

ESP 1000
STELLAR MARINE
ELECTRONIC SPEED PILOT

DeHART MARINE

ESP Test Results: M/V Ginger Moller

ESP 1000 Electronic Speed Pilot

M/V Ginger Moller Test Report

Overview

The ESP 1000 Electronic Speed Pilot is a vessel speed control system that fine tunes throttle settings to maximize propulsion efficiency.

The ESP 1000 was installed on the M/V Ginger Moller in July of 2002 for evaluation. The test period was structured and monitored by Emmett Neal, General Manager of Operations. With Mr. Neal's coordination and cooperation of the Vessel's crew, sufficient data was collected to evaluate the system.

This report describes test methods and results obtained during a seven month test period of the ESP. The purpose of the test was to evaluate the efficiency of the ESP in terms of fuel savings and speeds obtained, and determine whether the ESP was a cost effective device for the Ohio River.

Vessel Specifications

M/V Ginger Moller: 3600-hp towboat built by Jeffboat 1993
Size: 120 by 33.5 feet
Main Engines: Two EMD 16-645E6
Propellers: Two Fixed Pitch

Summary

Fuel Savings Differential

Operating Mode	Average Gallons per Mile	Percentage of Fuel Burned
RPM/Manual	19.654	100%
ESP Engaged	17.712	90.12%
ESP Savings	01.942	9.88%

Speed Differential

Operating Mode	Average Speed in MPH	Percentage of Miles Traveled
RPM/Manual	6.618	100%
ESP Engaged	6.939	104.85%
ESP Savings	0.321	4.85%

The ESP averaged burning 1.942 gallons or 9.88% less per mile when used in the Best Speed Mode. They also traveled .321 miles or 4.85% faster when using the ESP.

Test Method

Background

The ESP 1000 Electronic Speed Pilot was first introduced on the Mississippi River Systems in the spring of 1997. The original systems went through a series of trials, tribulations and modifications. With important feedback from the crew of the original test vessels, the manufacturer was able to redefine the system to work admirably on the Mississippi River.

Testing of the first installations concentrated on the accuracy of the data acquisition provided by the ESP. The ESP data was compared to a Fuel Mate System, using fuel flow meters. The data showed the ESP data was an unbiased record of the fuel consumption, making it valid for use in future testing.

Test Plan

The ESP 1000 was installed on the M/V Ginger Moller on July 13, 2002. Testing began immediately. Initially, the vessel ran the system in Best Speed mode as much as possible. This ran through July and August. Starting in September, the crew attempted to run this system 12 hours in Best Speed Mode and 12 hours in RPM or manual mode. We felt this would give a more composite data base for comparison.

Analyzing the test data proved to be very challenging. The vessel runs primarily on the Ohio River. Data showed that river conditions changed frequently, continuously affecting the response of the ESP. The Ohio River has several locks and tributaries that affect the current and river conditions. The vessel also turned frequently, sometimes as much as six times a month. As a result, a few days initially showed a loss of speed and higher fuel burn. However, on close inspection, it became obvious that these days were a result of the boat either changing directions, going through a lock, or re-configuring their tow size.

Data

The ESP program records all information the system monitors. This includes engine rpm and fuel burn per engine. Also speed and position are displayed. The information was then downloaded on disk monthly and sent to the office.

Concern was raised by Kenny Robinson, Port Engineer, of the quality of the days in the test. The actual data used in the report is every hour that the vessel was considered to be running at or near standard operating RPM levels. All data obtained when the vessel was stopped or running below 700 RPMs was excluded. This ensures the comparison to be as fair and accurate as possible.

The data was obtained over a seven month span, beginning July 13, 2002 and ending January 7, 2003. This is a total of 178 days. There were however missing days in the data files I received. A total of 43 days were missing, leaving 135 days of data to analyze.

