

To: Mark Kowaleski <mkowales@hq.nasa.gov>
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Fwd: RE: Code M Question
Cc: pete.rutledge@hq.nasa.gov
Bcc:
Attached: C:\Documents and Settings\mstamate\Desktop\Shuttle Failure Mode Counts by Element.doc;

Mark:
Here is the information you requested for Code M.
Michael

From: "BOYER, ROGER L. (JSC-NC) (SAIC)" <roger.l.boyer1@jsc.nasa.gov>
To: "'Michael Stamatelatos'" <mstamate@hq.nasa.gov>
Cc: "RAILSBACK, JAN (JSC-NX) (NASA)" <jan.railsback-1@nasa.gov>, "ROELANT, HENK (JSC-NC) (NASA)" <henk.roelant-1@nasa.gov>
Subject: RE: Code M Question
Date: Wed, 12 Feb 2003 12:48:00 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Michael,

Michael,

Here's what we pulled from the Critical Items List (CIL) for each of the Shuttle elements. I have more detail, but not electronically.

- 1) 1687 single point (Crit 1/1) failures for the Shuttle
- 2) By element, they are follows:

Orbiter	688
ET	453
RSRM	90
SRB	143
SSME	313
Total	1687

The attached table also provides the number of failure modes requiring multiple failures for each element (Crit 1R). I hope this answers the mail.

Roger

-----Original Message-----

From: Michael Stamatelatos [mailto:mstamate@hq.nasa.gov]
Sent: Monday, February 10, 2003 7:49 AM
To: RAILSBACK, JAN (JSC-NX) (NASA); BOYER, ROGER L. (JSC-NC) (SAIC)
Subject: Code M Question
Importance: High

Jan/Roger:

I need the answer to the following urgent questions:

1. How many single point failures are there in the entire Space Shuttle?
2. Do you have a breakdown of single point failures by Shuttle system (e.g. Orbiter, ET, SRB, etc.)? If so, what is it?

Michael

Dr. Michael Stamatelatos
Manager, Agency Risk Assessment Program
NASA Headquarters - Mail Code QE
Office of Safety and Mission Assurance
300 E Street, SW
Washington, DC 20024
Phone: 202/358-1668 Fax: 202/358-2778
E-mail: Michael.G.Stamatelatos@nasa.gov
(Please note change in e-mail address)

"Mission success starts with safety"

Date: Wed, 12 Feb 2003 15:56:03 -0500
From:
Reply-To:
Organization: Science Applications
X-Mailer: Mozilla 4.79 (Macintosh; U; PPC)
X-Accept-Language: en
To: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: AP Reporter

Michael:

I was just interviewed by the Washington Post with the approval of both NASA and SAIC.

I do not know how it will come out but I attempted to be factual and to the point and did not speculate as to the cause of the tragedy, although the reporter tried to get me to do so.

Michael Stamatelatos wrote:

> Joe:
> We, in Code Q, have been contacted by the press and have used the protocol
> of having someone from public affairs present (for the record) during the
> interview. Al Feinberg is such a PA individual (202-358-4504). You may want
> to chat with him; he can also set up the call to AP for you.
> Michael
>
> At 09:01 AM 2/12/2003 -0500, you wrote:
>>Michael:
>>
>>Jim Lloyd called and told me that he would like to speak to me about an
>>AP reporter. Apparently NASA is thinking of letting me speak about the
>>1995 PRA and its application to the Columbia problem.
>>
>>Please let me know what is going on. I have no problem speaking to the
>>press. I have done it many times successfully as I believe my NPR piece
>>shows, but I have been told that NASA no longer wants me to speak to the
>>press.
>>
>>Joe
>

> *****
> Dr. Michael Stamatelatos
> Manager, Agency Risk Assessment Program
> NASA Headquarters - Mail Code QE
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> 300 E Street, SW
> Washington, DC 20024
> Phone: 202/358-1668 Fax: 202/358-2778
> E-mail: Michael.G.Stamatelatos@nasa.gov
> (Please note change in e-mail address)
> *****
> "Mission success starts with safety"

To:
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Subject: Re: AP Reporter
Cc:
Bcc:
Attached:

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To:
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: AP Reporter
Cc:
Bcc:
Attached:

Thank you.
I am sure you handled it in a professional manner.
Michael

At 03:56 PM 2/12/2003 -0500, you wrote:
Michael:

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I do not know how it will come out but I attempted to be factual and to the point and did not speculate as to the cause of the tragedy, although the reporter tried to get me to do so.

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> Washington, DC 20024
> Phone: 202/358-1668 Fax: 202/358-2778
> E-mail: Michael.G.Stamatelatos@nasa.gov
> (Please note change in e-mail address)

> *****

> "Mission success starts with safety"

To:
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: AP Reporter
Cc:
Bcc:
Attached:

This was a good move to make sure that what you said would not be used out of context.
Michael

At 04:13 PM 2/12/2003 -0500, you wrote:
Michael:

I tried, but with the Post who knows how it will come out. At least the SAIC PR person taped the interview.

Michael Stamatelatos wrote:

> Thank you.
> I am sure you handled it in a professional manner.
> Michael
>
> At 03:56 PM 2/12/2003 -0500, you wrote:
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>>> Manager, Agency Risk Assessment Program
>>> NASA Headquarters - Mail Code QE
>>> Office of Safety and Mission Assurance
>>> 300 E Street, SW
>>> Washington, DC 20024
>>> Phone: 202/358-1668 Fax: 202/358-2778
>>> E-mail: Michael.G.Stamatelatos@nasa.gov
>>> (Please note change in e-mail address)

>>> *****

>>> "Mission success starts with safety"

>

> *****

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> E-mail: Michael.G.Stamatelatos@nasa.gov
> (Please note change in e-mail address)

> *****

> "Mission success starts with safety"

To: Alan Feinberg <afeinber@hq.nasa.gov>
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Re: PRA RTQ's
Cc:
Bcc:
Attached: C:\Program Files\Eudora\Attach\PRA RTQ.doc;

Alan:
I made a few changes. See attached.
Michael

At 11:50 AM 2/14/2003 -0500, you wrote:
Mike -

Lemme know if this works.

Thanks again for your help!

- Al F.

P.S. Forgot to bore you with this bit of info before: my brother is a retired sociology professor at the University of Cincinnati who has published research (using computer modeling) on how people/families react in fires, and how/why neighborhoods change.

X-Sender: boconnor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 07:00:02 -0500
To: Faith Chandler <fchandle@hq.nasa.gov>
From: boconnor <boconnor@hq.nasa.gov>
Subject: Re: Fwd: MORT

Faith,
Thanks, we are probably still another day or two from deciding on our analysis technique. I'll keep this and Larry Gregg himself as an asset in mind.
Thanks,

At 12:33 PM 2/2/2003 -0500, you wrote:
Bryan,

Here are some overview charts on "MORT" from the NSTC instructor Larry Gregg.

From: "GREGG, LARRY (JSC-NT) (MEI)" <larry.gregg1@jsc.nasa.gov>
To: "fchandle@mail.hq.nasa.gov" <fchandle@mail.hq.nasa.gov>
Cc: "JOHNSON, ELMER R. (JSC-NS) (NASA)" <elmer.r.johnson@nasa.gov>
Subject: MORT
Date: Sat, 1 Feb 2003 11:50:13 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Attached is the section of the MI class where I talk about MORT. There are a few cartoons and such, and I just left them in there. Please feel free to contact me directly if there is ANYTHING I can do.

<<MORT.ppt>>

Larry Gregg
281-244-1278

~~~~~  
Faith Chandler

NASA Headquarters  
Office of Safety and Mission Assurance  
Code Q Rm 5x40  
300 E Street, S.W  
Washington, D.C 20546

202-358-0411  
202-358-2778 (fax)

~~~~~

O'C

Bryan O'Connor
Associate Administrator
Office of Safety and Mission Assurance

X-Sender: p.d.arbuckle@express.larc.nasa.gov
Date: Wed, 5 Feb 2003 09:13:14 -0500
To: prutledg@mail.hq.nasa.gov, prichard@mail.hq.nasa.gov
From: Doug Arbuckle <p.d.arbuckle@larc.nasa.gov>
Subject: Re: Fwd: On-orbit tile repair
Cc: d.c.freeman@larc.nasa.gov, d.l.dwoyer@larc.nasa.gov,
m.j.shuart@larc.nasa.gov, a.h.phillips@larc.nasa.gov,
fchandle@hq.nasa.gov

Dr Rutledge--

Mr John Gleason is currently an aircraft maintenance technician assigned to the Airborne Systems Competency. Many years ago he was a technician assigned to the Structures and Materials Competency, during which time he apparently participated in the studies that you describe.

LaRC's experts in this subject, and most matters relating to Orbiter tiles, are in the Structures and Materials Competency. To assure that LaRC provides the most-informed and most-timely product to Code Q, Mr Gleason will be assigned to pull together what information he has in hand and provide it to the Structures and Materials Competency as soon as possible. Mark Shuart, Director of the Structures and Materials Competency, will be responsible for the final product delivery to Code Q.

