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Our ref MAK (MT)
Your ref

Re: Hybrid Powered Airbus for easyJet

Dear Matthew

Thank you for your letter regarding your ideas for incorporating a thrusting open rotor on the A320 in place of the APU.

As you may be aware, Rolls-Royce is at the forefront of work on the Open Rotor concept for the '150-seat' replacement market as part of our Option15-50 Programme announced at Farnborough. The Open Rotor clearly has the potential to reduce fuel burn significantly but there are significant technical risks to mitigate before the technology is sufficiently mature for airline service.

As part of this programme, we are already running contra-rotating blades in a rig to understand the noise characteristics and validate the performance of such an engine. We anticipate results from this important test programme being available towards the end of the year.

In these times of increased fuel costs we all must seek new ways of reducing cost and our environmental footprint and the Open Rotor is just one of the elements of our Option Programme.

With regard to your specific proposal, any aircraft design is always a delicate balance of conflicting requirements and it has always proved very difficult to make a positive change one element without changing others in the negative direction.

Rolls-Royce has looked at various configurations of thrusting APUs on several occasions and should you wish to discuss your proposal in more detail, then I would be happy for a meeting to be arranged with our experts but in summary here are their initial thoughts.

The addition of a thrusting APU to any aircraft inevitably increases the technical complexity of the solution and this tends to lead a worsening in system reliability and higher maintenance costs.

The contra-rotating prop, as opposed to a single stage of propeller, is necessary to achieve the required aircraft speed, and as yet the Open Rotor gearbox, pitch control and blades are not yet proven, risk-free technologies. This means that the Open Rotor element of your concept could not be available earlier than around 2018.

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The overall fuel burn of an aircraft fitted with an Open Rotor thrusting APU would only improve by a very few percentage points. In addition, the combination of Turbofans and an Open Rotor on the same aircraft would lead to a degrading of total system efficiency since the turbofans are designed to operate at cruise speeds above 0.8 mach whereas the Open Rotor has its peak efficiency at 0.76 mach. Thus one or both engine types would have to operate well away from its optimum speed – worsening fuel burn. Beyond this, a Turbofan and an Open Rotor have different lapse rates around the flight envelope again further reducing any benefit from the concept.

In our studies, the installation of a thrusting APU has always been problematic and in the case of an open rotor it is even more so, and would require a significant redesign of the whole empennage. A key issue here is that each prop blade would cut through the wake of each of the two horizontal and the vertical stabilisers, in each rotation, creating a noise sources. Each time a control surface on the tail was activated, it would change the incidence of airflow on to the prop blades, again changing the noise characteristic and reducing the efficiency of the blade's aerodynamics.

We have generally found that a business case for a thrusting APU can seldom be realised. In this instance, taking the cost of money into account, the pay back of the proposal is over 15 years. The additional factors discussed above would only degrade the payback. Additionally, the development costs of such a venture tend to be an order of magnitude greater than suggested in your paper.

I must apologise if this response appears negative to the suggestion, but Rolls-Royce has examined the thrusting APU concept on many occasions, seldom with a positive result.

However, let me assure you that we are working with the airframers to understand the potential of the Open Rotor concept and to mitigate its associated technical. If you would find it useful we would be more than happy to arrange for your team to come and meet with our technical experts to discuss further.

Yours sincerely



Mark A King
President – Civil Aerospace