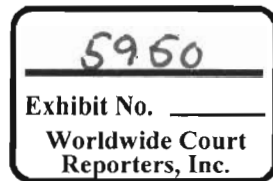


**Implementation of
High Reliability Organization(HRO)
Developments in
BP / Amoco Operations**

**Karlene Roberts and Bob Bea
*karlene@haas.berkeley.edu
bea@ce.berkeley.edu***



What is an HRO ?

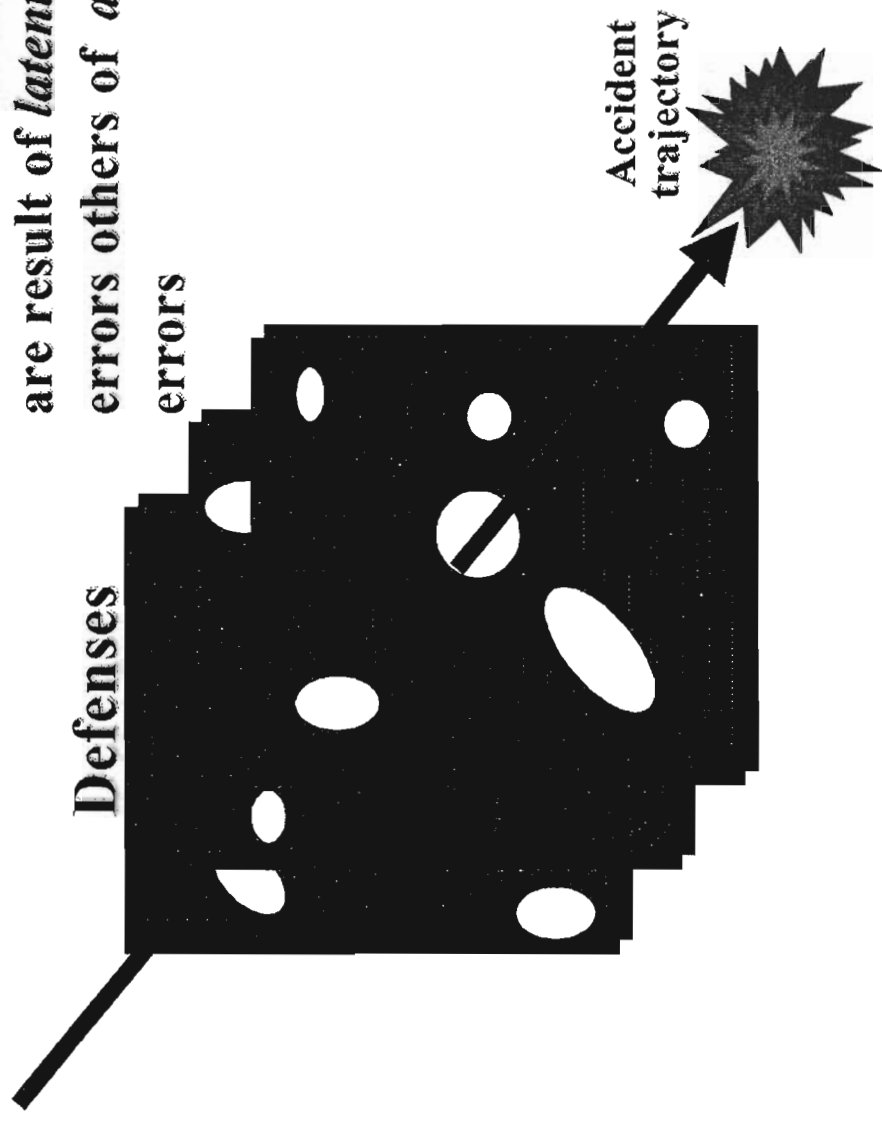
- **An organization**
 - conducting relatively error free operations
 - over a long period of time
 - and making consistently good decisions resulting in
 - high quality and reliability operations

Industries Targeting High Reliability Operations

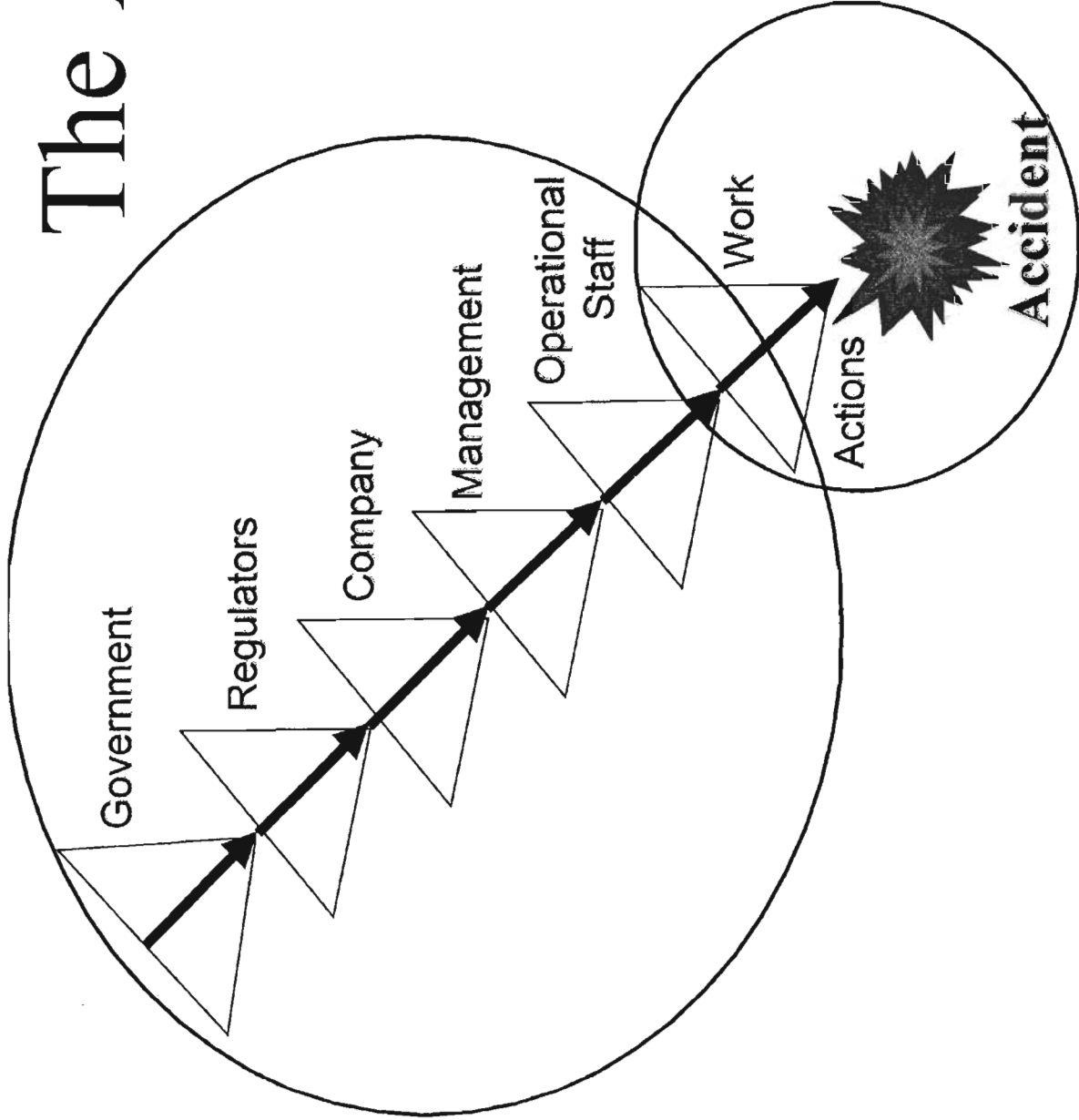
- Commercial Air Lines
- US Naval Carrier Aviation
- Commercial Banking
- Healthcare Industry
- Commercial Nuclear Power Industry
- Commercial Marine Industry
- Community Emergency Service (Incident Command Systems)
- Law Enforcement

