



# GreenLandings™ Real Time, Aircraft Landing Time Management

March 1, 2023



# *Rapid, Inexpensive Implementation*



## **GreenLandings™ Landing Time Management**

1. GreenLandings™ is inexpensive, fully developed, ready to deploy and easily crosses FIR and ATC sector boundaries.
2. What we are currently doing to prevent airline delays, congestion and excess CO2 is not working.
3. Delays, congestion and excess CO2 adds unnecessary stress to the airspace, ATC system, ATC controller, airport, airline, aircraft operator and pilot.
4. Because of the business needs of the individual airline/operator, only they can rapidly and efficiently prevent delays, congestion and excess CO2.
5. This problem costs an individual large airline \$5 Billion annually.
6. There is an inexpensive FAA, Embry-Riddle and GE Aviation operationally validated solution that can be implemented starting within months.
7. GreenLandings™ is an airport, airline or operator centric system solution that easily identifies/mitigates congested terminal/ramp/enroute airspace.
8. Finally, [ATC is not the problem](#), or the solution.

# *Wide Ranging Benefits*



## **GreenLandings™ Benefits**

- Improved profits
- Increased on time arrival
- Reduced fuel burn, CO2 and NOX
- Increased crew and system productivity
- Reduced ramp congestion
- Better gate utilization
- Improved product quality
- Increased NPS and less passenger stress
- Reduced ATC complexity and costs

***Each benefit pays for the program many times over. All benefits together make this a huge win for your passengers and shareholders.***

