IPD Case Studies
AIA, AIA Minnesota, School of Architecture University of Minnesota
February, 2011

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### Introduction

This study is the latest in a series of AIA reports on Integrated Project Delivery (IPD). Since the 2010 AIA/AIA-CC publication of “Integrated Project Delivery: Case Studies,” the number of projects using IPD has increased greatly. Whereas previous case study efforts were limited to the handful of projects executing IPD, this effort is framed broadly, choosing projects of various program types, sizes, team composition and locations. Additionally, this set of case examples documents a wide range of team experience, from teams with quite a bit of IPD experience to those who are using their project as a learning experience.

Unique to this study is the opportunity to study projects from early phases through completion. Following projects over time, we hope to gain insight on the evolution of each project, its collaborative culture and areas of success and challenge. This document presents work from the first phase of the study and is focused on project activities that lay the foundation for collaborative practices in IPD.
Executive Summary

IPD is being implemented in increasingly diverse settings, allowing us to better understand where it is most effective. It is difficult to predict the role of IPD in the future, possibly it will become the default method of delivery for all projects or it may become a specialized method used only in particular conditions. By studying a range of projects, we can better understand how IPD compares with traditional project delivery methods for different project and team types and envision its continued development.

Documenting how IPD has been adapted and applied to each of the projects in this study demonstrates that IPD is a method, not a contractual structure or management formula. By comparing this set of projects according to how they followed or adapted IPD contractual and behavioral principles, we can see how some aspects of IPD have had greater impact than others.

IPD was a new endeavor for all members in three of the study projects: Lawrence & Schiller Remodel, SpawGlass Regional Office and Mercy Medical Center Remodel. The other two, Federal Building Modernization and Cathedral Hill Hospital, had some (but not all) team members with extensive IPD experience. As one might expect, for the first time IPD teams, they are encountering a steep learning curve. For the two smaller office projects, the learning curve is made less steep by pre-existing professional relationships and relatively straightforward projects. For Mercy Medical, some pre-existing relationships were in place but the level of complexity was very challenging and external IPD consultant resources became essential. For the relatively experienced teams, IPD continues to be fine tuned and adjusted to meet specific project and team needs. Interestingly, only two projects are new construction. Renovation projects leverage both BIM and IPD differently than new construction due to the unpredictable nature of found conditions. Each team in this study is in a different phase of learning about IPD, but all are evolving their own understanding of how they need to work and how IPD enables the best interaction possible.

The information is presented in a matrix view, encouraging the reader to navigate in a variety of ways. Users can compare projects by looking at the holistic flow of narrative or look across particular strategies. By intention, this first phase focused on the activities that lay the foundation for IPD, including hard-to-quantify aspects of building trust, transparency and creating a collaborative culture. Even in these early stages, it’s clear that management and social strategies become inextricably linked to the legal/commercial strategies, which then are carried through in the environmental and technical strategies. While the matrix may appear to compartmentalize issues that should be interwoven, we hope that the cross linkages can serve to tie the narrative together while keeping the clarity of comparing like information. We look forward to continuing the study into the next phase during 2011.
IPD Definition - AIA

It is becoming clear that there are very few “pure” IPD projects. The survey response shows that the majority of projects pursuing IPD are using custom IPD agreements. Even those using standard multi-party agreements, such as the AIA C-191 Standard Form Multi-Party Agreement for IPD, customized the contracts to eliminate certain aspects of liability or shared risk/reward—components previously defined as critical to achieve “pure” IPD. As the industry struggles to define IPD in the ideal world, the messiness of the real world continues to shape our understanding of integration and collaboration. We found that although several of the case examples did not meet all of the contractual principles listed below in Integrated Project Delivery Defined: AIA/AIACC, 2010, they met all of the behavioral principles and offered insights into the ways IPD can be adapted.

Integrated Project Delivery Defined: AIA/AIACC, 2010
IPD is a method of project delivery distinguished by a contractual arrangement among a minimum of owner, constructor and design professional that aligns business interests of all parties. IPD motivates collaboration throughout the design and construction process, tying stakeholder success to project success, and embodies the following contractual and behavioral principles:

**Contractual Principles**
- Key Participants Bound Together as Equals
- Shared Financial Risk and Reward Based on Project Outcome
- Liability Waivers between Key Participants

**Behavioral Principles**
- Mutual Respect and Trust
- Willingness to Collaborate
- Open Communication
IPD Definition – This Report

Through a workshop process led by Professor Paolo Tombesi, Chair of Construction at the University of Melbourne and Markku Allison, resource architect for AIA, we adapted the contractual and behavioral principles above to more specifically define IPD for this study. We rearranged the characteristics to into two categories, IPD “markers” and IPD “strategies.” This helps to distinguish between the characteristics unique to IPD projects and the tactics or strategies employed, either commercial, social, environmental or technological, to support the IPD process.

For our study, we considered a project to be following IPD if they embodied the markers listed below. Variations were seen in strategies, tactics and contractual principles.

IPD Markers

- Relational Contracts
- Protection from litigation
- Aligned project goals (Jointly Developed Project Target Criteria)
- Informed and balanced decision-making (Collaborative Decision Making)
- Open Communication
- Risks Identified and Accepted Early

IPD Strategies

- Key Participants Bound Together as Equals (Multi-party Agreement)
- Budget & create team for design intensive work
- Early contribution of expertise (Early Involvement of Key Participants)
- Pre-existing relationships between parties
- Champion/ Facilitator (Leadership by All)
- Shared Financial Risk and Reward Based on Project Outcome
- Liability Waivers between Key Participants
- Fiscal Transparency between Key Participants
- BIM - virtual rehearsal of construction and ongoing constructability reviews
- Lean Construction processes
- Co-location
IPD Motivations

IPD offers many potential advantages over a tradition design-bid-build delivery model, but each team needs to determine why IPD is appropriate for them. The workshop also developed a method to profile each case in terms of their motivations for using IPD. As we follow-up with the second phase of this case study effort, we may find that there are certain projects better suited for IPD. For example the design complexity of the project might be high, therefore requiring earlier involvement of trade expertise. Even in this early stage of the study, we have seen teams find their initial reasons for choosing IPD are evolving as they better understand IPD’s benefits and challenges. In some cases, great value has been found in unanticipated areas.

Motivations for selecting IPD fall into five categories:

1. Market advantage: Choosing to use IPD can give market advantage. IPD may give the firms valuable experience upon which to market themselves as industry leaders. Improving the delivery may also be a market advantage if measurable results can be attained. For serial owners, savings on one project done in IPD can be leveraged across many buildings. The healthcare sector trends show that IPD may become an expected standard delivery method.

2. Cost predictability: All projects would like to meet budget, however, for some the predictability of cost is a notably driving factor.

3. Schedule predictability: Similar to cost, all projects share the goal of meeting their planned schedule, but for some projects this is a major factor.

4. Risk Management: Reducing or managing risk can be tied with cost or schedule, but also may include transactional risk inherent to project type, site or other conditions. If risk management is a critical factor, the increased communication in IPD may be of particular advantage.

5. Design Complexity: A high degree of complexity will usually demand integration of expertise and require a level of coordination that is achievable in an IPD environment.

The tactics for achieving the goals in each of these areas may or may not be exclusive to IPD, however, for projects that have strong motivations in several categories, IPD may offer an advantage over traditional delivery. Collaboration and integration can occur in any project delivery method, however, IPD sets up structures that make it more likely to occur than not. In particular, study participants noted good collaboration in design-build is raised to an even higher level in IPD. This improvement can be credited to a variety of sources, but most cited was the early involvement of a larger and more diverse set of expertise areas, including trade contractors.