Swiss Cheese Model

Some holes in defenses
are result of *latent*
errors others of *active*
errors



The Arrow

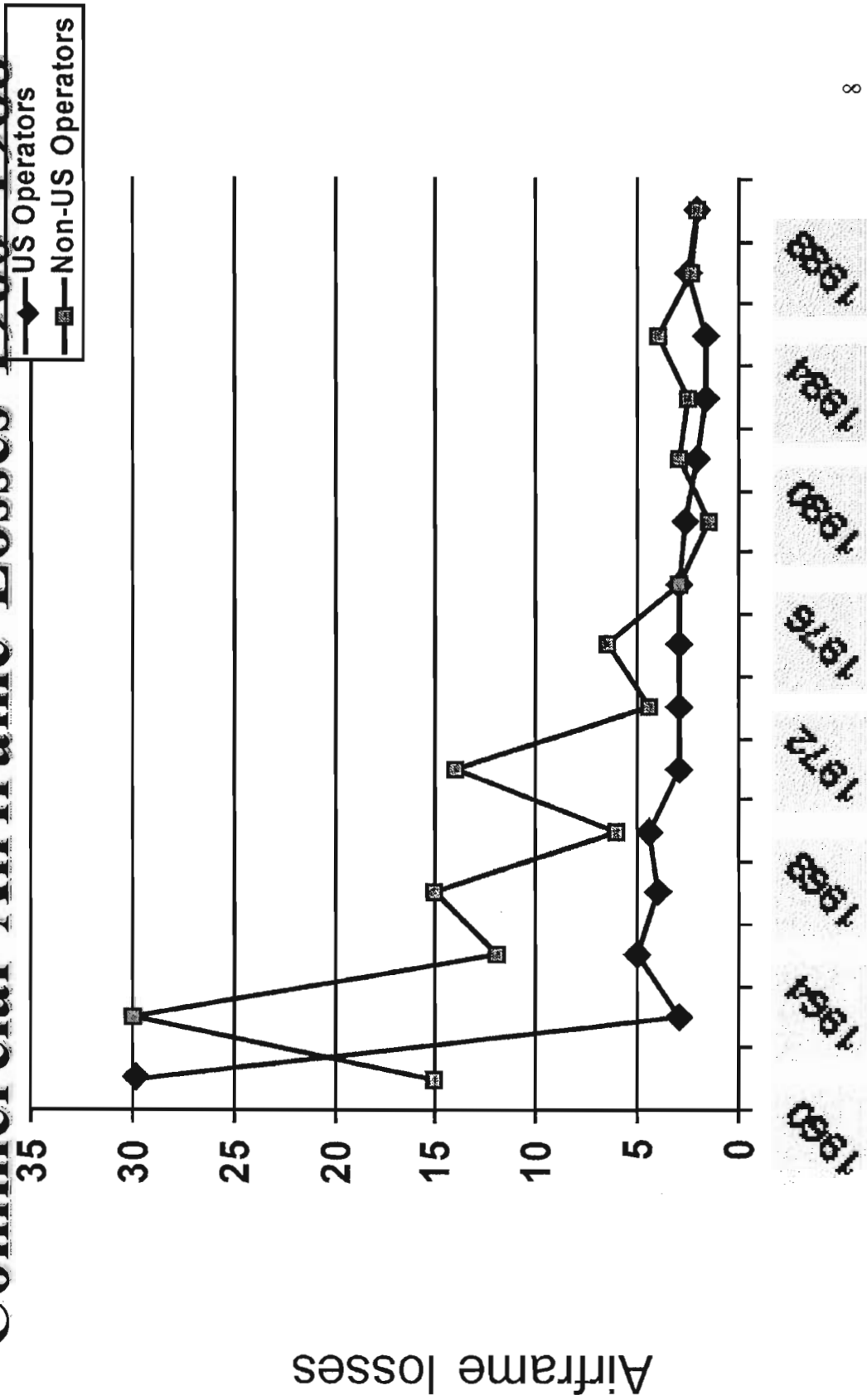


Safety

- Safety emerges from the interaction of components of the system.
- It is more than the absence of adverse outcomes.
- It is more than the avoidance of identifiable “preventable” errors or occurrences.