LaRC personnel stand ready to provide whatever expertise we have to support the Columbia mishap investigation.

Feel free to contact me at 757-864-1718 if you or Pamela have any questions.

Doug Arbuckle, Director
Airborne Systems Competency

X-Sender: prutledg@mail.hq.nasa.gov
Date: Tue, 04 Feb 2003 13:21:41 -0500
To: Tony.L.Trexler@nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: On-orbit tile repair
Cc: prichard@hq.nasa.gov

Tony,

Pamela Richardson of my staff has informed me that Mr. John Gleason of your staff has knowledge of historical studies at the NASA Langley Research Center regarding Shuttle on-orbit tile repair. This has been the subject of recent discussions here and was the subject of a memo from John Young at JSC just a couple of months ago. This subject is even more important as a result of the Columbia mishap. Could you please authorize time for Mr. Gleason to search for this information and forward it as soon as possible to:

Pamela Richardson
NASA Headquarters, Code QE

300 E Street SW
Washington, DC 20546

I can be reached at 202-358-0579 if you have any questions.

Thank you very much,

Pete

Peter J. Rutledge, Ph.D.
Director, Enterprise Safety and Mission Assurance Division
Acting Director, Review and Assessment Division
Office of Safety and Mission Assurance
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579
FAX:202-358-2778
e-mail: pete.rutledge@hq.nasa.gov

Mission Success Starts with Safety!

--

Tony L.Trexler
Head, Aircraft Systems Branch
Airborne Systems Competency
NASA Langley Research Center

Bldg.1244, MS 255
6 E.Taylor St.
Hampton, Va. 23681-2199
Phone 757-864-3922
Fax 757-864-8294

X-Sender: prichard@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 06:31:09 -0500
To: Faith Chandler <fchandle@hq.nasa.gov>
From: Pamela Richardson <prichard@hq.nasa.gov>
Subject: Re: Columbia Action

Thanks!

At 04:17 PM 2/12/2003 -0500, you wrote:
Pam,

FYI..Action taken and closed on Columbia

I was contacted by Kristen Erickson, Code U this afternoon. She received a request from the EPA for information concerning required Personnel Protective Equipment (PPE) necessary for use when handling space hab and other payload debris. Per Kristen's request, I contacted Mike Cardenelli at KSC to obtain more information concerning the EPA request. I then took the EP request to Bill Hill in the HCAT.

While with Bill Hill, we contacted the Action Center at Barksdale and requested that the Action Center communicate with Kathy McCormick from the EPA (who is in the field at Barksdale) to provide her with the PPE list that was provided by the Chief Medical Officer to Barksdale Action Center. Barksdale will communicate/transmit the necessary information to the EPA.

Faith Chandler

NASA Headquarters
Office of Safety and Mission Assurance
Code Q Rm 5x40
300 E Street, S.W
Washington, D.C 20546

202-358-0411
202-358-2778 (fax)

Pamela F. Richardson
Aerospace Technology Mission Assurance Manager
Enterprise Safety and Mission Assurance Division, Code QE
Office of Safety and Mission Assurance, NASA Headquarters
300 E. Street, S. W., Washington, DC 20546
phone: 202-358-4631, fax: 202-358-2778

"The meek can *have* the Earth. The rest of us are going to the stars." --- Robert Heinlein

"We have to learn to manage information and its flow. If we don't, it will all end up in turbulence." --- RADM Grace Hopper

~~~~~

X-Sender: prichard@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Thu, 20 Feb 2003 08:27:48 -0500  
To: a.h.phillips@larc.nasa.gov  
From: Pamela Richardson <prichard@hq.nasa.gov>  
Subject: CAIB website  
Cc: Faith.Chandler@hq.nasa.gov, Pete.Rutledge@hq.nasa.gov

Alan --

I just called the HCAT and chatted with Marion, who indicated that indeed there are plans for a CAIB website, but that the website is not up and running yet. As soon as we hear any information with a web address, I am sure that Code Q will not only forward it to you, but the other SMA Directors.

If you or anyone on your staff hear of a website location, please don't hesitate to let us know.

Hope this helps, Pam

-----  
Pamela F. Richardson  
Aerospace Technology Mission Assurance Manager  
Enterprise Safety and Mission Assurance Division, Code QE  
Office of Safety and Mission Assurance, NASA Headquarters  
300 E. Street, S. W., Washington, DC 20546  
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X-Sender: prichard@mail.hq.nasa.gov  
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2  
Date: Thu, 20 Feb 2003 10:27:50 -0500  
To: "Alan H. Phillips" <a.h.phillips@larc.nasa.gov>  
From: Pamela Richardson <prichard@hq.nasa.gov>  
Subject: Re: CAIB website  
Cc: Jim.Lloyd@hq.nasa.gov, Pete.Rutledge@hq.nasa.gov,  
Faith.Chandler@hq.nasa.gov

Thanks for the update, Pam

At 10:20 AM 2/20/2003 -0500, you wrote:

Thanks. From our Public Affairs folks this morning, received the following address that regular mail could be forwarded to:

Columbia Accident Investigation Board  
16850 Saturn Lane  
Houston, Texas 77058

The e-mail stated that "there will be an 800 number and web site coming in the days ahead."

Alan

Alan --

I just called the HCAT and chatted with Marion, who indicated that indeed there are plans for a CAIB website, but that the website is not up and running yet. As soon as we hear any information with a web address, I am sure that Code Q will not only forward it to you, but the other SMA Directors.

If you or anyone on your staff hear of a website location, please don't hesitate to let us know.

Hope this helps, Pam

-----  
Pamela F. Richardson  
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Alan H. Phillips
Director, Office of Safety and Mission Assurance
NASA Langley Research Center
5A Hunsaker Loop
Building 1162, Room 112C
Mail Stop 421
Hampton, VA 23681

(757)864-3361 Voice
(757)864-6327 Fax

~~~~~  
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To: boconnor@mail.hq.nasa.gov  
From: Faith Chandler <fchandle@hq.nasa.gov>  
Subject: Fwd: MORT  
Cc:  
Bcc:  
Attached: C:\Documents and Settings\fchandle\My Documents\attach\MORT.ppt;

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Here are some overview charts on "MORT" from the NSTC instructor Larry Gregg.

From: "GREGG, LARRY (JSC-NT) (MEI)" <larry.gregg1@jsc.nasa.gov>  
To: "fchandle@mail.hq.nasa.gov" <fchandle@mail.hq.nasa.gov>  
Cc: "JOHNSON, ELMER R. (JSC-NS) (NASA)" <elmer.r.johnson@nasa.gov>  
Subject: MORT  
Date: Sat, 1 Feb 2003 11:50:13 -0600  
X-Mailer: Internet Mail Service (5.5.2653.19)

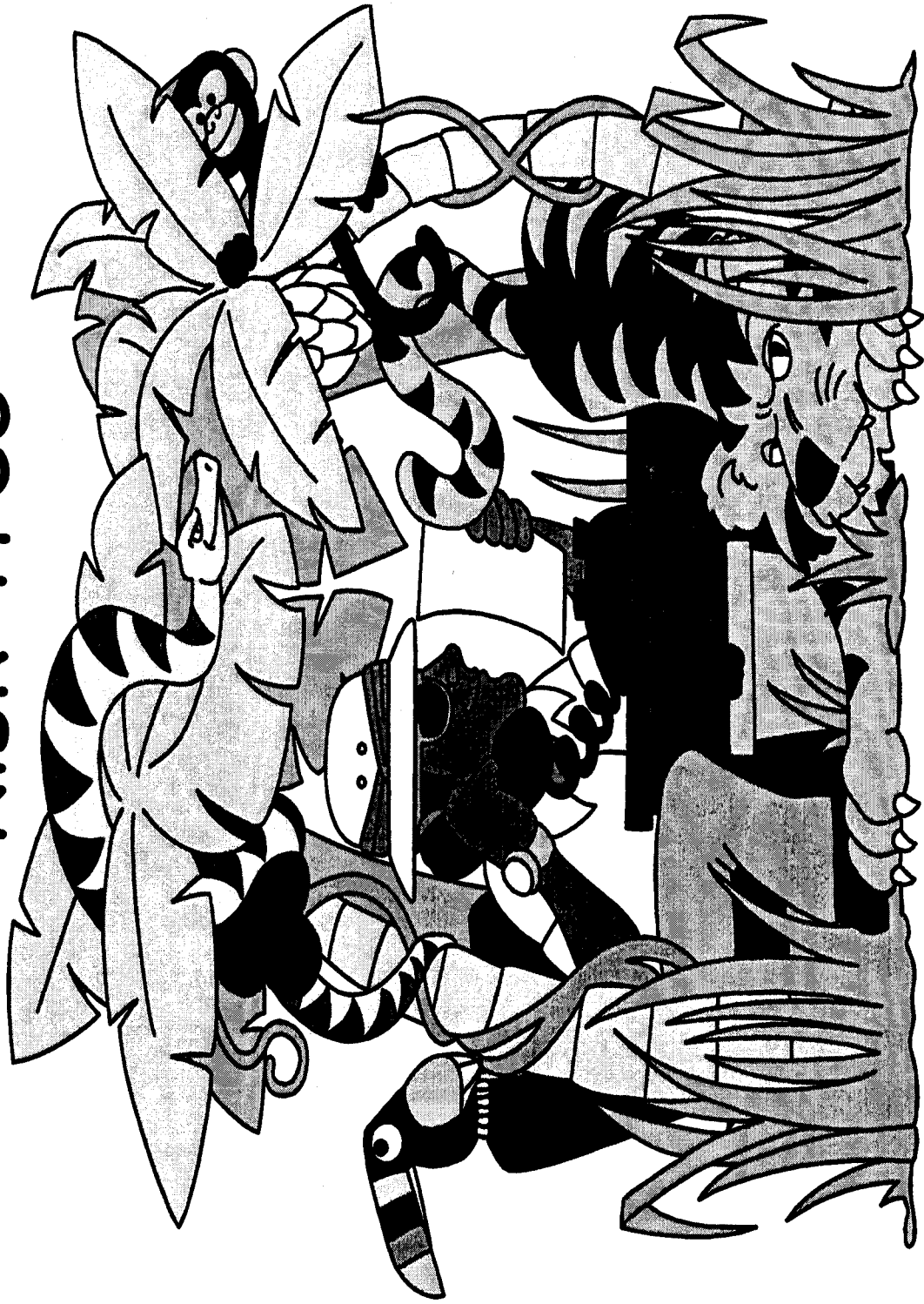
Attached is the section of the MI class where I talk about MORT. There are a few cartoons and such, and I just left them in there. Please feel free to contact me directly if there is ANYTHING I can do.