For test purposes, we separated the Northbound and Southbound trips. Northbound, we have data from 62 days in Best Speed Mode and 50 days in RPM or Manual Mode. Southbound, we have data from 44 days in Best Speed Mode and 32 days in RPM or Manual Mode. We also have 14 days in December, in which the vessel traveled on the Kentucky Lake, Tennessee River and Tenn-Tom Waterway. These are all included on the same table.

M/V Ginger Moller Test Data Summary

Fuel Savings and Speed Differential Northbound

Operating Mode	Average Gallons per Mile	Percentage of Fuel Burned	Average Speed in MPH	Percentage of Miles Traveled
RPM/Manual	24.25	100%	5.18	100%
ESP Engaged	21.68	89.4%	5.63	108.6%
ESP Savings	2.57	10.6%	.45	8.6%

Fuel Savings and Speed Differential Southbound

Operating Mode	Average Gallons per Mile	Percentage of Fuel Burned	Average Speed in MPH	Percentage of Miles Traveled
RPM/Manual	12.34	100%	8.88	100%
ESP Engaged	12.00	97.2%	8.87	99.8%
ESP Savings	.34	2.8%	-.01	0.2%

Fuel Savings and Speed Differential on Kentucky Lake, Tenn River, and Tenn-Tom

Operating Mode	Average Gallons per Mile	Percentage of Fuel Burned	Average Speed in MPH	Percentage of Miles Traveled
RPM/Manual	20.04	100%	6.57	100%
ESP Engaged	18.2	90.8%	6.59	100.3%
ESP Savings	1.84	9.2%	.02	0.3%

Observation and Analysis

ESP Efficiency

1. Northbound, the ESP averaged 2.57 gallons less fuel per mile or 10.6% fuel savings. The average speed was .45 mph faster or 8.6% increase.
2. Southbound, the ESP averaged 0.34 gallons less fuel per mile or 2.8% fuel savings. The average speed was relatively the same.
3. Running on the Kentucky Lake, Tennessee River and Tenn-Tom Waterway, the system averaged burning 1.84 gallons less or 9.2% fuel savings. This is only over 14 days of running, which is probably not enough time to give a reliable average.
4. The total accumulated savings equated to an average fuel burn of 1.92 gallons per mile or a 9.88% fuel savings. The speed differential was 0.321 miles an hour faster or a 4.85% increase in speed.
5. Based on the test data, Northbound, the vessel averaged using the ESP 47.75 miles per day. Going by the gallons saved per mile, this is an actual saving of 122.7 gallons per day.
6. Based on the test data, Southbound, the vessel averaged using the ESP 67.42 miles per day. Going by the gallons saved per mile, this is an actual saving of 22.92 gallons per day.
7. The ESP had a combined average saving approximately 110 gallons of fuel per day through the entire test period. This was based on an average daily use of the system of 7.5 hours per day.
8. The vessel actually averaged traveling 13 hours a day. This would have been a total fuel saving per day of approximately 190 gallons per day.

ESP Usability

1. From discussions with the pilots, it was determined the ESP was extremely user friendly. The pilots enjoy using the system and see many benefits from it.
2. The ESP saves fuel consistently, either north or southbound. It does however, save more fuel northbound when the vessel is experiencing the most resistance.
3. The system has few moving parts that can fail. The ESP is very low maintenance.
4. The ESP will give the boat maximum thrust and speed with the fewest RPMs required. The engines, by operating at a lower RPM average, will experience less wear. The ESP never gets tired and is always working for you.