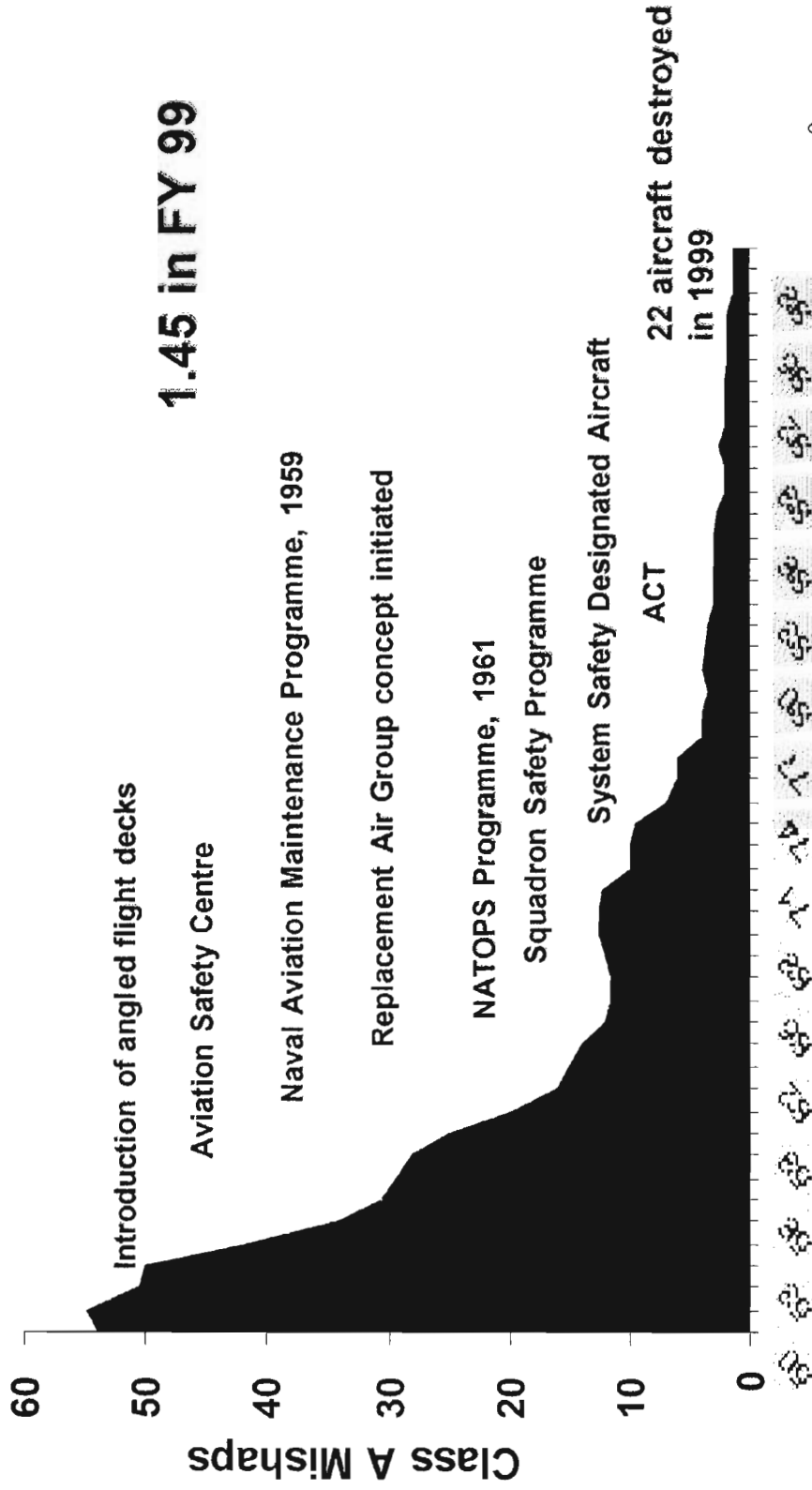
- Safety does not reside in a person, device or department.
- Improving safety depends on learning how safety emerges from the interactions of the components.

Commercial Airframe Losses 1960-1988



Naval Aviation Mishap Rate FY 1950-99 (per 100K flight hrs)

776 aircraft destroyed in 1954



• WHY DO THEY DO IT?

IT IS TOO EXPENSIVE NOT TO



HOW DO THEY DO IT?

HRO hypotheses
Libuser, Roberts, 1993

- **Extensive process auditing**
- **Risk mitigating reward systems**
- **Higher quality standards**
- **Risk perception**
- **Command & control systems**

1. Process Auditing:

- An established system for ongoing checks designed to spot expected as well as unexpected safety problems.
- Safety drills are in this category, as is equipment testing.
- Follow-ups on problems revealed in prior audits are critical.

2. Reward System:

- The reward system is the payoff an individual or organization receives for behaving one way or another.
- Organizational theory points out that organizational reward systems have powerful influences on the behavior of individuals in them.
- Similarly, inter-organizational reward systems also influence behavior in organizations.

3. Quality Degradation:

- Avoiding degradation of quality and/or developing inferior quality: This refers to the essential quality of the system as compared to a referent generally regarded as the standard for quality in the industry.

4. Perception of Risk:

- There are at least two elements of risk perception;
 - (1) Whether or not there is knowledge that risk exists, and
 - (2) If there is knowledge that risk exists, the extent to which it is acknowledged and appropriately mitigated and/or minimized
- Part two is a logical outgrowth of part one.

5. Command and Control Elements:

- Migrating decision making: (the person with the most expertise makes the decision).
- Redundancy: (people and/or hardware), i.e., backup systems exist.
- Senior managers who see the “big picture”: i.e., they don’t micromanage.
- Formal rules and procedures: A definite existence of hierarchy but not necessarily bureaucracy in the negative sense.
- Training.

HRO 'hows'
Weick, Sutcliffe, Obstfeld (1998)

- **Preoccupation with failure**
- **Reluctance to simplify interpretations**
- **Sensitivity to operations**
- **Commitment to resilience**
- **Under-specification of structures**
- **Highly developed capability infrastructures**

Non-HRO's

- **Focus on success**
- **Underdeveloped cognitive infrastructure**
- **Focus on efficiency**
- **Inefficient learning (episodic)**
- **Lack of diversity (focused conformity)**
- **Information & communications filtering**
- **Reject early warning signs of quality degradations**

Non-HRO's

Weick, Sutcliffe, Obstfeld (1998)

- “organizations in which people shuffle papers and lose a few,
- attend meetings and solve nothing,
- catch airplanes and miss ‘connections’,
- conduct briefings and persuade no one,
- evaluate proposals and miss the winners, and
- meet deadlines for projects on which the plug has been (or should be) pulled”