<<MORT.ppt>>

Larry Gregg  
281-244-1278

# Management Oversight &

# Risk Tree

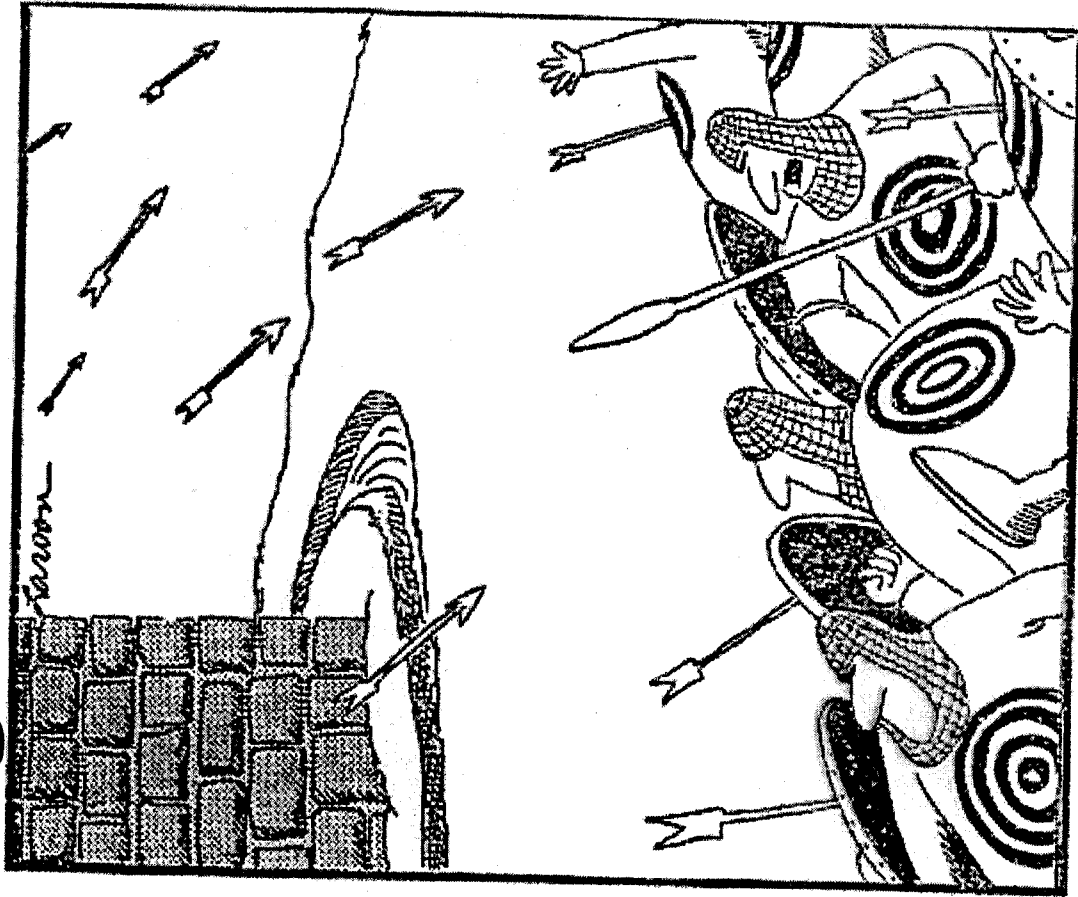


# MORT Principles

Management Oversight and Risk Iree

- A total safety program concept focused on *programmatic* control of safety hazards
- A logic diagram which displays the structured set of interrelated safety program elements and concepts that comprise the MORT Program model.

# Management's Fault?



"What did I say, Boris? . . . These new uniforms are a crock!"

