SMM and the Safety Possibilities with Good Data

Nancy Rockbrune
Head, Safety Management

ICAO SMM

Data Sources

- Mandatory reporting systems
- Voluntary reporting systems

Data Sources

Note 1.— SDCPS refers to processing and reporting systems, safety databases, schemes for exchange of information, and recorded information including but not limited to:

a) data and information pertaining to accident and incident investigations;

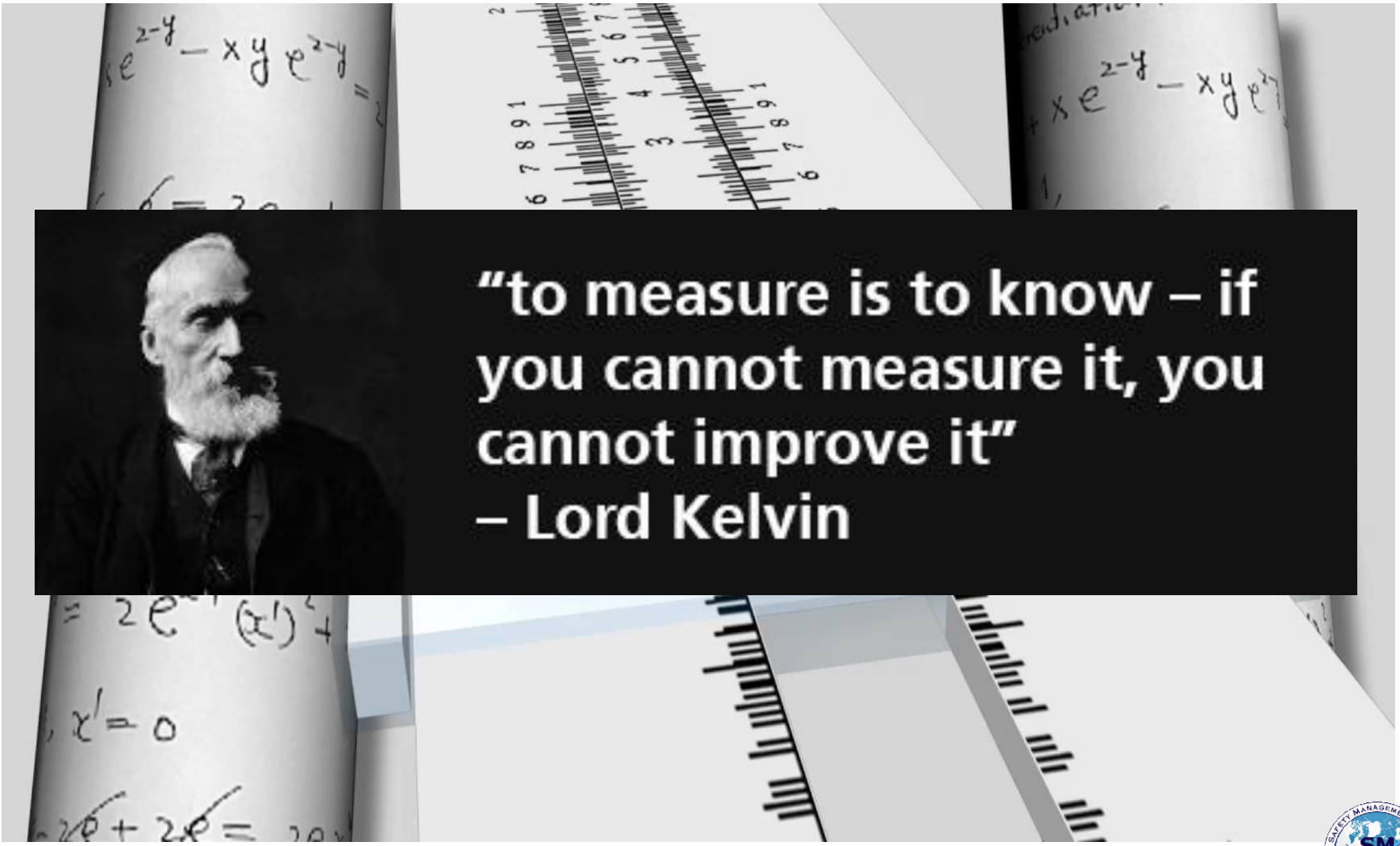
b) data and information related to safety investigations by State authorities or aviation service providers;

c) mandatory safety reporting systems as indicated in 5.1.2;

d) voluntary safety reporting systems as indicated in 5.1.3; and

e) self-disclosure reporting systems, including automatic data capture systems, as described in Annex 6, Part I, Chapter 3, as well as manual data capture systems.

Annex 19, 2nd Ed.


"to measure is to know – if you cannot measure it, you cannot improve it"
– Lord Kelvin

Use of Data

- Conduct analysis on clean defensible data / information
  - Identify hazards and risks
  - Prioritize risks and subsequent actions to mitigate
  - Measures process performance
  - Identify and prioritize contributing factors to process performance
  - Measure and predict process performance improvements
- Communicate findings as appropriate

Data Management Principles

- Managing by averages leads to flawed decision making - not accounting for process variation
- If measurement system variation is too large there is an increased risk of:
  - Rejecting good data
  - Accepting bad data
- Important to know how much of the observed variation of a process is due to the actual process itself

Data Management Principles

- Operational definitions (includes taxonomies) help reduce subjectivity and variance in a measurement system (data)
- Operational definitions can be:
  - A written statement
  - Templates
  - Display of comparisons (colour chart)
- Operational definitions should be:
  - Something people can really use
  - Enables different people to reach the same conclusion (repeatability)
  - Enables the same person to reach the same correct conclusion at different times (reproducibility)

Taxonomy / Operational Definitions

- Controls data inputs
- Reduce subjectivity
- Reduce variation
- Means for integration (internal and external)

5.1.5 **Recommendation**.— *The safety database should use standardized taxonomy to facilitate safety information sharing and exchange.*

Annex 19, 2nd Ed.

Measuring Safety Performance ~ SPIs

- Set measureable (SMART) safety objectives
  - Verify safety performance
  - Validate effectiveness of safety risk controls
- Track performance
- Compare against targets
- Achievement of a target consequently represents an improvement in performance

Metrics

- Typically focused on number of serious accidents / incidents
- High profile
- Easy to measure
- Reactive
  - Does not expose systemic issues or hazards


ACCIDENT
FREE!

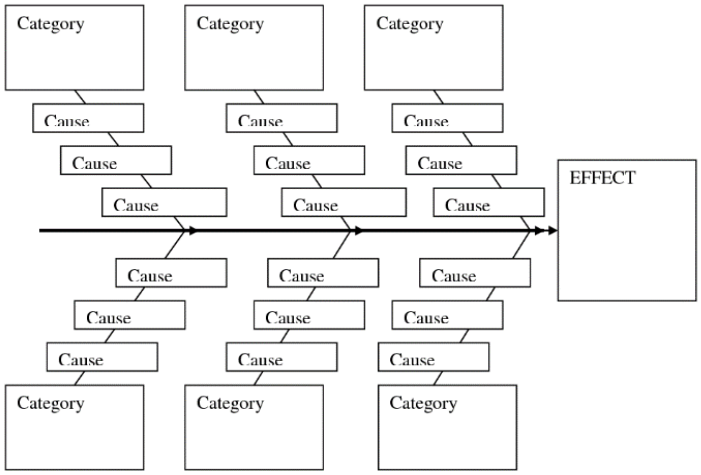

safety
pilot
Airplane
airport
Flight
Fly
IATA
ICAO
runway
wings
Paris
Rome
Sydney
Toronto
Miami
Moscow
Cairo
Dubai
London
Oslo
Beijing
flight attendant
flight operations

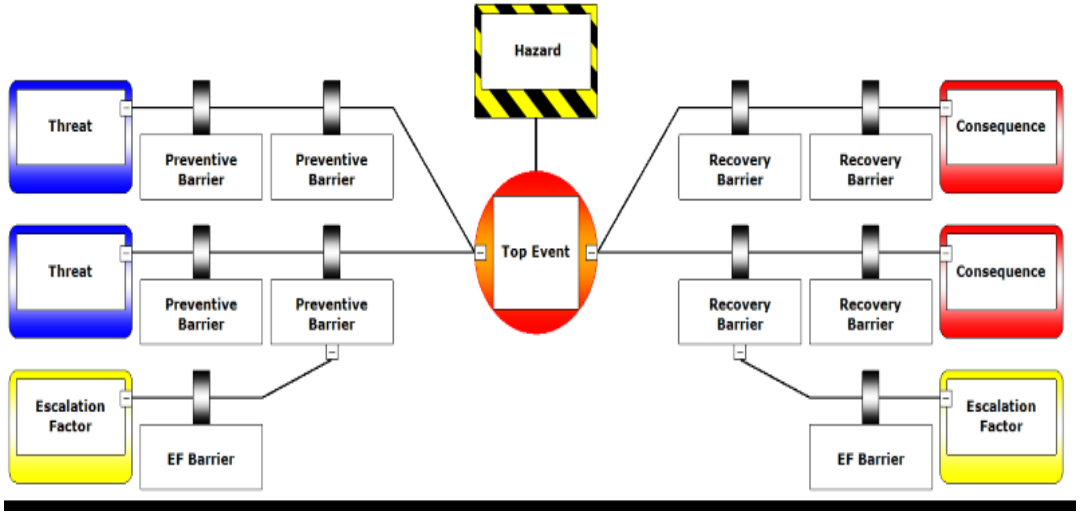
System Approach

- Managing at the process level is the basis of a “System” approach
- Considers all processes, their interrelationships and interactions

System Approach

- Direct relationship between inputs and outputs
- Therefore to improve the output, changes or improvements to the inputs are required

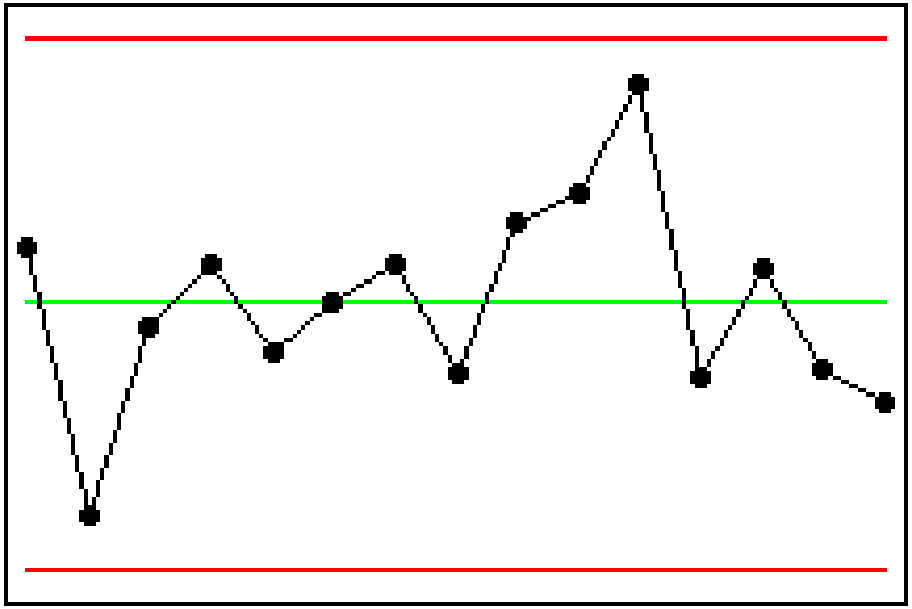




Control Charts

- Displays the control of a process
  - In control process shows random variation
  - Out of control process shows unusual variation due to special causes
- Help to determine where to focus problem-solving efforts by distinguishing between common and special-cause variation

