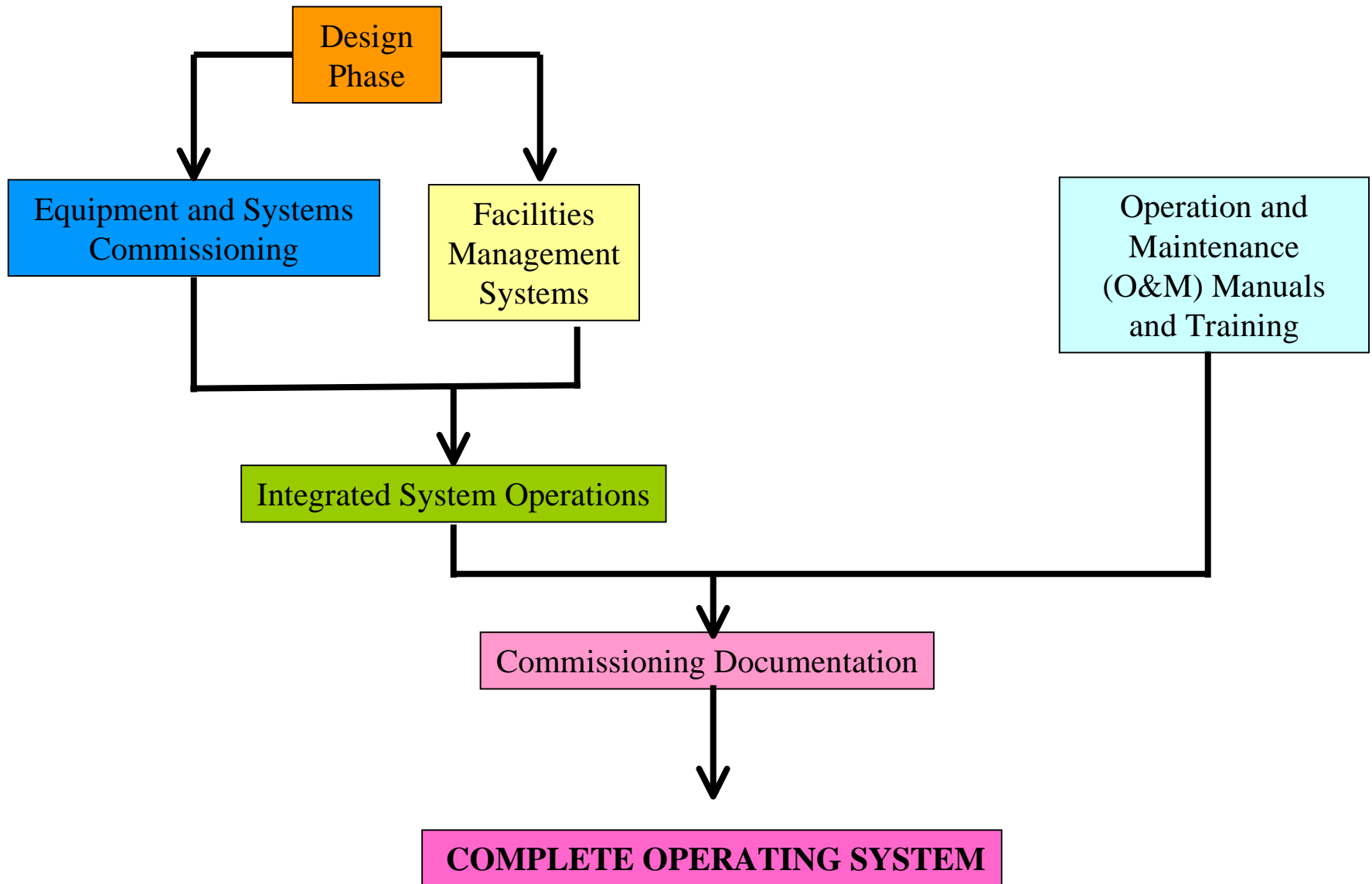


# ***COMMISSIONING PROCESS***

**Commissioning is the process of ensuring that mechanical, electrical and other building systems are installed, tested, and perform interactively in accordance with the design documents. This systematic process provides an independent verification that systems are functioning properly, as designed, and as required for a complete operating system.**

**The commissioning process provides the means to integrate the owner's facilities staff into day-to-day operation of the various systems. This interactive process enables the staff to keep track of system functionality testing leading up to final acceptance. Additionally, commissioning offers a mechanism for raising key operational issues and having them documented and addressed.**

# COMMISSIONING PROCESS



# COMMISSIONING PROCESS

## Design Phase

Design Document Review

Bid Package Review

Commissioning Plan and Documents

### Facilities Equipment and Systems

### Facilities Management Systems

### O&M Manuals and Training

Pre-Functional Process

Installation and Sequence Review

O&M Documentation Preparation

Contractor/Vendor Start-up

Pre-Functional Process

O&M Documentation Review

Test and Balance (HVAC)

Controls Point to Point

Network Verification and Communication

Sequence Programming

Draft O&M Documentation

Functional Performance Process

Controls Sequence Check and Tuning

Controls Systems Functional Process

Final O&M Documentation

Issue Tracking and Resolution

Integrated Systems Operation

Training

Commissioning Documentation

COMPLETE OPERATING SYSTEM

# ***COMMISSIONING PROCESS***

## **Design Phase**

**Design Document Review**



**Bid Package Review**



**Commissioning Plan  
and Documents**

- **Clear Communication of the Design Intent**
- **Commissionability**
- **Balancability**
- **Maintainability.**

- **Commissioning Process Is Clearly Defined**
- **Inclusion of Requirements and Information**
- **Assure Commissioning Process Will Be a Key Goal.**

- **Commissioning Process Developed**
- **Key Tasks, Participants, and Schedules**
- **Pre-functional, Functional, and Other Forms Developed**

# ***COMMISSIONING PROCESS***

## **Facilities Equipment and Systems**

**Pre-Functional Process**

Pre-functional process and checklists assure equipment and associated devices are installed per contract documents, manufacturer's recommendations and accepted construction practice.

**Contractor/Vendor Start-up**

Start-up is performed by the vendor or the contractors designated start-up personnel, who will fill out appropriate start-up documentation. This assures that ALL equipment has been checked and is ready to be operated as needed for Test and Balancing and Functional check-out.