Several of the cases have developed metrics and have preliminary results to measure. However, at this first phase of the study, it is too early to begin to draw conclusions on the successful results of any decisions related to IPD.
About this study

Study Data

The bulk of the study data presented in this phase is based on interviews with project participants and review of material documentation such as contracts, management logs, meeting minutes, schedule planners etc. Interviews were conducted with all key members of the team on a conference call. Follow up communication was typically with individuals. Additional information was gathered through questionnaires sent to the complete project team. Results from team responses will be included in the next phase of this study.
### Selection of Projects

Case projects were selected after applying several filters to a survey conducted by AIA in September 2010. The survey was sent to all those who had downloaded the 2007 AIA/AIA-CC publication, “Integrated Project Delivery: A Guide,” and asked respondents to identify their use or likeliness to use a multi-party or IPD agreement. Over 1,400 individuals responded, 25% indicated they were using or intended to use IPD on a project. This group was sent a second, more detailed survey asking specific information about their project. Since this case study effort was planned to have several phases, projects currently in their early phases of delivery were chosen. A further selection was made to ensure diversity of project profiles and a willingness to share information for the study.
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Paul Reiser, HerreroBoldt
Steve Peppler, SmithGroup

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Ray Corby, Array HFS
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Resources


About IPD

AIA Programs & Initiatives: Integrate Practice – Integrated Project Delivery
http://www.aia.org/about/initiatives/AIAS078435?dvid=&recspec=AIAS078435

AIA Center for Integrated Practice

AIA Integrated Project Delivery: A Guide
http://www.aia.org/contractdocs/AIAS077630

AIA Integrate Project Delivery: Case Studies
http://www.aia.org/about/initiatives/AIAB082049
### Project Description

**PROJECT**
Cathedral Hill Hospital

**LOCATION**
San Francisco, CA

**BUILDING TYPE**
Healthcare

**CONTRACT**
Single Multi-party Contract – (IFOA)

**OWNER**
California Pacific Medical Center, A Sutter Health Affiliate

**ARCHITECT**
SmithGroup, Inc

**CONTRACTOR**
HerreroBoldt – A Joint Venture

### Project Characteristics

- **PRIVATE**
- **PUBLIC**
- **PROFIT**
- **NON-HELP**
- **OWNER OCCUPIED**
- **SPECULATIVE**
- **NEW CONSTRUCTION**
- **RENOVATION**
- **RURAL**
- **URBAN**

### Team Size

**123 individuals**

- **OWNER**
- **IPD COORDINATOR**
- **ARCHITECT**
- **DESIGN CONSULTANTS**
- **PRIME CONSTRUCTO**
- **TRADE CONTRACTORS**
- **SUPPLIERS**
- **AGENCIES**

### Building Size

**858,000 sq. ft.**

### Project Cost

**$1,028,533,446**

### Schedule

- **55 months design**
- **48 months construction**
In 2000, California Pacific Medical Center (CPMC), an affiliate of Sutter Health, hired the architecture firm, SmithGroup/SOM, a joint venture, and SMWM to design the consolidation of two acute care facilities onto one of CPMC’s existing campuses. There were concerns about maintaining operations during expansion, so in 2002 when a property became available within the San Francisco metro area that was well suited for a new medical center, CPMC reconceived the project as a new hospital facility, the Cathedral Hill Hospital. After several years of planning, the project ran into budget and entitlements timing concerns and was put on hold in 2005.

At this time, Sutter began to broadly address problems of budget and schedule overruns occurring in many of their projects, eventually adopting Integrated Project Delivery and Lean Construction as their new method of project delivery. In 2007, SmithGroup was invited to continue working with CPMC to design the new 860,000 sf, 14 level hospital to house 555 beds, under the condition that they enter into Sutter’s version of a multiparty agreement, Integrated Form of Agreement (IFOA). Although relatively new to IPD, SmithGroup, and several of their design consultants, were interested in pursuing the project. Shortly after SmithGroup committed, Sutter brought in the contractor HerreroBoldt, and immediately thereafter, primary trade contractors were engaged.
Market Position was not a motivator for the owner. However, Sutter created a market by making IPD a requirement for the commission. For the architect, this project allowed them to enter the IPD arena. For the constructor, a new joint venture was formed specifically for this project.

Cost Predictability was Sutter’s primary driver for using IPD as a company. Enterprise-wide they were highly motivated to keep project costs reasonable.

Schedule Predictability was an important driver of using IPD because of several critical variables bearing on the project. California instated a 2013 deadline for meeting seismic and seismic retrofit requirements (California State Senate Bill 1953 and 1661). The complexity of the building and permitting process in San Francisco will make that deadline difficult to meet. Aging current facilities for CPMC demand investment to keep them functional, creating additional financial incentives to complete the new facility quickly.

Reduced Risk was a major motivator for the owner to shift to IPD. Sutter realized that their capital investments in construction could be better protected from risk with IPD.

Design Complexity was not a primary motivator for the owner to pursue IPD. Although a hospital is a complex building type, the owner has experience achieving complex projects with traditional delivery.
### Cathedral Hill Hospital

**MERCY Master Plan**
- Facility Remodel

**Lawrence & Schiller Remodel**

**SpawGlass Austin Regional Office**

**Edith Green Wendell Wyatt Federal Building Modernization**

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#### Survey Data

Data analysis to come in phase two of study.
Contract

**Single Multi-party Contract**
- Integrated Agreement for Lean Project Delivery between Owner, Architect & CM/GC – also referred as Integrated Form of Agreement (IFOA)

**Contract Issued**
- August 1, 2007

In 2007, California Pacific Medical Center (CPMC) and Sutter Health made the decision to use an Integrated Form of Agreement (IFOA) to deliver the Cathedral Hill Hospital in San Francisco. By then, Sutter was fairly experienced with IPD and Lean Construction having completed the Fairfield Medical Office two years before. On Fairfield, Sutter used an innovative IFOA agreement created for them by attorney William A. Lichtig. (Find more on this project in: Cohen, Jonathan. 2010. Integrated Project Delivery: Case Studies. Sacramento: AIA California Council.) The IFOA used on this project, Cathedral Hill Hospital, evolved compared to the Fairfield agreement, particularly refining the definition of shared risk/reward terms.

The IFOA addressed collaborative commercial terms, relational expectations, and the use of specific implementation processes, such as Lean Project Delivery tools, to support the relational expectations.

**Commercial Terms**
The Sutter IFOA requires well-known collaborative commercial terms such as: shared risk, performance incentives, compensation incentives, waiver of liability, and allowance for an Owner Controlled Insurance Program (OCIP) or project specific insurance.

**Relational Expectations**
The agreement includes some soft language defining the relational and behavioral expectations, for example Article 3.3 Trust states, “Parties shall work together in the spirit of cooperation, collaboration, and mutual respect for the benefit of the Project.”

**Social Strategies**
A large proportion of the IFOA defines tools and tactics to achieve relational expectations and processes to perform the design and preconstruction work. Many of the tools implemented on this project were based on Lean Construction practices, such as reliable promising, pull-based design production, Target Value Design, and the Last Planner System. Meeting frequency requirements are clearly defined for the Core Group, the executive level leadership, as well as their responsibilities in terms of developing work procedures for leading the Integrated Project Delivery Team.
Goals

Process

According to this team, one of the most critical components of goal development and alignment on an integrated team is having an actively involved owner.

Goals

The process started with the list of owner’s design goals:

- Excellence in clinical care
- Education
- Community service
- Patient satisfaction
- Family involvement with the patient
- Private rooms

Communication and Alignment

These goals were clearly communicated to the integrated team. Active involvement from the owner helped to reiterate, on an ongoing basis, what was of greatest value to them. Additional reminders were printed at large scale for posting in prominent locations around the co-located office. The posters acted as a constant reminder of client expectation to the team.
**Risk/Reward**

The IFOA established a risk-pool that the architect, CM/GC, primary design consultants and primary trade contractors were bound to. In this case, the IPD team members participating in the pool put a percentage of their profit at risk to partially fund cost overruns or other project liabilities if any occurred. As a positive incentive, this pool would provide payments if the team met performance metrics and achieved actual costs below the estimated maximum price.

