



## CASE STUDY:

Truly successful projects go well beyond being “on time and on budget.” Advanced American Diving Service, Inc. (AADS) exceeded the expectations of our client, the US Army Corps of Engineers (USACE), in the delivery of the Miter Gate Repair Project with excellence in innovation, client services, project management, and teamwork.

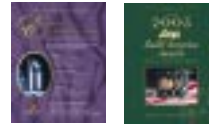
The Lower Granite Lock was 26 years old at the time the work was performed. In March, 1998 during a routine inspection, Corps engineers’ discovered serious cracks in the Lower Granite Navigation lock miter gate. These cracks were in the pintle area (pivot point) of both leaves of the gate skin plate and bottom horizontal rib. The cracks were considered to be a serious threat to future integrity and operation of the navigation lock. A major portion of the economy of Clarkston, WA, Lewiston, Idaho, and the surrounding areas is dependant upon commercial shippers being able to use the Lower Granite Lock and Dam. The lock allows a high volume of shippers to transport goods to and from all parts of the world to Lewiston, Idaho and Clarkston, Washington by waterways.

This project received an **“Outstanding Performance Rating”** from the Corps, and **Advanced American Diving Service was awarded the Department of the Army Certificate of Appreciation**, and received a \$200,000 bonus for early completion. All of the goals of the commercial shippers were met for achieving the minimum impact on the shipping of goods through the Lower Granite Lock and Dam. AADS met all of the goals of the project through teaming and partnering with the designers, the Construction Division of the USACE Walla Walla District and the USACE Operations staff at the lock and dam and implementation of innovative methods of work performance.

### Excellence in innovation and project management.

AADS recognized that the critical path to meeting project milestones and early completion was lifting and moving the gate leaves in a short time period. After careful consideration of all viable options, the method chosen was jacking and skidding. Jacking gates in place had been done by other districts, however, skidding was new to the Corps, especially with gates weighing 375 tons each and standing 122 feet tall. This became a tough sell to the Corps during early discussions. However, one of the main reasons the Corps provided an incentive bonus was to encourage the contractor to be innovative and to remove some of the upfront risk to the contractor for pursuing other methods of gate moving other than the costly and time-consuming use of conventional cranes. Jacking and skidding was accepted and proved to be the catalyst for early project completion.

**Keeping the client’s clients happy.** The customers for the project were the commercial shippers that use the navigation lock and the Lower Granite Dam Operations personnel. **The shippers were extremely happy to have the navigation lock return to service 17 days ahead of schedule.** The Walla Walla Corps District management gave a seven-day advance notification of the return of the lock to service, allowing the shippers to coordinate their plans for resumption of use. The Lower Granite Dam Operations staff were satisfied with the quality of the finished product, the minimal impact to operations, the maintenance work at the dam, and the overall cooperation of all of the project partners.



**Award Winning Project:  
Marvin M. Black Partnering Award  
Aon Build America Award**

Miter Gate Repair Project Reflects Highest Standards in Construction	
✓	Early Project Completion
✓	Exceeded Client’s Expectations
✓	Top Quality from Skilled Craftsmen under Challenging Conditions
✓	Genuine Partnership built on Trust, Respect and the Spirit of True Teamwork
✓	Innovative Techniques with the Application of New Technologies
✓	Excellence in Project Management: Scheduling, Communication, Quality Assurance, Security Maintenance
✓	A Safe Job from Start to Finish
✓	Money-Saving Value Engineering
✓	Protection of the High-Profile Salmon Fisheries
✓	Excellence in Supporting the Economic Needs of our Client’s Clients - the Commercial Shippers
✓	Outstanding Communication with Community to Diminish Traffic Confusion and Facilitate their Support



## MEETING THE CHALLENGE OF A DIFFICULT JOB

**Identifying the problem, its scope and impact.** The Corps removed the navigation lock from service for short periods between March 1998 and March 2000, to perform extensive testing and inspection to determine the extent of repairs needed. Through instrumentation and computer modeling, the Corps' engineers determined that the cracks were caused by the configuration of the skin plate and gate seal arrangement, which caused the gate to bind when it closed, and deterioration of the gate quoin seal contact blocks (the major bearing surface for hydrostatic loads), which prohibited proper load transfer of gate hydrostatic loads to the lock walls when the lock was filled. Detailed planning and design was performed by the Corps to insure performance of the required work within the smallest window of time, and with the highest quality finished product

