Control Chart Dashboards

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SPC Trending Primer/ Two Day Training
Introduction

• The Dashboard as a management tool
• Color coding and trending
• Integrating with SPC and Theory of Variation
• Creating dashboards using Excel spreadsheet
• The “FluorBoard”: publication and acceptance
What is a Dashboard?

Dashboards and “Balanced Scorecards” have been proposed as a communication tool and Executive Summary.

Can take a variety of inputs, and display them in one place.

“Analog aesthetics meets digital information”

(http://www.ambientdevices.com/cat/dashboard/)

Operational Dashboard: focuses on managing and measuring business and process activities in real time or near-real time. Operational dashboards provide deep visibility on a specific business area or business process activity. Key Performance Indicators and metrics are typically displayed by an assortment of dials, gauges and stoplights that resemble those found in a commercial plane cockpit.

http://www.dmreview.com/editorial/dmreview/print_action.cfm?articleId=1000940
Savannah River implemented the Key Performance Indicator format for corporate metrics in 2001.

Using the experience of WSRC, the EFCOG ISM Performance Metric Sub Group worked to develop a process and format for the DOE Complex.

In December 2001, Undersecretary Bob Card asked EFCOG and Bev Cook, EH-1, to develop a system for use by the DOE Complex. He asked that this system use a common format, similar to the one used by WSRC EFCOG Performance Metrics Manual published by WSRC.

EFCOG (WSRC) Format

- Cover sheet with colored panes, with 4 additional squares for the last 4 quarters performance

http://www.efcog.org/Best%20Practices/Performance%20Metrics.htm
Note: these months were yellow
EFCOG Format Shortcomings

- Only 12 data points shown
- Evaluated against numerical targets
- No use of statistical trending
- The extra four squares confused people
- Reaction to random noise
- Manipulation of criteria occurs in order to make things Green
- Manipulation (and destruction) of systems occurs in order to make the targets
Turnover Rate has increased slightly since the same time period last year, but remains below industry norms. The Turnover Rate for the first quarter (Q1) in FY04 was 1% more than the first quarter of last fiscal year, but the total number of employees increased by 4% (1,289 employees on July 1, 2002, 1,340 employees on July 1, 2003). Seventy-eight employees were terminated between July 1 and September 30, 2003, compared to seventy employees during Q1 of FY03.

What does this mean, and why is it yellow?
Creating a Management System (Review)

- Dr. Ackoff, *Creating the Corporate Future*
- **Three Management Functions:**
  - Identifying actual and potential problems (threats and opportunities)
  - Decision making (what to do and doing it, or having it done)
  - Maintaining and improving of performance under changing and unchanging conditions
Desirable Dashboard Features to Keep

- Overview many facets of performance simultaneously
- Avoid masking trends in individual facets (as compared to an index)
- “Drill down” to lower organization levels
- Use color coding (“stoplight”)
- Provide a “quick read”
- Provide bias for action, for execution
New Features Needed

• Be predictive and proactive (act on emerging trends rather than react to levels)
• Minimize reaction to random noise and false alarms
• Recognize when stable systems are not performing well
• Incorporate risk models / graded approach
• Determine effects of previous decisions
• Achieve good “Feedback and Improvement” (ISMS) characteristics
Statistical Process Control (Review)

- Segregation into Common Cause and Special Cause variation
- Minimization of Type I and II errors
- Use of specific rules to declare a “trend”
- Has proven to be effective, time saving, and inexpensive at Hanford
The “FluorBoard”

- A method to incorporate SPC and Colors was first proposed at Hanford in 1997
- “Stoplight Charts with SPC Inside” published by American Society for Quality 2004
- Has been in place as the Fluor Hanford Dashboard since FY 2005
- Utilized existing and familiar performance indicators
## Converting SPC Results to Colors

<table>
<thead>
<tr>
<th>Control Chart Result</th>
<th>Decision</th>
<th>Color</th>
<th>Leadership Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable (common cause variation)</td>
<td>Level is Acceptable</td>
<td>Green</td>
<td>Stay the Course</td>
</tr>
<tr>
<td>Stable (common cause variation)</td>
<td>Level is Not Acceptable</td>
<td>Yellow</td>
<td>Improve System</td>
</tr>
<tr>
<td>Trend (special cause variation)</td>
<td>Adverse</td>
<td>Red</td>
<td>Corrective Action</td>
</tr>
<tr>
<td>Trend (special cause variation)</td>
<td>Improving</td>
<td>Green</td>
<td>Reinforce – Stay the Course</td>
</tr>
</tbody>
</table>
Refinements

• Use WHITE if Stable at an “okay” level, but opportunity for improvement exists
• Use WHITE if currently Yellow or Red, but one month away from an improving trend
• Use YELLOW if one month from a non-improving trend
• Use RED if stable beyond a regulatory or customer specified threshold
Selection of Measures

- Ideally, the dashboard should reflect the management systems and business objectives
- Many times we chose the measures and then try to figure out what the objective was
- Be careful of wanting what you can measure versus measuring what you want (Ackoff)
- Leading indicators should be considered also
Example Measure and Definition