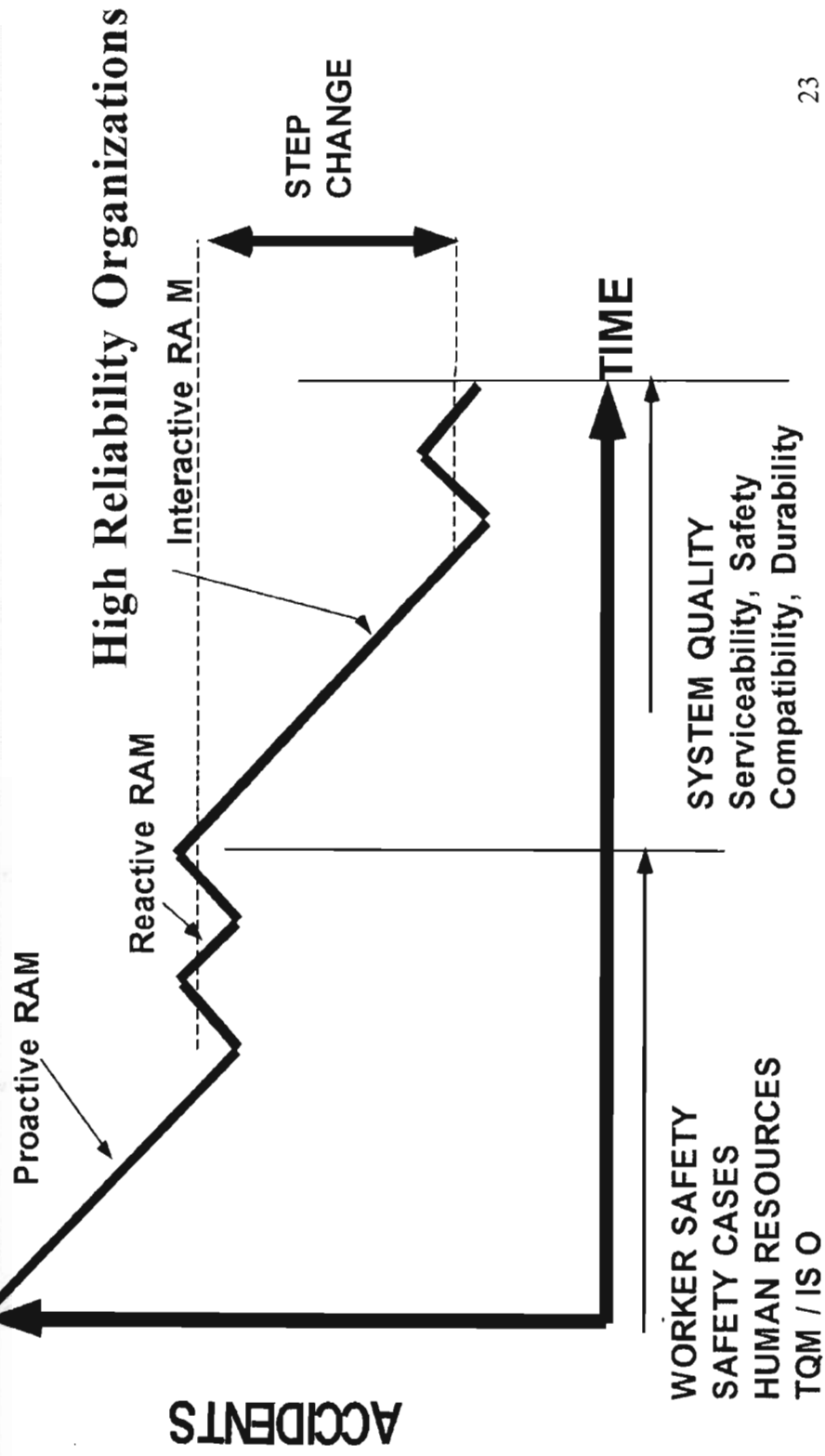
ORGANIZATION change & development

- **Episodic change based LRO's**
 - **Efficiency**
 - **Short-run adaptations**
 - **Imitation motivations**
 - **Operate at 'edge of chaos'**
 - **Logic of replacement (what to do)**
 - **High inertia**

The 'learning HRO's'

- **Continuous change based HRO's**
 - Natural adjustments
 - Continuous learning
 - Redirected efforts (adaptations)
 - Intentionally stabilizing
 - Logic of attraction (how to be)
 - Low inertia

Step Change in Quality Assessment & Management (QAM)

