



Premier Performance Process Presents . . .

Continuous Improvement Story Balance Team

February, 2000

Team Members

Mike Rudacille - Leader-ME

Bill Tracey - Operator

Chris Paraskevacos - PE (M-S)

Steve Estes - PE (Navy)

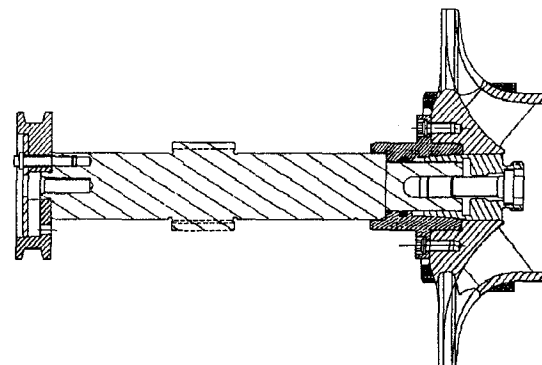
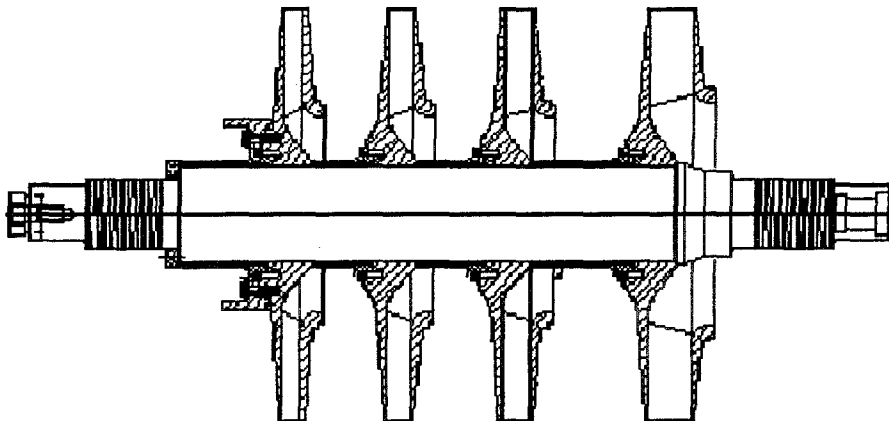
Sam Chatterton - Sponsor

(PT) Ravi Shankar - Quality Assurance

(PT) Kurt Nenstiel - Historian

(PT) Dale Unger - Acoustics/Vib. Lab

Dave Gregerson - Facilitator



IMPROVEMENT STORY SUMMARY - Balance Team



3 YEAR STRATEGY: Continuously Reduce Non-Value Added Costs

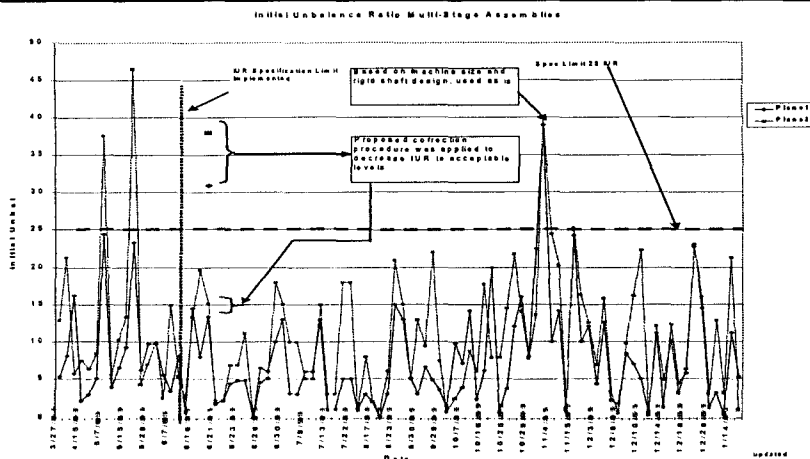
BU/GU OBJECTIVE: Eliminate system level failures, rework, and shipment delays

FOCUS AREA: Cost Avoidance of \$115,000 per year

PROBLEM / OPPORTUNITY STATEMENT: Determine why tested balanced parts, when installed in a compressor assembly, sometimes (6 / 111 in 1998) fail system level sound and vibration specification testing.