Sample ~ Control Chart



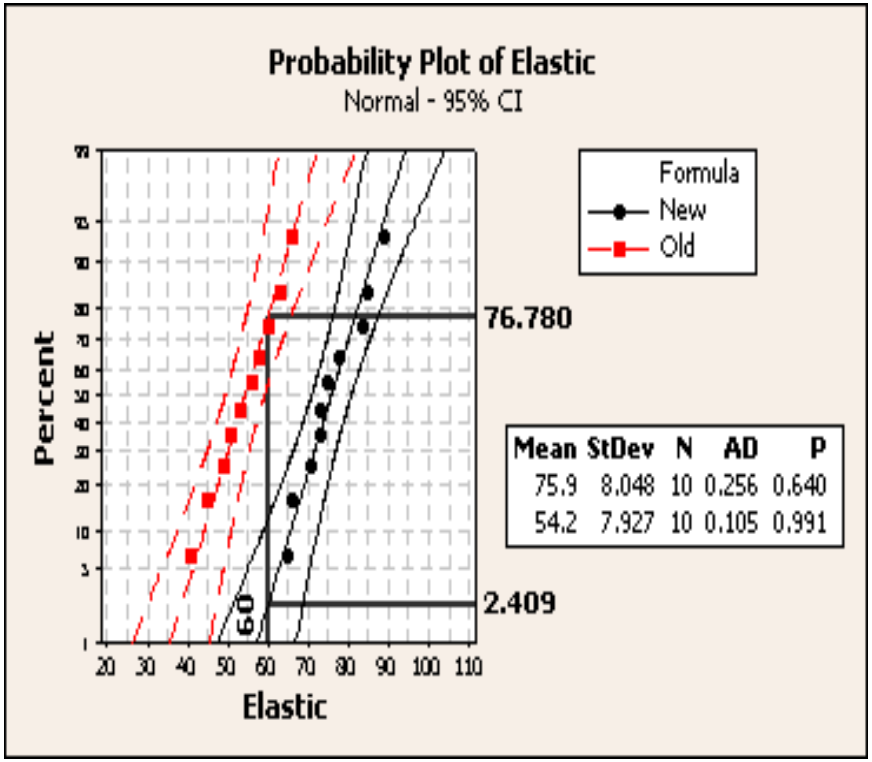
Upper Control Limit (UCL)

Centre Line

Lower Control Limit (LCL)

Sample ~ Probability Chart

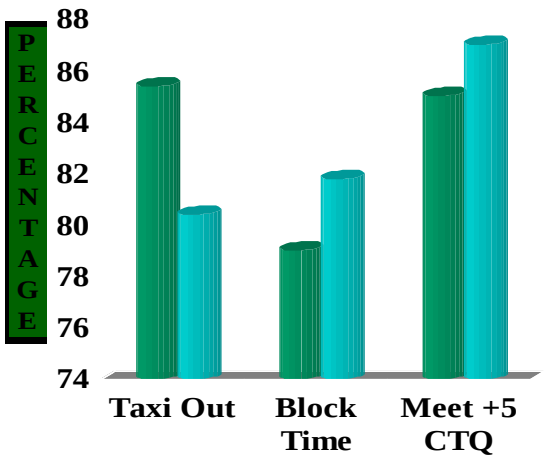
- Measure process improvements
- If distributions are normal can estimate the performance if new procedures are put in place

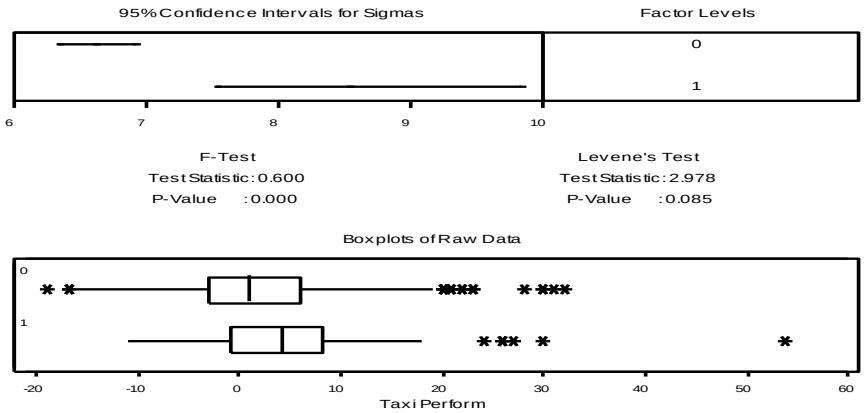


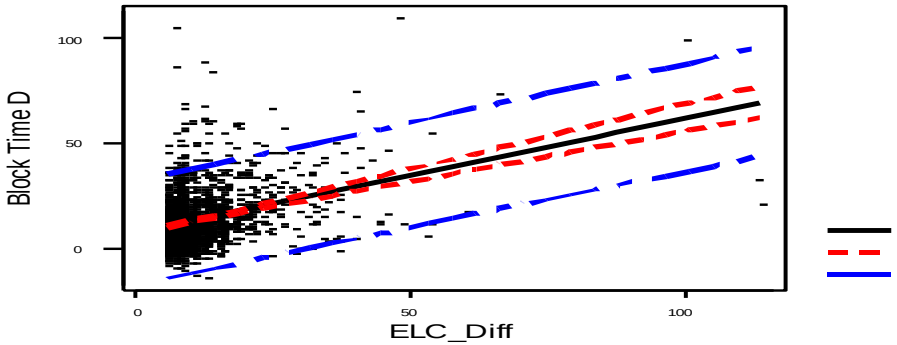
Why is Process Control Important?

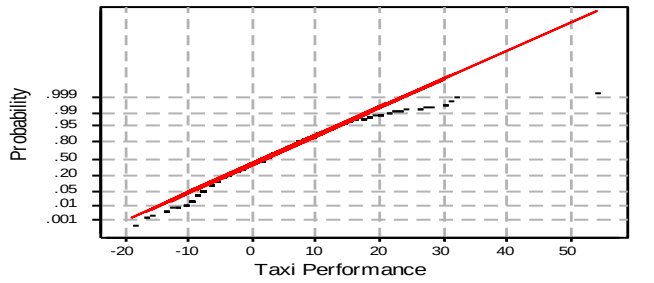
- Higher quality
- Increased efficiency
- Lower costs
- Fewer errors
- Leaner organization
- Sustained profitability
- Performance goals tied to business priorities
- Performance competencies ~ tools used to achieve goals