The architect and CM/GC placed 25% of their preconstruction and construction fixed fee profits at risk. At the time the contract was executed, the following additional parties were included in the Risk Pool IPD Team:

**Architect’s Consultants:** Degenkolb Engineers (structural), Silverman & Light Inc. (electrical), Ted Jacob Engineering Group Inc. (M/P)

**Trade Contractors:** Rosendin Electric (electrical), Southland Industries (mechanical), Charles Pankow Builders, Ltd. (concrete)
Liability

Sutter’s IFOA Article 33.1 explicitly limits liability between all Risk Pool IPD Team members (see Risk/Reward) and the owner. Any liabilities that arise related to the agreement, work or project would be satisfied exclusively from the At-Risk Pool Account. Exceptions to these limitations contain specific insurance-related conditions and include liabilities arising out of willful misconduct or intentional abandonment.

Furthermore, the agreement protects the architect and architect’s consultants if a government agency requires them to over-stamp a sub-contractors equivalent of a shop drawing. The contract states, “neither the Architect nor Architect’s Consultants shall assume any responsibility and/or liability for authorship or technical aspects of those documents.”

Dispute Resolution

Should any claim arise in connection with the agreement, the Parties, including all consultants and sub-contractors, are required to follow the dispute resolution procedure defined in Article 41 of the IFOA. The dispute resolution procedure sets out rigorous internal review processes following submittal of a Notice of Potential Claim to the Core Group. First, the owner, architect and CM/GC would hold a “Special Meeting” and attempt to resolve the issue through reasonable negotiation. If unresolved, the Claim would be elevated to the Core Group (made up of senior members of each major stakeholder). If the Core Group cannot reach resolution, the Claim elevates to the Senior Executives of each respective organization, who would meet, exchange information, discuss candidly and reach a reasonable compromise. Before entering non-binding mediation, an independent expert would be brought in to review the Claim, the cost of which would be shared among the Core Group members. Should the internal process not result in resolution, any party has the option of initiating confidential and non-admissible mediation procedures using a third party mediator. The cost of such would be borne by only the parties in dispute. If the claim reaches an “unsolved impasse,” the parties have the option of pursuing the “legal and equitable remedies available to them.”
### Insurance

At the time this case study was conducted, the Cathedral Hill Hospital IPD Team was still determining how the project specific insurance would be handled. This project will be one of the first to use an insurance product designed specifically for Integrated Project Delivery. Two major insurers visited the project site to familiarize their understanding of the processes and will be presenting IPD insurance options to the team in January 2011.

General Liability and Professional Liability insurance is required for the architect and the architect’s consultants. The contract requires standard CM/GC insurance, however as noted above, the team will be using an IPD specific insurance product. It is yet to be determined if this will be an owner or contractor controlled policy.
Leadership

Champion
- Owner
- CM/GC

Team Structure
- Core Group
- Cluster Groups

California Pacific Medical Center (CPMC) is an affiliate of Sutter Health, a large healthcare owner that has pioneered IPD since 2005 (see Contract). Sutter and Boldt have experience with IPD and Lean Construction. Together they have been championing the process on this project team and within the larger design and construction industry.

As defined in the Integrated Form of Agreement (IFOA), the Core Group provides primary leadership. The Core Group consists of a senior representative from Sutter Health (specifically from their division of Facility, Planning and Development – referred to as the FPD), California Pacific Medical Center (owner), SmithGroup (architect) and HerreroBoldt (CM/GC). The Core Group is responsible for project coordination, management and administration consistent with principles of Lean Project Delivery. Sutter’s representative from their FPD division facilitates and coordinates the activities of the Core Group. CPMC’s representative is responsible for coordinating activities between the project participants and ensuring that decision makers on the owner’s side are available as needed.

Leadership is further distributed into a series of Cluster Groups, which are interdisciplinary groups comprised of architects, engineers and trade partners. Cluster Groups were assigned to specific design areas, for example, structural, exterior, interior, and medical equipment. Each cluster was responsible for designing their assigned segment within the Target Value (see Implementation and Early Involvement) using whatever resources required.

Each of the three parties, owner, architect and CM/GC, championed the integrated delivery process in different ways. Members of the Core Group occasionally dropped into Cluster Group meetings to observe the process and offer suggestions. In the beginning of the project, Sutter’s Facility, Planning, and Development (FPD) representative regularly attended the Target Value Design and Last Planner meetings to help coach people through the cultural and behavioral expectations of IPD and Lean.

Boldt, with their extensive experience and history with the Lean Construction Institute, served as a mentor to educate the Integrated Project Delivery Team on Lean. Specifically, Boldt appointed one individual as the Value and Lean Process Manager, responsible for incorporating Lean Construction practices into the IPD Team. This individual trained team members in Lean practices and task management tools through regular Study Action Groups. All team members, regardless of experience level, participated in these groups.
Firm Selection

Architect
SmithGroup was one of the firms originally contracted with California Pacific Medical Center (CPMC) for the original Cathedral Hill Hospital design. That project was put on hold and restarted 2 years later using Sutter’s Integrated Form of Agreement (IFOA). Based on SmithGroup’s past experience with CPMC, the architect and several of their consultants were invited back to work on the restarted Cathedral Hill Hospital project.

The architect observed that SmithGroup has been trending away from the traditional design-bid-build to alternative delivery models. They discovered that the IPD arrangement used in this project is far superior to the other delivery models and they intend to identify appropriate clients who agree to work this way in the future. They found that the team relationship formed through the IPD process allows for a better design process.

Contractor (CM/GC)
Sutter and Boldt both studied IPD and Lean Construction for over seven years and had a long-standing relationship with Sutter.

Design Consultants
Many of the design consultants working on the original renovation project carried over to the Cathedral Hill Hospital project. For consultants, previous experience in IPD or pre-qualifying their ability to collaborate was secondary to the continuity gained by building on previously established goals, values and ideas. A few consultants were not comfortable with the collaborative process set forth for Cathedral Hill and declined to participate. All consultants that committed to the project went through the Study Action Group training to educate them in the philosophy of IPD and Lean Construction.

Trade/ Sub-Contractor
In contrast to the selection of the design consultants, trade partners (or sub-contractors) were subject to a thorough selection process specifically targeting their collaborative experience or demonstrated ability to collaborate. Three primary trade partners who had established relationships with Boldt were brought onto the project very early. Each had already incorporated Lean Construction practices into their organizations and demonstrated willingness to pursue Integrated Project Delivery.

An extensive and collaborative review process was used to select additional trade partners. Cluster Groups generated the initial list of potential trade partners and the CM/GC pre-qualified the list before presenting to the Core Group. These pre-qualified firms were required to respond to an RFP presenting typical budget and profit margin information as well as their experience with or willingness to be a part of an integrated project delivery process. Shortlisted firms were interviewed by a cross section of the IPD Team, including someone from the CM/GC, design firm, design consultants, the owner and other trade partners. These team members provided their recommendations to the Core Group who made the final selection.

The most highly prized characteristic was the willingness to collaborate. This was particularly critical for this project since full participation by trades was required during the Target Value Design process and there was no intention for any hard bid or lump sum sub-contracts.
### Team Selection

According to the contractor, the type of individuals they selected were innovative thinkers with an entrepreneurial spirit and an element of leadership. Because everyone on the team had the ability to influence the design, confidence to offer input was crucial. A “top down, central command approach does not work on this project,” so along with the characteristics above, a humble and collaborative style was just as important. In an IPD project, there is a great deal of uncertainty and each individual has to have the ability to adapt daily, sometimes following and sometimes taking the lead.