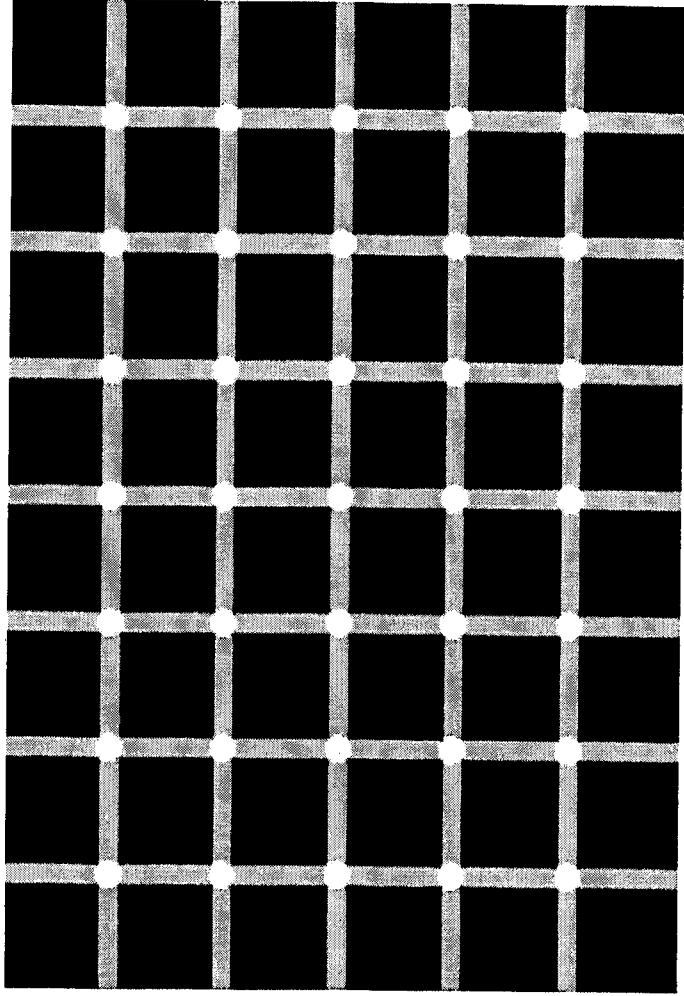


# MORT Principles

MORT does not seek to say that  
everything is management's *fault*,

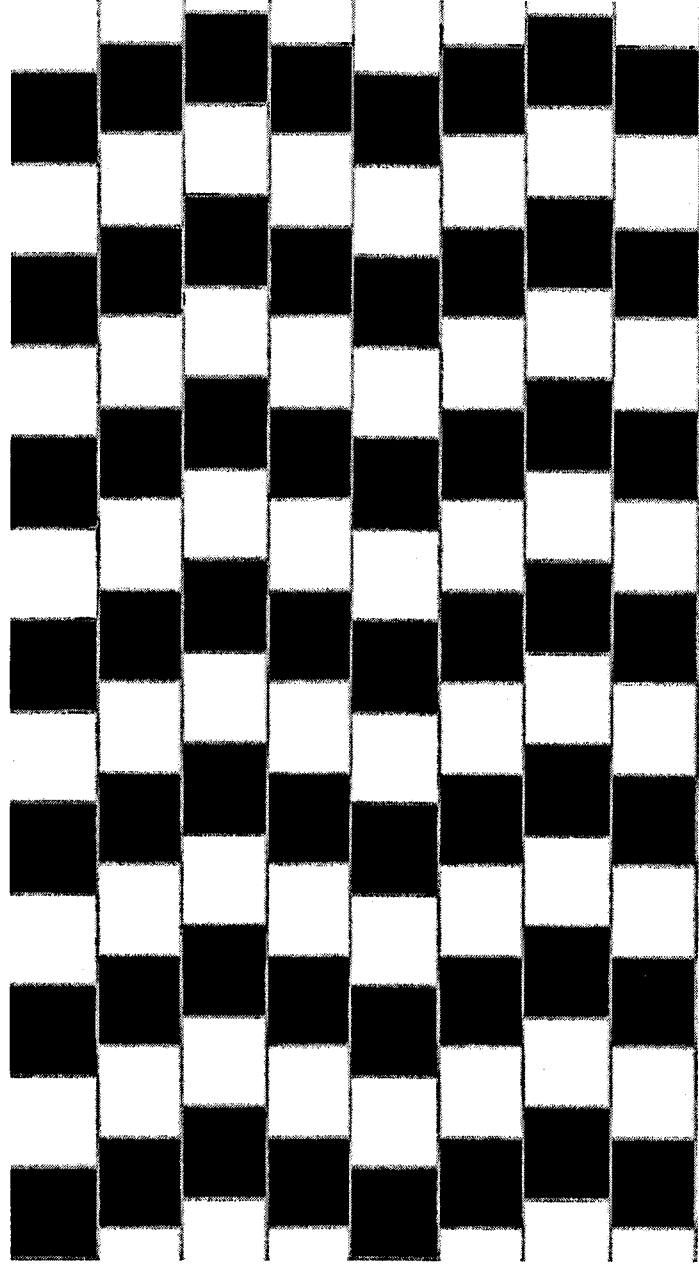
but it does acknowledge the fact that  
everything is management's  
*responsibility*

# Change the Way you Look at Things



Count the black dots! :o)

# Change the Way you Look at Things

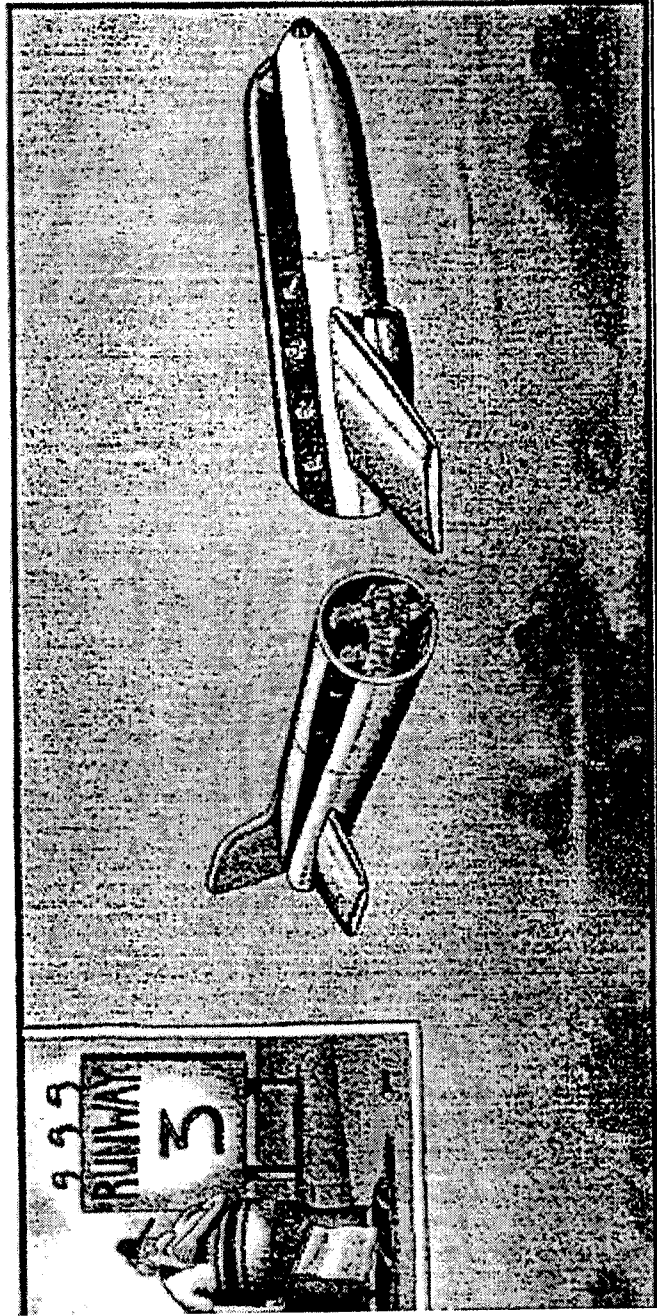


Are the horizontal lines parallel or do they slope?

# MORT Principles

- Basic MORT Principles
  - Safety cannot be assured at the worksite alone (immediate cause vs root cause)
  - Programmatic approach to safety
- MORT most commonly used for MI, but also was designed to be used pro-actively

# Programmatic Approach to Safety



# **MORT Advantages**

- **Goal Oriented**
- **Comprehensive**

# Comprehensive

98 Generic Problems

1,500 Possible Causes

Thousands of Criteria

# **MORT Advantages**

- **Goal Oriented**
- **Comprehensive**
- **Systematic**
- **Effective**
- **Addresses Human Factors Causes**

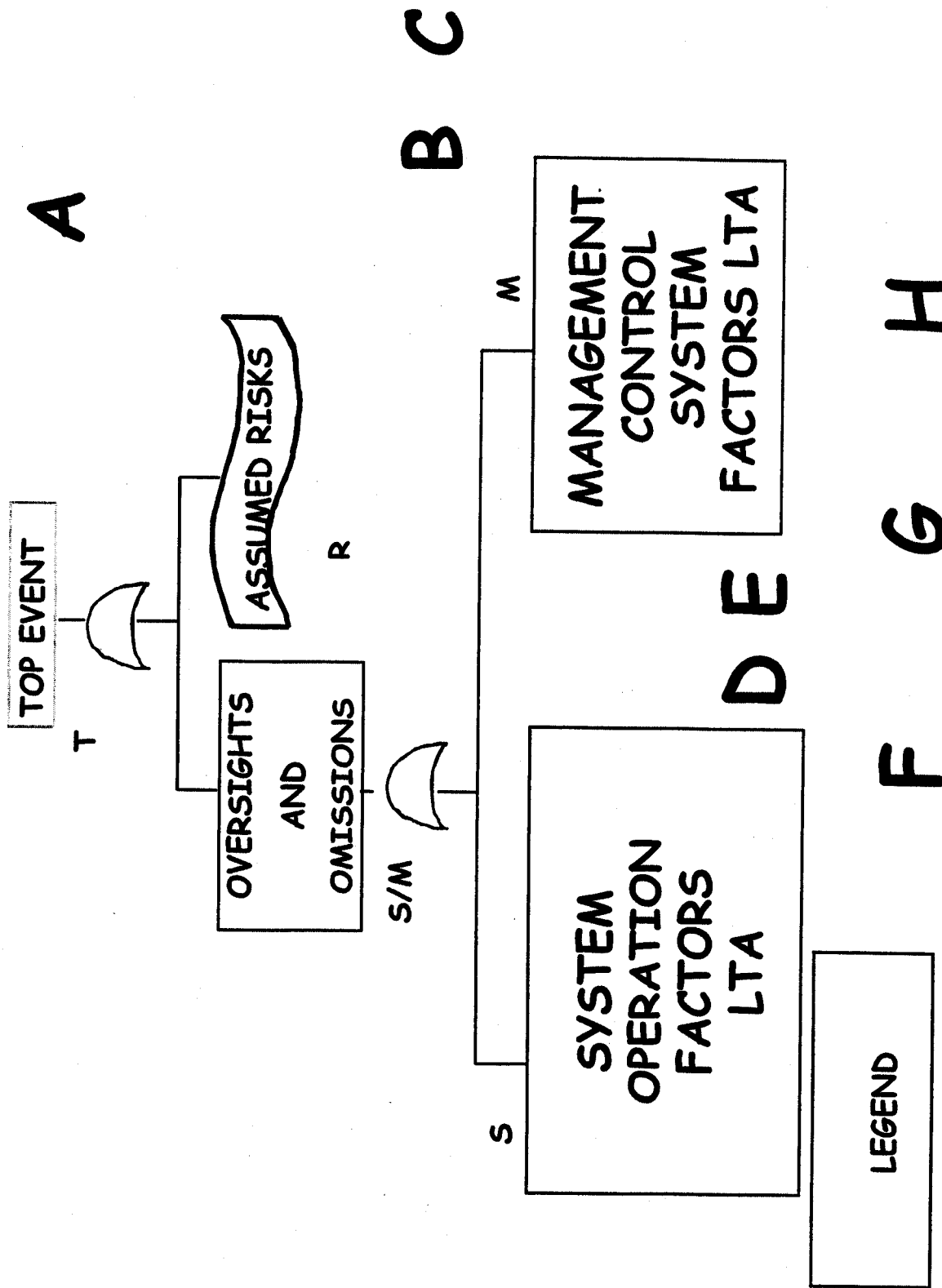


# **DOE-HQ-441-103**

## **MORT User's Manual**

- March 1995 (for use with Nov 94 Diagram)
- Document to Use with MORT Diagram
- Includes a series of interrelated Questions that provide a disciplined method for determining systemic causes and contributing factors.