Process Control Example ~ ELC

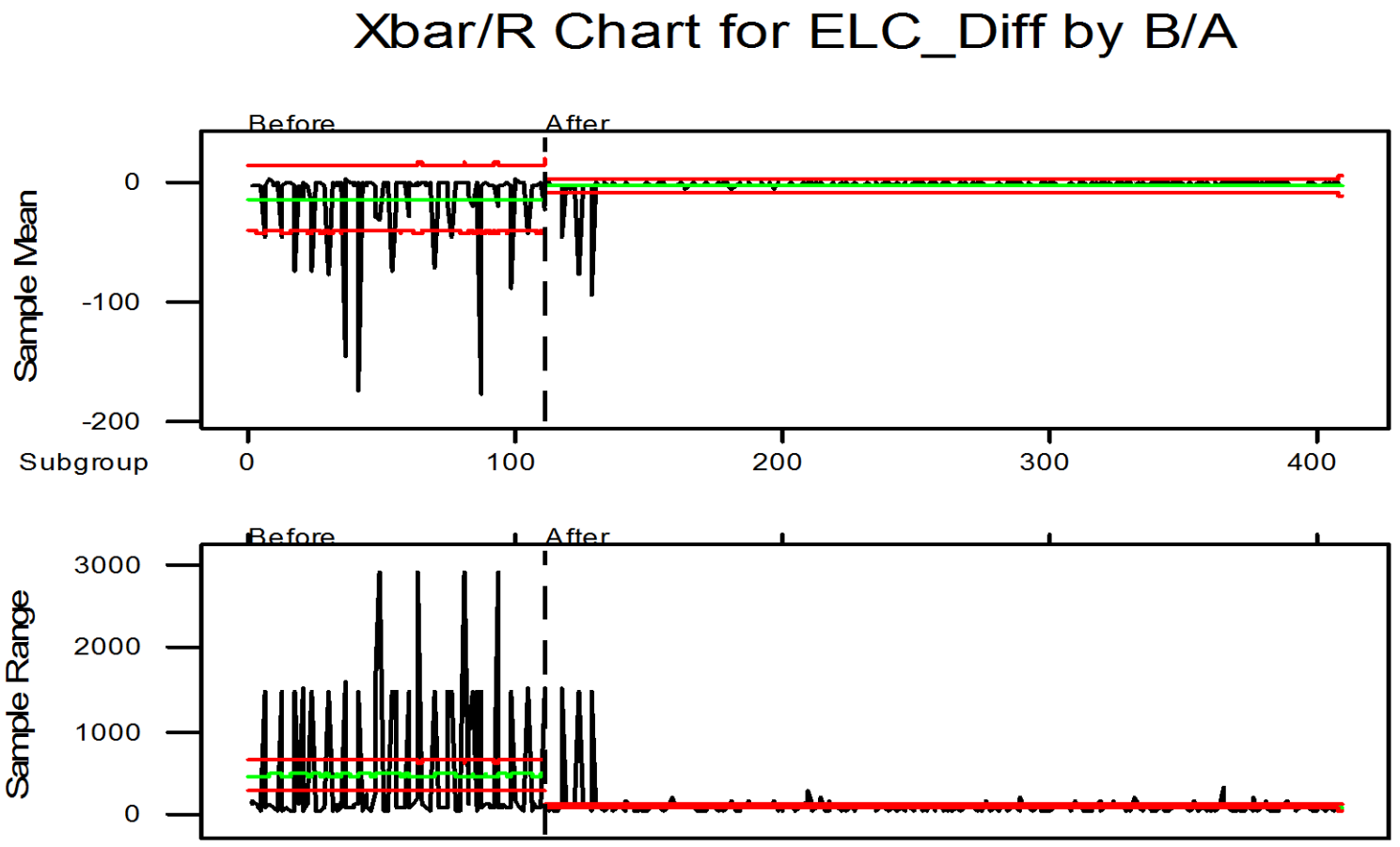








Process Control ~ Example

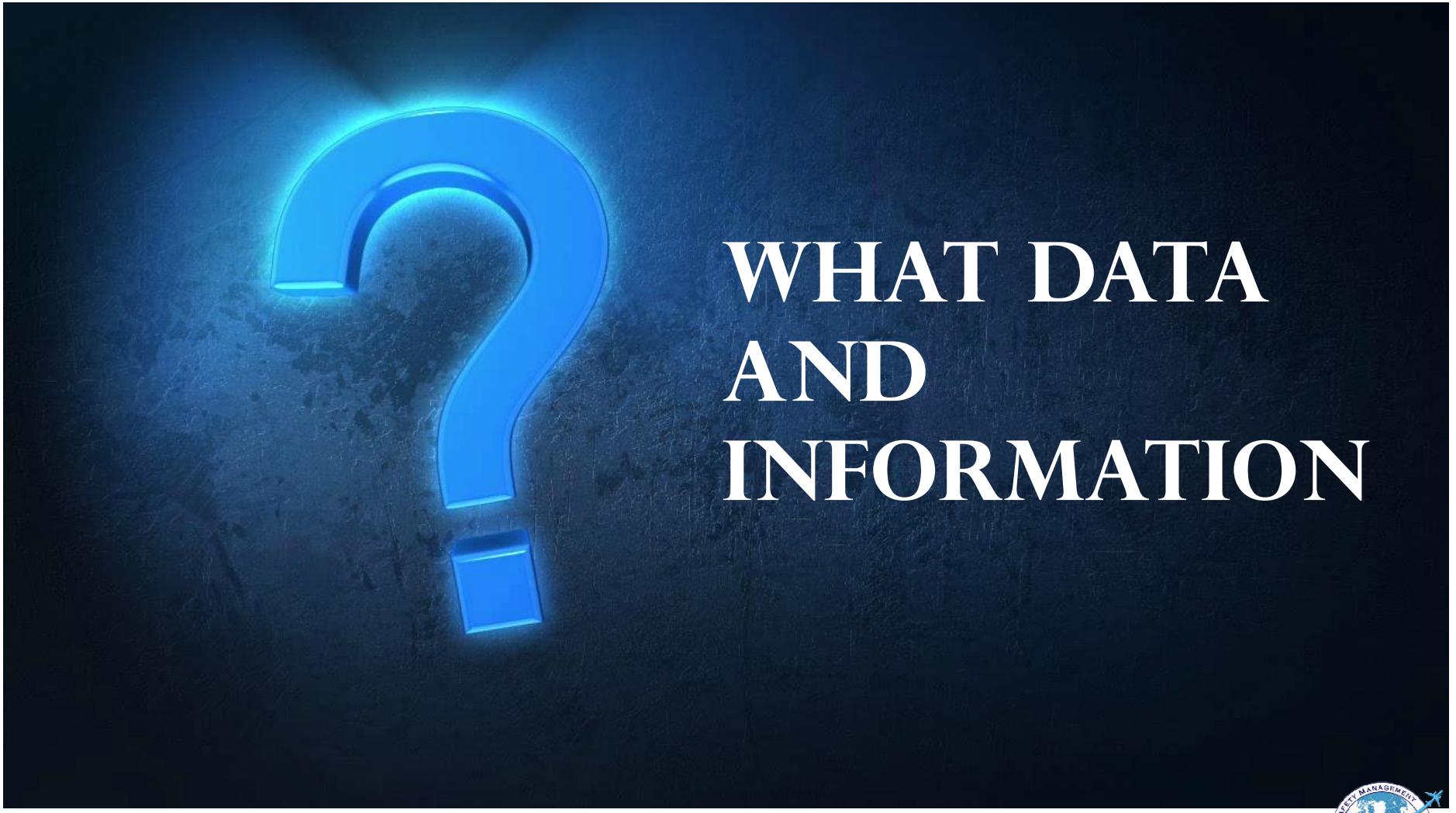


Other Examples

- Unstable approach criteria
  - Studies being made to evaluate the FSF initiative to reduce the height to 300ft before Go-Arounds
  - Data will identify if feasible or not
- RNAV vs Visual Approach
  - Comparing the approach tracks and monitor how many flights flying visual app vs RNAV results in Go-Arounds
  - Airline can then quantify the cost, review their processes

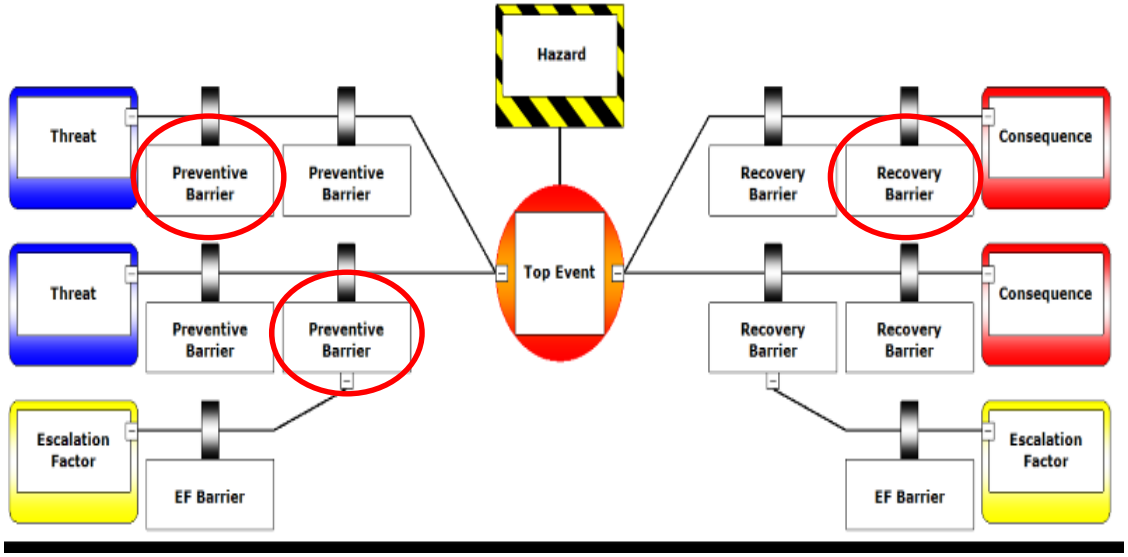
Other Examples

- Proactive maintenance
  - Data can support airlines engine inspections and avoid costly repairs when too late
  - Specific attention given to engine vibrations
- Predictive Maintenance
  - Use of AI


WHAT DATA
AND
INFORMATION

Proactive Shift

- SPIs measure performance of safety controls
  - Preventative
  - Recovery
- Shift focus to precursors



Sample SPI

IATA SPI GROUP: Draft SPI Candidate	
SPI / Safety Objective (SO)	Long Landing
Area of Safety Concern	Organizational
Safety Aim	Zero instances of long landings
Definition(s)	Threshold ~ touchdown >x m from runway threshold Distribution ~ distance from runway threshold at landing
Possible Data/Information Source(s) & (Expected Reliability for Source)	FDM (High) Touchdown point Length of Runway
SPI Data Source(s)	Distance from runway threshold at landing
Reporting Period and Interval	As determined by operator
Output format	As determined by operator
Alert Level	Each operator to determine their own alert level
Safety Performance Target	Each operator to determine their own target
Safety Action Plan(s)	Each operator to determine their own safety action plan.
Notes	Can do comparisons if carriers have same threshold limits

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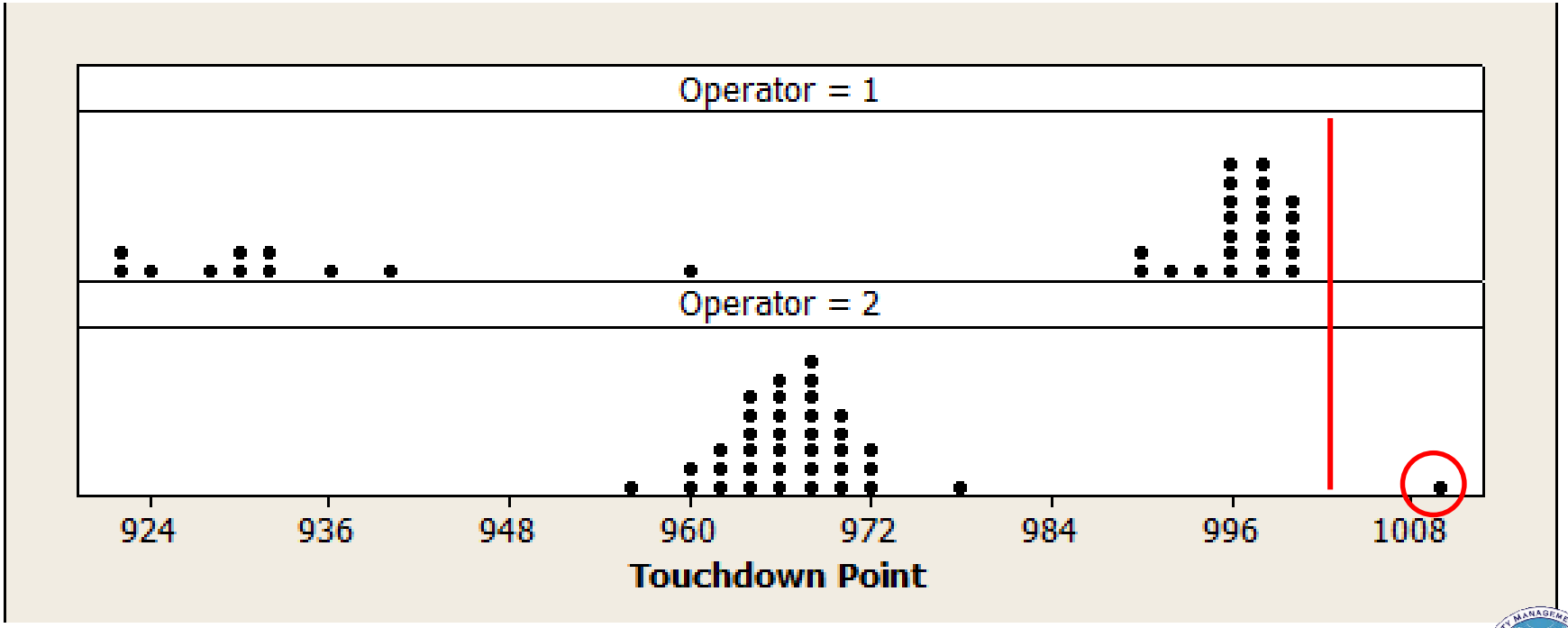
- Identify touchdown points of ALL flights



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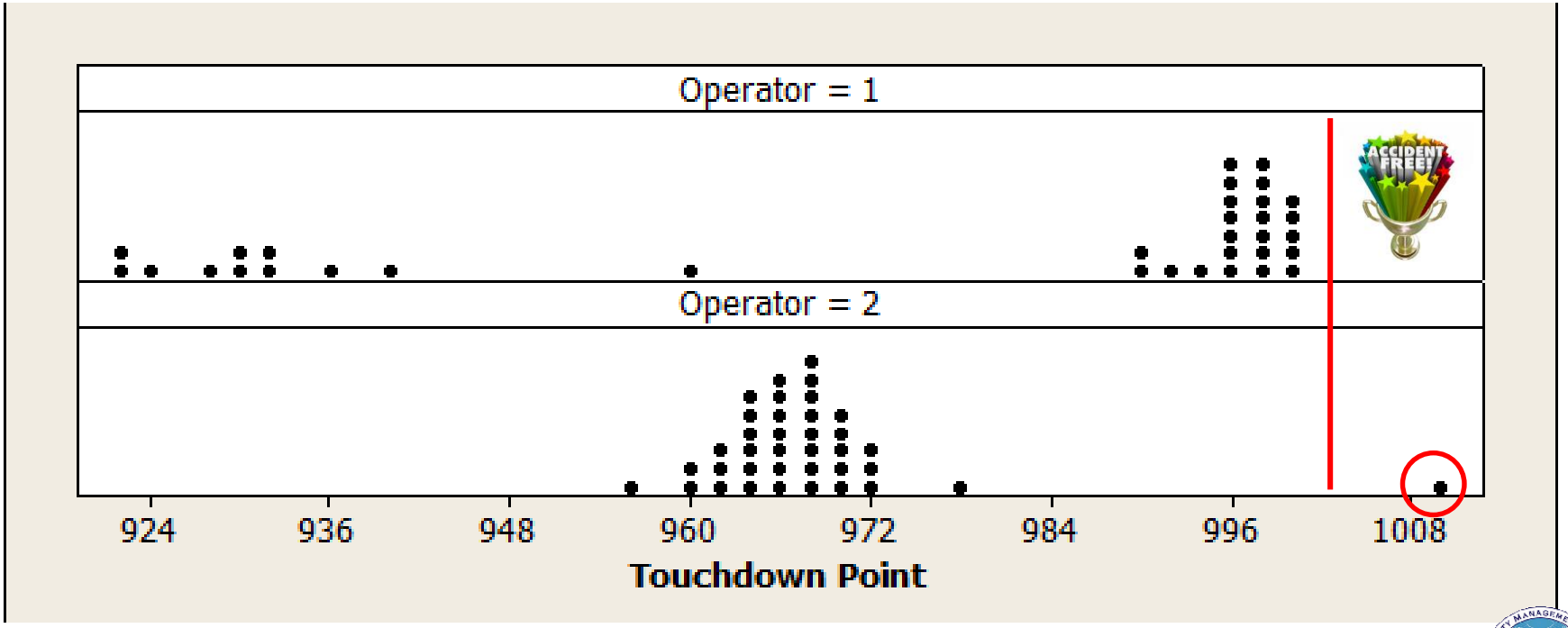