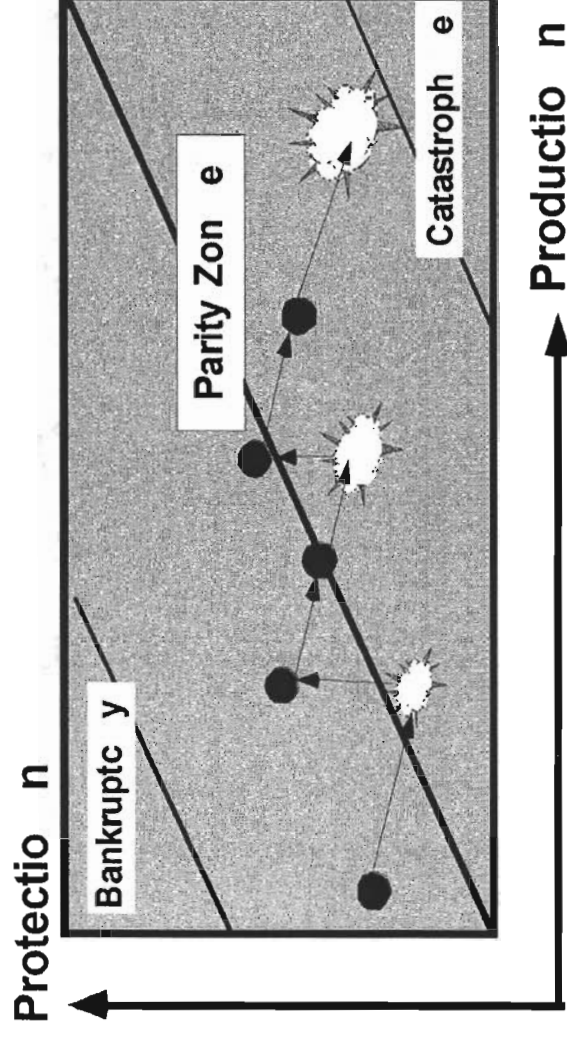


**Implementation success factors =
5 C's (7 U.S. energy industry orgs.)**

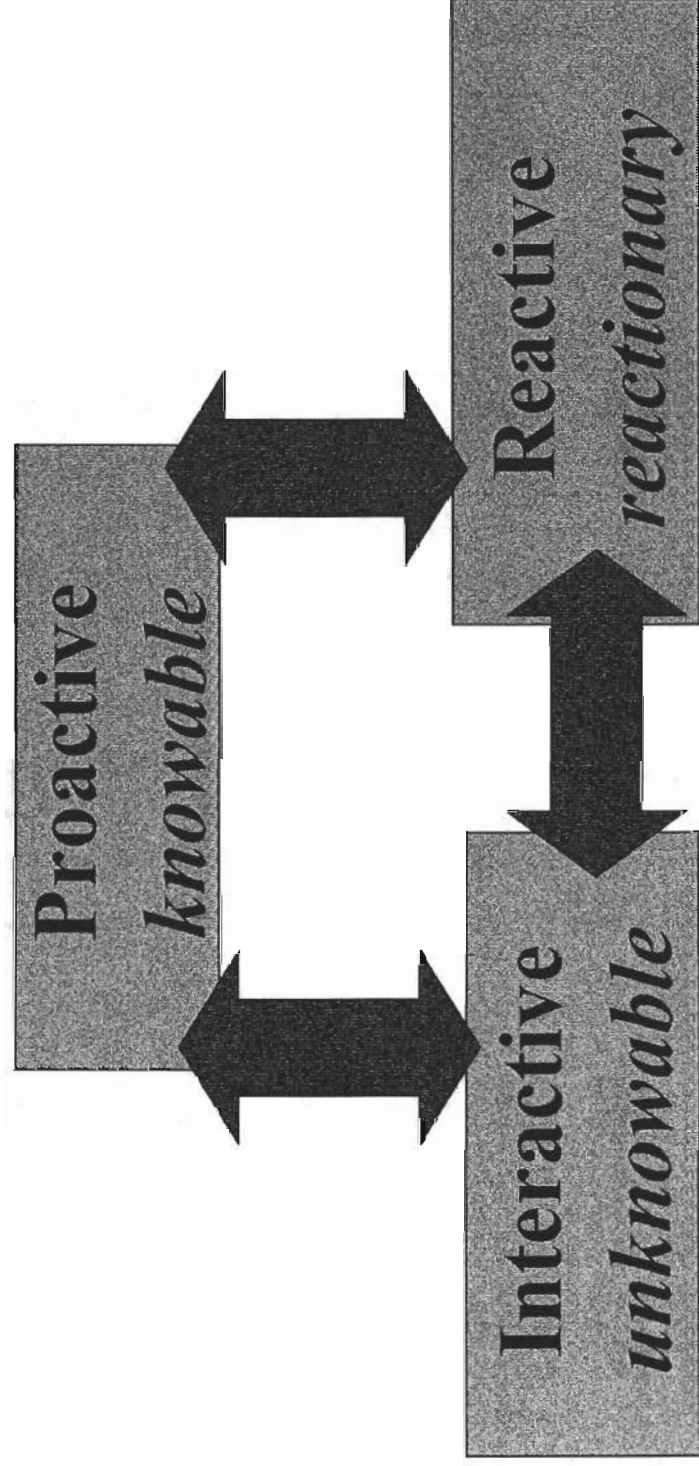
- **Commitment** - top down and bottom up
- **Capability** - sensitivity and technical / management abilities
- **Cognizance** - awareness of hazards, risks
- **Culture** - quality & reliability
- **Counting** - measures created to recognize tangible financial and intangible benefits

**2 out of 7 'succeeded' temporarily
but, the pipes are leaking again!**

- **Leaders retired**
- **New leadership**
- **New agendas**
- **Down-sizing**
- **Out-sourcing**
- **Cost-cutting**
- **Destabilized**



3 primary QAM approaches



3 primary QAM strategies

Reduce Likelihoods -
HROs & SMAS

Reduce effects -
*robustness &
human friendly*

Increase detection
& correction -
*requisite variety &
expert QA/QC*

QUALITY
ability to satisfy requirements

Serviceability
use for purpose for conditions

Safety
acceptability of risks

Compatability
acceptability of impacts

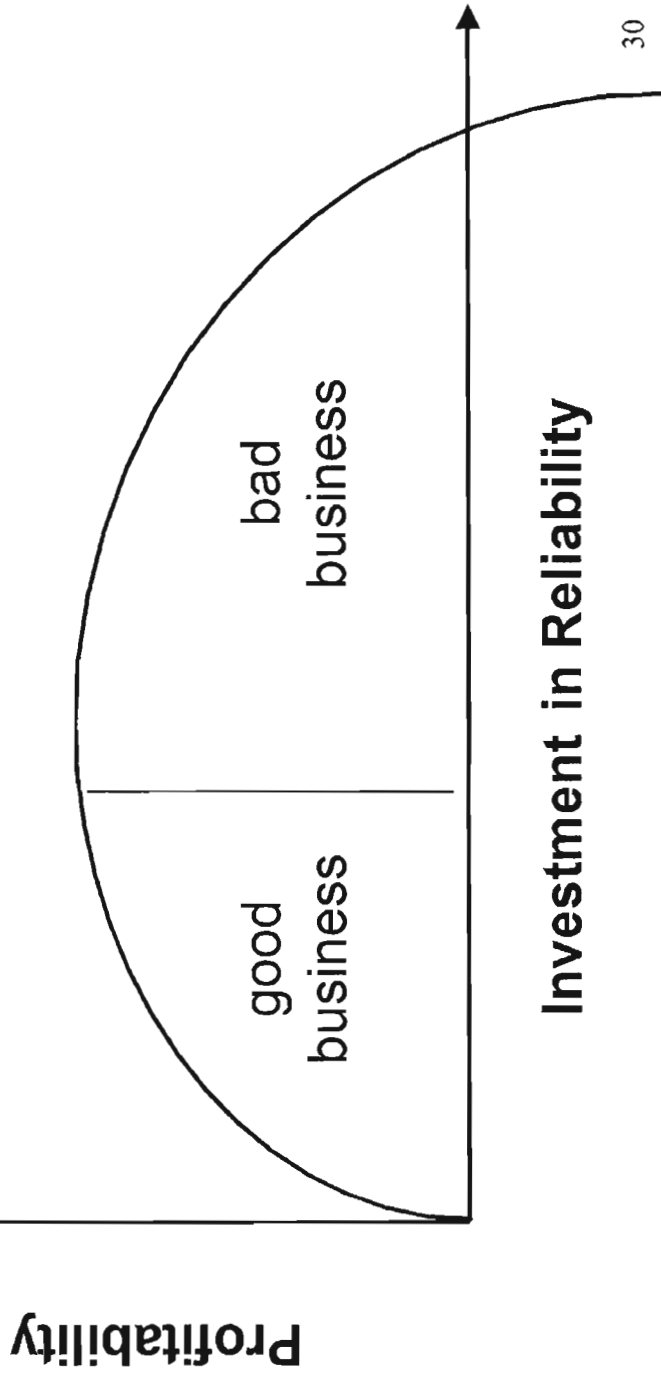
Durability
freedom from unanticipated degradation

Reliability = likelihood of realizing desirable Quality

Implementation results measurements: benefits >>costs

- **Not simple or easy**
- **More often done poorly**
- **Challenge is not to let measurement become the objective**
- **The objective is improved quality and reliability to reduce costs & increase income**
- **Qualitative and quantitative measurements**

Business metric #1 = money!
***Profitability provides the resources to
achieve improved quality & reliability***

