

ICAO Interface to the Estimation of Fuel Savings Accrued from Operational Improvements



IFSET Workshop
Singapore - December 2011



Background

ICAO – STRATEGIC OBJECTIVE

Safety – Enhance global civil aviation safety

Security – Enhance global civil aviation security

Environmental Protection and Sustainable Development of Air

Transport - Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment

- Assembly resolutions
- Action Plans
- GATMOC/GANP

Assembly

- Every 3 years
- Defines the road for the organization
- Directs Secretariat, States and International organizations towards global objectives
- Most recent in October 2010
- Assembly Resolutions related to Safety, Security, Environmental Protection and Sustainability of Air Transportation

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- Further endorsement of the global aspirational goal of 2 per cent annual fuel efficiency improvement up to year 2050;
- A medium-term global aspirational goal from 2020 that would ensure that while the international aviation sector continues to grow, its global CO2 emissions would be stabilized at 2020 levels;
- Further work to explore the feasibility of a long-term global aspirational goal for international aviation;
- Development of a global CO2 Standard for aircraft aiming for 2013;



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- Development of a framework for market-based measures, including further elaboration of the guiding principles adopted by the Assembly, and exploration of a global scheme for international aviation;
- Concrete steps to assist States to contribute to the global efforts;
- *de minimis* provisions to ensure that States with small contributions to the global air traffic are not burdened disproportionately; and
- States' action plans, covering information on CO2 emissions reduction activities and assistance needs.



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Action Plan

- “A document that identifies the steps the State intends to take over a given time period to achieve the desired objectives.” adapted from NavCanada
- Opportunity to identify measures that will improve fuel efficiency and reduce emissions.
- Allows future progress toward the global environmental goals to be assessed.
- Domestic Aviation? Important to separate...



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Action Plan

At a minimum:

- Expected results: International RTK, fuel consumption, and projected future CO₂ emissions (to 2050 is ideal);
- List of proposed measures; and
- Information on any assistance needs.

But, more information can be included, such as:

- Baseline to describe the emissions that would result in the absence of action;
- Detailed information about the proposed measures and their incremental results; and
- Supporting materials and references to other documentation.



Action Plan

Key steps

- Preparatory activities, including:
 - Administrative and organizational arrangements
 - Identification of national conditions
- Estimation of historical CO₂ emissions from international aviation
- Identification of actions to mitigate CO₂ emissions
- Calculation of expected results from the actions



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Example: Australian Action Plan

- Strategies for meeting aspirational goals
 - Through implementation of action to address climate change – rather than constrain growth
- Identifies “business as usual” process
- Identification (through quantification)
 - Step measures are needed – CO₂ continues to grow
 - Projection of BAU; biofuels; MBMs



ATM Vision

- GATMOC - “Long term Vision for ATM”
 - integrated, harmonised, interoperable –To achieve an interoperable global air traffic management system, for all users during all phases of flight, that meets agreed levels of safety, provides for optimum economic operations, is environmentally sustainable and meets national security requirements.
- GANP - “Strategic Vision”
 - To foster implementation of a seamless, global air traffic management system that will enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and without compromising agreed levels of safety.



Supporting Measures

- What measures are needed?
 - Action Plan – projections?
- How do we measure? IFSET? Modelling tools?
- CANSO ATM Performance measurement
 - Phase of flight approach
 - Vertical measurement
 - White paper development 2012



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Questions?