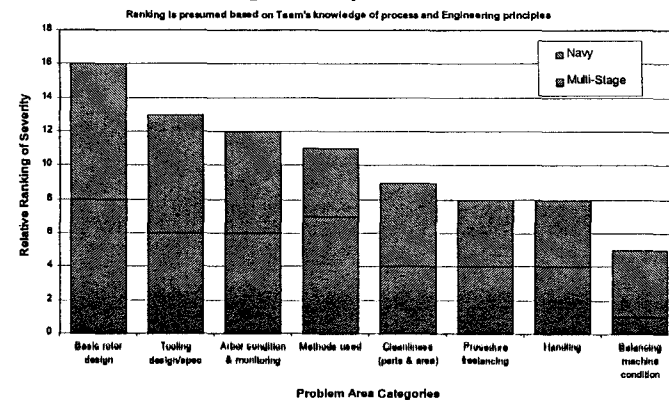
OBJECTIVE OWNER: Steve Ryan

Metric

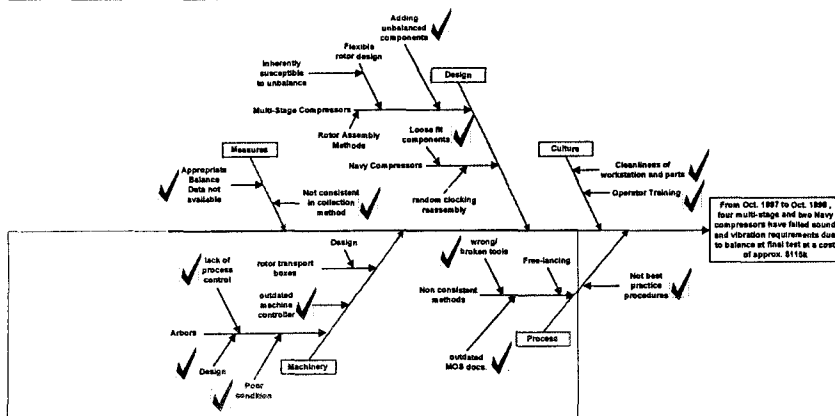


Barriers

Balancing Procedure Problem Severity Multi-Stage and Navy Products combined



Analysis



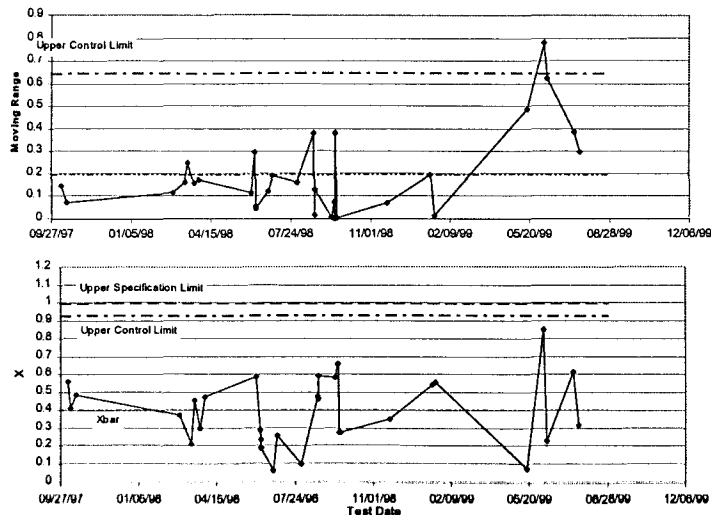
Countermeasures

NO DATA AT BALANCE	CREATE DATA SHEET	TEAM	18-Oct-98
ARBOR CONDITIONS	STORAGE UNITS	SS TEAM	14-Jan-99
ARBOR FITS/TOLERANCES	INITIAL UNBALANCE RATIO	TEAM	18-Jun-99
CLEANLINESS	SS AREA	SS TEAM	14-Jan-99
ARBOR CONTROL	CREATE CALIBRATION	TEAM	19-Feb-99
DESIGN MULTISTAGE	REDESIGN OIL PUMP	CHRIS PARASKEYAKOS	Design Iteration II Mar-00
DESIGN NAVY	EVALUATE FITS	STEVE ESTES	Dec-99
OUTDATED EQUIPMENT	PURCHASE CAS 180H	MIKE RUDKILL	8-Feb-99
