Executive Summary

Standards, and rigorous discipline to the standards, are vital for every business. This concept is deeply rooted in history and has proven to be one of the most important aspects of every successful manufacturing operation. Without standards chaos prevails and improvement is thwarted. A manufacturing business with poor discipline to standards absolutely will fail; it is just a matter of time.

For direct labor in a manufacturing environment, the best way to set and maintain financial and operational standards is by utilizing Maynard Operation Sequence Technique (MOST®).
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1 INTRODUCTION

Most people would agree about the importance of standards. The finance group compares performance to the standard, creates variances, and operations personnel explain why they had a (+) variance (excuses) and revel in the (-) variances (results?!?).

The first question should be, “How were the standards determined?”

If the direct labor financial standards were determined using highly detailed job instructions/elements and manpower models which were developed with scientific methods, then those standards are likely to be an excellent measure to help manage the operation. If the standards were developed in this manner, the company is in the rare minority.

2 MAYNARD OPERATION SEQUENCE TECHNIQUE (MOST)

MOST® is a work measurement technique developed by H.B. Maynard and Company, Inc. in the United States. MOST has been introduced into a wide variety of industries, such as aerospace, automotive, chemical process industries, clothing, electronics, etc., in EU, US, and Asia. Work standards and measurements are the basics for business management; measurement of actual for comparison against a standard is only as good as the standard. MOST is a work measurement system for developing standard work and cost that can be easily implemented and practically maintained.

MOST is a worldwide standard for developing standard work, standard costs, manpower models, and staffing levels.

3 BACKGROUND AND HISTORY OF MOST

MOST is a Predetermined Motion Time System (PMTS) that has evolved over time to the current model, released in 1972 internationally and in 1974 in the United States.

MOST EVOLUTION

Fredrick Winslow Taylor, known as the Father of Scientific Management (Principles of Scientific Management, 1911), was famous for many things including time studies and standard work.

Taylor's scientific management consisted of four principles:

1. Replace rule-of-thumb work methods with methods based on a scientific study of the tasks
2. Scientifically select, train, and develop each employee rather than passively leaving them to train themselves
3. Provide detailed instruction and supervision of each worker in the performance of that worker's discrete task
4. Divide work nearly equally between managers and workers, so that the managers apply scientific management principles to planning the work and the workers actually perform the tasks

Frank and Lillian Gilbreth developed motion studies independently of Taylor, and used them to increase efficiency in many industrial fields.

They classified 18 basic hand motions, called Therbligs (Gilbreth spelled backward).

H.B. Maynard, et al., combined the time study with the motion study and created Methods Time Measurement (MTM), released in 1948. MTM is a predetermined motion time system based in scientific measurement and statistical analysis of work performed. MTM is the outcome of that analysis. The result is the ability to analyze manual operations, usually in industrial settings, and determine the standard time a worker should be able to complete the task.

BasicMOST, which evolved from MTM, is simpler and easier to apply and is used for the same purpose: to determine the standard time for a manual operation based on the average time it would take the average worker working at an average rate to complete the sequence of tasks (called the 100% Pace).

MOST consists of three basic sequence models for manual work: General Move, Controlled Move and Tool Use.

MOST was expanded to encompass high-speed operations with short movements or repetitive cycles (MiniMOST), slower or longer operations with longer movements (MaxiMOST) and the ability to analyze administrative tasks (AdminMOST).

Timing is measured in Time Measurement Units (TMU); there are 27.8 TMU’s per second.

Several major advantages for using MOST to measure manual operations for sequence and timing are:

- MOST develops detailed sequencing for constructing standard work, the cornerstone of safe operation and every Lean Production System.
- MOST does not require long and detailed time studies, because it is based on scientifically derived standards using statistical analysis of a large database of measures. MOST can be applied in a fraction of the time it takes to perform traditional time study or other predetermined motion time systems
- Since MOST is scientifically derived, it is well accepted by employees, unions all over the world, and management for the development of worker standards and times to complete manual operations
- MOST eliminates the subjectivity involved in performance rating an activity, since the MOST technique is based on a 100% pace (average worker working at an average rate)
Because of its universal applicability, MOST has become the standard for thousands of companies in a broad range of industries. In fact, there are many thousands of certified MOST applicators in the United States, Japan, and at least 30 other countries.

At Xcellus, MOST is one of the core components of the Xcellus Performance System. For developing Standard Work and Labor Cost reduction MOST is unrivalled. MOST can be used as the baseline standard from which to improve upon.

4 WORK MEASUREMENT TECHNIQUES

The basis for each of the four versions of the MOST Work Measurement Technique is BasicMOST. In turn, BasicMOST is built on the concept that work is defined as the product of force and distance (w=f∙d). Within MOST, however, the primary work units are no longer basic motions; they are fundamental activities dealing with the entire event of “moving one or several objects from one location to another.” These activities are described in terms of basic parameters (or sub-activities) that are fixed in “activities sequence.” As a result, the basic “move object” pattern is described by a universal sequence model instead of detailed and independent basic motions.

Analysis of extensive work measurement data indicates that certain sequences of motions repeat consistently. Through research and experimentation, these sequences were verified and organized to form the basics of MOST. The most common activity sequence represents the spatial movement of objects. For BasicMOST, three sequence models have been established; General Move, Controlled Move, and Tool Use.

