

Marine & Offshore 船舶及海洋工程

April 2009

Dynamic Positioning Systems 动力定位系统

2009年4月



DP Basic Principles

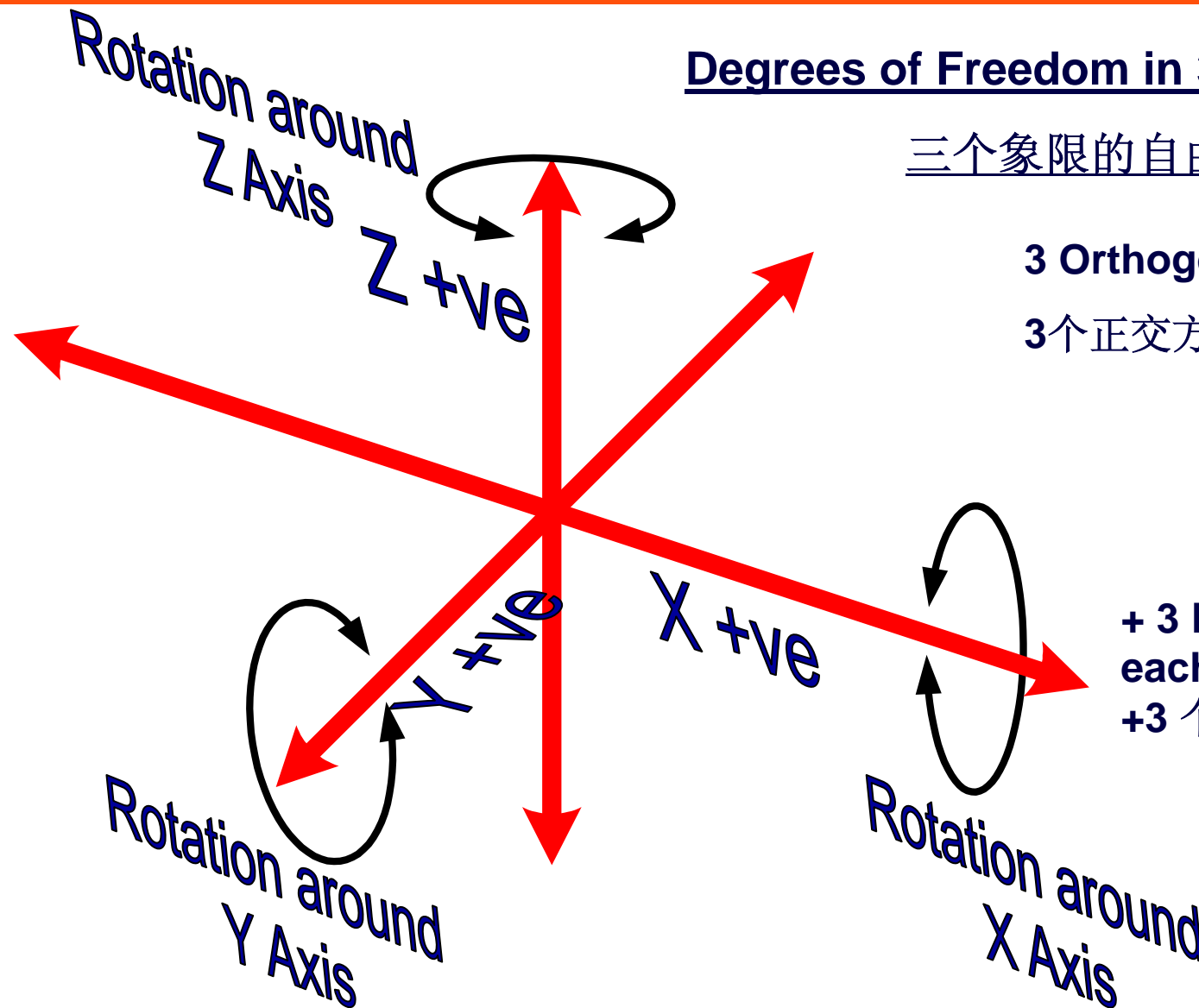
DP 基本原理

INTRODUCTION 介绍

- **Basic Principles** 基本原理
- **Class Rules** 船级规范
- **Sensors** 传感器
- **Position Measurement Equipment (PME)**
- 位置测量装置
- **Control Modes** 控制模式
- **Operator Interface** 操作员界面
- **Basic Hardwired Interface** 基本接口界面

