Southeast Alaska Pilots Association Tractor Tug Research Project Committee Report

Project Committee Members:
Captain Hans Antonsen, Captain Levi Benedict,
Captain Frank Didier, Captain Scott Jones.

In May of 2018, SEAPA membership authorized funding to research tractor tugs for Southeast Alaska. The project was intended to evaluate tractor tugs versus the conventional twin-screw tugs currently available in Southeast Alaska, with the base line being the power and maneuvering characteristics of the currently available tugs. The project end goal was to determine the size of tractor tugs necessary to improve the safety of narrow channel transits and protection of port infrastructure and commerce during an emergency response and or casualty underway. The project focused on VLCS class vessels as the measure for risk mitigation relating to tug performance.

I. **Base reasoning for the project.**
   a. Very large cruise ships (VLCS) and increases in the numbers of cruise vessels have escalated challenges to the standard of care required to maintain port and vessel safety. *(end note 1)*
   b. Port infrastructure which includes tugs to mitigate the escalation of risk have not kept up with increases in cruise industry commerce.
   c. Due to increased numbers of vessels and vessel size, tractor tugs may be needed to mitigate the escalation of risk, protect human life, shipping, the marine environment and commerce that local communities depend upon. *(end note 2)*

II. **Research Facility location.**
   a. AVTEC simulator in Seward Alaska December 2 to 12, 2018.

III. **Simulation interactions.**
   a. The project utilized two interactive simulators.
   b. The project used a total of two tugs in simulation.
   c. The forward tug was used either on the port or starboard bow of the vessel made up laying alongside at the beginning of the simulation and controlled by the simulator operator.
   d. The aft tug was used in a tethered mode from the centerline of the ships stern and was operated from the second simulator by trained conventional and Z-Drive tug masters.

IV. **Tug interactions.**
   a. The tug interactions were directed by the pilot via radio in the ship simulator while conning the vessel.
   b. The pilot directed the tug as to actions and force applied.

V. **Tugs used in the simulation were,**
   a. Twin screw conventional 3000HP, not to exceed 30 tons bollard pull.
   b. Z-Drive tractor tug 4000HP, not to exceed 50 tons bollard pull.
   c. Z-Drive tractor tug 6000HP, not to exceed 70 tons bollard pull.
   d. The maximum working load for all simulations were not to exceed 70 tons on a vessel per each tug.

VI. **Vessel Models Used in Simulation.**
   a. The research project used two VLCS class models for determining the effectiveness of tug forces. *(end note 4)*

VII. **Geographic location for simulation.**

a. Area waterway simulated was Tongass Narrows from Potter Rock, East Channel to north of the airport seaplane float.

VIII. **Environmental conditions.**

a. The environmental conditions developed were leveraged at the upper end of wind and current combinations, where the point of vessel failure might occur. This was intentionally done to evaluate tug forces at the point where vessels were becoming limited.
b. The exception to this were environmental conditions for emergency response. The emergency response was considered as those upper level conditions a pilot might consider as safe and not out of the ordinary when calling on the port.
c. Seven differing environmental conditions were scripted, the environments included variations in both the wind and current along the geographic area to account for local conditions. *(end note 3)*

IX. **The simulation runs,**

a. Dry runs, both north and south bound, between Potter Rock to the airport seaplane float with no environmental or tugs. (To evaluate models)
b. Potter Rock Buoy NB California / Idaho Rocks.
c. Doyons Landing SB California / Idaho Rocks.
d. ½ mile south of Pier 1 NB to Pier 3.
e. Wreck Buoy SB to Pier 3.
f. North of airport seaplane float SB to clear shipyard.
g. ½ mile off Pier 4 NB to clear shipyard.

X. **Simulation run considerations.**

a. The same environmental and run combinations for the two vessels were vetted against the 3 differing tug types evaluated.

XI. **Number of Simulations Run.**

a. The team ran 64 simulations consisting of 48 transits and 16 emergency maneuvers; 32 for each vessel model.