The architect formed a team with a variety of experience levels and technical abilities. They felt there was no special experience or skill requirements unique to IPD since the process provides excellent opportunities for mentorship and learning at all phases. They did however observe that IPD was a challenge for individuals who have been practicing a certain way for many years. Shifting their familiar roles and responsibilities to take input from non-designers was uncomfortable for some.
Early Planning

Resources Referenced
- Experienced IPD Team Members (Owner Organization, CM/GC Organization)
- Sutter Health IFOA
- Lean Construction Institute

Compared to a traditional project delivery, there is a great deal more time spent planning out the process in IPD. Because IPD was new for a large number of individuals on the team, the process was intentionally slow in the beginning. This allowed team members to develop and learn new processes while getting to know each other. There was a great deal of time spent on planning before design work began.

Of great value to this project was past experience in IPD and Lean Construction by Sutter, Boldt and many key individuals of the IPD Team. The team leveraged their experience and resources, which allowed them to further refine previously developed IPD processes, such as the Target Value Design plan and the Last Planner Process, for the Cathedral Hill Hospital project (see Implementation and Early Involvement).

The strong relationship with the Lean Construction Institute (LCI), who is partnered with UC Berkeley, was an asset for this project. The project benefited from regular visits by Glenn Ballard of LCI, an expert in Lean Project Delivery, and graduate students who observed and reported their observations of the project team. Students reported on different areas of their practice, such as the Last Planner System, change order processes, and accounting practices, which helped the team evaluate and improve their own performance.
Implementation

Tools

- Multiple Lean processes
- Target Value Design
- A3 and A4 Reports
- Co-location
- BIM

The Integrated Form of Agreement (IFOA) stipulates that the Integrated Form of Agreement (IFOA) stipulates that the IPD Team use the Last Planner System (a Lean Construction tool) for planning and scheduling of design coordination and implementation. As part of the Last Planner System, the IFOA requires, at a minimum, the development of “a milestone schedule, collaboratively created phase schedules, ‘make ready’ look ahead plans, weekly work plans, and a method for measuring, recording and improving planning reliability.” The IFOA describes each one of these Last Planner System tools and processes in detail.

To implement the design, the IPD team organized into interdisciplinary Cluster Groups. These groups were separated by design area, for example exterior architecture, interior architecture, structural, medical equipment, etc. Each group was responsible for coordinating their design area both internally within each Cluster and between other Cluster Groups or design areas.

Work within each Cluster Group was facilitated using the Last Planner System. The Last Planner system required each group to work backward from the milestone and phase schedules to develop their weekly work plan. Work plans in conjunction with detailed weekly look-ahead schedules identified activities required in order to meet schedule and any constraints in the way of those activities. Activities were converted into commitments, which were assumed by individuals who promised to fulfill them within a week or two.

Week time period. By tracking commitments, groups were held accountable by a reliability metric that was measured on a weekly basis. The Last Planner process not only helped individuals become more reliable, it also improved their ability to identify and communicate what they need to achieve their commitments. The goal on the Cathedral Hill Project was to maintain 90% reliability in each Cluster Group, a significant improvement from the 50% average estimated by the CM/GC’s project executive for a traditional delivery process.

Regular meetings were set up for formal cross-Cluster coordination. These meetings occurred on bi-weekly basis during the intense design phases and shifted to a weekly meeting as the design was finalized. These meetings provided a forum for teams to report on their Last Planner commitment status and score each group’s reliability, helping to hold Clusters accountable for their goals and commitments.

Each Cluster Group also followed a Target Value Design (TVD) process, which designates value, cost, schedule, and constructability as basic components of the design criteria, see Early Involvement for advantages of TVD. This process required the CM/GC and trade contractors assigned to each Cluster Group to provide ongoing cost information and estimating. This input was intended to help shape the design, especially informing system selection and detail development, thus ensuring the design met the value targets established by the Core Group. Target Value progress and target achievement was also reported in the weekly IPD Team meetings, becoming another tool to hold each Cluster Group accountable for meeting value targets.

Increased collaboration and coordination inherent to IPD resulted in an increased number and frequency of meetings. This fact made using tools such as BIM and the Last Planner System, more critical to ensure meetings were effective, short, and directed towards solutions.
## Early Involvement

### CM/GC Validation (Feasibility/Programming)

The contract required the CM/GC, trade partners and suppliers to provide input early, during the validation and preconstruction phases of the project.

The owner, California Pacific Medical Center (CPMC) and Sutter Health paid a premium for the early involvement of team members to supplement the A/E team. Involving the contractor and trade partners from the very beginning of the project was a significant investment, but at the time this study was conducted, had yielded measurable savings. According to the contractor’s project executive, the owner had already achieved a 200% return on investment (ROI) for the additional cost of IPD pre-construction services. The return comes from savings in project costs. The initial target cost developed by the team early in the project was approximately 14% or $80 million below market average. At the time of this report, the team estimates an additional $22 million dollars will be saved below the market average. The team cited a $400,000 savings gained by eliminating continuous backing for handrails. The BIM model accurately located each metal stud, so that backing was made redundant. Team members noted that in a traditional delivery method, the BIM model is rarely used to control construction costs at this level of detail.

**Additional time during preconstruction was compensated based on time and materials, consistent with the terms of the IFOA.** Team members observed that early and continued involvement by consistent team members reduces the number of handoff points, thereby maintaining project knowledge and reducing disconnects between designers and contractors. It is expected that the architect’s involvement in the construction phase will be less demanding than early phases. The architect also anticipates that their increased involvement will lead to additional efficiency, reduced waste and a return to the risk pool.

### Trade Contractors Validation (Feasibility/Programming)

Complementary to the Cluster Group estimators, trades engaged in early decisions brought detail and accuracy to the design. Additionally, as trade partners became more familiar with the project, they gained greater confidence in their ability to estimate costs, helping to eliminate inflation of prices and costly contingencies.

The team primarily focused on maximizing the value of the design, however information gained through the involvement of the trade partners brought a level of detail to the BIM model that the team believes will reduce material waste and construction time. The team cited a $400,000 savings gained by eliminating continuous backing for handrails. The BIM model accurately located each metal stud, so that backing was made redundant. Team members noted that in a traditional delivery method, the BIM model is rarely used to control construction costs at this level of detail.

**It’s important to note that while early involvement contributed expertise, the structure of the risk pool risk/reward provided incentive for the IPD Team to reduce costs.**

### Budgeting for Early Involvement

Accurately budgeting for effort proved to be difficult for the architect. SmithGroup anticipated additional effort, but assumed, while it would be more than traditional delivery, it might be similar to design-build. They expected most of their effort to be expended during schematic design and design development before handing off much of the work during construction documents. With this IPD project, effort required in the early phases was as expected, but the biggest surprise was the sustained high level of effort required during detail design. The level of design detail required was higher than they expected, as the architect stated, “we are designing how we are going to build the building.”

Additional time during preconstruction was compensated based on time and materials, consistent with the terms of the IFOA. Team members observed that early and continued involvement by consistent team members reduces the number of handoff points, thereby maintaining project knowledge and reducing disconnects between designers and contractors. It is expected that the architect’s involvement in the construction phase will be less demanding than early phases. The architect also anticipates that their increased involvement will lead to additional efficiency, reduced waste and a return to the risk pool.
### Transparency

All parties, including the architect, architect’s consultants, CM/GC and trade partners were paid on a time and material’s basis for the work performed during pre-construction services. Profits were based on a fixed fee with 25% of the fee exposed in the shared at-risk pool. This structure makes project finances transparent and ensures that all estimates are based on cost. According to the team, there have been no hidden contingencies or hidden allowances.

