AIRBUS

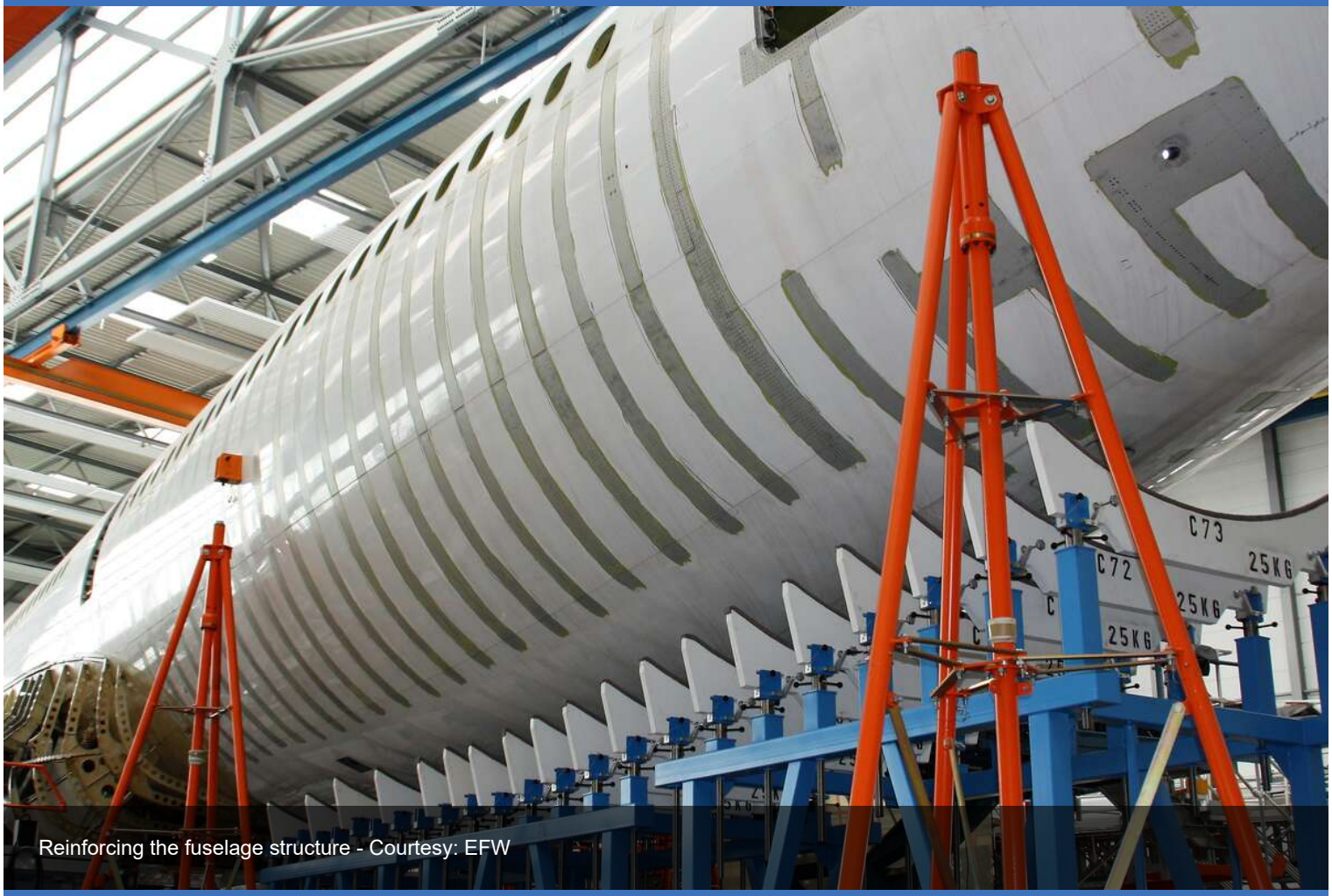
FAST magazine - Mar 2021

Passenger-to-freighter conversions

What operators need to consider

Article by:
Martin FENDT
Technical editor - AIRBUS

Interview with EFW



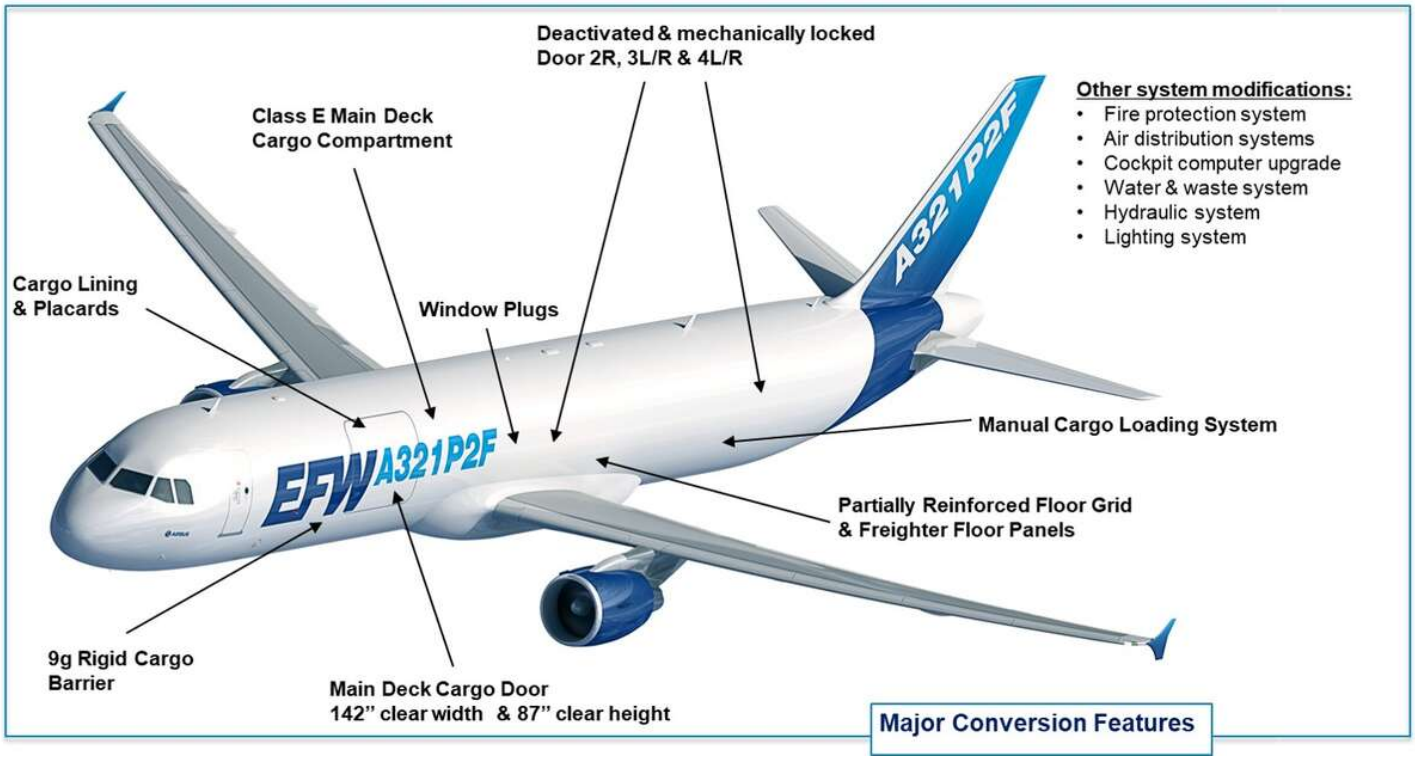
Reinforcing the fuselage structure - Courtesy: EFW

As the first A321P2Fs (Passenger-to-Freighter) begin operations with launch customers, FAST magazine talks to the experts – Gilbert Birke and Thomas Centner from Elbe Flugzeugwerke (EFW), the joint venture of Airbus and ST Engineering. We examine what makes this aircraft operationally unique, as well as the technical and conversion considerations for operators who plan to bring this type into their fleets.

Q1: Can you outline the process of converting the A321 passenger aircraft into a P2F? – What do you remove; what do you install?

T.C. – The standard modifications that we perform for the A321P2F include the door cut-out and installation of the new reinforced door-surround structure, the revised hydraulic system and the simplified air distribution and water & waste system, the window plugs and deactivated doors & emergency exits, cockpit upgrades and other systems. Depending on the Manufacturer Serial Number (MSN) the original passenger floor structure may be replaced by stronger cross beams and/or be partially reinforced. Whereas the A330P2F uses a 9g net in the forward fuselage, the A321P2F is equipped with a Rigid Cargo Barrier (RCB) which incorporates a sliding door to allow access to the main deck cargo compartment.