Sample FDM Parameters

SPIs	FDM PARAMETERS																				
	Speed over the threshold	Speed on ground	Autopilot disengage	Altitude	AoA	Pitch	Bank angle	G forces	Flap settings	Landing gear	Spoiler position	Aircraft weight	Center of gravity	Touch-down point	Breaking action	General landing configuration (flap/gear/altimeter etc. settings)	Glidepath deviation (horizontal - altitude / vertical - azimuth)	Course deviation/correction	Proximity to another aircraft	EGT (exhaust gas temperature) or RPM	Application of reverse thrust
Long Landing	X			X		X			X			X	X	X		X	X				
Runway End Zone Ground Speed	X	X	X	X		X			X			X	X	X	X		X				X
Runway Turn-Off Speed		X									X				X			X			X
Sink Rate Before Touch Down	X				X	X			X		X	X	X				X				
Tail Clearance at Take-Off		X				X			X			X	X								
Tail Clearance on Landing	X			X	X	X			X		X	X	X				X				
Bank Angle During Landing				X			X				X							X			
EGPWS ~ Pull-Up	X			X					X	X	X						X				
Rejected Take Off (RTO)		X							X	X	X		X					X		X	X
a. Environmental Risk																					
b. Runway Side Excursion																					
c. Runway Over-Run																					
Taxi Speed Exceedance	X	X									X	X		X	X		X			X	X
TCAS RA			X	X		X													X	X	
Unstable Approach Continued	X			X	X	X	X	X	X	X	X			X		X	X	X		X	
Height that Stabilization Achieved	As above																				
Proximity to Alpha Max	X				X	X	X	X	X	X	X	X	X				X				
Unusual Attitude ~ Pitch						X			X												
Unusual Attitude ~ Bank Angle							X											X			
In-Flight Shut-Down (IFSD)																				X	
Landing Below Final Reserve Fuel																					

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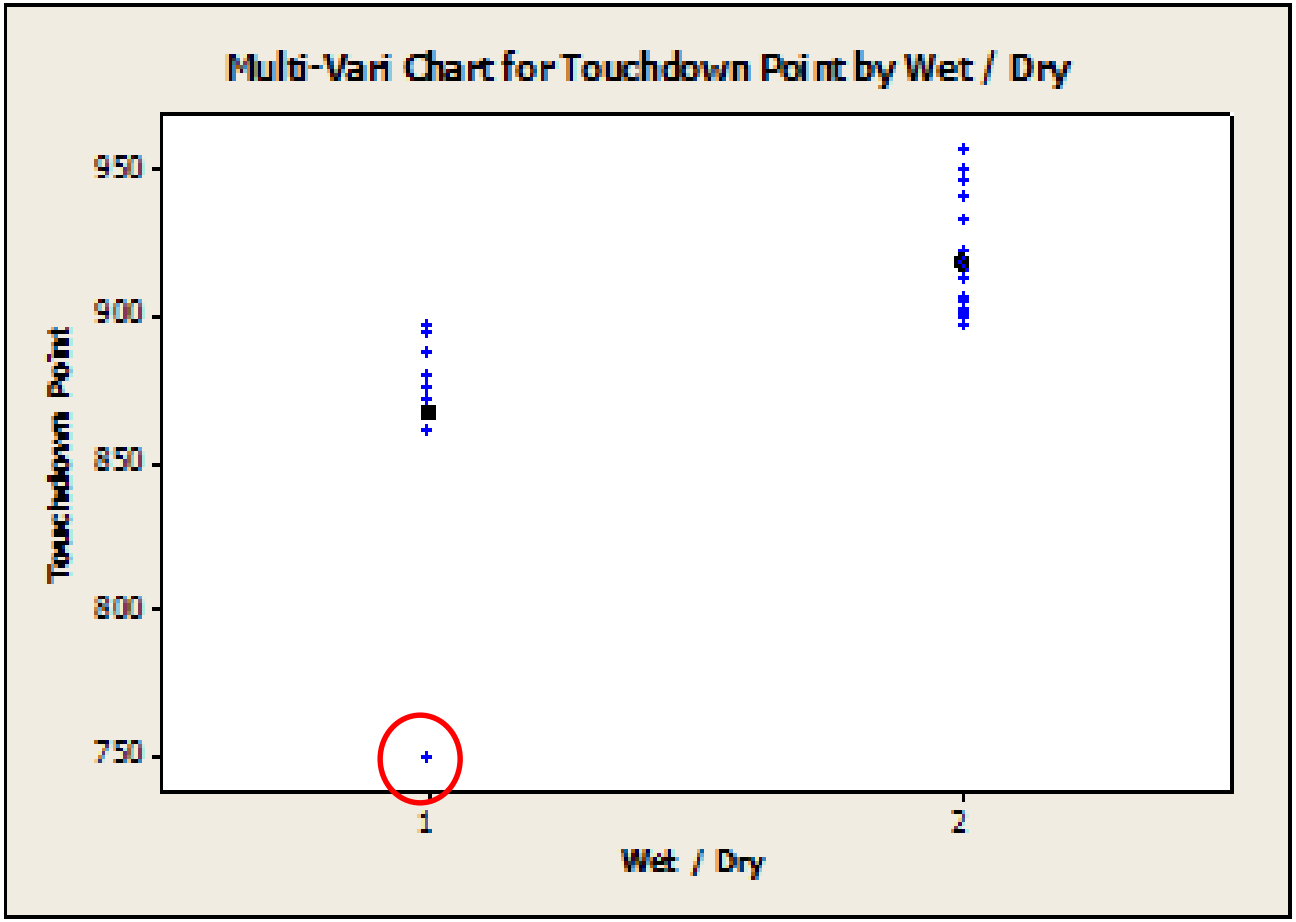

This multi-vari chart shows condition of runway surface is a contributing factor

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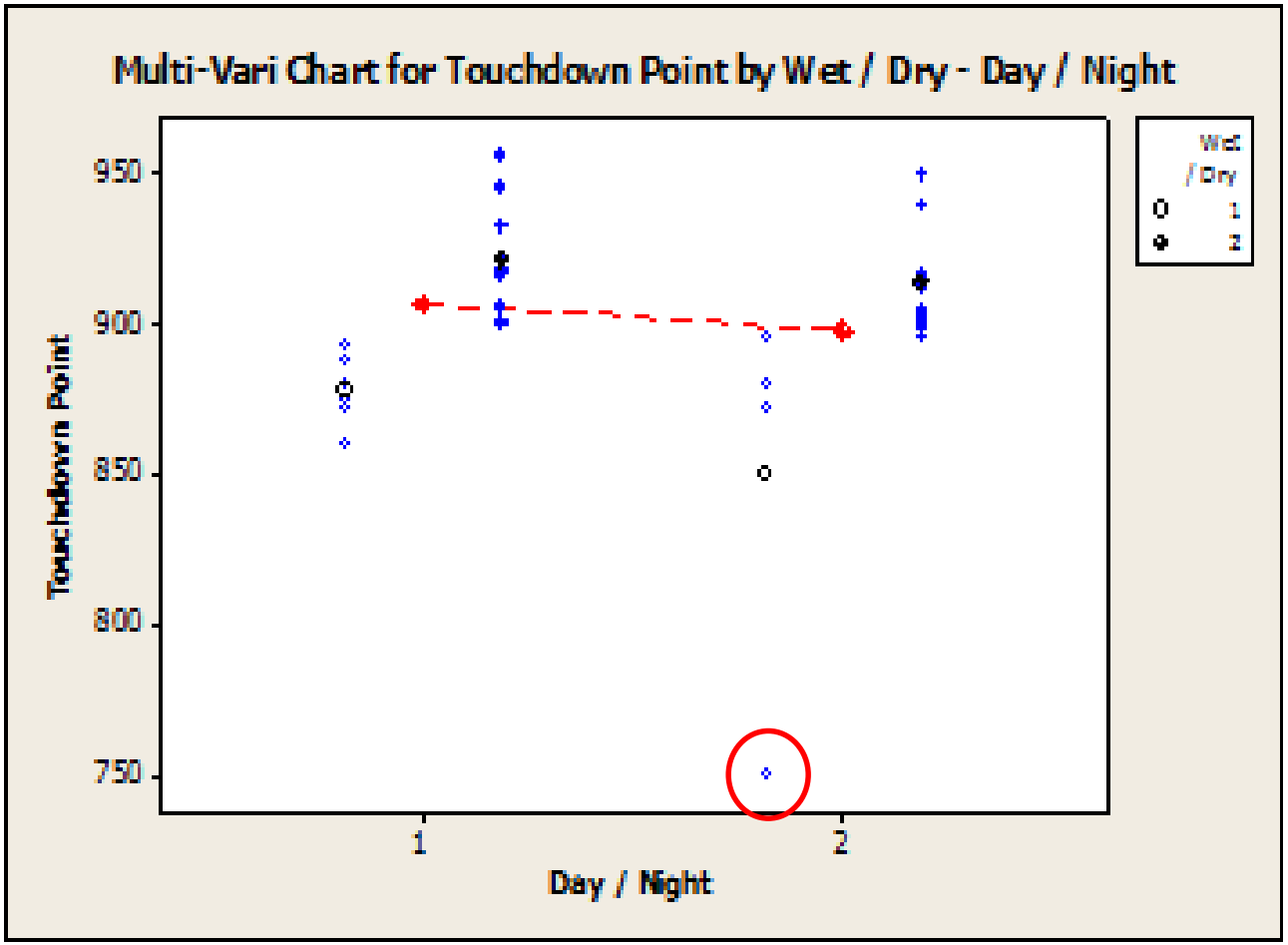
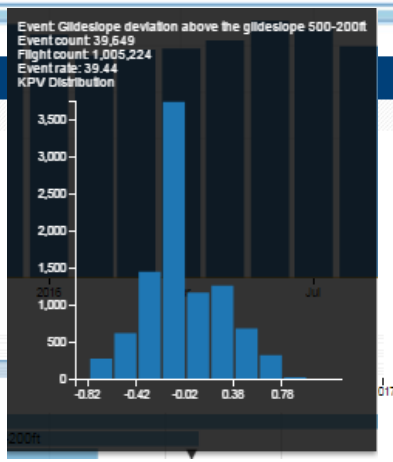
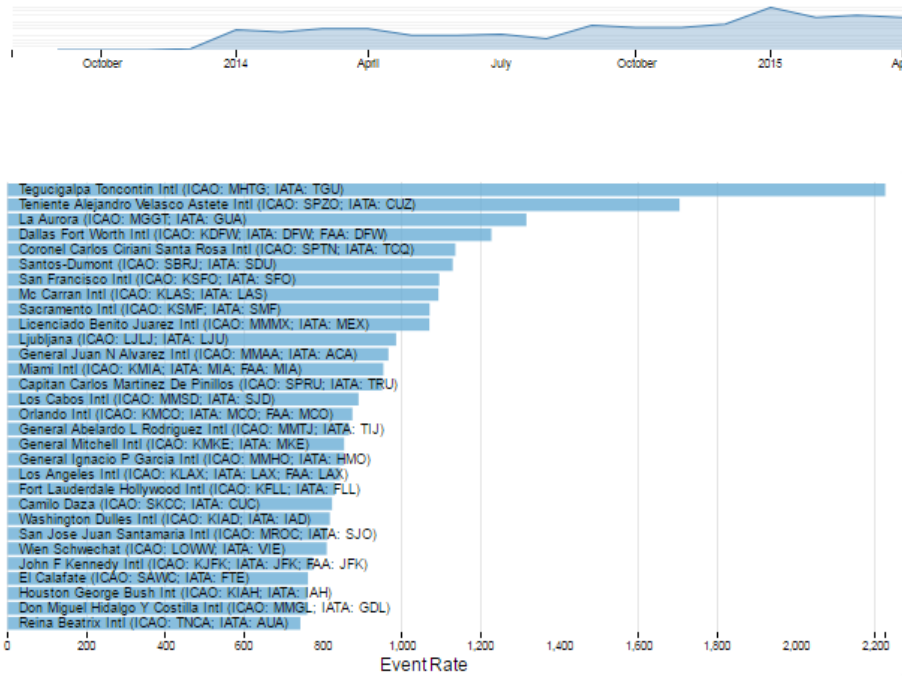


