

# ***DORNIER LUFTFAHRT***

*A Fairchild Aerospace Company*

## ***728JET - A New Family of Regional Aircraft***



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**Reinhold Birrenbach  
Former VP Engineering, Dornier Luftfahrt GmbH**

# 728 New Family of Regional Transport Aircraft

## Market Situation

Demand in regional air transport is still growing fast. The hub and spoke system reaches its limits in busy regions. More slots can not be made available at major hubs. Direct links to smaller communities/airfields could avoid congestion at hubs.

Propeller Aircraft are rated as less comfortable, noisy, unsafe and old fashioned. Some fatal accidents in flights under icing conditions are serious arguments. The public not fully understand the real causes:

- insufficient ice protection of critical leading edges in front of control surfaces,
- operational aspects when flying through freezing drizzle or super cooled droplets at high liquid water content.

New regional transport aircraft must offer comfort and reliability like the modern large Airlines, but operate at lower cost.

In past 10 years period (1989-1998) 2336 aircraft in the capacity range of 40 to 110 seats (1005 turboprops and 1331 jets.) are delivered. Forecast for the next 10 years period is 3710 aircraft in that capacity range, in a split of 560 turboprops and 3150 jets.

Strong cost driven competition forced major airlines to form global alliances and get also control on regional Air transport. The big 4 group: Star Alliance, Wings; Qualiflyer and Oneworld are dominating today's air transport by serving more than 2800 international cities world-wide, flying more than 600 million passengers a year and a turnover of 110 billion US\$ per year. They play an important role now in decision making process on regional aircraft. It is not the small airline any more we are selling to.

Number of OEM's are down to 3 in the regional jet market. Cost competition and risky investment in new programs limit survival chances to 2 or 3 OEM's at maximum.

## Aircraft Layout

New aircraft have to be overall more attractive than competing one's already in service. Beside performance and cost, cabin layout has high impact on passenger appeal. Seat width, -pitch, head-, shoulder-, window seat foot clearance and aisle width are rated comfort parameters. In 728 design a family of aircraft sizes (55, 70, 100 seats) is considered from the beginning. Trade-off studies

advised optimum cabin width of 128 inch in a 5 abreast seat arrangement for tourist- and 4 abreast in first class. It offers more space than today's regional aircraft and is like A320 or Boeing 717. The required field-, climb- and cruise performance could best be met by a low wing, below wing mounted engines and low horizontal stabilizer configuration, at lower weight and less drag. With doors front and aft it allows an undisturbed cabin (no emergency exits in between), it provides flexibility for any cabin arrangement from 55 seater 528 to 105 seater 928.

A common wing of 75 sqm with slats, inboard Krüger flaps and single slotted flaps meets performance required for 728 and 528. For 928 wing size will increase to 84sqm by extended wing tips and redesigned inboard section. Fine tuning of wing design by reshaping of pylon leading edge and reduced gap between extended Krüger flap and pylon helped to increase max lift coefficient. Beside a drag cleanup, staggering of fin and tail with fin tuning of rear fuselage reduced drag by 6%. Results are now confirmed by wind tunnel testing.

Power is provided by General Electric CF43-8D Engines with 46,2 inch fan for 728, derated for 528 and -10D derivative with 53 inch fan in a modified nacelle for 928.

## Progress in Aircraft Systems

Aiming for reliable low cost operation with minimum time on ground at acceptable pilot workload are arguments for higher system integration and application of new technologies. Here only examples are given.

### Avionics

Primus EPIC avionics system from Honeywell with its bus systems links all other aircraft systems together, provides reliable data processing, indication, monitoring and control via 2 cursor. It provides additional capabilities for future communication and navigation systems. All systems status data are processed in smart centralized maintenance computer and necessary action after next landing are transmitted to the ground maintenance operation. All needed activities can be prepared before touch down and delays be minimized.

### Flight controls

728 family will be equipped with all fly by wire flight controls with pilot fully in the loop. Mechanical inputs from the pilot be translated in electrical signals processed in duplex surface control modules, producing input signals to duplex actuator control units. Hydraulic actuator feed is by

triplex power supply. Force feed back to pilot generates familiar handling qualities.

## **Electric Power Supply**

Fly by wire flight controls require 4 independent electric power supply systems. 3 identical generators take power from each engine and APU, the fourth generator is driven by ram air turbine in case of power loss in all 3 other supplies. Power is controlled by 2 integrated primary, 1 emergency- and 4 secondary control units; this avoids lots of fuses in the overhead panel.