NON CONSISTANT PROCESSES	FLOWCHARTING, UPDATE MOST'S	TEAM	Aug-99
FREE LANCING	MOST'S FLOOR	TEAM	August
MULTISTAGE TRANSPORT	DESIGN NEW BOXES	TEAM WITH GARY SWENSON	28-Feb-00

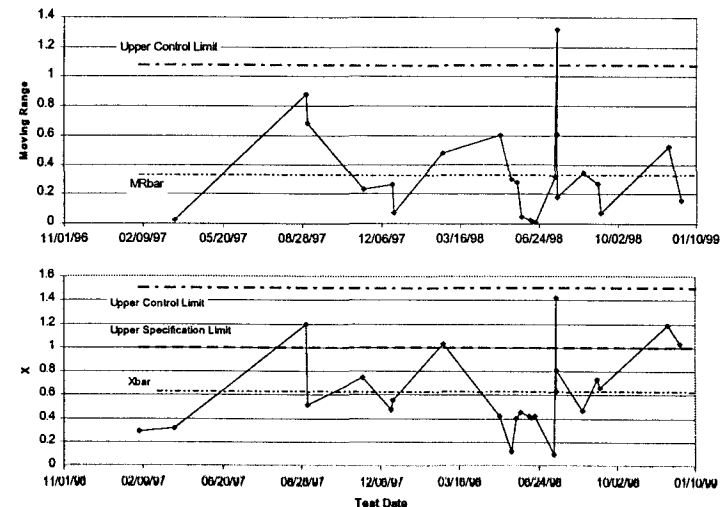
IMPROVEMENT STORY - STEP 1 IDENTIFY THE PROBLEM



Rigid Rotors (X - MR Chart)



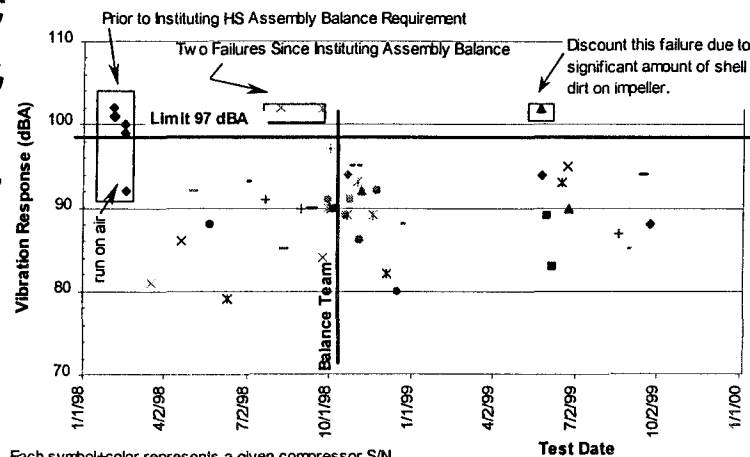
Flexible Rotors (X-MR Chart)



TEAM ACTIVITY:

An evaluation was made for rotors when installed in systems and sound and vibration was tested.

Navy DDG Compressors at System Level Sound & Vibration Testing



FINDINGS:

- Final test vibration is a lagging indicator and does not provide direct information as to the balance quality.
- It was found that failures were either "Flexible rotor design" M compressors or Navy units.