# The MORT Diagram



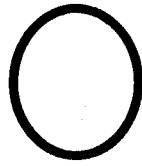
# Legend

- Word & Letter Abbreviations
  - LTA - Less than Adequate
  - D/N - Did Not
  - D/NP - Did Not Provide
  - F/T - Failed To
  - HAP - Hazard Analysis Process
  - JSA - Job Safety Analysis
  - C, S, & R - Codes, Standards, & Regulations

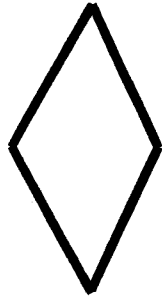
# Legend - Symbols



Event (Fault, Oversight, Condition)



Basic Event (Component/Part Failure)



Undeveloped Terminal Event (Lack of Information, Consequences, Solution)

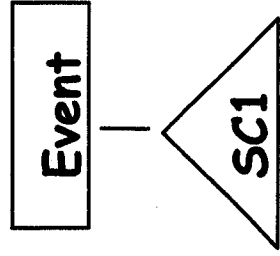


Satisfactory Event/Completion of Analysis

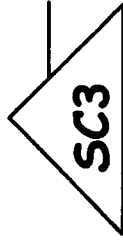


Normally Expected Event

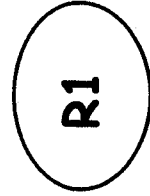
# Legend - Transfers



Transfer In From Event/Element  
SC1

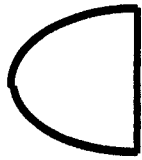


Transfer Out From Event/Element  
SC3



Assumed Risk Transfer

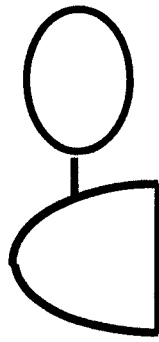
# Legend - Gates



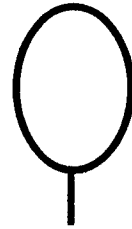
And-Gate



Or-Gate

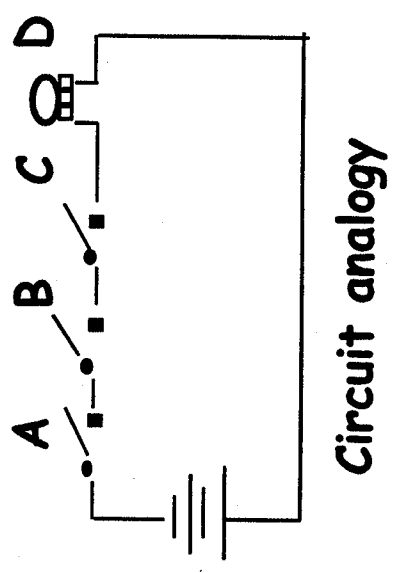
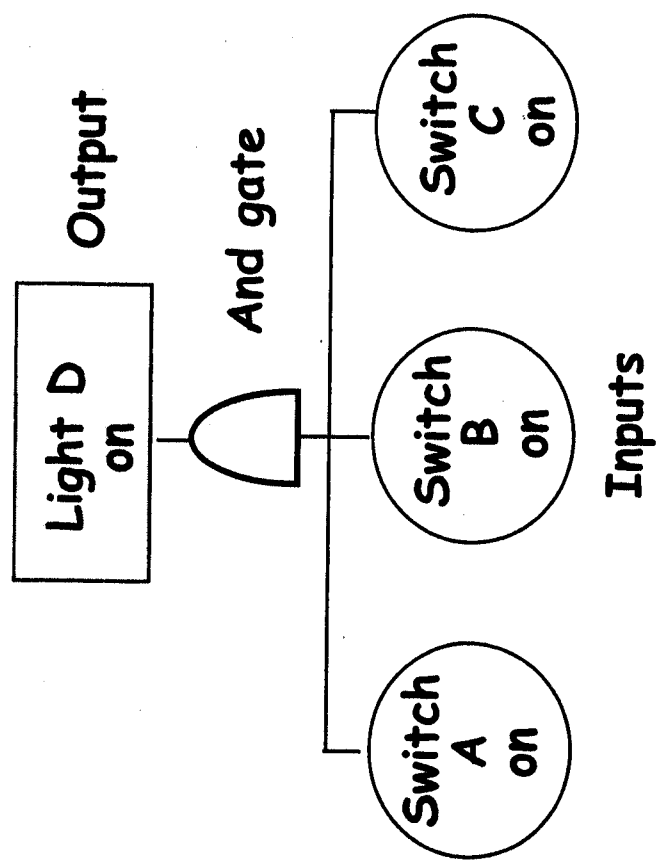


Conditional Gate

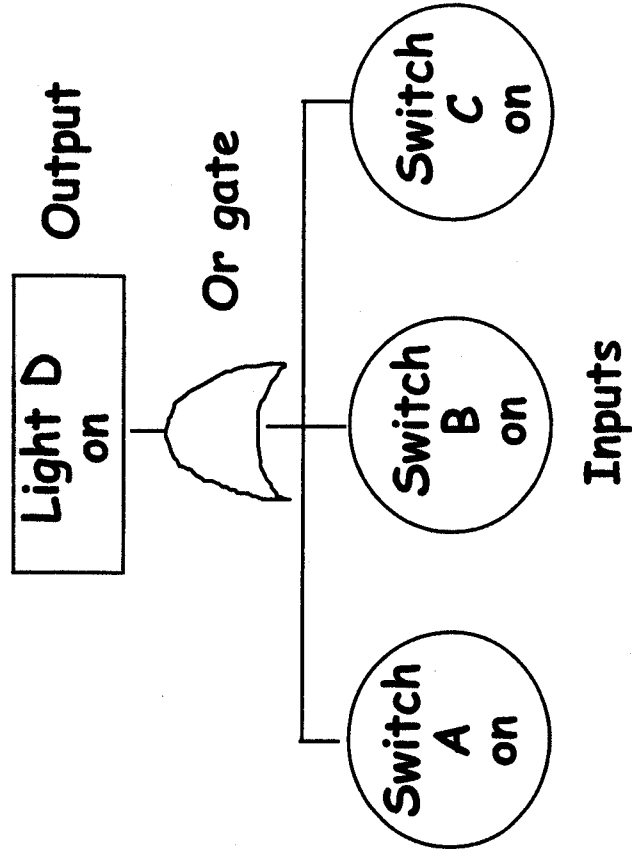
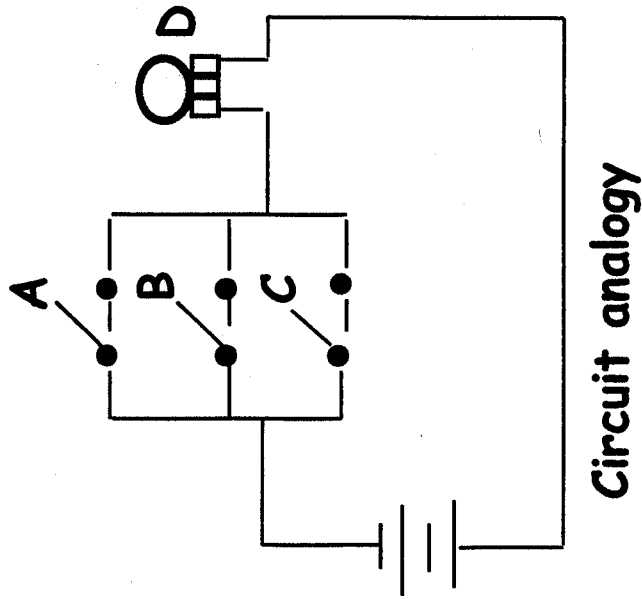


