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MODERN AUTOSHIP ANALYSIS FOR „ACADEMIC STAR" CUTTER STATUS

Valentin ONCICA[1]
Ionut-Cristian SCURTU[2]
[1]Commander (navy) Lecturer eng. PhD, Faculty of Navigation and Naval Management, "Mircea cel Batran" Naval Academy
[2] Lieutenant (n) Instr.Eng. PhD Candidate. Faculty of Navigation And Naval Management, "Mircea Cel Batran" Naval Academy, MAIL: scurtucristian@yahoo.com, The source of the material: PSCD poz.131 concluded on 15 november. 2013

Abstract. *The present paper is based on the first analysis of shape for the „ACADEMIC STAR" Cutter. Measurements in situ were ued to 3D draw the cutter forms in AUTOSHIP software. Results from Autohydro component are analyzed and presented related to actual ship construction and stability requirements. Based on this analysis the ship owner can decide if the ship is according to actual nautical and stability requirements.*
Keywords*: Autoship, Cutter, Autohydro, Stability.*

INTRODUCTION

Academic Star was built by students Naval Academy "Mircea cel Batran" in 1985, held until 2002 called cutter training school in the sea. Designed and developed by scientific-technical departments, machinery and electrical and sailor practice and practice with the support of the Department of Palazu Mare, in the sea cutter included in its draft and numerous graduate student projects. Boat in the sea is made of fiberglass and synthetic resins, under the guidance of the Institute of Marine academics "Mircea cel Batran" under the direct leadership of Eng. Haralambie Beizadea and Capt. Pr. Philip II Vieraşu. The dimensions used in construction were analyzed for nautical performances with Autoship software. Based on measurement on situ the cutter size and shape was realized in 3D software in order to evaluate all components with Autohydro and ModelMaker.

„ACADEMIC STAR" HISTORY

The expression in the sea link education with practice and scientific research. The purpose of its existence: the complex preparation of future naval officers and conducting research into the sea in terms of saving fuel "(Vam. Gheorghe Anghelescu).
Made of fiberglass reinforced after an absolutely original conception, was in the sea, the release date, the largest object made of this material in Romania (length 14m, width 4m) with a sail area of 130sqm, two masts and a displacement 16.5 tons and can take on board up to 24 people.
The cutter made the first experiment on Lake Mamaia on Thursday 11 November 1985 and at sea, after which he made the first voyage under the command of Capt. Pr. Philip II Vieraşu the itinerary Constanta (port Tomis) - Danube-Black Sea Canal - Old Danube - Sulina arm - Black Sea - Port Tomis.
In the years that followed cutter Academic Star participated in student practical programs under the leadership of the Naval Academy "Mircea cel Batran" and enter into conservation in 2010, remaining in this situation until now.

FIRST 3D MODELING FOR THE CUTTER

Since they could not recover the original plans were necessary in situ measurements for the realization of the 3D ship (Fig.1).

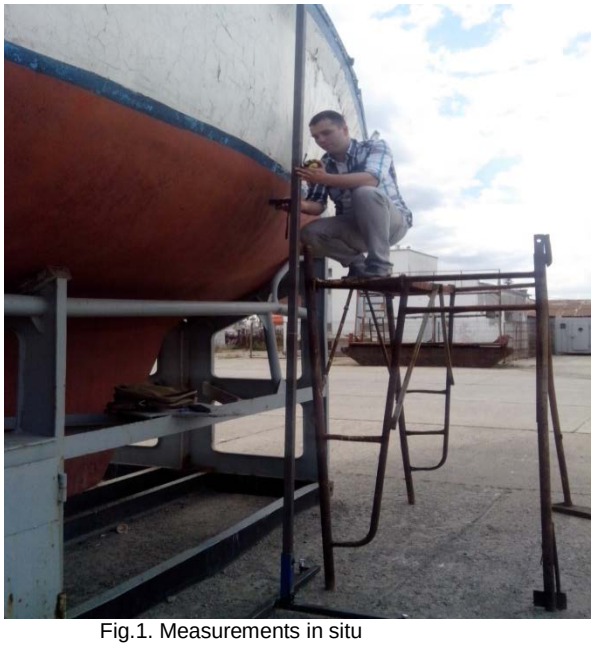

Fig.1. Measurements in situ

With software package ModelMaker from Autoship hull was modeled based on measured data for 60 theoretical stations. It was modeled separately keel, which was then attached body by command "Joint to"[13] and helm modeled as a separate object. The results are shown in fig. 2. and fig.3.

