

MERPAC/Industry Work Group 9/99 Report
Specification of minimum standard of competence for officers in charge of an engineering watch in a manned engine-room or designated duty engineers in a periodically unmanned engine room

	Performance Objective	Condition for Assessment	Performance Measure	Performance Standard
31A1	Competence: Use appropriate tools for fabrication and repair operations typically performed on ships			
31A1.1	Characteristics and limitations of materials used in construction and repair of ships and equipment			
31A1.1.1	Knowledge of strength of materials such as yield strength, tensile strength, impact resistance and ductility (Redundant requirement under 31A2.1)	Related coursework	Describe the characteristics and limitations of materials used in the construction and repair of ships and shipboard equipment	Successful completion of related coursework
31A1.1.2	Knowledge of the types of material failures experienced under stress and strain conditions, such as fatigue, corrosion, brittle and ductile failures and creep	Related coursework	Describe the types of material failures experienced under stress and strain conditions	Successful completion of related coursework
31A1.2	Characteristics and limitations of processes used for fabrication and repair			
31A1.2.1	Welding	Aboard ship / Laboratory	Demonstrate the ability to perform basic welding tasks	Safely performs basic welding in accordance with proper welding procedures
31A1.2.2	Machining	Aboard ship / Laboratory	Demonstrate the ability to perform basic machining tasks	Safely performs basic machining in accordance with proper machining procedures
31A1.3	Properties and parameters considered in the fabrication and repair of systems and components			
31A1.3.1	Knowledge of manufacturer's recommendations, and statutory regulations pertaining to the fabrication, repair and testing of systems and components	Related coursework	Describe the significance of manufacturer's recommendations, and statutory regulations pertaining to the fabrication and repair and testing of systems and components	Successful completion of related coursework
31A1.4	Application of safe working practices in the workshop environment			
31A1.4.1	Proper and safe use of tools and equipment	Aboard ship / Laboratory	Demonstrate the proper and safe use of tools and equipment utilized to perform typical shipboard repairs and fabrications	Use of equipment and procedures is appropriate and safe

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31A1.4.2	Proper procedures used in the performance of shipboard repairs	Aboard ship / Laboratory	Demonstrate proper procedures used in the performance of shipboard repairs such as replacing a section of pipe, replacing a gasket, repairing a valve, etc.	Use of equipment and procedures is appropriate and safe
31A2	Competence: Use hand tools and measuring equipment for dismantling, maintenance, repair and re-assembly of shipboard plant and equipment			
31A2.1	Design characteristics and selection of materials in construction of equipment			
	Satisfied under 31A1.1.1			
31A2.2	Interpretation of machinery drawings and handbooks			
31A2.2.1	Use technical manuals and machinery drawings	Aboard ship / Laboratory	Demonstrate the use of technical manuals and machinery diagrams during the disassembly, maintenance, repair or re-assembly of machinery	Use of equipment and procedures is appropriate and safe
31A2.3	Operational characteristics of equipment and systems			
31A2.3.1	Knowledge of measuring instruments	Related coursework	Describe the proper use of measuring instruments to determine operational parameters and system limitations	Successful completion of related coursework
31A2.3.2	Knowledge of hand tools	Related coursework	Describe the proper use of hand tools such as chisels, hammers, screwdrivers, hacksaws, wrenches, etc.	Successful completion of related coursework
31A3	Competence: Use hand tools, electrical and electronic measuring and test equipment for fault finding, maintenance and repair operations			
31A3.1	Safety requirements for working on shipboard electrical systems			
31A3.1.1	Knowledge of lock-out, tag-out	Related coursework	Describe procedure for lock out, tag out of electrical equipment	Successful completion of related coursework
31A3.1.2	Use electrical measuring instruments	Aboard ship / Laboratory	Demonstrate ability to safely measure circuit values (i.e., voltage, resistance, current) and trouble shoot electrical faults using electrical measuring instruments	Correctly measures circuit voltage, resistance, and current.