Constraint

# And-Gate Logic



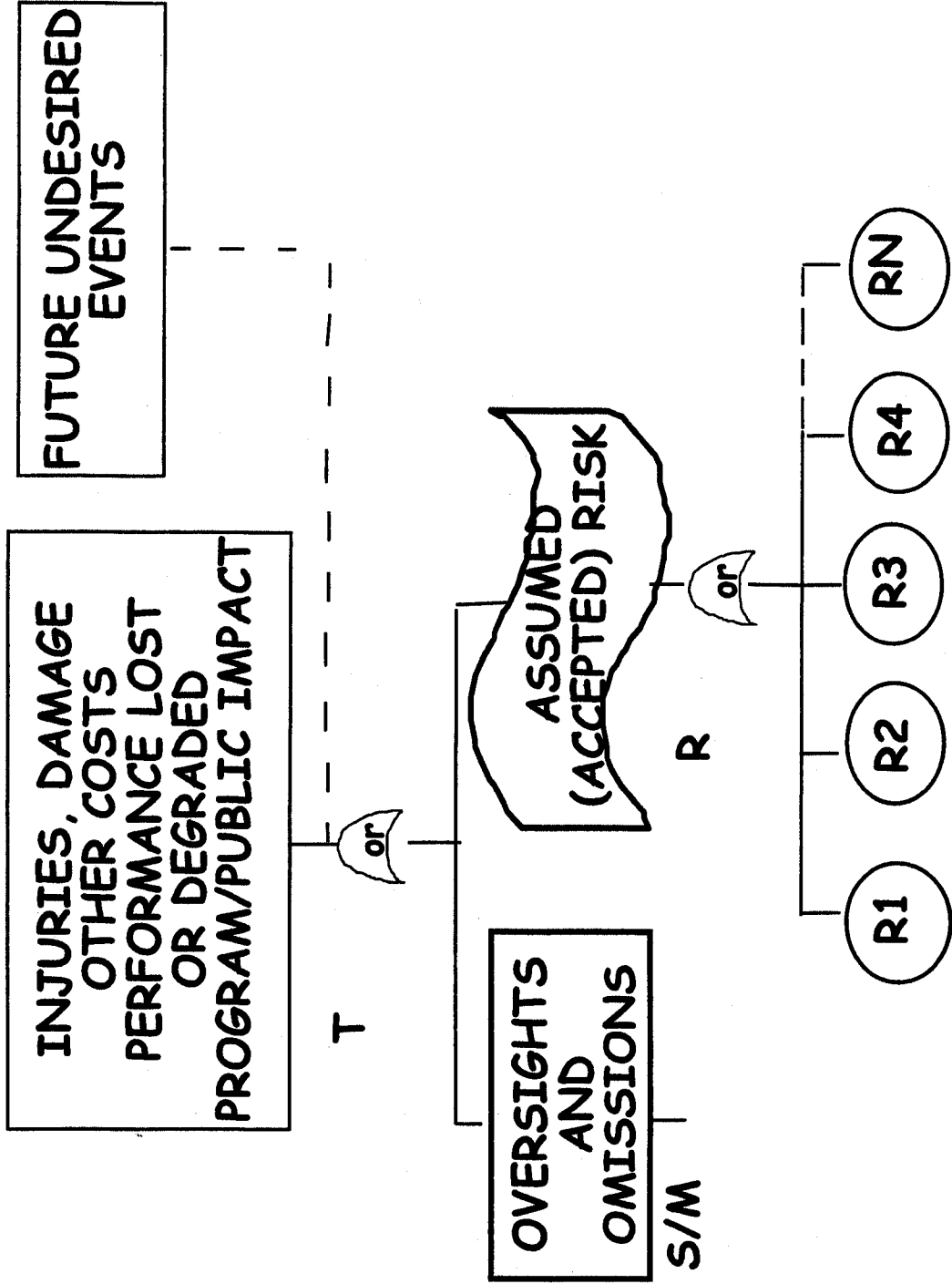
# Or Gate Logic



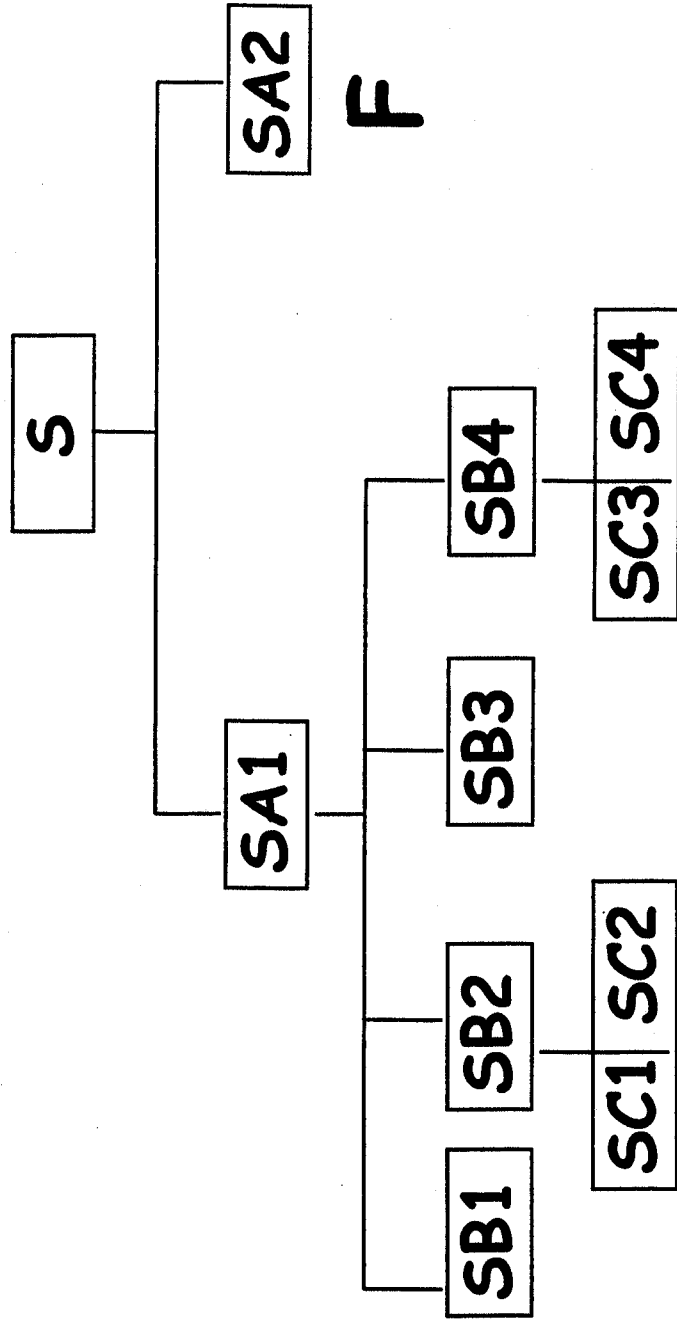


# The MORT Diagram

WHAT & HOW LARGE  
WERE THE LOSSES?