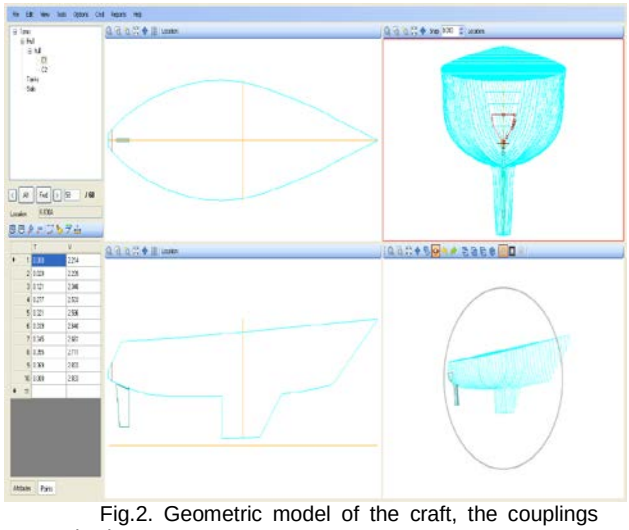

Fig.2. Geometric model of the craft, the couplings Isometric view

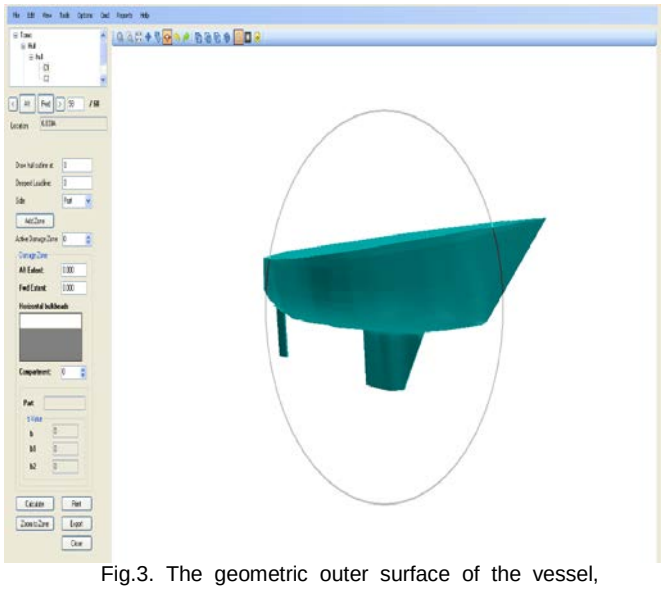

Fig.3. The geometric outer surface of the vessel, Isometric view

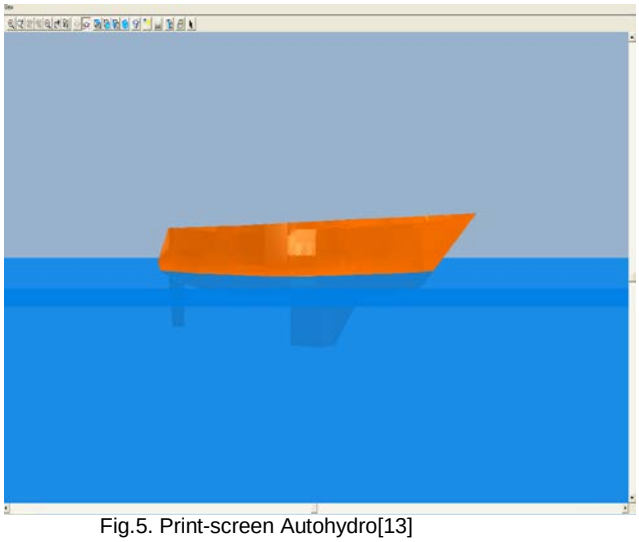

Fig.5. Print-screen Autohydro[13]

BUOYANCY AND STABILITY CALCULATIONS

The ModelMaker geometric created was exported to Autohydro program where defined elements displacement resulting situation shown in Figures fig.4 and fig.5.

The data entered by means of the program have been calculated and plotted graphs of variation for the quantity characterizing the buoyancy and stability of the craft fig. 4-9 and tables 1 and 2.