To maximise the available main deck space the RCB is located at the most forward position possible, between the foremost left and right-hand doors ("Doors 1 L/R"). In turn this necessitates the original door-surround structures to be removed and re-skinned, while the doors themselves are replaced by a simplified Crew Entry Door (CED) and the lavatory is replaced by a new one re-located to the right-hand side. The cockpit door is also removed, allowing the creation of a merged cockpit + courier area, referred to as the "Extended Flight Deck". In addition, the A321's "Doors 4" L/R are removed and re-skinned, which is necessary to accommodate a 14th full-size container position without limitation. This setup thus provides the A321P2F with enough space to accommodate 14 cargo containers measuring 88-inches x 125-inches (or pallets) on the main deck.



Courtesy: EFW

Q2: What are the new innovations in the A321P2F design (ie versus EFW/ST's existing & previous cargo-conversion programmes)?

T.C. – The conversion design is based on the Supplemental Type Certificate (STC) process, like it was for the previous generation A300/A310P2F and the current A330P2F. I would regard the main "new design feature" in the A321P2F to be the very foremost positioning of a rigid cargo barrier and the creation of an extended flight deck (cockpit and courier area combined) which allows the maximum volumetric use of the main deck.

Q3: Why is the A321 ideal for freighter conversion?

T.C. – The strength of the A321 is clearly its capability to accommodate fully containerised cargo on both decks – a game-changer in this freighter size segment, and something which is not available on competing freighter platforms up to the B757. We also highlight the A320 Family's unique cargo "belly" hold (ie lower deck) which allows for mixed-fleet operation and interlining between Airbus single-aisle passenger aircraft and freighters, which is a significant operational and commercial advantage for airlines.

Q4: What new benefits & features does the A321P2F bring to operators?

T.C. –

High containerised cargo volume

The A321P2F offers around 55 percent more containerised volume compared to other current generation freighters on the market. This is thanks to its 14 full size 88inch x 125inch main deck positions plus another 10 lower deck "AKH" container positions. We are convinced that the significant benefits of operating containers in the bellies of Airbus A321P2Fs will enhance the quality of service, especially since containers provide protection for sensitive goods under all environmental conditions – such as rain, snow and heat. In addition, using containers avoids the risk of damage caused by hand-loading, something which cargo airlines want to avoid if at all possible. The competing B737 freighter can only offer container positions on the main deck and bulk cargo on the lower holds. Furthermore, access to the B737's lower-hold is constrained due to its smaller and inwards-opening doors.

