Agenda

- Introductions
- Corporate Overview
- Fluor commitment to AWP/WFP
- Successful Implementation
- AWP/WFP Automation Setup
- Conclusions
- Q&A
Introductions

- **Max Eklund** – Construction Automation Manager (Central/West Regions)

- **Silvana Lara** – Global AWP /WFP Manager
Fluor Corporate Overview

- One of the world’s largest engineering, procurement, fabrication, construction, and maintenance companies
- Designs, builds, and maintains capital-efficient facilities for clients on six continents
- Delivers integrated solutions for clients in the energy, chemicals, government, industrial, infrastructure, mining and metals, and power market sectors
- Serving more than 4,000 clients in over 100 countries
- #155 on the 2016 FORTUNE® 500 list with revenue of $18.1 billion in 2015
- More than 60,000 employees executing projects globally
- 104-year Fluor legacy
Fluor Corporate Overview
Differentiators

- Executing work in challenging locations
- Mobilizing diverse workforces
- Linking global engineering resources
- Developing innovative and cost-effective project financing
- Sourcing material globally
- Meeting compressed schedules
- Managing joint ventures and alliances worldwide
- Providing global fabrication capabilities
- Utilizing modular construction techniques
- Optimizing assets’ life cycle
Fluor Corporate Overview

Integrated Solutions

Comprehensive Life-Cycle Services for Client Capital Assets

- Design
  - Conceptual Design
  - Estimating
  - Feasibility Studies
  - Permitting
  - Process Simulation
  - Project Financing
  - Routing
  - Scope Definition
  - Siting
  - Technology/License Evaluation

- Engineering
  - Cost Control
  - Detailed Engineering
  - Fabrication
  - Front-end Engineering
  - Modular Construction
  - Planning & Scheduling
  - Process Simulation
  - Safety Planning
  - Systems Integration
  - Advanced Work Packaging

- Procurement
  - Contract Staffing
  - Contracts Management
  - Expediting
  - Fabrication
  - Logistics
  - Low Cost Country Sourcing
  - Materials Management
  - Purchasing
  - Requirements Planning
  - Sourcing
  - Supplier Quality
  - Warehousing

- Fabrication
  - Contractor Management
  - Material Control
  - Modular Construction
  - Purchasing
  - Quality Control
  - Safety Programs
  - Self-Perform Fabrication
  - Sourcing

- Construction
  - Construction Management
  - Contractor Management
  - Craft Staffing & Training
  - Equipment, Tools & Fleet Services
  - Field Mobilization
  - Material Control
  - Modular Construction
  - Project & Program Management
  - Quality Control
  - Rigging
  - Safety Programs
  - Scaffolding
  - Self-Perform Construction
  - WorkFace Planning

- Start-up
  - Commissioning
  - Engineering Support
  - Initial Production
  - Plant Readiness
  - Precommissioning
  - Systems Checkout
  - Turnover
  - Validation

- Maintenance, Modification & Asset Integrity
  - Asset Management Solutions
  - Electrical & Instrumentation
  - Fabric Maintenance
  - Inspection & Integrity
  - Mechanical & Piping
  - Power Services & Products
  - Equipment, Tools, and Fleet Services
  - Contract Staffing
Construction & Fabrication President Commitment

“With Fluor’s continued focus on construction-driven execution and improving project productivity and predictability, as well as starting with the end in mind; a continuous development and implementation of game-changing solutions like Advanced Work Packaging (AWP) and WorkFace Planning (WFP) is paramount.”

Jack Penley
President
Fluor Construction & Fabrication
Successful Implementation - cases

- Fluor has been implementing the AWP/WFP Processes worldwide since 2006.

- Fluor has developed AWP/WFP standard processes to be adapted to meet client needs.
  - Depending on the stage and type of project, Fluor can offer AWP/WFP or WFP only.
  - Fluor’s goal is to provide the most capital-efficient solution by adapting the client-specific AWP/WFP processes.

- Experience demonstrates that Fluor-implemented AWP/WFP processes provide our clients the most certainty in COST and SCHEDULE.
Successful Implementation

- Fluor has global experience implementing AWP/WFP in many industries and under various contract arrangements (reimbursable / lump sum).