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Thank you



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Spare slides



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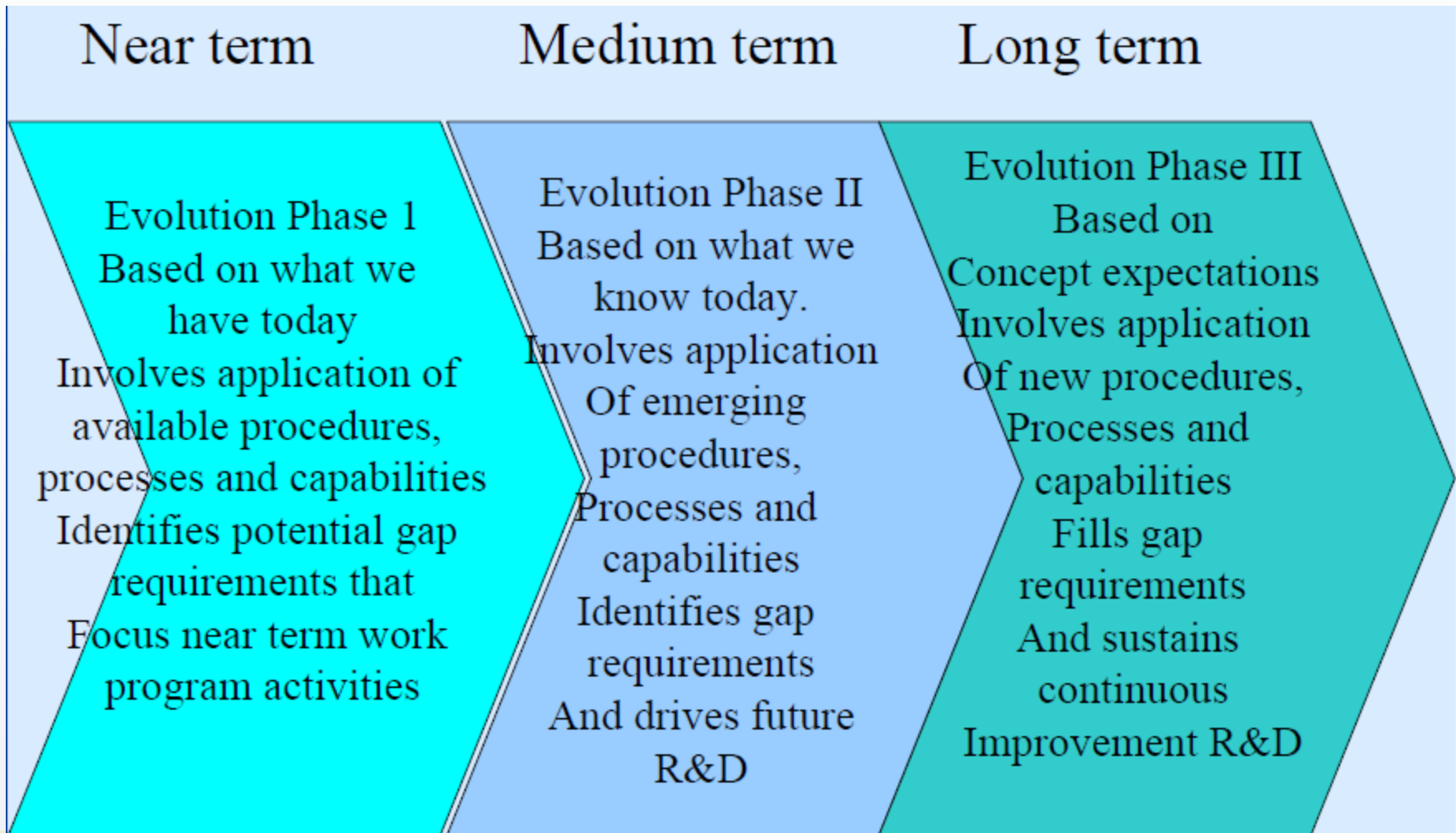
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GANP

- Strategic document describing the methodology for global air navigation harmonisation
- Establishes the focus for near and medium term activities
- Set of GPI
 - Implementation methodologies (tactics)
 - Measureable progress towards GATM Operational Concepts



Global Plan Evolution



CANSO's Work on the Environment

Common metrics

Excess Time Flown converted to fuel	Measured by additional time versus an unimpeded time and converted for various ac types. This method could apply to the taxi phase or a flight phase as a first approximation
Vertical Inefficiency	Measured by level flight segments on departure or approach as well as non-optimal cruise altitudes
Distance flown	Measured in NM or km, a potential proxy for fuel burn and emissions
Excess Fuel on Oceanic Routes	Measured as a modelled optimum versus actual fuel burn. Requires sophisticated wind modeling
Percentage achievement of CCO and CDO	A potential measure of flight in a relatively efficient mode
NATS 3DI score	Evaluates entire trajectory for distance and vertical based inefficiencies.



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Combined Vertical + Horizontal

Given an Actual Trajectory – Act (x)

Actual Trajectory

Let

Opt(x₀) be an Optimum Trajectory

Vertical efficiency

With

X₀ as an un-impeded distance for Act (x)

Unconstrained Vertically
(Same distance)