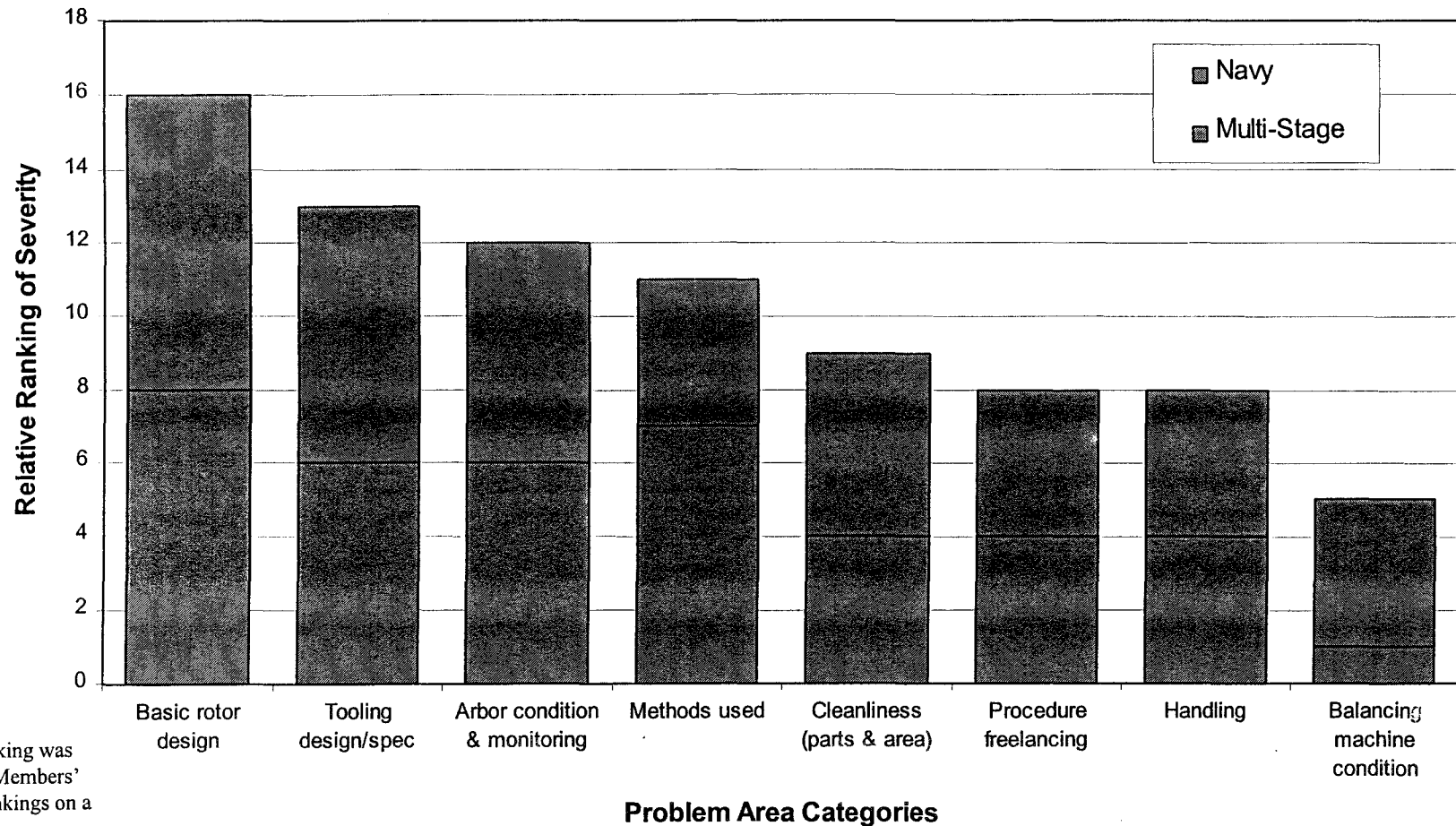
IMPROVEMENT STORY - STEP 1

IDENTIFY THE PROBLEM



Balancing Procedure Problem Severity Multi-Stage and Navy Products combined

