Example Application of Ramp Error Decision Aid (REDA)

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In Conjunction with:

GAIN Working Group B, Analytical Methods and Tools

September 2004

Preface

This example application has been prepared by the Boeing Company in conjunction with the Global Aviation Information Network (GAIN) Working Group B (Analytical Methods and Tools) (WGB) as one of a number of such examples of the use of analytical methods and tools described in the "*Guide to Methods & Tools for Airline Flight Safety Analysis*". The intent of these example applications is to illustrate how various tools can be applied within an airline flight safety department, and provide additional information on the use and features of the tool and the value of such analysis. GAIN WG B hopes that these example applications will help increase the awareness of available methods and tools and assist the airlines as they consider which tools to incorporate into their flight safety analysis activities.

Each example application of an analytical method or tool is posted on the GAIN website (*www.GAINweb.org*). Readers are encouraged to check the website periodically for a current list of example applications, as further examples will be added as they become available.

Ramp Error Decision Aid—A tool for Investigating Apron System Failures

1 Introduction

REDA is a reactive tool designed to assist airlines, maintenance and repair organizations (MRO) and apron service providers (ASP) in identifying factors that negatively affect the performance of their workforce. Workforce performance issues such as errors and productivity have been shown to have a significant impact on risks associated with flight, personnel and environmental safety.

1.1 OVERVIEW OF THE TOOL FUNCTIONALITY

REDA is based on a systems approach where the apron environment is viewed as a system and those individuals involved in apron operations are part of that system. The objective of REDA is to identify physical, organizational and cognitive factors that have a negative affect on both the worker and on overall apron system performance. These negative effects manifest themselves by increasing the probability apron system failures such as errors, procedural violations and/or the inability or staff to perform tasks in the required time. Typically, apron system failures such as error result from the presence of a several contributing factor. So, we say that system failures are the result from a series of contributing factors.

A large number of these contributing factors are under management control. In order to change the probability that a system failure will occur in the future, the contributing factors must be addressed (i.e. changed, fixed or accounted for). For example, if a person parks a baggage cart outside of the approved parking area because the zone marks were worn and hard to see, another worker could make the same error. If you wish to change the probability that the error will occur in the future, you need to repaint the zone marks.

The REDA analysis identifies 10 major categories of contributing factors:

- Information
- Equipment/Tools/Safety Equipment
- Aircraft Design/Configuration/Parts
- Job/Tasks
- Technical Knowledge/Skills
- Individual Factors
- Environment/Facilities
- Organizational Factors
- Leadership/Supervision
- Communications
- Other

1.2 INTRODUCTION TO THE EXAMPLE APPLICATION

A REDA investigation was conducted after the left engine nacelle of a Boeing 737-400 struck a service truck while the aircraft was being guided into the gate. This is described further in section 3.2.

2 Input Data

In addition to the collection of general event information, the essential data for the REDA process are gathered from structured interviews with ramp crews who were involved in the event.

3 Analytical Process

3.1 INVESTIGATION PROCESS

REDA is an event based process. That is the investigation is carried out after an event occurs in order to find out why the event occurred. However, before carrying out a REDA investigation, we must determine weather some aspect of human performance such as an error or the inability to complete a task in the required time, led to the event.

The next thing that must be done is to find the ramp workers who were the most closely involved with the event.

Then you interview the ramp worker using the REDA Results Form, in order to find out two things:

- What the contributing factors were to the system failure, and
- What ideas the ramp worker has for improving/fixing the contributing factors.

Obviously, using the interview to understand the contributing factors to the failure is the primary purpose of the REDA investigation. The ramp worker is, at that time, probably the world's expert on the contributing factors to that specific apron system failure. It is the investigators job to find out what those contributing factors are. In addition, the ramp worker is also probably the world's expert on what changes need to be made to the contributing factors in order to keep them from contributing to future, similar errors. So, another task of the investigator is to get ideas for improvements to the contributing factors from the ramp worker.

During the interview with the ramp worker the investigator may obtain information that requires follow-up in order to gain full knowledge about the contributing factors or other circumstances. This may include follow-up interviews with other ramp personnel in the same work group. Or, it may include inspecting something like a tool that the ramp worker said was hard to use or the lighting in an equipment marshalling area.

