of ATC delay, cut flights by 3 times as much.
4	The MAX grounding effect will widen to a 0.3%-0.4% impact by the end of the year, as more deliveries are postponed.
5	2020 should see around 20 737 MAX deliveries per month to European carriers once approved by EASA for return to service.

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