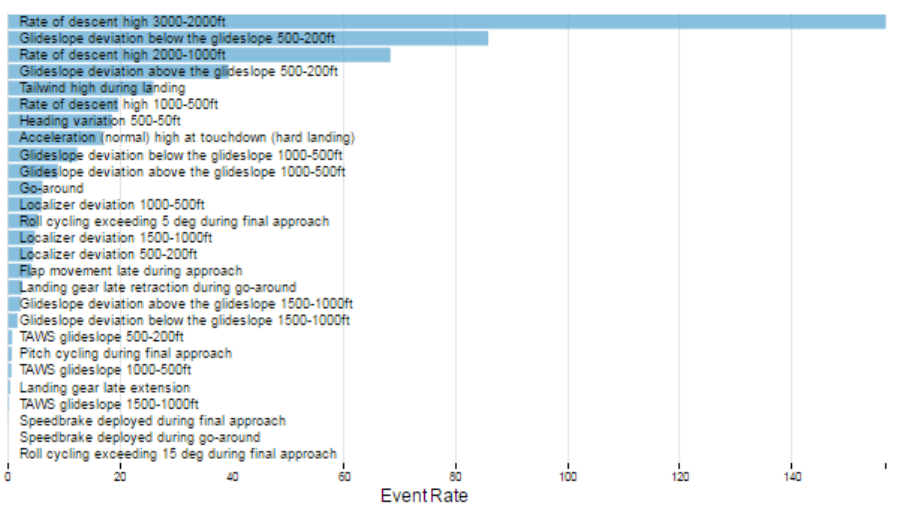
Outlier (750’) at night with a wet runway surface ~ only 1 instance

Runway Approach & Landing

The Approach and Landing Accident Reduction page contains metrics on go-around, long landing, tailwind, stopping distance events and other KPVs. Currently displaying all event levels.







Safety Information Exchange Program

Background

- States must manage the safety performance of its aviation system
  - Requires safety management inputs by both the State and Service Providers
- States have recognized the value of using this aggregated, de-identified Operator information to support State safety activities
  - All safety data and safety information deemed relevant by a State is in scope for a IATA Safety Information Exchange Program

IATA Program

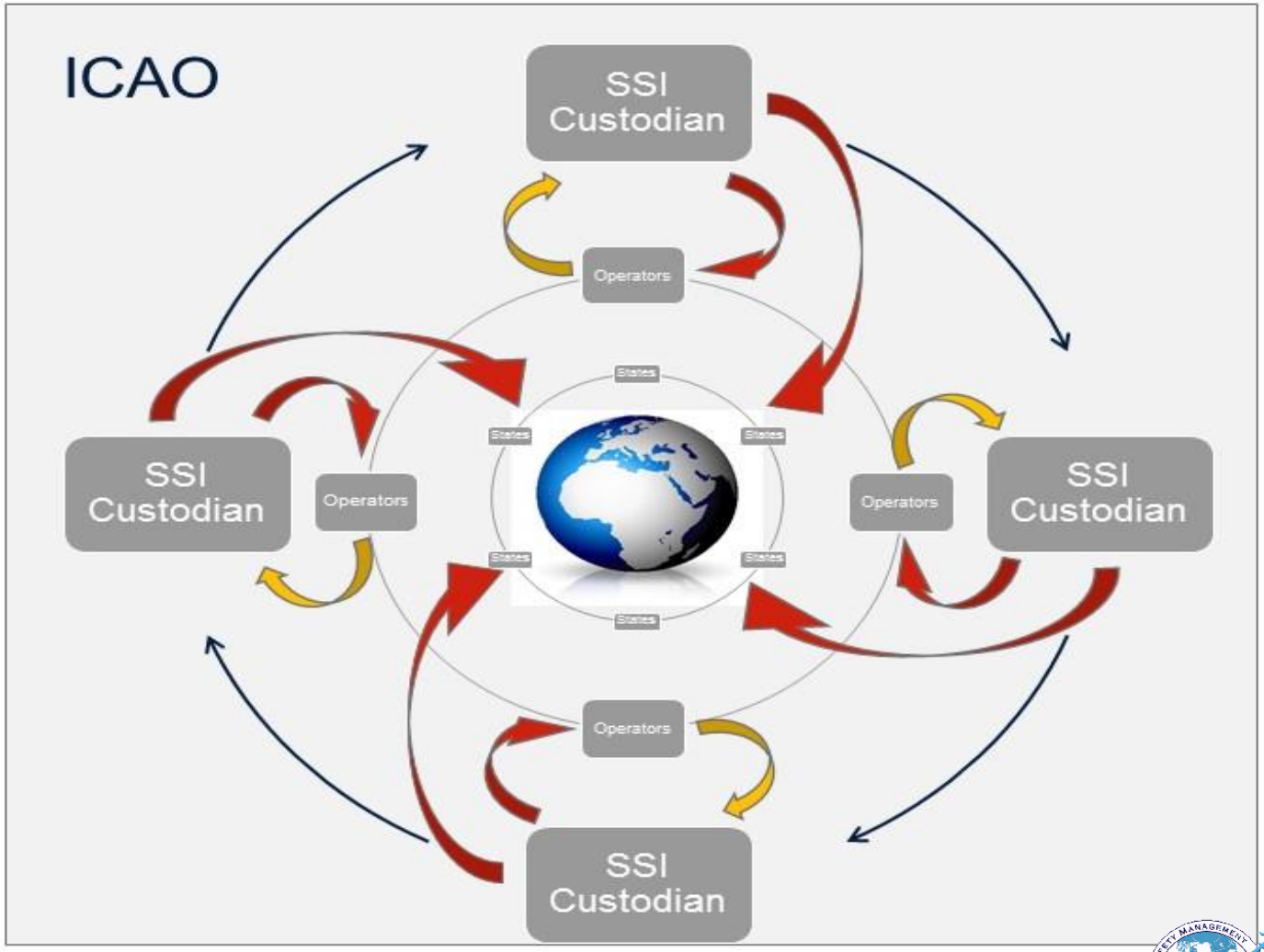
- Industry / State collaboration to develop Safety Information Exchange and Analysis
  - ICAO Assembly A39-WP/117

- Models would:
  - Meet the needs of an SSP to manage safety at the State level
  - Address Industry concerns
  - Adhere to Annex 19 protection principles
  - Streamline global safety-sharing channels and harmonize metrics

Collaborative Approach to SM

- IATA Safety Information Exchange Program
  - Enables States access to de-identified aggregate Safety information collected by IATA
  - Supports both State and Regional Safety Oversight Organization (RSOOs) Safety Management activities
  - Also supports the ICAO Global Aviation Safety Plan (GASP) objectives and the work of the Regional Aviation Safety Groups (RASGs)

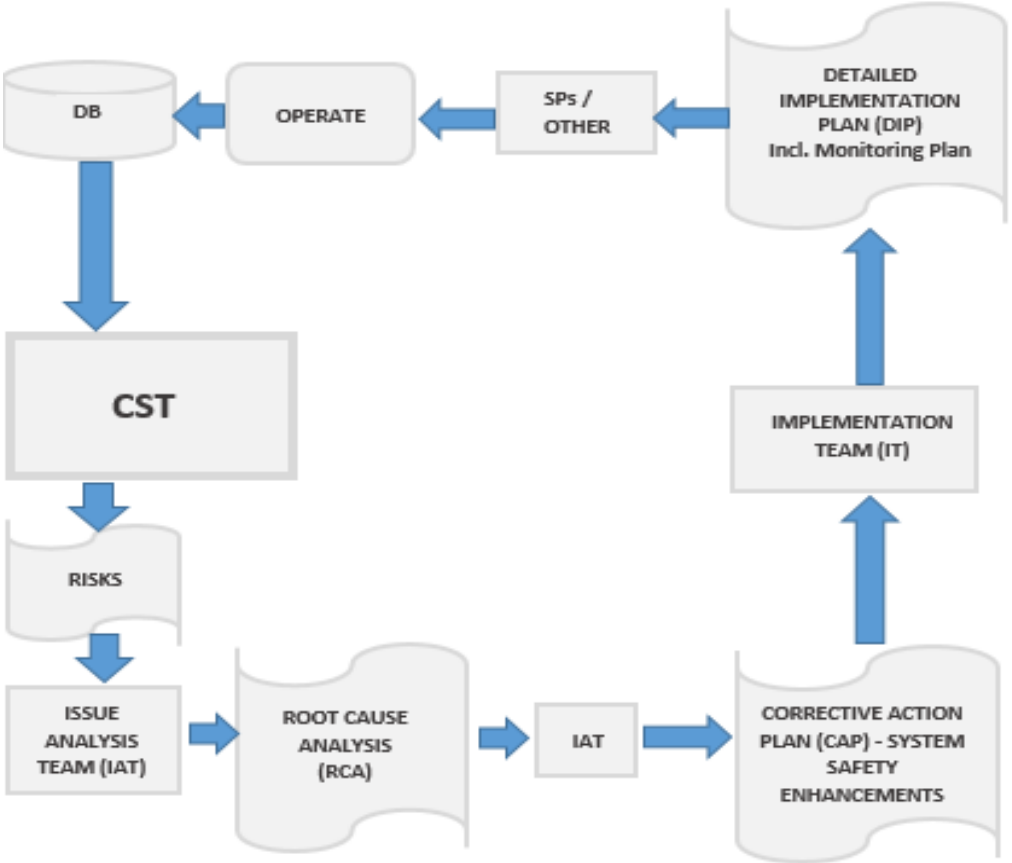
Safety Information Exchange Model



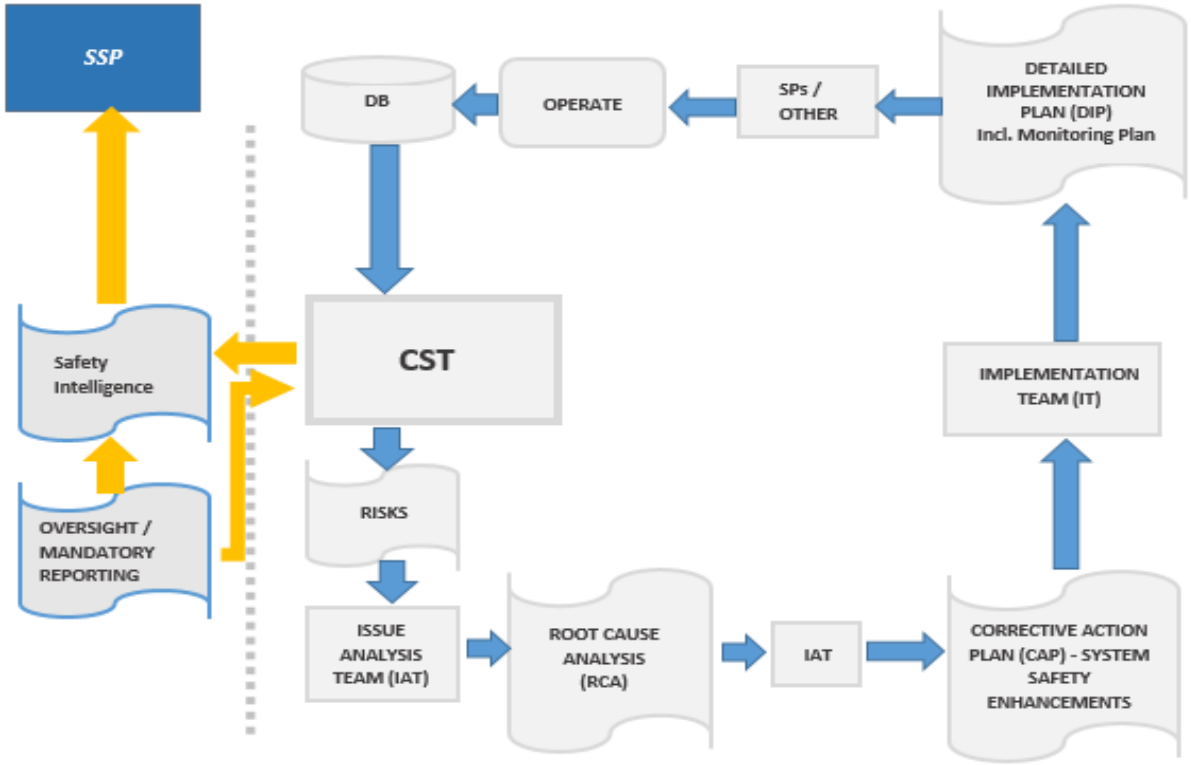
Collaborative Approach to SM

- Establishment of a “Collaborative Safety Team”
  - Mechanism for safety information sharing and exchange to identify top safety risks, and develop mitigation strategies to improve the safety performance of the respective State aviation system
  - Team includes representation from the State and aviation system Service Providers
  - Team establishes the protocols for the Safety Information Exchange (SIE)
  - Frequency of the meeting based on the need and desire of the State and participating Service Providers