- **OSHA Recordable Case Rate**
- **Definition:** Multiply the number of OSHA recordable injuries and illnesses by 200,000 and divide by the total number of work hours.
- **Data Source:** Injuries from EX3 Reporting System. Hours from HANDI with supplemental Subcontractor data.
- **Red:** Statistically significant non-improving trend, or a stable above 2.9 cases per 200,000 hours (Contingency Payment of Fee is two quarters at 2.9)
- **Yellow:** One point away from a statistically significant non-improving trend, or a stable between 1.0 and 2.9. Basis: The FY 2005 DOE baseline goal is 1.0.
- **White:** Stable between 0.75 and 1.0. Basis: The FY 2005 DOE stretch goal is 0.75, and the Fluor CY 2005 corporate goal is 0.75. If currently Yellow or Red, and one point away from a statistically significant improving trend, then set to White.
- **Green:** Statistically significant improving trend, or stable less than 0.75. Basis: this is less than both the DOE stretch goal and the Fluor corporate goal.
Trend Criteria

- **Individual points** outside the Control Limits.
- Seven points in a row all above average or all below average.
- Seven points in a row increasing or decreasing.
- Ten out of eleven points in a row all above average or all below average.
- Cycles or other non-random patterns in the data.
- Two out of three points in a row outside of two standard deviations above/below the average.
- Four out of five points in a row outside of one standard deviation above/below the average.

Low Rate Special Case:

- When data have been zero for more than 7 data points in a row, or more than 10 of 11 in a row, the baseline average will be shifted to zero.
- When baseline average is zero, a significant trend will be noted if there are more than 2 non-zero values in 8 data points, or more than 3 non-zero values in 12 data points. The chart will be marked as Yellow for one month. On the following month, a non-zero baseline will be established, and the chart evaluated against its existing color criteria for baseline averages.
Creating a Dashboard Presentation

- An effective dashboard may be created on a fileservcer using readily-available Excel spreadsheet
- Excel offers the capability to perform Statistical Process Control
- Colors are set manually
- Hyperlinks are established in order to open indicator definitions, and chart pages
- Conditional Formatting is used to color the panes in the dashboard
### LEADING INJURY INDICATORS

<table>
<thead>
<tr>
<th>Indicator (with link to definition)</th>
<th>FH Overall</th>
<th>PFP</th>
<th>K Basins</th>
<th>FFTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Aid Case Rate</td>
<td>W</td>
<td>Y</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>ORPS</td>
<td>W</td>
<td>W</td>
<td>G</td>
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</tbody>
</table>

Conditional Formatting (making the cell change colors automatically):

- Click on cells to be colored
- Select Format, then Conditional Formatting
- Enter Cell Value Is, Equal To, =“R”, then hit Format Button
- Set Patterns to Red, Font to White
- Add>> two more, for Yellow and Green.
Case Rate Stable. Stable at an acceptable level. Potential increasing trend however.

Seven months below average (at zero). Significant improving trend.

A 4 per page layout is a good compromise to keep it readable, but keeps the number of pages down.

Put chart definitions and ownership in a separate file.
Each chart has the past two fiscal years, plus the current year.

SPC baseline and control limits added.

Control limit towards the non-improving direction is made Red, improving direction is Green.

Trends are circled.

CY and FY rates may be added (and the box automated with a “concatenate” command on the source data file).
## Links to Charts

<table>
<thead>
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### Hyperlinks

- Right click on the cell
- Select “Hyperlink”
- Browse through files until you get to the desired file
- Select “OK”

Now, whenever someone left clicks on the cell, the linked file will open.

Do the same for chart definitions.
## Links to Colors

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</tbody>
</table>

### Cell References

- Click on the cell desired to be colored
- Enter “=”
- Window to the file with the Chart in it
- Click on the cell under the chart with the chart color code
- Hit “Enter”
Finishing Touches

- Setup these files on a fileserver
- Give out access
- Extra links may be added next to charts for lessons learned, managers’ comments, or any additional information that may be useful.
<table>
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<th>Indicator (with link to definition)</th>
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<th>WS&amp;D</th>
<th>SW/GWVZ + WSCF</th>
<th>CP D&amp;D &amp; RCC</th>
<th>CS&amp;I</th>
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Benefits

• No special software need be purchased
• Uses relatively easy features in Excel
• Once one file is set up, it can be easily replicated and modified
• Presentation is kept simple, intuitive navigation for users
• Combines advantages of SPC with popularity of colors
Pro-active Trending

• The color is not just set based upon level, but also includes trends.
  - If you are currently at a good level, but there is a trend in the wrong direction, you will pick up a Yellow or Red
    - If you are currently at a bad level, but are making progress, you get positive reinforcement.

• Reinforces Defense Nuclear Facilities Safety Board (DNFSB) statements that trends are more important than level.
Publication and Publicity

- The FluorBoard was published by the American Society of Safety Engineers in May 2006 *Professional Safety*
- The article generated a high level of interest with DOE Headquarters
- The September 2006 ISMS Best Practices Workshop included positive comments on this system by Assistant Secretary of Energy James Rispoli
Conclusion

• This methodology is a conjunction of:
  – Statistical Trending
  – Color Coded Executive Summaries
  – Leading and Lagging Indicators

• The methodology has been very effective in driving improvement, and delighting customers