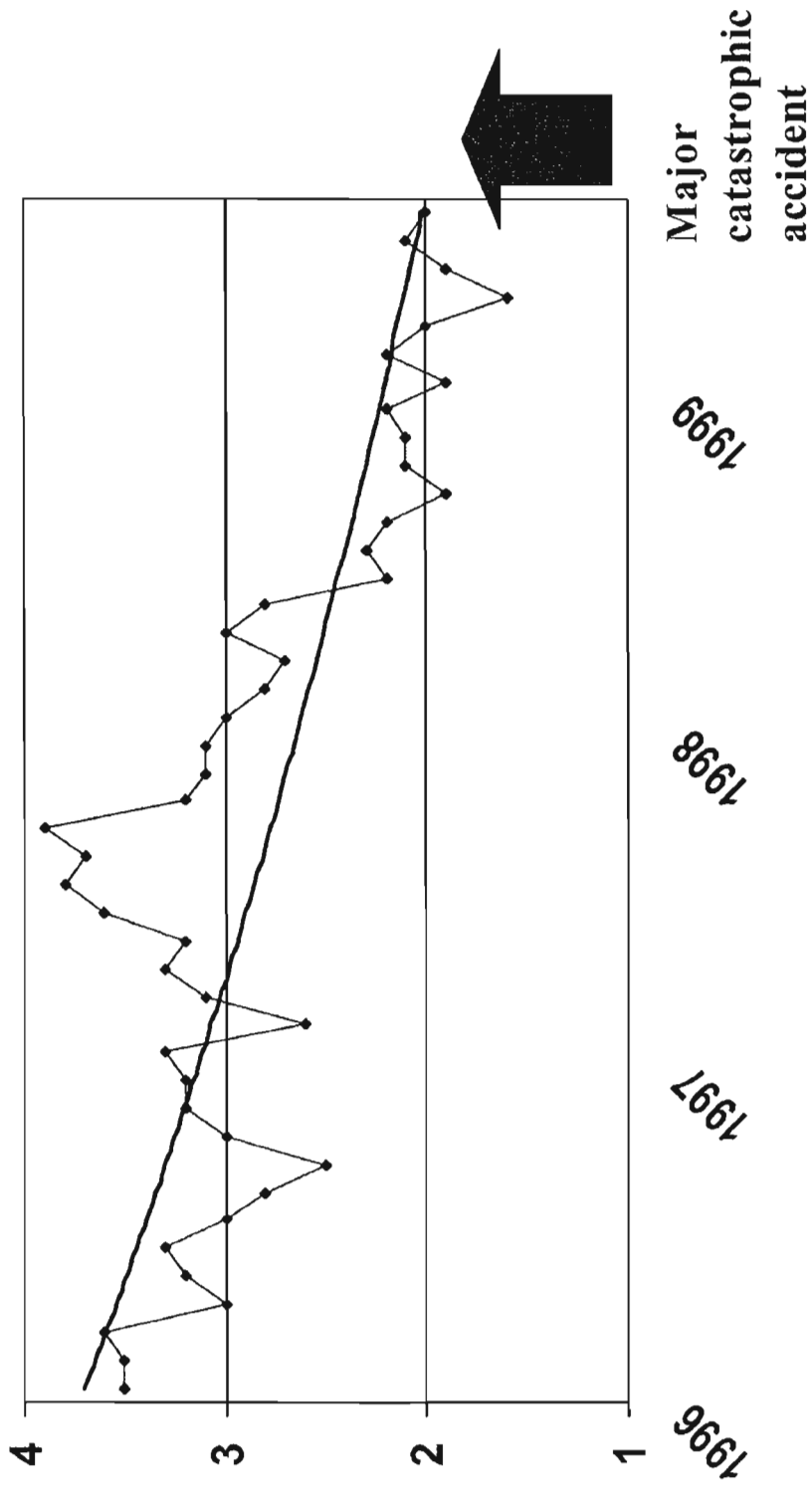


**Must have clear vision of what
trying to accomplish!**

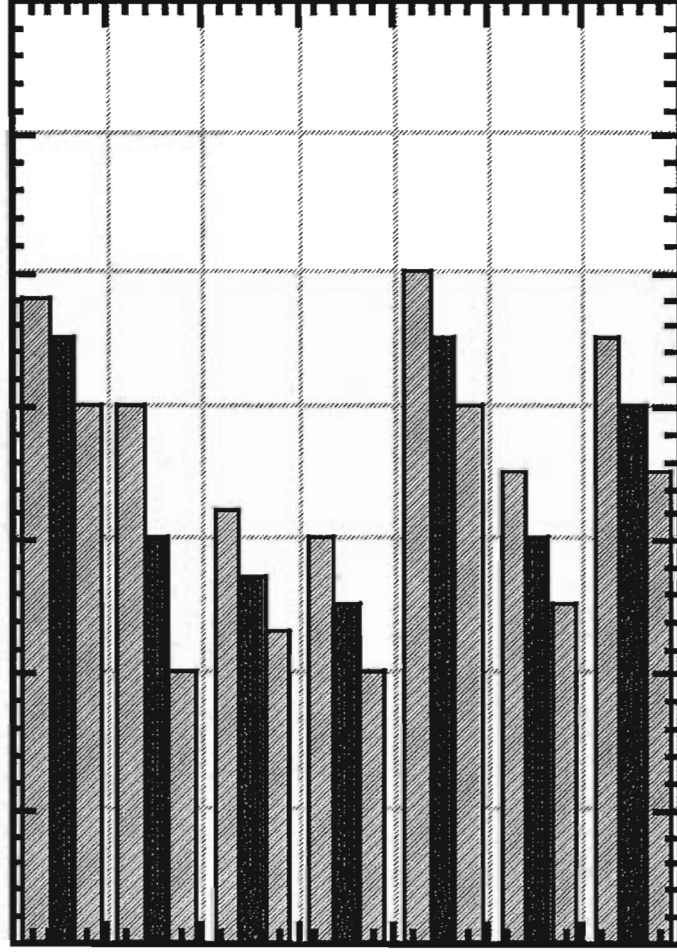
- Reduce lost time incidents / accidents - safety
- Increase productivity / decrease lost production
- Increase capture of new production opportunities
- Reduce major / catastrophic losses