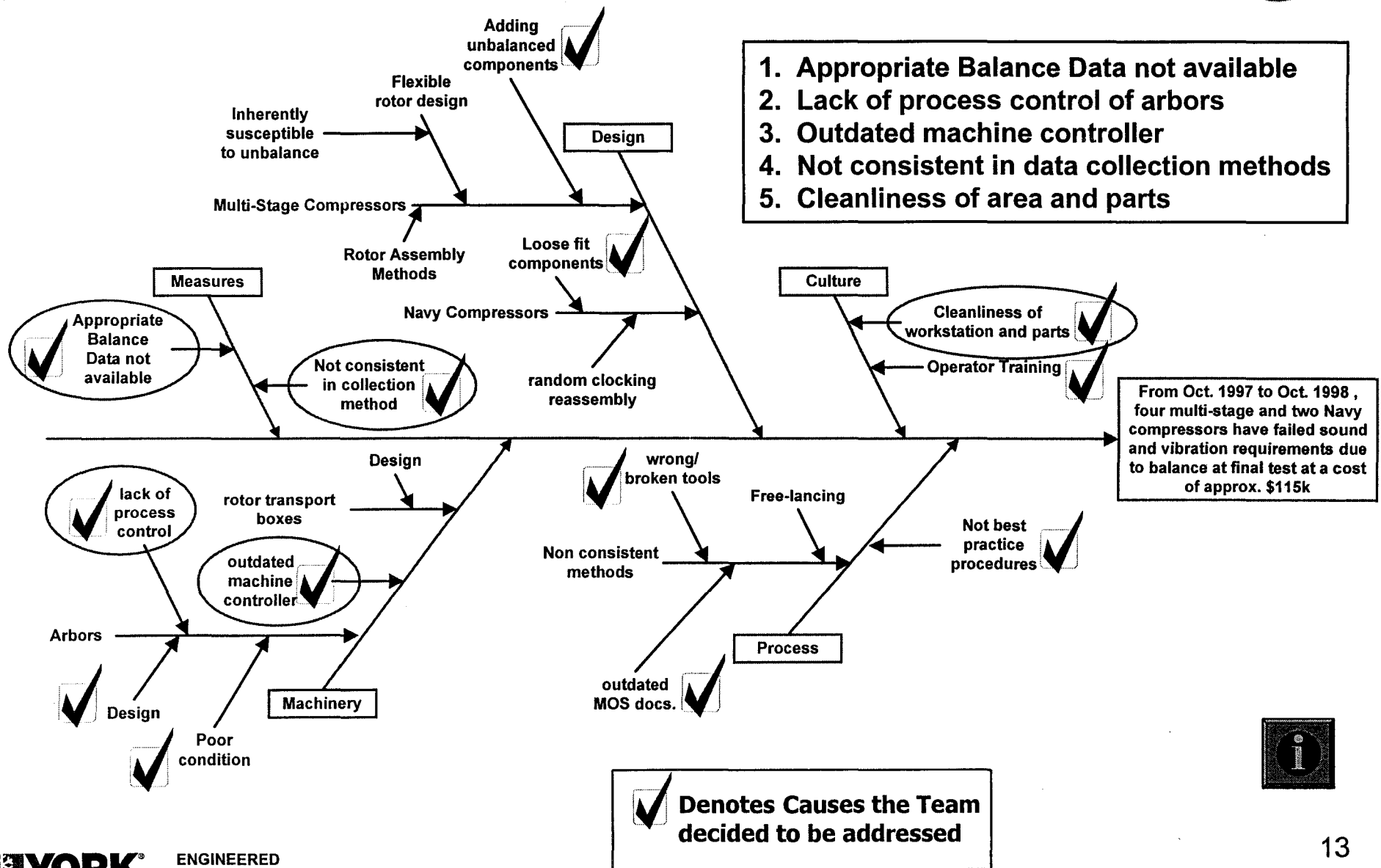
Ranking is presumed based on Team's knowledge of process and Engineering principles