Total ATM benefits pool
Time & Fuel

Horizontal efficiency

Let Fuel Benefit =

Unconstrained Trajectory

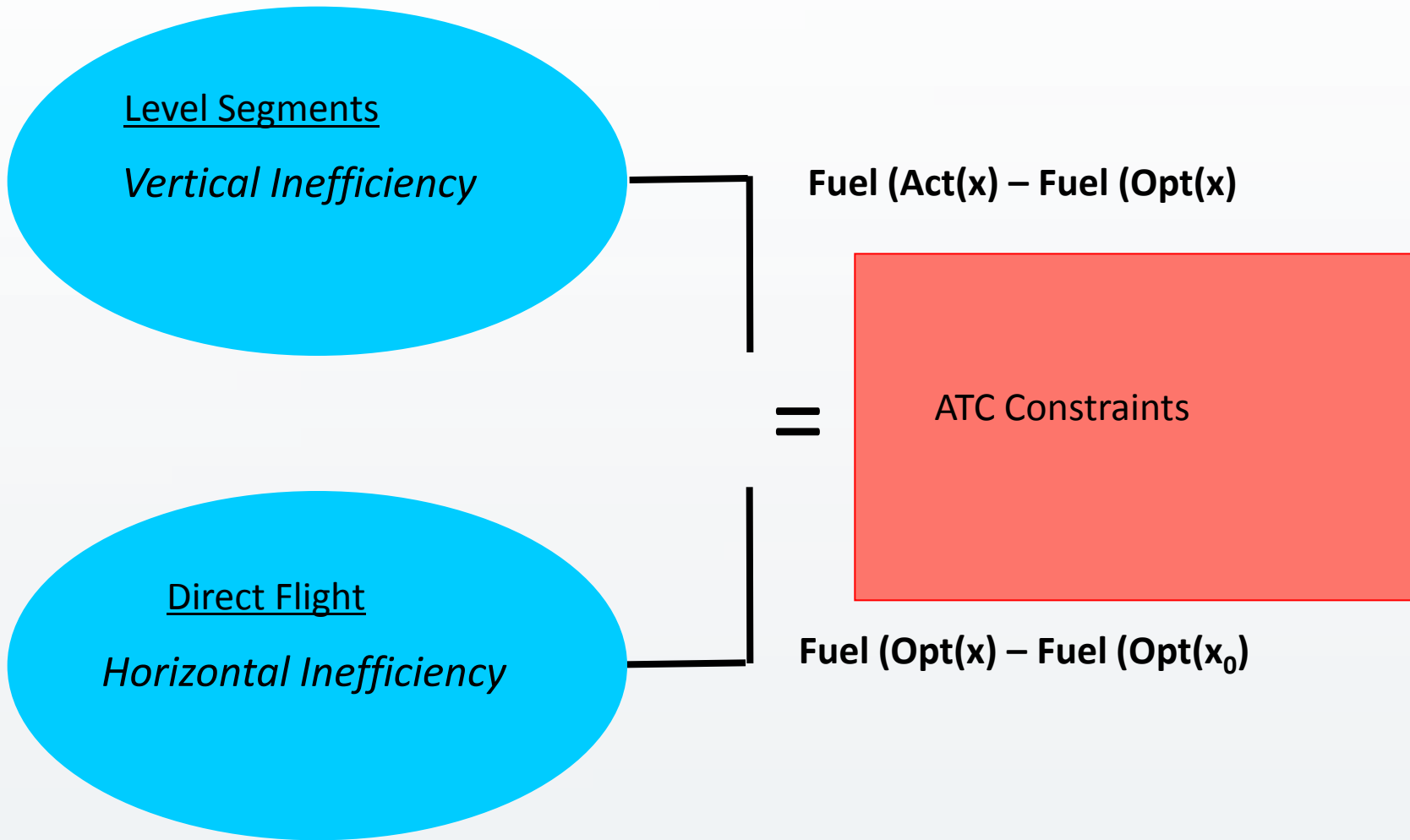
Fuel (Act(x)) – Fuel (Opt(x₀))