Construction services will be paid on a fixed fee, based on an agreed upon estimated amount of labor, to be determined in the Work Plan.
### Decision Making

The primary vehicle used to formalize, document and evaluate project decisions is called an A3 report, named after the size of the piece of paper upon which it’s printed. The team borrowed this tool from the car company, Toyota who uses it to evaluate complex decisions. The standard form A3 facilitated consistent problem identification, analysis, assessment and solutions. A3’s could be initiated by anyone on the team and cover a range of issues; the criteria for its use was intentionally left undefined to give IPD Team members the ability to follow their own intuition and take initiative.

Once an individual formally initiated an A3, the form was submitted to the Core Group for review and final decision. The benefit of A3 reporting is that it documents the problem, records the involved parties, and establishes the assumptions for consideration. This provided the Core Group with a holistic understanding and created a consistent and effective format for them to evaluate the situation and make a final decision.

At the time of this report, over 300 A3’s had been generated and more than 200 had reached resolution. So effective has the formal A3 process proven, Cluster Groups began to use informal A3 processes to work through routine problems.
Culture

A number of factors contributed to breaking down traditional barriers and shifting traditional roles. The contractual arrangement, management tools, early involvement and co-location all contributed to the creation of a learning environment. For example, the Cluster Groups create highly collaborative interdisciplinary teams that might include two plumbing trade detailers, one HVAC trade detailer, and a technical architect – all sitting and working together. As the contractor described it, “that is unique because that would never happen on a traditional project.” The architect observed that IPD allowed them design to a much higher level of detail than in a traditional project. The process provided them greater knowledge of construction assemblies and cost and thereby gave them more control of the design outcomes.

In general, team members adapted easily to the collaborative and integrated work style of IPD. Even though the team included well over 100 people, the project executives could identify only a handful of people who did not fit the culture and were removed from the team. IPD is difficult for individuals who have worked a certain way for many years and feel strongly that certain roles are sacred. For these people, it was difficult to change and relinquish some control. Given the nature of the Cluster Groups, those individuals quickly became apparent and typically were removed. While the learning curve varied, the vast majority of team members found IPD to be a very different but very rewarding way of working together.

At the time of this study, Boldt's project executive observed that after 3 years of co-location and collaborative working, the cultural shift to collaboration, innovation, and integration had become ingrained in the team’s work habits. In his experience, this has not been the case on smaller projects where people go on and off the project at shorter time increments; they require much more continued and sustained leadership and guidance in the principles of IPD.
Workplace

Co-located – full time

At the time of this study, the team had been co-located for 3 years. They used space provided by California Pacific Medical Center (CPMC), which was located in a former a bank building. Given the previous use, the space had many cubicles that are not ideal for the collaborative intentions of IPD. According to the Boldt project executive, “people keep taking partitions down. We don’t need them.”

The office space included an abundance of publicly shared information to help communicate status, report on Last Planner System metrics, identify process issues, and remind individuals they are part of an Integrated Team (see Implementation and Information Sharing). Information and educational materials about Lean processes, learning resources, and Last Planner metric reports by Cluster Group were posted along a main central corridor within the office. Each Cluster Group was provided pin up space where images, diagrams, outstanding design issues and Target Value Design status were posted to help inform other groups of their status or coordination items needed.

Other protocols and tools, such as decision-making pyramids, were posted in multiple locations, such as conference rooms, to keep team members aligned with the design and team performance goals of the project. These visual reminders encouraged the team to embrace the Lean Culture, facilitate the integrated philosophy, and continue to serve as “advocates of the client” when making project decisions.

Co-location, coupled with early involvement greatly supported the relationship-building mission of IPD. These strategies allowed the team to become quickly acquainted with each other, build familiarity and trust that supported open communication and transparency.
Information Sharing

Tools
- SMART Boards
- BIM
- Face-to-face exchange – co-location
- Autodesk Buzzsaw
- Shared server (at co-located site)

Many of these tools were leveraged by co-location. See greater detail on how information was shared publicly in workplace.

Meeting Frequency
- Weekly Core Group Meetings
- Bi-weekly/weekly IPD Team (Cluster Group Coordination) Meetings
- Target Value Design
- Last Planner System
- Daily Cluster Group Meetings
- Detailer Meetings
- Specialized as needed

With the increased planning and collaboration required in IPD, meeting frequency increased. It was important to incorporate tools to maintain meeting efficiency and effectiveness (see Implementation).
BIM

Model Manager

• Shared between Architect (SmithGroup) and CM (HerreroBoldt)

Management Protocol

• Custom Virtual Design and Construction (VDC)
  – Issued November 12, 2010, replaced originally developed BIM Standards Book

A custom Virtual Design and Construction (VDC) document was developed that clearly articulated the procedures and responsibilities for modeling, coordinating and sharing the BIM model. BIM use was required of all IPD team members, including trades. Primary management and coordination of the BIM was shared between the architect, SmithGroup and the CM/GC, HerreroBoldt.

On this project, they have set a goal to have the BIM model fully describe 4D (time), enabling the IPD team to simulate the construction process and virtually test construction alternatives to find an optimal method. To achieve this, a 4D sequencing and scheduling model will assemble all the 3D building objects into a single building model and add information on the construction schedule, resources, equipment, site logistics, and construction process. The team was also investigating the opportunities of 5D, which would allow quantity take-offs and cost estimating from the BIM model. The team has not yet established 5D processes, however this project will be a test case to determine the types of data that can be exchanged, software requirements for 5D, and the limitations to implementation.

Each company/trade participating on the IPD team was responsible for modeling the scope of their work in BIM. A Cluster Group assembled to manage BIM resources was comprised of a BIM champion from each company participating on the IPD team. The role of a BIM champion varied depending on the size and risk of each company’s scope of work. For example, the BIM champion for a large company with a major investment in the project would fill a management role and delegate day to day execution to others, while a smaller company could appoint a BIM champion to serve as both manager and modeler. Each BIM champion was responsible for training their respective organizations in the Virtual Design and Construction (VDC) process.

The VDC document allowed each company to select the software and authoring tools with which they were familiar, with the caveat that their choices were clearly communicated to all BIM champions and were compatible with Autodesk Navisworks Manage. Any changes to BIM software were made following the A3 decision-making process (see Implementation) and required consensus of the BIM Champions.

Hardware selection was also addressed in the VDC. Before any project-wide implementation of hardware or software, stress tests were required. The stress test ran the systems loaded with an equivalent amount of 3D objects and data as the intended scope. The results of the test informed A3 decision making, provided feedback to software vendors, and informed decisions on how the model would be divided into specific design areas (e.g. exterior, interior, floor level).

Frequent sharing of progress models was encouraged. Progress models could be shared in their draft form as long as the file content and degree of completion was articulated and a File Sharing Checklist had been complete. Progress models could be posted for use by other IPD team members without requiring tedious "clean up."

Design and controlling in the BIM was guided by a Coordination Master Process. This process creates a detailing environment and workflow that ideally eliminates all construction issues and conflicts before construction, maximizing field production efficiency. An important tool used in this process is called an A4 report. A4’s are used to plot a path of resolution when a question or issue was raised about a certain detailing area. The A4 is a standard one-page form that allowed the BIM Cluster Group to identify and record the detailing issue, prioritize issues to maintain streamlined production, and identify the root cause of each issue in order to prevent future problems.

For each area of the building, a detailing schedule defined the sequence that trades would add their detailing information. Sequencing trades to avoid model clashes required frequent progress updates and communication between IPD team members to ensure systems were populated in an orderly way. Detailing was executed in two phases. Phase 1 modeling was done at a macro scale that followed a modeling sequence that mirrored construction installation. Phase 2 was done at a micro scale to meet the final construction level of detail (LOD). LOD was defined in a matrix form, similar to the AIA E202 document. The matrix identified the LOD of each building system or component for Phase 1 and 2, the responsible party, and the software platform used. Following a common LOD scale, most of the building systems were specified to reach 400, defined as 3D actual objects modeled for use in fabrication and assembly.