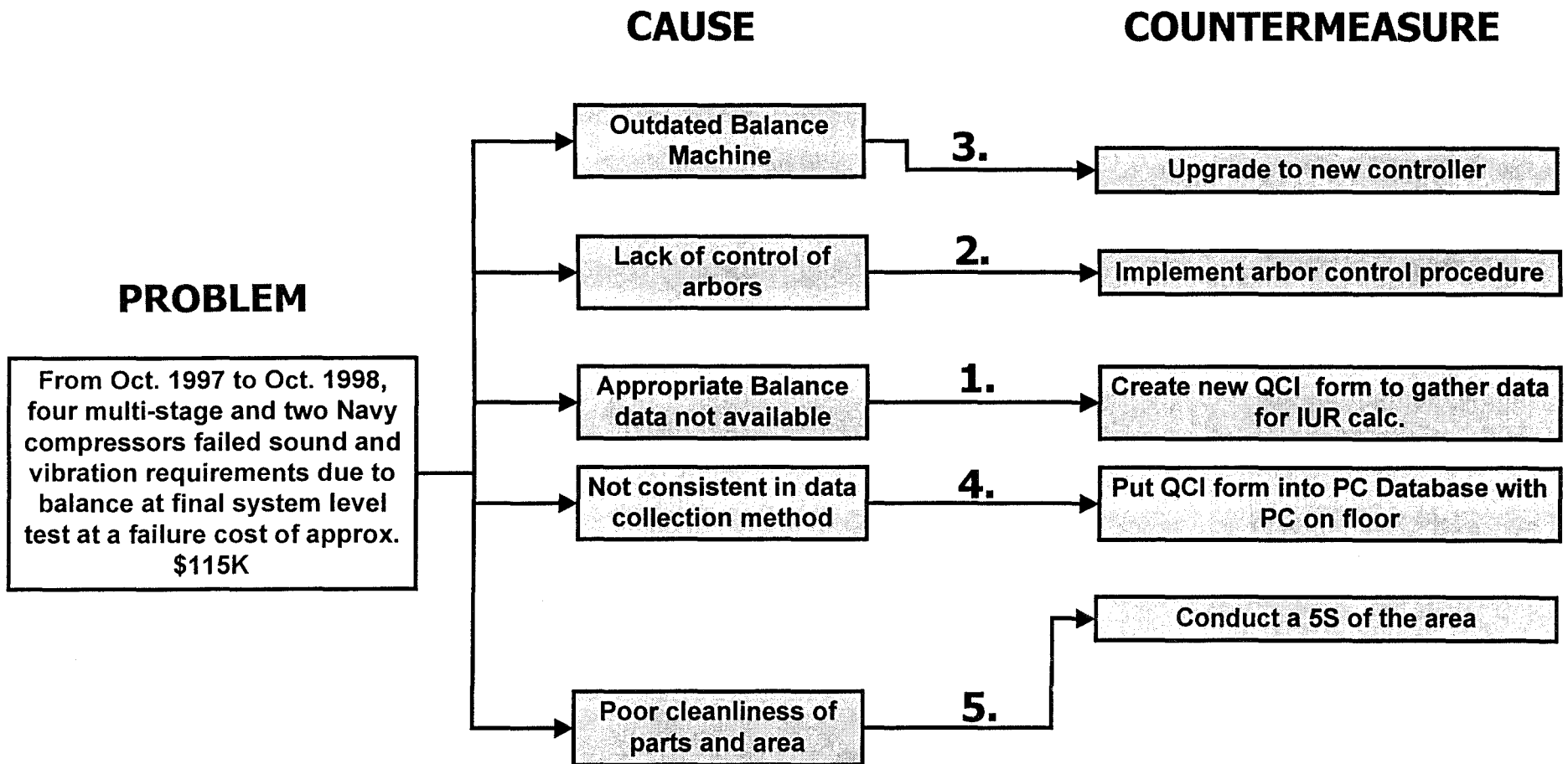
Average Ranking was based Team Members' individual rankings on a 1-10 scale