Space-efficient door configuration

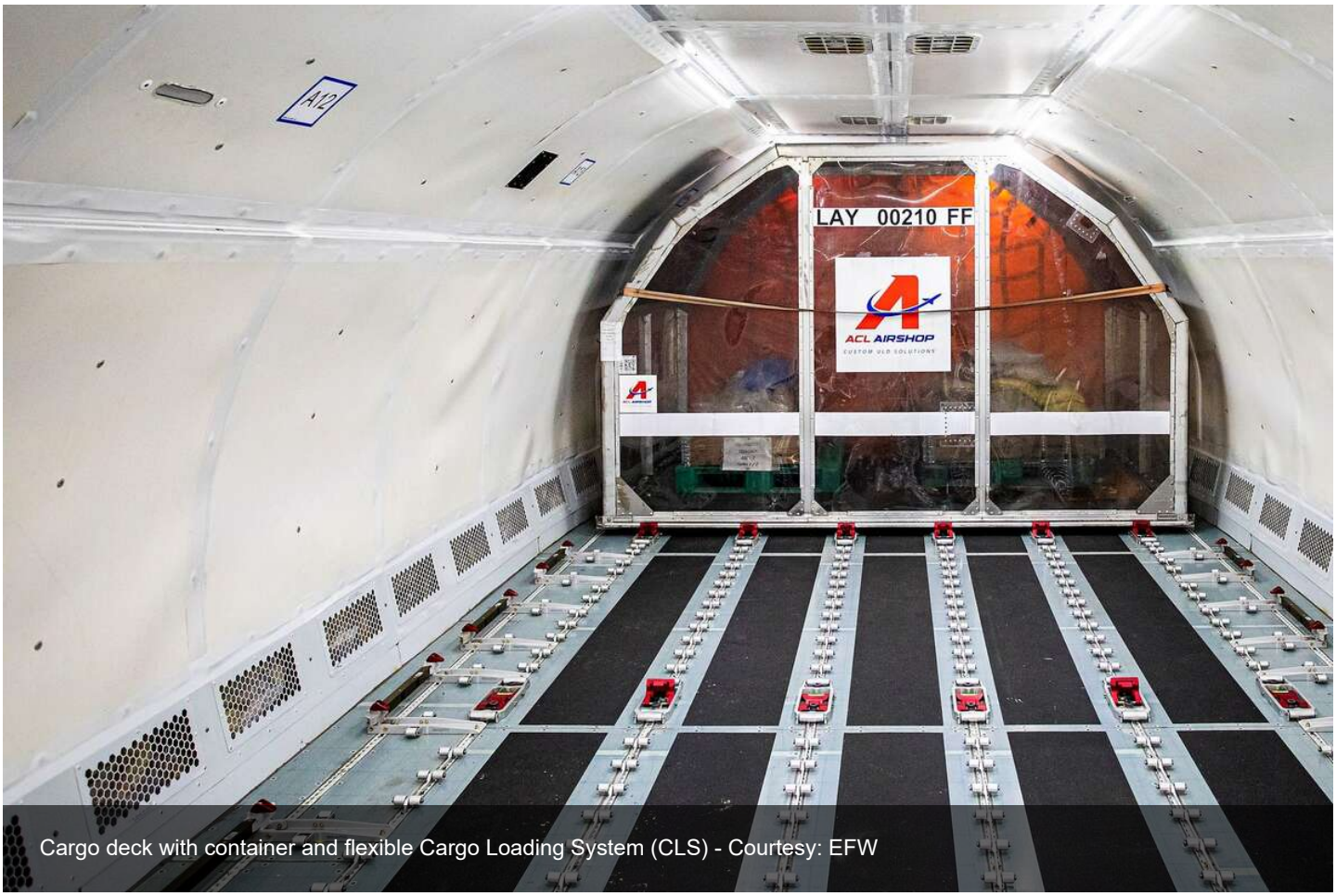
To accommodate 14 full container positions on the main deck we slightly extended the cargo compartment closer to the cockpit. To achieve this, EFW deleted the "Doors 1" L/R at the front of the fuselage. This allows us to locate the rigid cargo barrier at this position. Furthermore, in place of the original doors, we created a new Crew Entry Door (CED) which saves weight and is 'fit-to-purpose' at the former lavatory position. In turn, the new lavatory is located on the right-hand side. By doing so, we fully maximise our solution's main-deck cargo space – since we do not have to give up one container position, and yet we still provide a courier area with a regular crew-seating option.

Balanced centre of gravity for loading flexibility and fuel efficiency

Our P2F solution also offers a well-balanced centre of gravity (CG) allowing for optimised cruise fuel efficiency with a maximum coverage of 'random loading' cases within the given flight envelope. Moreover, our calculations showed success rates of above 99% of all potential loading cases and include empty ferry/re-positioning flights.

Flexible cargo-loading system (CLS)

The Ancra-produced CLS chosen by EFW for the A321/A320P2F can support industry standard "Unit Load Device" (ULD) containers other than the 88inch x 125inch containers on option – such as the 96inch x125inch containers. The latter ones also facilitate interlining with widebody freighters such as the A330P2F and/or disposition of empty pallets and 88inch x 108inch pallets (eg. for interlining with smaller freighters such as the BAE146/AvroRJ).



Cargo deck with container and flexible Cargo Loading System (CLS) - Courtesy: EFW

Q5: What are the key selection criteria for the ideal “feedstock” – ie the candidate airframes for conversion?

T.C. – In principle all A321s can be converted to freighters. In order to avoid additional cost, the airframes sourced by the customers should ideally be the upper Type-Certified “Weight Variants” (WV) and be equipped with the most recent avionics hardware and software. If this is not the case upgrades can be installed which can be coordinated with Airbus’ and EFW’s respective upgrade services teams. Also, conversion candidates with a lower deck Cargo Loading System (CLS) already installed may be a good baseline to avoid extra spending. However, in the end the feedstock selection depends on the ‘ramp price’ after conversion, so each business case is individual. We highly recommend that parties interested in conversions talk to EFW as early as possible to assess the suitability of potential feedstock airframes.