Collaborative Safety Team (CST)



CST ~ SSP Interface



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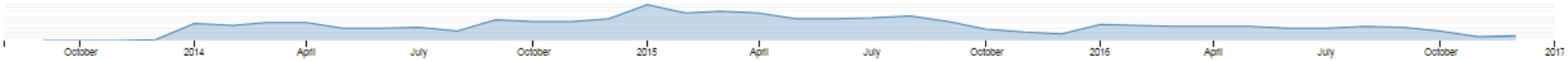
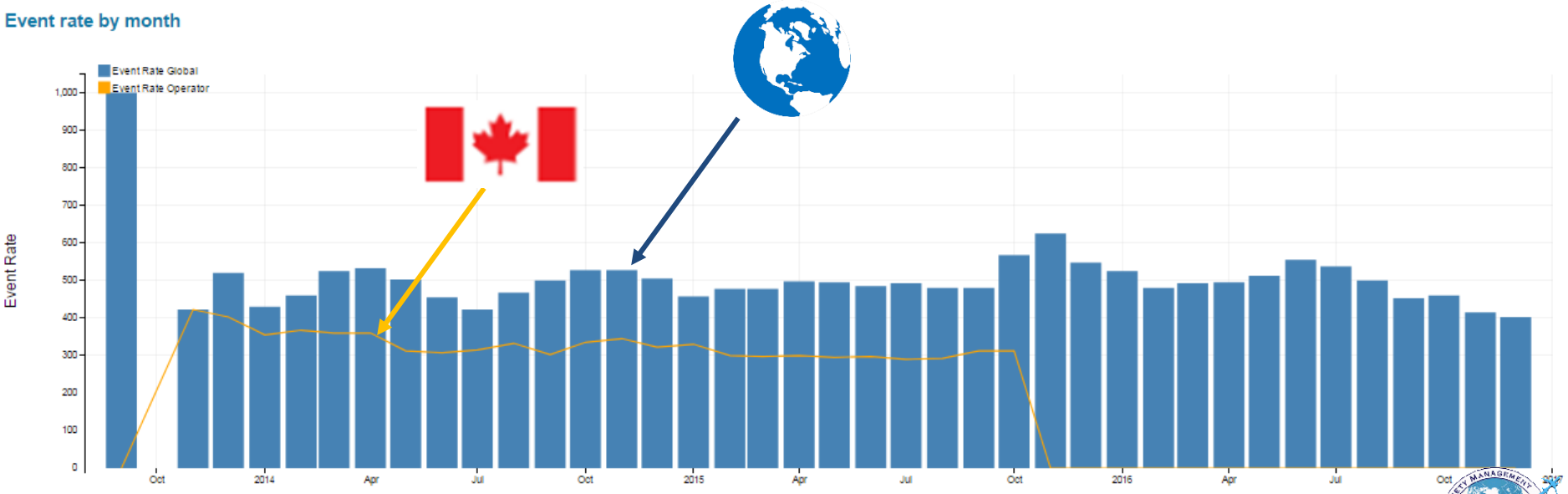
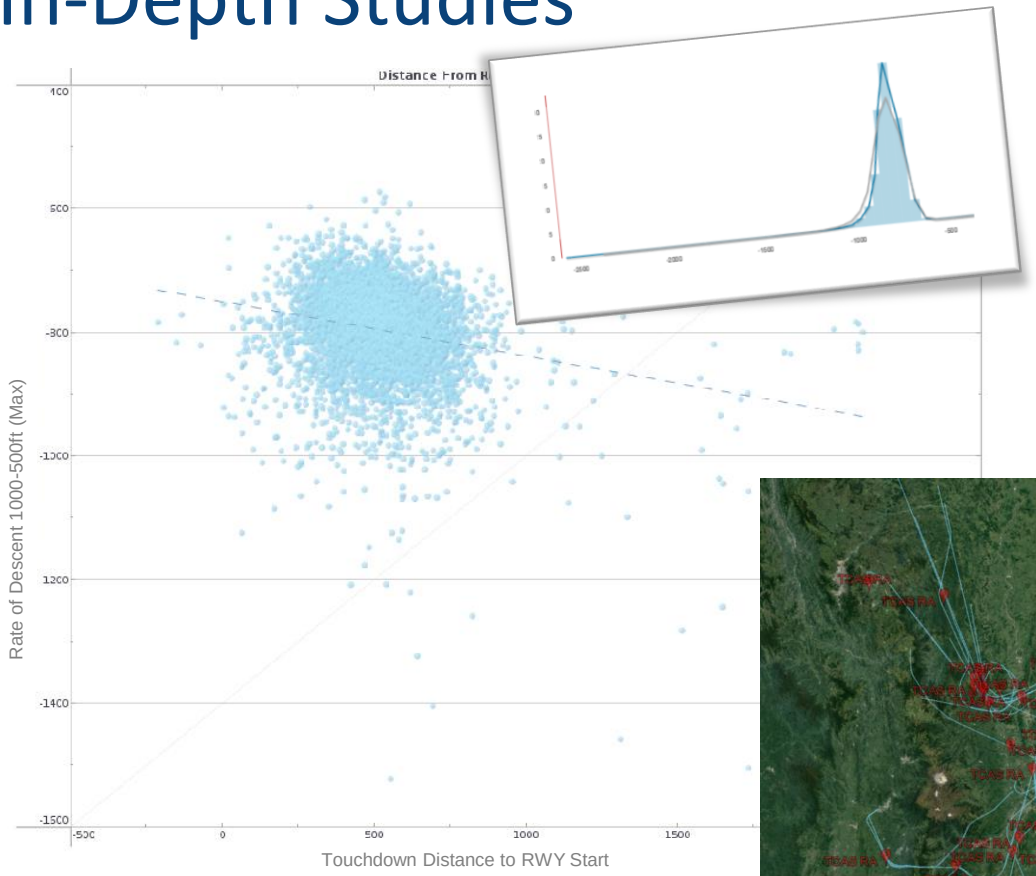
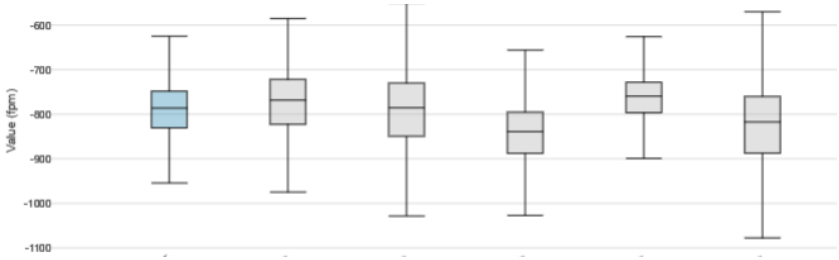


Event rate by month

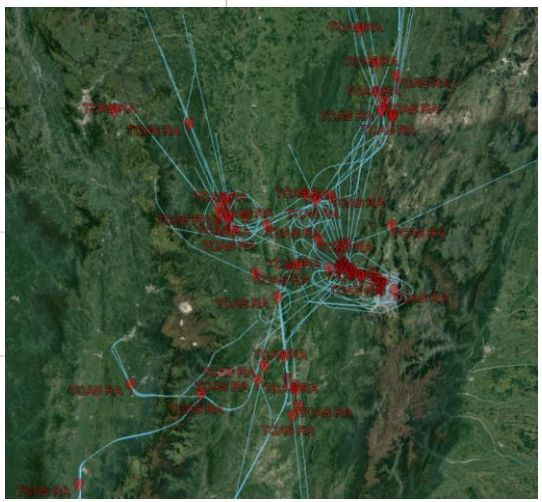


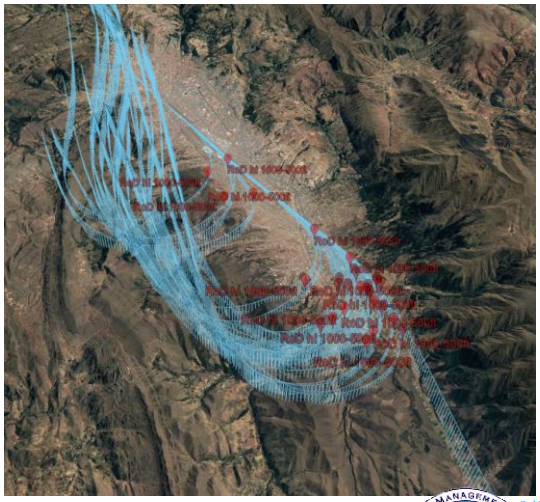
In-Depth Studies





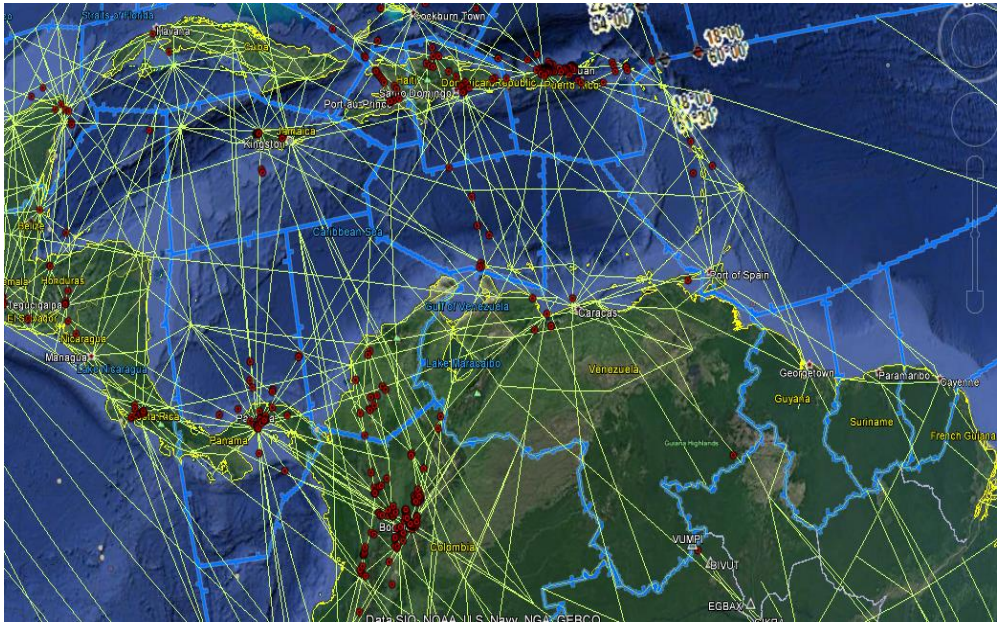
Minimum:	-2524	-1685	-1772	-2327	-1984	-1970
Average:	-796	-777	-799	-847	-768	-834
Maximum:	-40	-585	-378	-11	-1	0
Std Dev:	76	82	102	84	65	143
Range:	2484	1100	1394	2316	1984	1970
Count:	1000's	1000's	1000's	1000's	1000's	1000's





How has FDX been used?

