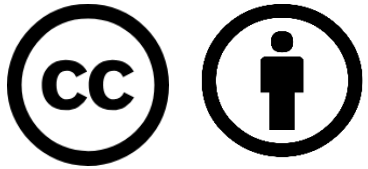
Ship Operating Conditions and Mission Profiles Examples

Revision of 9 March 2026

Dr. Norbert Doerry



Essential Questions

What are ship operational (operating) conditions and what are they used for?	Understand
What are operational modes and ship states and what are they used for?	Understand
What is a ship state participation table and what is it used for?	Understand
What is a ship deployment and employment profile and what is it used for?	Understand

Introduction

- A representation of the physical ship is often insufficient to predict performance of the ship. Other possible factors include:
  - The environment the ship operates in (not the subject of this presentation)
  - Different ways the ship is intended to be used
    - Operational (or operating) conditions.
  - The percentage of time that the ship is in each operational condition
    - Mission profiles
- Each type of analysis may have different sets of operational conditions and mission profiles.

EPLA

- Determine required power (current) rating of power system equipment.
  - Generator sets, switchboard bus bars, bus ties, transformers, power electronic converters, shore power connection.
- Also used to determine 24-hour averages for fuel consumption calculations.
- DPC 310-1 or IEEE Std 45.1
- Uses operating conditions
- Does not use Mission Profiles

Endurance Fuel Calculations

- Determine the required size of fuel tanks.
- DPC 200-1
- Operating conditions
  - 24-hour average loads
- Mission Profile
  - Operational presence speed time profile

Annual (lifetime) fuel calculations

- Estimate the amount of fuel consumed each year over the lifetime of the ship.
- Used as part of calculating Total Ownership Cost estimates.
- DPC 200-2
- Operating conditions
  - Ship States correspond to operating conditions
- Mission Profiles
  - Each ship state may have a speed-time profile.
  - Operational modes expressed as a fraction of time in each ship state
    - Ship state participation table
  - Ship deployment and employment profile indicates fraction of time in each operational mode for each year of the ship's service life
    - May have multiple deployment and employment profiles

Example: Annual Fuel Calculations

Speed (knots)	Profile % time
5	20%
10	30%
15	25%
20	15%
25	8%
30	2%

Underway – Mission Speed – Time Profile

Ship deployment and employment profile

Operational Modes

Ship States (Operating Conditions)

Ship state participation table

	Inport – shore	Underway – Economic al Transit	Underway – Surge to Theater	Underway – Mission
Maintenance and Modernization	0.9	0.05	0.0	0.05
Predeployment Training	0.6	0.2	0.0	0.2
Deployment	0.1	0.2	0.0	0.7
MCO	0.05	0.15	0.05	0.75

Operational Modes

	Low OPTEMPO (fraction of time)				High OPTEMPO (fraction of time)			
Year	Maintenance and Modernization	Predeployment Training	Deployment	MCO	Maintenance and Modernization	Predeployment Training	Deployment	MCO
1	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
2	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
3	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
4	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
5	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
6	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
7	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
8	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
9	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
10	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
11	0.25	0.25	0.5	0.0	0.16	0.17	0.0	0.67
12	0.25	0.25	0.5	0.0	0.16	0.17	0.0	0.67
13	0.25	0.25	0.5	0.0	0.16	0.17	0.0	0.67
14	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0
15	0.25	0.25	0.5	0.0	0.25	0.25	0.5	0.0

MCO = Major Combat Operations

Source: DPC 200-2

Example: Annual Fuel Calculations (continued)

Operational Mode fuel rate

	Inport - Shore	Underway - Economical Transit	Underway - Surge to Theater	Underway - Mission	Calculated Operational Mode Fuel Rate (kg/h)
Fuel Rate(kg/h)	0	3070	12028	3150	
Maintenance and Modernization	90%	5%	0%	5%	311
Predeployment Training	60%	20%	0%	20%	1244
Deployment	10%	20%	0%	70%	2819
MCO	5%	15%	5%	75%	3424

High OPTEMPO Annual (Lifetime) Fuel Consumption

Year	Maintenance and Modernization (1000 kg)	Predeployment Training (1000 kg)	Deployment (1000 kg)	MCO (1000 kg)	Total Fuel (1000 kg)
1	682	2,726	12,356	0	15,763
2	682	2,726	12,356	0	15,763
3	682	2,726	12,356	0	15,763
4	682	2,726	12,356	0	15,763
5	682	2,726	12,356	0	15,763
6	682	2,726	12,356	0	15,763
7	682	2,726	12,356	0	15,763
8	2,726	0	0	0	2,726
9	682	2,726	12,356	0	15,763
10	682	2,726	12,356	0	15,763
11	682	2,726	0	20,112	22,402
12	682	2,726	0	20,112	22,402
13	682	2,726	0	20,112	22,402
14	682	2,726	12,356	0	15,763
15	682	2,726	12,356	0	15,763
				Lifetime Fuel (1000 kg)	243,331