Degrees of Freedom in 3 Dimensions

三个象限的自由度



3 Orthogonal directions

3个正交方向

X = Surge 纵荡

Y = Sway 横摇

Z = Heave 垂举

+ 3 Rotations around each Axis

+3 个轴向的旋转

Roll 摇摆

Pitch 倾斜

YAW 偏航



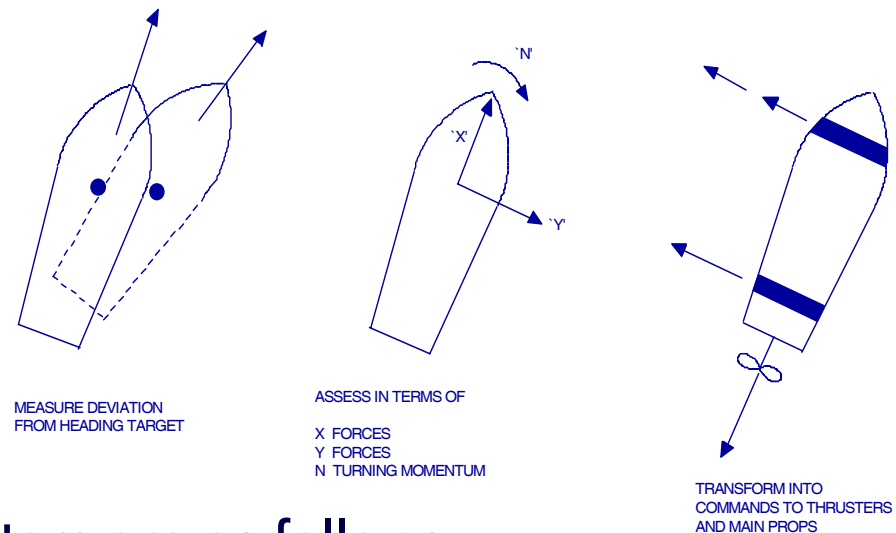
For DP We Control only Three

对于DP系统我们仅控制三个

DP Control, Illustrated

In Broad Terms

DP主要控制系统



- The main elements of a DP system are as follows:

