



# Predetermined Motion Time Systems

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Sections:

1. Overview of Predetermined Motion Time Systems – **part 1**
2. Methods-Time Measurement – **part 2**
3. Maynard Operation Sequence Technique



# Predetermined Motion Time Systems

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## *2. Methods-Time Measurement*



# Methods-Time Measurement

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- MTM is used to:
  - analyze method for performing a given task
  - set a time standard for the task
- Definition:

“Procedure which *analyzes any manual operation* or method into the *basic motions* required to perform it and assigns to each motion a *predetermined time standard* which is determined by the *nature of the motion* and the *conditions* under which it is made”



# Methods-Time Measurement

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- “Methods-Time” hyphen shows connection bet.:
  - basic motions used to perform a task
  - time values associated with these motions
- Note,  $T_{std}$  should not be calculated until:
  - task is divided into its component elements
  - then determining if methods improvements can be made (step 3 in PMTS procedure)



# Methods-Time Measurement

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- MTM versions:
  - MTM is family of PMT systems
  - MTM-1
    - original MTM
    - first-level PMTS upon which all of the other MTM systems are based
  - MTM is a family of products available through the MTM Association in Des Plaines, Illinois



# MTM-1

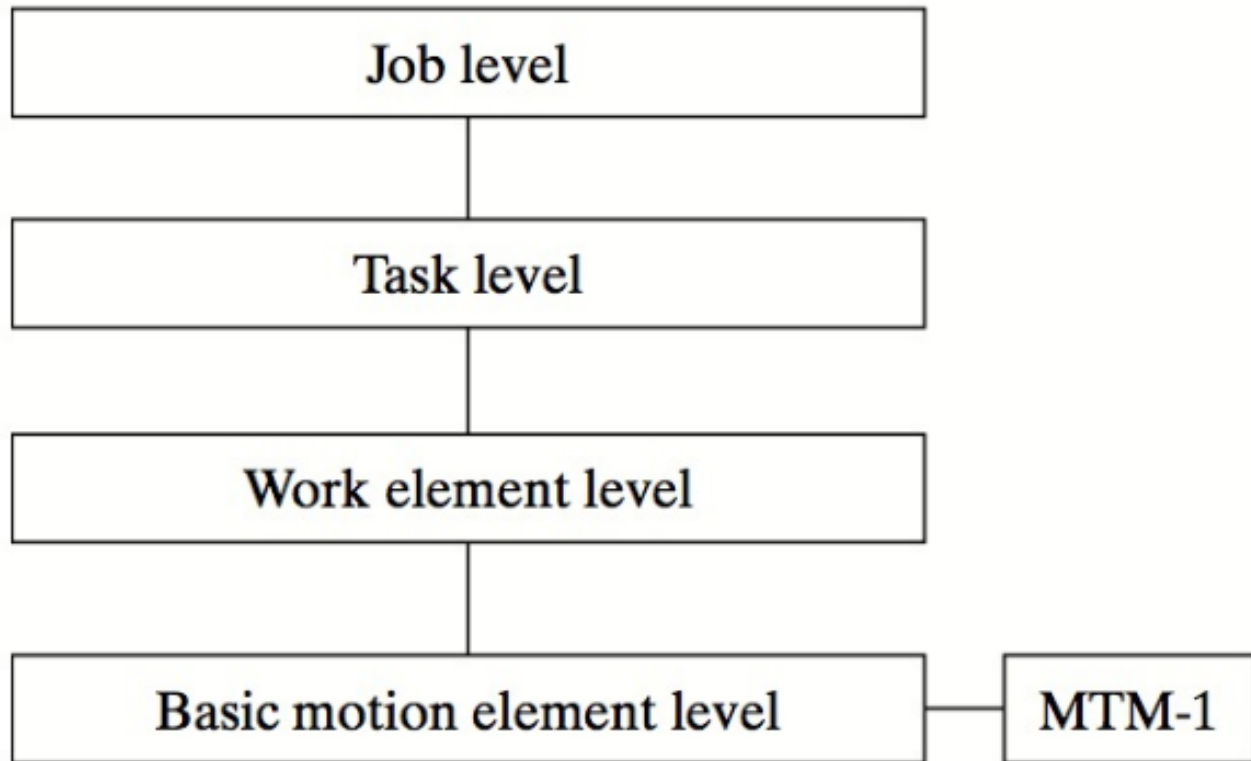
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- MTM basic motions
  - Operates at BME level in pyramidal structure of work
    - Most MTM-1 BME's involve hand and arm movements
    - Also: BME's for eye, leg, foot, and body actions
  - Many BME's correspond to original therbligs developed by Frank Gilbreth
  - However, changes include:
    - Adjustments to conform to needs of MTM
    - Adding new elements not included in original therbligs