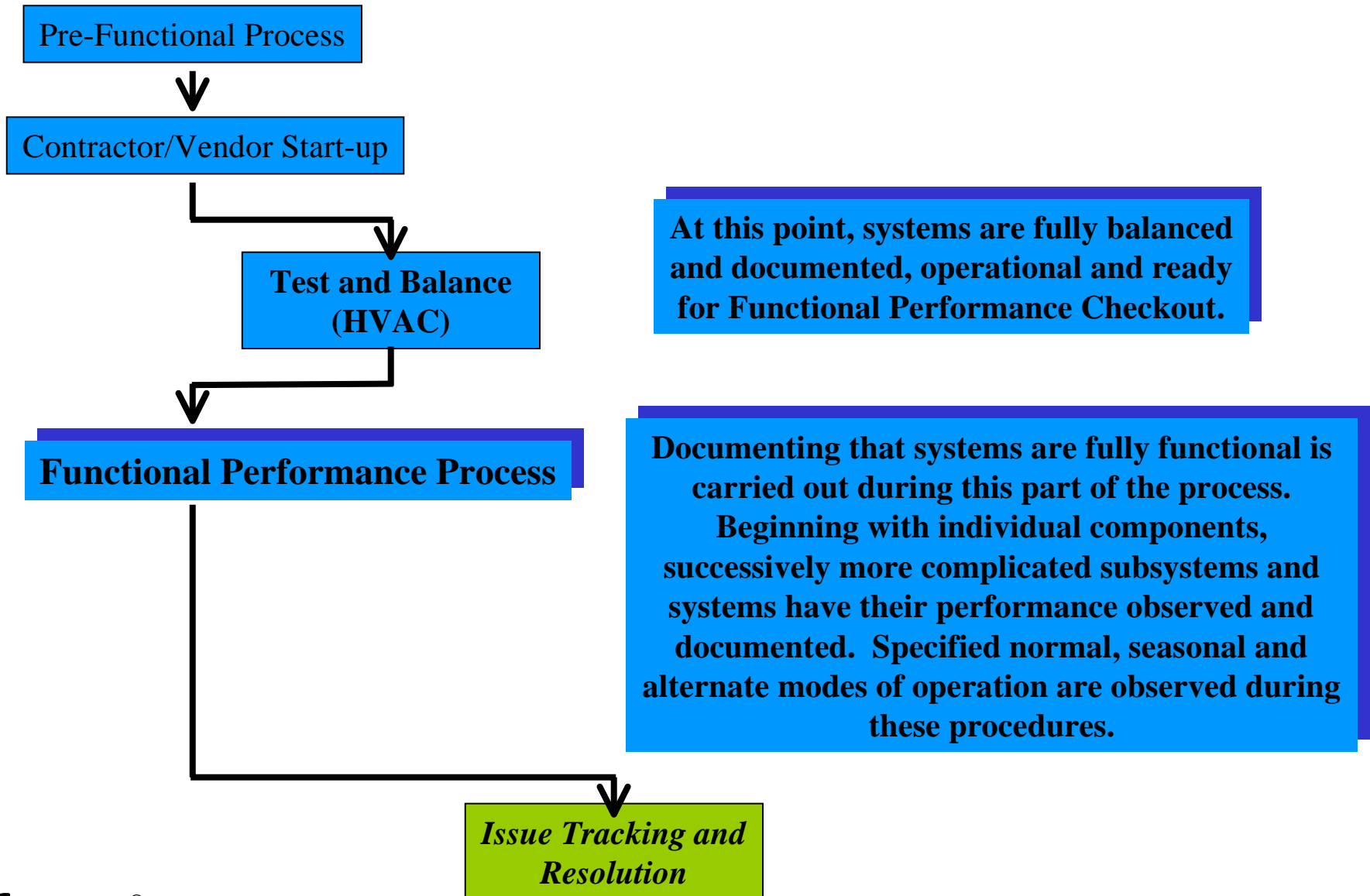
**Test and Balance  
(HVAC)**

**Functional  
Performance Process**

***Issue Tracking and  
Resolution***

# ***COMMISSIONING PROCESS***

## **Equipment and Systems Commissioning**

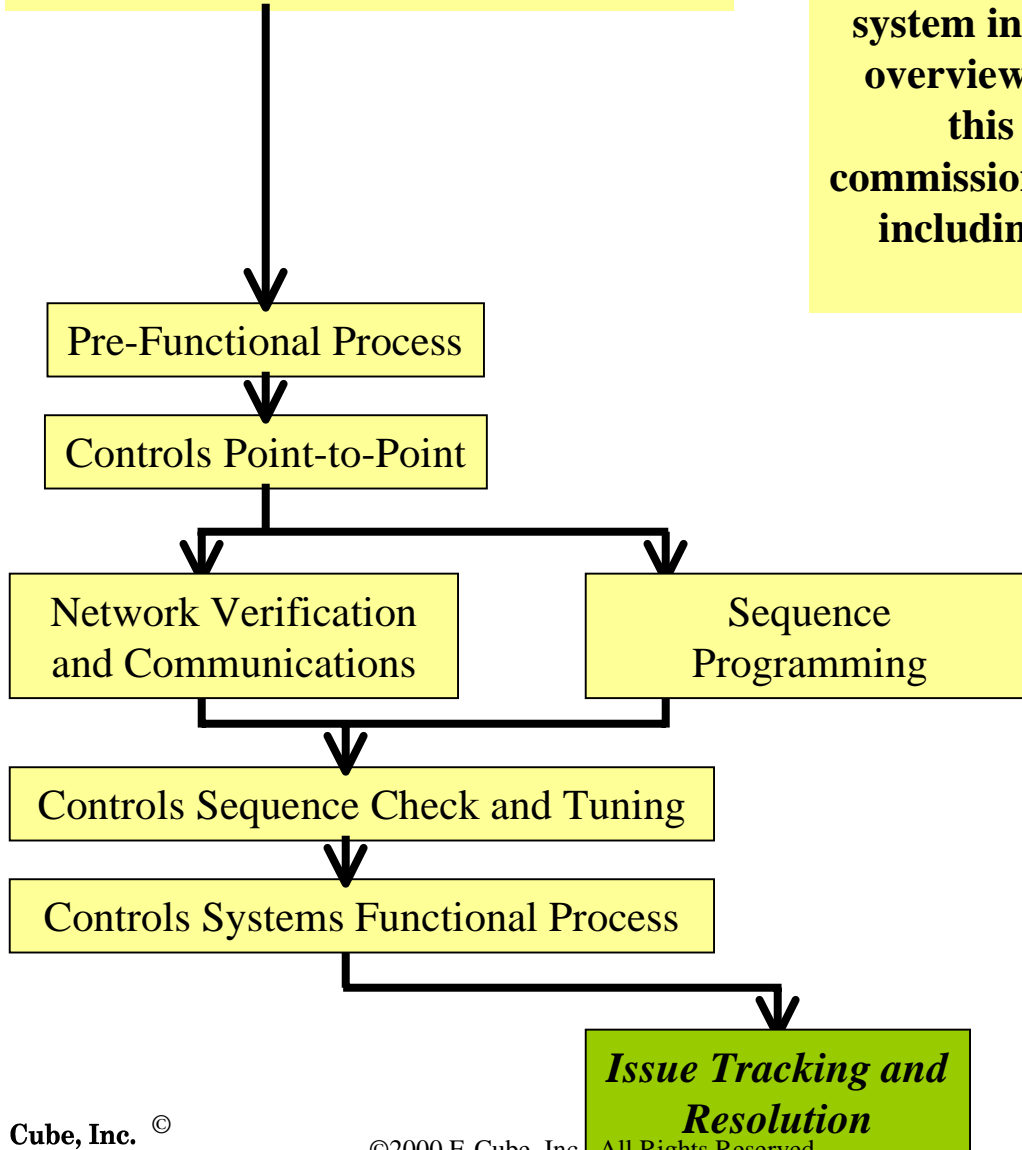


# ***COMMISSIONING PROCESS***

## **Facilities Management Systems**

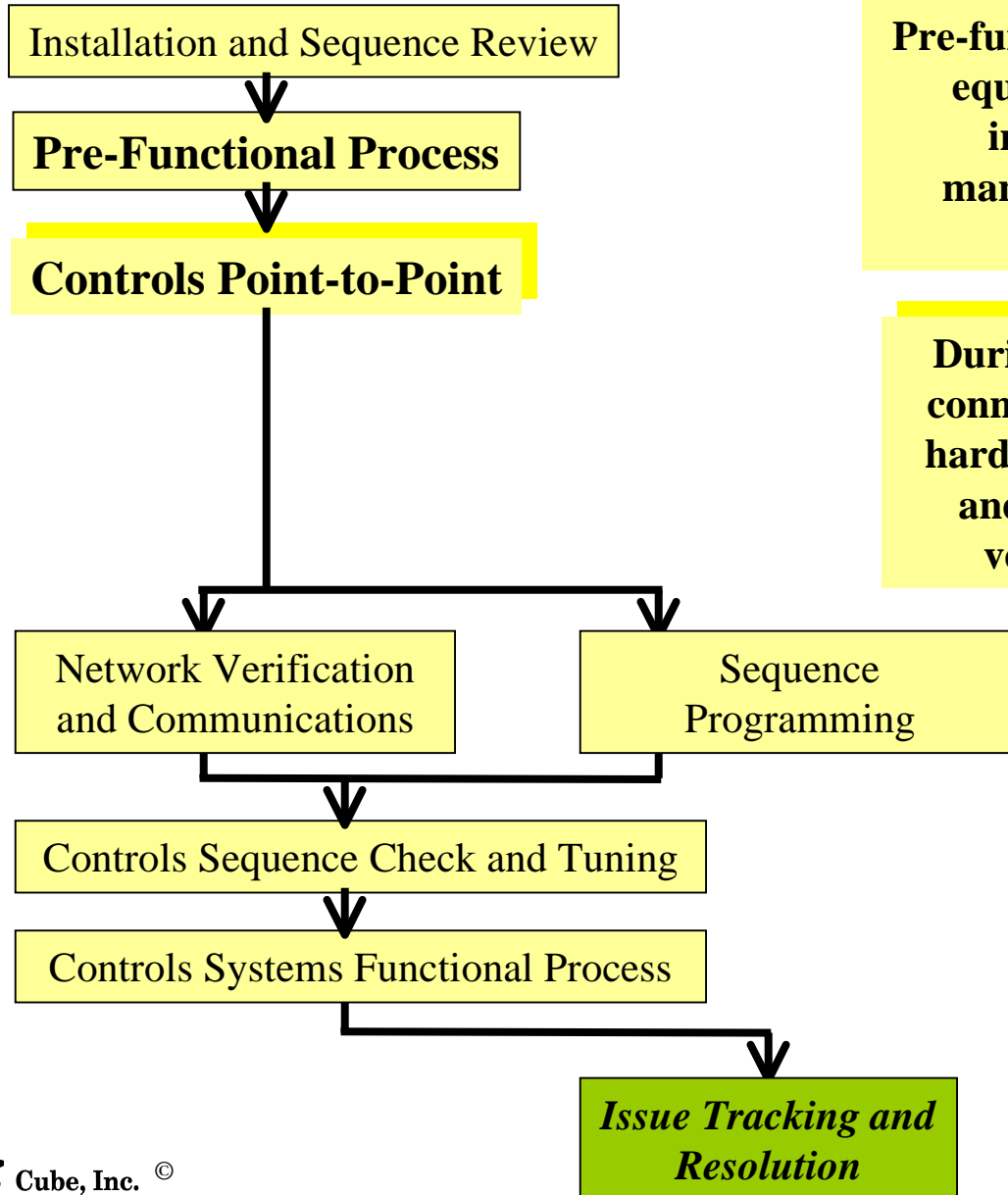
### **Installation and Sequence Review**

**This early step focuses on review of the controls system installation plan along with the sequence overview and implementation process. During this stage the ensuing installation and commissioning steps will be planned and agreed to including the verification and documentation goals and objectives.**