Q6: Do different certified Weight-Variants standards of the passenger feedstock aircraft have a bearing on the final P2F performance capabilities? Can you bring them all to the same standard for -P2F operation?

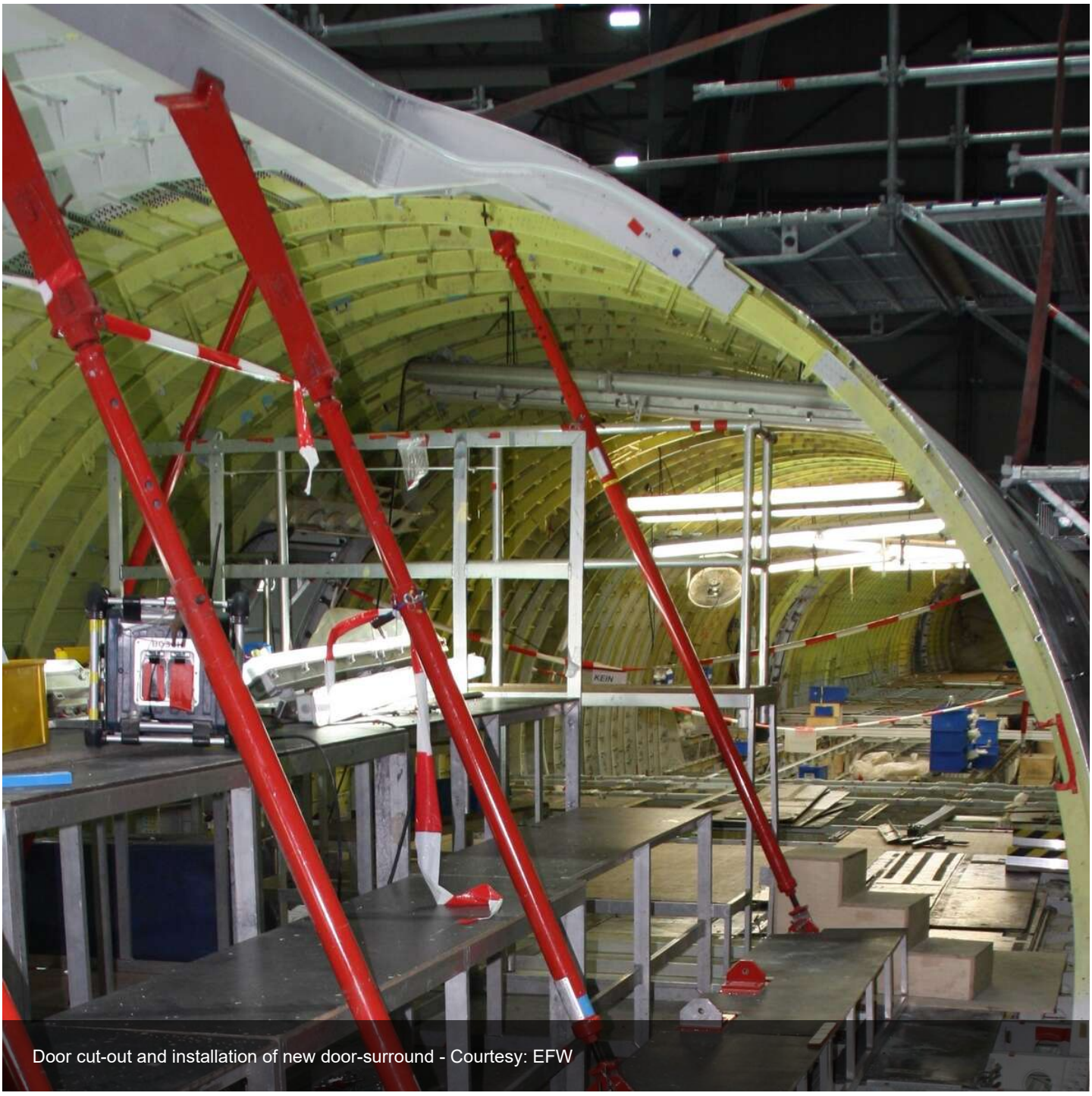
T.C. – The Weight Variants (WV) have an impact on the performance of freighters as they do on the passenger aircraft, because they determine the payload-range characteristic of the converted freighters in general. While the P2F process itself does not require any WV change, WV upgrades/downgrades can be performed on customers’ request if a particular feedstock airframe has that WV option. In such cases upgrade requests are closely coordinated with EFW’s and Airbus’ Upgrade Services teams, with EFW acting as the MRO to install any required Service Bulletin (SB) kits as part of its additional services for the customer.