all require similar but different strategies

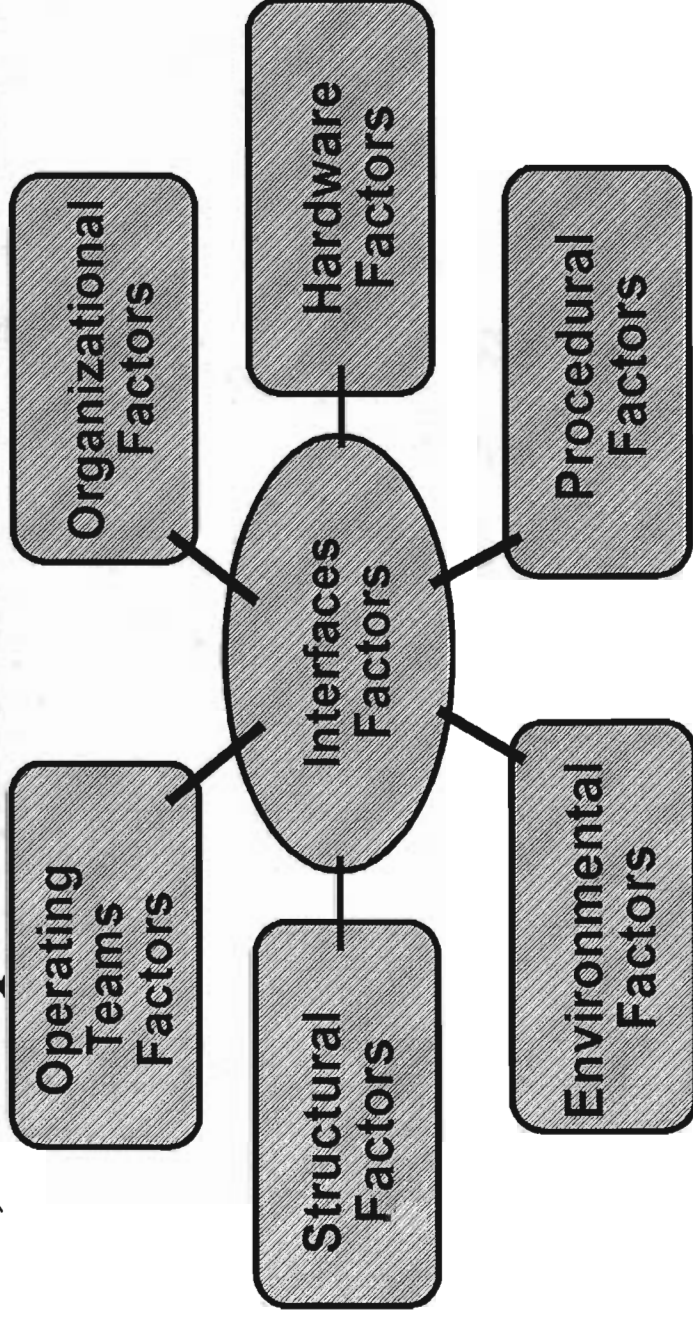
Lost time accidents metric



Lead Indicators: *I-QMAS reviews*



How to measure an HRO? *Quality Management Assessment System* *(QMAS) components*



QMIAS components, factors, attributes



COMPONENTS

- 1 - operators, 2 - organizations, 3 - procedures, 4 - equipment, 5 - structure, 6 - environments, 7 - interfaces

FACTORS - *graded*

- 1.0 - operators
- 1.1 - communications, 1.2 - process auditing, 1.3 - safety culture, 1.4 - risk perception 1.5 - emergency preparedness, 1.6 - command & controls 1.7 - training, 1.8 - resources, 1.9 - requisite variety

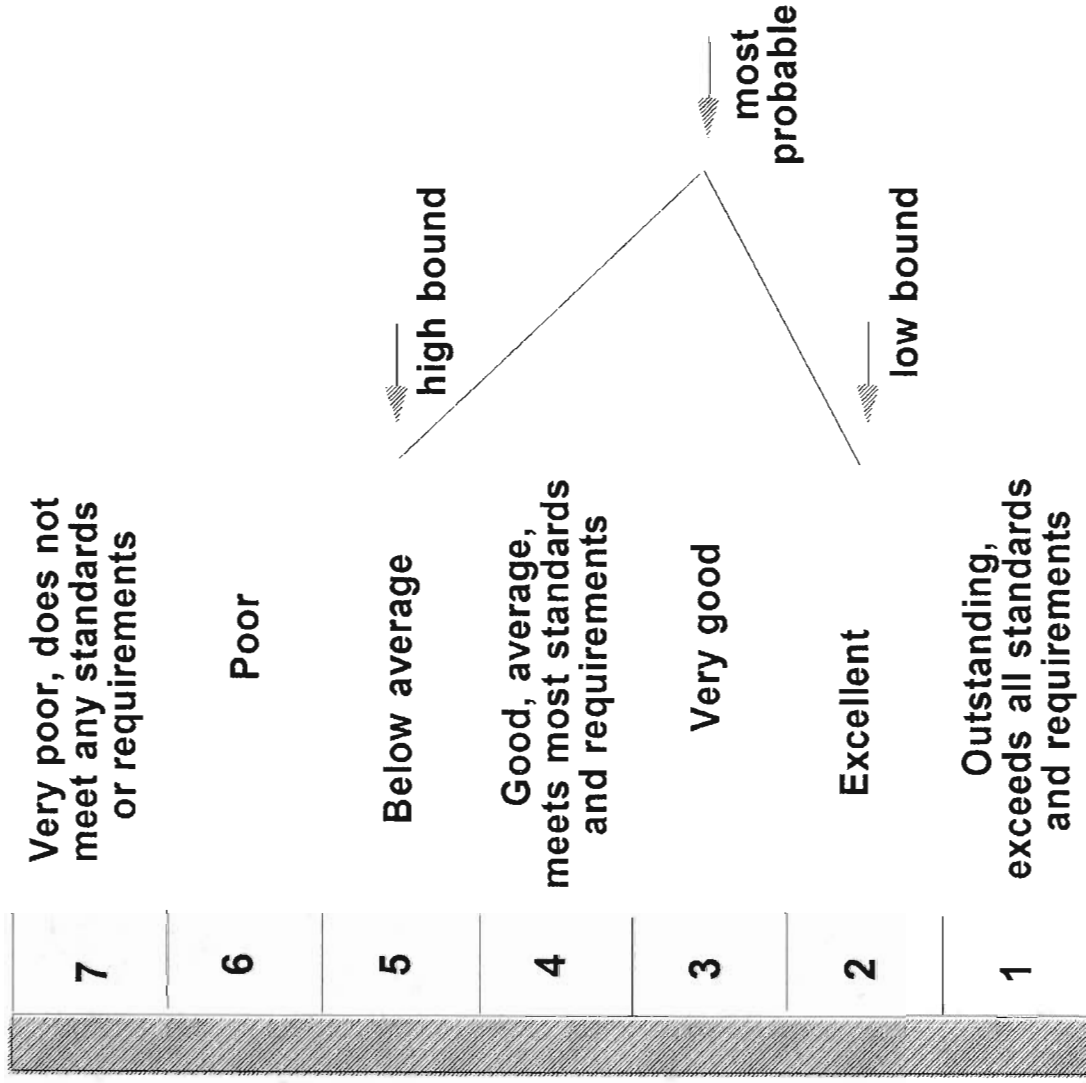
ATTRIBUTES - *reasons for grades*

- 1.1 - communications
- 1.1.1 - same language, 1.1.2 - same vocabulary, 1.1.3 - established forms, 1.1.4 - clarity, 1.1.5 - concise, 1.1.6 - timely, 1.1.7 - appropriate amount 1.1.8 - feedback, 1.1.9 - no significant barriers

