Perfect Flight

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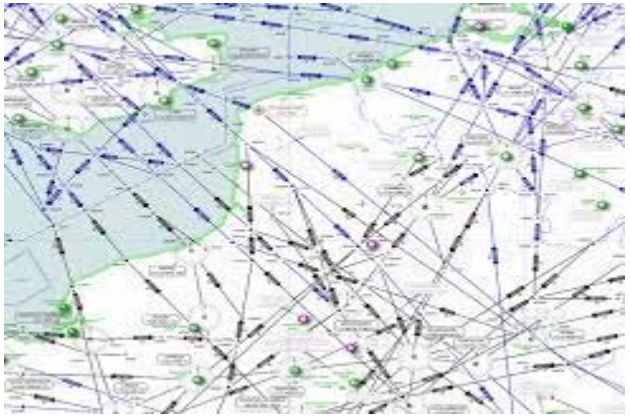
2018



Economic development worldwide is getting a significant boost by increasing connections between cities from air transport. This wider economic benefit is being generated by the flow of goods, people, capital, technology and ideas – and falling air transport costs.

The number of unique city-pair connections is forecast to have exceed 21,000 this year, more than double the connectivity by air twenty years ago. The price of air transport for users continues to fall, after adjusting for inflation. Compared to twenty years ago real transport costs have more than halved

Air transport is vital for manufactures trade, particularly trade in components which is a major part of cross border trade today. We forecast that the value of international trade shipped by air this year will be $6.9 trillion. Tourists travelling by air in 2018 are forecast to spend $794 billion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IATA User Requirements for Air Traffic Services (URATS)

User Requirements for Air Traffic Services (URATS)

Communications, Navigation, and Surveillance (CNS) Technologies

Edition 3.0 - JULY 2017

- https://www.iata.org/whatwedo/ops-infra/air-traffic-management/Documents/Requirements-URATS-CNS-technology_Edition%203_2017.pdf

4 Pillar Strategy

1. Technology
2. Operations
3. Infrastructure
4. Economic Measures

Lets look at a “Perfect flight”

What makes a perfect flight ?

- Addressing traffic flows from end-to-end
- Efficient ground movements (for aircraft and passengers)
- Optimised flight profile:
  - unrestricted climb
  - fuel efficient airspeeds
  - optimum cruise levels
  - uninterrupted descent profiles
- Maximising aircraft capabilities/Minimising ATC intervention
- Predictable departure and landing (all weather ops)

Some facts

From gate to gate

At the gate:

- Unnecessary fuel on board means unnecessary additional aircraft weight
- Data link Departure clearance
- Shortest taxi route to runway with rolling line up
- Runway direction matched to departure direction, if possible

Factsheet

It takes fuel to carry fuel!

Taxi-out

Factsheet

Aircraft engines are designed for flying

- Each 1 min taxi burns 3-10kg fuel
- **A340** can save 140kg fuel by taxiing for 8 min on 1 engine.

- Accurate taxi estimates by ATC permits pilot to plan for...
  - APU start-up / shut-down
  - Engine start-up
- ATC "keeps them moving"
  - Slow taxi speeds cost time
- During taxi, ATC updates on take-off sequence
  - Allows pilots to complete pre-take off check lists in good time - reducing runway occupancy

Approaching the runway

↗ Rolling take-off avoids spooling up engines while holding in take-off position

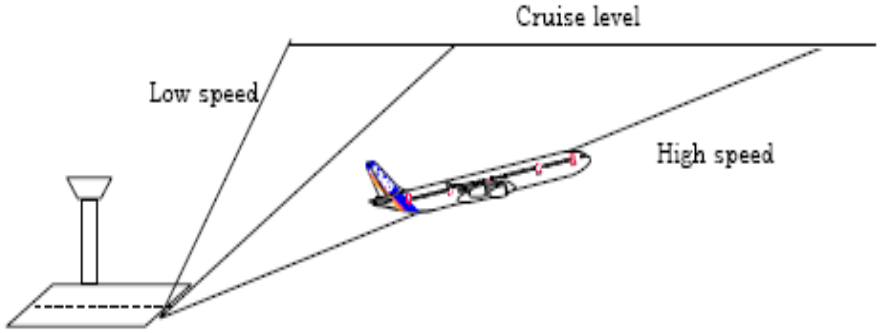
↗ Allowing smaller aircraft with intersection take-offs saves fuel for all