Support to Airspace Optimization work



- IATA has been working with region's ANSPs on optimizing routings and separation requirements amongst FIRs
- FDX TCAS data is being used in order to avoid airspace redesign efforts that conflict with known safety risks
- Key point: aggregate data is supporting alignment between operations and safety efforts

Other Programs

Data4Safety
Partnership for Data Driven Aviation Safety Analysis
Supported by EASA

"The programme aims at collecting and gathering all data that may support the management of safety risks at European level."

asias

SPARC

CAAS
Civil Aviation Authority of Singapore
Enabling opportunities through aviation

IATA

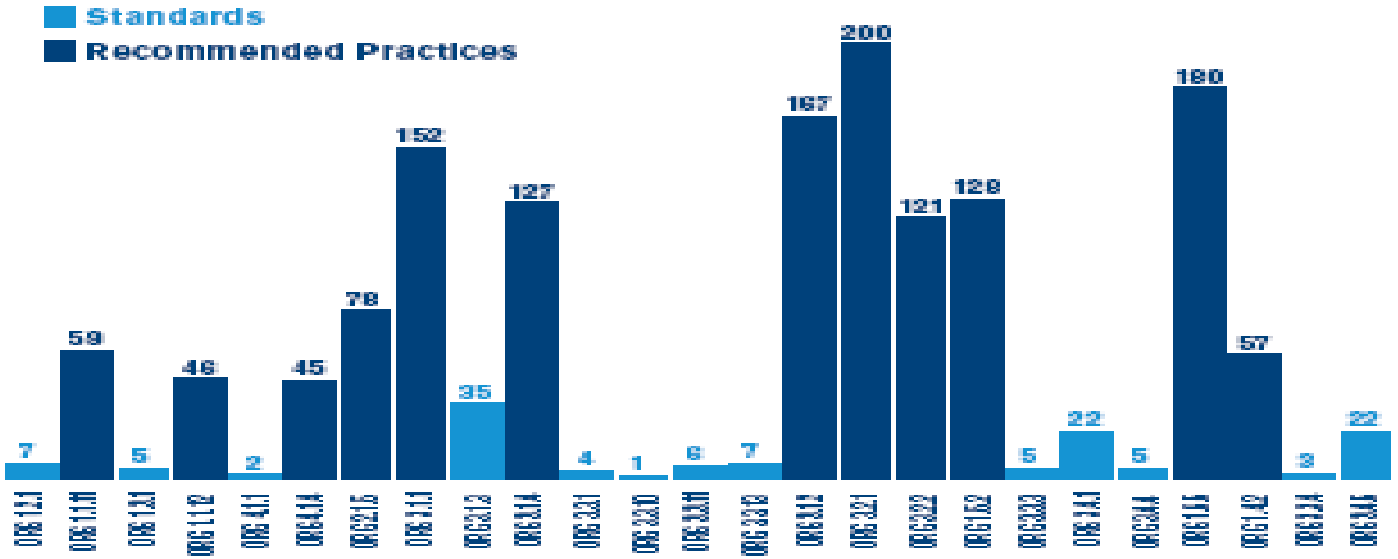
Global Safety Predictive Analytics Research Center

SM ICG

IOSA SMS Strategy

IOSA SMS Audit Results

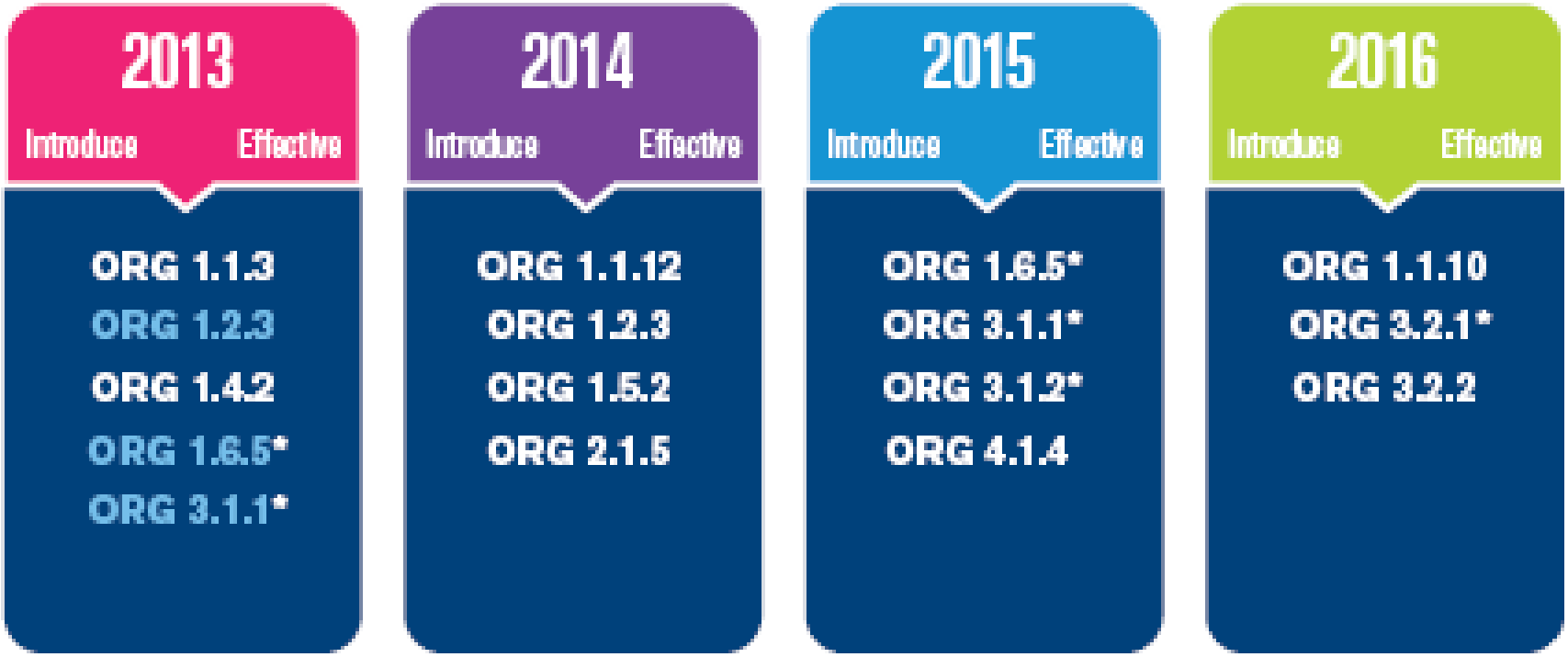
- SMS designated SARPs introduced in 2010
- Over 330 audits since
- Significant implementation ~ much yet to be done



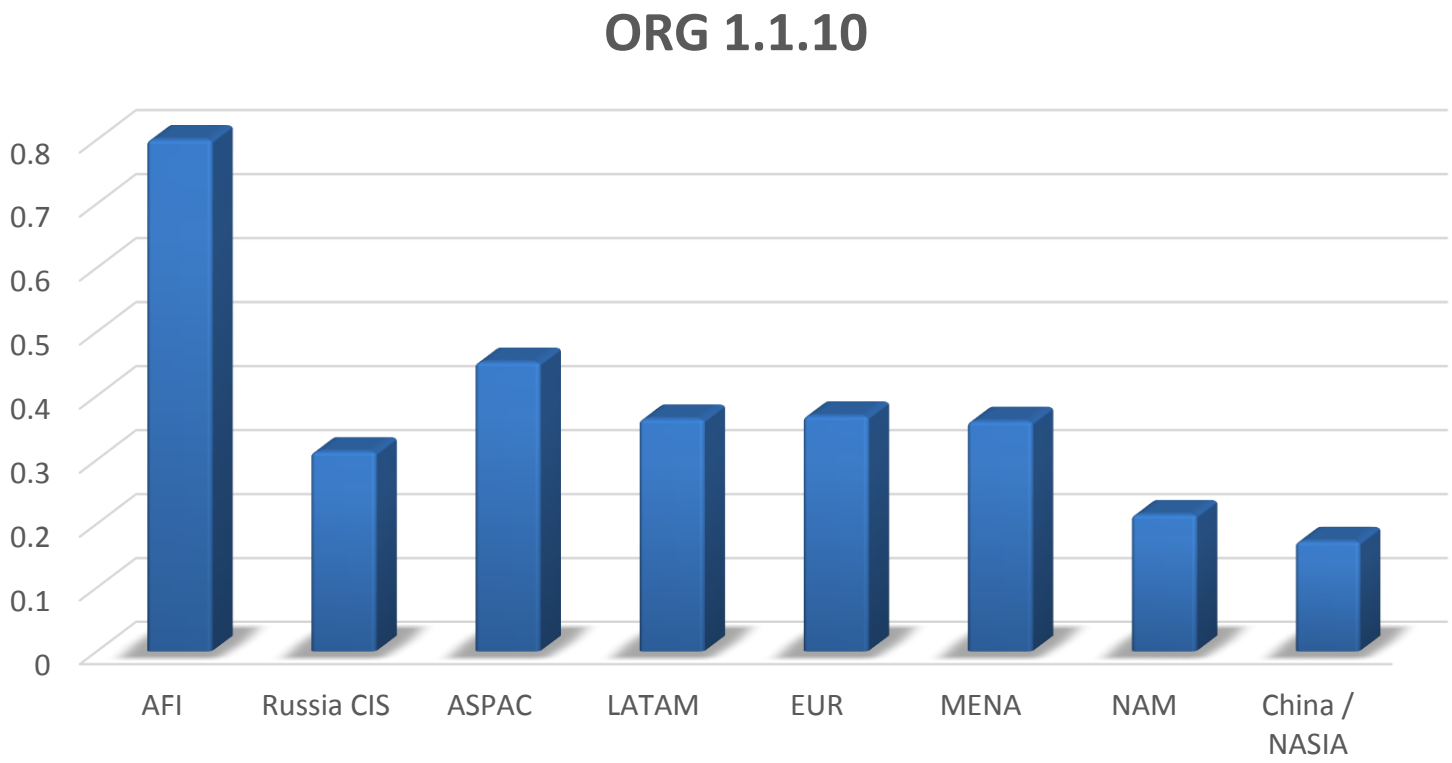
IOSA SMS Strategy

- IOSA reflects ICAO SMS framework
  - As standards and recommended practices
- SMS designated SARPS remained primarily untouched
- IOSA ideal mechanism to advance SMS implementation
- Strategy elevated all IOSA SMS designated provisions to standards by 2016