M/V Ginger Moller Test Data Summary

Northbound on Ohio River Monthly Averages

Month	Mode	Days Used	Hours	Miles	Speed	GPM
July, 02	RPM/Man	10	1.87	10.20	5.49	21.61
	Best Speed	15	8.38	56.27	6.90	17.12
Aug, 02	RPM/Man	3	5.16	17.54	5.36	21.44
	Best Speed	9	10.74	69.25	6.55	17.91
Sept, 02	RPM/Man	10	7.36	46.92	6.37	19.57
	Best Speed	9	6.99	46.23	6.53	18.01
Oct, 02	RPM/Man	10	8.47	51.45	6.10	20.52
	Best Speed	11	7.87	46.13	5.95	19.98
Nov, 02	RPM/Man	8	8.46	39.48	4.67	26.96
	Best Speed	7	8.52	42.53	5.03	22.88
Dec, 02	RPM/Man	5	9.29	38.06	4.16	29.10
	Best Speed	6	6.95	28.09	4.31	26.73
Jan, 03	RPM/Man	4	8.91	36.74	4.12	30.55
	Best Speed	5	10.96	45.74	4.12	29.04
Average	RPM/Man	50	7.07	22.55	5.18	24.25
	Best Speed	62	8.63	47.75	5.63	21.68
Difference					0.45	2.57

Southbound on Ohio River Monthly Averages

Month	Mode	Days Used	Hours	Miles	Speed	GPM
July & Aug, 02	RPM/Man	3	3.56	25.53	7.42	12.26
	Best Speed	17	10.22	83.07	8.21	13.25
Sept, 02	RPM/Man	11	6.85	57.82	8.29	13.85
	Best Speed	10	5.75	46.50	8.12	13.94
Oct, 02	RPM/Man	12	6.94	60.85	8.65	13.73
	Best Speed	8	6.29	56.27	8.51	13.20
Nov & Dec, 02	RPM/Man	5	8.14	71.29	9.09	11.42
	Best Speed	6	4.37	35.77	9.12	9.64
Jan, 03	RPM/Man	1	4.46	48.88	10.96	10.44
	Best Speed	3	10.64	115.5	10.37	9.99
Average	RPM/Man	32	5.99	53.27	8.88	12.34
	Best Speed	44	7.45	67.42	8.87	12.00
Difference					-0.01	0.34

Kentucky Lake, Tenn River and Tenn-Tom Combined Average

Month	Mode	Days Used	Hours	Miles	Speed	GPM
Dec, 02	RPM/Man	11	6.57	44.30	6.57	20.04
	Best Speed	11	6.59	56.58	6.59	18.2
Difference					0.02	1.84

**M/V Ginger Moller
Northbound on Ohio River
Detailed Test Data**

DATE	HOURS	MILES	MPH	GPM	HOURS	MILES	MPH	GPM
	ESP	ESP	ESP	ESP	ESP	ESP	ESP	ESP
	ON	ON	ON	ON	OFF	OFF	OFF	OFF
7/13	11.20	70.67	6.31	20.94	2.20	10.27	4.68	26.60
7/14	8.55	54.46	6.37	20.84	1.28	6.99	5.46	23.14
7/16	9.80	65.07	6.64	15.66	2.56	14.98	5.85	19.13
7/17	7.26	43.56	6.00	20.18	2.10	9.99	4.76	23.90
7/18	14.08	86.17	6.12	19.60	2.43	13.30	5.47	21.27
7/19	9.01	59.64	6.32	19.70	1.36	6.00	4.41	25.33
7/20	10.75	78.48	7.30	15.60	1.23	8.89	7.23	17.41
7/21	5.01	36.97	7.38	15.35	*			
7/22	10.35	69.45	6.71	16.23	1.81	11.10	6.13	16.12
7/23	5.55	37.07	6.68	16.73	*			
7/24	3.80	32.49	8.55	12.21	*			
7/25	5.21	43.87	8.42	12.43	*			
AVG	8.38	56.27	6.90	17.12	1.87	10.2	5.49	21.61