Factsheet

Fuel consumption at take-off and missed approach is about three times higher than in arrival

Take-off

- Optimum climb-out speed
- Pilot:
  - *"NEW YORK TOWER, CLEANAIR 242 REQUESTS 300 KTS CLIMB SPEED"*
- Controller:
  - *CLEANAIR 242, NO SPEED RESTRICTION*



Climb profiles

Factsheet

Need for speed

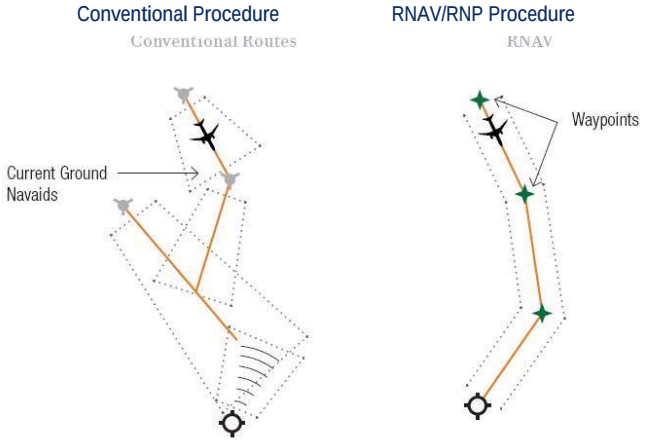
- A 20kt speed increase for A340 from 280kt to 300kt will result in a 135kg saving.
- Time: A 1 minute savings per movement also improves airport throughput.

Standard Instrument Departure

- Optimally designed (RNP/RNAV) Standard Instrument Departure (SID) eliminates time & distance required to over-fly conventional ground based radio-navigational aids
- Flight can avoid noise sensitive areas
- Flown by computers with high precision of track and time keeping accuracy

Factsheet

- An RNAV SID design can deliver 7 nautical miles or more by avoiding ground-based flight tracks
- Built up areas can be easily avoided