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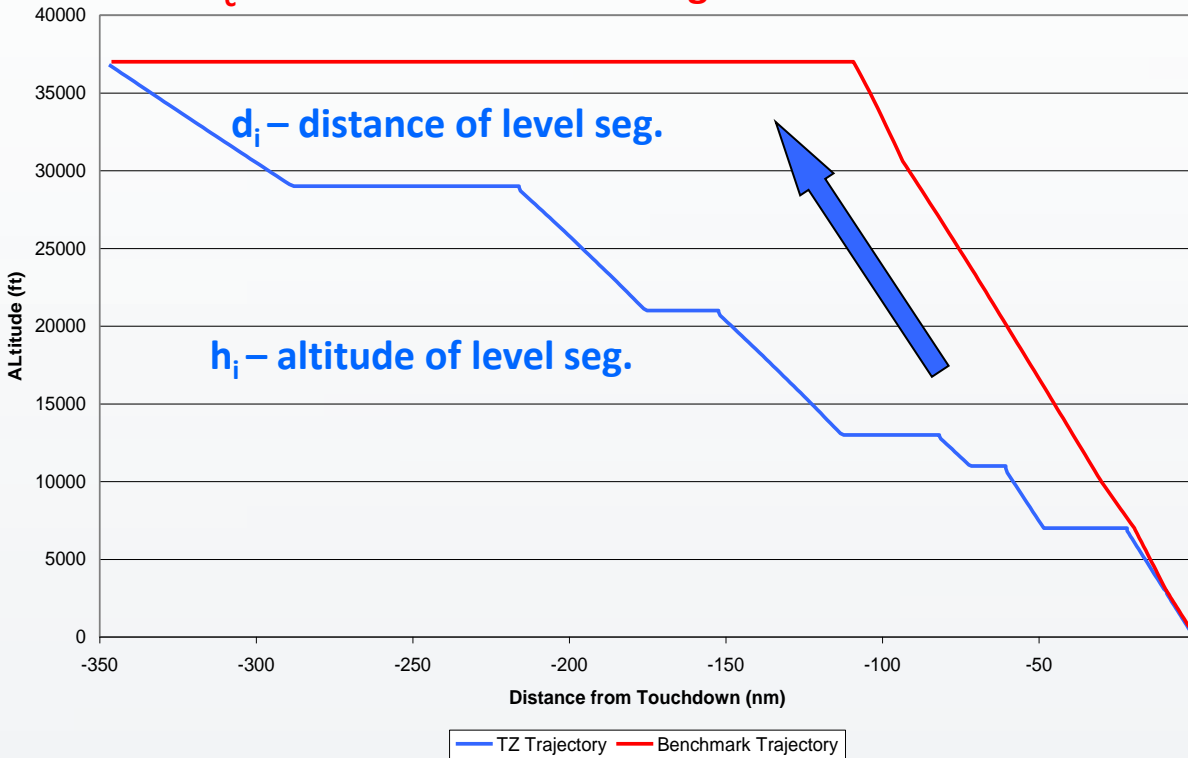
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Inefficiency Detected from RADAR Data or improvements related to airspace design



Vertical Component

h_c – new altitude of level segment



ΔT Change in Time

ΔF Change in Fuel

From BADA

$v(h)$ – Speed at Alt h

$f(h)$ – Fuelburn at Alt h



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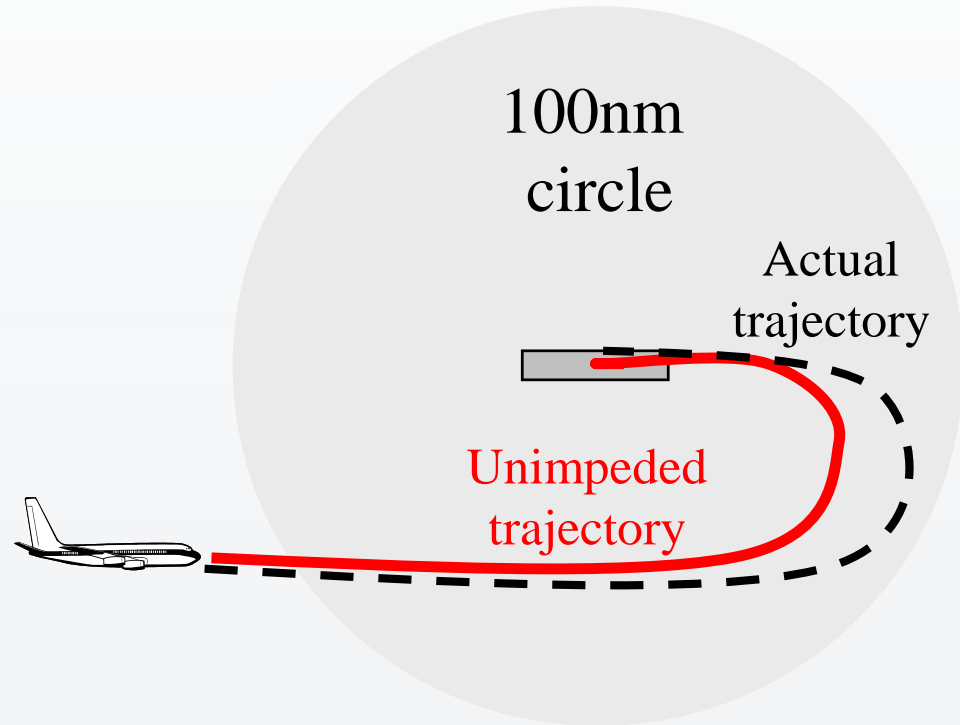
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Horizontal Component

