

The proposed project will triple the functional capacity to repair, maintain and construct vessels. Capacity increases grow the workforce base providing job creation) and increase revenues providing sustainability of KSY. Table 7 shows increased capacities resulting from TIGER funding.

Table 7: KSY Capacity Analysis Summary	2005	Current	TIGER	AIDEA
Pierside Berths, number of vessels	3	3	5	5
Drydock 1 Berths, number of vessels	1	1.3	1.5	1.5
Drydock 2 Berths, number of vessels	0	1	1	1
Land-level Berths, number of vessel	0	1	2	3
Production Shop Capacity (square feet)	22,750	28,375	94,312	123,250
Theoretical maximum number of annual contracts based on all berths occupied	59	82	110	114
Maximum revenue (millions)	\$18	\$36	\$54	\$60

Capacity analysis: A nominal ship length is 250 feet. Drydock #1 is 450 feet so can accommodate one large or two smaller vessels. Drydock #2 can accommodate 250 ft vessels. Routine pierside and dry dock repairs are nominally 15 days in the dock plus 6 days pierside and one day dock dry dock preparation and cleanup. More complex repairs and new construction are nominally 90 days berth use (more complex or larger vessel construction would be considered multiple nominal contracts) and would use land-level facilities. Use of Drydock #1 has been limited because of the need for emergency repair. The addition of Drydock 2 raises effective berth capacity and flexibility. Efficiency upgrades in production complex and other facilities raises Drydock #1 capacity to effectively 1.5 berths. Pierside berths under TIGER presume use of pier space north of the shipyard as needed currently used solely for AMHS vessels. Capacity assumptions include annual time for shipyard maintenance. Note: the shipyard after TIGER will have capacity for emergency repairs, short-notice new construction, and non-marine work such as Alaska pipeline fabrication. More detailed capacity analysis is available, along with historic shipyard use of piers, dry-docks and the relatively new land-level berth.

KSY Efficiency Problems and Issues

Part 1 – Installed capacity and improvement opportunities

Installed capacity refers to the physical infrastructure of the KSY. A key finding of KSY development planning is the capacity to perform ship repair and construction process in buildings. Currently the KSY has no (zero) installed capacity to do vessel repair or ship assembly under cover and limited capacity to fabricate and assemble larger ship components, modules, or sub-assemblies supporting ship repair or outfitting processes.

Precipitation effects – work disruption: Ketchikan has on average only 100 sunny days annually. Other days may or may not rain or snow (average precipitation over 155 inches annually). General productivity on a rainy day is disrupted (labor loss) nominally 2 hours re-arranging work sequences, rigging and adjusting temporary covering systems that must later be removed and disposed as waste. Cumulative rain impact per 100 workers is 45,000 lost productive hours annually until corrected.

TIGER funded corrections and efficiency gains will provide two enclosed berths saving over 125,000 MH annually at full employment of 350 shipyard technicians, (16 % efficiency gain. Elimination of protective material purchases, set-up time, and disposal as waste will produce a 2 percent efficiency gain. Total efficiency gain from protection from precipitation is 18 percent.

Control of hazardous and waste materials: Performance of Vessel repair and new construction in the open exposes waste materials such as sand blast grit, paint chips, and oil leaks to rain. Currently rain events disrupt ship production processes to prevent contamination of surface runoff. Mitigation measures include immediate clean up of used sand blast grit, custom-built weather protection systems, along with continuous supervisory monitoring and labor for multiple cleanups during each shift to maintain compliance with clean air and water regulations.

TIGER corrections and efficiencies through the provision of two enclosed berths will save over 8,000 MH annually, eliminate cost and disposal for special coverings on 2 berths, allow efficient waste material handling and storage (5 percent efficiency gain).

Wind effects – welding and painting disruption: Climate data shows predominant winds of 8-12 MPH prevailing from southeast and northwest with wind gusts and high probabilities of high wind over 50 MPH during KSY peak demand September through June. Heavy and gusting wind disrupts shield gasses needed for crack-free weld joints and disrupts surface preparation and coating operations. Uncontrolled paint spray can adversely affect surfaces at the shipyard and neighboring properties. Wind induced set-up, takedown, and disposal of temporary wind protections, production hindrances, and re-work to correct problems are part of the production inefficiencies currently experienced at the KSY.

TIGER correction and efficiency gains resulting from two enclosed berths and production facilities will save over 10,000 MH annually at full employment of shipyard technicians; 350 workers. Reduced re-work, material replacement, and reduction of temporary enclosure purchase, set-up time, and disposal cost, as waste, will produce wind effect efficiency gains of 5 percent.

Daylight effects – workday flexibility: KSY's location in the northern latitudes reduces daylight hours during winter months. September through June is the shipyard's heaviest demand for vessel repair because vessels in the North Pacific and Arctic Oceans operate in the short summer periods season. Temporary lighting can accommodate night-time work but requires set-up and frequent adjustment. Shipyard operations in periods of darkness makes material handling, crane operations, walking, and location of tools and equipment more difficult.

TIGER correction provides two enclosed, fully lighted repair and assembly berths and production facility. Installed lighting capacity facilitates full production during short day light shifts and easy shift extension to overtime or multi-shift operations as needed. Flexibility and productive work efficiency gains from lighting is estimated at 3 percent.

Work process flow: Shipyard layout requires material handling between shops, fabrication areas, and vessels under repair or construction. People flow, mostly walking, between production engineering or project management offices, tool and parts centers and the work sites add inefficiency. Reducing

distance traveled by co-locating repair and assembly halls with production and management centers rates high in value network analysis for efficiency.

TIGER improvements reduce material handling and people travel inefficiency between the new production center, operations offices, existing berths and three new berths. Routine efficiency improvements generated from improved production flow are estimated at 4 percent.

Production equipment and tooling: The current shipyard lacks installed facilities with a range of production equipment and tooling needed to use the increased repair-new construction berth capacity at full efficiency. For example, steel cutting and forming processes are routinely outsourced to Lower 48 vendors. This supply chain adds time a minimum of 2 to 3 days for order turn-around even when planned and disrupts emergent work, customer change requests, and needed re-work.

TIGER improvements will add a comprehensive production complex and associated infrastructure such as electrical distribution system, material movement equipment such as internal cranes. Better flexibility and control of production processes can add efficiencies estimated at 4 percent overall.

Installed Capacity Efficiency Improvement Summary: Efficiency gains derived from installed capacity that minimizes impacts of precipitation, wind, darkness, work process flow, and co-located production equipment and tooling can increase current shipyard efficiency by about 39 percent.

Part 2 – Management and workforce efficiency problems and issues

The shipyard has an experienced and capable workforce of about 125 full time employees. The shipyard has insufficient excess capacity of managers and subject matter experts to operate the expanded and improved shipyard. The shipyard lacks resources to train, coach, and monitor the workforce expansion needed to achieve full capacity of installed facilities improvements. The shipyard's management system for public communications (industry image), marketing, sales, contract administration, materials, labor recruiting-hiring-training-retention, productive space allocation is adequate for contracts at \$18 million annually, but will cause inefficiencies as greater capacity and work complexity occurs.

Correcting potential causes of inefficiencies through operating expense categories that can be capitalized during the expansion and improvement project years can bring workforce and management to highly efficient state-of-the-art to match productive capacity changes. Other shipyards that invest funds and time to achieve better management and workforce competence with state-of-the-art tools and methods can raise efficiencies nominally 15 percent beyond efficiencies gained by installed capacity improvements and ad-hoc management-workforce changes.