Integrating a Work Package Based Engineering Phase with AWP

Presenter: Andrew Herbst
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To consistently provide the successful execution of the detailed engineering phase in heavy industrial projects.

**Success Criteria:** STBQ

- Safely
- On-Time
- On-Budget
- Meets Quality Requirements
Phase-Gate Projects

- Opportunity
- Feasibility
- Conceptual
- Preliminary
- Detailed Design & Construct
- Start-up
## STBQ Acceptability Domains

<table>
<thead>
<tr>
<th></th>
<th>Safely</th>
<th>Timely</th>
<th>Budget</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Over</strong></td>
<td>Unacceptable</td>
<td>Unacceptable</td>
<td>Unacceptable</td>
<td>Acceptable</td>
</tr>
<tr>
<td><strong>Goal</strong></td>
<td>Zero LTIs</td>
<td>On Schedule</td>
<td>On Budget</td>
<td>Meets Quality</td>
</tr>
<tr>
<td><strong>Under</strong></td>
<td>Acceptable</td>
<td>Acceptable</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
</tbody>
</table>

1. Sr. Management to recognize **all** WP team members when S,T,B, & Q are **all** in the green zones.

2. Conduct Lessons Learned sessions to capture what needs improvement when **any** red zones are encountered.
Apply the 100% Rule

No Gaps or Overlaps
Types of Work Packages

- **EWP** – for Engineering (internal, external, or interim)
- **CWP** – for Construction (ECWP?)
- **FWP** – for Fabrication (single craft)
- **MWP** – for Modularization (multi-craft)
- **SWP** – for Suppliers
- **FIWP** – for Field Installation
- **ITP** – for Inspection and Testing
- **STP** – for System Turnover
- **SCP** – for System Commissioning
Integrate

Integrate the method with two widely used standards and an industry best practice:

- ISO 9001:2015 Quality Management Systems - Requirements
- CII IR-272-2, version 3.1 - Advanced Work Packaging: Design through Workface Execution
Outputs of Key Planning Steps

**Requirements Analysis**
- WBS
- WP List
- Contract Strategy
- Milestone Schedule
- Applicable Standards and Specifications
- Project Org Chart
- CBS
- Timesheet Set-up
- Approval Reqts
- Analysis of Client General and Special Conditions
- Initial Risk Assessment

**Initial Planning**
- Critical Path Schedule by WP
- Purpose and Users of each WP
- Identification of Inputs by WP
- List of Outputs by WP
- WP Budget Allocation
- WP Leader Assigned
- Resource Assignment by WP (Preliminary)
- Hiring Requirements
- Training Requirements
- Risk Analysis

**Look-ahead Planning (Each Near-term WP)**
- Detailed Scope
- Status of Inputs
- Detailed Definition of Outputs
- Cost Breakdown of Budget
- Schedule Deadline Criterion
- Quality Checklist(s)
- Additional Hiring Requirements
- Additional Training Requirements
- New Software Implementation
- Safety Concerns

**Commitment Planning (Each WP)**
- Inputs Review
- Detailed Plan and Schedule
- Assignment of Final Checker
- Team Member Start Dates Confirmation
- Team Member Orientation and Scope Briefings
- Safety Plan
Example WBS – Level 2
WBS Level 3 (WP level)

1.4 P&IDs & LDTs

1.4.1 P&IDs & LDTs
Issued for Internal Review

1.4.2 P&IDs & LDTs
Issued for Client Review & Comment

1.4.3 P&IDs & LDTs
Issued for HAZOP Review

1.4.4 P&IDs & LDTs
Issued for Engineering

1.4.5 P&IDs & LDTs
Issued for Construction
NTLAP & M/C/R WPs

8.3 Near-Term Look-ahead Plan
- 8.3.1 NTLAP Period 1
- 8.3.2 NTLAP Period 2
- 8.3.3 NTLAP Period 3
- 8.3.4 NTLAP Period 4
- 8.3.5 NTLAP Period 5

8.4 Monitor/Control/Report
- 8.4.1 M/C/R Period 1
- 8.4.2 M/C/R Period 2
- 8.4.3 M/C/R Period 3
- 8.4.4 M/C/R Period 4
- 8.4.5 M/C/R Period 5
Commercial Linking Diagram

3-D CAD Model
EWP-0001
(internal)

FWP-1021
Piping

FWP-2021
Insulation

FWP-3021
Electrical

FWP-5021
Structural

FWP-1022

FWP-2022
etc.

MWP-0121
Fabricate Module #21

CWP-0121
Install Module #21

MWP-0122

CWP-0122

MWP-0123
etc.

CWP-0123
etc.