To ensure the Virtual Design and Construction (VDC) process was followed, Sutter Health regularly reviewed the team. Sutter had high expectations that this team address the virtual design lessons learned from Sutter’s previous projects using BIM, IPD and co-location.
**At a Glance**

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<th>Project Description</th>
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**Project Description**
- **PROJECT**: MERCY Health Partners Facility Masterplan
- **LOCATION**: Lorain, Ohio
- **BUILDING TYPE**: Hospital
- **CONTRACT**: Single Multi-party Contract - AIA C-191
- **OWNER**: Mercy Health Partners Regional Medical Center / Community Health Partners
- **ARCHITECT**: Array Healthcare Facilities Solutions, Inc.
- **CONTRACTOR**: Donley’s Inc.

**Project Characteristics**
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- **RURAL**
- **URBAN**

**Building Size**
- 94,439 sq. ft.

**Project Cost**
- $19,425,447

**Schedule**
- 14 months design
- 27 months construction
In fall 2009, the architecture firm Array HFS submitted a strategic facility master plan to Mercy Health Partners, a regional healthcare provider. The plan included a series of renovation projects within Mercy’s Regional Medical Center in Lorain, Ohio. A short time after the plan was submitted, Mercy’s board voted to proceed with the project and awarded the work to Array. After receiving Board approval, Array proposed an Integrated Project Delivery approach for the project. Mercy agreed to use IPD and to accept Array’s recommendation of Donley’s as the General Contractor. Array and Donley’s, worked together to develop a custom IPD contract agreement to present to Mercy.

In spring of 2010, after several months of contract negotiations, the owner acknowledged that their understanding of IPD, particularly with regard to the legal terms, was not aligned with the architect and contractor. To facilitate resolving these differences, the owner brought in an IPD consultant. The owner’s IPD consultant suggested using the recently released AIA C-191 Standard Form Multi-Party Agreement for Integrated Project Delivery as the basis for agreement. All parties felt the AIA document represented the majority of what they were trying to do with their custom agreement; however the contract continued to be negotiated for an additional 8 months until November 2010. During this negotiation period, the entire integrated team, which included the owner, architect, contractor, design consultants and first tier sub-contractors, was committed to the IPD process, worked (and were compensated) as if there was a contract in place.
**IPD Profile**

"I think in the end, the owner gets the most for their money. They get long-term reliability. Maintenance issues are addressed during construction that normally aren’t, so they get a building that is more economical to maintain and get the features that they truly need based on what their budget could afford." – **Project Architect** on the benefit of IPD to the owner

“There have been bigger projects, but this one is complex and we are dealing with unforeseen conditions everyday. It is good to have a team approach.” – **Owner’s consultant**

“Even though from a cost standpoint $20 million is not a lot of money, we now realize we took on one of the toughest projects for Integrated Project Delivery [due to the complexity of renovating an older building]. The advantage is that we are learning the most about IPD and had to do it well with this tough project.” – **Principal Architect, Array**

**Market Position** was important for all parties involved. Array works exclusively in healthcare and recognized IPD was where their market was headed. They made the strategic decision to gear up their multiple offices and worked to prepare their regional partners for the shift to IPD. They had been looking for an opportunity to fully execute an IPD contract and Mercy Health Partners was the first to agree. As a large healthcare system, the owner has multiple healthcare facilities and was interested in finding a project delivery method that would be flexible, give them more control and better value.

**Cost Predictability** was not identified as an initial motivator for selecting IPD, but the team discovered that the scheduling advantages of having all the team members (owner, architect, contractor) coordinating. Given that the project is within an existing and operating facility, logistics and scheduling are both complex and critical to maintain hospital operations. The integrated nature of the team and close coordination with the owner allowed all of the activities occurring on the medical center campus, including activities internal and external to the project, to be combined into the team’s construction schedule. This allowed the team to accommodate all of the owner’s other initiatives, avoid conflicts, and better achieve the owner’s goals.

**Reduced Risk** was a long-term motivation for the owner. As a healthcare system they wanted to find a better way to manage projects. There was not necessarily a clear understanding of this advantage going into IPD, but the team has discovered that having an integrated and consistent team through the duration of the project significantly reduces risk to the owner. This is primarily due to the fact that the entire integrated team (owner, architect, consultants, GC, and subs) is responsible for addressing schedule, constructability, and cost; one discipline can’t deflect issues to another. Positive or negative, the integrated team has to solve problems together.

**Design Complexity** was not an initial motivator for selecting IPD, but the team has recognized that the collaborative nature of the process coupled with early involvement has been a significant advantage, especially for a hospital remodel. Design and construction were happening concurrently for a significant portion of this project. With a 60+ year old medical center, there were many unforeseen conditions discovered during renovations that allowed the field team to provide detailed input to the design team to make better design decisions and avoid issues in the field.

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## Survey Data

Data analysis to come in phase two of study.
**Contract**

**Contract Type**
- Single Multi-party Contract – AIA C-191 Standard Form Multi-Party Agreement for Integrated Project Delivery

**Contract Issued**
- October, 2010

Array completed a Master Plan for Mercy Hospital and received approval to move forward with the project in fall 2009. Upon approval to proceed, Array proposed to the owner to follow an Integrated Project Delivery model, now for Mercy. After several educational presentations, Mercy Health Partners agreed that IPD was an appropriate delivery method for this project. The owner asked the architect to propose a contract for IPD. Array was inexperienced with IPD but had been researching the method for some time. The contract Array proposed was a custom agreement they developed based on other models, such as Sutter’s Integrated Form of Agreement (IFOA). After reviewing the agreement, the owner realized their expertise did not grant them a high level of comfort with the contract. In spring 2010 Mercy hired an independent consultant, an architect with experience in AIA contract documents and familiar with ‘Lean Construction’. The IPD consultant recommended using AIA C-191 Standard Form Multi-Party Agreement for Integrated Project Delivery in lieu of the custom agreement proposed by Array. All parties agreed the AIA document aligned well with what they were trying to develop in their custom document, so the owner opted to use the AIA C-191.

After the AIA C-191 was chosen, it took the owner, architect and contractor almost 8 months to negotiate and revise the document to develop an agreement with which all parties were comfortable. This time period was difficult but the entire integrated team, including the owner, architect, contractor, design consultants, and first tier sub-contractors, remained committed to IPD throughout the negotiations and continued work without a contract in place.

As a standard form multi-party agreement, the AIA C-191 contract incorporates the common range of IPD strategies, covering the areas of commercial terms, relational expectations, and implementation tools. There were a number of changes that had to be negotiated to reach consensus; most of these changes were regarding the commercial terms.

**Commercial Terms**
The standard contract language on compensation, risk, and reward incentives had to be modified to satisfy the owner, architect and contractor, see more in Risk/Reward. Limitations on liability were agreed to between the A/E and contractor, but the owner did not agree to waive liabilities. The insurance section was also edited; the owner wanted to follow a more traditional bond approach with conventional professional liability insurance for the architect and engineers. And finally the ownership and use of documents had to be negotiated to reach a compromise that protected both the architect and the owner.

Defining the contingencies was another significant addition to the standard form contract. Contingencies were critical on this project because they were operating with a very tight budget and multiple risks due to the high number of unknown conditions inherent to any renovation project. Two contingencies were established as part of the Target Cost breakdown, a Design and Construction Contingency and an Owner Contingency. The Design and Construction Contingency would cover “reasonable refinement” of design details within the original scope of the contract documents, and changes required by code officials. The Owner Contingency would cover owner scope changes, extraordinary events or circumstances, and unforeseen construction conditions that could not have been reasonably determined prior to work.