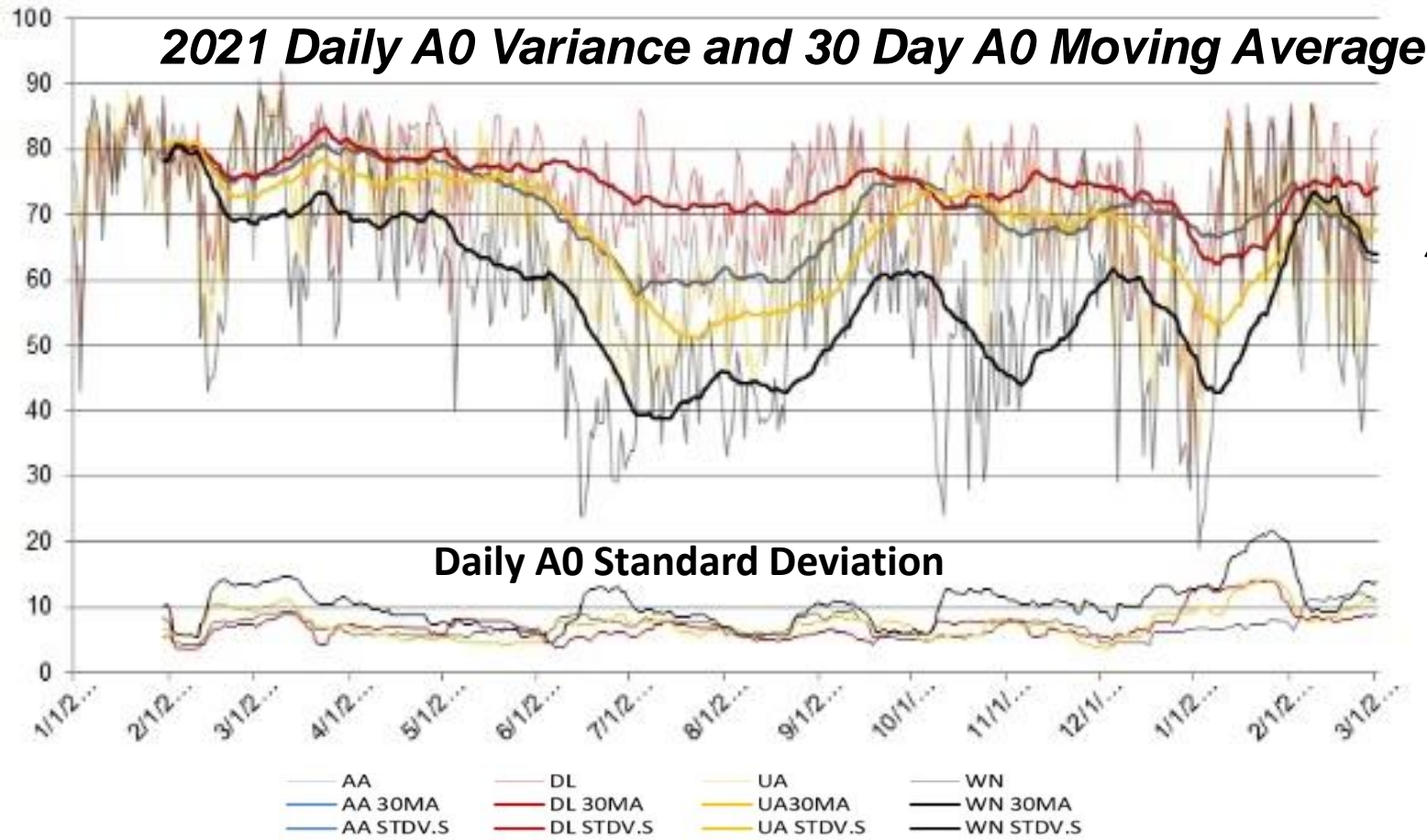
# ***Not Working!***



Airlines have consistently delivered 30% of their customers late for the last 40 years. During this time:

- ATC has continuously promised delay/congestion relief
- ATC has literally spent \$100s of Billions
- Airlines have spent \$100s of Billions on new aircraft/avionics