The Corps knew that the economic impact of an extended outage to the commercial shippers had to be balanced with the construction cost of the repairs. The length of the proposed outage and extent of the repairs were discussed at several biannual meetings with river users. Detailed schedules indicated that rehabilitation of the gate would take three months, **requiring the longest lock outage ever taken on a Snake River navigation lock.** The navigation lock outage and repairs were scheduled to be performed during the time period of January 28 through April 29, 2002 after thorough coordination with the commercial shippers.

**Timely Completion Imperative.** In addition to normal concerns about quality and safety, the Corps was very concerned about the timely completion of repairs to insure that the navlock could be reopened on the date promised to the shippers. The "unknown" that had to be considered was how the successful contractor would lift and move the gate leaves out of the way to perform pintle replacement. **Timely completion was dependent on the contractor's ability to quickly and efficiently remove, temporarily "store", and reinstall the two gate leaves.** Considering the size, weight, and sail area of the leaves, the required movements of the gate leaves were critical tasks. The decision was made to include an incentive clause which would pay the contractor \$10,000 per day for each day of early completion up to a maximum

amount of \$200,000. The Corps reasoned that this would allow contractors to be innovative, with a means to recoup up-front investments for their innovation. The Corps also had to decide whether or not to require the contractor to work on a 24/7 schedule to insure completion in the shortest possible time or allow the contractor the freedom to determine his own work schedule. The Corps had committed to shippers that the repair work would be completed as quickly as possible. There was concern that the successful bidder may not be motivated to finish early and, by not requiring work on a 24/7 schedule, the shippers may perceive the Corps as renegeing on its commitment. The decision was made to require work on a 24/7 schedule. After thorough exploration of the alternatives, with careful consideration to economic and schedule impacts, the Corps proceeded with solicitation and awarded a firm fixed price contract to Advanced American Diving Service (AADS), a heavy marine civil contractor.

**No Room For Error.** Many Corps districts have replaced pintles and bushings through the normal method which requires only hoisting the gate in a fixed position, then lowering it back down. The repairs on this project required moving the gates horizontally at least 4 feet as well as hoisting the gates. Because of the extensive crack repair, replacement of the pintle ball, upper bushings replacement and quoin seal replacement, the gate had to be moved upstream to provide room for access, albeit limited work space. Also unique, is the size of the gate - **at 122 feet tall, this is the tallest miter gate in North America.** The project work entailed hoisting and moving, repair, and reinstallation of the navigation miter gate leaves. The repairs consisted of removal, replacement and repair of 1" thick skin plate, repair and replacement of existing girders, addition of vertical stiffener plates, replacement of the pintle ball and heel on each gate, replacement of the quoin and miter contact block seals (vertical steel seals on each side of the leaves), removal and refurbishment of the wall quoin seals, replacement of the gudgeon pins (top pivot point) and adjustment of the seal angle for contact with the rubber J-seal at the gate bottom.



## MEETING THE CHALLENGE OF A DIFFICULT JOB (CONT'D)

Each miter gate leaf is approximately 122-foot tall, 54-feet wide and weighs 375 tons. **Almost all welds were full penetration welds and were 100 percent ultrasonically tested.** Full penetration welds require the welded joint to be beveled to a 45 degree angle and welded the full thickness of the joined steel. Ultrasonically testing identifies all porosity and imperfections within the total thickness of the weld and is the highest existing welding standard in the industry.

**Reassembly and reinstallation of the miter gates required strict adherence to detail to achieve the critical tolerances necessary for the proper reinstallation and operation of the gate leaves.**

The geometric design of the gate uses a metal-to-metal seal (quoin contact blocks) to achieve water-tightness when the gates are subject to 115 feet of hydraulic head during lock operation. All the work was completed during the scheduled lock shutdown, and the mutual goal of early completion was realized.