DATE	HOURS	MILES	MPH	GPM	HOURS	MILES	MPH	GPM
	ESP	ESP	ESP	ESP	ESP	ESP	ESP	ESP
	ON	ON	ON	ON	OFF	OFF	OFF	OFF
8/02	14.96	93.5	6.25	19.28	1.55	7.80	5.03	21.02
8/03	150.3	92.58	6.16	19.82	1.91	10.08	5.28	22.07
8/04	10.81	68.43	6.33	19.03	*			
8/16	4.21	31.36	7.45	13.61	1.41	8.70	6.17	15.05
8/17	14.33	96.58	6.74	16.25	*			
8/18	16.55	104.76	6.33	18.53	*			
8/19	3.71	22.96	6.19	19.47	*			
8/22	12.21	82.66	6.77	16.81	*			
8/24	15.35	92.25	6.01	20.30	2.13	8.88	4.17	28.65
8/25	10.05	66.43	6.61	17.83	*			
8/30	4.30	31.56	7.34	15.22	8.48	52.24	6.16	20.43
8/31	7.41	47.94	6.47	18.43	*			
AVG	10.74	69.25	6.55	17.91	5.16	17.54	5.36	21.44

Note: * Not sufficient hours used to establish an accurate average for that day.

**M/V Ginger Moller
Northbound on Ohio River
Detailed Test Data**

DATE	HOURS	MILES	MPH	GPM	HOURS	MILES	MPH	GPM
	ESP	ESP	ESP	ESP	ESP	ESP	ESP	ESP
	ON	ON	ON	ON	OFF	OFF	OFF	OFF
9/02	7.23	52.13	7.21	12.64	10.45	75.56	7.23	13.32
9/04	9.38	64.25	6.85	17.13	10.61	62.81	5.92	21.78
9/07	3.80	24.40	6.42	18.68	7.35	47.04	6.40	19.89
9/08	4.61	28.86	6.26	19.06	8.98	58.37	6.50	19.52
9/09	11.68	78.96	6.76	17.75	1.65	10.89	6.60	19.90
9/11	*				9.41	66.62	7.08	16.59
9/12	7.96	48.64	6.11	20.12	*			
9/14	*				9.03	57.61	6.38	20.57
9/15	10.75	70.95	6.60	18.30	2.95	18.67	6.33	20.37
9/16	4.91	32.16	6.55	18.16	8.80	43.82	4.98	25.35
9/17	2.60	15.69	6.03	20.25	4.40	27.76	6.31	18.38
AVG	6.99	46.23	6.53	18.01	7.36	46.92	6.37	19.57

DATE	HOURS	MILES	MPH	GPM	HOURS	MILES	MPH	GPM
	ESP	ESP	ESP	ESP	ESP	ESP	ESP	ESP
	ON	ON	ON	ON	OFF	OFF	OFF	OFF
10/03	7.55	45.83	6.07	20.50	9.61	56.89	5.92	22.10
10/04	8.71	52.00	5.97	20.59	8.70	56.38	6.48	19.32
10/05	5.86	36.74	6.27	19.29	3.63	22.69	6.25	20.04
10/06	4.55	29.39	6.46	18.26	9.35	69.28	7.41	15.67
10/10	8.80	54.65	6.21	19.45	10.18	66.17	6.50	18.97
10/14	7.48	35.68	4.77	25.15	10.83	57.83	5.34	24.21
10/15	11.03	58.13	5.27	22.73	*			
10/25	*				5.81	36.66	6.31	18.66
10/26	6.38	39.24	6.15	19.08	9.73	56.34	5.79	21.75
10/28	5.58	38.78	6.95	14.27	7.61	43.68	5.74	20.52
10/29	11.43	66.29	5.80	19.65	*			
10/30	9.21	50.75	5.51	20.78	9.21	48.54	5.27	23.99
AVG	7.87	46.13	5.95	19.98	8.47	51.45	6.10	20.52

Note: * Not sufficient hours used to establish an accurate average for that day.