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31A3.2	Construction and operational characteristics of shipboard AC and DC electrical systems and equipment			
31A3.2.1	Knowledge of AC/DC rotating machinery	Related coursework	Describe the fundamentals of AC/DC rotating machinery	Successful completion of related coursework
31A3.2.2	Knowledge of electrical components	Related coursework	Describe the fundamentals of transformers, rectifiers, breakers, fuses, electromagnetic relays	Successful completion of related coursework
31A3.2.3	Knowledge of electrical schematic diagrams	Related coursework	Describe and interpret electrical schematic diagrams	Successful completion of related coursework
31A3.3	Construction and operation of electrical test and measuring equipment			
31A3.3.1	Knowledge of electrical measuring equipment construction and operation	Related coursework	Describe construction and operation of electrical test and measuring equipment	Successful completion of related coursework
31A4	Competence: Maintain a safe engineering watch			
31A4.1	Duties associated with taking over and accepting a watch			
31A4.1.1	Take over the watch	Aboard ship	Demonstrate duties associated with taking over and accepting a watch including such as making a round, understanding special instructions and standing orders, determining plant status	Correctly performs all tasks in accordance with supervisor's instruction
31A4.2	Routine duties undertaken during a watch			
31A4.2.1	Perform watch duties	Aboard ship	Demonstrate monitoring the main propulsion plant auxiliary systems and machinery spaces until properly relieved	Correctly performs all tasks in accordance with supervisor's instruction
31A4.3	Maintenance of the machinery space logbook and the significance of the readings taken			
31A4.3.1	Maintain the machinery space logbook	Aboard ship	Demonstrate the ability to maintain machinery space logbook	Correctly performs all tasks in accordance with supervisor's instruction
31A4.3.2	Knowledge of readings	Related coursework	Describe the significance of the readings recorded	Successful completion of related coursework

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31A4.4 Duties associated with handing over a watch				
31A4.4.1	Hand over the watch	Aboard ship	Demonstrate the procedures for handing over the watch	Correctly performs all tasks in accordance with supervisor's instruction
31A4.5 Safety and emergency procedures; change-over of remote/automatic to local control of all systems				
31A4.5.1	Knowledge of emergency and safety procedures	Related coursework	Describe safety and emergency procedures; change-over of remote/automatic to local control of selected systems	Successful completion of related coursework
31A4.6 Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems				
31A4.6.1	Knowledge of safety precautions	Related coursework	Describe precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	Successful completion of related coursework
31A5 Competence: Use English in written and oral form				
31A5.1 Adequate knowledge of the English language to enable the officer to use engineering publications and to perform engineering duties				
31A5.1.1	Read manuals and communicate effectively	Aboard ship / classroom	Demonstrate sufficient knowledge of the English language to interpret engineering technical manuals, and communicate effectively while performing engineering duties	English language publications relevant to engineering duties are correctly interpreted Communications are clear and understood
31A6 Competence: Operate main and auxiliary machinery and associated control systems				
31A6.1 Preparation of main machinery and preparation of auxiliary machinery for operation				
31A6.1.1	Operate centrifuge	Aboard ship / Laboratory	Participate in operating an oil centrifuge	Use of equipment and procedures is appropriate and safe
31A6.1.2	Clean centrifuge	Aboard ship / Laboratory	Participate in the cleaning and inspection of an oil centrifuge	Use of equipment and procedures is appropriate and safe