x - Actual Distance

x_0 - Minimum Distance

h_c - Cruise Altitude



From BADA

$v(h_c)$ Nominal Speed at Cruise

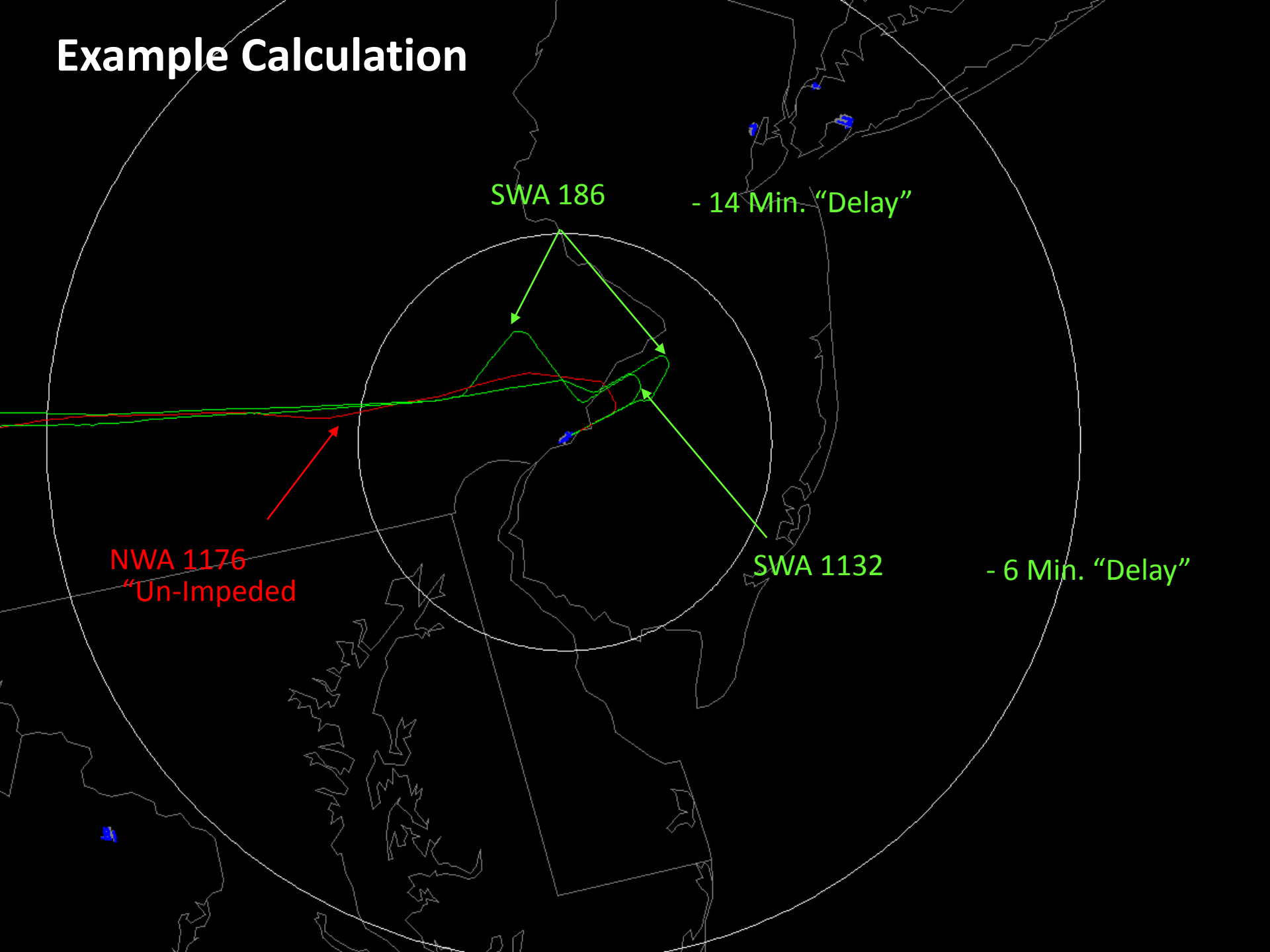
$f(h_c)$ Nominal Fuel at Cruise