- Yet, the ATC solution is always 10 years and \$100 Billion into the future. This was true in 1980, 1990, 2000, 2010, and still true in 2022.

# Airlines Desperately Need To Solve This



**DOT 2021  
A14 Ontime  
Statistics**  
(DOT Air Travel  
Consumer Report)

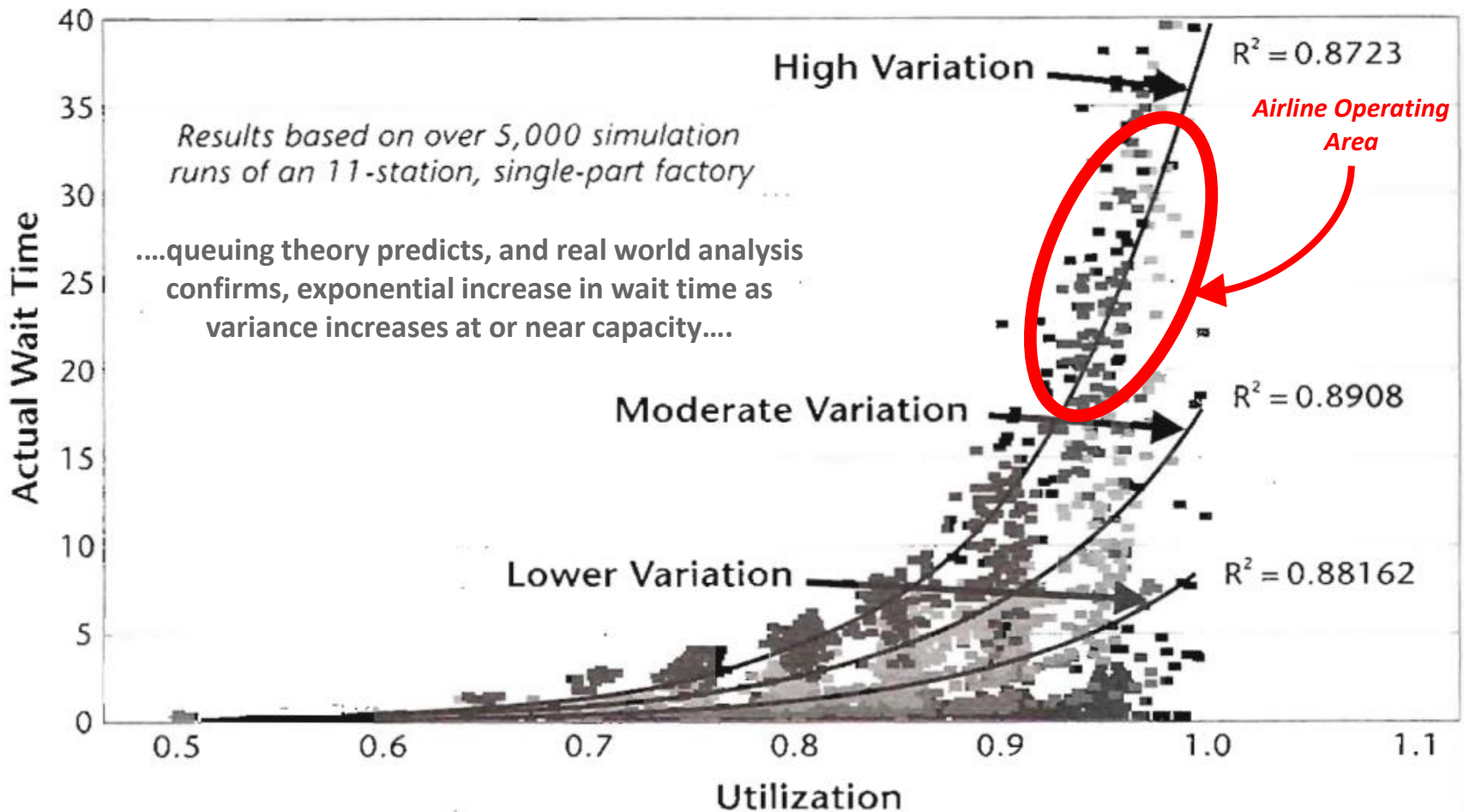
**AA - 81.5%  
DL - 89.0%  
UA - 80.3%  
WN - 76.3%**