Field Contract
(external)

Module P. O.
(external)
Quality Checkpoints in WPs

3-D CAD Model
EWP-0001
(internal)

Quality Checkpoints

FWP-1021
Piping

FWP-2021
Insulation

FWP-3021
Electrical

FWP-5021
Structural

FWP-1022

FWP-2022
etc.

MWP-0121
Fabricate Module #21

MWP-0122

MWP-0123
etc.

CWP-0121
Install Module #21

CWP-0122

CWP-0123
etc.

Module P.O.
(external)

Field Contract
(external)

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Work Package Inputs and Outputs

- Project Execution Plan
- Scope and Purpose of WP
- Budget person-hours by discipline
- Safety Concerns
- Capital Budget
- Scheduled completion deadline
- Basis of Design
- Output from other WPs
- Client Specifications
- Vendor Information
- Assign competent personnel and train if required
- Identify Users of WP
- Identify Standard Procedures
- Provide required checklists
- Assign WP Leader

Scope and Requirements

Execute Work Package

Distribute outputs to all users

Gather and report STBQ data

Audit and Feedback

- Transmittal from Document Control
- Update Project File
- User Feedback
- Compile STBQ Data
- Identify WPs and people for recognition
- Identify WPs and people for Lessons Learned Session
- Update project cumulative STBQ data
- Audit
- Lessons Learned
- Recognition of Success
- HR Records Updated
- Procedures, Checklists, & Training Improved
Q. Is it worth the effort?

WP-Based Project Engineering Management System

Project Team
Effect of Work Packaging on the Task Environment

**HOMOGENEOUS**

Highly centralized with few functional divisions, reliance on standards, rule applying departments, and an administration stressing rule enforcement.

**DYNAMIC**

Subdivided only as required to prevent over extension, and be less concerned about rule enforcement and more concerned about responding to the changes to the task environment.

**HETEROGENEOUS**

Divisions or boundary-spanning units would be differentiated functionally, and control would be decentralized to allow planning and monitoring of responses to adapt to fluctuations in its task environment.

**STABLE**

Tend to have a variety of functional divisions possibly subdivided by geography or some other basis, and these would be rule-applying agencies.

Effect of Work Packaging:
- Smaller teams more homogeneous
- Better definition from advanced planning
Knowledge Management Loop

1. Team member intuits and interprets to the WP sub-team

2. Sub-team agrees and recommends integration into job instructions by PMT

3. PMT agrees and integrates into PEP and recommends institutionalizing as company standard by Higher Mgt.


Worker Motivation

• Need workers committed to completing their tasks on-time and within their own budget. This requires motivation.

• Use positive motivation only for this purpose. Recognition of work done correctly, on-time, on-budget should be done routinely with enthusiasm.
## Motivation Theorists

adapted from J. D. Westbrook 2011

<table>
<thead>
<tr>
<th>Maslow</th>
<th>McGregor</th>
<th>Herzberg</th>
<th>McClelland</th>
<th>Skinner</th>
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<tbody>
<tr>
<td>Esteem, Recognition, Achievement, Career Advancement</td>
<td>Theory Y</td>
<td>Motivators</td>
<td>nAchievers</td>
<td>Rewarded behavior is repeated</td>
</tr>
<tr>
<td>Membership, Security</td>
<td>Theory X</td>
<td>Hygienes</td>
<td>nAffilliators</td>
<td>Ignored behavior is extinguished; punished behavior generates a negative, fragmented response</td>
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</table>

**Notes:**

- Maslow's hierarchy includes Esteem, Recognition, Achievement, and Career Advancement.
- McGregor's Theory Y focuses on Motivators.
- Herzberg's Motivators are associated with Rewardsed behavior being repeated.
- McClelland's nAchievers highlight the significance of rewarded behavior.
- Skinner's perspective emphasizes the extinction of behavior through punishment.

**Images:**

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Hierarchy of Needs

A.H. Maslow, 1943

Self-actualization

Esteem

Love/Belonging

Safety

Physiological

- morality, creativity, spontaneity, problem solving, lack of prejudice, acceptance of facts
- self-esteem, confidence, achievement, respect of others, respect by others
- friendship, family, sexual intimacy
- security of body, of employment, of resources, of morality, of the family, of health, of property
- breathing, food, water, sex, sleep, homeostasis, excretion

Motivate here
McGregor’s Theory X and Theory Y

• **Theory X** - The average human being has an inherent dislike of work and will avoid it if he can.

• **Theory Y** - The expenditure of physical and mental effort in work is as natural as play or rest. Depending upon controllable conditions, work may be a source of satisfaction.