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31A6.1.3	Knowledge of steering gear arrangement	Related coursework	Describe the steering gear system arrangement	Successful completion of related coursework that's included in approved training
31A6.1.4	Test steering gear	Aboard ship / Laboratory	Participate in the preparation and testing of the steering gear system for getting underway	Use of equipment and procedures is appropriate and safe
31A6.1.5	Monitor steering gear	Aboard ship / Laboratory	Demonstrate monitoring steering gear systems	Use of equipment and procedures is appropriate and safe
31A6.1.6	Knowledge of change-over of steering gear	Related coursework	Describe changing over to the standby steering system	Successful completion of related coursework that's included in approved training
31A6.1.7	Knowledge of refrigeration and air conditioning systems	Related coursework	Describe the operation of a refrigeration and air-conditioning systems	Successful completion of related coursework that's included in approved training
31A6.1.8	Monitor refrigeration and/or air conditioning system	Aboard ship / Laboratory	Demonstrate monitoring of on refrigeration and/or air conditioning system	Use of equipment and procedures is appropriate and safe
31A6.1.9	Operate compressed air system	Aboard ship / Laboratory	Participate in the operation of a compressed air system	Use of equipment and procedures is appropriate and safe
31A6.1.10	Monitor potable water, sanitary, and sewage systems	Aboard ship / Laboratory	Demonstrate monitoring of potable water, sanitary, and sewage systems	Use of equipment and procedures is appropriate and safe
31A6.1.11	Knowledge of fresh-water generation equipment construction and operation	Related coursework	Description of the operation of fresh-water generation equipment construction and operation	Successful completion of related coursework
31A6.1.12	Operate fresh-water generation equipment	Aboard ship / Laboratory	Participate in operation of fresh water generation equipment	Use of equipment and procedures is appropriate and safe
31A6.1.13	Knowledge of diesel engine construction and operation	Related coursework	Describe the principles of construction and operation of a medium and slow speed engines	Successful completion of related coursework

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31A6.1.14	Knowledge of diesel engine auxiliary systems	Related coursework	Describe diesel engine systems such as cooling, lube, fuel, starting, intake, exhaust, and control	Successful completion of related coursework
31A6.1.15	Prepare main diesel engine for start	Aboard ship / Laboratory / Simulator	Participate in preparation of the main propulsion diesel engine for departure, including all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily	Correctly performs all tasks in accordance with supervisor's instructions
31A6.1.16	Monitor main diesel engine	Aboard ship / Laboratory / Simulator	Demonstrate monitoring main diesel engine	Use of equipment and procedures is appropriate and safe
31A6.1.17	Knowledge of main and auxiliary steam turbines	Related coursework	Describe the principles of construction and operation main and auxiliary steam turbines	Successful completion of related coursework
31A6.1.18	Knowledge of auxiliary steam systems	Related coursework	Describe auxiliary systems such as condensate, feed, lube, gland seal, and air removal	Successful completion of related coursework
31A6.1.19	Start main steam turbine	Aboard ship / Laboratory / Simulator	Participate in preparation of the main propulsion steam turbines for departure by carrying out all necessary checks and actions to ensure that all the auxiliary and control systems are functioning satisfactorily	Correctly performs all tasks in accordance with supervisor's instructions
31A6.2	Operation of steam boilers, including combustion systems			
31A6.2.1	Knowledge of auxiliary boilers construction and operation	Related coursework	Describe the principles of construction and operation of the oil-fired and exhaust gas boiler	Successful completion of related coursework
31A6.2.2	Start steam boiler	Aboard ship / Laboratory / Simulator	Participate in the start-up of a steam boiler	Use of equipment and procedures is appropriate and safe
31A6.2.3	Knowledge of main boiler construction and operation	Related coursework	Describe the principles of construction and operation of a main propulsion steam boiler and ancillary systems	Successful completion of related coursework
31A6.2.4	Monitor steam boiler	Aboard ship / Laboratory / Simulator	Participate in steam boiler operation by following stipulated safe operating procedures	Use of equipment and procedures is appropriate and safe