# The MORT Diagram



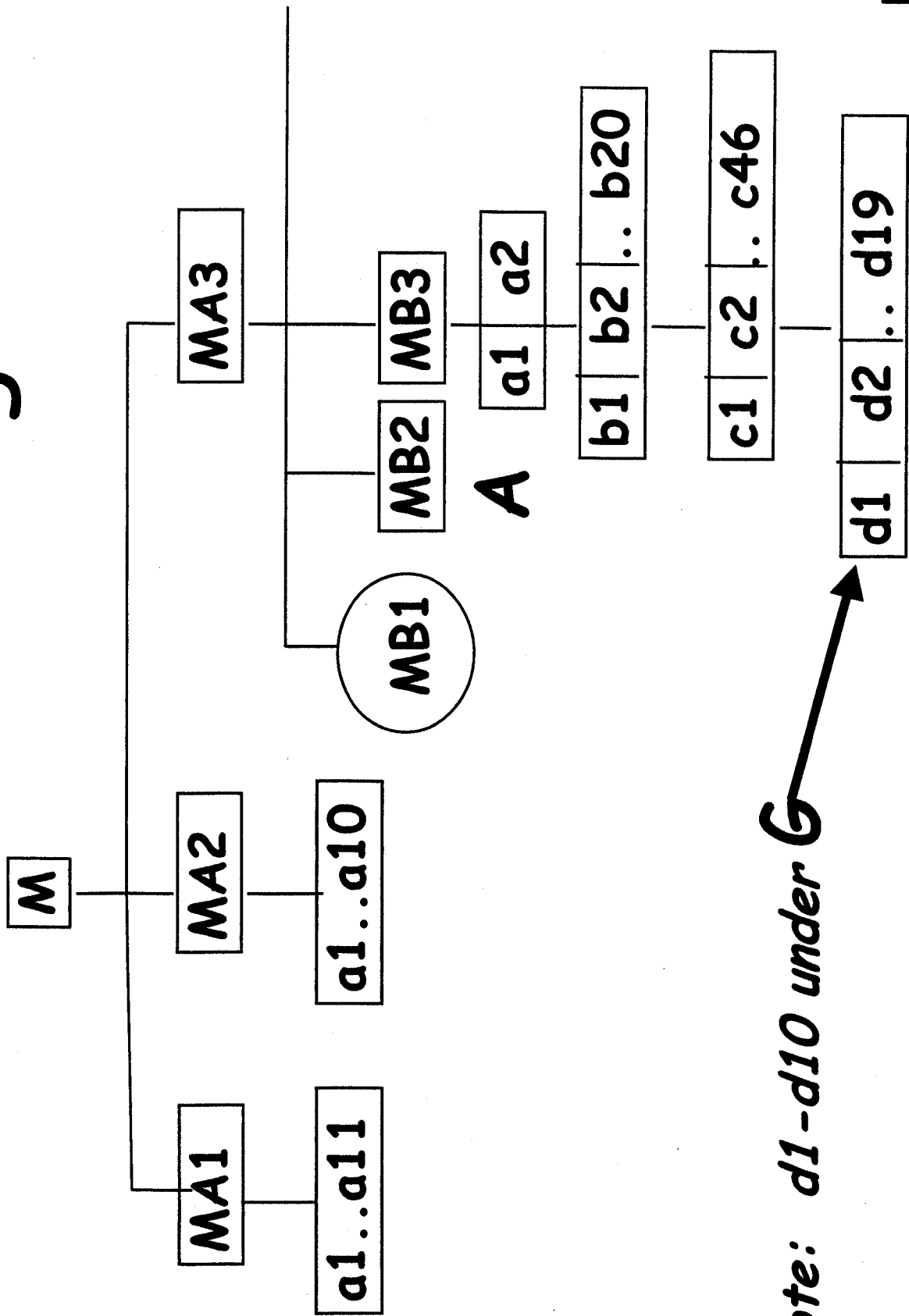
SD1 SD2 SD3 SD4 SD5 SD6

A a1-a4 B C a1-a4 E

b1-b5 D H

g1-g4

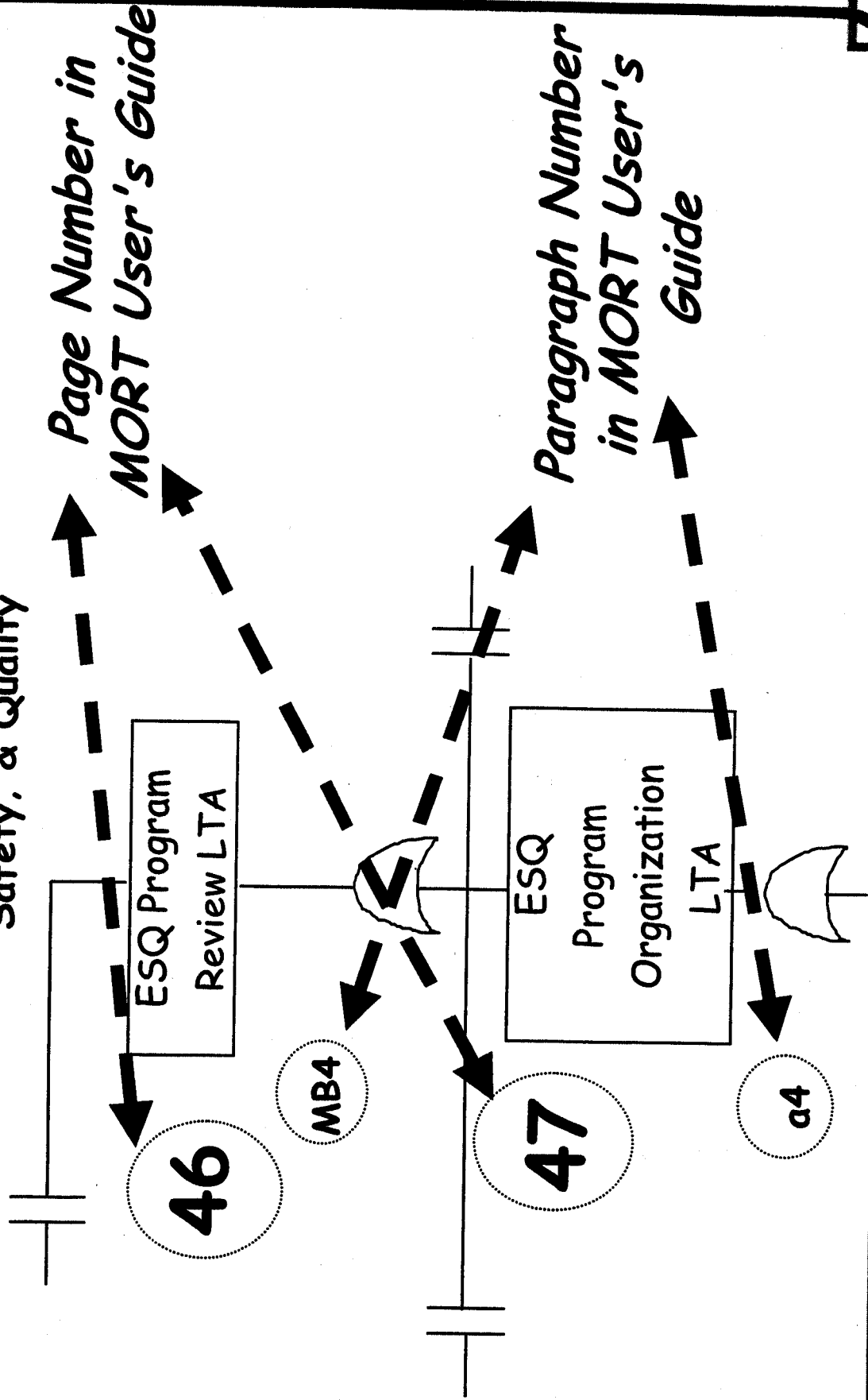
# The MORT Diagram



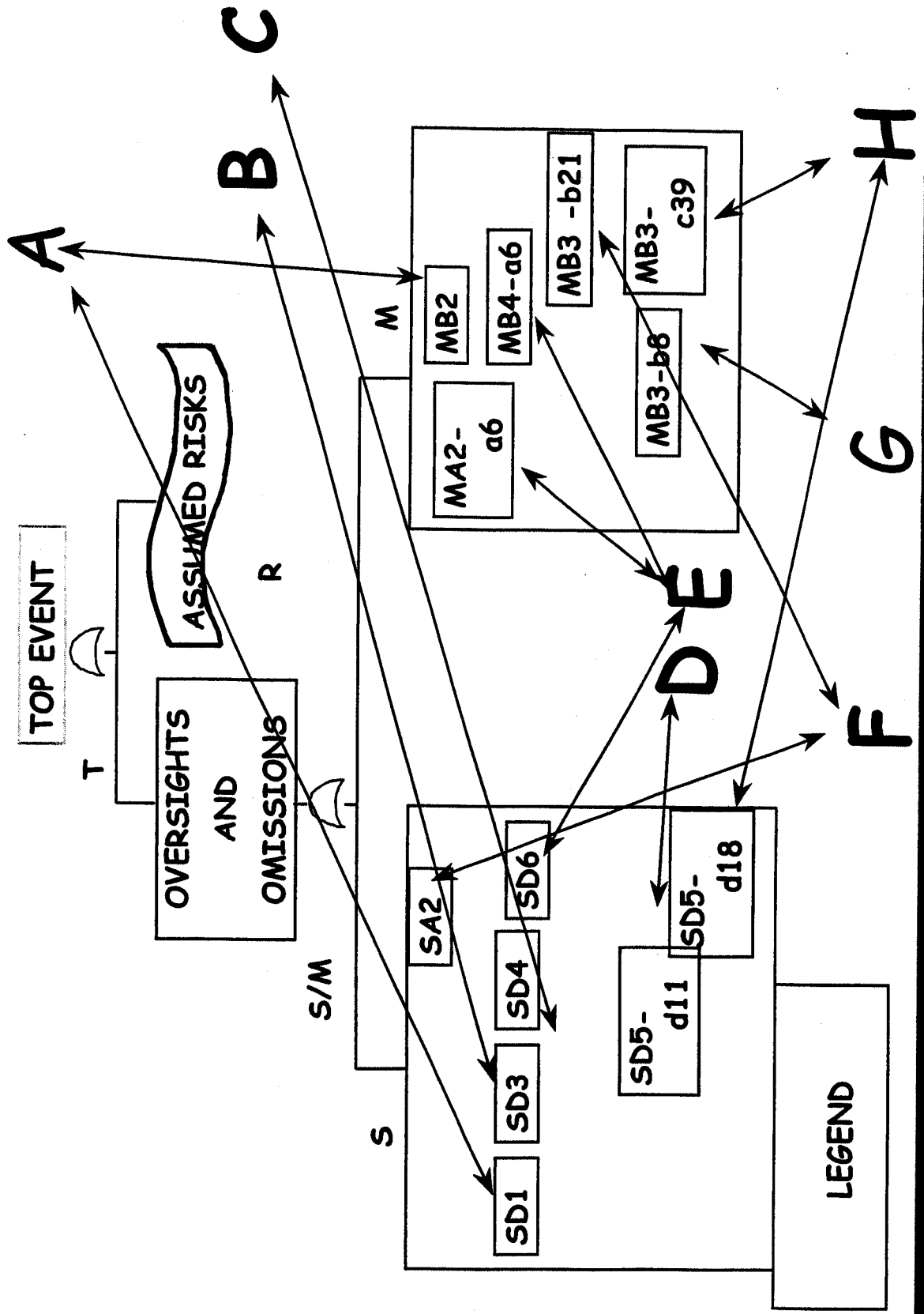
Note: *d1-d10* under *G*

# The MORT Diagram

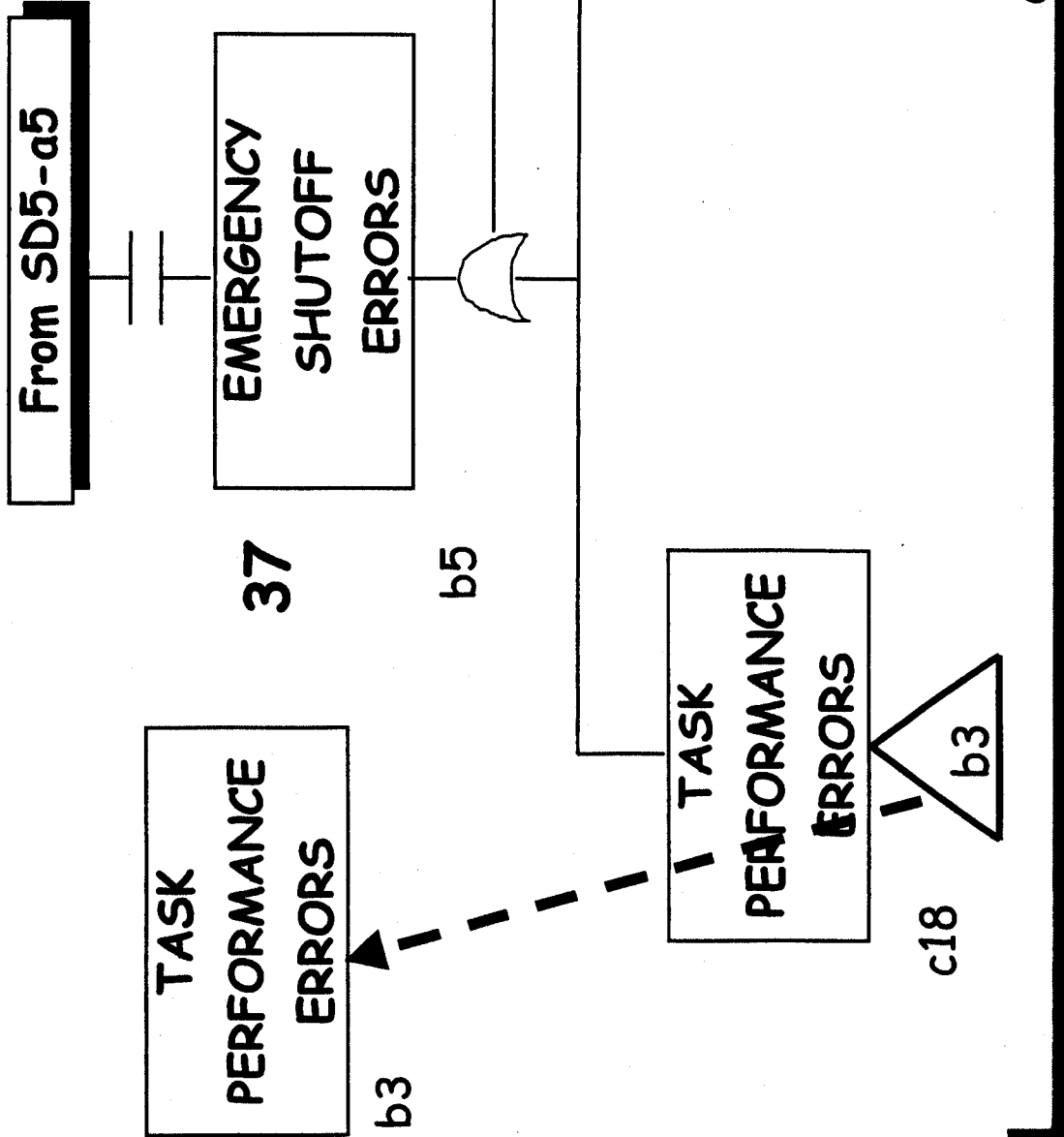
ESQ = Environmental,  
Safety, & Quality



# Sub-Tree Transfers



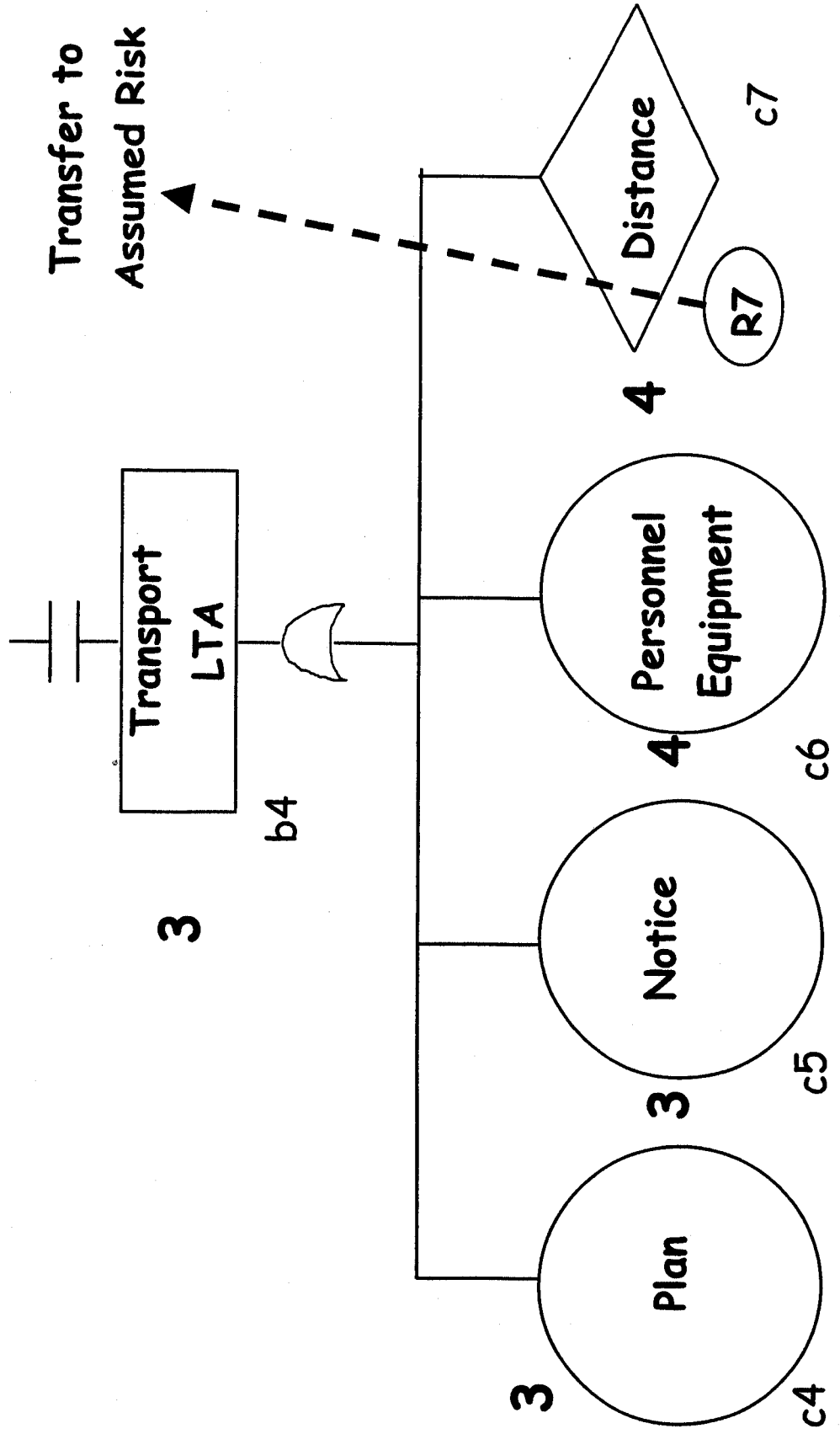
# Transfers





# Risk Transfers

Amelioration LTA





# Using MORT

## Investigate Causes for Top Event (Mishap) Occurrence

- Oversight & Omissions
  - System Operation Factors (What Happened)
  - Management Control System Factors (Why)
- Accepted/Assumed Risk
  - Specific, identified, analyzed, quantified to the maximum practicable degree, and accepted by the right level of management after proper evaluation

# Using MORT

- Energy Trace and Barrier Analysis (ETBA) Technique
  - SB1 - SB4 represent an ETBA
  - Use ETBA to identify barrier and control failures
  - Ask Questions provided under SC1 to identify factors leading to control failures

# Key MORT Areas

- Potential Dominant or Contributing Root Causes (SD1-6)
  - Technical Information Systems
  - Facility Functional Operability
  - Maintenance
  - Inspection
  - Supervision
  - Higher Supervisory Services

# Key MORT Areas

- Task Performance Errors & Human Factors Design - Dominant Root Cause & Contributing Root Causes/factors for Human Error
- Potential Systemic/Programmatic Contributing Root Causes (MA 1-3)
  - Policy
  - Implementation of Policy
  - Risk Assessment System

# Using MORT

- Don't be intimidated
- Use questions in manual to ensure comprehensive evaluation of management policy, system, organization & implementation
- Do initial "quick look" evaluation to help organize your investigation
  - Update after acquiring more information
- Don't get bogged down
  - Use chart as a working tool
  - Evaluate/mark each element as you go