- Recent projects for the **Power** industry include:
  - Citrus Country, Crystal River Florida -- Current WFP
  - Greensville Country, Virginia -- Current WFP
Successful Implementation

- **Oil & Gas Projects**
  - Sunoco - Toledo, Ohio -- 2006 WFP
  - Amgen - San Juan -- 2008 WFP
  - BP Whiting Refinery - Whiting, Indiana -- 2012 WFP
  - Vale Project - Long Harbour, Newfoundland -- 2014 WFP
  - Shell Quest Project - Edmonton, Alberta -- 2013 AWP
  - North West Upgrader -- Current on Construction AWP 2012
  - Sasol Louisiana -- WFP
  - Suncor ETFD, Fort McMurray -- AWP
  - TCO Kazakhstan -- Current AWP
Successful Implementation

Greenville County Power Plant

- $1.3 billion, lump sum
- Fluor implemented WFP
- 2,100+ IWPs – Early stage of implementation, 100 IWPs already executed
- Safety documentation identified, produced in conjunction with supervision and supplied to field within IWP
- Implemented an entirely new program to the Fluor’s Power Business Line
- Sister project to Citrus Combined Cycle Project
- Automation tools used:
  - SPR/InVision
  - MatMan
  - MCPlus
  - Weld Console
  - MileMarker
Successful Implementation

Citrus Combined Cycle Project

- $1.5 billion, lump sum
- Fluor implemented WFP
- 1,150+ IWPs – Early stage of implementation
- Incorporated HSE documents into packages (excavation permits), which improves productivity and safety planning
- Collaborating with Greensville County (sister project) to share ideas and implement a standard WFP program for all Power jobs moving forward

Automation tools used:
- InVision
- PDS
- MatMan
- MCPlus
- Weld Console
- MileMarker
- Nucleous
Successful Implementation

TCO TENGIZCHEVROIL – Kazakhstan

*Future Growth Project, Wellhead Pressure Management Project*

- $6.9 billion, EPC, reimbursable
- 20,000+ peak construction workers. First oil is planned for 2022.
- Fluor implemented AWP/WFP
- Early stage of implementation – Total number of IWPs TBD
- Automation Tools used:
  - SPC
  - SPR/InVision
  - MatMan
  - MCPlus
North West Redwater Refinery

- $2.3 billion, 5 million direct manhours, reimbursable
- Fluor implemented AWP/WFP
- 4,100+ IWPs
- 2,415 IWPs issued; 1,685 IWPs backlog
- Implementation of the AWP/WFP program reduced craft field Hours 15% approximately 800,000 manhours during early design estimate
- Safety documentation identified, produced in conjunction with supervision and supplied to field within IWP

Automation tools used:
- SPC to create IWPs
- SPR/InVision
- MatMan
- MCPlus
- NEWS
- MileMarker
AWP / WFP Automation Setup

- AWP / WFP is possible by integrating work processes, procedures and the use of certain construction automation tools according to the nature of the project and the scope of work to manage the large amount of required data.
# Construction Automation Tool timeline

<table>
<thead>
<tr>
<th>FEED</th>
<th>Detailed Design</th>
<th>Model Review 1</th>
<th>Model Review 2</th>
<th>Model Review 3</th>
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<tbody>
<tr>
<td>SP3D</td>
<td>3D plant image with walk through capabilities</td>
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<td>Primavera (P6)</td>
<td>Project scheduling and resource allocation</td>
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<td>Material Manager</td>
<td>Purchasing, expediting, warehousing, and Material control system</td>
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<tr>
<td>InVision</td>
<td>3-D Visualization for Project Management, Construction, Engineering and Materials Management</td>
<td>4-D simulation for execution planning</td>
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<td>InSequence</td>
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<td>WorkFace Planning Framework</td>
<td>Smart Plant Construction</td>
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<td>WorkFace Planning Framework</td>
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**SITE CONSTRUCTION START**
Project Interfaces - Tools

- Quality Control Weld Console
- Commissioning and Turnover MC Plus
- Progress Mile Marker/Schedule
- Material Management MatMan
- SPC SPR/InVision
SmartPlant® Construction (SPC)

What is SPC?

- SPC is an integrated software platform developed by Intergraph that helps to automate part of the work packaging effort.
- SPC allows Work Face Planners to effectively and efficiently develop and then manage Installation Work Packages.

SmartPlant® Construction
Requirements For SPC

- 3D models & 2D drawings from Engineering
- Estimate data from Estimating
- Level 3 (CWP-Level) Schedule from Project Controls
- Material specified at the correct level of detail in MatMan®
- Issued For Construction engineering documents available in Projects OnLine (POL)
- Quality information and requirements align early with the project
SmartPlant® Construction
Model and Data Flow

- Early identification of Construction requirements to Engineering and Other Disciplines

S3D Model and 2D Drawings

SPC Consumes 3D Model and 2D Drawings
SmartPlant Construction (SPC)

- Work Package Planning
- 4D Animation
- Materials Forecast
- Materials Reservation
- Construction Status & Visualization
- 3D Model Filters
- Drag and Drop

3D Model

Document Management System

Materials Management

Schedule

Non-Modeled Items - Excel

Fabricated Steel
SPC’s primary benefit is the automation of otherwise manual processes and activities. This leads to better efficiency and correctness for several WorkFace Planning processes. These include but are not limited to:

- Data collection
- Material take-offs
- Material forecasts/reservations
- Activity take-offs
- Schedule interfacing
- Constraint management
- Change management
What is InVision?

