



Agenda Item 5: Collision risk assessment and LHD

- c) Mitigation of LHD: ATS incidents analysis, Human factors and AIDC. Related states /ANSPs programs.**

Data Visualization in Air Traffic Management: Mitigation of LHDs, Risk Management and Monitoring

(Prepared by Trinidad and Tobago)

SUMMARY

This working paper proposes that Data Visualizations should be an integral element in the mitigation efforts and risk management of LHDs and Loop Errors. Using organized data from 2019 for the ANSP, the ATS and ANS Safety Department deployed an interactive Dashboard to drive the mitigation process in assessing the trends, ranking the deficiencies, improving collaboration between ATC interfaces and raising Safety Awareness among all stakeholders.

References:

<https://prezi.com/i/c2jipwjluw6f/>

<https://prezi.com/i/8-t8s0nctx7h/>

1. Background

1.1 When we hear the word “pipeline” we think about the transport of gas in the crude oil industry and rightly so because an internet search will take us to some of the longest gas pipelines in the world. However, pipelines are not limited to the petro chemical sector. In the agro industry, farms use pneumatic pipelines for the sorting and movement of grains via a compressed vacuum technique. In technology, there are pipelines for the organization of data, which collectively describes the process of acquisition, preparation, analysis, movement and presentation of data. One technological platform claims, “A well-organized data pipeline is [a good] foundation of data visualization.” (Tech Insight Today, Dec 2022)

1.2 We all have data pipelines. Some of us have pipelines that are more complex because we have a decade of data organization, while the rest of us are now laying down the infrastructure. However, irrespective of the degree of complexity of our pipeline system, we are all at the juncture of the next step: data visualization. We are ready to use our data

1.3 Each time we see our data we ask ourselves: How can this data help us? What lessons can we learn at various strata of Operations and Management? Then we attempt to answer these questions either with smiles or with groans depending on the amount and nature of the challenges surrounding our data. We may deploy one of two or a mix of either the traditional approach and/or the pipeline approach.

We are familiar with the traditional approach of investigative methodology, which is about finding answers to **6 generic questions: Who? What? When? Where? Why? How?**

We gather the facts and we tell a story.

Alternatively, we can use our data pipelines and tell the same story by “showing the data” (Tufte, 1983). Let us compare both methods using the example of Large Height Deviations (LHDs) in Trinidad and Tobago (TTO).

2. Analysis

2.1 The Data Pipeline TTO

In Trinidad and Tobago, the ANS Safety Unit has collected data on Large Height Deviations (LHDs) from the electronic reports of the regional monitoring agency (CARSAMMA) in the present to archived and yellowing paper reports in thick binders from as far back as 2011. First, using the traditional investigative approach, we summarize the occurrences of LHDs by answering the six W’s with organized data from 2019.

2.2 The Traditional Approach

Since 2019, the amount of LHDs occurring yearly seem to be decreasing. This ANSP experienced 45 LHDs for the last four years with an annual average of 10 to 12. The year 2020 saw a maximum of 15 LHDs and a minimum of seven in 2019. Last year there were 10. In addition, each year recorded three to seven months with no LHDs.

Our count shows 11 vulnerable waypoints that had at least two occurrences from 2019 to present. The most vulnerable waypoints are TRAPP, DAREK, KORTO and ROHPL, where there were at least three occurrences, each.

The other waypoints at risk were CITRS, DOLRO, ELJEZ, EKNUT, FISST, GEECE and OPADO.

Most of the LHDs occurred with the Air Traffic Control (ATC) interfaces of New York Oceanic and Paramaribo.

The classification system from the LHD Manual prepared for the region identified 69% of these deviations as Code E – “the results of Coordination errors in the transfer of control responsibility due to Human Factor issues”.

A causal analysis of the descriptive remarks and the supplementary reports for the Coordination Error scenarios revealed 6 intermediate factors and 3 Human Factor issues that contributed to the errors in Coordination.