IMPROVEMENT STORY - STEP 2

ANALYZE THE PROBLEM



IMPROVEMENT STORY - STEP 3 GENERATE AND SELECT COUNTERMEASURES

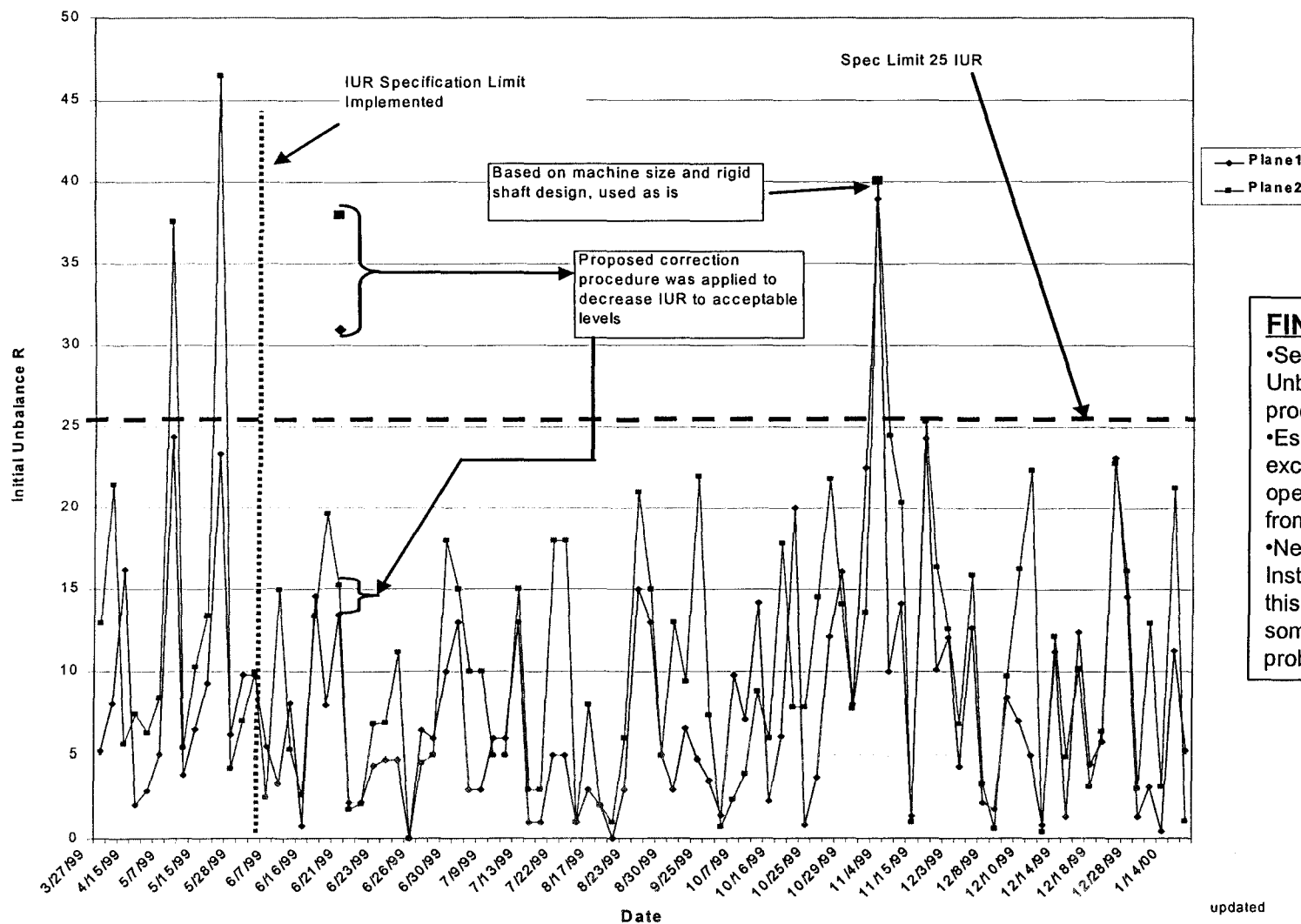


IMPROVEMENT STORY - STEP 4

1. IMPLEMENT DATA GATHERING FOR IUR MEASUREMENT



Initial Unbalance Ratio - Multi-Stage Assemblies



FINDINGS:

- Selected IUR (Initial Unbalance Ratio) as a in-process indicator.
- Establish a IUR limit, where, if exceeded during assembly, the operator must seek direction from ME or design engineer.
- New American Petroleum Institute document supported this practice and recommended some actions to correct the problem.