- InVision or Plant Pilot is an add-on 3D visualization application that works with Intergraph SmartPlant® Review to enable external system interface and simplify review of 3D plant models.

- No matter how complex your 3D model, Plant Pilot allows you to organize and present model data to your staff in a structured fashion using a familiar Windows Explorer-style interface.

- InVision can be used to monitor material delivery, construction progress review, quality control, project turnover and project completion through color coded 3D models.
InVision® – Data Flow

Fluor Suite of Tools and Databases

- Material Manager
- Weld-Console
- Milemarker
- MCPlus

- Work Packages
- Primavera
- Welding Data
- Construction Progress
- Turnover Status

MATERIALS PLANNING AND WAREHOUSE STATUS

FAB SHOP ETA’S

DESIGN OFFICE ENGINEERING

Engineering

Project model

InVision®

FLUOR®
Project Tool Interfaces

- Quality Control Weld Console
- Commissioning and Turnover MC Plus
- SPR/SPC InVision
- Material Management MatMan
- Progress Mile Marker/Schedule

AWP/WFP
Material Management

- Engineering / Procurement allocate material by EWP
- WFP planners to assign material by IWP scope of work
- Confirm material constraint free
- WFP team request material by IWP for construction installation
## Material Status

**SPC/MatMan API**

![Image of Material Status: SPC/MatMan API](image)

### Material Status Table

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<th>Drawing Number</th>
<th>Commodity Code</th>
<th>Description</th>
<th>Size 1</th>
<th>Size 2</th>
<th>Bin Type</th>
<th>ETA</th>
<th>BCM Quantity</th>
<th>On Hand</th>
<th>Required On Site</th>
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Project Tool Interfaces

- Quality Control
- Weld Console
- Commissioning
- and Turnover
- MC Plus
- Progress
- Mile Marker/
- Schedule
- Material
- Management
- MatMan
- SPR/SPC
- InVision
- AWP/WFP
IWPS included in Schedule – 3 Week Look Ahead

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Start Date</th>
<th>Finish Date</th>
<th>Y3BL Status</th>
<th>PFS</th>
<th>SCH Date</th>
<th>SCH Finish</th>
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<td>A1 - Electrical</td>
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<td>A1 - Electrical Cable Tray &amp; Accessories</td>
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<td>A1 - Electrical Power Cable Pull &amp; Terminate</td>
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<td>A1 - Instrument Cabling &amp; Terminations</td>
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<td>A1 - Structural Steel</td>
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(*Table continues with details for various activities and dates*)
Project Tool Interfaces
Quality Documents

- WFP Processes help in the reduction of the overall punch list items by:
  - including all the relevant information,
  - ensuring all quality requirements are met before starting the installation, and
  - ensuring proper and qualified personnel are assigned to the task.

- WFP ensures all the external resources (NDE, torqueing, loop checking, etc.) are available at the required time.
Project Tool Interfaces

Quality Control
Weld Console

Commissioning
and Turnover
MC Plus

Progress
Mile Marker/
Schedule

AWP/WFP

Material
Management
MatMan

SPR/SPC
InVision
What is MCPlus?

- Fluor’s construction completion management tool
- Provides a single repository for construction related data
- Capable of managing work flow
- Manages construction related activities such as:
  - Quality inspection
  - Punch listing / Rolling Complete Lists
  - Equipment Preservation
  - RFIs
  - Manages system turnover deliverables and generate electronic dossier
Commissioning and Turnover - ITRs

- Identification of Tagged Items within EWP
- Systems definition
- ITRs included in IWP
- Completed ITRs transmitted to Turnover and input in MCPlus
- WFP leads to a Progressive Turnover

Plan with the end in mind.
Conclusions

- BENEFITS OF AWP
  - Increased visibility and predictability of construction execution
  - Improved safety performance
  - Improved cost performance between 15 -18%
  - Improved schedule performance
  - Substantial reduction in RFIs
  - Incorporation of Turnover & Commissioning requirements
  - Opportunities for automation to add value to AWP
“The Fluor system for Workface Planning is mature, well developed and is compliant with the Clients procedures and intent. The creation of IWPs is having a significant positive impact in field level productivity. The suggestions for optimization are incremental changes that would fine tune a functioning program”

TRADITIONAL PROJECTS

Fluor PROJECT CYCLE 1

Fluor PROJECT CYCLE 2