## Customers Feel Variation, Not Averages

(Making Six Sigma Last, George Eckes, 2001)

Data/graph provided by [AERA Air Ops View](#), [RW Mann and Company](#) and [DOT Air Travel Consumer Reports](#)

# Standard Queuing Theory Applies



**Higher variation contributes to longer wait times**

Michael George, Lean Six Sigma, 2002

# Capacity and Schedule Are Not The Problem

## On Time, Uncongested Landing Capacity available forward in time

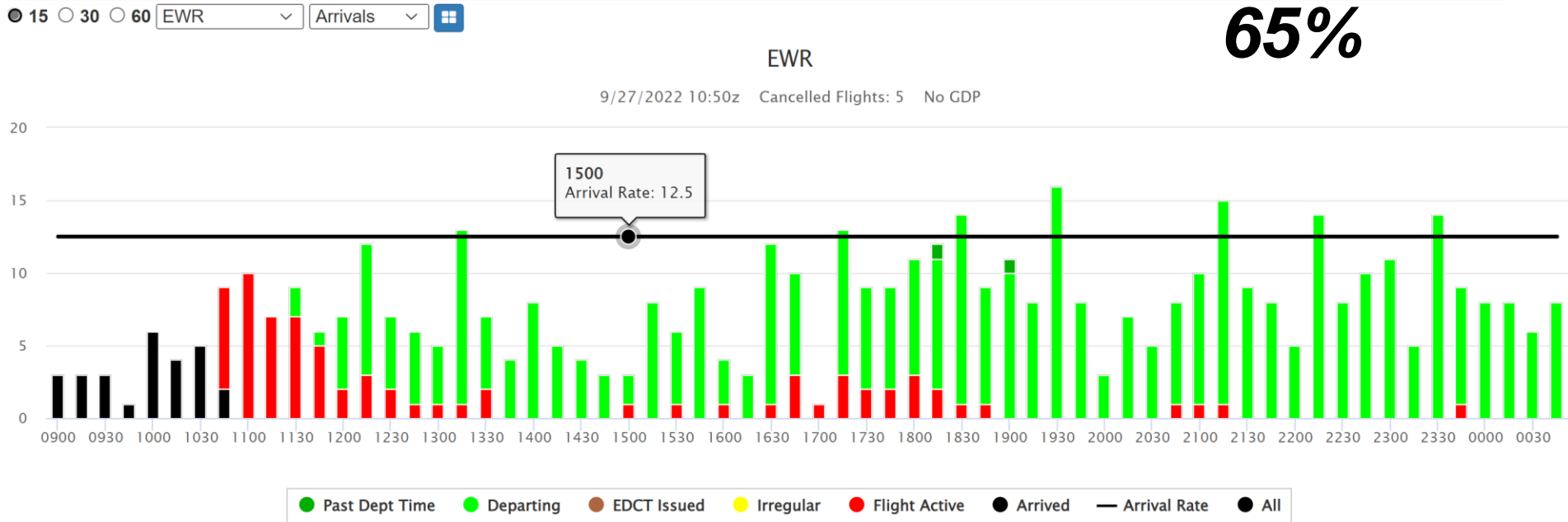


Airport Arrival Demand Chart

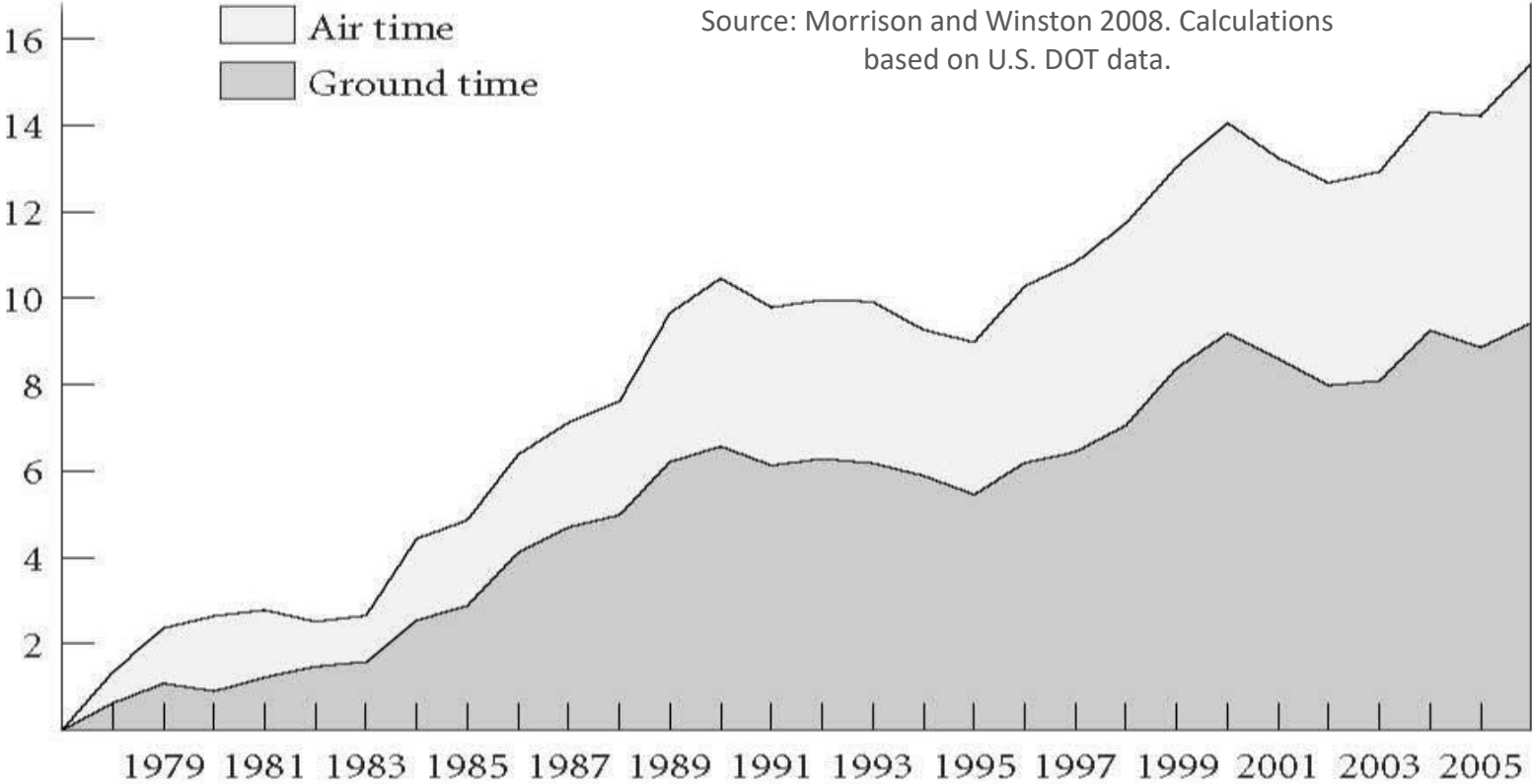
Add New Graph

Newark A0 for Sep 27<sup>th</sup>

65%



# Increasing Block Time Institutionalizes Delays



***"It cost approximately 8 to 10 airplanes per day if we add just a couple of minutes of block time to each flight in our schedule."***