动力定位系统的主要要素

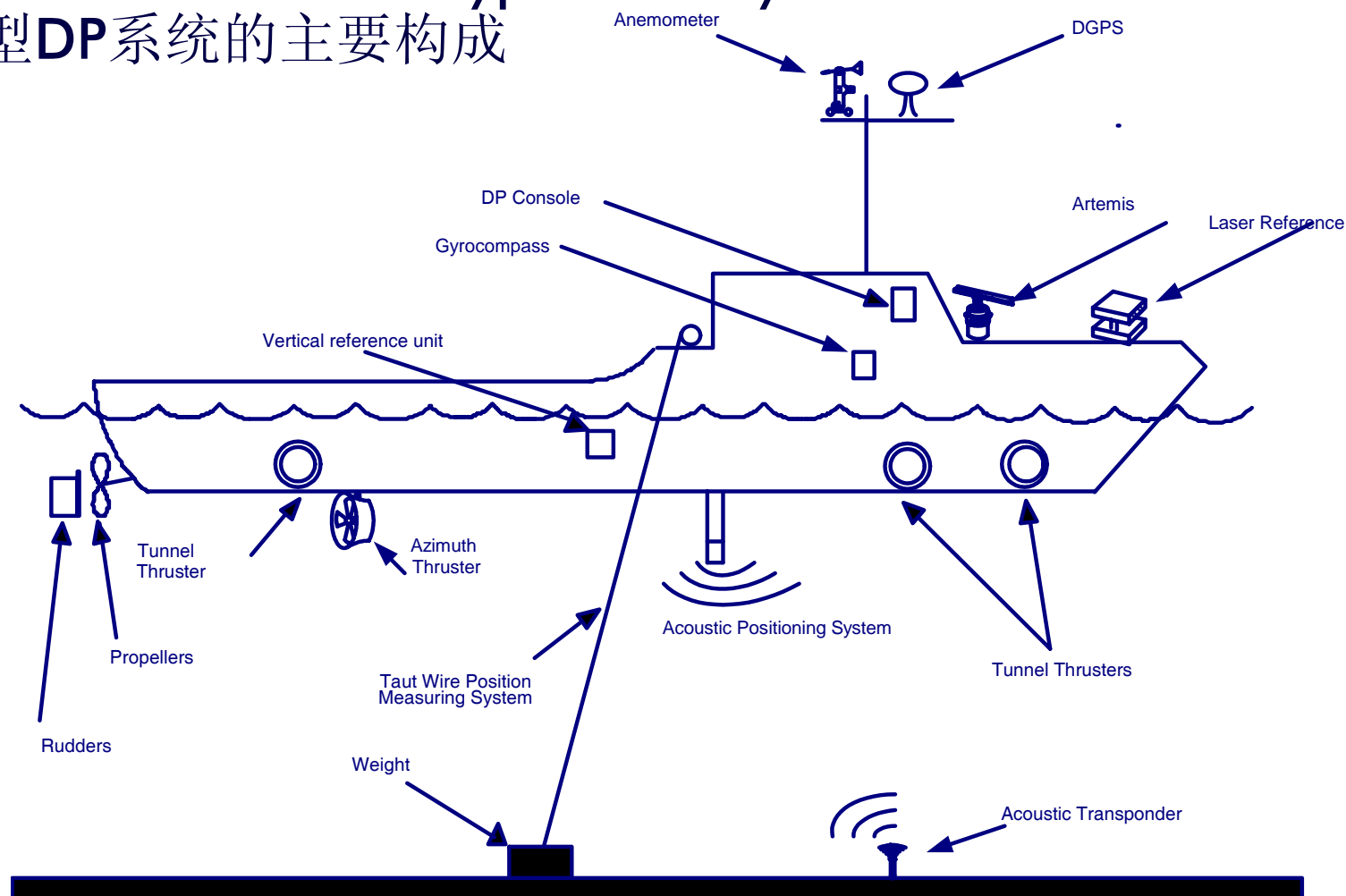
- **A suitable and adequate thruster installation**
合适及足够的推进器
- **Suitable position measurement equipment**
合适的位置测量设备
- **Suitable gyrocompass**
合适的电罗经
- **A control system which interfaces to the points mentioned**
一套连接以上各点的控制系统

Critical Factors 关键因素

- **Thruster sizing adequate for weather conditions**
推进器的大小满足海况条件
- **Position Measurement System - accuracy & repeatability**
位置测量系统-精确度及可重复性
- **Sensor Systems - accuracy & repeatability**
传感器系统-精确度及可重复性
- **Accuracy of ship model / tuning**
船舶建模的精确度
- **Thruster Control System setting accuracy & repeatability**
推进控制系统设定的精确度及可重复性

Main Elements of a Typical DP System

典型DP系统的主要构成



Dynamic Positioning 动力定位

The vessel is to maintain **HEADING** and **STATION** (either fixed or moving) by use of the **THRUSTERS** to counteract the effects of **DISPLACING FORCES** such as **WIND**, **CURRENT** and **WAVE** action.

动力定位就是使用船舶所配备的推进器来抵抗风,流及浪等产生的位移力,以保持船舶的航向及船位(固定的或移动的)