**M/V Ginger Moller
Northbound on Ohio River
Detailed Test Data**

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
11/03	*				4.46	19.76	4.43	28.38
11/04	8.25	45.13	5.47	20.68	11.5	57.96	5.04	23.00
11/05	4.45	22.38	5.03	21.83	7.48	46.97	6.28	16.72
11/06	8.66	52.57	6.07	15.81	9.66	42.41	4.39	29.03
11/07	7.85	41.53	5.29	22.54	5.23	23.73	4.45	28.28
11/13	10.41	46.85	4.50	24.20	10.16	41.86	4.12	31.00
11/14	8.80	35.29	4.01	30.05	8.51	38072	4.55	28.22
11/15	11.20	53.98	4.82	25.05	10.71	44.45	4.15	31.07
AVG	8.52	42.53	5.03	22.88	8.46	39.48	4.67	26.96

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
12/18	*				7.93	31.32	3.95	31.14
12/19	12.10	47.67	3.94	30.9	10.86	37.90	3.49	37.13
12/20	7.60	26.83	3.53	35.68	*			
12/21	*				8.55	37.62	4.40	25.8
12/22	11.45	45.34	3.96	27.62	11.41	44.50	3.90	28.98
12/23	3.60	17.89	4.97	21.22	*			
12/25	1.08	5.59	5.18	20.71	7.68	38.94	5.07	22.43
12/26	5.86	25.20	4.30	24.24	*			
AVG	6.95	28.09	4.31	26.73	9.29	38.06	4.16	29.1

January, 2003

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
1/1	13.05	68.38	5.24	21.03	5.85	24.04	4.11	30.58
1/2	11.30	44.18	3.91	30.31	10.30	43.78	4.25	29.42
1/3	10.81	43.89	4.06	29.13	11.8	47.20	4.00	31.31
1/4	10.76	39.06	3.63	33.40	7.70	31.96	4.15	30.90
1/5	8.88	33.21	3.74	31.35	*			
AVG	10.96	45.74	4.12	29.04	8.91	36.74	4.12	30.55

Note: * Not sufficient hours used to establish an accurate average for that day.

M/V Ginger Moller
Southbound on Ohio River
Detailed Test Data

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
7/14	5.23	53.45	10.22	7.12	*			
7/15	9.45	87.41	9.25	6.83	3.96	27.90	7.52	8.25
7/23	6.01	45.56	7.58	15.04	*			
7/25	8.48	60.63	7.15	17.01	*			
7/26	5.40	40.07	7.42	15.88	*			
7/27	12.80	99.20	7.75	15.34	*			
7/28	18.16	141.65	7.80	15.10	*			
7/29	4.56	35.98	7.89	13.94	*			
AVG	8.76	70.49	8.13	13.28	3.96	27.90	7.52	8.25

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
8/06	5.55	42.46	7.65	15.03	*			
8/07	14.65	106.07	7.24	16.11	*			
8/08	11.53	87.40	7.58	14.40	4.00	27.00	6.75	15.81
8/09	6.88	58.69	8.53	12.79	2.71	21.68	8.00	12.71
8/19	11.51	101.86	8.85	11.95	*			
8/20	16.23	157.11	9.68	8.18	*			
8/26	16.45	126.67	7.70	15.18	*			
8/27	10.33	76.34	7.39	15.45	*			
8/28	10.56	104.33	9.88	9.68	*			
AVG	11.52	95.66	8.28	13.22	3.36	24.34	7.38	14.26

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
9/03	5.11	40.47	7.92	14.0	7.88	71.94	9.13	11.83
9/05	5.21	41.26	7.92	13.99	8.85	76064	8.66	13.59
9/06	6.08	52.04	8.56	12.84	8.03	72.75	9.06	12.33
9/09	*				5.35	44.67	8.35	13.93
9/10	9.45	77.87	8.24	13.38	7.58	68.67	9.06	12.34
9/14	4.55	37.36	8.21	13.58	*			
9/15	*				5.45	46.49	8.53	13.52
9/16	3.83	32.29	8.43	13.4	*			
9/18	*				3.45	26.19	7.59	16.41
9/19	7.21	54.44	7.55	15.17	4.15	29.96	7.22	16.03
9/20	5.93	43.88	7.40	16.65	11.11	87.21	7.85	15.24
9/21	5.43	41.87	7.71	15.05	9.66	84.91	8.79	12.62
9/22	4.70	43.48	9.25	11.37	3.83	26.58	6.94	14.47
AVG	5.75	46.5	8.12	13.94	6.85	57.82	8.29	13.85