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Example Calculation



SWA 186

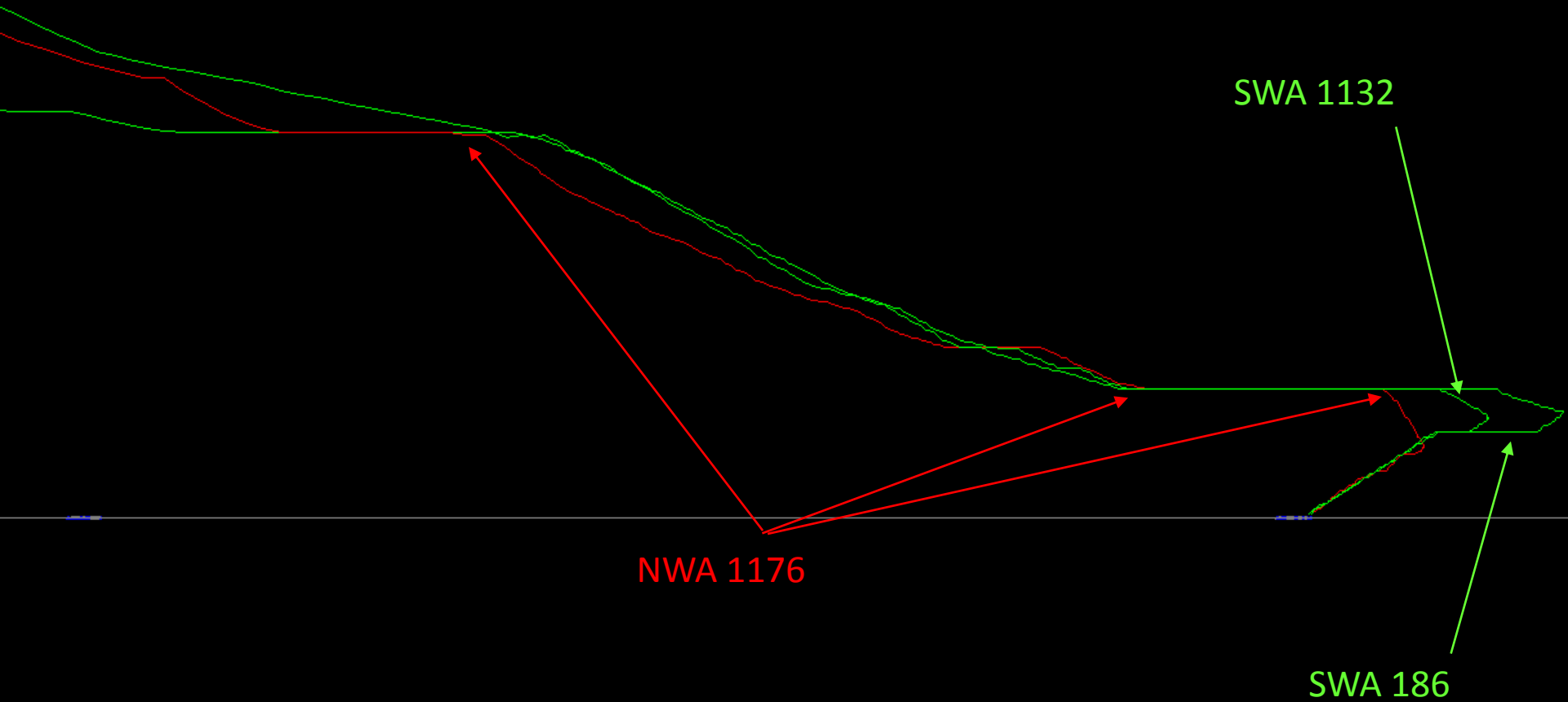
- 14 Min. "Delay"

NWA 1176
"Un-Impeded"

