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AVIATION OPERATIONAL MEASURES FOR **FUEL AND EMISSIONS REDUCTION** **WORKSHOP**



Weight Management

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Aircraft Panel
Ottawa, 5-6 November 2002

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Weight Management




- ➔ Weight effects on fuel and CO₂
- ➔ Weight reduction initiatives - a few examples
- ➔ Tracking weight growth and fuel efficiency
- ➔ Epilogue:
 - ✧ To paint, or not to paint - that is the question

Conflicts

- 
- ✈ Weight minimisation - easy to see the benefits

BUT.....

- 
- ✈ There are usually conflicts with other policies as well



Why look at weight?



✈️ A “rule of thumb”:

- ✧ additional fuel requirement:
= 3-4% of weight increase x hours flown
 - e.g. extra weight = 500 kg
 - flight time = 10 hours
 - extra fuel burn = 150-200 kg
 - extra CO₂ = 470 - 630 kg

✧ For Every Flight!



Fuel cost of Weight

- 
- 
- ✈ assuming 5,000 hours/year
 - ✧ extra fuel burn = 87 500 kg
 - ✧ extra CO₂ = 276 000 kg
 - ✧ extra cost = \$ 22 000
 - and that's just the fuel!
 - ✈ Weight control is important



Catering - a lot of weight!



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Potable Water

- Aircraft carry potable water in water tanks for use in flight
- Not all are necessarily required, but mostly always filled to capacity



Potable Water



- ➔ Blanking off 1, out of 3 potable water tanks for “medium-haul” B777-200, prevents their use
- ➔ 100kg of water, per flight not loaded
- ➔ Annual savings estimated as
 - ✧ 380 tonnes fuel, 1 200 tonnes CO₂

Plastic cutlery

- ✈ Post 11th September 2001
 - ✧ Many new measures to improve security
 - ✧ Most add weight
 - ✧ One actually reduces weight - plastic cutlery



Plastic Cutlery



- ➔ Using one route as an example
- ➔ Weight reductions (LHR-NY):
 - Concorde - 34.26 kg
 - B747-400 - 32.60 kg
 - B777-200 - 34.40 kg
- ✧ Equates to: 52 t/yr fuel (\$ 13k)
- ✧ 165 t/yr CO₂

Conflicts




**BUT THEN WHO
LIKES EATING
WITH PLASTIC
CUTLERY?**



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Plastic Gin Bottles

- 
- ✈ Duty Free bottles of Gin
 - ✧ Opportunity to substitute plastic bottles for glass ones
 - ✧ Weight saving approx. 0.5 kg per bottle
 - ✧ Average of 12 bottles carried on each Long-haul flight



Plastic Gin Bottles



✈ Total annual fuel savings for Long-haul flights

✧ B747-200 = 4.7 tonnes

✧ B747-400 = 51.2 tonnes

✧ B777-200 = 39.3 tonnes

✈ Total fuel saved = 95.2 tonnes

✈ Total CO₂ saved = 300.3 tonnes

No Conflicts?

Gin unaffected!

Conclusion:

Help the Environment,
Buy Duty Free on board



Modifications



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Concorde - weight goes up

✈ Additional weight due to:

✧ Fuel tank liners - 400 kg

✧ Unusable fuel - 200 kg

✈ Total extra weight:

✧ 600 kg per aircraft



Concorde - weight goes down

- ✈ Reduction in weight due to:
 - ✧ New cabin interior - 350 kg
 - ✧ New tyres - 164 kg
- ✈ Total weight reduction:
 - ✧ 514 kg per aircraft



Concorde - weight the same?

✈ Weight change summary:

- ✧ Increase - 600 kg
- ✧ Reduction - 514 kg
- ✧ Overall - 86 kg increase

✧ Modifications can make a difference!



Modifications



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Modifications

- ✈ Modifications usually add weight
- ✈ Important to ensure that mods are fully removed when no longer required!
- ✈ One of the reasons for unaccounted weight growth



Monitoring and Control



measure

- ✧ Modifications (mandatory & other)
- ✧ Unaccounted weight growth
- ✧ Tankering of fuel
- ⇒ Extra fuel requirement, Emissions

→ Extra expense, less profit!



Monitoring and Control



- ✧ track aircraft weight over time
- ✧ monitor the actual weight of mods

→ Fuel Efficiency Group

- ✧ track aircraft fuel efficiency over time
- ✧ Allows the use of statistical contingency fuel (worth \$7M per year to BA)

→ Saves fuel/money/Environment



Paint - who needs it?

✈ Paint weighs a lot!

✧ A320-200, approx. 110 - 150 kg

✧ B747-400, approx. 410 - 550 kg

✈ But it also provides a service:

✧ Protection - helps prevent corrosion

✧ Ensures a smooth surface

✧ Provides an identity



So - who does need paint?



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Thank you !



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