XII. **Overall Factor in simulation environment.**

a. The factors for the simulations included the effectiveness of the tug forces utilized.
b. The tug forces were weighted against the environmental conditions simulated in the regional waterway.
c. The actual success of the maneuver being simulated was discussed in validation.
d. Scoring was tabulated from 3 professionals with extensive experience in regional pilotage and tractor tug usage.

XIII. **Debriefs were conducted. The following considerations were discussed,**

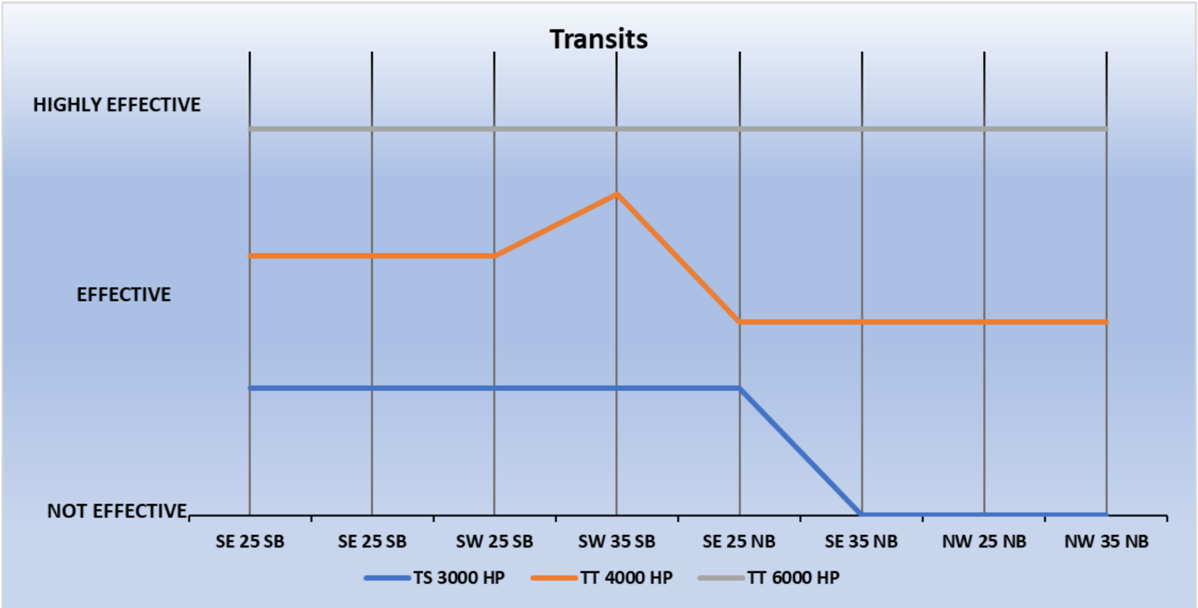
a. Were the tugs having a positive effect on the transit and or maneuver?
b. What was the maximum power required and for how long?
c. Was a steering force used and was it effective?
d. Was a breaking force used and was it effective?
e. Was a dynamic force used by the tugs and was it effective?
f. Was directional control achieved and by what method?
g. Was control of the ship achievable?
h. Were the tugs able to mitigate set and drift while making way?

i. Were the environmental conditions apparent in simulation?
j. Were the tugs, "Highly Effective", "Effective" or "Not Effective"?
k. Was the maneuver Safe or "Potentially Hazardous" for the tugs?