CAUSES OF COORDINATION ERRORS	CONTRIBUTION (%)	HUMAN FACTORS
ESTIMATE LATE	6	Communication
LEVEL CHANGE NOT ISSUED	9	
LEVEL NOT REVISED	29	
LEVEL STATE NOT INCLUDED	12	Distraction
NO COORDINATION	42	Perception
TIME NOT REVISED	13	

Now, let us take that same data and show the same story, twice:

2.3 Data Visualization – Showing the story

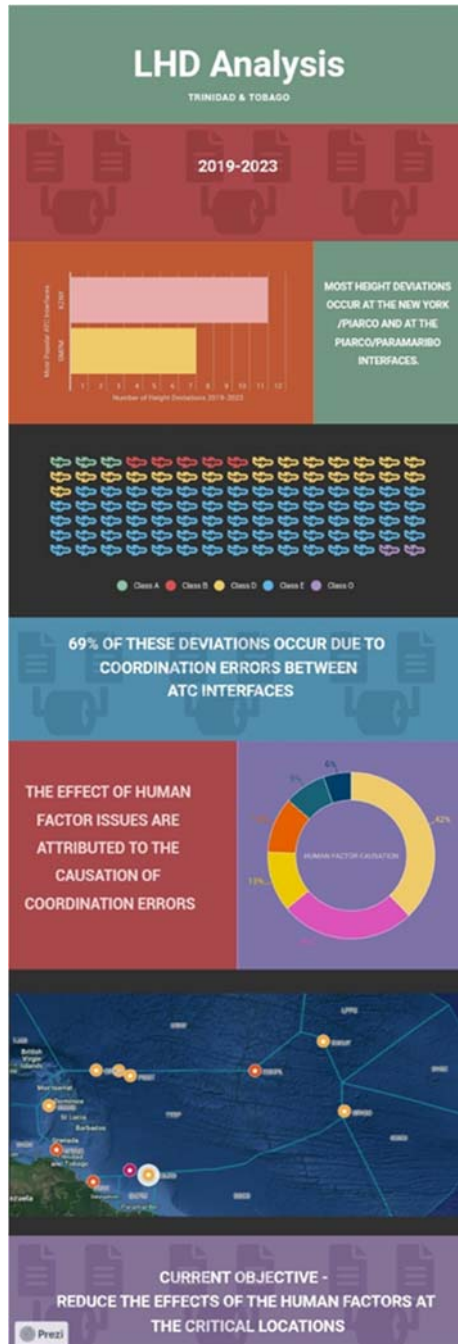
2.3.1 Part I – Showing the story with an LHD Analysis Dashboard



In addition to answering the generic questions of the traditional approach, the Dashboard goes further by using the last chart (depicted in the bottom right) to highlight:

- the key deficiencies with each neighbouring interface,
- which aspect is critical
- the potential benefit from focusing on mitigating a particular causation.

2.3.2 Part II – Showing the story with an LHD Analysis Infographic



2.3.3 The Traditional Approach versus the Pipeline Approach

Remember the rhetoric: How can this data help us and what lessons can we learn at various strata of Operations and Management?

Well which approach was more meaningful? Both told the same story but the visualization of data facilitates better collaboration by helping us to comprehend the whole picture, gain insights, identify the trends and

pinpoint the deficiencies without relying on information overload. Data visualization appeals to our visual perception, cognitive faculties and memory. These facets render data visualizations as effective Safety checks, collaborative platforms and decision-making tools at various levels of Air Traffic Management (ATM), mitigation of risks and monitoring. We are helped to remain focused on the objectives whether deployed as a Dashboard, which provides a conglomeration of key points quickly (in a dash) or as an Infographic, which highlights 1-3 key issues (info in a flash).

2.3.4 Applying Data Techniques to Mitigation

Since 2019 mitigation efforts include:

- Better collaborative meetings between ATC interfaces
- Consistent refresher training aimed at reducing the negative effects of Human Factors
- Raising awareness at the Supervisory Level via presentations
- Revision of procedures
- Tracking equipment failures

2.3.5 Conclusion

Our ANSPs; ATM and monitoring agencies all already have the required data pipelines. This qualifies us collectively for the next juncture: data visualization. Data visualization is an invariable part of the mitigation efforts in the Risk management of LHDs. Using organized data from 2019 for the ANSP, deployment of an interactive Dashboard acts as a driver of the mitigation process in assessing the trends, ranking the deficiencies, improving collaboration between ATC interfaces and raising Safety Awareness from the Supervisory Level upwards.

3. **Action by the meeting**

3.1 The meeting is invited to:

- a) consider the information presented;
- b) urge States and other aviation organization and agencies to make the use of Dashboards as an integral element in their mitigation efforts for management of LHDs and Loop Errors;
- c) consider how to support States in these efforts; and
- d) provide direction as deemed necessary.