# ***COMMISSIONING PROCESS***

## **Facilities Management Systems**

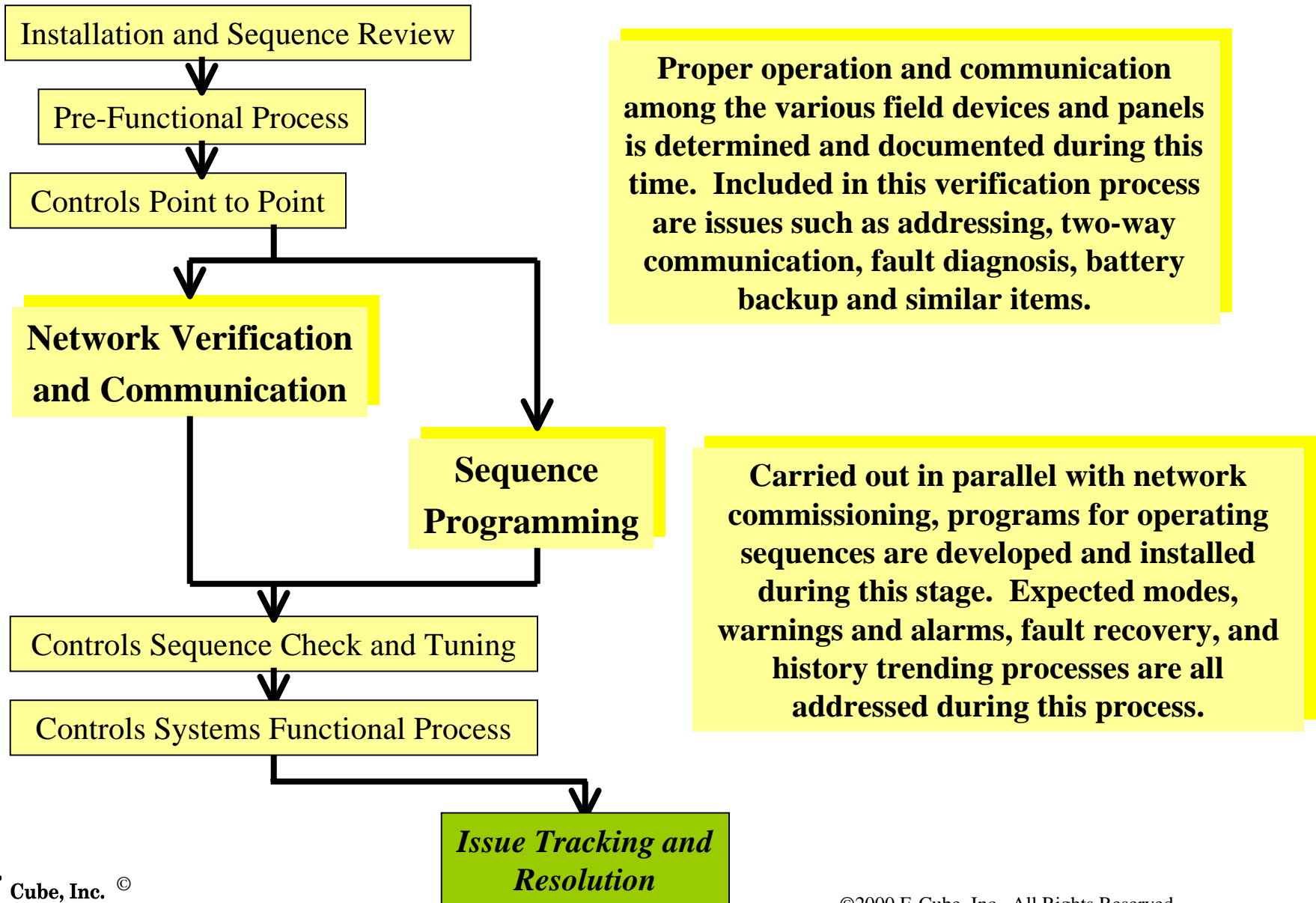


**Pre-functional process and checklists assure equipment and associated devices are installed per contract documents, manufacturer's recommendations and accepted construction practice.**

**During this portion of the process, proper connection, labeling, calibration and other hardware installation issues are confirmed and documented by the contractor and verified by the commissioning team.**