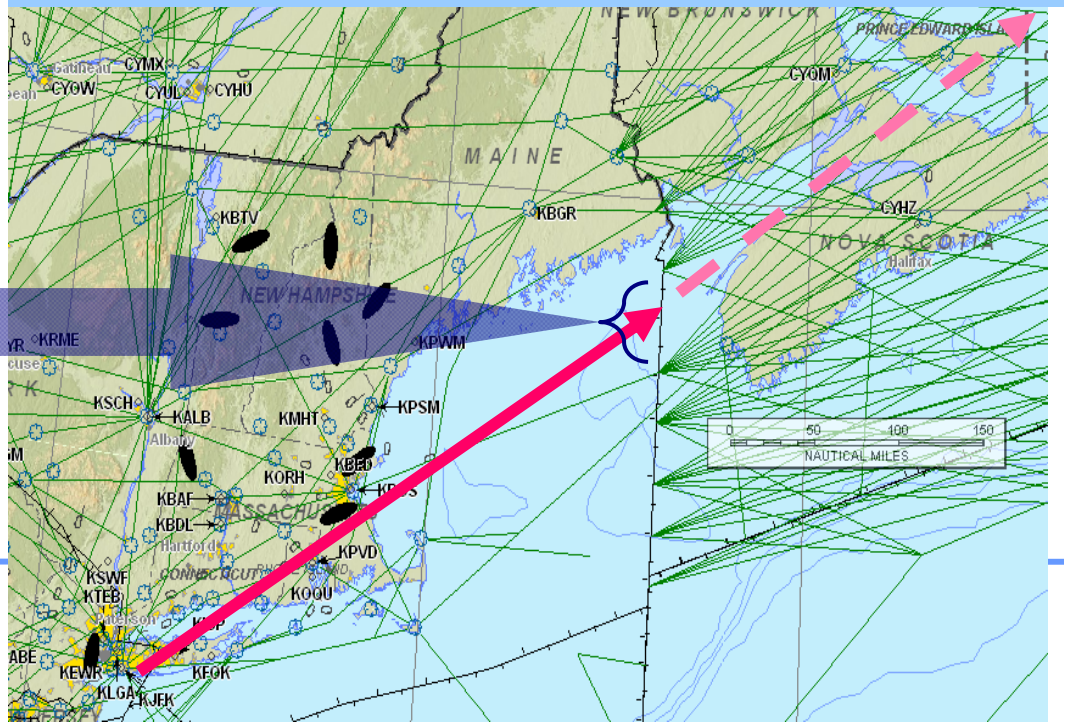
Climbing to Cruise Altitude

- Where it is practical and consistent with safety, Controllers should consider cancelling SID restrictions as soon as possible after take off
- At many airports, it is permissible to allow aircraft to accelerate to optimum climb speed as soon as clear of traffic.
- Civil/Military cooperation plays an important role in saving fuel

Factsheet

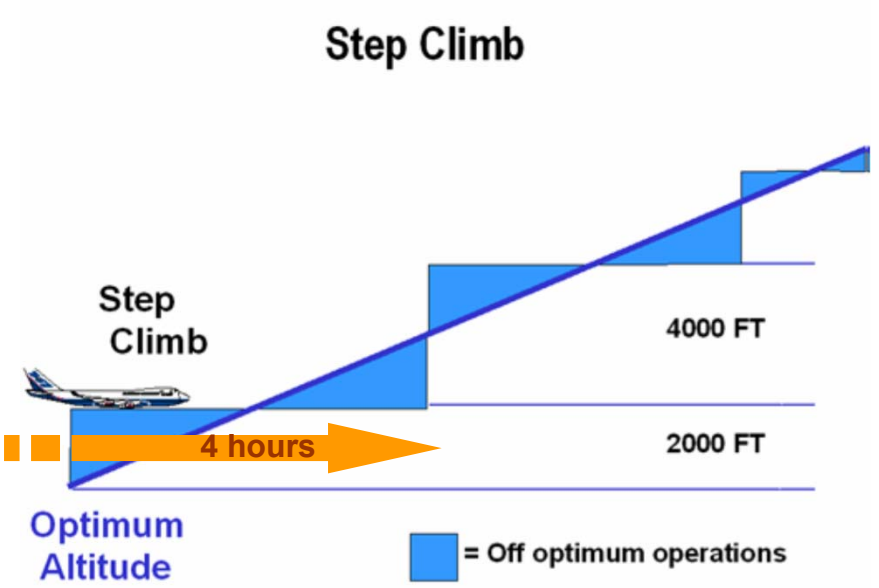
Airspace is a finite resource

- Approx 40% North Atlantic flights do not receive requested clearance
- Globally, approx 30% airspace belongs to military
- Most air-routes developed over 50 years ago have changed little



Enroute

- After 4 hours flying, the aircraft is 24,000kg lighter and needs to climb to a higher optimum altitude
- Pilot requests climb clearance via data link
- Clearance to climb is received via data link within 2 minutes
- Best case scenario - ATC, seeing no conflicting flights, authorises the pilot to “cruise climb” at his own discretion



Factsheet

Optimum Routes altitudes

- Reroutes and altitudes impact time and fuel

En-Route

- ATC where possible should allow airlines to fly the efficient routes based on the best winds.
- Fixed airways, limited entry/exit points generates inefficiencies in flight planning