• Assume Theory Y and try to create a situation where the employee can achieve his own goals best by directing his efforts toward the objectives of the enterprise.
Herzberg’s Motivators/Hygienes


Factors Affecting Job Attributes as Reported in 12 Investigations*

Factors characterizing 1,844 events on the job that led to extreme dissatisfaction

Factors characterizing 1,753 events on the job that led to extreme satisfaction

<table>
<thead>
<tr>
<th>50%</th>
<th>40</th>
<th>30</th>
<th>20</th>
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Achievement
Recognition
Work itself
Responsibility
Advancement
Growth

Company policy & administration
Supervision
Relationship with supervisor
Work conditions
Salary
Relationship with peers
Personal life
Relationship with subordinates
Status
Security

* Adapted from Herzberg’s Exhibit 1, page 90. Overall, the motivators accounted for 81% of the factors that lead to job satisfaction and 31% of the factors contributing to job dissatisfaction. The hygiene factors accounted for 19% of the factors leading to job satisfaction and 69% of the factors contributing to job dissatisfaction.
McClelland’s Needs/Achievement Theory

McClelland, D.C, Human Motivation, 1987

• Achievers are motivated by the attainment of realistic but challenging goals, and advancement in the job.

• There is a strong need for feedback as to achievement and progress, and a need for a sense of accomplishment.
Characteristics of Achievers

- Achievement is more important than material or financial reward.
- Achieving the aim or task gives greater personal satisfaction than receiving praise or recognition.
- Financial reward is regarded as a measurement of success, not an end in itself.
- Security is not a prime motivator, nor is status.
- Feedback is essential, because it enables measurement of success, not for reasons of praise or recognition (the implication here is that feedback must be reliable, quantifiable and factual).
- Achievement-motivated people constantly seek improvements and ways of doing things better.
- McClelland firmly believed that achievement-motivated people are generally the ones who make things happen and get results.
- This extends to getting results through the organization of other people and resources, although they often demand too much of their staff because they prioritize achieving the goal above the many varied interests and needs of their people.
Behavior that is **rewarded** tends to be repeated

Behavior that is **ignored** tends to be extinguished

Behavior that is **punished** generates a negative, fragmented response
STAGE II
Detailed Engineering

Schedule Development

Engineering

Detailed Construction Schedule

Detailed Level 3:
- E – by discipline, by EWP
- P – by commodity, by construction need date

Preliminary Level 3:
- C – by CWP

Execute EWP Standard

Final Level 3
STAGE III
Construction

1. IWP Creation
   - Regular superintendent meeting to identify task groupings
   - Create IWPs
   - Create IWP release schedule
   - Monitor constraints
   - Notify required support trades

2. Document Control Interface
   - Send sequence and content of IWP to Document Control

3. Issuance to the Field
   - Hard-copy IWP created
   - Issue IWP to field once constraints are satisfied
   - Field executes the work

4. Control of the IWP in the Field
   - Report progress
   - Yes Complete
   - No Monitor completion status in the field
   - Field executes the work

5. IWP Closeout
   - Close out
   - Report |WPs that are complete
   - Remove items not completed
   - Leave in field until completion

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Installation Work Package Life Cycle

2 Document Control Interface

See #1 IWP creation (A)

Applicable superintendent vets the IWP Content and Plan

Obtain remaining signatures

IWP hard copy is created by Planning

Electronic Document list is sent to Document Control

Hard-copy IWP is turned over to Document Control

See #1 IWP creation (B)

Document Control loads log into system to use as place holders

Doc Control loads IWP content into system using place holders created from log

Doc Control verifies document revision and signatures

Doc Control creates two hard copies filing one as master

Doc Control monitors the electronic document list for each IWP and transmits any revision notices to Planning

Doc Control transmits two hard copies to Planning for issuing

See #3 IWP Issuance to the field (A)
Installation Work Package Life Cycle

4 Control of IWP in the Field

Return IWP to Planning
Planning files complete IWPs
Confirm progress report
See #5 IWP Closeout (A)

Completed Items

Monitor the status until complete
Remove unfinished tasks for repackaging
See #1 IWP Creation (A)

Removed Items

Is the IWP 100% complete within scheduled time frame?
Is it feasible for IWP to remain in the field?
Is the IWP to be held or unfinished items to be repackaged?

YES
YES
NO
NO

Return IWP to Planning
Monitor IWP until hold is removed or constraint is resolved
See #3 IWP Issuance to Field (A)

Hold

Planning records progress from field

See #3 IWP Issuance to the Field (A)

YES
NO
Installation Work Package Life Cycle

5 IWP Closeout

1. Confirm quantities
2. Input IWP progress in Project Controls
3. Notify Document Control of completion and no change to master
4. Transmit all notes and copies of redlines to Doc Control for update of master
5. Send redlines to field engineer for inclusion in master set
6. Field engineer performs required updates
7. Document Control updates master set

See #4 Control in the Field (A)
The planning will be done, either in advance, or on weekends and evenings.”

– Bill Tillman
Thank you for listening!

Questions?