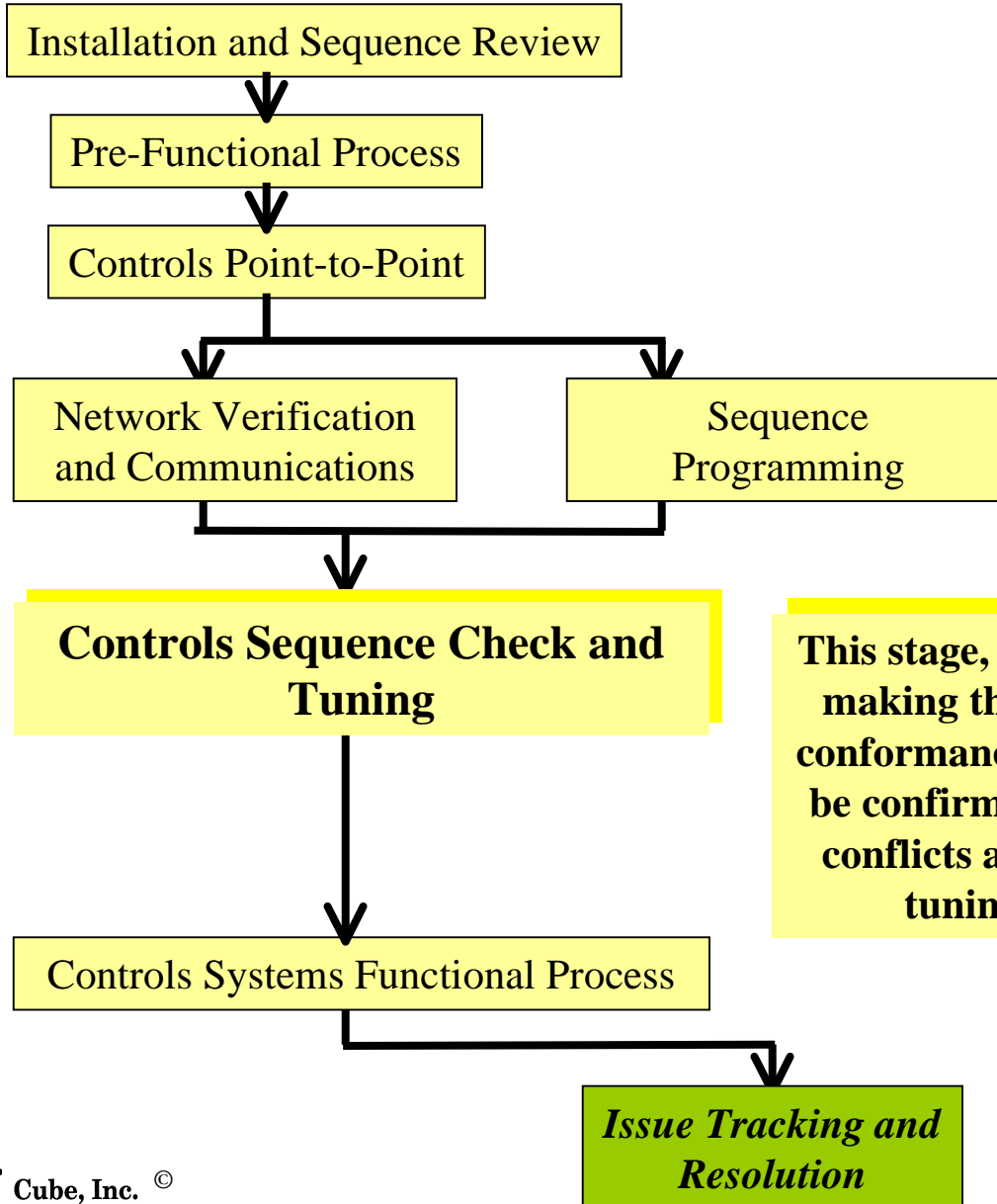
# ***COMMISSIONING PROCESS***

## **Facilities Management Systems**



# ***COMMISSIONING PROCESS***

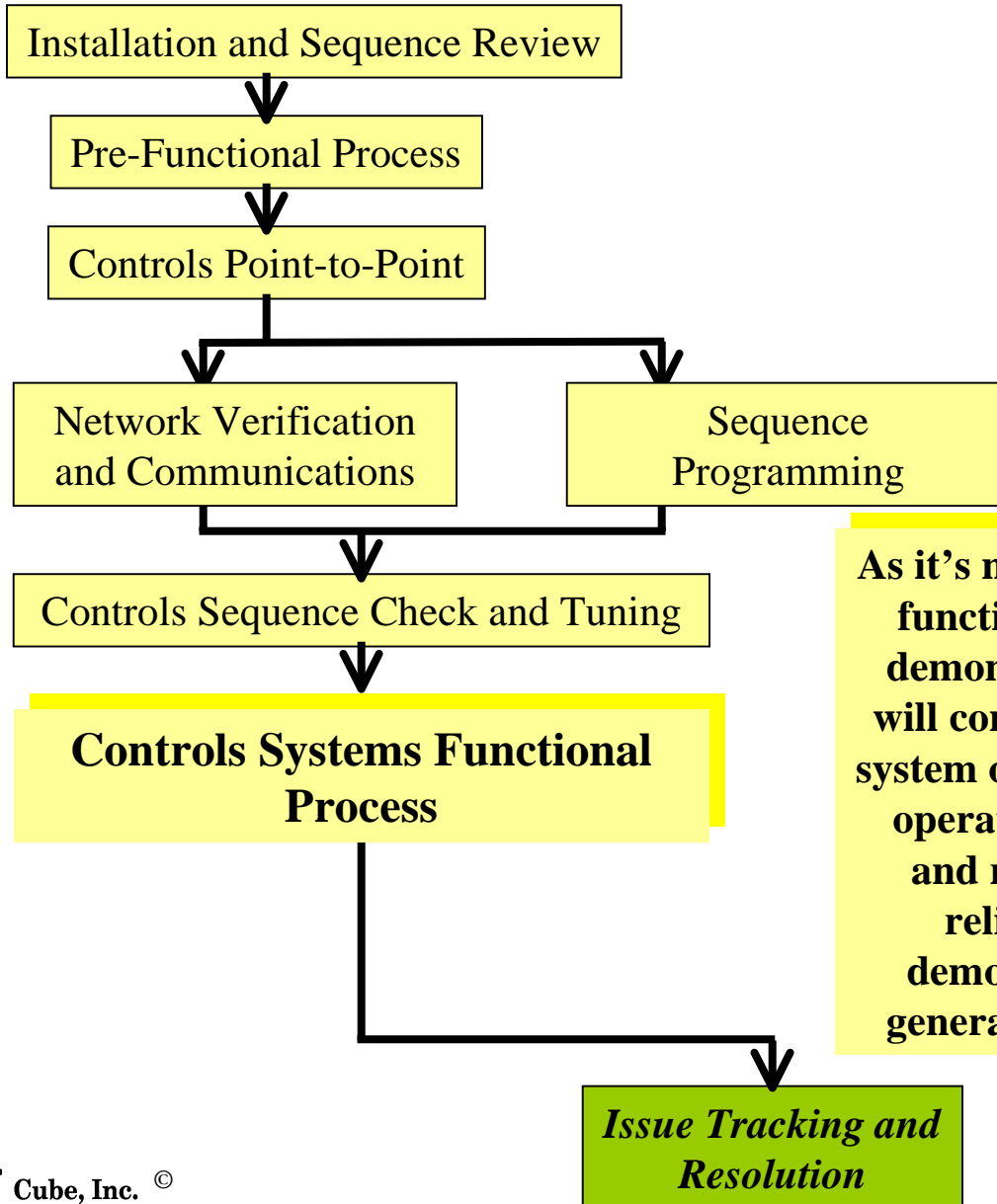
## **Facilities Management Systems**



**This stage, similar to Equipment Start-Up, deals with making the FMS operational. During this process, conformance to the specified operating sequences will be confirmed and documented. Operating/sequence conflicts and inconsistencies as well as control loop tuning will be addressed during this time.**

# ***COMMISSIONING PROCESS***

## **Facilities Management Systems**



**As it's name suggests, during this stage the full functionality of the controls system will be demonstrated and documented. This phase will consist of observing proper, "hands-off", system operation during the required modes of operation. Full use of system documenting and reporting capabilities will be heavily relied upon during this work, to both demonstrate their functionality as well as general much of the overall documentation.**

# ***COMMISSIONING PROCESS***

## **O&M Manuals and Training**

### **O&M and Training Preparation**

This step begins the process of assembling project-specific O&M manuals and training program. During this step the structure and organization of the O&M manuals and draft training agendas are developed. Collection and organization of basic materials are carried out during this time.

### **O&M Documentation and Training Review**

As the O&M materials and training agendas are collected, organized and assembled into their preliminary formats, review of this material is undertaken. During this time, project specific documentation is added and the basic manuals are developed along with training outlines.

