

What's the score with the 727 freight floor?

The four ADs issued against the 727 freight conversions STCs have limited net payloads by up to 15,000lbs per aircraft. There are already some fixes on the market which could overcome these limits. If they do not succeed aircraft will have to be modified at high cost.

After months of worrying, 727 freighter operators have now been made aware of the challenges they must face. Four Airworthiness Directives (ADs) were released in January 1999 with respect to the safety of the 727 freighter's floor strength. Each AD has been released in relation to the four supplemental type certificates (STCs). There are four 727 freighter conversions.

The issue of floor strength first arose when Hamilton Aviation applied for a freight conversion STC. The company had to provide an analysis of the 727's floor and door surround strength. The analysis raised concerns about the floor's ability to hold its full payload during a wind gust. As a result, issues were then discovered with the other four 727 freight conversion STCs. The four new ADs limit payload and speed of aircraft modified by one of the four STCs prior to the floor being strengthened.

The 727-200F

The 727-200F has a basic maximum structural payload of 58,360lbs (see *Freighters with the optimum configuration for small packages*, page 56). This is carried across 12 pallet or container positions. The standard container size is 125 x 88 x 82 inches. The average maximum weight per container position is therefore 4,863lbs. The positions over the wing centre section can permit higher weights because of the stronger floor structure in this part of the aircraft. Also, because of freight loading, there is a high variation in container weights. Airlines therefore rely on the aircraft being permitted a higher average container weight for flexibility of operations.

This average weight per container position is equivalent to a net payload of

727 freight conversion STC holders are confident aircraft using their freighter modification will not need to have their floors modified. If this is incorrect strengthening modification could cost up to \$700,000 per aircraft.

4,613lbs per position after deducting the container tare weight of 250lbs. Each container has an internal volume of 458 cu ft. When packed at a typical small packing density of 7.0lbs per cu ft, the net payload of each container is 3,206lbs. Total weight per container with small packages is therefore 3,456lbs; and 41,472lbs for the whole aircraft (see *table, page 54*).

There are also several options for loading the 727-200F. FedEx has its own unique design for containers and uses AYY and SAA containers in the 727.

The AYY containers are shaped so that they fit half way across the 727's fuselage cross-section; the SAA is basically two AYYs put together, which fit across the entire width of the fuselage. The 727-200 accommodates 11 SAAs and 22 AYYs.

Because of typical packing densities of small packages, the weights carried are such that full structural payload is not reached. A packing density of 7.0lbs per cu ft with SAA containers takes the total payload and tare weight to 39,204lbs. This is equal to 3,564lbs per container

position. The SAA tare weight is 575lbs and so the net payload of each container is 2,989lbs and 32,879lbs for the aircraft (see *table, page 54*).

Payload restriction

The ADs issued by the Federal Aviation Administration (FAA) were numbered ADs 98-26-18/-19/-20/ and -21. One AD was issued against each of the STCs used for freight conversion. STC holders for 727 freight conversions are FedEx, Aeronautical Engineering Inc, Ataz and Pemco. Each STC is subject to scrutiny by the FAA.

With the issuance of the ADs, each STC is subject to interim and long-term payload restrictions. The FAA has issued interim maximum floor loading allowances for each of the STCs. This limits payload and, as a consequence, the revenue-earning capacity of the aircraft.

The FAA has given each STC holder 28 months either to strengthen the floor of the aircraft and allow original payloads to be carried, or prove to the FAA that the original STC modification



727-200 FREIGHTER STANDARD, INTERIM AND NON-COMPLIANT PAYLOAD DATA

Standard and un-modified payloads

Aircraft status	Standard	Small package operations	FedEx	Un-modified
Maximum structural payload lbs	58,360	41,472	36,300	36,000
Container positions	12	12	11 (SAA)	12
Weight per position lbs	4,863	3,456	3,300	3,000
Container tare weight lbs	250	250	575	250
Net payload per position lbs	4,613	3,206	2,725	2,750
Net payload aircraft lbs	55,356	38,472	29,975	33,000

Interim payloads

Aircraft status	AEI Sidelocks	AEI No sidelocks	FedEx Sidelocks	FedEx No sidelocks
Maximum structural payload lbs	57,600	48,000	52,800	33,000
Container positions	12	12	11 (SAA)	11 (SAA)
Weight per position lbs	4,800	4,000	4,800	3,000
Container tare weight lbs	250	250	575	575
Net payload per position lbs	4,550	3,750	4,225	2,425
Net payload aircraft lbs	54,600	45,000	46,475	26,675

has sufficient floor strength and does not require any further modification.

The 28-month period gives STC holders until June 2001 to prove the integrity of their modifications or to modify their aircraft again. Considering there are about 270 aircraft currently affected by these ADs, an average of 10 aircraft will have to be modified each month until that date. This does not take into account the time STC holders will take attempting to convince the FAA that their STCs are safe and that their aircraft do not require modification.

If aircraft do have to be modified, current estimates are that the cost will be about \$700,000 per aircraft. The modification work will require substantial downtime and will raise serious questions about the economic viability of keeping many aircraft operational. STC holders are already confident, however, they can prove the integrity of their STCs and thus avoid

modification.

The ADs become effective in mid-February 1999. Operators now have 90 days to comply with the AD (that is, to adopt interim reduced payload), which gives them time to amend their flight operations manuals.