M/V Ginger Moller
Southbound on Ohio River
Detailed Test Data

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
10/01	*				9.25	89.36	9.66	10.68
10/02	4.78	41.97	8.78	11.35	2.83	20.09	7.10	16.61
10/05	2.48	21.08	8.50	12.98	3.00	25.98	8.66	13.34
10/07	*				7.86	51.25	6.52	19.43
10/08	5.65	54.39	7.11	16.71	11.98	87.21	7.28	17.11
10/09	6.61	46.47	7.03	16.64	1.98	13.48	6.81	17.33
10/11	5.73	44.87	7.83	14.83	7.88	70.48	8.99	12.82
10/12	11.73	110.97	9.46	11.63	8.35	81.25	9.73	11.95
10/15	*				6.40	61.06	9.54	12.50
10/23	5.81	52.06	8.96	12.11	9.98	92.41	9.26	12.18
10/27	7.51	78.33	10.43	9.31	4.86	51.76	10.65	9.47
10/31	*				8.95	85.47	9.55	11.29
AVG	6.29	56.27	8.51	13.20	6.94	60.85	8.65	13.73

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
11/08	6.90	50.99	7.39	9.58	7.64	58.06	7.64	12.9
11/09	6.41	45.00	7.02	8.82	6.79	34.36	6.79	12.06
11/10	3.43	32.07	9.35	12.24	9.23	78.46	9.23	12.31
AVG	5.58	42.69	7.92	10.21	7.89	56.96	7.89	12.42

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
12/20	2.26	25.2	11.15	10.47	10.48	115.38	11.01	10.76
12/21	1.23	14.8	12.03	8.37	*			
12/23	*				6.53	70.20	10.75	9.11
12/24	6.00	45.56	7.76	8.36	*			
AVG	3.16	28.85	10.31	9.07	8.50	92.79	10.88	9.94

January, 2003

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
1/05	4.91	42.18	8.59	9.99	*			
1/06	13.80	156.63	11.35	9.92	*			
1/07	13.21	145.69	11.18	10.06	4.46	48.88	10.96	10.44
AVG	10.64	115.5	10.37	9.99	4.46	48.88	10.96	10.44

M/V Ginger Moller
Kentucky Lake, Tennessee River and Tenn-Tom
Detailed Test Data

DATE	HOURS ESP ON	MILES ESP ON	MPH ESP ON	GPM ESP ON	HOURS ESP OFF	MILES ESP OFF	MPH ESP OFF	GPM ESP OFF
12/04	2.83	16.07	5.68	17.20	2.80	17.70	6.32	15.64
12/05	9.28	61.06	6.58	12.56	*			
12/07	*				4.41	29.68	6.73	16.63
12/08	11.58	69.13	5.97	18.49	12.11	63.34	5.23	23.86
12/11	*				5.18	51.96	10.03	10.53
12/12	*				11.53	112.88	9.79	11.75
12/13	1.83	8.89	4.86	24.04	3.61	16.79	4.65	23.15
12/14	10.01	61.16	6.11	18.88	10.01	47.65	4.76	24.12
12/15	5.28	23.39	4.43	28.07	10.08	40.82	4.05	34.59
12/17	6.88	69.69	10.13	10.54	3.66	39.67	10.84	8.71
12/28	12.28	63.86	5.20	22.66	5.25	33.60	6.40	19.46
12/29	11.40	47.08	4.13	28.61	7.93	33.15	4.18	31.98
12/30	11.36	96.67	8.51	10.23	*			
12/31	9.70	105.34	12.86	8.94	*			
AVG	8.40	56.58	6.59	18.20	6.96	44.30	6.57	20.04

Note: * Not sufficient hours used to establish an accurate average for that day.