**Unforeseen Conditions Pose Additional Challenges.** Although numerous inspections had occurred prior to the outage, the existing structural steel was found to have numerous additional flaws (additional hidden cracks, lamellar tears, incomplete welds, slag inclusions) which were unknown due to inaccessibility and geometric constraints. Because of this, an additional 1005 man hours of welding time was spent repairing defective existing welds and structural steel. **Even with the added work, the project was completed seventeen calendar days ahead of the scheduled April 29, 2002 deadline, culminating in a high quality project.** As a result, AADS received their entire incentive clause payment of \$200,000.

## EXCELLENCE IN PROJECT MANAGEMENT

The success of the Lower Granite Miter Gate Repair project can be attributed to the spirit of partnering and cooperation that was established at the first project team meeting. At this meeting, the team committed to the following ambitious project goals:

**Open/timely communication & coordination with partners & stakeholders** - Throughout the project, the team exchanged information on an open and informal basis. A two-week schedule was updated every week, and open discussions were held at the site. The contractor and owner site representatives prepared daily inspection/progress reports. **With rapid response time and ever-growing mutual respect, there was a high level of confidence that all objectives would be accomplished.**

**Complete Gate testing & Repair by April 7, 2002** - This partnering goal was set by Dee Burch, the president of Advanced American Diving Service to complete the work 22 days ahead of schedule. The contract completion date was April 29, 2002. The actual date was April 12, 2002, **17 days ahead of schedule.** **With the unforeseen conditions challenging the critical path, the team went into overdrive and delivered an additional one thousand plus man-hours of work,** thereby meeting the ambitious schedule goal.

**Maintain Security Protocol** - As a result of the September 11, 2001 attacks, the Corps invoked tighter security at Lower Granite Dam than AADS had anticipated when they originally bid the job (pre-September 11<sup>th</sup>). AADS included the security staff in the planning and scheduling of shift changes, delivery of materials and equipment, and provided the security staff with contractor radios to facilitate communication. **Top-level security was maintained and team spirit was further enhanced.**

**Timely Administration** - All required submittals were made prior to the start of work, and owner review was made promptly. **Open, informal communication during the submittal review process expedited the process,** eliminating time-consuming re-submittals. Requests for Information (RFIs) were submitted with complete descriptions of the needed clarification, and again, open informal communication accelerated the response time for the owner.



## EXCELLENCE IN PROJECT MANAGEMENT

### **No Reportable Accidents - The project had an excellent safety record of no lost time accidents.**

This project was performed under accelerated conditions of working two 10-12 hour shifts each day, seven days per week. The primary work area was 132 feet below the upper roadway of the navigation lock. All materials had to be lowered using cranes, causing a risk of falling objects. Another safety concern was the risk of eye injuries from the steel grinding. The use of top quality eye protection, attentiveness of the workers and adept project management effectively resulted in no serious injuries during the project.

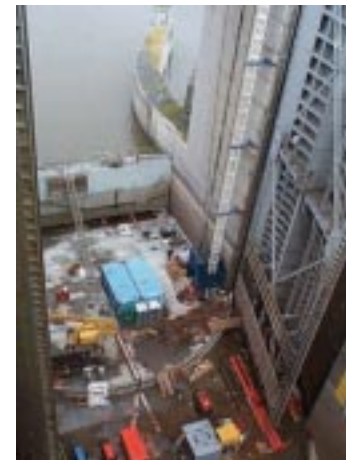
### **Satisfied Customers - The customers for this project were the commercial shippers that use the navigation lock and the Lower Granite Dam Operations personnel. The shippers were extremely happy to have the navigation lock return to service 17 days ahead of schedule.**

The Walla Walla District management gave a seven-day advance notification of the return of the lock to service, allowing the shippers to coordinate their plans for resumption of use. The Lower Granite Dam Operations staff were satisfied with the quality of the finished product, the minimal impact to operation and maintenance work at the dam and the overall cooperation of all of the project partners.