*(Greg Wells, March 3<sup>rd</sup>, 2011 Chicago Tribune article)*



# GreenLandings™ Ops Concept

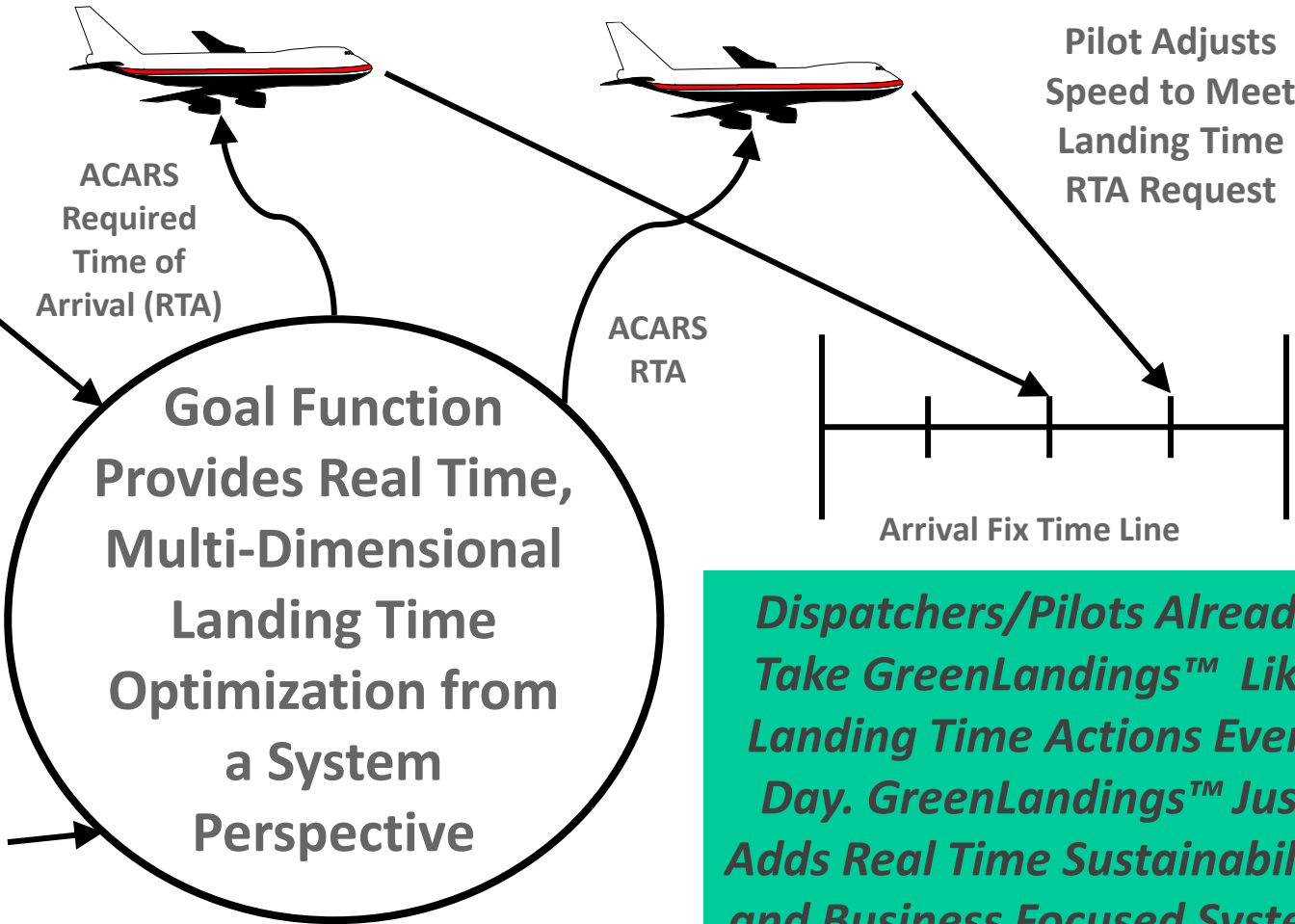


## Big Data “Day of” Predictions

Cornerpost, landing and gate ETA , enroute speed, altitude and path, weather, etc. (SWIM, Flt Plan, FMS, ADS-B/C, airport capacity, runway direction, etc.), *starting hours prior to landing.*

## Airline “day of” Business Goals

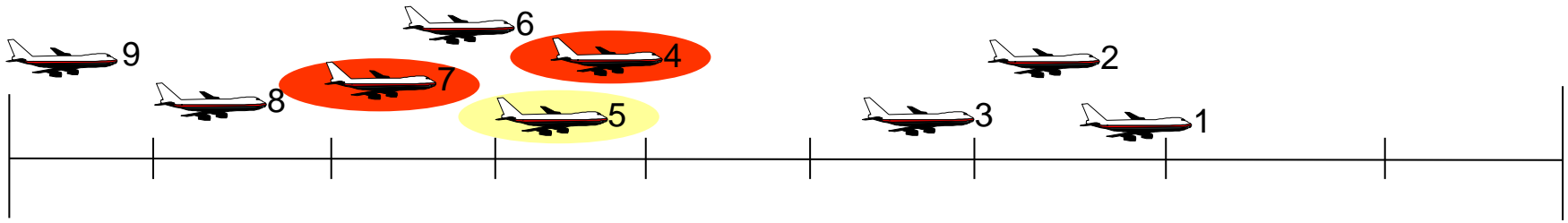
CO2 Reduction, schedule, connections, gate availability, maintenance, crew legalities, weather, etc.