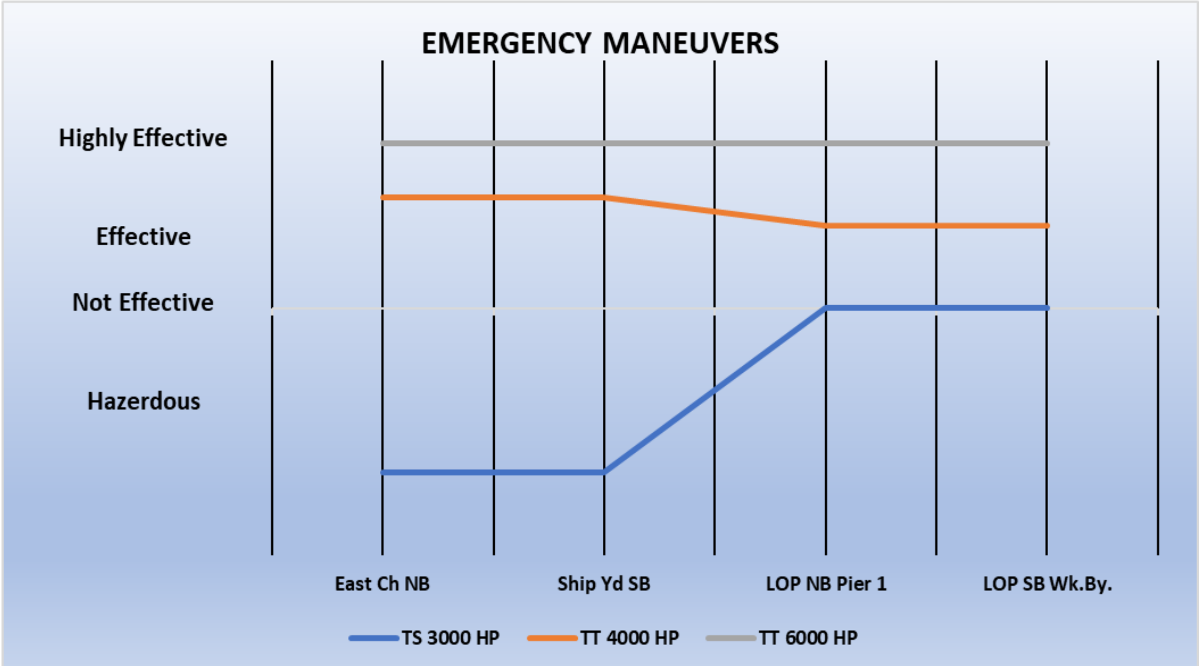
XIV. Base for establishing a score.

a. Both the tug masters and the pilots discussed each simulation. Their professional opinions determined the scoring for each exercise.
b. The simulation scoring was tabulated from the opinions of the participants as,
   i. Not Effective = -1
   ii. Effective = 1
   iii. Highly Effective = 3
   iv. Safe = 1
   v. Potentially Hazardous, = -3
c. From the score, determinations as to effectiveness of the tug forces were developed.
d. Highly effective, meaning that the forces the tug exerted on the vessel were apparent and measurable by the pilot and tug operator, and produced the desired outcome.
e. Tug forces that were effective, meaning that tugs did produce the desired effect, but may or may not have been readily apparent early in the exercise are graphed according to the determinations made by the participants.
f. Tug forces when not effective were graphed accordingly.
g. When a hazardous maneuver occurred for the tug, they were graphed to indicate under which conditions the hazardous event occurred.

XV. Simulation Results, Transits. Results are rated from highly effective to Not Effective



XVI. Simulation Results, Emergency Maneuvers. Results are rated from highly effective to Hazardous.



XVII. Conclusions.

a. The appropriate tractor tug infrastructure is non-existent and contributing to an elevated risk to commerce and those communities dependent upon it. The elevated risk, lacking efforts in mitigation, may hazard shipping, human life, the marine environment and other maritime commerce activities.

b. Tractor tugs in the range of 70-ton bollard pull proved to be most effective in performance for tethered escort, underway swept area mitigation, maneuvering assistance and emergency response.

c. Conventional tugs, in the range of 30 tons bollard pull were least effective but, in some cases, while the ship was making way could provide some positive benefit.

d. Conventional tugs, in a tethered position could be introduced into a potentially hazardous maneuver for the tug.

e. Vessels need to be fitted with the appropriate mooring bitts and chocks to accommodate the forces involved.

f. Tractor tug deployment, joint training for tug crews, vessel crews and pilots will need to occur.