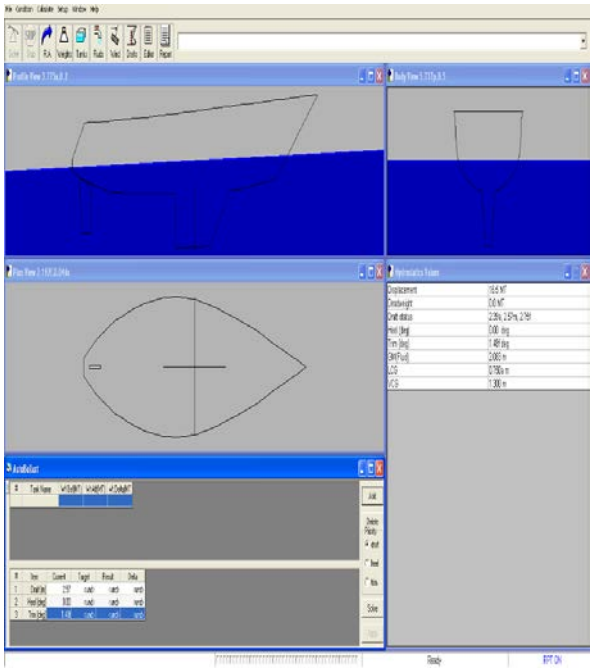

Fig.4. Print-screen Autohydro

Data hull
Baseline Draft: 2.569 at Origin
Trim: fwd 1.48 deg.
DIMENSIONS
Length Overall: 14.000 m LWL: 12.318 m Beam: 4.100 m BWL: 3.691 m
Volume: 16.097 m3 Displacement: 16.500 MT
COEFFICIENTS
Prismatic: 0.447 Block: 0.153 Midship: 0.343 Waterplane: 0.619

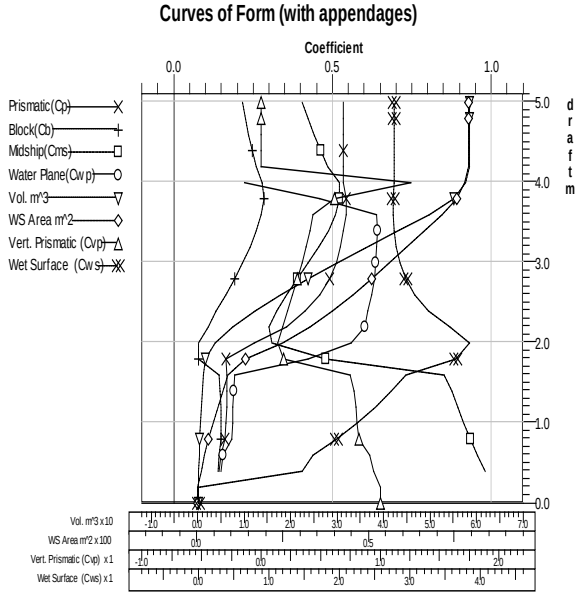

Fig.6. Cross curves results from Autohydro[1,2,3]

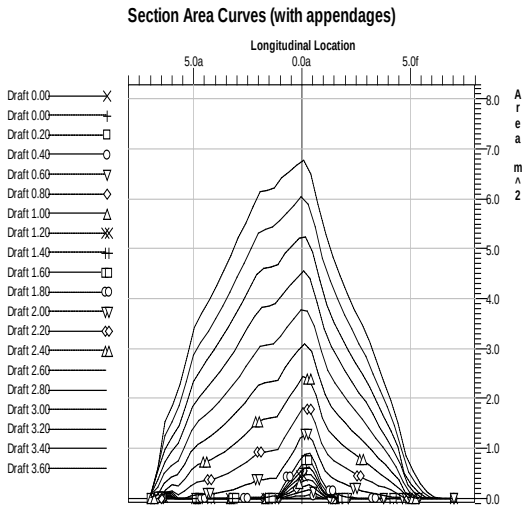

Fig.7. Section area curves results from Autohydro[4,5,6]

Table 1. **Weight distribution table[14]**

Item	Weight (MT)	LCG (m)	TCG (m)	VCG (m)
Light Ship	16.50	2.000a	0.000	1.300
Displacement	16.50	2.000a	0.000	1.300