Once all of the interviews/investigation has taken place, the Results Form data would be added to a database. Analysis can then be done to find trends in system failures or contributing factors. This type of analysis will probably not be that useful until a number of investigations have been done—probably 20 or more—because trends might not be visible.

It is time to make improvements to the contributing factors. Management would typically make these types of decisions, since improvements to some contributing factors might cost money or manpower to implement. These decisions are often made at an existing meeting of managers, such as at the weekly/monthly QA audit findings meeting. Also, decisions about improvements might be made on the basis on one investigation, if there are obvious and relatively straightforward contributing factors that need to be fixed (like improved lighting or labeling). These decisions could also be made based on the analysis of several like events, if the improvements are less obvious or are expensive to make so that additional data are necessary to make a important, high-cost decision (like changing the shift handover procedure).

It is important to provide feedback to the ramp personnel to let them know what improvements are being made. This will show them that the process is being used to make improvements and is not being used to punish ramp personnel.

3.2 EXAMPLE CASE

A REDA investigation was conducted after the left engine nacelle of a Boeing 737-400 struck a service truck while the aircraft was being guided into the gate. The service truck was not parked in the approved parking zone. The initial investigation revealed:

1. There were two workers present to receive the aircraft:
    a. Worker A—28 years old, 6 years experience
    b. Worker B—22 years old, 5 months experience
2. Company policy required that three individuals be present to receive an aircraft, one to guide the aircraft in and a wing walker on each wing
3. The flight was 40 minutes late
4. Worker B left the service truck in the improper location
5. There was approximately one inch of snow on the tarmac at the time of the accident

Both workers were interviewed according to the REDA process and the following contributing factors were identified:

1. Due to weather conditions in the eastern region of the country the majority of flights were delayed. This created a condition where flights were arriving out of sequence and non-scheduled times.
2. There was not enough staff to be able to react to the upset conditions.
3. The staff considered it an acceptable practice to violate company policy regarding the minimum number of personnel required to receive aircraft at the gate during upset conditions.
4. The parking zone marking at the gate were painted white and were in poor condition. This made the markings difficult to see under the snow.
5. Due to a lack of sufficient class space, Worker B had not received the required driver training class at the time of the accident.

As the result of the REDA investigation the airline implement the following improvements to reduce to probability of a similar accident:

1. Changed the companies policy regarding calling in additional staff during conditions of unusually high arrivals and departures
2. Informed staff that those policies regarding minimum required personnel to receive an aircraft at a gate are to be followed under all circumstances
3. Repainted parking zone marking with yellow paint
4. Increased the number of driving classes

See REDA Results Form Below:

REDA Results Form

Section I -- General Information

Reference #: ___ ___ ___ ___ ___
Airline:_____
Station of Error:_____
Aircraft Type/Reg. #:_____
Equipment Type: _____
_____
Ref. # of previous related event: ___ ___ ___ ___ ___

Interviewer's Name:_____
Interviewer's Telephone #: __ __ __ __ __ __ __ __ __ __
Date of Investigation: __ __ / __ __ / __ __
Date of Event: __ __ / __ __ / __ __
Time of Event: _ _ : _ _ am pm
Shift of Error: _____
Date Changes Implemented: __ __ / __ __ / __ __

Section II -- Event

Please select the event (check all that apply)

1. Aircraft Damage Event
( ) a. Cargo Door
( ) b. Passenger door
( ) c. Tail
( ) d. Nose/radome
( ) e. Wing
( ) d. Engine/cowl
( ) e. Landing gear/doors

2. Equipment Damage Event
( ) a. Bag tug/cart
( ) b. Loading bridge (jetway)
( ) c. Belt loader
( ) d. Container loader
( ) e. Truck (lav, fueling, or water)

3 Personal Injury Event
( ) a. Strain
( ) b. Sprain
( ) c. Laceration
( ) d. Contusion
( ) e. Fracture
( ) f. Other

4 Environmental Impact Event (explain below)
( ) a. Spill
( ) b. Release
( ) c. Contamination

Describe the event.
While the aircraft was being guided into the jetway, it's number 1 engine nacelle struck a service truck

Section III -- Ramp Error

Please select the ramp error(s) that caused the event:

1. Improper Use of Equipment
( ) a. Driven too fast for conditions?
( ) b. Not for intended use
( ) c. Defective equipment used
( ) d. Incorrectly operated
( ) e. Equipment left in wrong place?
( ) f. Driven/pushed/towed into?