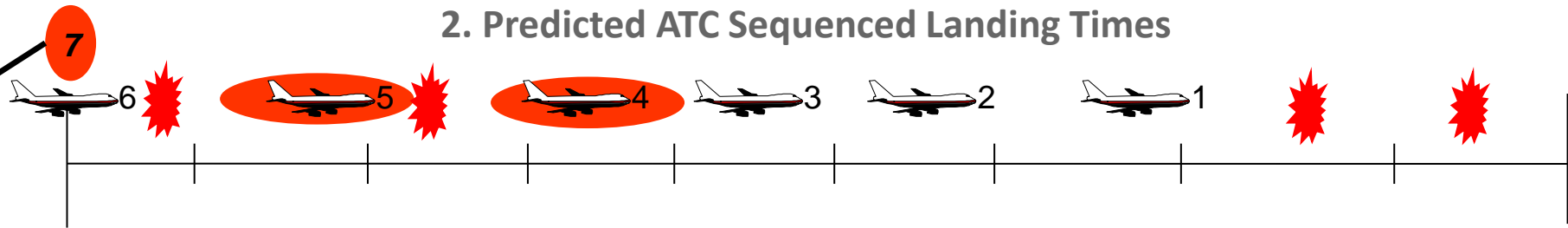
*Dispatchers/Pilots Already Take GreenLandings™ Like Landing Time Actions Every Day. GreenLandings™ Just Adds Real Time Sustainability and Business Focused System Based Coordination*

# GreenLandings™ - Defect Prevention

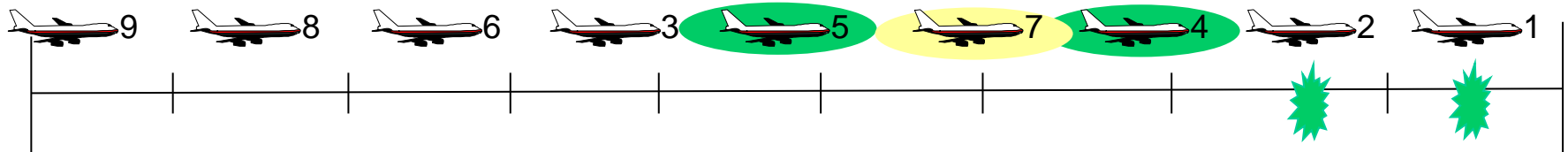
## 1. Predicted Random, Unaltered Landing Times