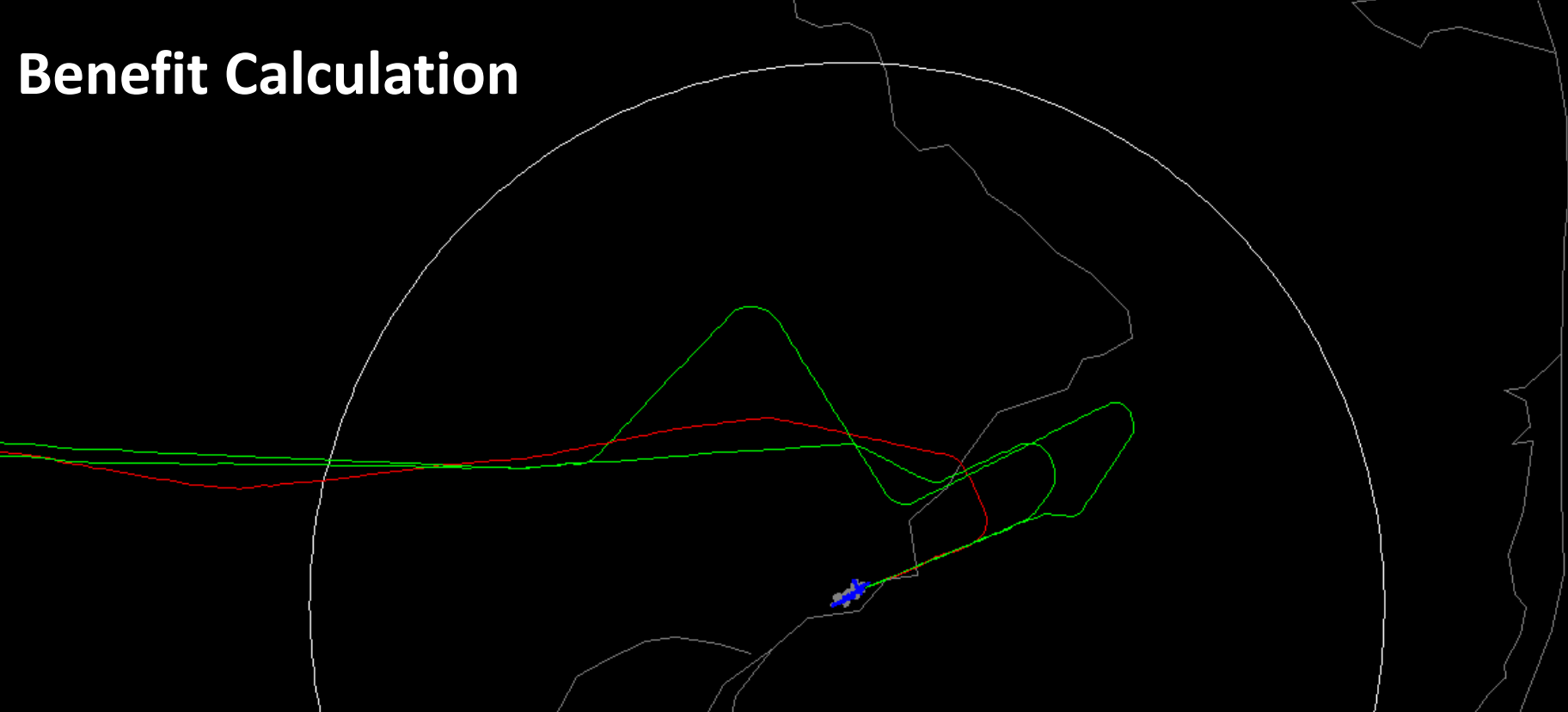
SWA 1132

- 6 Min. "Delay"

