INTEGRATED NAVIGATION SYSTEMS

Basic terms

*integrated navigation system *control system *propulsion system *cargo system *digital processing unit *sensor *electronic circuits *sensor output *pulsed input *master navigation unit *speed over ground *speed through the water *inclinometer *alarm systems *VDU Visual Display Unit *Satnav Receiver *display *GPS Global Positioning System *Omega/Loran Receiver *Coverage *Decca *RDF *anti-collision radar*

A modern integrated control system aims to enable one watch-keeping officer to control the ship's navigation, her propulsion system and the cargo spaces. At its heart there is a digital processing unit which is interfaced with multiple sensors.

Recent advances in electronic navigation apparatus and circuits have provided a suitable sensor output switch which can be integrated into one master navigation unit.

The input data required for a safe and economical navigation and for an integrated navigation system are available from:
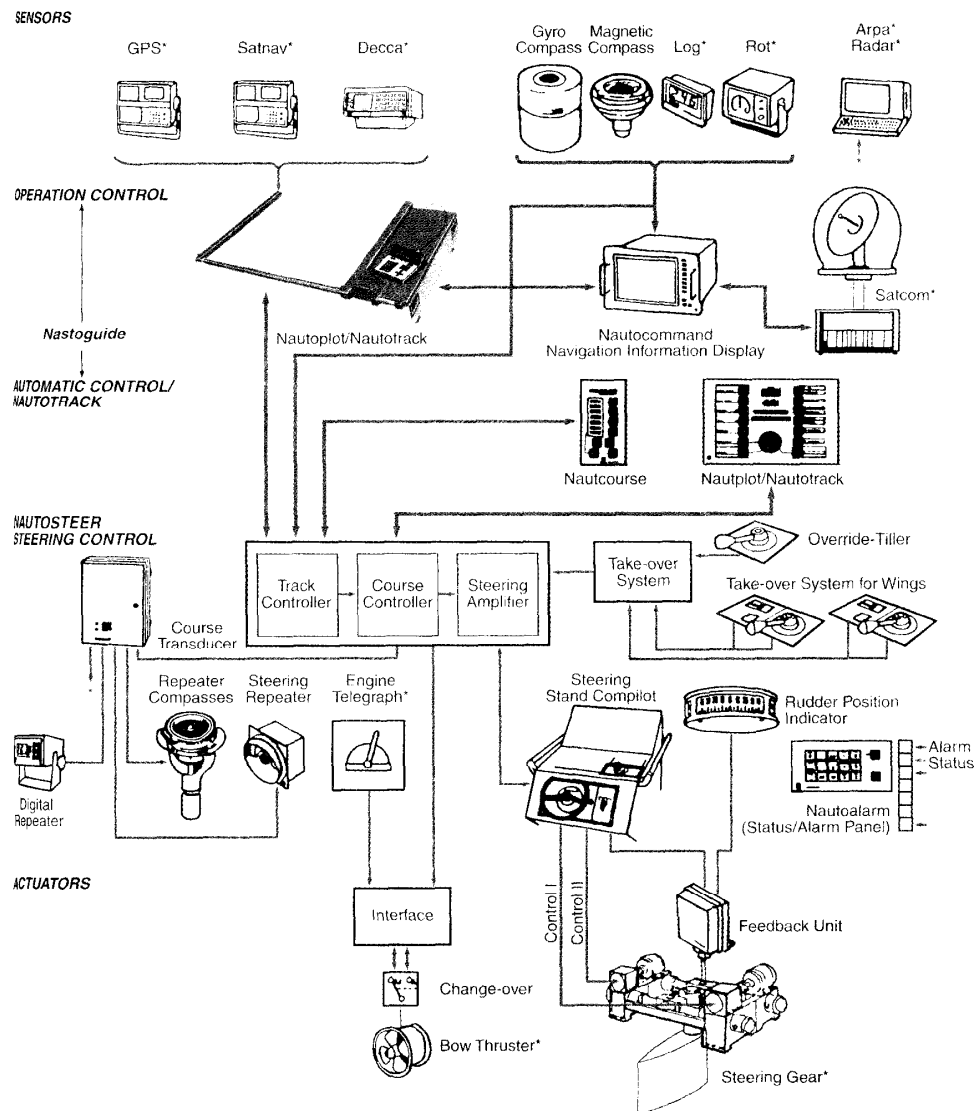
- a heading sensor, i.e. pulses from a gyroscopic compass including the correction of gyro errors
- a velocity sensor providing a pulsed input from a dual axis speed log, with corrections for the differeoce in speed over ground (SOG) and speed through the water
- sea water temperature anti-salinity sensors
- a pitch and roll sensor, with an electronic inclinometer compensating for changes in the indicated speed
- a depth sensor (e.g. output from an echo sounder displayed on the VDU)
- Satellite Navigation Receiver. Output of a single or dual channel receiver is used to update the DR position
- GPS - global positioning system
- Omega/Loran-C Receiver (regional and worldwide coverage)
- Decca or other local navigation system
- RDF interfaced to the master unit
- Radar. Processed data from both 3 or 10 cm (s and x band)
- anti-collision radar is of vital importance for the safe passage of a vessel (ARPA)
- Auto-Pilot, with a rudder movement indicator
- Satcom