QMAS factors

Operating Teams Process Auditing Safety Culture Risk Perception Emergency Preparedness Command & Controls Training Communications Requisite Variety	Organizational Process Auditing Safety Culture Risk Perception Emergency Preparedness Command & Controls Training Communications Resources	Procedures Operating Maintenance QA/QC Contractor selection Pre-start up review Emergency response Management of change Validations
Equipment Design guidelines and specifications Materials Demand systems Power systems Configurations Control systems	Structure Design guidelines & specifications Materials Loadings Structure configuration Computer programs Research, development and testing background	Environmental External (Weather) Internal Social External - (Regulatory, Society) Social (Internal) (Within organization and operating team)
Operators & other Organizations & other	Interfaces Procedures & other Environmental & other	Equipment & other Structure & other

QMAS gradings



Phase 1 Menu Main Menu

Module Name: 01 Operating Team 05

Factor Name: Culture 24

Attribute Name/Definition: Shared Attitudes 032

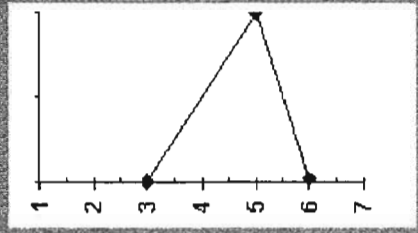
To what extent does a safety culture characterize the operating team? (Def'n: Attitudes, Values, Behavioral norm, and Expectations toward safety shared by members)

Shift members have the same attitudes about how to work.

Likelihood Worst Not Applicable

- Always True
- Almost Always True
- Majority of the time True
- Most of the time True
- Sometimes True
- Infrequently True
- Never True

Best	1	2	3	4	5	6	7
	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Likelihood	1	2	3	4	5	6	7
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most Probable	1	2	3	4	5	6	7
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Worst	1	2	3	4	5	6	7
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>



Comments:

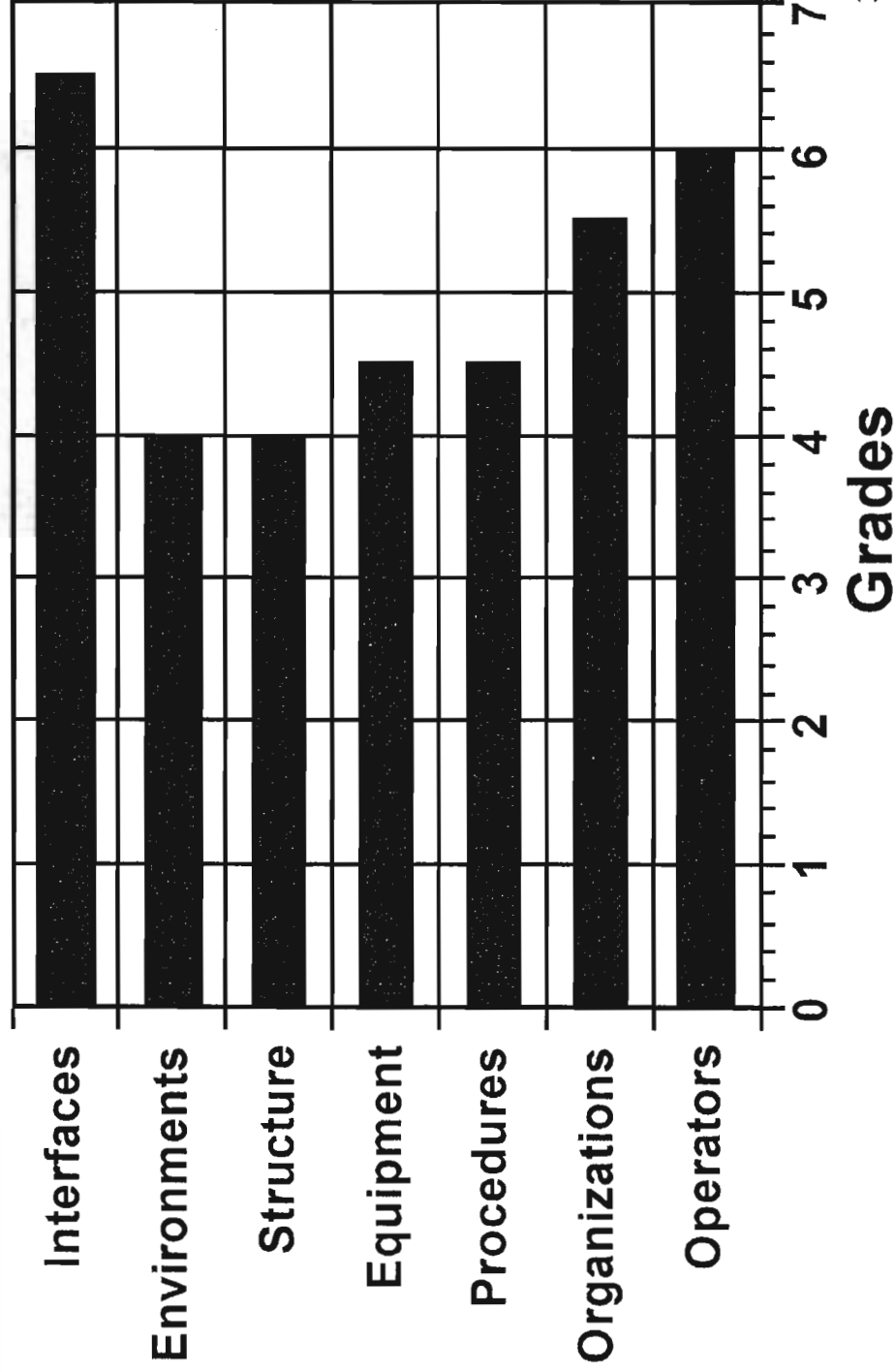
Record: 32 of 140

Navigation buttons: Home, Back, Forward, End

Form View

FLTR NUM

QMAS mean results



QMAS assessors

- **SMIAS counselors (external)**
- **SMIAS assessors**
 - Facility operators
 - Facility management
- **SMIAS training program**
 - HOF / HRO background
 - SMIAS operations
 - SMIAS applications

QMAS assessors

- **Experienced**
 - Facility
 - Process auditing
- **Respected**
- **Integrity**
- **Motivated**
- **Observant**
- **Thoughtful, insightful**