## **Operational Aspects**

Technical efficiency can be measured in weight per passenger and block fuel burn per seat mile. Even with more comfortable fuselage diameter the 728 manufactures empty weight is below competitors aircraft and also is fuel burn. As final result the direct operating cost on example stage length of 500 NM 728 comes out 15 % better in seat mile cost and more or less equal in aircraft mile cost. Cumulative noise level has margin of 15 EPNdB against ICAO Annex 16 requirements. Emissions are far below of ICAO Annex 16.

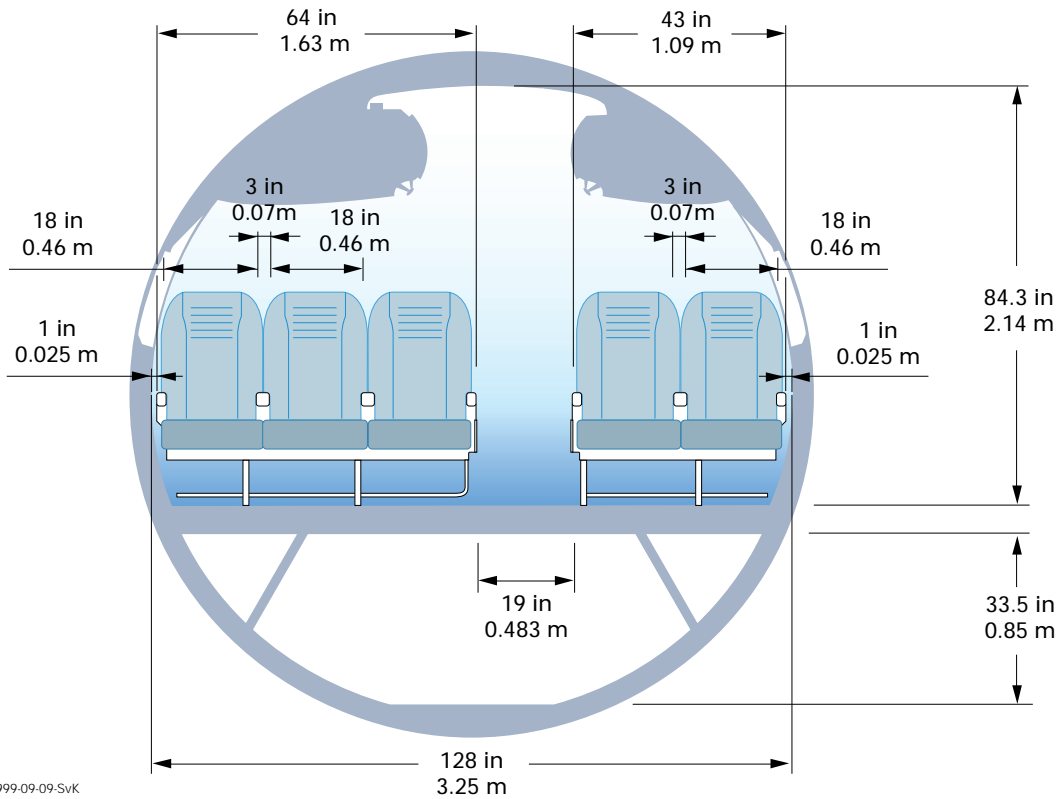
## **Impact of Commonality on Operation**

In a mixed fleet of 42 aircraft with the capacity of 728 and 928 as common out of a family versus different models, investment saving can be 14 million US\$ and an annual saving of 8,5 million US\$.

## **Summary**

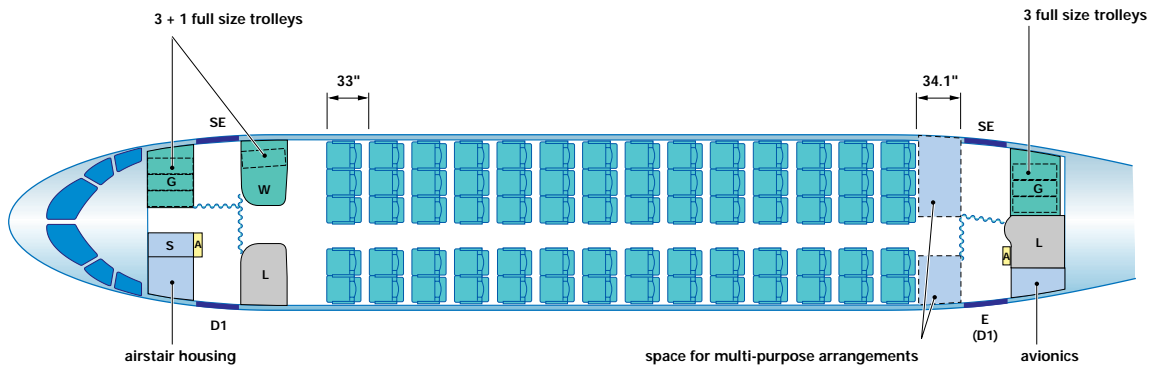
Future traffic growth in regional transport can be served by bigger aircraft operated in the hub and spoke system and by more direct links. The 4 major alliances having more and more impact on regional air traffic now. The fierce competition is down to 3 OEM's. Regional aircraft have to offer comfort and operation like airliner but at lower cost. Higher aircraft system integration and fly by wire flight controls are good examples of technical improvements. Design for operational commonality can produce attractive cost savings in investment and operation of different capacity size family of aircraft.

