An Integrated Propulsion System onboard *Makin Island* (LHD 8)

At a Glance

What is it?

- *Makin Island* (LHD 8) is the first U.S. Navy surface ship to implement a 4160 VAC Zonal Electrical Distribution System (AC ZEDS) as well as incorporating 5000 HP electric propulsion motors that can be configured in an "integrated power system" (IPS) mode to take power from the electrical generation / distribution system. The LHD 8 concept for electrical power generation, distribution and electric propulsion represents the intent of the all-electric warship. The purpose of the electric drive system is to provide a fuel saving as an alternative to the use of the gas turbine engines during low speed operations, where the gas turbines are less fuel efficient.

How does it work?

- The LHD 8 amphibious assault ship utilizes a hybrid propulsion plant, where the ship has the capability to be propelled by auxiliary electric propulsion motors or gas turbine engines.
- *U.S.S. Iwo Jima* (LHD 7) was the last ship of this class to retain the original steam plant for ship propulsion and auxiliary ship services. The Navy's desire not to continue with conventionally steam powered ship designs was in part because of the high life cycle costs associated with steam plants. The replacement propulsion system developed for
- LHD 8 is an innovative hybrid propulsion system using both the recently developed General Electric LM2500+ gas turbine (engine rated @ 35,000 horsepower) for main ship propulsion duty and an electric propulsion system (motor rated @ 5000 horsepower) for more economical ship propulsion duty whenever practical, termed the Auxiliary Propulsion System (APS).

Points of Contact:

- C. David Mako (NSWCCD 937)
  215.897.1195
  charles.mako@navy.mil
- Justin Kersey (NAVSEA PMS 377)
  202.781.4251
  justin.kersey@navy.mil

Description:

The LHD 8 Auxiliary Propulsion system (APS) has 3 Major Components based on commercial technology, ruggedized for LHD 8 based on Grade B Shock requirements:

Transformer - 5.0 MVA, 4160/724V, 60Hz, 3 phase, Water Cooled, Marine Transformer Type: Step-down and Power Isolation Transformer (One Primary, Four Secondary Windings)

Variable Speed Drive (VSD) - 4000 kW, Water Cooled, Marine, 24 Pulse Width Modulated (PWM) Rectifier MV3000 Microprocessor Controller (with Local Control Panel) Closed Circuit Water Cooled with associated Cooling Pumps

Motor - 5000 HP, Water Cooled, Marine, Induction Motor 100-1800 rpm, 592V, 3-Phase, Squirrel Cage Induction Motor

Benefits:

- Primary purpose to provide fuel savings during low speed (12 knots and below)
- Redundant source of propulsion
- Ship can perform all it's mission requirements with the gas turbine engines
- Clutch and control system design allows for transitions "on-the-fly" from gas turbine to Auxiliary Propulsion System
- Operational to extent that excess electrical power is available
- Utilizes existing gas turbine propulsion drive train
- Capable of starting stopped shaft
- Integrated with Machinery Control System (MCS) for full remote control