IMPROVEMENT STORY - STEP 4

4. IMPLEMENT PC ON FLOOR TO AUTOMATE DATA COLLECTION



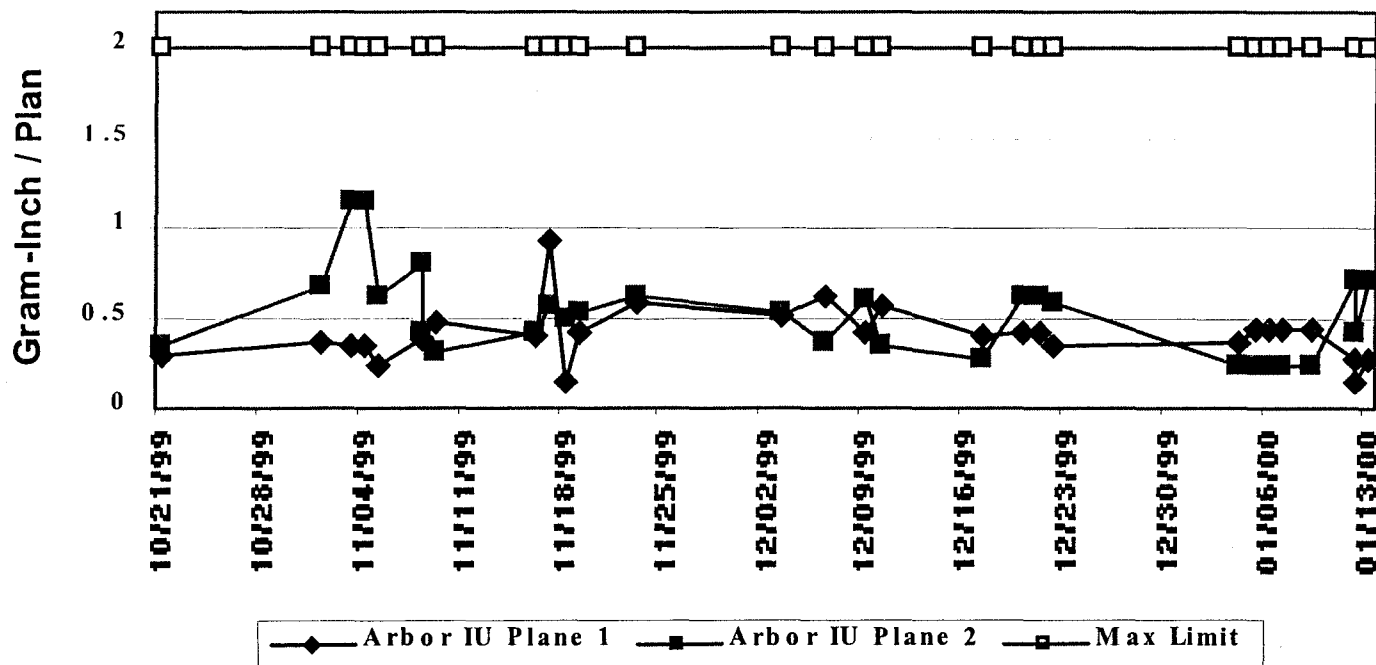
TEAM ACTIVITY

Trending and Review of Arbor balance data

FINDINGS:

Team needs to adjust balance and dimensional tolerances of arbors based on trend data.

Arbor IU Plane Trend . Arbor # 119848 A



12 Month Rolling Average Multi-Stage Compressor Failures due to Balancing Problems