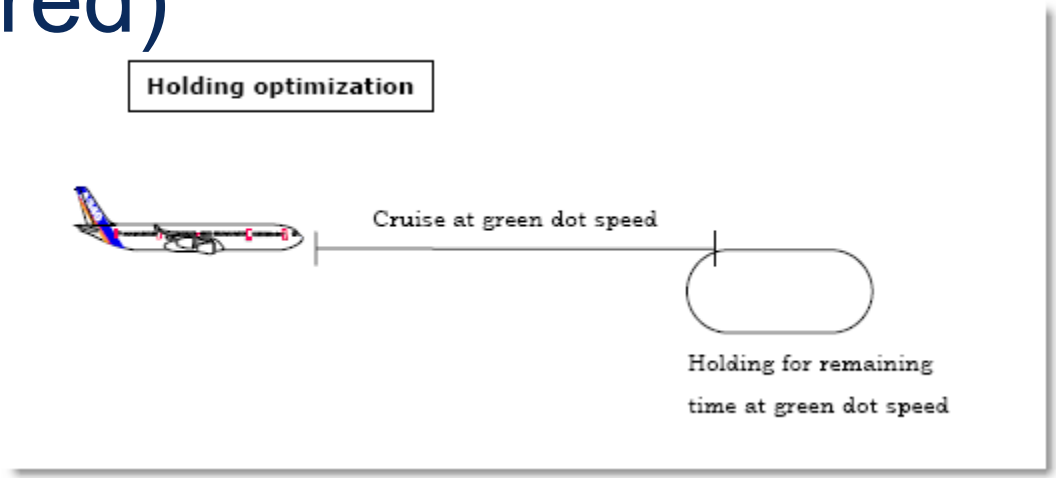
Factsheet

Flexible Routing, User Preferred Routes,

- Routes change by day, month, season, flight direction etc.
- Flying fixed routes is no longer efficient

Holding - (if required)

- Approaching destination, ATC realises delayed arrival if aircraft continues at its present speed.
- ATC advises pilot (as far out as possible) and gives clearance to slow down while the aircraft is still at a fuel efficient cruising altitude.
- ATC further realises slowing down is insufficient and instructs pilot to enter a hold – but at a fuel efficient cruising level.



Factsheet

- Aircraft transitioning from enroute environment towards an airport tend to converge, generating a ‘’funnel’’ effect
- Linear Holding cruise & hold in altitude.
  - A 15min hold on an A340 at FL350 instead of FL150 saves 128kg.
- Accommodate flexible clean speed configurations where possible

Descent

(about 120nm from destination)

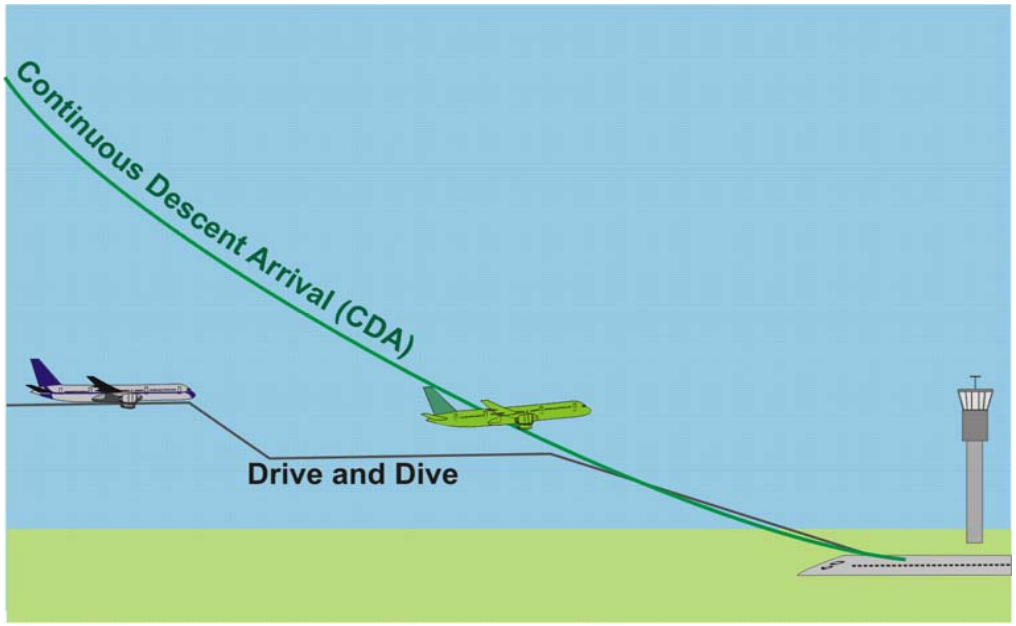
- Continuous Descent
  - While still at cruising level ATC clears pilot to descend at pilot's discretion

    "Pilot's discretion descend and maintain 3,000 feet"
  - This clearance allows the pilot to reduce thrust to flight-idle setting. The flight management computer is allowed to optimize and manage:
    - Speed (cost index)
    - Rate of descent
    - Gate management
    - Accurate time predictions at gate (connecting pax.)