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	Performance Objective	Condition for Assessment	Performance Measure	Performance Standard
31A6.2.5	Knowledge of combustion control	Related coursework	Describe the operation of the fuel oil service and combustion air system, including combustion control systems	Successful completion of related coursework
31A6.2.6	Knowledge of water treatment and boiler operational procedures	Related coursework	Describe routine operational procedures such as blow down, soot blowing, water testing and water treatment for steam boilers	Successful completion of related coursework
31A6.3	Methods of checking water level in steam boilers and action necessary if water level is abnormal			
31A6.3.1	Knowledge of boiler water level	Related coursework	Describe factors affecting boiler water level during varying load conditions such as maneuvering and soot-blowing, and means to monitor and adjust same	Successful completion of related coursework
31A6.3.2	Knowledge of boiler water casualties	Related coursework	Describe correct response to boiler water level casualties	Successful completion of related coursework
31A6.3.3	Monitor main or auxiliary boiler water level	Aboard ship / Laboratory / Simulator	Participate in the correct operation of boiler water level and feed water control systems under varying conditions	Correctly performs all tasks in accordance with supervisor's instructions Water levels are maintained within safe operating parameters
31A6.4	Location of common faults in machinery and plant in engine and boiler rooms and action necessary to prevent damage			
31A6.4.1	Knowledge of main diesel engine faults and alarms	Related coursework	Describe possible abnormal conditions of the main diesel engine and appropriate corrective actions	Successful completion of related coursework
31A6.4.2	Knowledge of main and auxiliary boiler faults and alarms	Related coursework	Describe possible abnormal conditions of main and auxiliary boilers and appropriate corrective actions	Successful completion of related coursework
31A6.4.3	Knowledge of turbine faults and alarms	Related coursework	Describe possible abnormal conditions of the main propulsion steam turbine and appropriate corrective actions	Successful completion of related coursework

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	Performance Objective	Condition for Assessment	Performance Measure	Performance Standard
31A7	Competence: Operate pumping systems and associated control systems			
31A7.1	Routine pumping operations			
31A7.1.1	Knowledge of storage tanks (Redundant requirement under 31D1.1)	Related coursework	Describe tanks, tank vents and overflows, filling connections and sounding tubes	Successful completion of related coursework
31A7.1.2	Knowledge of safe entry into confined spaces	Related coursework	Describe procedure for safe entry of confined spaces	Successful completion of related coursework
31A7.1.3	Knowledge of fuel transfer (Redundant requirement under 31D1.1)	Related coursework	Describe the fuel transfer systems and procedures	Successful completion of related coursework
31A7.1.4	Transfer fuel	Aboard ship / Laboratory / Simulator	Participate in the transfer of fuel between tanks onboard	Use of equipment and procedures is appropriate and safe
31A7.2	Operation of bilge, ballast and cargo pumping systems			
31A7.2.1	Pump bilges	Aboard ship / Laboratory / Simulator	Demonstrate pumping out bilges, ensuring that all anti-pollution regulations and requirements are observed	Use of equipment and procedures is appropriate and safe
31A7.2.2	Knowledge of oily water separator (Redundant requirement under 31D1.1)	Related coursework	Describe the construction and operation of the oily water separator	Successful completion of related coursework
31A7.2.3	Knowledge of ballasting (Redundant requirement under 31D1.1)	Related coursework	Describe the ballast systems and procedures	Successful completion of related coursework
31A7.2.4	Knowledge of bunkering (Redundant requirement under 31D1.1)	Related coursework	Describe bunkering systems and procedures, including all precautions, requirements relating to safety and pollution prevention	Successful completion of related coursework