In addition to these sensors the integrated navigation system may also include memory, engine and fuel sensors, cargo sensors, various alarm systems. Likewise, a display of weather forecasts and warnings as well as of reports to navigators are available via satellite. Port information may be included, too.
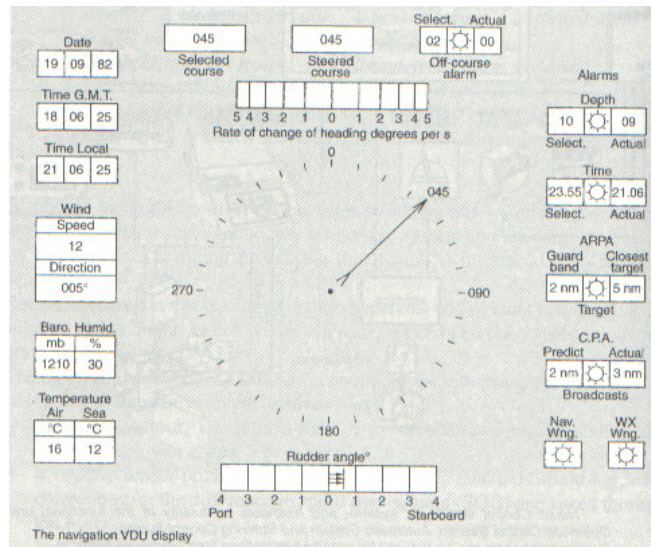
The most popular systems in use today are GPS/Transit, Loran/GPS and Satnav
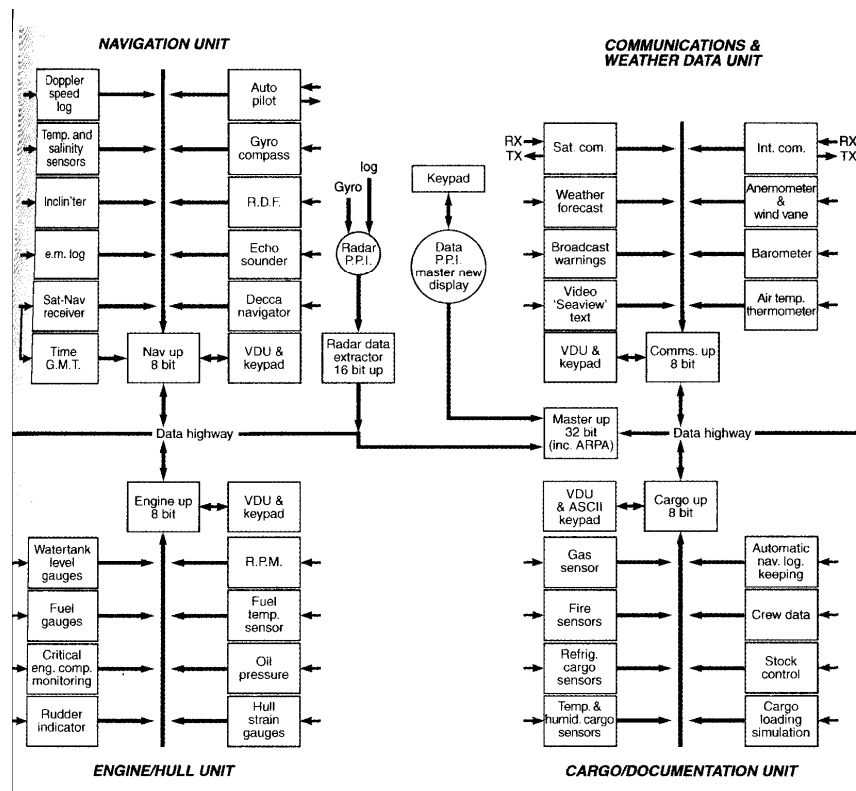 + Omega with interfaces from a gyro compass and speed log.