Factsheet

Continuous descent arrival / approach represents :

- 10% less fuel
- 40% less noise
- 150 - 640kg less CO_2



Landing

Factsheet

↗ One go-around for A340 costs approx.4000kg in fuel and an additional 15 minutes of air-time.

↗ An arrival procedure that avoids noise sensitive areas is flown, with a constant glide towards the runway.

↗ ATC is conscious of the implications of a go-around

↗ The landing runway chosen is the closest to the passenger terminal and minimizes taxi time

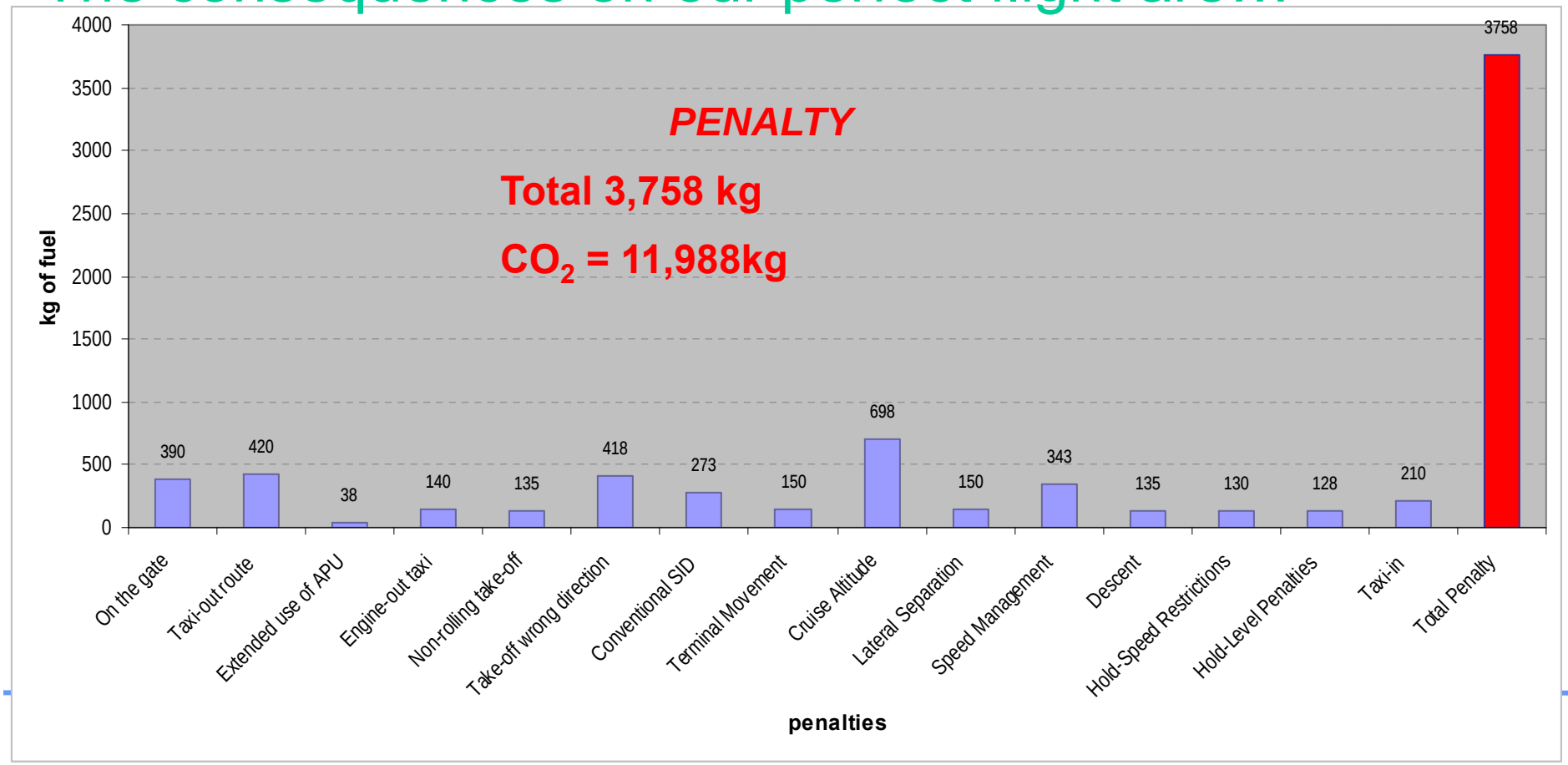
Taxi-in

- Vacate runway via high speed taxiway is included in landing clearance
- Advance gate information allows the pilot to plan for fuel savings techniques such as partial main engine shutdown prior to arrival on stand


BUT!