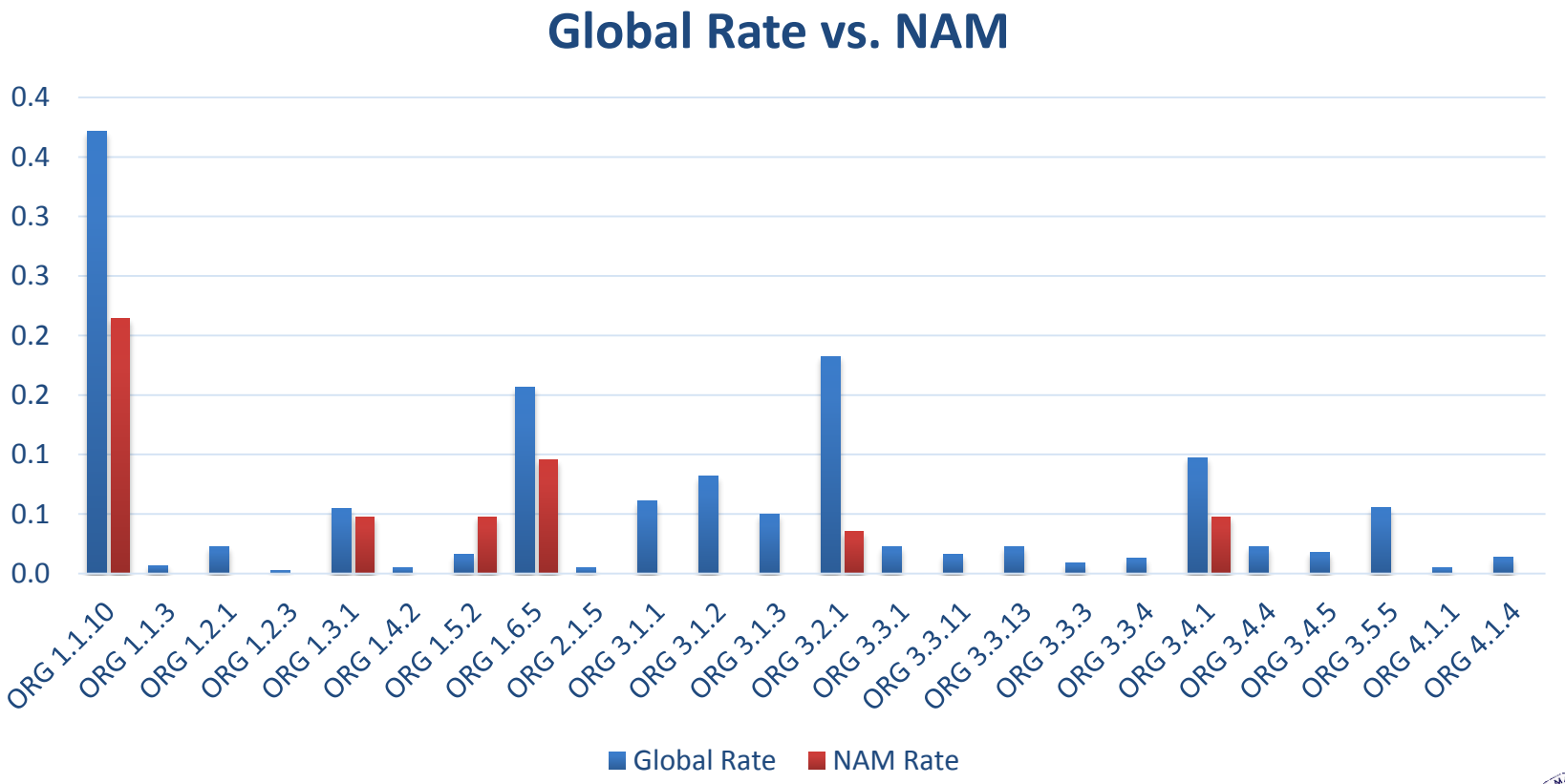
Timeline


2013
Introduce
Effective
ORG 1.1.3
ORG 1.2.3
ORG 1.4.2
ORG 1.6.5*
ORG 3.1.1*
2014
Introduce
Effective
ORG 1.1.12
ORG 1.2.3
ORG 1.5.2
ORG 2.1.5
2015
Introduce
Effective
ORG 1.6.5*
ORG 3.1.1*
ORG 3.1.2*
ORG 4.1.4
2016
Introduce
Effective
ORG 1.1.10
ORG 3.2.1*
ORG 3.2.2

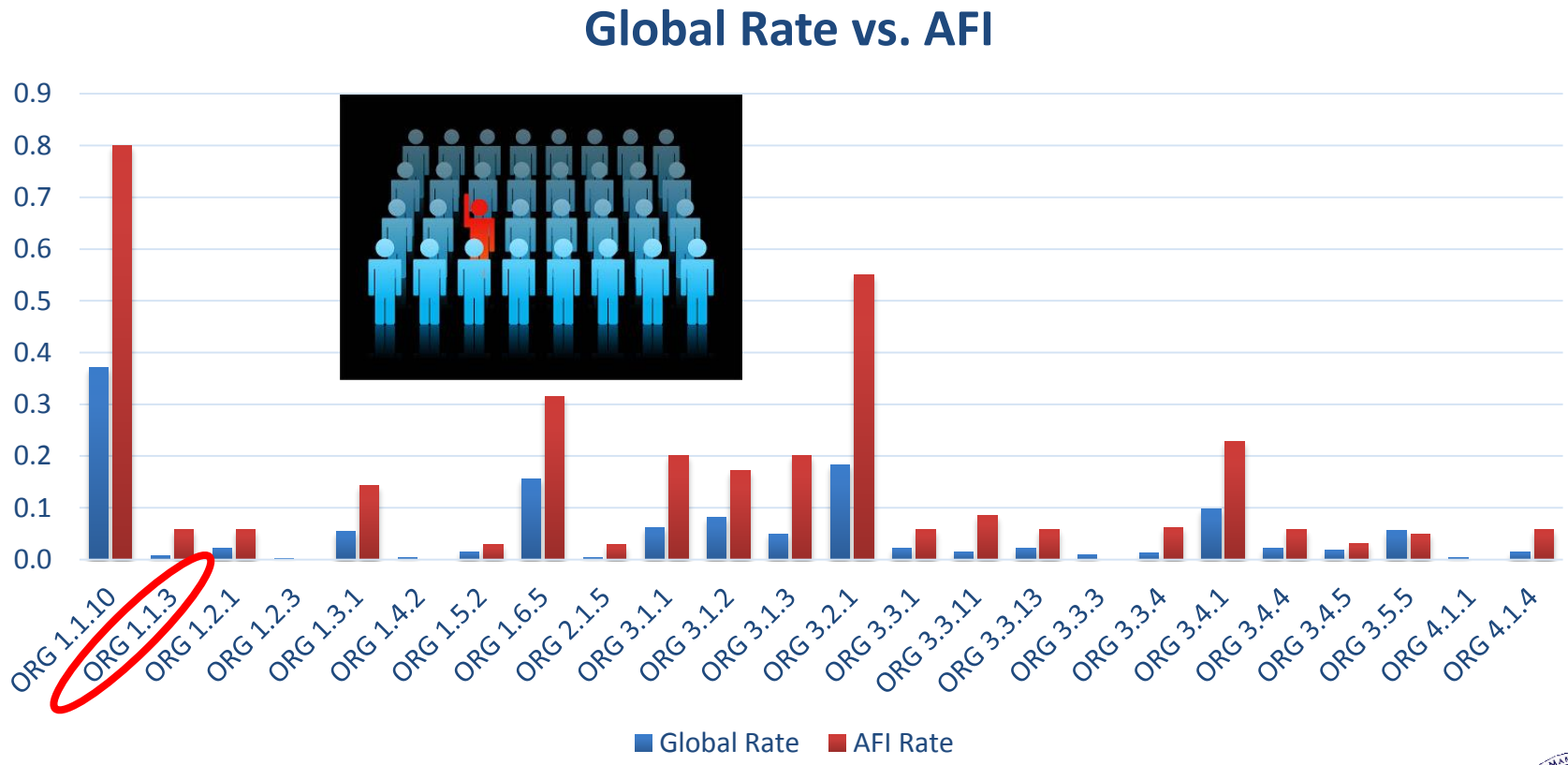
IOSA 2016-2017 Finding Rate



IOSA 2016-2017 Finding Rate

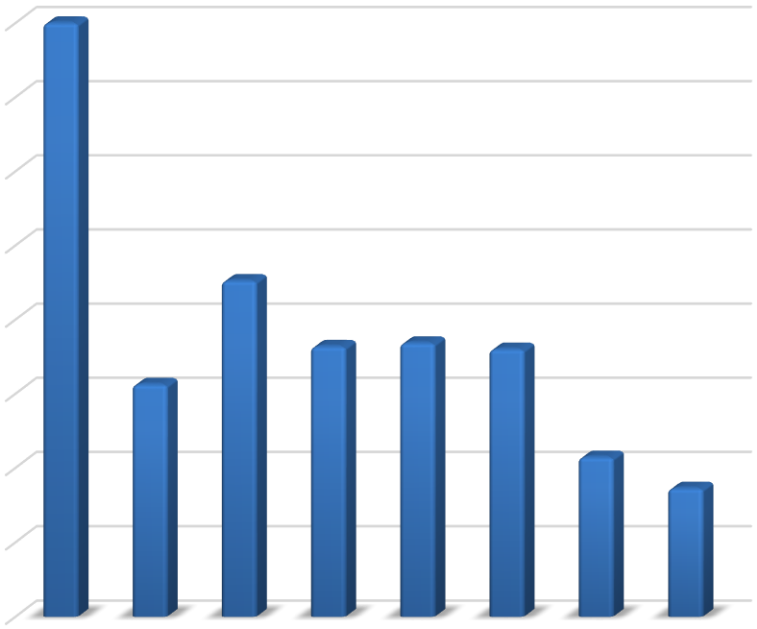


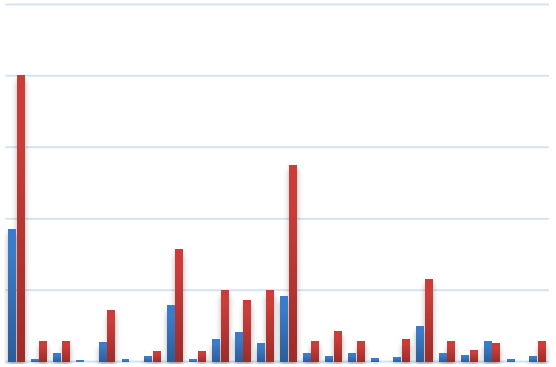
IOSA 2016-2017 Finding Rate

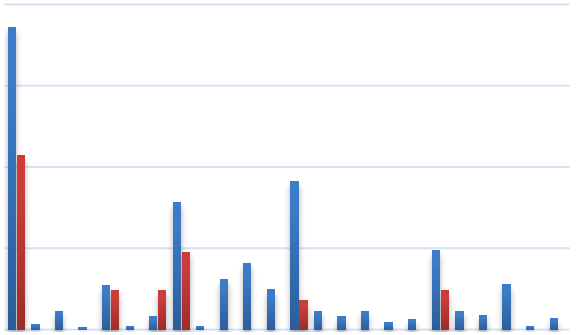


Next IOSA SMS Strategy

Challenges

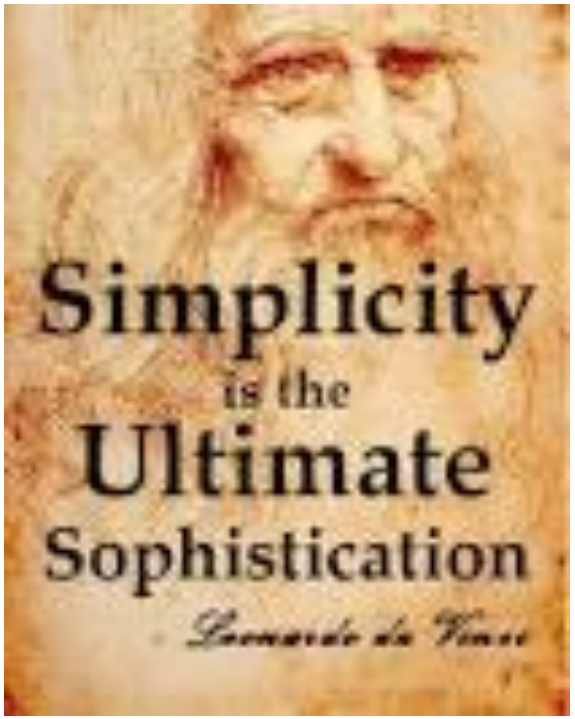






Keep it Simple

- Can get caught up in all of the data and information gathered
- Need to focus on the problems not the solution



Thank you!