### **Enduring Quality, Understand Intent, Do It Right the First Time - The quality of the finished product is outstanding, and is expected to endure at least another 26 years. The welding of the structural steel repairs was the controlling element of work for the project, and amounted to approximately 10,000 man-hours of work. All welds were 100% ultrasonic tested, and only two small areas of weld porosity had to be repaired due to failed tests. Pride of workmanship of the ironworkers over came the difficult welding positions and cramped working space. Quality was not compromised to achieve the accelerated schedule.**

### **Lasting Level of Mutual Respect - All members of the partnering team established a high level of respect that has already extended onto other projects and endeavors. This was a demanding 24-hour / 7-day-a-week project, requiring all participants to be available at all times. The instant cooperation of all parties on weekends, at night, and holidays, made the project a fun and prideful job.**



### **Value Engineering - Use of the jacking and skidding system eliminated the need for a large crane for removal and replacement of the gate leaves. A significant benefit to this was the elimination of the need to install a temporary detour bridge for traffic across the dam. AADS submitted a Value Engineering Proposal for substituting traffic control through the work area in lieu of construction of the temporary detour bridge. The Value Engineering proposal resulted in a net contract savings of \$42,770 to the Walla Walla District, and eliminated a significant amount of work at the very beginning and at the very end of the project, thereby accelerating the completion of the entire project. With the savings realized from this VE proposal an additional improvement was made to the navigation lock. Every year, Operations personnel must remove gravel cobbles and debris which is moved into the lock by tug propwash. To eliminate this maintenance expense, they requested that the "floor" of the lock be extended downstream. A change order was issued to add precast panels to the floor. AADS was able to complete this work without impact to the project schedule and made the Operations customer very happy.**



## Advanced American Diving Service's Innovation

AADS used an old approach to moving heavy loads with the adaptation of new technology. The moving of the gates using jacking and skidding methods instead of the use of a large crane was made possible through the **use of laser controls and manifolded hydraulic systems**. The 375 ton, 122 feet tall gates were jacked one foot vertically and skidded approximately 4 foot horizontally. Multiple hydraulic jacks were used to lift the gates. The plumbness of the gates were controlled constantly during the lifting procedure. The gates were welded to the skidding system after the lifting was completed. The skid rails were at the bottom of the gates had large hydraulic push/pull cylinders to move the gates horizontally. Hydraulic Cylinders were attached to the top of the gates to maintain the gates in a vertical attitude during the lifting and moving process. The hydraulic cylinders were continually adjusted using a laser monitoring system as guidance to determine the appropriate adjustment.

## Innovative Technology

The innovative technology used on this project was the **testing and computer modeling** used to determine the internal stresses and the causes of the stresses. The Corps removed the navigation lock from service for short periods between March 1998 and March 2000, to perform extensive testing and inspection to determine the extent of repairs needed. Through instrumentation and computer modeling, the Corps' engineers determined that the cracks were caused by the configuration of the skin plate and gate seal arrangement, which caused the gate to bind when it closed, and deterioration of the gate quoin seal contact blocks (the major bearing surface for hydrostatic loads), which prohibited proper load transfer of gate hydrostatic loads to the lock walls when the lock was filled.

## Sensitivity to the Environment and Surroundings

The Lower granite Lock and Dam is the furthestmost upstream dam on the Snake River. **The dams on the Lower Snake River are high-profile in ecological impact concerns related to the Salmon fisheries in Idaho, Washington and Oregon.** Ecological impact to the waterways is a high profile concern as a consequence the concern regarding the fisheries. The work was performed at a depth of approximately 117 feet below the water surface of the upstream face of the dam, river water flowed through the work site, and not pollution of petroleum products would have been acceptable. Constant monitoring and maintenance by all parties eliminated all environmental impacts.

## Excellence in Client Service

The true clients for this project were the commercial shippers that use the locks for transportation of commercial goods upstream and downstream through the dam, and the Corps employees who manage and operate the lock and dam. **The commercial shippers and dam employees benefited by the early completion of the project.** The dam employees further benefited by **not having any of their operations disrupted by the construction process, and by the creation of a more cost-efficient maintenance program.**



## Contributions to the Community

The local community benefited from the project through the **minimal impact to their travel across the dam** during the life of the project. The dam serves as a travel route across the Snake River for local residents and business people. AADS' cooperation with the community facilitated their daily travels.