Vertical Profile View

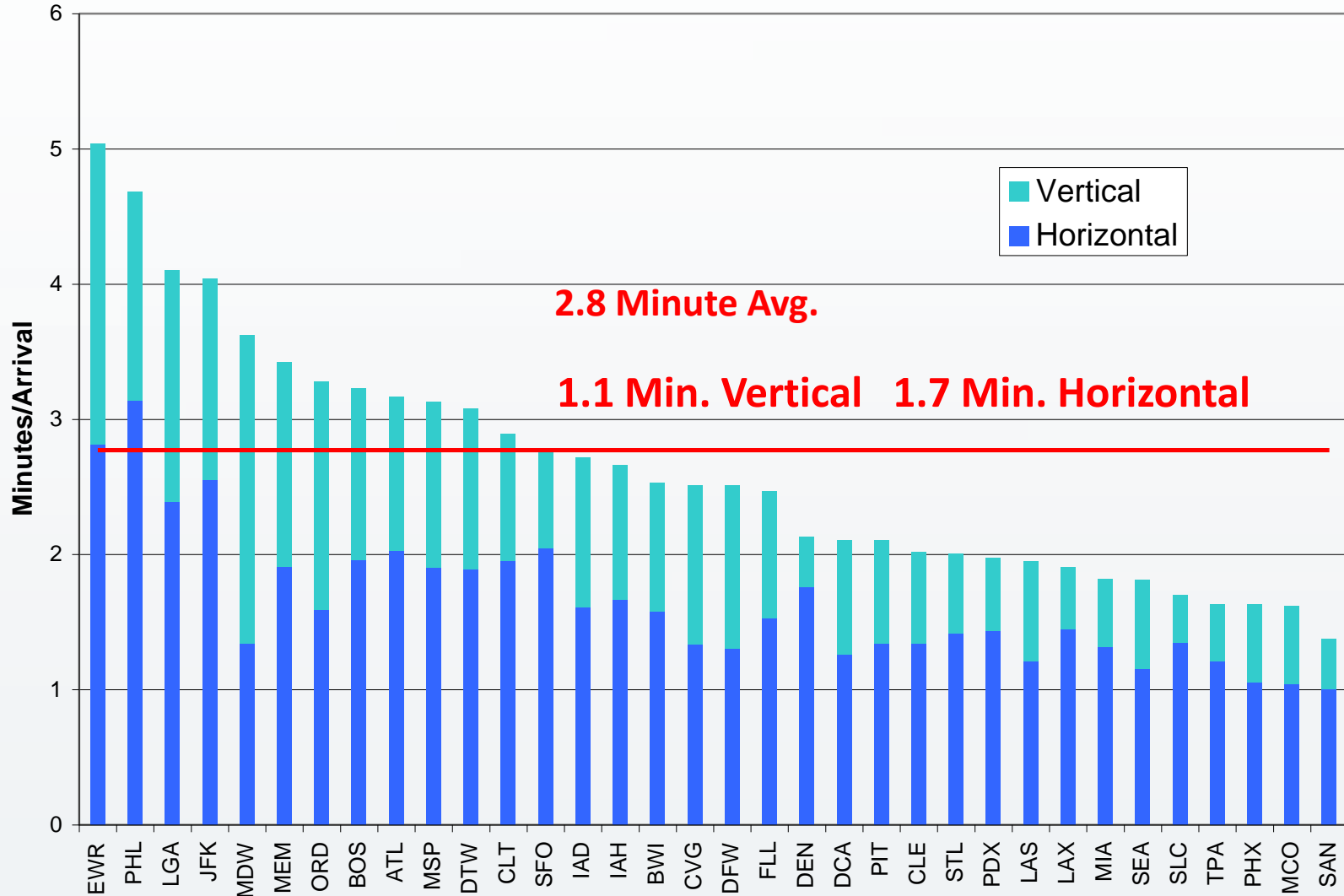


Benefit Calculation



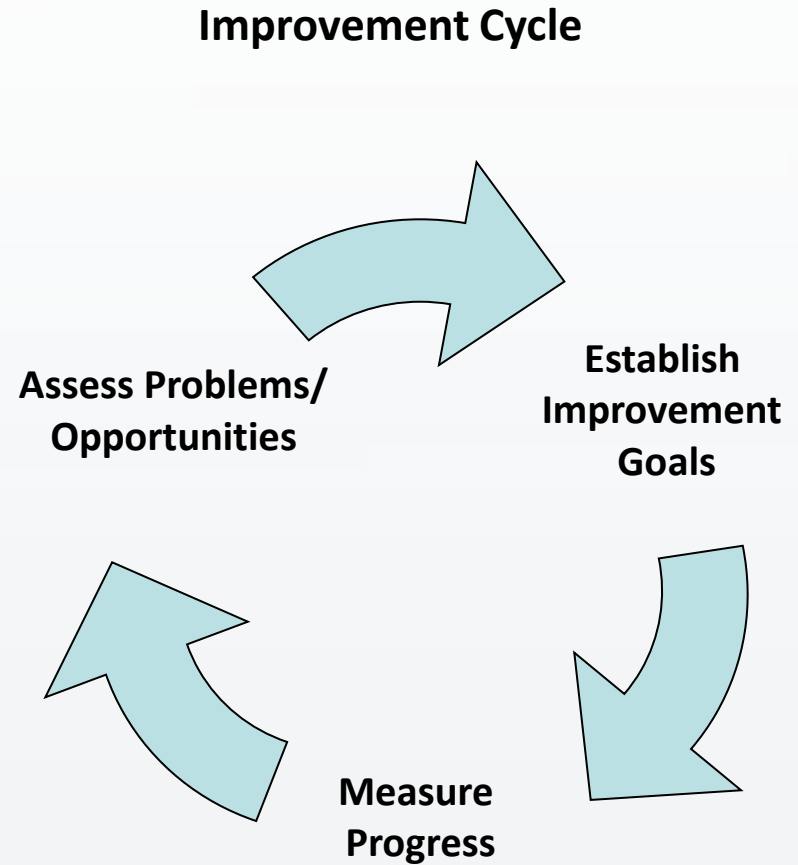
			A100	VERTICAL		HORIZONTAL		excess distance	
Carrier	Flt. #	AC Type	Time (min)	Fuel (kg)	Time (min)	Fuel (kg)	Time (min)	100-40 (nm)	40-0 (nm)
NWA	1176	DC95	0.0	75.6	1.9	18.9	0.5	0.0	3.2
SWA	1132	B737	5.9	68.5	2.5	75.7	2.1	0.2	14.5
SWA	186	B733	14.0	90.4	4.9	241.0	5.8	0.0	39.9

Potential Time Savings (Per Arrival)



Political Will for Environmental Change

- Identify Improvement opportunities
 - Deliver objective data to support decision making
 - Value Potential Investments
 - Drive Political Will for change/improve
- Identify Best Practices
- Accountability to Stakeholders



Bureaucracy (but necessary)

- QUESTIONS?