Nauto Control stands for system and hardware modularity of the functional units:
Operation Control System, Automatic System and Steering Control System.
System extensions can be realized for specific applications (see funcional diagram)

SENSORS

GPS*   Satnav*   Decca*   Gyro   Magnetic   Log*   Rot*   Arpa*
                             Compass Compass   Radar*

OPERATION CONTROL

Nastoguide   Nautoplot/Nautotrack   Nautocommand
                                                  Navigation Information Display   Satcom*

AUTOMATIC CONTROL/
NAUTOTRACK

                                                  Nautcourse   Nautplot/Nautotrack

NAUTOSTEER
STEERING CONTROL   Override-Tiller

                                        Track   Course   Steering   Take-over
                                        Controller Controller Amplifier   System   Take-over System for Wings
                             Course
                             Transducer

        Repeater   Steering   Engine   Steering
        Compasses Repeater   Telegraph*   Stand Compilot   Rudder Position
                                                                        Indicator
                                                                                          Alarm
                                                                                          Status
Digital
Repeater   Nautoalarm
                                                                        (Status/Alarm Panel)

ACTUATORS
                             Interface   Feedback Unit

                             Change-over

                             Bow Thruster*   Steering Gear*

Integrated navigation systems

The navigation VDU display

Architecture of a complete integrated system

A simplified overall functional block diagram of Magnavox MX 1105
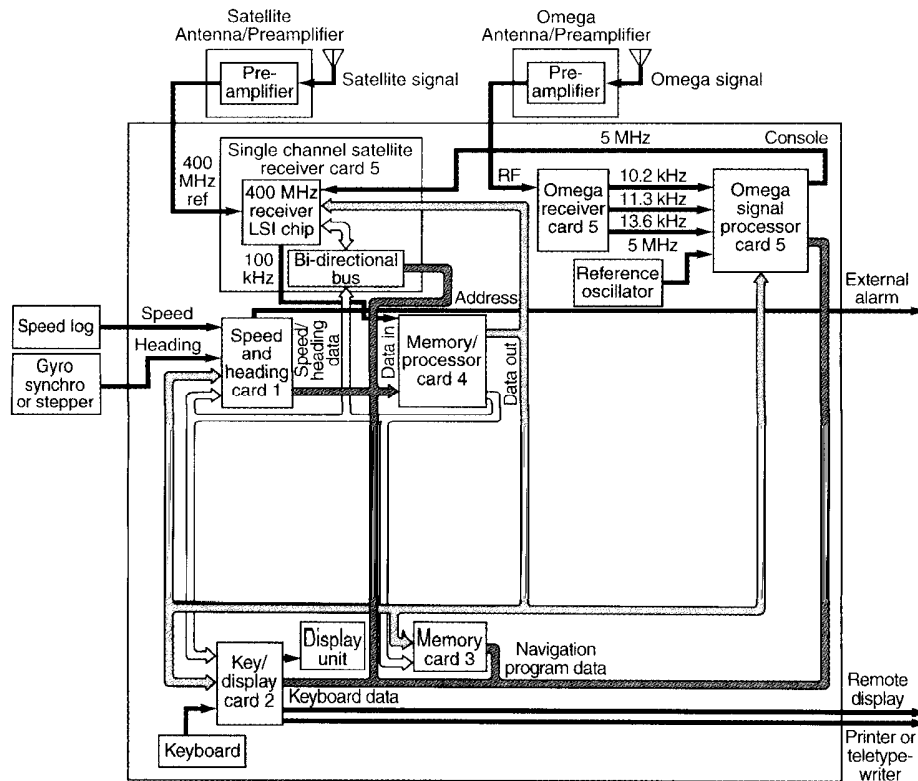
A. Comprehension & vocabulary

A.1 Study the drawing (Integrated navigation systems) and describe the navigation VDU display:

A.2 Complete the following sentences:

1. The speed data is obtained from _____.

2. Data from the inclinometer is used to _____.

3. Omega is preferred to Loran-C because _____.

4. Decca is interfaced when sailing in _____.

5. Satnav input data are used to _____.

6. Time display, accurate to one second GMT, is derived from _____.

7. For display on the radar PPI we can interswitch radar types such as _____.

A.3 *Study the drawing (Architecture of a complete integrated system) and describe the four units of the ship's integrated control system:*

A.4 *Explain the following abbreviations:*
VDU _____
GPS _____
SOG _____
COG _____
DR _____
Satnav _____
LORAN _____
Satcom _____
ARPA _____
RADAR _____
UTC _____
RDF _____

B. Grammar

B.1 *Rewrite the sentences putting the verbs in brackets in the correct place in the sentence.*

Magnavox MX 4400 GPS & navigation systems

POS present position *(show).* It also altitude by GPS *(display)* and entered altitude above mean sea level.

PLAN This function for planning operations *(use)* which GPS satellite coverage *(require).* It also rise and set times of 2, 3, or 4 satellite constellations for any specified location and date *(show).*

NAV course and speed over the ground *(display).*

WPT the operator set and review the location of up to 30 waypoints *(let).*

DEST range and bearing to the intended waypoint, which is a Rhumb Line or Great Circle *(display).* It also heading to steer to at a specified waypoint *(show, arrive).*

ETA at the specified waypoint also *(display).*

TIME as UTC or LT *(show).*

KYBD the operator to select desired level of keyboard and display illumination *(enable).*

B.2 *Find the words in the reading text that have the function (attributive) of an adjective:*
EXAMPLE
ship's navigation (*possessive* case of the noun "ship")
propulsion unit (noun "propulsion")