With Current Operational Constraints

The consequences on our perfect flight are…



• Based on an A340-500 – 6 hours flight

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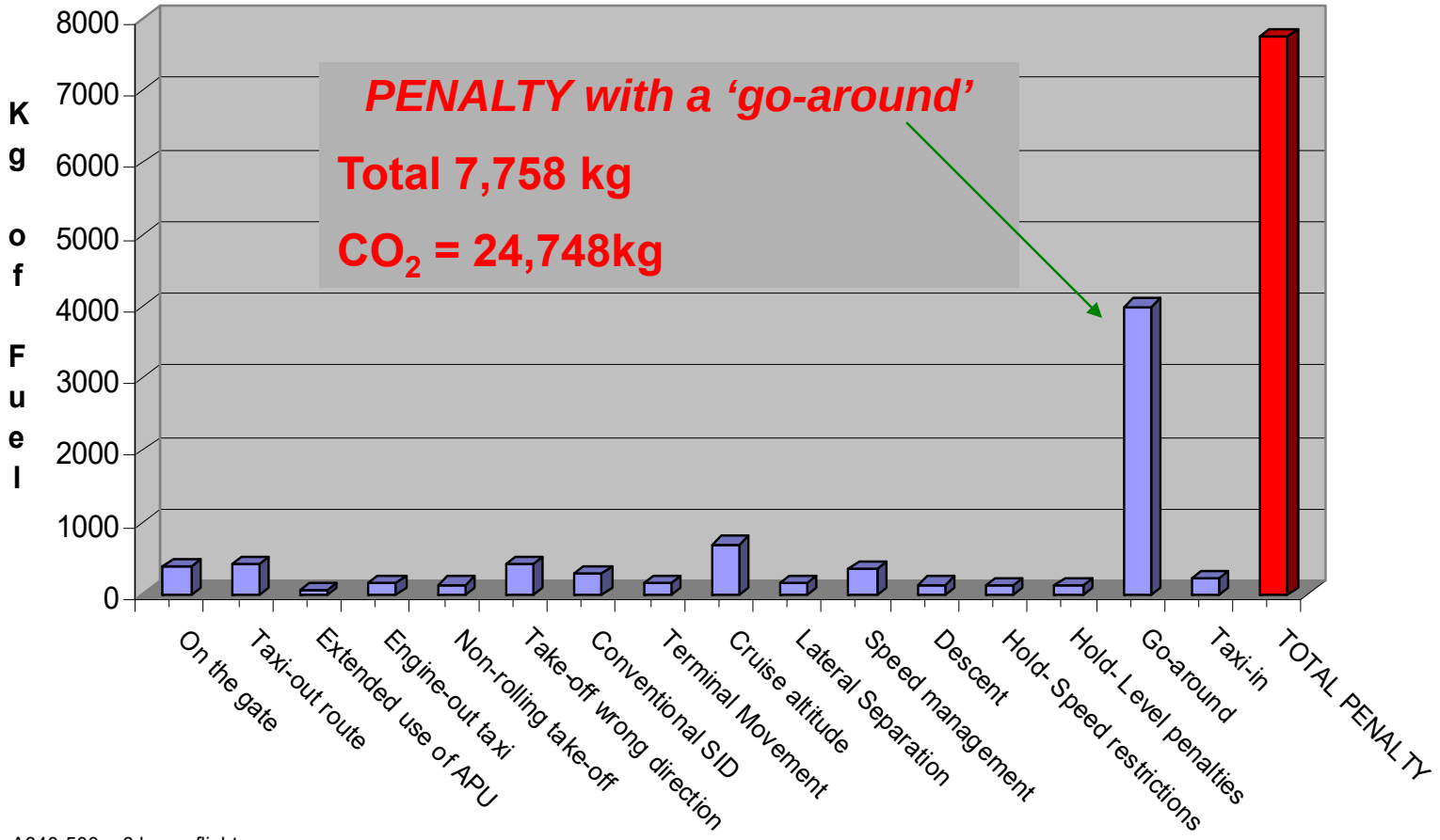


• Based on an A340-500 – 6 hours flight

The perfect flight can be flown today!

