Propulsion System Concept of Operations

Shipboard Power System Fundamentals

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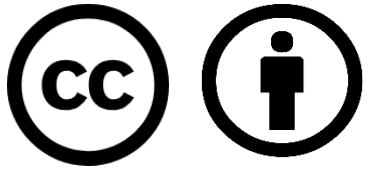

Essential Questions

What is a Propulsion System Concept of Operations?	Remember
What is a Propulsion System Concept of Operations?	Understand
How is a Propulsion system concept of operations developed?	Apply

Introduction

- The propulsion system concept of operations (PS-CONOPS) documents how the designer intends for the ship's propulsion system is to be:
  - Designed
  - Operated during normal, nominal operations
  - Operated during restorative operations
  - Maintained
  - Repaired
  - Upgraded
- PS-CONOPS is a working document
  - Content is generated during the design process as needed to support design and analysis
  - Serves as single source of truth to ensure consistency for calculations, analyses, and simulations

PS-CONOPS uses

- Serve as a single source of truth for design assumptions needed to support design and analysis activities (including simulations).
- Define standard propulsion system line-ups.
- Reflect knowledge gained from propulsion system studies.
- Provide operators, designers, and maintainers with insight as to how the designers intended for the propulsion system to operate under different conditions.

PS-CONOPS as part of the design process

- Part of the digital thread within a digital design environment.
  - Evolution of the PS-CONOPS should be traceable over time.
  - May refer to other configuration managed documents or databases that serve as a single source of truth.
    - PS-CONOPS should only link to authoritative sources of data.
- As the PS-CONOPS evolves, changes should be examined to determine if analyses should be repeated to reflect the changes.

PS-CONOPS content

- Overarching assumptions and requirements
- Propulsion system machinery line-ups
- Nominal Operations
- Restorative Operations
- Propulsion system trade studies
- Maintenance / repair strategy
- Modernization strategy

Overarching assumptions and requirements

- Typical overarching assumptions and requirements documented or referenced in the PS-CONOPS:
  - Margin and service life allowance policy
  - Ship service life
  - Redundancy requirements
  - Survivability requirements
  - Maneuvering requirements
  - Turning requirements
  - Crash stop / reversal requirements
  - Dynamic positioning requirements
  - Autopilot requirements
  - Propulsion system lineups for endurance calculations

Propulsion system machinery lineups

- For each operating condition detailed in the EPS-CONOPS
  - Propulsion scheduling table
  - Propulsion system configurations
- Used in
  - Endurance fuel calculations
  - Annual fuel calculations

Nominal operations

- Describe how the propulsion system is intended to operate:
  - For each of the operating conditions, what performance attributes should be optimized.
  - The process for transitioning between propulsion system lineups.
  - Limitations for the use of auxiliary propulsion motors and thrusters.
  - Expected control modes (constant power, constant torque, or constant speed) and limitations on the use of control modes.
  - Limitations, if any, on operating in trail-shaft.
  - Uses of jacking gear and turning gear.
  - Shaft grounding system / cathodic protection system description.
  - Operation of steering gear.
- Used in:
  - Creating simulation models for dynamic simulations.

Restorative operations

- Describe how the propulsion system is intended to be restored to nominal operation following failure or damage
  - Local control modes.
  - Use of clutches, shaft brakes, shaft seals, etc. in restorative operations.
  - Limitations on ship speed for different types of casualties and restorative methods.
  - Emergency steering procedures.
- Used in:
  - Creating simulation models for dynamic simulations.
  - Survivability analyses.
  - Reliability analyses.

Propulsion system trade studies

- Document insights gained from analyses and trade-studies.
- Used in:
  - Ensuring all other analyses and design activities reflect the insights.

Maintenance / repair strategy

- Document maintenance and repair strategies of propulsion system equipment.
- Used in:
  - Determining how much redundancy to provide.
  - Determining Mean-Time to Repair for reliability analysis.
  - Determining how many spare parts are required onboard.

Modernization Strategy

- Document features, if any, within the propulsion system design that facilitate modernization of the ship.
- Used in:
  - Design of the propulsion system.
  - General arrangements.

PS-CONOPS development

- Should be developed incrementally in a configuration managed environment.
- Content should be developed in the order required to support ongoing analyses.
  - Information needed to support endurance fuel calculations and annual fuel calculations typically required first.
  - The creation of some content may be delayed to preliminary design.