### Cross-Section 5-Abreast – 128 in



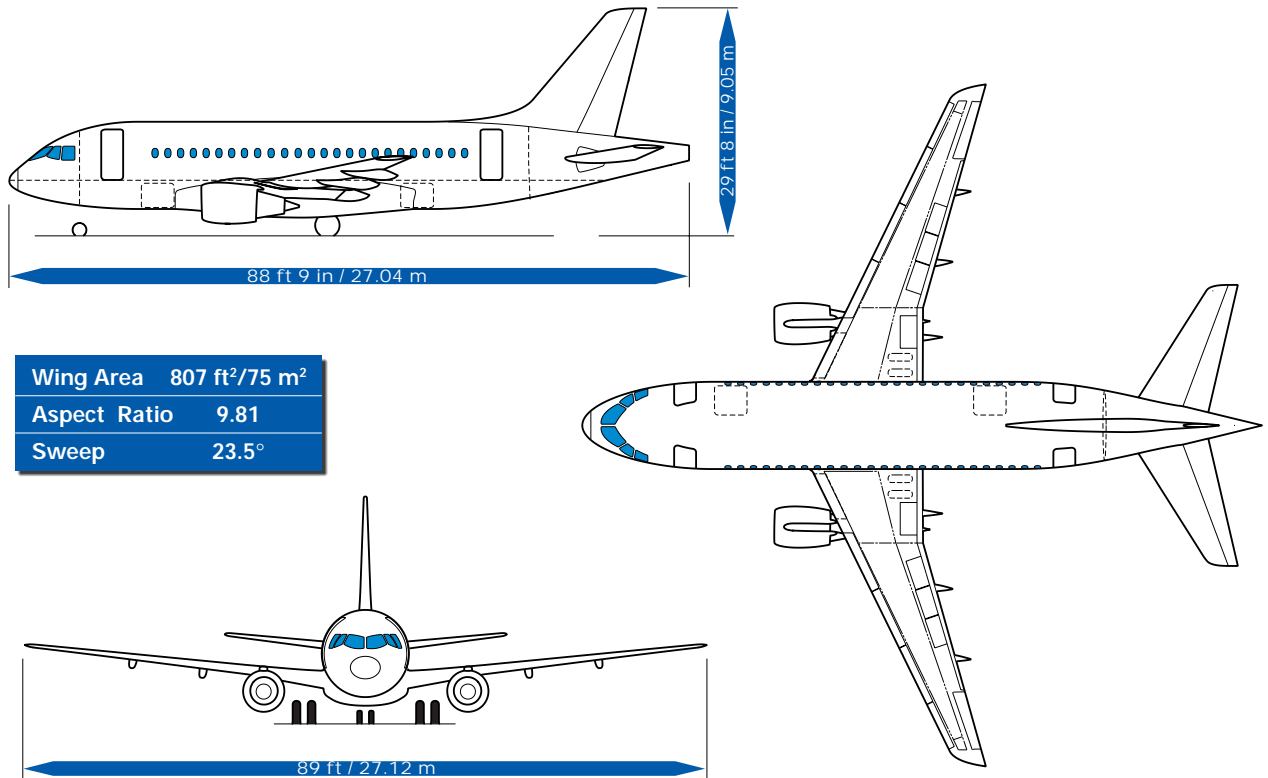
### 728JET Cabin Layout for 70 Passengers

70 Seats at 33" Seat Pitch



|                             |   |                       |
|-----------------------------|---|-----------------------|
| D1 = Passenger Door (Typ C) | SE = Service Door & Emerg. Exit (Typ C) | L = Toilet & Lavatory |
| A = Attendant Seat          | E = Emergency Exit (Typ C)              | G = Galley            |
| W = Wardrobe                |   | S = Storage           |

### 728JET – 3-View



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### Pitch Cockpit Control

