Methodologies and Tools for Repeatable, Efficient Space Operator Training and Certification

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Introduction

- Value Proposition
  - If operations systems are at the heart of every space mission, then efficiently training operators is a key enabler of those operations systems
  - Efficient training is achieved through a streamlined Instructional Systems Design (ISD) process; Systems Engineering Principles; and focused, flexible training development tools
- ISD process
  - Analysis
  - Design
  - Development
  - Implementation
  - Evaluation

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Training Process

- Analysis
  - Identify and document what needs to be trained
  - Determine knowledge needed and what tasks are to be performed for each task
- Design
  - Establish Enabling Objectives (EOs) and performance criteria for each task
  - Determine lesson content (i.e. put EOs into lesson groups)
- Development
  - Create lessons to fulfill EOs (classroom, on-line, hands-on, blended)
  - Generate products to support lessons (Instructor Manuals, Student Guides, assessments, etc)
  - Maintain traceability from Tasks -> EOs -> Lessons -> Flows -> Ops Positions
- Implementation
  - Present training materials to students
  - Measure training results vs performance criteria to determine effectiveness
- Evaluation
  - Incorporate performance improvements, student feedback into lessons

Analysis

Design

Development

Implementation

Evaluation

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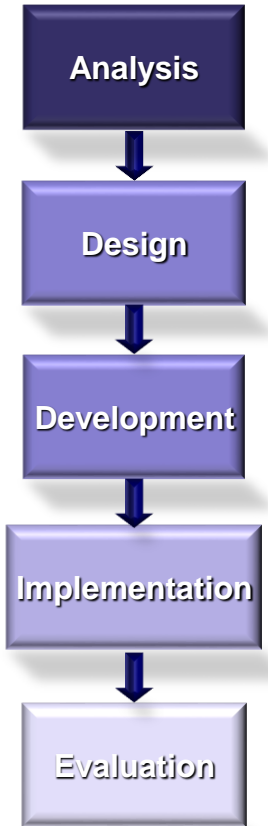
Task Analysis Examples and Tools

Controller high-level tasks:
1) Monitor assigned Assets
2) Control assigned Assets
3) Manage ground configuration for assigned Assets
4) Respond to anomalous conditions

High Level Tasks

1) Monitor assigned Assets
   a) Identify assigned Assets
   b) Verify State-of-Health (SOH) of assigned operational or spare Asset
      i) Perform continuous TLM monitoring and limit checking Asset
      ii) Perform simultaneous TLM monitoring and limit checking of multiple Assets
   c) Monitor TTC data recording

Detailed Tasks

- Training/Cert Approach
- Resources and Phases
- Lesson catalog
- Training flows
- Schedule

Lesson / Cert Guides

Training Plan

Enabling Objectives (EO)

Knowledge (K): Enabling Objectives

Performance (P): Enabling Objectives

Master Objectives Task List (MOTL)
- *Example 1*
- *Example 2*

Position Tasks → **Enabling Objectives** → **Lesson groups** → **Training Flows** → **Training Plan**

Lesson / Cert Guides

Training Flows

SGSS Overview Training

SGSS Familiarization — CR 6:00

Fleet Mgmt & Control Overview — CR 6:00

Maintenance, Training, Development Overview — CR 4:00

Tracking Services Overview — CR 4:00

Ground Network Architecture Overview — CR 6:00

Network Management Overview — CR 4:00

Q

Network Fault Management

Network Fault Management — CR 8:00

Network Fault Management — HO 6:00

Lessons May be Taken in Parallel

TDRS Telemetry, Tracking & Command

TDRS TT&C — CR 8:00

TDRS TT&C — HO 8:00

TDRS Bus Mgmt Part 1 — CR 6:00

TDRS Bus Mgmt Part 1 — HO 6:00

Q

C ← TT&C Certification

Continue to Next Training Block

C - Certification Point
CR – Classroom
HO – Hands-on
Q - Qualification Point

Training Program Examples

NASA GEO

Commercial LEO

Planning
- Analysis
- Design

Execution
- Development
- Implementation
- Evaluation
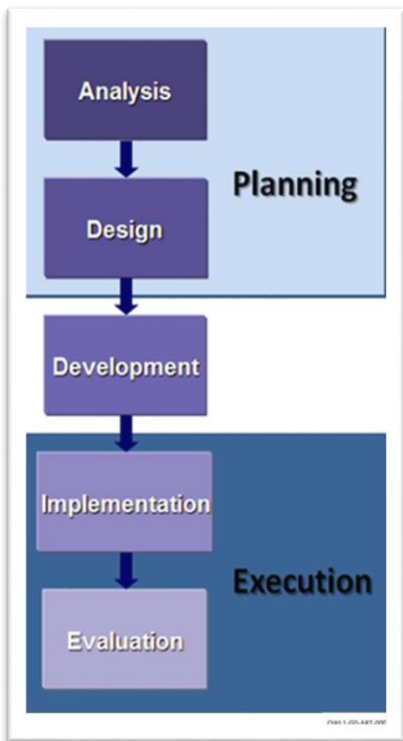
Training Plan

Training Plan

84 lessons
- Classroom (CR), 48 (57%)
- Hands-on (HO), 36 (43%)

52 lessons
- CR   10 (19%)
- On-line (OL)   24 (46%)
- HO   18 (35%)

CR	HO
204	172

lesson hours developed

CR	OL	HO
24	58	40

lesson hours developed
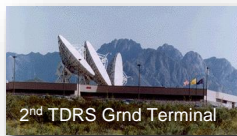
2nd TDRS Grnd Terminal