Q7: If a customer is, say, planning a fleet of 10 A321 P2Fs, would you be looking to source identical certified Weight Variants? Or is this an unrealistic expectation?

T.C. – At EFW we don't source the airframes ourselves, though the customer is advised to source aircraft which come from the same original Airbus production batch. Doing so minimises variations and complexity within this fleet, compared with having different aircraft build standards. Nevertheless, there can still be some unavoidable differences between candidate feedstock aircraft, for example if the new P2F fleet is being created from six A321s purchased from airline X and four A321s purchased from airline Y – which will likely comprise aircraft originally from different production batches. In short, WV standardisation can be part of specific agreements with customers if conversion feedstock is acquired from multiple sources.

Q8: What type of technical upgrade / transition work do you typically need to undertake on an airframe before you can begin the actual P2F conversion work?

T.C. – There is typically no specific upgrade work required 'pre-slot-in'. The passenger-to-freighter conversion process includes all the preparations to access the airframe structure which includes stripping inside the cabin to remove all cabin items such as seats, galley monuments, lavatories, overhead bins, linings etc. A partial paint stripping provides access to the modification areas of the structure.



Door cut-out and installation of new door-surround - Courtesy: EFW

Q9: Do incoming feedstock undergo a D-check - and do EFW undertake this?

T.C. – We recommend that customers assign heavy checks to the modification site (ST Engineering and EFW) in conjunction with the P2F conversion. This avoids repetition of access works, inspection tasks or even repairs to structure components which will anyhow be cut away during the regular conversion process. In the vast majority of conversions, such heavy maintenance activities can be performed without having an impact on the normal conversion layover if they are carefully planned in advance and if there are no major findings. With this in mind, most of our customers are electing that we at EFW and ST Engineering perform heavy maintenance checks in parallel to the freighter conversion process.

Q10: What factors determine the pricing structure between EFW and the customer?

G.B. – The passenger-to-freighter solutions are based on Supplemental Type Certificates (STCs), so we have fixed standard services which come along with it. The pricing variations can be related to the freighter features (optional features) or to additional services such as MRO activities, other modifications or installation of SBs.

Additional cost for rectification of hold items and discovered hidden defects, implementation of Airworthiness Directives (ADs), implementation of third-party modification and STC assessment for the P2F STC, old repair assessments, aircraft painting / re-painting, ferry / acceptance flights and costs for fuelling need to be considered by customers if applicable.

Q11: As some parts of the P2Fs are 'made to measure', does each completed aircraft require an individual certification?

G.B. – We have a standard P2F kit that fits at say 90% of the final scope. For the remaining proportion each individual aircraft (eg. MSN no.) requires aircraft-specific adaptations to the standard design. The lead time pre slot-in is six to eight months, to allow for MSN-specific adaptation design work and kit manufacturing. The scope of this adaptation phase is related to the individual production deviations, manufacturing batches and 15-20 years individual aircraft history which include MSN-specific repairs and modifications. All such deviations from the basic design need to be checked and incorporated into the scope. That is why we request all relevant documentation and data access from our customers well in advance to each slot-in.

Q12: What is entailed in terms of pre-delivery ground- & flight-testing of a newly built A321 P2F? What criteria are evaluated before the Transfer-of-Title (ToT) to the customer?

T.C. – Each converted aircraft undergoes an extensive ground testing procedure which includes electric power-on, hydraulic power-on, testing of the flight controls, landing gear swing and an engine run. Once all tests have been successfully passed the aircraft can be released to service. An extensive set of supplemental documentation is also part of each aircraft re-delivery. Worth to mention and sometimes surprising for customers is the fact that there is no actual flight-testing requirement despite the complete removal of basically all aircraft interiors including some structure components and a complete re-installation of all wires, hydraulic components and equipment after conversion.