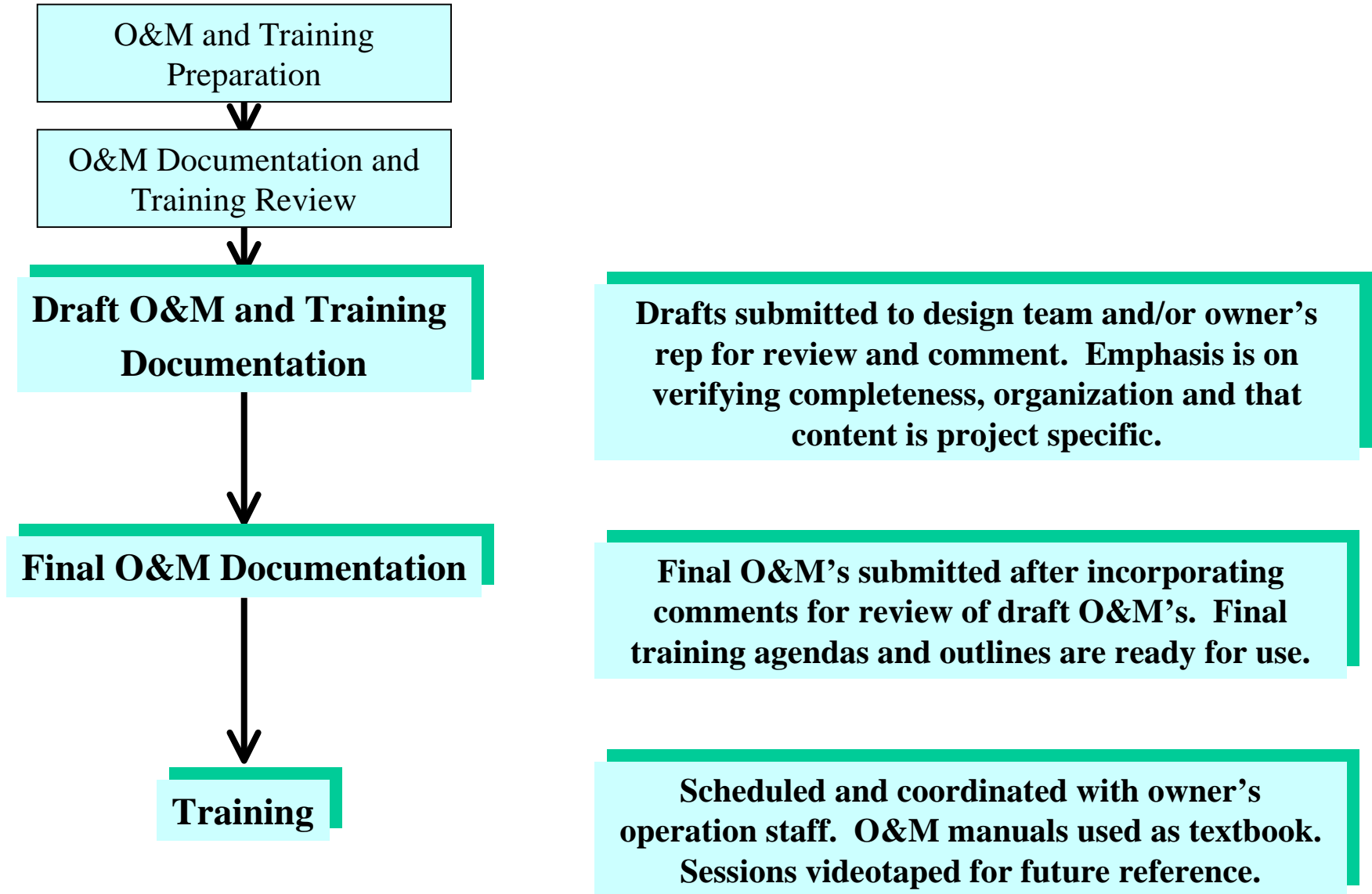
Draft O&M and Training Documentation

Final O&M Documentation

*Training*

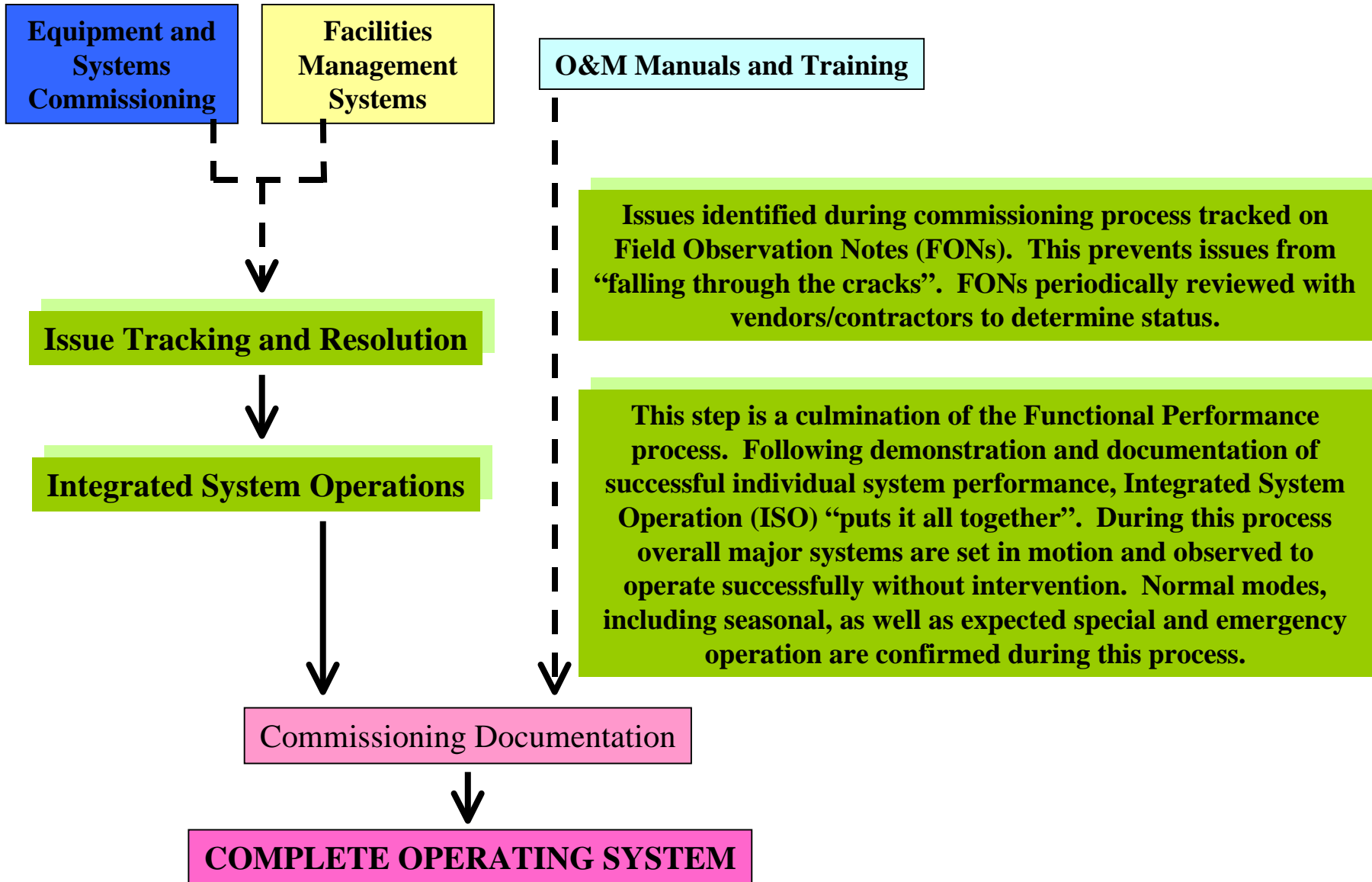
# ***COMMISSIONING PROCESS***

## **O&M Manuals and Training**



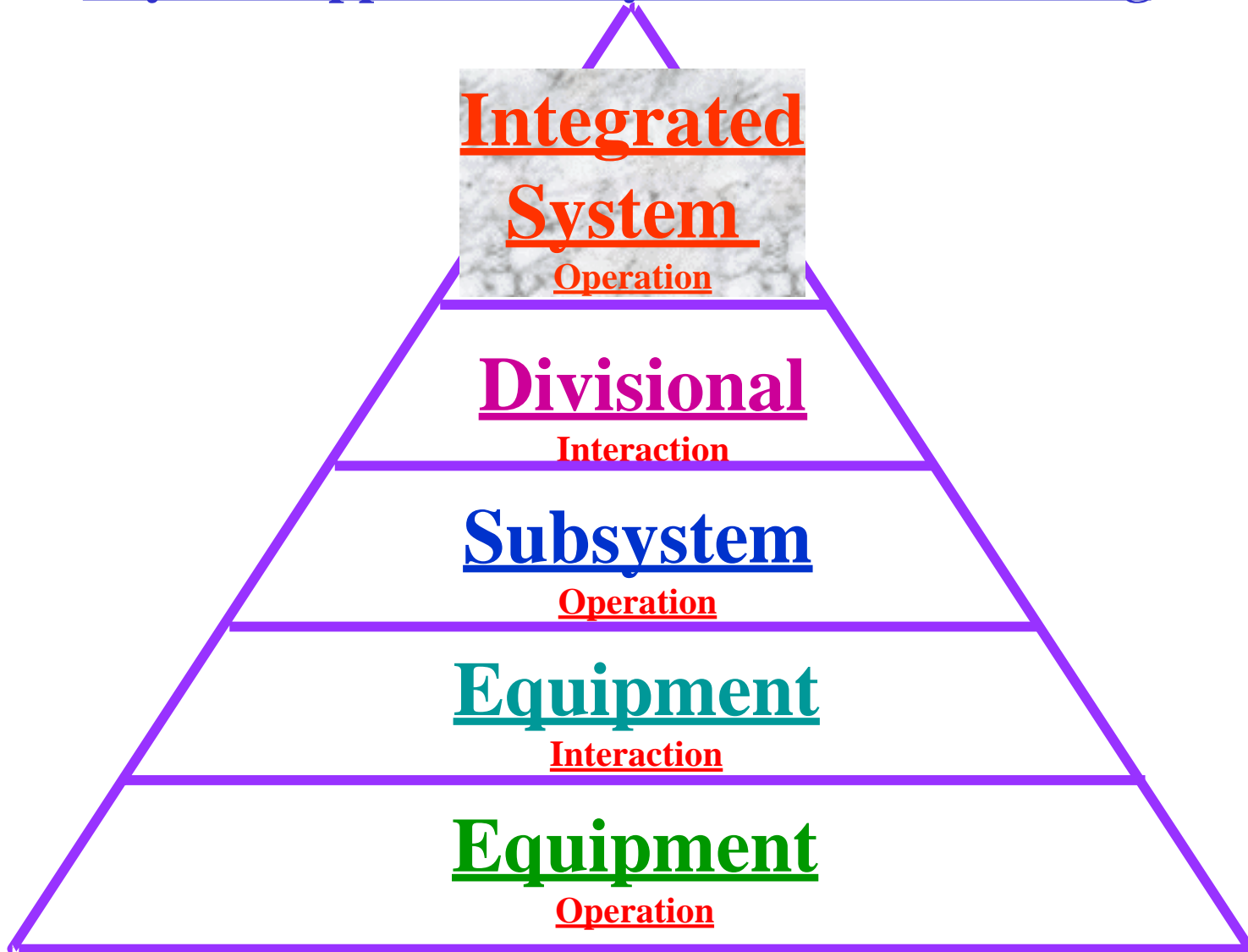
# COMMISSIONING PROCESS

## Final Steps



# ***COMMISSIONING PROCESS***

## **Layered Approach to Systems Commissioning**



# ***COMMISSIONING PROCESS***

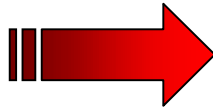
## **Direct Project Benefits**

**Improved  
Construction  
Schedules**



Through extensive field presence, the commissioning process aids in the construction schedule in a number of ways. First, delays from reworking are reduced by catching numerous items prior to their final installation. Second, by keeping abreast of the field work of various contractors, commissioning aids the construction team in avoiding delays from overlapping tasks. Finally, by assisting with early identification and resolution of issues that may ultimately delay the project, the overall process is improved.

**Fewer Change  
Requests**



Similar to the schedule impacts, issues are frequently identified prior to progressing to the point where expensive rework is required. Additionally, by serving as a “sounding board” for various ideas, commissioning can further reduce subsequent rework. This is especially true for multi-discipline systems with overlapping responsibilities.