*Table 2.***Hydrostatic properties resulted from Autoship[13]**

Draft at Origin (m)	Displ (MT)	TPcm (MT/cm)	MTcm (MT-m /deg)	KML (m)	KMT (m)
0.400	0.079	0.006	0.001	1.964	0.422
0.600	0.208	0.007	0.000	1.202	0.482
0.800	0.350	0.008	0.009	2.710	0.579
1.000	0.516	0.009	0.033	5.017	0.686
1.200	0.696	0.009	0.036	4.235	0.796
1.400	0.891	0.010	0.039	3.779	0.910
1.600	1.101	0.011	0.042	3.507	1.026
1.800	1.493	0.050	0.230	10.110	1.434
2.000	3.494	0.146	1.353	23.481	2.707

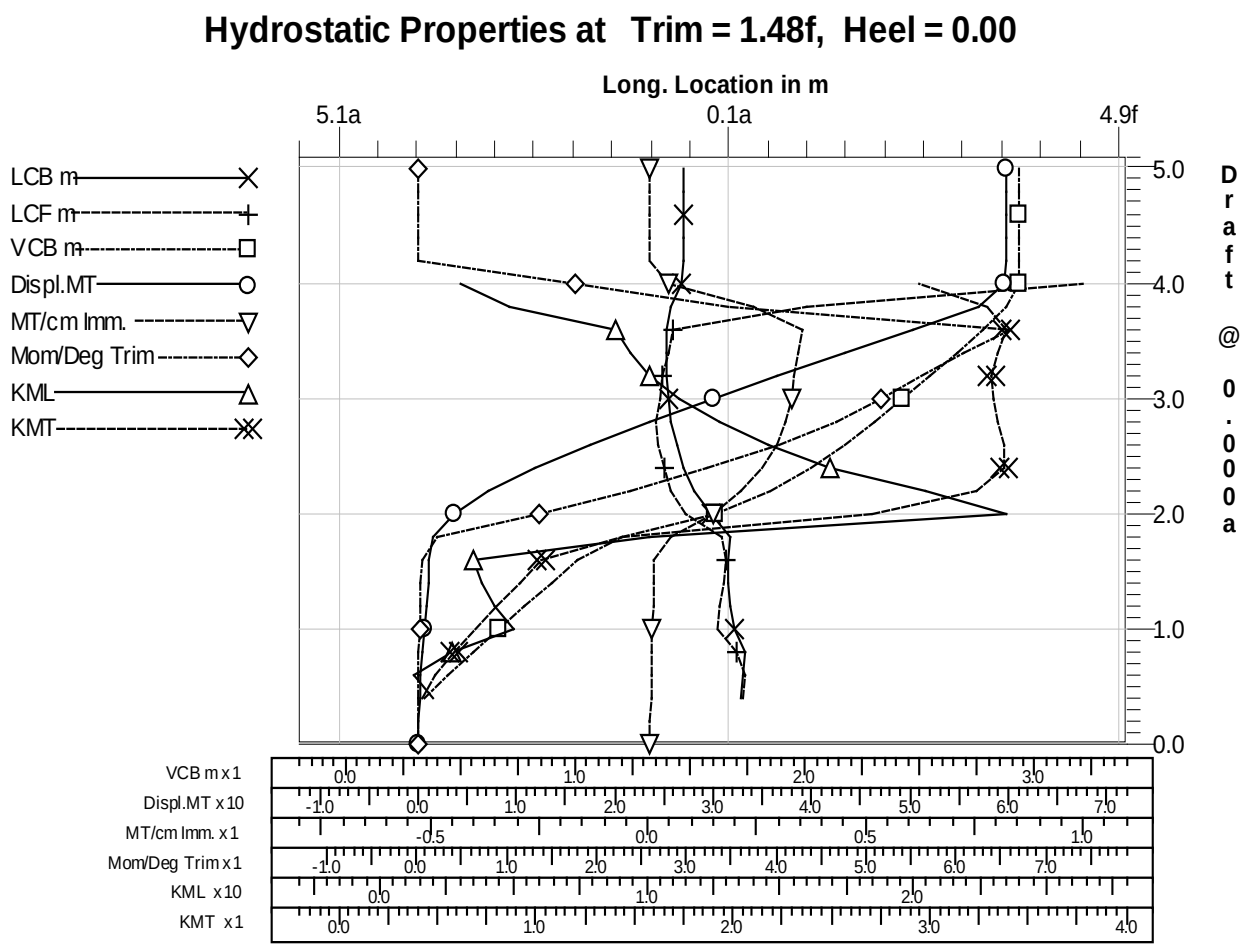

Fig.8. Hydrostatic properties resulted from Autoship[9,10,11]