## 2. Predicted ATC Sequenced Landing Times

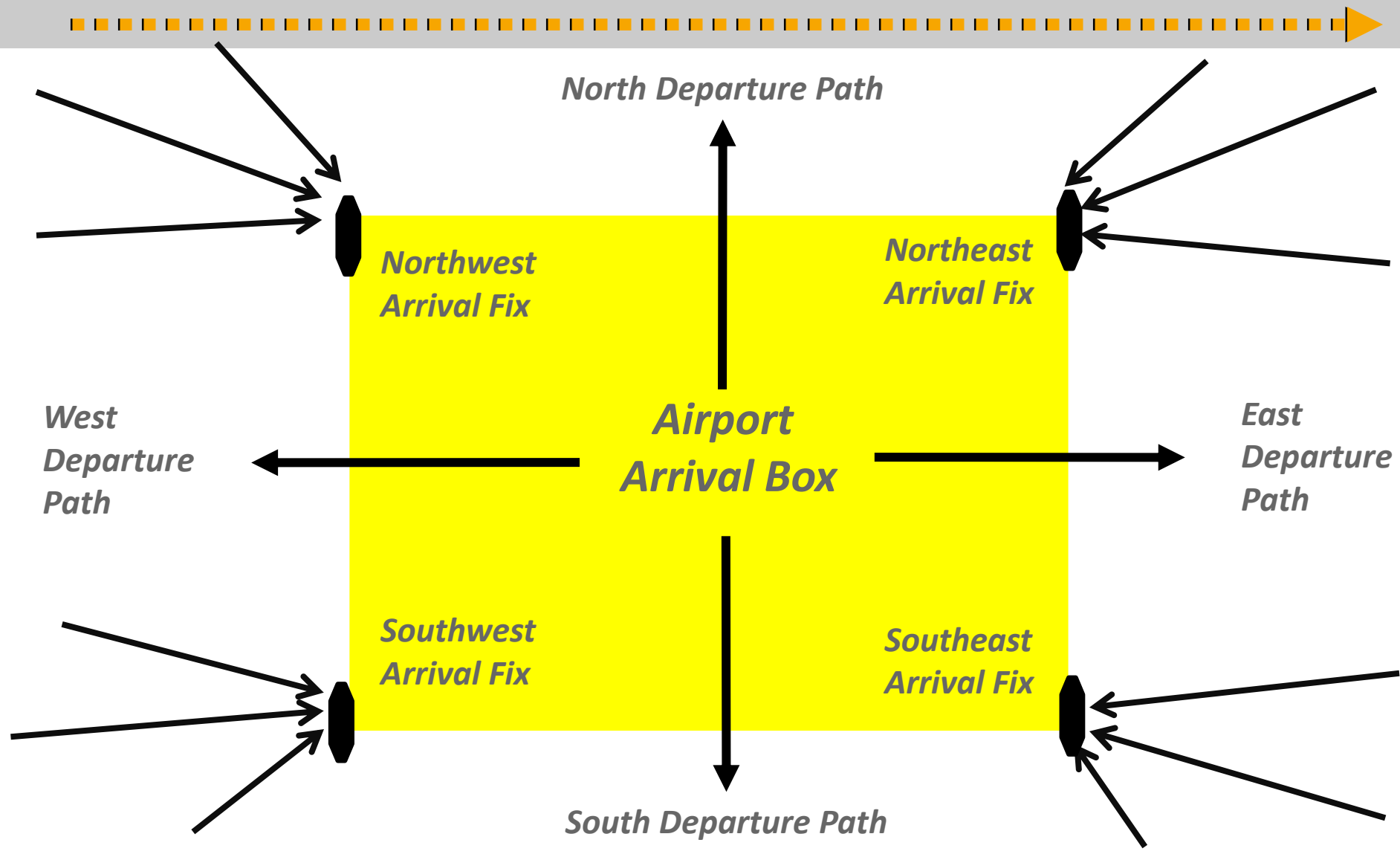


## 3. GreenLandings™ Sequenced Landing Times



- Real Time airline goals considered by GreenLandings™ Process
  - Aircraft #1 and #2 are **early**, but benefit entire queue by moving forward
  - Aircraft #4, #5 and #7 are **late** but managed to early
  - Aircraft #3 is slightly ahead of schedule and may be re-sequenced to remain OT
- Capacity Spoilage  and Recovery 

# Cutting Costs/CO2/Noise - Don't Overload The Box



# Cost Reduction Opportunities

## Single Airline Annual GreenLandings™ Benefit Analysis Preventing CO2, Defects, Fuel Waste and Productivity Loss

Annual Crew Buffer Cost	\$	304,166,667
Annual Defect Rework Cost	\$	113,150,000
Annual Overnight Rework Cost	\$	169,725,000
Annual Fuel Buffer Cost	\$	937,145,672
Annual Aircraft Lost Productivity Cost	\$	3,090,333,333
Annual Lower Ticket Revenue with Low A0 Quality	\$	226,300,000
<b>Total Single Airline Annual Buffer/Rework Cost</b>	<b>\$</b>	<b>4,840,820,672</b>
Annual Recoverable Crew Buffer Cost	\$	91,250,000
Annual Recoverable Defect Rework Cost	\$	28,287,500
Annual Recoverable Overnight Rework Cost	\$	42,431,250
Annual Recoverable Fuel Buffer Cost	\$	281,143,701
Annual Recoverable Aircraft Productivity Revenue	\$	618,066,667
Annual Additional Ticket Revenue with A0 Quality	\$	226,300,000
<b>Total Annual Recoverable Buffer/Rework Cost</b>	<b>\$</b>	<b>1,287,479,118</b>
<b>Total Annual Tons of Single Airline CO2 Generated</b>		<b>32,686,567</b>
<b>Total Annual Tons of Buffer/Excess CO2 Generated</b>		<b>4,358,209</b>
<b>Total Annual Tons of Buffer/Excess CO2 Easily Prevented</b>		<b>1,307,463</b>
<b>Total Annual Fuel (gallons)</b>		<b>3,268,656,716</b>
<b>Total Annual Buffer/Excess Fuel (gallons)</b>		<b>435,820,896</b>
<b>Total Annual Buffer/Excess Fuel Easily Saved (gallons)</b>		<b>130,746,269</b>
<b>Total Buffer/Excess Aircraft Required</b>		<b>103</b>
<b>Total Buffer/Excess Aircraft Easily Recovered</b>		<b>21</b>
<b>Total Number of Buffer Pilots Required</b>		<b>1,333</b>
<b>Total Number of Buffer Pilots Easily Recovered</b>		<b>400</b>

**800 LB Gorilla**

### Primary inputs:

- 4,000 flights per day
- 20 buffer min per flight
- Recovery of 6 min per flight
- \$2.15/gallon

# GreenLandings™ Actual Atlanta Results

August 2006 through October 2013

*GreenLandings™ Delivers the **Green** for Delta  
Over \$74,069,046 Saved in Fuel Alone*