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	Performance Objective	Condition for Assessment	Performance Measure	Performance Standard
31B1	Competence: Operate alternators, generators and control systems			
31B1.1	Appropriate basic electrical knowledge and skills			
31B1.1.1	Knowledge of emergency generator	Related coursework	Describe automatic start-up of emergency generators	Successful completion of related coursework
31B1.1.2	Knowledge of emergency electrical system	Related coursework	Describe the emergency electrical system, including circuits served, safety devices, batteries and charging systems	Successful completion of related coursework
31B1.1.3	Knowledge of electrical distribution system	Related coursework	Describe arrangement of electrical distribution system from generator to final use	Successful completion of related coursework
31B1.2	Preparing, starting, coupling and changing over alternators or generators			
31B1.2.1	Start and parallel generators	Aboard ship / Laboratory / Simulator	Demonstrate the proper paralleling of generators, load transferring, and changing over following applicable safety procedures	Use of equipment and procedures is appropriate and safe
31B1.2.2	Start emergency generator	Aboard ship / Laboratory / Simulator	Participate in starting the emergency generator	Use of equipment and procedures is appropriate and safe
31B1.3	Generating plant - Location of common faults and action to prevent damage			
31B1.3.1	Knowledge of electrical faults	Related coursework	Describe possible abnormal conditions in the electrical system, and appropriate corrective actions	Successful completion of related coursework
31B1.4	Control systems - Location of common faults and action to prevent damage			
31B1.4.1	Knowledge of trouble shooting electrical faults	Related coursework	Describe possible abnormal conditions in the control systems associated with electrical generation and distribution, and appropriate corrective actions	Successful completion of related coursework
31C1	Competence: Maintain marine engineering systems, including control systems			
31C1.1	Marine Systems - Appropriate basic mechanical knowledge and skills			
31C1.1.1	Trace and draw systems	Aboard ship / Laboratory	Demonstrate the ability to trace out and produce one line diagram of shipboard piping systems	Correctly performs all tasks in accordance with supervisor's instructions

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31C1.1.2	Knowledge of shipboard process control	Related coursework	Describe shipboard process control systems	Successful completion of related coursework
31C1.2	Safe isolation of electrical and other types of plant and equipment required before personnel are permitted to work on such plant or equipment			
31C1.2.1	Perform lock-out, tag-out	Aboard ship / Laboratory	Demonstrate the proper procedure for lock out, tag out, of an electrical component, and a component of a fluid system	Use of equipment and procedures is appropriate and safe
31C1.3	Undertake maintenance and repair to plant and equipment			
31C1.3.1	Knowledge of diesel engine maintenance	Related coursework	Describe routine maintenance and inspection on diesel engines including safety procedures	Successful completion of related coursework
31C1.3.2	Knowledge of electrical equipment maintenance	Related coursework	Describe routine maintenance on electrical equipment including safety procedures	Successful completion of related coursework
31C1.3.3	Knowledge of deck machinery maintenance	Related coursework	Describe routine maintenance on deck machinery such as, lifeboats and davits including safety procedures	Successful completion of related coursework
31C1.3.4	Perform maintenance	Aboard ship / Laboratory	Participate in the inspection and repair of machinery	Correctly performs all tasks in accordance with supervisor's instructions
31C1.3.5	Knowledge of boiler maintenance	Related coursework	Describe routine maintenance on boilers including safety procedures	Successful completion of related coursework
31C1.3.6	Knowledge of turbine maintenance procedures	Related coursework	Describe routine maintenance on turbines including safety procedures	Successful completion of related coursework
31C1.3.7	Knowledge of shipboard inventory control	Related coursework	Describe shipboard inventory control systems	Successful completion of related coursework
31C1.3.8	Perform maintenance	Aboard ship / Laboratory	Participate in the inspection and repair of machinery	Correctly performs all tasks in accordance with supervisor's instructions
31D1	Competence: Ensure compliance with pollution-prevention requirements			
31D1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment			

Satisfied under 31A7.1.1, 31A7.1.3, 31A7.2.2, 31A7.2.3, and 31A7.2.4

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31D1.2	Anti-pollution procedures and all associated equipment			
31D1.2.1	Knowledge of anti-pollution regulations and procedures	Related coursework	Describe anti-pollution regulations and procedures	Successful completion of related coursework
31D2	Competence: Maintain seaworthiness of the ship			
31D2.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment			
31D2.1.1	Knowledge of hydrostatics	Related coursework	Describe ship's hydrostatic characteristics	Successful completion of related coursework
31D2.1.2	Knowledge of stability curves	Related coursework	Describe the use of the displacement and other curves and cross curves of stability in calculating ship's stability and trim	Successful completion of related coursework
31D2.2	Understanding of the fundamentals of watertight integrity			
31D2.2.1	Knowledge of ship structure	Related coursework	Describe the use of ship's structures to establish watertight integrity	Successful completion of related coursework
31D2.2.2	Knowledge of maintaining water tight integrity	Related coursework	Describe shipboard procedures for maintaining watertight integrity	Successful completion of related coursework
31D2.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy			
31D2.3.1	Knowledge of stability and trim	Related coursework	Describe the effects of change in weight on stability, trim, list and draft	Successful completion of related coursework
31D2.3.2	Knowledge of damage control	Related coursework	Describe the actions to be taken to minimize the impact of damage on the stability of the vessel	Successful completion of related coursework
31D2.4	General knowledge of the principal structural members of a ship and the proper names for the various parts			
31D2.4.1	Knowledge of ship structure	Related coursework	Describe the principal components of ship structures	Successful completion of related coursework