ADP01/ADP11 System Features

ADP01/ADP11 系统要素

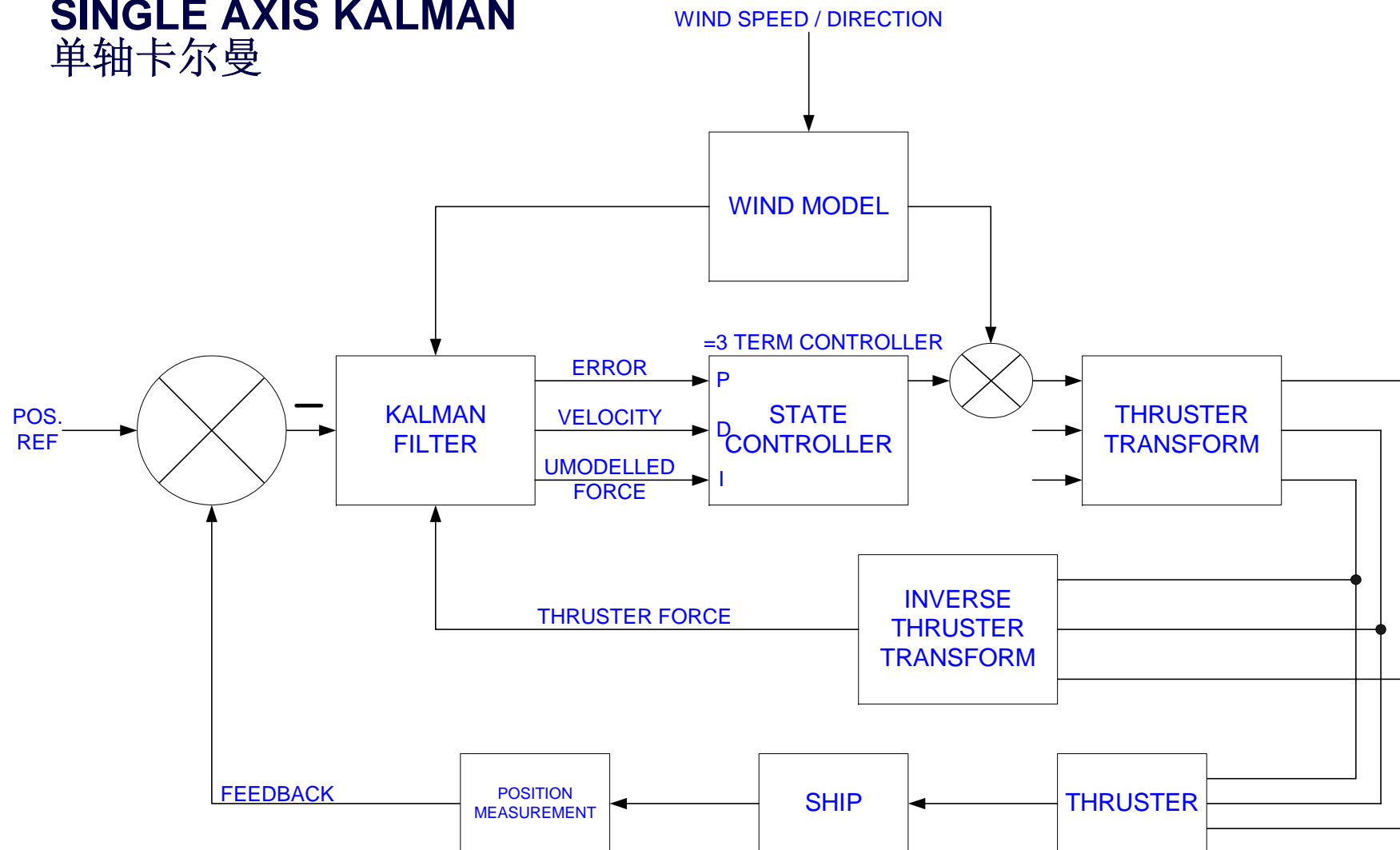
- System based on Kalman Filter, which includes:

基于Kalman滤波器的系统包括:

- Low frequency inertial model of ship (mass & drag)
船舶低频率惯性模式(集中和缓慢的运动)
- High frequency wave motion and measurement noise model.
高频率波动和噪音测量模式
- Mathematical model of external environment force. (Wind)
外部环境力数学模型 (风)
- All working measurements are available to the Kalman Filter.
所有的工作测量都可以用于Kalman滤波器

SINGLE AXIS KALMAN

单轴卡尔曼



Converteam A Series Converteam A 系列

- **SIMPLEX - MIKA 1**



- **SIMPLEX - QM2**



Converteam A Series Converteam A 系列

- Typical AHT / Supply



- Triplex - Q4000





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动力定位系统