SHIPMA
SHIP-MAneuvring Numerical Model
(the soul of SHIPMA)
SHIPMA - Index

- Intro
- What is SHIPMA?
- For what is SHIPMA?
- Working with SHIPMA
- Challenges
- Improvements
1992
SHIPMA – HP1000
- Open Source
SHIPMA – Own translation to PC
SHIPMA – 4
- MS-DOS interface // Batch Mode
SHIPMA – 6
- Windows interface
- Auto-Pilot improvements
SHIPMA – 7
- Interface improvements
2003
2012
2013
2014
2018
What is SHIPMA?

**SHIP MAnoeuvring**

- **Numerical Model**
  - Deterministic
  - To simulate the manoeuvring behaviour of vessels in ports and fairways.

The application of SHIPMA is primarily in port and fairway design, referring to both approach channels and inland waterways. **FEASIBILITY of Manoeuvres.**

- **Fast-Time Simulation**
- **Fast-Track Simulation**
- **Autopilot Model**
How does SHIPMA work?

Flowchart: mathematical manoeuvring model

- desired track
- desired velocity or rpm
- desired course offset

Autopilot

- rudder angle
- rpm
- thruster settings
- tug orders

Tug forces

Thruster forces

rudder and propeller forces

Hydrodynamic forces

Wind forces

Wave drift forces

Bank suction forces

Solve and transform

- position
- course angle
- velocity
Any Numerical Model...

1. Collecting Data
2. Input Data (Modelling)
3. RUN
4. Results
5. Analisys of Results (Evaluation)
Flowchart: mathematical manoeuvring model

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Solve and transform
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Current
Depth
Wind
Waves
Banks
But SHIPMA...

Collecting Data → Input Data (Modelling) → RUN → Results → Analisys of Results (Evaluation)
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Current
Depth
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Banks
And…

Collecting Data

Input Data (Modelling)

RUN

Analyses of Results (Evaluation)

Track Optimization

AutoPilot

Results
Flowchart: mathematical manoeuvring model

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Solve and transform

- position
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</table>
Desired track
Desired velocity or rpm
Desired course offset

... ARE NOT...
• “a priori” inputs (one exception)

... ARE ...
• Parameters for optimization

... REQUIRE ...
• Interactive process to find the “best” manoeuvre
Track Optimization - One exception

- Upgrading of Nautical Channels
- Constant speed navigation
- No manoeuvring areas (stop, turning)
- No berthing/unberthing (no approach)
- Testing new bends layout with crossing waves, winds and currents
- Feasibility study
- Manoeuvres consisting in:
  - Constant setting order
  - Imposed track
  - Power burst (if required)
  - No tug assistance (escort)
- Comparing weather conditions to set operational limits
Track Optimization - One exception (2)
For what is SHIPMA?

SHIP MAnoeuvring studies
SHIP MAneuvring studies

**SHIPMA**
- A tool to evaluate cases/alternatives using simulation of ship manoeuvres
- Entrance and exit of ports, passage of bridges, passage of channels, entrance of locks, offshore operations

**Purpose of SHIPMA**
- To evaluate the feasibility of manoeuvres under specific environmental conditions;
- Determine the consequences for the dimensions of infrastructure;
- Determine the consequences for the vessel’s equipment (e.g. thrusters) or assistance (e.g. tugs).
SHIP MANoeuvring studies

- First stages of the Project
- Conceptual Design
- Selection of Alternatives

- Basic Design (Pre-FEED // FEED)
- Previous design checking
- Feasibility studies

- Advanced Design
- Layout/Dredging optimization
- Human factor consideration for operational stage

Standard procedures...

But NOT always
SHIP MANoeuvring studies
Fast-Time vs Real-Time

Deterministic vs Probabilistic  Ship Feasibility vs Human Safety

SHIPMA versus simulator

**Advantages:**
- All physics incorporated
- Runs can be reproduced and are comparable
- Fast

**Disadvantages:**
- No human element
- No multi ship situations
Working with SHIPMA

Port Design ➔ Civil Engineers

Ship Behaviour ➔ Naval Architects

Nautical ➔ Seamen (Pilot, Captains)

Operator is only one person, learning and listening from the others
Only Civil Engineering

- Justification: only channel design, just tugs exercise, ...
- Is it realistic?
- Initial conditions (departure) determine the success of the manoeuvre
- Is this manoeuvre similar to the future real-life operations?
Only Ship Behaviour

- Do you understand the Project?
- Focus “only” in ship characteristics
- What’s about other restrictions:
  - port infraestructura, AtoN
  - Dredging
  - Harbour rules
  - environmental issues?
- What’s about pilot strategies, towing issues,... ?
- What’s about safety margins?

EXAMPLE: Sailing at 4 knots against another vessel. SHIPMA performs the simulation, stops and turns before Collision (even at enough distance) but... what can a pilot think about risky situation?

ALSO: 2D perspective is different than 3D. So safety “feeling” is so different
Only Nautical

- No experience in:
  - Modelling
  - Analysis
  - Objective comparison
  - Understanding of the project
Working together
Nowadays, in the Middle East, a typical ToR (Terms of Reference) for a tender has the following reference:

The Desktop Navigation Study shall be undertaken adopting two-dimensional real time navigation software. For clarity, fast-time navigation software will not be accepted, and technical proposals which make use of fast-time navigation software will be disqualified.

Why?

Possible answers:
• Competence has no Auto-pilot models. High influence in the area
• Nautical sector (Pilots, Captains) doesn’t understand well the software (very engineering)
• No nautical aspects are considered in many studies (better practices)
• Lower prices of Real-Time simulation (Desktop simulators, 2D, ...)
SHIPMA Future Improvements

Possible suggestions:

• Collision module (improve unberthing operations)
• Independent propellers/rudders
• Post-processing (more friendly and flexible; combining different tracks)
• More flexibility for usability of ship models (SCAMCO?)
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