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31D2.4.2	Knowledge of bending moments	Related coursework	Describe the proper use of bending moment diagrams to calculate the structural strength of the ship	Successful completion of related coursework
31D2.4.3	Knowledge of load lines	Related coursework	Describe the significance of the ship's load line and how it is designated	Successful completion of related coursework
31D3	Competence: Prevent, control and fight fire onboard			
31D3.1	Knowledge of fire prevention			
31D3.1.1	Satisfied by successful completion of USCG approved Basic and Advanced Fire fighting			
31D3.2	Ability to organize fire drills			
31D3.2.1	Satisfied by successful completion of USCG approved Basic and Advanced Fire fighting			
31D3.3	Knowledge of classes and chemistry of fire			
31D3.3.1	Satisfied by successful completion of USCG approved Basic and Advanced Fire fighting			
31D3.4	Knowledge of fire-fighting systems			
31D3.4.1	Satisfied by successful completion of USCG approved Basic and Advanced Fire fighting			
31D3.5	Action to be taken in the event of fire, including fire involving oil systems			
31D3.5.1	Satisfied by successful completion of USCG approved Basic and Advanced Fire fighting			
31D4	Competence: Operate lifesaving appliances			
31D4.1	Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements and their equipment, including radio life-saving appliances, satellite EPIRB, SARTs, immersion suits and thermal protective aids			
31D4.1.1	Satisfied under STCW 95 Basic Safety Elements Assessment			
31D4.2	Knowledge of survival at sea techniques			
31D4.2.1	Satisfied under STCW 95 Basic Safety Elements Assessment			
31D5	Competence: Apply medical first aid onboard ship			
31D5.1	Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur onboard ship			
31D5.1.1	Successful completion of a basic first aid course which meets requirements of 46CFR and STCW			

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31D6	Competence: Monitor compliance with legislative requirements		
31D6.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment		
31D6.1.1	Satisfied under STCW 95 Basic Safety Elements Assessment		

STCW Work Group 6/99 Report

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Definition of Terms:

Describe - The candidate will communicate through oral or written form, a comprehensive knowledge of the task or criteria to a designated examiner. Describe assessments may also be satisfied by individual demonstration.

Participate - The candidate will be an active member of a group sharing in the performance of the task (using approved in-service experience, approved training ship experience, approved simulator training where appropriate, or approved laboratory equipment training) under the supervision or guidance of a designated examiner or observed and verified by a licensed officer using criteria provided by a designated examiner for the purpose of assessment. Participate assessments may also be satisfied by individual demonstration.

Demonstrate - The candidate will individually perform the task (using approved in-service experience, approved training ship experience, approved simulator training where appropriate, or approved laboratory equipment training) for the purpose of the assessment under the supervision or guidance of a designated examiner or observed and verified by a licensed officer using criteria provided by a designated examiner.

Related Coursework – is a relevant component or course within a USCG approved program

Operate - Start, place into service, monitor, and secure machinery.

Monitor – Perform routine checks and adjustments in order to maintain machinery at required operational status.

Note: It is recognized that through the continual and frequent observation of certain performance-based demonstrations where detrimental harm may occur to required machinery, equipment, or systems, an alternative plan can be employed, utilizing partial performance observations to include a combination of ship board equipment, computer simulations, mechanical mock-ups, etc., or a combination of these as long as the outcome is capable of replicating 100% of the indicated task conducted aboard ship.