

---

SEPTEMBER 10, 2008

**STABILITY AND WINDAGE ANALYSIS  
75 FT. STEEL TRAWLER**

THE INTENT OF THIS STUDY IS TO DETERMINE NOT ONLY THE FEASIBILITY OF ADDING A TOP DECK CABIN ADDITION BUT TO ASSESS THE GENERAL STABILITY AND SAFETY OF THE VESSEL IN ADVERSE WIND AND SEA CONDITIONS. THE DATA COLLECTED IS MINIMAL WITHIN THE TIME LIMITS ALLOWED FOR THE STUDY. THE STABILITY DATA IS DETERMINED THROUGH A SYSTEM OF AVERAGING BLOCK STRUCTURES, ESTIMATING THEIR WEIGHTS AND POSITIONING THEIR VERTICAL CENTERS OF GRAVITY. THE RESULT IS A MERE GENERALIZATION AND NOT A TRUE ACCURATE ASSESSMENT OF THE ACTUAL PHYSICAL STABILITY OF THE VESSEL BUT ALLOWS FOR AN ESTIMATE OF THE TREND OF THE VESSEL TO BE SEAWORTHY.

THE DISPLACEMENT OF THE SHIP IS TAKEN AT HER DESIGN WATERLINE FROM THE HULL LINES PLAN AND STATED AS 200,000 LBS.

**STABILITY:**

A STANDARD TRANSVERSE MOMENT OF INERTIA CALCULATION ABOUT THE WATER LINE PLANE ACCURATELY STATES THE RIGHTING LEVER ARM COMPONENT OR  $I/V$  WHICH TRANSLATES TO BM POSITIONING USING THE ESTIMATED VERTICAL CENTER OF BOUYANCY. WHEN COUPLED TO THE ALSO ESTIMATED VERTICAL CENTER OF GRAVITY, THE COUPLING OF GM CAN BE FURTHER EXTRAPOLATED TO OBTAIN A RIGHTING ARM (RA) AND RIGHTING MOMENT (RM) WHICH IS COUPLED TO ANY ANGLE OF HEEL TO ARRIVE AT A TANGIBLE STABILITY FACTOR. THIS METHOD IS ACCURATE IF THE INPUT DATA IS ACCURATE ALSO...WHEN GENERALLY ESTIMATING THIS DATA, ONLY A TREND CAN BE REALIZED AND IS ALWAYS SUBJECT TO A FINAL, DETAILED WEIGHT, TRIM AND STABILITY ANALYSIS WHICH IS ALWAYS NECESSARY ON ALL VESSELS TO DETERMINE SEAWORTHINESS WITHOUT RISK OF DANGEROUS SURPRISES AFTER LAUNCH AND SEA TRIALS...I STRONGLY RECOMMEND THAT THIS BE DONE PRIOR TO FINISHING THE VESSEL AS BALLAST MAY HAVE TO BE ADDED AS LOW AS POSSIBLE IN THE HULL..

**WINDAGE:**

THE AREA OF THE SIDE PROFILE ABOVE THE WATERLINE IS MEASURED AND ADDED TO THE STUDY IN THE FORM OF A WIND PRESSURE COEFFICIENT VERY MUCH LIKE THE ASSESSMENT OF THE HEELING MOMENT OF A SAILING VESSEL PRODUCED BY THE SAIL AREA. THIS IS EXPRESSED IN LBS./ SQ.FT. IN RELATION TO THE SIDE AREA AND HEELING FORCE PRODUCED AT A GIVEN WIND VELOCITY. THIS IS CALLED THE W.P.C. EXPRESSED IN MPH. THE ASSUMPTION IS A BROADSIDE (90 DEGREE) WIND FORCE TO PRODUCE A SPECIFIC ANGLE OF HEEL...IT IS, AGAIN, DEPENDENT UPON THE ACCURACY OF THE INITIAL STABILITY RIGHTING MOMENT EVALUATION.

## PAGE 2...STABILITY ESTIMATE

THE FOLLOWING ARE SOME OF THE VALUES ARRIVED AT THROUGH THIS BRIEF STUDY.

RIGHTING MOMENTS VS. HEELING MOMENTS AT ANGLES OF HEEL WHERE THE HEELING MOMENT IS 10,475 FT LBS...

1 DEGREE OF HEEL:	RM 1050 FT LBS	WPC .12 = 6 MPH	WIND VELOCITY
5 DEGREES	RM 5400 FT LBS	WPC .515 = 13 MPH	
10 DEGREES	RM 10,800 FT LBS	WPC 1.0 = 16 MPH	
15 DEGREES	RM 15,600 FT LBS	WPC 1.5 = 20 MPH	
20 DEGREES	RM 20,400 FT LBS	WPC 1.95 = 22 MPH	

THESE VALUES INDICATE THAT THE BOAT HAS INSUFFICIENT STABILITY IN THAT IS NOT ONLY SENSITIVE TO WIND BUT IF THERE ARE 10 GUESTS LINED UP ALONG THE RAIL THEY WILL HEEL THE BOAT ABOUT 12 DEGREES AS CALCULATED IN THIS STUDY.

### ANALYSIS:

THE MAIN ISSUE IS THAT THIS A DEEP, RELATIVELY NARROW WATERLINE, MODERATE DISPLACEMENT VESSEL. HER METACENTER IS LOWER THAN A SHALLOW WIDE HULL OF THE SAME DISPLACEMENT. HENCE THE SHORT GM WHICH IS THE COMPONENT COUPLED TO VESSEL DISPLACEMENT TO ESTABLISH THE RIGHTING MOMENT, THE MAIN COMPONENT OF STABILITY...

THE ADDITION OF THE EXTRA CABIN ON THE 03 DECK MEANS LITTLE AS THE PROBLEM LIES IN THE TYPE OF HULL FORM RATHER THAN THE POSITION OF IT'S PARTS... THAT IS WHY THESE HEAVY CRUISERS CARRY BALLAST TO MAKE UP FOR THEIR LACK OF FORM AND DYNAMIC STABILITY... TO FURTHER REFINE THIS ANALYSIS, IT WILL BE NECESSARY TO COMPLETE THE FULL WEIGHT, TRIM AND STABILITY CALCS, A PROJECT REQUIRING ABOUT 18-20 NET HOURS.

### CONCLUSION:

I SAY GO AHEAD WITH YOUR CABIN ADDITION AS IT MATTERS LITTLE AT THIS JUNCTURE. WE WILL HAVE TO ADDRESS THE STABILITY ISSUE AND ARRIVE AT A MORE CERTAIN CONCLUSION BEFORE YOU ADD ANY BALAST... YOU WILL NEED TO KNOW HOW MUCH AND WHERE TO SATISFY TRIM ADDITIONALLY.

BEFORE THE HULL BOTTOM IS COVERED AND FINALLY PREPARED, WE SHOULD REFINE THIS STUDY AND MAKE CERTAIN THE BOAT IS SAFE... IT IS ENTIRELY POSSIBLE WITH LITTLE ADDITIONAL BUILDING EXPENSE AND WILL EFFECT HULL SPEED AND FUEL ECONOMY ONLY SLIGHTLY ON THIS TYPE OF VESSEL...

SHAD TURNER, na