The interim payloads allowed for each container or pallet position varies from position to position and between STC holder. The reduced payload required after 28 months if the STC has not found a modification or cannot prove the safety of the floor is 3,000lbs per position. This is a total of 36,000lbs, including pallet or container tare weights, for the whole of a 727-200. For 125 x 88 x 82 inch containers each weighing 250lbs, the aircraft's net structural payload is reduced to 33,000lb. This compares to an unrestricted payload of 41,427lbs for regular containers and 32,879lbs for FedEx SAA containers when packed at 7.0lbs per cu ft for small

packages.

In addition to restricted payloads, the aircraft will also have a restricted speed limit to withstand a strong wind gust. Restricted operating speeds will further impact on the efficiency of airline operations.

Interim payloads

The interim payloads vary for each STC holder, since the FAA permits the use of vertical side constraints on the fuselage wall to increase interim payloads.

FedEx, which used its STC to modify its huge fleet, has done extensive testing to prove the safety of its STC-modified 727. FedEx has done a joint team test with the FAA to prove the integrity of the 727's floor strength. FedEx got the FAA to put together the test plan and tests were done during September 1998 in California with the FAA in attendance.

FedEx claims the tests had positive results and it expects to receive the FAA's conclusions by May 1999. FedEx says these results should confirm the safety of the floor of its STC-modified aircraft. The aircraft will therefore not require any strengthening modification and can have its original payloads restored.

FedEx's current average payload is 3,300lbs per SAA position. This is equal to 36,300lbs for a 727-200 or 29,700lbs for a 727-100. The limit imposed on FedEx by the interim payload is 3,000lb per container, or 33,000lb for the aircraft. The interim limits therefore reduce FedEx's payload by 3,300lbs.

Like all other STC holders, FedEx has until June 2001 to prove the integrity of its modified aircraft— or face modifying its floor beams. The company already meets certain constraints for re-establishing original payloads. It has fitted sidelocks on the fuselage to secure containers and has adopted the aircraft's speed limit. The use of sidelocks has raised FedEx's interim weight limit to 4,800lbs per position, thereby lifting any payload loss the aircraft would have suffered by carrying small packages.

FedEx's aircraft are still speed-restricted, however. The interim limit of 4,800lbs is the average weight of two adjacent containers, thus allowing for container-loading variations. Many other STCs do not use sidelocks and so their interim weight limits are not as high as that of FedEx.

The company is convinced that its tests will confirm the STC's integrity and that it will not have to modify any of its aircraft, and that future conversions using the STC will not be affected.

AEI's STC is affected by AD 98-26-19. The standard weight limits per standard container position are 6,500lbs for container positions 1 and 12 and 8,000lbs for all other 10 positions.

AEI president Charles Perry explains that if the operator uses vertical restraints on the inside of the fuselage then the interim limits are that two adjacent containers may not exceed 9,600lbs, 4,800lbs per container, and one may not exceed 8,000lbs. The aircraft's standard payload of 60,000lbs means an average load of 5,000lbs per position. The interim payload of 4,800lbs per position is therefore not too bad, since only 200lbs per position – or 2,400lbs for the aircraft – is lost.

If sidelocks are not used then the interim limits are 8,000lbs for two adjacent containers. This means the aircraft's total payload is limited to 48,000lbs, with a loss of 10,000–12,000lbs payload.

Like FedEx, AEI is confident it has data to demonstrate the STC's integrity. Perry says AEI can lift interim position weights to 6,000lbs, except those over the wing, which can be raised to 8,000lbs each. Positions 1 and 12 will still be limited to 4,000lbs each.

This will take the total weight limit to well over the aircraft's structural payload limit of 60,000lbs. If AEI is able to get these weight limits then its STC-modified aircraft will not require any further modification, although all aircraft will have to have sidelock fitted.

STC fixes

There are already modifications available on the market to overcome the interim limits imposed by the ADs.

Kitty Hawk has developed a solution that it has already applied to one of its aircraft and is planning to use on the rest of its Ataz-modified fleet. The solution should allow 6,000lbs per position, which will raise the aircraft's payload to its full original level. This is expected to be offered for about \$75,000 per aircraft.

Altair is also offering a modification, which is just a paper change to the aircraft and allows upgraded payloads for Pemco- and AEI-modified aircraft. This is being offered at \$10,000 per aircraft and allows a maindeck capability of 75,000lbs without sidelocks and 85,000lbs with sidelocks. Although 75,000lbs is in excess of the aircraft's structural payload, the 85,000lbs limit allows greater weight flexibility in the container loading.

Structural Integrity Engineering (SIE) has developed a documentation change that will allow container weight positions of 10,000lbs each over the wingbox area for a cost of \$15,000 per aircraft. SIE has also developed a side restraint system which will allow a container position weight of 4,800lbs, costing \$25,000, and

a superlock system allowing a container weight of 6,900lbs, costing \$55,000.

Hamilton Aviation, meanwhile, has recently received an STC for 727 freighter conversion, which allows a weight of 8,000lbs for eight of the 12 container positions. Positions 1 and 12, and 7 and 8 in the wing box area are still limited to the interim limits specified by the four ADs, but upgrades will be available shortly.

Hamilton Aviation has also made its STC available as an alternative means of complying with the four issued ADs. That is, operators data from Hamilton Aviation's recently awarded STC can be used and applied to their aircraft modified under an earlier STC and generate a strengthening modification so the aircraft complies with its relevant AD.

An amendment to Hamilton Aviation's STC will also provide a floor limit of 6,000lbs per position. Alternatively, the data from Hamilton Aviation's STC can be used to prepare alternative means of compliance (AMOC) with the four ADs. Again this would entail using the data to generate physical modifications to the aircraft's floor beams. These AMOCs would allow floor position weights of either 6,000lbs or 8,000lbs. Operators can also have a mix of 6,000lbs and 8,000lbs positions. 