White Sands Grnd Terminal

USSOC

UKSOC

~250 students, 4 Ops, 9 support positions
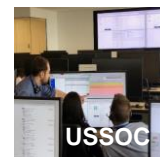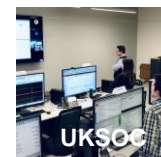
~150 students, 6 Ops, 2 support positions

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Example Training Products

NASA GEO

Commercial LEO

Knowledge Lessons
1. Classroom (CR)
2. On-line (OL)
3. Instructor Manual
4. Student Guide

Low Interactive

High Interactive

Low Interactive

Performance Lessons
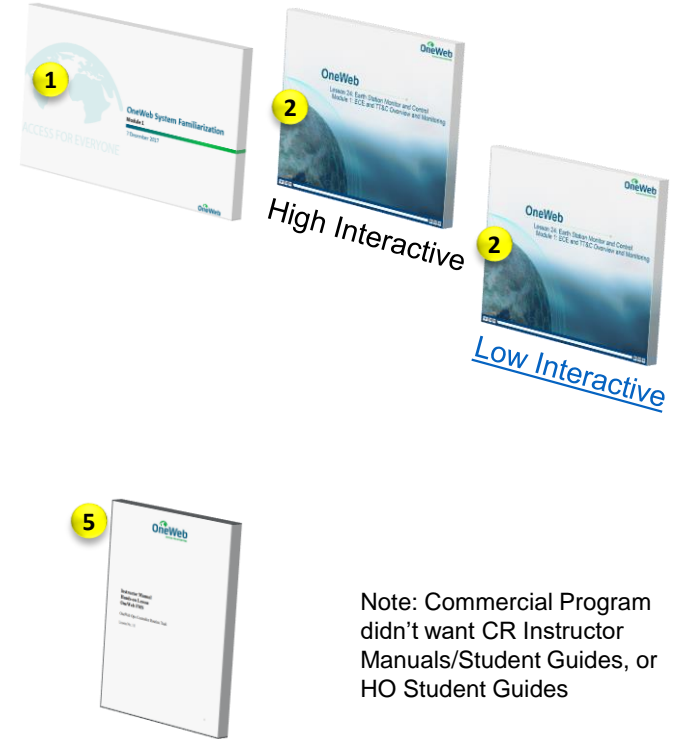   i.e. - Hands-on (HO)
5. Instructor Manual
6. Student Guide
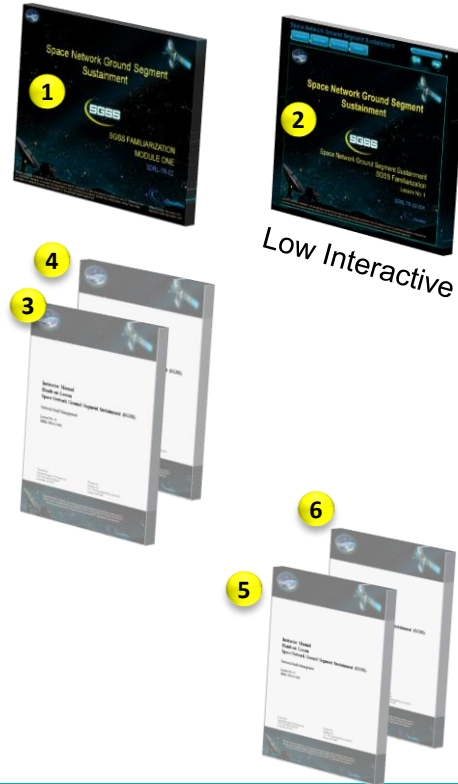
Note: Commercial Program didn't want CR Instructor Manuals/Student Guides, or HO Student Guides

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NASA GEO

- Classroom Lesson Product Lineage

Classroom Lesson (.pptx)
- Instructor access only
- Master file
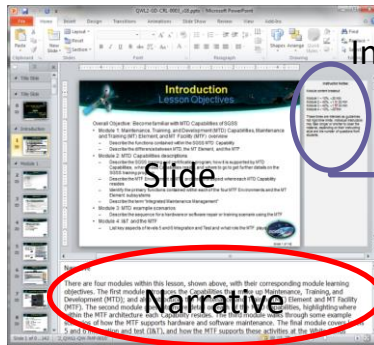- Wall projection

Instructor Manual (.pdf)
- Instructor access only
- Formatted from Master file
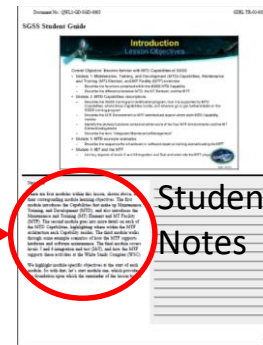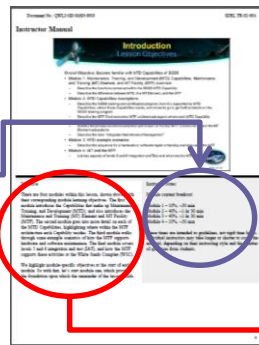- Annotated, referenced during classroom delivery

Student Guide (.pdf)
- Student use
- Notes taken during classroom delivery

Instructor Notes

Slide

Narrative

Student Notes

Take Away

- **Proven:** Efficient, and effective training planning, development, and execution processes and tools critical to training and mission success
- **Flexible:** Methodology structures training support to provide a complete program (start to finish), or anywhere along the development continuum
- **Efficient:** Create individual lessons and multiple supporting training products from a master file, or convert existing training material to multiple formats
- **Disciplined:** Use proven methodologies and workflows for consistent, repeatable results
- **Cost Effective:** Implemented by degreed engineers, early in their career, with a demonstrated passion for learning and instructing. Trained in proven methodology, and led by a senior team lead for optimum results.

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