With the available infrastructure

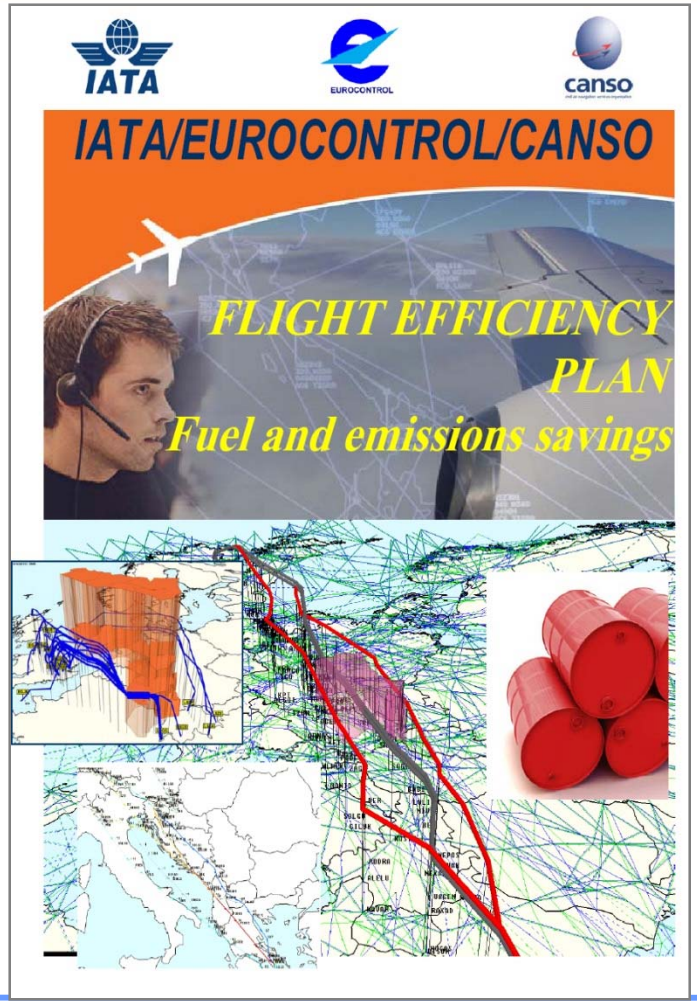
- Best Practices in Air Traffic Services
  - Efficient Ground Movements
  - Clean Airspeed Departures
  - Flying at Optimum Altitude
  - Random Routes (wherever possible)
  - National Airspace Management Plans (civil / military)
  - Pilot Discretion Descents
  - Holding of Aircraft - alternate solutions

Embrace Technology

- ATC/Airline cooperation in embracing the new technology can lead to huge saving for LH and ULH routings.
- Utilize systems such as
  - CPDLC for Oceanic airspace
  - Performance Based Navigations (PBN) capabilities (En-route &Terminal).
  - Automatic Dependent Surveillance–Broadcast (ADS-B)
  - Automatic Dependent Surveillance–Contract (ADSC)
  - etc.

Flight Efficiency Plan

1. Airspace design.
2. PBN
3. Route shortening, flight plan quality improvements.
4. TMAs, CDAs.
5. Airport ops, Collaborative Decision Making.
6. Awareness raising on ATM fuel performance management.



The Way Forward

Much can be done with existing capabilities

ICAO Aviation System Block Upgrades (ASBU)

- ✓ **Enables global interoperability**
- ✓ **Develops clear solutions**
- ✓ **Establishes a transition plan**
- ✓ **Need for a Collaborative Approach**
- ✓ **Planning for implementation**

❖ **Must Involve all stakeholders**

Summary

- Much can be done today
- Consider the procedures on offer
- What can be done
  - All the time
  - Some of the time
- Any saving is a benefit
- The savings are accumulative

“PERFECT FLIGHT”

from vision to reality