2. Actions Causing Foreign Object Damage (FOD)
( ) a. Material left on ramp
( ) b. Material dropped into open system
( ) c. Material left in aircraft/engine
( ) d. Failure to see FOD on ramp
( ) e. Other (explain below)

3. Improper Aircraft Operations
( ) a. Driven into equipment/facility
( ) b. Driven off ramp/taxi way guidance?
.

4. Improper Aircraft Handling
( ) a. Pushed into
( ) b. Towed into

5. Actions Causing Personnel Injury
( ) a. Slip/trip/fall
( ) b. Caught in/on/between
( ) c. Struck by/against
( ) d. Hazard contacted (e.g., electricity, hot or cold surfaces, and sharp surfaces)
( ) e. Hazardous substance exposure (e.g., toxic or noxious substances)
( ) f. Hazardous thermal environment exposure (heat, cold, or humidity)
( ) g. Incorrect body position for manual handling
( ) h. Other (explain below)

Describe the specific ramp error

Flight PU33 was being guided into the jetway at gate C-32. The number 1 engine nacelle struck a service truck, which was improperly parked at the gate

Section IV -- Contributing Factors Checklist

N/A ☐

A. Information (e.g., written procedure)

__ 1. Not understandable
__ 2. Unavailable/inaccessible
__ 3. Incorrect
__ 4. Too much/conflicting information
__ 5. Insufficient information
__ 6. Update process is too long/complicated
__ 7. Incorrectly modified manufacturer's MM/SB
__ 8. Information not used
__ 9. Other (explain below)

Describe specifically how the selected <u>information</u> factor(s) contributed to the error.

N/A ☐

B. Equipment/Tools/Safety Equipment [Personal Protective Equipment (PPE) and Collective Protective Equipment (CPE)]

__ 1. Unsafe
__ 2. Unreliable
__ 3. Layout of controls or displays
__ 4. Mis-calibrated
__ 5. Unavailable
6. Inappropriate for the task
__ 7. Cannot use in intended environment
__ 8. No instructions
__ 9. Too complicated
__ 10. Incorrectly labeled/marked
__ 11. Not labeled/marked
12. PPE/CPE used incorrectly
__ 13. PPE/CPE not used
__ 14 Driven too fast
15 Other (xplain below)
__
__

Describe specifically how selected <u>equipment/tools/safety equipment</u> factor(s) contributed to the error.

N/A ☐

C. Aircraft Design/Configuration/Parts

__ 1. Complex
__ 2. Inaccessible
__ 3. Aircraft configuration variability
__ 4. Parts (antenna, masts) hard to see
__ 5. Poorly marked
7. __ Other (explain below)

Describe specifically how the selected <u>aircraft design/configuration/parts</u> factor(s) contributed to error.

N/A ☐

D. Job/Task

__ 1. Repetitive/monotonous
__ 2. Complex/confusing
__ 3. New task or task change
__ 4. Different from other similar tasks
__ 5. Requires forceful exertions
__ 6. Requires kneeling/bending/stooping
__ 7. Requires twisting
__ 8. Long duration
__ 9 Awkward position
__ 10. Other (explain below)

Describe specifically how the selected <u>job/task</u> factor(s) contributed to the error.

N/A _

E. Technical Knowledge/Skills

__ 1. Skills
__ 2. Task knowledge
__ 3. Task planning
☑ 4. Airline process knowledge
__ 5. Aircraft system knowledge
__ 6. Aircraft configuration knowledge
__ 7. Other (explain below)

Describe specifically how the selected <u>technical knowledge/skills</u> factor(s) contributed to the error.

4. Earl didn't know the company processes regarding vehicle parking zones on the ramp

N/A ☐

F. Individual Factors

__ 1. Physical health (including hearing and sight)
__ 2. Fatigue
__ 3. Time constraints
__ 4. Peer pressure
__ 5. Complacency
__ 6. Body size/strength
__ 7. Personal event (e.g., family problem, car accident)
__ 8. Workplace distractions/interruptions during task performance
__ 9. Memory lapse (forgot)
__ 10. Other (explain below)

Describe specifically how the selected <u>factors affecting individual performance</u> contributed to the error.