For any issues caused by errors or omissions in the documents, the team would be held responsible, but was given the option to use their profit pool, pay out of pocket or to use insurance proceeds.

**Relational Expectations**
There were also several modifications that redefined responsibility for particular contract requirements from “Parties” or “Team,” in the collective sense, to one party in particular, such as the architect, contractor or owner. These modifications may seem to compromise the collaborative intent of the contract by putting in place traditional, isolated decision-making; however, interviews with the team indicate that these contractual definitions have not negatively affected collaboration.

**Implementation Tools**
The AIA C-191 includes several exhibits that help the team collaborate and align goals such as the Target Criteria Amendment and Target Cost. The agreement also recommends the use of collaborative technologies such as BIM.

¹ Lean Construction extends from the objectives of a lean production system – maximize value and minimize waste – to specific techniques and applies them in a new project delivery process.


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### Goals

**Process**
Goals were established with collaborative input from the team. The owner’s IPD consultant developed and led the process of defining goals. Special effort was dedicated to this process, because lessons learned from other IPD teams warned that a lack of goal definition and alignment at the beginning of a project caused serious problems later. Compared with the long and difficult contract negotiation, consensus on goal definition was very easily reached.

**Goals**
Six goal categories were developed. They were:

1. Cost
2. Schedule (early start/finish)
3. Quality (such as meeting hospital and accessibility codes and standards, team performance, and zero complaints from staff/patients)
4. Diversity (workforce firms to include minority, female and local)
5. Sustainability
6. Implementation (team responsiveness)

**Communication and Alignment**
From this list, a scorecard was created to measure achievement. The architect’s profit and contractor’s fee earned were tied to goal achievement. According to Article 4 of the contract, Compensation, goals are to be reviewed at monthly increments to determine what percent of profit would be paid.

All team members, including consultants and subcontractors, were informed of the project goals and received a blank copy of the scorecard to reiterate the goals and metrics for which they would be held accountable.
### Risk/Reward

One of the modifications made to the AIA C-191 was the elimination of the Goal Achievement Compensation, which are payments made to the team for achieving project goals developed according to the Target Criteria Amendment process and are not contingent on the actual costs of the project, even if they exceed the target cost. According to the modified contract, the architect and contractor waived the rights to the Goal Achievement Compensation; however, revisions to Article 4, Compensation, established a compensation structure similar to the Goal Achievement Compensation, but puts the architect's profit and contractor's fee at risk. Payment is contingent on points earned for each goal as defined by collaboratively developed metrics, tracked using the project goals scorecard. (Also see Goals).

The team agreed to the AIA C-191 standard Incentive Compensation. This compensation is paid if the actual costs are less than the target costs. As per contract, the owner would retain 50% of the cost differential with the architect and contractor each receiving 25%. The project budget was incredibly tight and at the time this case study was conducted, the team had not realized any savings. They are closely tracking costs, taking advantage of the open book transparency and ongoing cost estimating.
Liability

The standard AIA C-191 contract waives claims and liability between all contracting parties under Article 8, Risk Sharing; however, in this case the document was modified to waive claims only between the architect and contractor and their respective consultants and sub-contractors. The owner declined to waive claims or liability. The waivers are general, but also include specific waivers of claims for consequential damages and subrogation. Other exceptions generally included issues arising out of “willful misconduct,” unfulfilled warranty obligations, or failure to procure insurance.

Dispute Resolution
Any claims permitted under Article 8, Risk Sharing are required to follow procedures defined under Article 9, Dispute Resolution. Should a dispute arise, the issue is first to be addressed by the Project Executive Team or the Project Management Team. If an agreement cannot be reached, the AIA C-191 standard contract outlines internal resolution through mediation between a predefined “Dispute Resolution Committee,” which would be made up of a group of representatives from each party, and a neutral party. However, in this case, the team intentionally omitted the internal Dispute Resolution Committee and its mediation process. The process described in Article A.15 of the modified agreement resolves issues through “unanimous decisions of the Project Executive Team or the Project Management Team.” For any issues that cannot be resolved by those teams, resolution would be reached through arbitration with the American Arbitration Association, in accordance with the Construction Industry Arbitration Rules.

Any claims permitted by the risk sharing and dispute resolution articles are limited to “no more than 10 years after the date of substantial completion.”
### Insurance

The AIA C-191 standard contract, Article 7, Insurance and Bonds, recommends hiring an insurance consultant to assist in obtaining integrated insurance products. This might include “Owner or Contractor Controlled Insurance Programs” or the “individual insurance requirements for the Parties and other Project Participants.”

In this case, the owner preferred to follow a conventional insurance and contractor bond approach and struck the reference above from the agreement. The architect and contractor carry standard Professional Liability insurance, specifics of which were attached in a detailed schedule of requirements.
# Leadership

## Champion
- **Architect**
- **Owner’s Representative (IPD Consultant)**

## Team Structure
- **Project Executive Team**
- **Project Management Team**
- **Implementation Team**

The architecture firm Array championed the use of Integrated Project Delivery from the start of the project. As Array and the contractor, Donley’s, attempted to negotiate the terms of the contract with the owner, the owner realized their company needed internal support and expertise to help advise them on IPD. The IPD consultant brought on board by the owner was experienced with fast track projects, Lean Construction techniques, and early involvement. The consultant became integral to the project, coordinating with the owner’s legal team through the contract negotiation as well as facilitating the IPD process and eventually serving as the Owner’s Representative.

Team leadership occurs at three levels: Project Executive Team, Project Management Team, and the Implementation Team. As outlined in the AIA C-191 contract Article 2, Management of the Project, the Executive team is responsible for major decisions and is comprised of one high level representative from each contracting party. The Project Management Team is also made up of one representative from each party and is responsible for execution of project decisions and directives given by the executive team. The Implementation Team is the group responsible for executing the design, documentation, and fieldwork. The Project Management team was tasked with educating, training and managing the Implementation team, ensuring that the entire team adhered to the principles of Integrated Project Delivery.

The owner’s IPD consultant led the process of forming and coaching the Executive and Project Management teams. The owner’s IPD consultant characterized the underlying values of an integrated team as, “everyone steps up when they need to step up; whether it is a foreman, project manager, estimator, project engineer, or project architect.” Essentially, the Project Management team needs to set up an environment that allows team members to take leadership as needed and create a culture of distributed leadership and ownership.
Firm Selection

Architect
Array was selected to do a facility master plan for Mercy Health Partners and went through a conventional interview process; IPD was not a consideration at that point. Once Array completed the facility master plan, the hospital board elected to move forward with Array as the architect for implementation, no additional criteria or qualifications were required. It was after Array was approved to move ahead on the project that they proposed using an Integrated Project Delivery approach. Once the owner agreed to try IPD, Array took the lead on the selection process for the design consultants and contractors.

Contractor
The architect drove the selection of the contractor without much participation by the owner. Array sent a Request for Qualification (RFQ) to six general contractor firms requesting information in the following categories: general company information, regional experience, healthcare experience, and IPD knowledge and experience. Array developed a scorecard that guided their evaluation of each RFQ response to create a short list of firms. Shortlisted firms were interviewed in detail on topics such as: relational aspects of project delivery, budgeting process, and logistical strategies specific to healthcare and IPD environments. After the interview stage, Donley’s was selected. Donley’s and Array had previous shared project experience, including a $30 million parking garage for a University hospital that was ongoing during the selection process for this project. After going through the RFQ evaluation, Array felt confident that Donley’s would be good partners in a collaborative endeavor.