g. Tugs in port, standby and non-tethered escorts do not generate the opportunity for vessel and port protection necessary for the standard of care. Tugs need to be positioned and actively engaged, appropriately made up to vessels, to provide risk mitigation. Continuous use provides training for vessels, tug crews and pilots.

h. The benefits are a greater margin of safety for VLCS vessels which extend to guarding port facilities and other vessels operating in ports where tractor tugs are deployed.

i. The deployment of tractor tugs for the ports of Juneau, Skagway and Ketchikan may provide the ability for timely emergency response to vessel casualties occurring elsewhere within or adjacent to the region/port.

XVIII. **Recommendations.**

a. The deployment of tractor tugs in the 70-ton bollard pull range is a necessary component of port infrastructure that is currently non-existent. It is recommended that 2 tractor tugs in the 70-ton bollard pull range be deployed in the ports of Juneau, Skagway and Ketchikan.
b. Considerations should be made to increase tug infrastructure in other not named ports in the region to support emergency response.
c. The deployment of tractor tugs for the ports of Juneau, Skagway and Ketchikan, will provide the ability for timely emergency response to vessel casualties occurring elsewhere within or adjacent to the region. Tug escort, response and assist plans should be developed for each port taking into considerations the currently available tugs and possible scenarios for emergency response.
d. Hold open meetings or town forums with the COTP, Port Authorities and Communities, State Regulatory and Legislative Representatives, Cruise Industry Representatives and other interested parties to discuss the standard of care for our ports, waterways and communities.
e. Identify regulatory and voluntary processes which will contribute to establishing the deployment of tractor tugs in order to meet the standard of care.

XIX. **Participating and or Observing in the simulations.**

(end note 5)