5 GENERAL MOVE

This covers the movement of none or more objects from one location to another freely through the air. This activity is represented by the following sequence of sub-activities or parameters:

```
Get A B G A B P A
```

in which:

A = Action Distance (mainly horizontal)
B = Body Motion (mainly vertical)
G = Gain Control of object
P = Placement of object
### Table 1: General Move Example Card – H.B. Maynard and Company, Inc.

<table>
<thead>
<tr>
<th>ABG</th>
<th>ABP</th>
<th>General Move</th>
<th>Gain Control</th>
<th>Placement</th>
<th>Index</th>
<th>Steps</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>2 in. (5 cm.)</td>
<td>Pickup</td>
<td>Toss</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>Within Reach</td>
<td>Light Object</td>
<td>Light Object</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1 - 2 Steps</td>
<td>Light Objects Non-sim</td>
<td>Light Objects Non-sim</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>3 - 4 Steps</td>
<td>Light Pressure</td>
<td>Lay Angle</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>5 - 7 Steps</td>
<td>Care or Precision</td>
<td>Object</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>8 - 10 Steps</td>
<td>Double Placement</td>
<td>Adjustments</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Meanwhile, the variation for each sub-activity, based on workplace conditions and the method used, is indicated by an index value. For example, if you needed to determine the standard for walking a few steps, bending over, picking up a marker, and setting it on the easel:

\[
A_6 \quad B_6 \quad G_1 \quad A_1 \quad B_0 \quad P_3 \quad A_0
\]

in which:

- \( A_6 = \) Walk three or four steps
- \( B_6 = \) Bend and rise
- \( G_1 = \) Simple grasp of a light object
- \( A_1 = \) Move object within reach
- \( B_0 = \) No body motion
- \( P_3 = \) Place object with adjustment
- \( A_0 = \) No return move

In addition, the sub-activities within each activity sequence are “slotted” into fixed time ranges represented by an index value corresponding to the median of each range. The time intervals for each of these index values are calculated using standard statistical principles based on predetermined accuracy requirements. The common scale of index numbers for all MOST sequence models is 0, 1, 3, 6, 10, 16, 20, 24, 32, 42, etc. The time value for a sequence model in BasicMOST is obtained by simply adding the index numbers for each individual sub-activity (or parameter) and multiplying the sum by 10. For instance, the standard time in TMUs (time measurement units) for the sequence in the above example is:

\[
6+6+1+1+0+3+0 = 17 \times 10 = 170
\]

Since one TMU equals 1/100,000 of an hour, 170 TMUs are equal to approximately 6 seconds.

Note, however, that the sequence model with index values provides more than just the total time value (normal time) for the activities. It also describes the method used. In Computer MOST, all index values are automatically assigned to a sequence model by entering
workplace data and a method description based on “keywords.” Allowances are also automatically added to yield the allowed or standard time.

6 CONTROLLED MOVE

This sequence model is applicable when the object retains contact with another object during the move (i.e. a lever, crank, or pushbutton).

The Controlled Move sequence model is similar to the General Move:

\[ \text{Get} \quad \text{A} \quad \text{B} \quad \text{G} \quad \text{M} \quad \text{X} \quad \text{I} \quad \text{A} \quad \text{Return} \]

with three different parameters:

- \( M = \text{Move Controlled} \)
- \( X = \text{Process Time} \)
- \( I = \text{Alignment} \)

7 TOOL USE

This covers more than just conventional hand tools like wrenches, screwdrivers, gauges, writing tools, etc. It also covers fingers and mental processes. However, the Tool Use sequence model does not define a third basic activity -- normally it is a combination of General Move and Controlled Move activities.

The Tool Use sequence model is also similar to the General Move:

\[ \text{Get Tool} \quad \text{A} \quad \text{B} \quad \text{G} \quad \text{A} \quad \text{B} \quad \text{P} \quad * \quad \text{A} \quad \text{B} \quad \text{P} \quad \text{A} \quad \text{Return} \]

* = Tool Action

\[ \text{Put Tool} \quad \text{Aside Tool} \]
8 CONCLUSION

MOST, including the Basic, Admin, Mini, and Maxi versions, makes the measurement of work a practical, efficient, and inexpensive task for the industrial engineer and others determining standards.

A powerful analytical tool that helps increase productivity, improve methods, facilitate planning, establish workloads, estimate labor costs, improve safety, and maximize resources, MOST can be applied to any type of work for which a method can be defined and described.

User-friendly and easy to learn, MOST has been accepted by countless industries as the most efficient work measurement technique available. In addition, a majority of the colleges and universities that teach industrial engineering now include an appreciation of MOST in their curricula.

- Reduces costs and paperwork and improves productivity
- Streamlines operations and quickly identifies inefficient methods
- Developed using large samples of all kinds of work motions to ensure statistical significance
- Provides consistent standards and accuracy to within ± 5% with a 95% confidence level – the standard for statistical significance
- Can be applied to any method-defined manual work
- Reduces the time required for data development and standard setting
- Is easy to learn and use; even non-Industrial Engineers require little training
- Can be applied from memory, work in-progress, or video

MOST is the worldwide standard, and the Xcellus method, for developing standard work, standard costs, manpower models, and staffing levels.

MOST® is a registered trademark of H. B. Maynard and Company, Inc., now Accenture

References:
Wikipedia