# VOITH SCHNEIDER (CYCLOIDAL) PROPULSION

# L.A. FIREBOAT 2

## INTRODUCTION

**The design of L.A. Fireboat 2, the Warner L. Lawrence, is based upon the tractor tug concept, including the use of cycloidal propulsion. Most important among the many advantages of cycloidal propulsion is exceptional maneuverability at all speeds and the ability to simultaneously operate the fire pumps without compromising that maneuverability. Cycloidal propulsion allows the main engines to power fire pumps at speeds appropriate to the various demands of firefighting while the same engines also maneuver the fireboat at maximum efficiency.**

## OPERATION

**Two engine driven, counter-rotating rotors (disks) are mounted horizontally in the bottom of the hull approximately one-third back from the bow. Each rotor carries five vertically mounted blades, each blade controlled from either Pilot's Console in the Pilot House.**

**Each of these fore and aft operator's positions consists of a wheel to control transverse (port and starboard) thrust and two pitch levers to control longitudinal (ahead and astern) thrust. The Pilot selects main engine RPM from six setpoints, "IDLE" through "SP5". Maneuvering is accomplished when movements of the wheel and levers are transmitted through purely mechanical linkages to the VSP units below. While either Voith drive unit alone can successfully maneuver Fireboat 2, the combination of the two units working together is far more effective.**

**An operational "model" that works with Fireboat 2 is to operate as if the pitch levers control the ahead and astern thrust of twin propellers mounted aft, and that the wheel controls a bow thruster.**

**"WHEEL HAS PRIORITY": when the wheel is activated, longitudinal thrust is reduced proportionately up to 100%, even if the pitch levers are kept in a position that would otherwise induce ahead or astern motion. Conversely, when wheel is reduced longitudinal (ahead and astern) thrust is restored according to the pitch lever positions. If thrust ahead or astern is needed it is best not to exceed pitch 5 with the wheel; Fireboat 2 will then still respond to operation of the pitch levers.**

**PIVOT POINT: Fireboat 2 pivots in the area of the crane pedestal while maneuvering; in many circumstances it is best to approach stern first in order to position the less maneuverable stern/pivot point near the objective, then "thrust" the highly maneuverable bow to the side as needed.**

**STERN FIRST: in addition to the advantage mentioned above, "stern first" affords the operator excellent visibility in the direction of travel and the best (smallest) wake characteristic up to 8 or 9 knots, depending on load distribution.**

**SPLITTING THE PITCH LEVERS: as in more conventional propulsion systems, "splitting" the pitch levers one ahead and one astern has the effect of beginning a slow rotation in the direction of the "AHEAD" positioned lever.**
**NOTE: in order to adjust movement of Fireboat 2 ahead or astern while continuing movement to the side, both pitch levers should be moved in the same direction while not altering the space between the levers.**

**"CRABBING": in order to move Fireboat 2 directly to the side it is best to get the (less responsive) stern moving first using the pitch levers (see "Splitting the Pitch Levers", above), then to adjust the bow movement with the wheel.**
**NOTE: the nozzle effect of the propeller guard will cause the thrust of the propeller working astern to be less than the thrust of the propeller working ahead; therefore the pitch of the ahead propeller should be set lower than the pitch of the astern propeller.**

**EMERGENCY STOP: Pull the pitch levers steadily to Pitch 6 in the opposite direction and slowly increase to Pitch 10 if necessary. Make certain that wheel is at zero. Increase the Set Point setting if necessary to stop faster. Reduce pitch if engine speed slows. Fireboat 2 can be expected to stop within its own length from its top speed of 13 knots.**

**Fireboat 2 can be stopped even more rapidly by setting the pitch levers to zero and putting the wheel hard over (Pitch 10) to port or starboard as the situation requires.**
**CAUTION: This method requires an open area since Fireboat 2 will pivot in accordance with the input from the wheel.**