**Reduced  
Warranty and  
Follow-Up**



By identifying and addressing numerous installation issues, post-acceptance follow-up work is reduced. This benefit applies to warranty issues, with reduced time and effort spent resolving items through the warranty process. Secondly, many out-of-scope optimization items can be addressed during the construction phase if identified early and those that can't are at least identified for later attention.

# ***COMMISSIONING PROCESS***

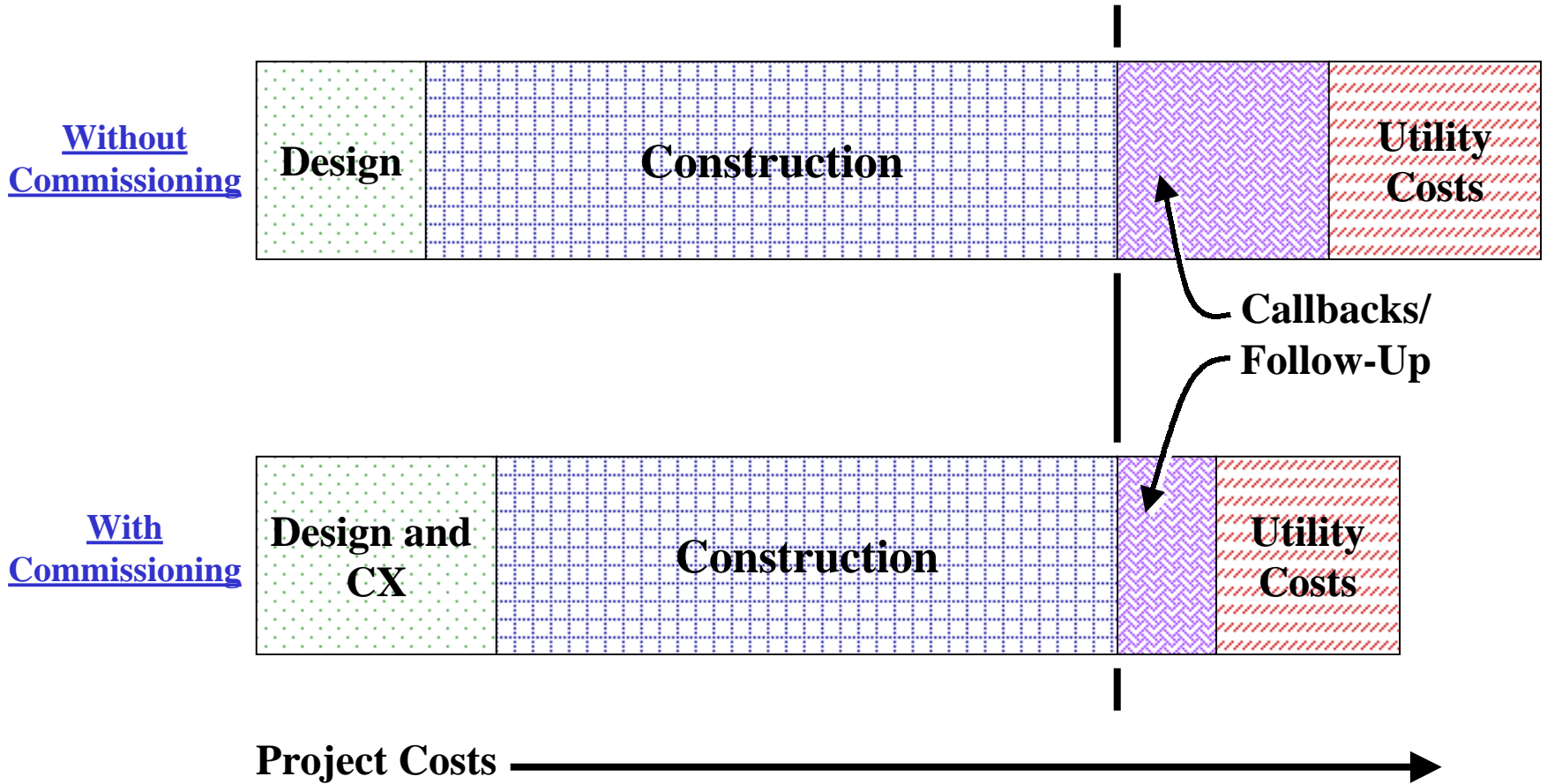
## **Operational Payback**

**Commissioning further pays it's way through added energy efficiency, helping realize design intent efficiency and Green Building goals.**

| <b>Source</b>                                     | <b>Number of Buildings</b> | <b>New/<br/>Retrofit</b>    | <b>Avg. Cost<br/>(% of const. cost)</b>     | <b>Simple Payback<br/>(yrs.)</b>                         |
|---|----------------------------|-----------------------------|---|--|
| <b>Bjorklund @ EII</b>                            | <b>3</b>                   | <b>retro.</b>               | <b>6.5</b>                                  | <b>0.1</b>   |
| <b>Schexnayder @<br/>LA Dept.<br/>Water/Power</b> | <b>6</b>                   | <b>new &amp;<br/>retro.</b> | <b>(22.7% of<br/>incentive<br/>payment)</b> | <b>1.0</b>   |
| <b>Piette &amp; Nordman @<br/>LBL (for DOE)</b>   | <b>16</b>                  | <b>new &amp;<br/>retro.</b> |   | <b>3 @ avg. US rates,<br/>6.5 @ Pacific NW<br/>rates</b> |

# ***COMMISSIONING PROCESS***

## **Overall Cost Reductions**



**Construction costs are not increased, only shifted.**

**Overall project costs are reduced.**

# ***COMMISSIONING PROCESS***

## **Contacts**

### **E-Cube, Boulder**

**1900 Folsom Suite 109  
Boulder CO 80302**

**Jack Wolpert**

**Ph: (303) 443-2610**

**Fax: (303) 443-3704**

**Cell: (303) 517-9286**

**[jwolpert@ecube.com](mailto:jwolpert@ecube.com)**

### **E-Cube, Chicago**

**606 W. Park St.  
Arlington Hts IL 60005**

**Tom Vannatta**

**Ph: (847) 818-6739**

**Fax: (847) 818-9015**

**Cell: (847) 910-5587**

**[tvannatta@ecube.com](mailto:tvannatta@ecube.com)**

# ***COMMISSIONING PROCESS***

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