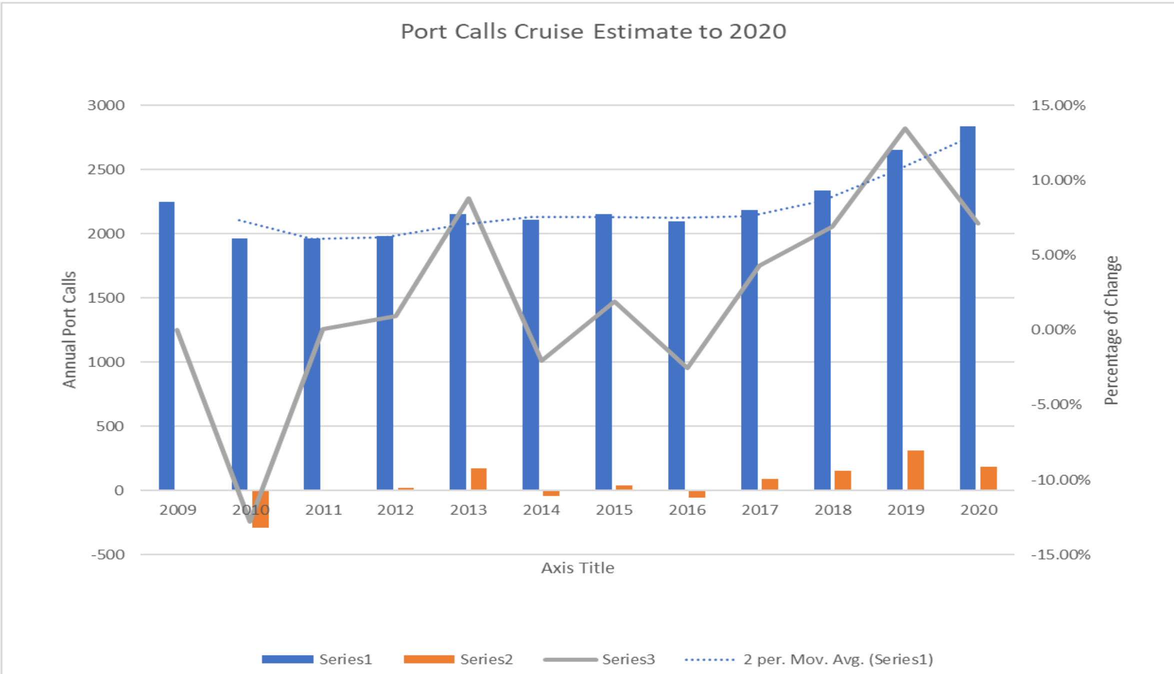
XX. **Disclaimer**

a. This document is the result of research funded and conducted by the Southeast Alaska Pilots Association (SEAPA). SEAPA has no economic interests or ownership in any companies which may be considered as providing tractor tug services.
b. SEAPA's primary interest is the responsibility SEAPA has in providing pilotage services to vessels in Southeast Alaska. These responsibilities include meeting the standard of care necessary to insure the protection of human life and our coastal communities, safe commerce of shipping and protection of the environment.
c. The research for this project was conducted by both professionally licensed pilots and experienced tug operators. The product returned represents their professional opinions obtained during the project.
d. The indication of "Effective or Highly Effective" is not a guarantee that any simulation or in the case of a real-life transit/maneuver, may be concluded without incident, but rather the ability to mitigate an incident or situation may be possible.
e. The opinions and conclusions expressed within this report are not intended to represent opinions of those other persons that may have observed the research process.
f. The simulation exercises were for the sole purpose of evaluating the forces as represented by the tugs. While the scenarios were intended to be as close to real life as possible, the scripted exercises often included the pilot making emergency ship handling decisions within the scripted simulation. Because of the scripted nature, there is a departure from real life where other factors may influence the decision-making process.

<u>End Note 1</u> VLCS Class Vessels, 120,000GT and greater represent.

2017 – 2 vessels, 9% of regional tonnage.
2018 – 2 vessels, 10% of regional tonnage
2018 – 3 vessels, 16% of regional tonnage.
2019 – 6 vessels, 29% of regional tonnage.
2020 – 7 vessels, 33% of regional tonnage. (Estimated)

<u>End Note 2</u>



<u>End Note 3</u> Simulation Environmental conditions

a. Wind SE-25, Current NB 1.5 knots. (Transit)
b. Wind SE-35, Current NB 2.5 knots. (Transit)
c. Wind SW-25, Current NB 1 knot. (Transit)
d. Wind SW 35, Current NB 2 knots. (Transit)
e. Wind NW-25, Current SB 1 knot. (Transit)
f. Wind NW-35, Current SB 2 knots. (Transit)
g. Wind SE 20, Current NB 1 knot. (Emergency Maneuvers)

<u>End Note 4</u> VLCS models used in simulation.

140,000 Gross Ton Twin Screw, Inboard Turning, Fixed Propeller, Diesel Electric.

167,000 Gross Ton Twin Azipod Propulsion.

<u>End Note 5</u> Participating and or Observing in the simulations. **SEAPA:** Captain Frank Didier (Tug Master/Pilot), Captain Scott Jones (Pilot), Captain Levi Benedict (Tug Master/Pilot), Captain Kathleen Flury (Pilot), Captain Hans Antonsen (Tug Master/Pilot), Captain Barry Olver (Pilot), Captain Steve Axelson (Pilot), Captain Tomi Marsh (Pilot), Captain Norbert Chaudhary (Pilot), Captain Rich Preston (Pilot), Captain Jeff Baken (Pilot). **Amak Towing**: Captain Mike Korsmo (Tug Master), Captain Lonnie Adams (Tug Master). **CLAA:** Mr. Rick Erickson. **Board of Marine Pilots:** Captain Dave Arzt (AMP, Pilot Member), Charles Ward (MPC). **Captain of the Port:** Sector Juneau, Captain Stephen White (USCG). **SWAPA:** Captain Bryan Vermette (Pilot), Captain Josh Weston (Tug Master/Pilot), Captain Jeff Pierce (Pilot). **Hawaii Pilots:** Captain Ed Enos (Pilot).