# Methods-Time Measurement

## Hierarchy of Work Activity



**Figure 1** The position of MTM motion elements in our work hierarchy.



# MTM-1

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- TMU's:
  - time measurement units
  - developed by studying motion pictures of work activity
  - TMU is now defined as:

$$1 \text{ TMU} = 0.00001 \text{ hr} = 0.0006 \text{ min} = 0.036 \text{ sec}$$

$$1 \text{ sec} = 27.8 \text{ TMU}$$

$$1 \text{ min} = 1667 \text{ TMU}$$

$$1 \text{ hr} = 100,000 \text{ TMU}$$





# MTM-1

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- Table 3: defines the MTM-1 motion elements
- Table 4: tabulation of time values\*
- Steps for MTM:
  - **Step 1:** analyst describes task in terms of these BME's
    - taking note of:
      - *work variables* that influence element time
      - accounting for *simultaneous right-hand and left-hand motions*
      - *internal elements* when task involves operation of machine, etc.



# MTM-1

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- Cont. Steps for MTM:

- **Step 2:**

- analyst retrieves time for each BME\*
    - normal time for task:

$$T_n = \sum T_{BME}$$

- analyst then adds  $A_{pfd}$  according to company policy work being measured:

$$T_{std} = T_n (1 + A_{pfd})$$

- note, analyst must first receive proper training in technique



## Other MTM Systems

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- Additional MTM systems added:
  - serve specific work situations:
    - clerical activity
    - machine shop work
    - electronic testing
  - second- and third-level systems:
    - reduce time required to develop  $T_{std}$
  - several computerized systems have been developed based on MTM\*



## Other MTM Systems

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- MTM-2 – Second-level PMTS in which basic motion elements are combined into motion aggregates
  - GET – combines Reach and Grasp
  - PUT – combines Move and Position
  
- MTM-3 – Third-level PMTS which has four motion categories
  1. Handle
  2. Transport
  3. Step and foot motions
  4. Bend and arise



# Other MTM Systems

**TABLE 5** Members of the MTM Family of Predetermined Motion Time Systems

**MTM-1:** The first level MTM, in which basic motion elements are used to describe, analyze, and determine the normal time for a manual task. The MTM-1 motion elements and associated times are listed in Table 3 and 4. MTM-1 is best suited to high production operations with relatively short cycle times. The analyst time required to apply MTM-1 is about 250 times the task cycle time.

**MTM-2:** A second-level MTM system, in which the basic motion elements are combined into motion aggregates in order to reduce the analyst's time to apply the technique. MTM-2 consists of 11 motions and motion aggregates, called *motion categories*. The two most important MTM-2 categories are GET, which combines Reach, Grasp, and Release; and PUT, which combines Move and Position. MTM-2 is suited to operations that are not highly repetitive and the cycle times are greater than 1 min. The analyst time required to apply MTM-2 is about 100 times the task cycle time.

**MTM-3:** A third-level MTM system designed to further reduce the analyst's time to set a time standard but at some sacrifice in accuracy. MTM-3 has only four motion categories: (1) Handle, (2) Transport, (3) Step and foot motions, and (4) Bend and arise. Tasks that include additional elements, such as eye movements, should not be analyzed using MTM-3. The analyst time required to apply MTM-3 is about 35 times the task cycle time.

**MTM-UAS:** A third-level MTM system that is suited to applications in batch production. It includes seven basic motion categories: (1) Get and place, (2) Place, (3) Handle tool, (4) Operate, (5) Motion cycles, (6) Body motions, and (7) Visual control. Additional second-level standard data in MTM-UAS cover activities such as fastening, marking, packing, and assembling. The analyst time required to apply MTM-UAS is about 30 times the task cycle time.

**MTM-MEK:** A third-level system intended for work measurement applications in small lot production with long cycle times and other tasks performed infrequently. Time standards are usually not established in these work situations by conventional time study because the cost of setting the standard is too high. MTM-MEK can be used for these cases and the analyst time is about 5 to 15 times the cycle time.





# Other MTM Systems

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**TABLE 5** (continued)

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**MTM-HC:** A functional PMTS designed for work activities found in the health-care industry. It is described as a standard database by the MTM Association.

**MTM-C:** A functional MTM system used for work measurement applications of clerical work activity, such as typing or keypunching, filing, reading, and writing. It was developed by an association of banking and other service industries. There are two levels of MTM-C: MTM-C1 and MTM-C2. The difference is that MTM-C1 emphasizes precision and motion detail in its applications, while MTM-C2 emphasizes speed of application. The analyst time to apply MTM-C1 is about 125 times the task cycle time, and about 75 times for MTM-C2.

**MTM-V:** A functional standard data system developed using MTM-1 for work measurement in machine tool operation. Its work elements include handling of work parts, operating a machine tool and other equipment (e.g., cranes, fixtures, chucks), and setting up a job for production. The analyst time required to apply MTM-V is about 10 times the task cycle time.

**MTM-TE:** A functional standard data system designed for work measurement in electronic testing applications. Its work elements cover both manual and mental activities.

**MTM-M:** A functional MTM system for measuring assembly work that is performed under a stereoscopic microscope.

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