Courtesy: ST Engineering

Q13: What kind of aircraft freighter performance guarantees do you provide the customer?

T.C. – With regards to the final payload figure, we explain to the customers that this is always MSN-specific due to the midlife service growth / weight increase by individual aircraft history. Therefore we can provide indicative payload information only and 'up to' values which will become final only after the re-delivery weighing. Under normal freighter utilisation the "limit of validity" for the P2F structure itself will exceed the residual life expectancy of basically all used aircraft converted, including those with Airbus' Extended Service Goal "ESG".

Q14: How is P2F-specific aftersales support & parts inventory organized and implemented? Does EFW/ST provide worldwide onsite support at customers' mainbase and/or AOG for the P2F-specific systems, as well as planned servicing etc.?

G.B. – For in-service support, it is essential for us to be closely aligned with Airbus' Customer Support organisation. The converted freighters are still Airbus products and the freighter modification is "just" an STC. Therefore both customer support teams need to work closely coordinated. Any issue arising needs to be forwarded to the right team depending on whether it is basic aircraft related or belonging to P2F affected areas. EFW has its own AOG service 24/7. P2F related spares supply and unplanned repairs will be handled by EFW.

Q15: What particular aspects of the A321P2F product design are you most proud of and why?

T.C. – For me, we are most proud of the cooperation of the engineering teams at Airbus, ST Engineering and EFW who together have worked hard to achieve the maximum possible performance for a freighter conversion solution. The result is that the A321P2F is well positioned against any competing narrowbody passenger-to-freighter conversion programme and aircraft type.

The A321P2F – in a nutshell

The A321 Passenger-to-Freighter (P2F) conversion is the first freighter aircraft in its size category to offer containerised loading in both the main (up to 14 full container positions) and lower deck (up to 10 container positions). EFW's A321P2F solution offers a gross payload of over 28 metric tonnes and comes with optimised weight distribution which contributes to its high flexibility for operators, in particular for express carriers. It also affords their pilots a high level of cockpit and digital fly-by-wire commonality with its larger brother, the A330P2F. Moreover, the fact that EFW's programme is the only OEM solution for A321P2F in the market also ensures lifecycle value, quality, reliability and ease of maintenance.

Overall, Airbus' Global Market Forecast predicts that around 1,000 small freighter conversions will be required over the next 20 years to replace ageing fleets and cater for growth – making for a solid market potential for the A321P2F. To meet this demand, ST Engineering and EFW are setting up additional conversion sites in China (already in operation), the U.S. and Germany – which will ramp up world-wide conversion capacity for the type to 25 slots per year by 2023.

The A321P2F key milestones

- **June 2015**
  The A320/A321P2F conversion programme was launched by proven players in the conversion market: ST Engineering, Airbus and their joint venture Elbe Flugzeugwerke (EFW). Within this partnership, ST Engineering is responsible for the engineering development up to the Supplemental Type Certificate (STC) issuance and the conversion kit supply. Airbus, as the OEM (Original Equipment Manufacturer) provides technical data and certification support, development of on-board computers, airframe engineering, flight physics and flight test expertise.

EFW is the STC holder and leads the overall programme and commercialisation.

- **February 2020**
  Supplemental Type Certificate (STC) approval for the A321P2F from the European Union Aviation Safety Agency (EASA)
- **July 2020**
  Validation of the STC from the U.S. Federal Aviation Administration (FAA)
- **October 2020**
  Delivery and entry-into-service (EIS) of the first converted aircraft on lease from Vallair to Qantas, to operate services on behalf of Australia Post.
- **January 2021**
  EFW delivery to second customer, the lease management company BBAM Limited Partnership for operation with Titan Airways.

Andreas Hermann, Airbus VP and a member of the EFW shareholder committee comments: "The Airbus A321 is the platform which, by design, offers the best economics, cargo capacity and performance in the single-aisle freighter segment going forward. For any asset owner this will provide a great opportunity to leverage future growth and replacement waves, underpinning the already great value proposition of the A321 today."

Article by:
Martin FENDT
Technical editor - AIRBUS
martin.fendt@airbus.com

Interviewed:
Thomas CENTNER
Director Sales Aircraft Conversion - EFW

Interviewed:
Gilbert BIRKE
Head of Sales for Airbus Freighter Conversion - EFW