THE STABILITY OF THE CRAFT

Static stability arm resulted in Autohydro analysis

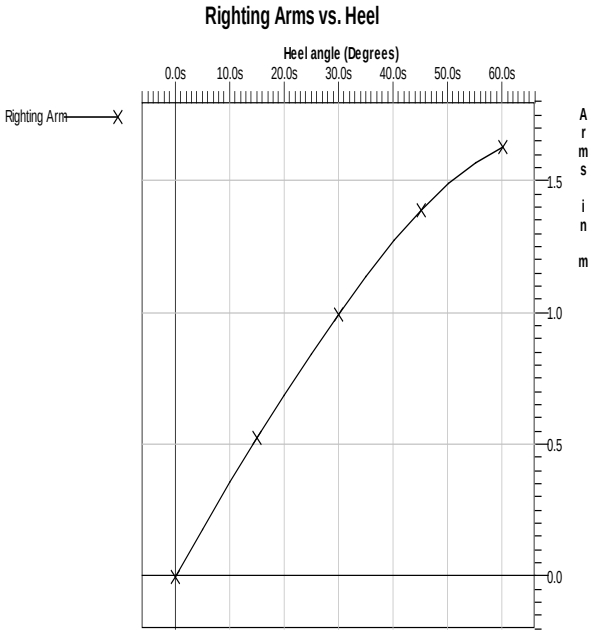

Fig.9. Righting arm resulted from Autohydro[12]

TECHNICAL ASSESSMENT OF CURRENT STATUS

General characteristics and structure of the cutter body

Star Academic cutter, fig.10, was built with technology and materials since 1985 and has been oversized to ensure the safety of the crew and students participating in nautical practice. The plating coating has a thickness of 12 mm instead of 7-8 mm, and thickness of bottom shell is 20 mm instead of 15 mm which results in additional weight of the cutter body. Comparisons are made with existing similar vessels made with the same technology and are detailed in Table 3. The cutter presented is more difficult to operate due to low engine power, high displacement and low maneuvering properties.

*Table 3.***General comparative characteristics**

Denumire mărime	U.M.	Beneteau Oceanis	Academic Star
LOA	m	14,27	14,20
Lpp	m	13,6	14,00
Lx	m	12,74	12,32
B	m	4,35	4,10
Draft	m	2,10	2,57
Light ship dispalcement	tone	12,60	16,50
Fuel capacity	l	210	440
Water	l	360	0
Engine power	kW	41	14
Engine type	-	Volvo Penta D2-55	Ruggerini
Mast height	m	20,75	16,50
Passengers nomber	-	10	24

Fig.10. Image on board the cutter Academic Star

It is seen from the above table that boat in the study, Academic Star, is too large for its size displacement, main motor power too small, and it must safely transport a larger number of passengers.

The evaluations carried out on board the cutter were identified following items related to its construction:

Conclusions

Academic Star cutter was built with materials and technology borrowed from large vessels making the total weight of the cutter to live up to the value of 16 tons[14]. Compared to a modern craft that has between 7 and 10 tonnes cutter is very difficult and this is felt in increased resistance and decreased forward speed to the same installed power of the propulsion engine. On the right are two comparative picture of how building interiors and it can be seen that the current interior design is inappropriate for a craft practice and competition. The body requires replacement of all outlets bottom of the outer layer of gelcoat repair, inspection and replacement of aluminum being corroded by salt marine environment. Propulsion severe mechanical defects to be resolved for reasons of crew safety during student practice. Low power and high displacement makes it difficult to maneuver if the wind blows against the direction of march. Propulsion be reconfigured using sails total for easier maneuvering. To this must be increased sail area and should be replaced by modern masts and maneuvers appropriate materials and marine environment.

Taking into account the Academic Star cutter repair, installation of new equipment requires strengthening the areas where these are attached as ribs have continuity. Strengthening grip areas will lead to increased displacement of the craft. Increased displacement adversely affect drag, fuel consumption and range cutter, so all material weaknesses identified must be performed with specific light naval small craft.

This document summarizes information on the current state of the cutter Academic Star and highlights items on the body, plants, rigging and propulsion. Academic Star is a value built by students and teachers Naval Academy and needs repairs that will certainly prove more costly than building a modern cutter.

Acknowledgement

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