

PMI® Case Study

DENVER INTERNATIONAL RUNWAY PROJECT:

Project Management Ensures the Largest Runway in the United States
is Compiled on Time and Under Budget

In spite of budget challenges in the air travel industry resulting from the 9/11 terrorist attacks, the Denver International Airport (DIA) project team was able to construct one of the largest runways in the U.S.—the 16R/34L Runway, otherwise known as the Denver International Runway (DIR). The DIR construction enabled the airport to accommodate international flights and help Denver, Colorado, meet its economic development objectives.

Background

The ability of an airport to serve international air traffic has a direct effect on the economic development of a city. Jets used for international and trans-oceanic travel are larger than those used in domestic travel, and need larger runways to take off and land. In order to encourage international airlines to include Denver in their schedules, the DIA needed a runway that could accommodate these larger jets.

The DIA called upon a project team from construction firm DMJM Aviation to design and construct the runway. The scope of the project included coordinating design services and insurance, engineering grading and drainage systems, paving, lighting and construction of an electronics control station.

The project team committed to delivering the completed runway in less than three years. The original project budget was set at \$166 million (US).

Challenges

The project team would need to consider several factors in designing and constructing the DIR. International runways are longer than standard domestic runways as they must accommodate larger jets. Additionally, airport management determined that it would need to consider the next generation of jet engineering to attract international air traffic from the major airlines.

The new jumbo jets, such as the Airbus A380, are considerably larger than their predecessors and require more runway area to takeoff and land. In addition, jets taking off and landing at higher altitudes require longer runways than those at or below sea level as their engines do not perform as efficiently in the thinner air. Due to these factors, the DIR would need to abandon standard models of runway construction to ensure the runway could support the size and weight of these flying giants.

Although the project would cover a massive area, it was also necessary that the project not interfere with the daily operations of the airport. Therefore, acceptance testing posed a challenge. Engineers often conduct acceptance tests on the materials used in construction to ensure they perform as they should. Industry standards require acceptance testing on only 10 percent of the materials used in the construction of a runway. However, due to problems with other runways around the country, the Federal Aviation Administration required that the city conduct acceptance testing on 100 percent of the materials.

Extensive testing requirements coupled with a scheduling miscalculation created additional pressure on the project. The charts pilots use to navigate the runways around the country are updated every 56 days. The project had to meet its deadline in order to be included in the chart; otherwise, it would need to wait an additional 56 days to become available to air traffic. The team originally received incorrect information on the publishing deadline of the chart. The team had to accelerate the project schedule by two weeks while maintaining its commitment to quality to be ready in time for the publishing deadline.

The 9/11 terrorist attacks created the most pronounced challenges for the project. Following the attacks, the DIA had to close the project site for several weeks. When the airport reopened the project site, heightened security measures restricted access. The attacks also created a strain on the FAA's budget, and it withdrew a portion of the funding from the project in September 2002.

Solutions

Each of these issues challenged the team to complete the project on time and on budget. The standard project management methodologies described in *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* provided the project team with the necessary tools to navigate these challenges and eliminate their effect on the finished product.

The *PMBOK® Guide* outlines the processes for completing a project and describes the project management knowledge areas with which project teams should be familiar. Within each of these processes and knowledge areas are methodologies that help project teams to deliver high quality products on time and on budget.

During the initiating process, the project team defines the

organization's objectives and why this project would be the most effective means of reaching those objectives. It also documents the project's preliminary scope, the time and budget available for the project, and the other resources necessary for the project's completion. The planning process follows the initiating process, during which the project team further defines the schedule and budget requirements. Within the planning process the team explores how the project will navigate the knowledge areas in addition to collecting information and creating a project schedule. For the DIR project team, the project's initiating and planning phases were built into the airport's original plan. This helped ensure that the project team, the airport and the FAA were in agreement on the project's basic parameters.

A time management method described in the *PMBOK® Guide* is fast-tracking, a schedule compression technique in which activities that are normally done in sequence are instead performed at the same time. The DIR team employed fast-tracking during the first year of the project by developing the paving and lighting contracts while simultaneously reviewing bids and completing the site preparation and earthwork components. Runway paving and lighting are subject to numerous regulations, making for a laborious contract development process. The team was able to devote the time provided by the relatively low activity level required of the bidding process to ensure that the lighting and paving contracts met all regulations.

The team used standard procurement management methodologies to ensure that all contractors were clear on the services they were to provide and to eliminate the possibility of contract disputes. In order to help simplify the procurement process, the project was broken into multiple components, which were addressed by multiple contracts. To further expedite and simplify the procurement process, one project manager was devoted to approving bids.

By combining risk management knowledge with the procurement process, the DIR team was also able to recover from several setbacks, the first of which came during the paving process when the runway base material collapsed as the team was attempting to install a lighting system on the runway. The team, which had never worked with that material before, had built a contingency plan into its budget, schedule and contracts. Knowledge of risk management enabled it to anticipate possible problems and structure the project around them so as to minimize their effects.

The DIR project was able to avoid being derailed by the budget

challenges brought by the 9/11 terrorist attacks through the use of time and risk management methodologies. In September 2002, the FAA was forced to withdraw funding from the DIR project due to budget constraints resulting from 9/11. Federal funding can be unpredictable due to changes in government priorities, and the team had identified a potential risk in depending on this type of funding. In preparation for this possibility, the team developed responses and contingencies should the FAA need to reduce or withdraw funding. The team determined that, should the project lose funding, they could reduce work on the more expensive components of the project, such as paving, and use the remaining money to cover less expensive work while it concentrated on reestablishing its budget. It also included shutdown options in each of its contracts, enabling it to maintain positive relationships with vendors in spite of the need to temporarily delay work. Finally, in December 2002, the team secured alternate funding from Congress and was able to begin work again.

The Results

The Denver International Airport 16R/34L Runway was completed on 18 August 2003. Upon its completion, the DIR was the first runway in the world designed to handle the next generation of large, long-distance aircraft. While budget issues forced the team to delay paving, project management processes for time, risk, procurement, and budget enabled the team to complete the project on time and under budget.

- The project team completed the DIR **significantly under budget**. The original budget estimation was \$166 million (US); the final cost of the project was \$154 million.
- Due to the **extra budget available** after completion of the project, the team was asked to design and construct an airport rescue and fire-fighting station.
- The DIR was **completed 18 days ahead of schedule**.
- The DIR is **one of the largest runways in the U.S.** It is 33 percent longer than the other runways at the DIA and approximately twice as long as runways at lower altitudes.
- The 16,000-foot-long, 200 foot wide runway has 3.2 million square feet of concrete surface areas and 168,000 cubic yards of concrete.
- The runway is so long that **a jet parked at one end is not visible from the other end due to the curvature of the earth**.