N/A __

G. Environment/Facilities/Ramp

__ 1. High noise levels	__ 5. Rain	__ 9. Vibrations	__ 13. Inadequate ventilation
__ 2. Hot	__ 6. Snow	__ 10. Cleanliness	__ 14. Inadequate blast protection
__ 3. Cold	__ 7. Wind	__ 11. Hazardous/toxic substances	✓ 15. Ramp markings
__ 4. Humidity	__ 8. Lighting	__ 12. Power sources	__ 16. Other (explain below)

Describe specifically how the selected <u>environment/facilities</u> factor(s) contributed to the error.

15. Ramp markings were worn off and were hard to see. A light dusting of snow compounded the problem

N/A __

H. Organizational Factors

__ 1. Quality of support from technical organizations (e.g., engineering, planning, technical pubs)	__ 7. Union action
__ 2. Qualify of support from airport vendors	__ 8. Work process/procedure
__ 3. Quality of support from airport organizations	✓ 9. Work process/procedure not followed
__ 4. Company policies	__ 10. Work process/procedure not documented
✓ 5. Not enough staff	✓ 11. Work group normal practice (norm)
__ 6. Corporate change/restructuring	__ 12. Failure to follow ground guidance
	__ 13 Failure to follow airport authority guidance
	__ 12. Other (explain below)

Describe specifically how the selected <u>organizational factor(s)</u> contributed to the error.

5. Not enough staff. This contributed to the work process not being followed
9. Work processes not followed because of lack of staff (two people instead of the three required by the process)
11. Is a work group norm to use less than three people in this type of situation

N/A ✓

I. Leadership/Supervision

__ 1. Planning/organization of tasks	__ 3. Delegation/assignment of task	__ 5. Amount of supervision
__ 2. Prioritization of work	__ 4. Unrealistic attitude/expectations	__ 6. Other (explain below)

Describe specifically how the selected <u>leadership/supervision</u> factor(s) contributed to the error.

N/A ✓

J. Communication

__ 1. Between departments	__ 4. Between ramp staff and lead	__ 7. Between other operators and ramp staff
__ 2. Between staff	__ 5. Between lead and management	
__ 3. Between shifts	__ 6. Between flight crew and ramp staff	__ 7. Other (explain below)

Describe specifically how the selected <u>communication</u> factor(s) contributed to the error.

N/A ✓

K. Other Contributing Factors (explain below)

Describe specifically how this <u>other factor</u> contributed to the error.

Section V – Error Prevention Strategies

A. What current existing procedures, processes, and/or policies in your organization are intended to prevent the incident, but didn't?

( ) **Ramp Policies or Processes** (specify) 120-4_____

B. List recommendations for error prevention strategies.

Recommen-dation #	Contributing Factor #	
1	*E.4*	*Get more driving classes*
2	*G.15*	*Repaint the ramp markings*
3	*H.5*	*Hire additional staff for high workload times*
4	*H 9-11*	*Communicate to staff that process deviations are not acceptable*

(Use additional pages, as necessary)

Section VI – Summary of Contributing Factors, Error, and Event

Provide a brief summary of the event.

(Use additional pages, as necessary)

4 Tool's Output

While the procedural deviations or ramp crew errors are necessary to link the contributing factors to the outcome, the key output is an organized description of the contributing factors and recommendations for how to address those factors. The contributing factors to errors constitute threats, hazards, or system imbalances managers will want to consider in their risk management processes. Additionally, the output will include a complete event summary, including ramp crew errors and contributing factors that presents the "whole story" of what happened.

While the REDA doesn't currently have an electronic data storage, interested airlines, may develop or use an existing database for the purpose of the data storage and analysis.

5 Application of the Analysis Results

In this particular example, ramp crew management will continue to promote the procedural compliance while looking into providing additional driving classes for the ramp crews. scheduling more ramp crew during peak hours, and notify the airport manager about the condition of ramp marking at this gate.

The above example highlighted the value of using open communication with limited amnesty to obtain an in-depth understanding of the contributing factors to errors that led to an incident. By seeing the relationships between the errors and the factors, ramp crew management can take more precise actions to prevent the effects of significant contributing factors in the future. .

What might have happened without REDA

Due to damage and financial loss, the ramp crewmembers might have been disciplined and the problem of procedural non-compliance, inadequate ramp work force, and marking would have remained undetected. One significant side effect of such inferential (or "unjust") administrative action could be a further drain on efficiency. Because of fear those ramp crews, as well as other employees, might resort to career-protecting behaviors that may not be in the interest of the airline's safety.