- Fuel Saved in Gallons.....30,091,899
- CO2 Reduction in Pounds.....634,788,613
- Flight Time Saved in Minutes.....1,662,726
- Days of Operation.....2,432
- Slots Recovered..... 34,375

# *Independent Analysis*



## *GreenLandings™ Actual Dubai Results*

KEY METRIC	RESULT
A0 Improvement (Passive to Active)	14.82 %
A14 Improvement (Passive to Active)	12.04 %
Dwell Time Reduction	2.98 Minutes
Fuel Reduction	25,055 Kg / Day

# Actual Independently Validated Benefits

**Table 2. Monetized Benefits Summary (for first year of operation)**

	<i>US Airways-CLT</i>		<i>Delta Air Lines-MSP</i>	
	<i>Active Phase 1</i>	<i>Active Phase 2</i>	<i>All Observations</i>	<i>Representative Days</i>
<b>Total System Costs</b>	\$1,587,458	\$4,337,458	\$1,553,530	\$1,553,530
<b>System Monetized Benefits</b>	\$1,232,774	\$5,649,473	\$12,328,152	\$5,242,340
<b>System Benefit/Cost Ratio</b>	0.78	1.30	7.94	3.37
<b>Total Participant Costs</b>	\$1,587,458	\$1,587,458*	\$1,553,530	\$1,553,530
<b>Participant Monetized Benefits</b>	\$1,130,337	\$3,127,668	\$3,330,214	\$1,373,975
<b>Participant Benefit Cost Ratio</b>	0.71	1.97	2.16	0.88

(\*)One Airline Attila™ system

# *Block Time = Largest Opportunity to Cut Cost*

## **Sample Value of Productivity Gains**

<b>Domestic Aircraft Only (727, 737, 757, DC10-10)</b>	<b>411 aircraft</b>
<b>Average Daily Flight Hours (Block)</b>	<b>10.85 hours/day</b>
<b>Average Number of Flights</b>	<b>4.92 flts/day</b>
<b>Average Hours per Flight (Block)</b>	<b>2.21 hrs/flt</b>
<b>Average Time Savings (all sources)</b>	<b>18.08 mins/flt</b>

**$18.08 \text{ mins/flt} \times 4.92 \text{ flts/day} \times 1 \text{ hour}/60 \text{ mins} = 1.48 \text{ hrs/day/airplane}$**

**$1.48 \text{ hrs/day} \times 1 \text{ flt}/1.91 \text{ hrs} \times 411 \text{ airplanes} = 319 \text{ flights per day}$**

**$100 \text{ pax/flight} \times \$160/\text{pax} = \$16,000 \text{ per flight (does not include cargo)}$**

**$\$16,000 \text{ revenue/flt} - \$5,000 \text{ direct cost/flt} = \$11,000 \text{ contribution per flight}$**

**$\$11,000 \text{ contribution/flight} \times 319 \text{ flts/day} \times 365 \text{ days/year} =$**

**\$ 1.3 Billion per year additional contribution**

**Source: United Airlines**

**Note: Unaudited Data, for  
Illustration purposes only**



# ***Additional Information***



## **GreenLandings™ Articles and Videos**

- [\*ATC is Not the Problem\*](#) (Managing the Skies, Spring 2022)
- [\*Aviation Needs a New Direction - Driven by Vision and Leadership\*](#)  
(Managing the Skies, Nov/Dec 2019)
- [\*GreenLandings™ Heathrow Interview\*](#) (video - 46:46, 2020-12-30)
- [\*GreenLandings™ Independently Validated Benefit Summary 2022-05\*](#)
- [\*Air Traffic Control Is Not The Real Cause Of Airline Delays\*](#)  
(Forbes.com, 2017-03-23)
- [\*Institutionalizing Airline Operational Dismality\*](#), (Managing the Skies, Fall 2021)
- [\*Fastest Airlines in the U.S.\*](#) (Forbes.com, 2019-06-17)

# ***Sustainability, Quality and Profits***



- GreenLandings™ is critical path to Operational Excellence and rapidly benefits the airline, pax, environment, ATC
- GreenLandings™ focuses on ***defect prevention*** versus defect correction
- GreenLandings™ independently validated by FAA, Embry-Riddle, GE Aviation, Georgia Tech and others
- GreenLandings™ implementation at first airport in 9 months and system wide at all an airline's airports within 3 years
- GreenLandings™ require no new avionics, no new airborne/ground equipment and no new ATC procedures
- ***Immediate Benefits - cash-on-cash ROI achieved in months***