Design Consultants
Array put together an RFQ survey that they sent to a dozen engineering companies. The survey questions related to the firm’s experience with and commitment to IPD, Revit/BIM experience, general technological capabilities, and degree of integration in house (i.e. number of disciplines under one roof). Like in the contractor selection, Array used a scorecard to guide their evaluation of the potential firms’ responses and did an interview with shortlisted firms. Mercy Health Partners and Donley’s also did independent reviews and gave their top two recommendations to Array. Array maintained final decision-making power since they were the party contracting directly the selected firm. Osborn was selected primarily because their firm housed all their engineering disciplines in one location: structural, electrical, mechanical, plumbing, fire protection, and technology and data. The co-location of engineers was attractive for ease of communication and coordination.

Subcontractors
The prime contractor went through a similar selection process for the primary sub-contractors as the architect did for primary consultants – an RFQ survey and interview. They broke the project up into three main sub-contracting packages: interior demo and finishes package, general trades package, and a MEP/technology package. Qualified subcontractors were sent a qualifications survey that asked about experience with IPD, experience with other technologies that would be used on the project, and financial background. The architect and owner reviewed the survey responses and provided feedback to Donley’s. The three major sub-contractors were selected by Donley’s and brought on board at the start of criteria design.
## Team Selection

In general, team members were selected based on their past ability to work collaboratively in a team environment. Individuals who tended to push their point of view without considering others were not selected for the team. Other criterion important to selection included experience working in healthcare facilities and experience with design-build.

In the case of Osborn, there were two key engineers that the Executive Team identified as highly desirable for the team and whose inclusion positively influenced the selection of their firm. Osborn’s Mechanical Engineer had a hospital facilities background and their IT professional had excellent experience with certain technologies important to the project.
Early Planning

Resources Referenced
- Experienced IPD Team Member (Owner Consultant)
- Sutter Health IFOA
- Boldt Lean Construction Practices
- AIA C-191 Standard Form Multi-Party Agreement for Integrated Project Delivery
- Various online resources

The team had a difficult time finding resources to help them prepare documents and management strategies for the IPD process. Without references, they had to invent new ways of doing things. For example Array put a great deal of effort into strategizing the RFQ process for selecting the engineer consultant, which was different than their previous practices (see Firm Selection). Jointly there was additional effort in developing the metrics scorecard (see Goals) and embellishment of AIA exhibits.

To supplement the scarcity of IPD resources, the owner’s IPD consultant contacted other companies experienced with healthcare and IPD. The contractor Boldt was willing to share resources and advice based on their experience integrating Lean Construction with IPD in the healthcare sector. Because of conversations with Boldt and others, this project has incorporated Lean Construction techniques, such as the Last Planner System, in the belief that Lean helps to facilitate the IPD process.

Team members struggled through the early planning process, but felt the tools they invented and lessons learned through conversations with others were good investments preparing for future IPD projects.
**Implementation**

**Tools**
- Last Planner System (Lean Tool)

The team adopted the Last Planner System to help facilitate communication and track reliability of committed actions. Initial training was required to encourage team members to be open and transparent and to take initiative to raise issues. The Last Planner System also helps to monitor the effectiveness of the team. According to the owner’s IPD consultant, a University of Pennsylvania study reported that a traditional project delivery approach typically achieves 50% reliability of work completed and that last measurement recorded for this IPD team was 80%.

For fieldwork, the team used a Lean tool called “daily huddles.” Donley’s superintendent and project foreman led these huddles. Participants included the trade workers, the owner’s facility personnel, and sometimes hospital nurses and staff. These short 15-20 minute meetings, held each morning, have been very effective in communicating the daily activities and ensuring the team is aligned in their goals for the day. This has been especially valuable for daily logistics, coordinating security and scheduling shutdowns, all critical to keep the hospital functioning during construction.
Early Involvement

The architect, engineers, and contractor were very experienced with the design-build delivery approach, which typically involves the contractor much earlier than in a traditional design-bid-build model. Unique compared to the team’s previous design-build experience was that sub-contractors were on board during criteria design, only a month after the prime contractor was brought on. With early involvement of both the contractor and sub-contractors, everyone started when the project was still in development; this allowed for creation of aligned goals, a sense of ownership, and eliminated the knowledge disconnect during project handoff points.

Early involvement helped build trusting and respectful relationships between the designers, engineers and builders. The sub-contractors expressed that they gained a much broader perspective of the project by witnessing the challenges the architects, engineers and prime contractor had to face in the development of scope of work, schedule and budget. Sub-contractors reported that they avoided getting wrapped up in their own isolated issues because, by working closely with other team members early on in the process, they were able to see how each discipline was inter-dependent. This built respect and helped motivate the team to be more responsive and better support other disciplines.

In this case, one of the biggest benefits of having the sub-contractors on board during criteria design was the information gained through their access to the facility. They were able to look behind ceilings and walls, discovering conditions that normally would not have been known until construction. Having that information early allowed the design team to make better design decisions and develop strategic construction phasing solutions. Sub-contractors also provided valuable feedback based on their expertise. For example, there was a condition where the mechanical engineer recommended the removal of a section of the ceiling. Sub-contractors pointed out that removal would require both an inspection and upgrade of the area to bring it up to code. To avoid these additional costs and delays, an alternate solution was found.

Another benefit of early involvement was an increased accuracy in estimating. The sub-contractors had to revise their typical estimating procedures because criteria design required early estimation to be done without detailed information. But because sub-contractors were involved in design decisions that influenced cost and provided them with more intimate knowledge of the project as it evolved, they were able to arrive at more accurate estimates when establishing the Target Cost.

Responsiveness, enabled by early involvement, has proven to add significant value to the owner. Early involvement may be particularly advantageous for renovation projects, where unknown conditions are routinely discovered and benefit greatly from fast collaborative response by an integrated team. As the owner’s consultant commented, “there have been bigger projects, but this one is complex and we are dealing with unforeseen conditions everyday. It is good to have a team approach.”

Budgeting for Early Involvement.

For typical design and construction projects, the majority of fee expenditures occur during the construction document phase; in IPD the largest expenditure of fees occurs in the criteria design phase (similar to schematic design phase in traditional project delivery phasing). Based on their research, the team anticipated their effort to be front-loaded, however in spite of their planning, fees exceeded estimates.

There were several factors that contributed to extra time spent in criteria design. The first had to do with time required to reduce the scope and achieve the $20 million budget (estimates for the original scope was $40 million). The master plan project consisted of 9 separate remodel projects, so establishing scope and budget allocation was extraordinarily complex. Second, was the nature of remodeling a 60+ year-old building. There were renovations in the 1960s, 70s, and 80s that were not documented. Unexpected early fee expenditures were triggered when contractors in the field made discoveries and needed answers quickly. The IPD process is beneficial in these situations because the team is able to coordinate and develop solutions rapidly, but it also requires time and effort.
Transparency

The AIA C-191 contract supports transparent sharing of all project information.

Contract Section 2.4 Team Meetings, Communication and Recordkeeping empower team members to share relevant project information directly with one another, eliminating contractual hierarchy and pre-defined communication channels. This allows all team members, including design consultants, sub-contractors, advisors and agents to communicate directly with one another.

Contract Section 4.6 Recordkeeping and Owner Audit Rights requires that all parties maintain detailed accounting records of all finances related to the cost of work. The contract language was modified to specify that only the architect and contractor be required to maintain these records, releasing the owner from this obligation. The open book contract language gives the owner the right to audit or review any information relating to accounting records and business methods used to determine costs. The contract excludes open book access for any agreed upon fixed dollar amounts.
Decision Making

The Project Management and Implementation Teams have met weekly for 3-4 hours since the project began. Meeting efficiency has improved as the teams have learned how to have the right people there at the right time. The meetings became more effective by splitting the time into two halves. The first half of the meeting includes the entire team and typically focuses on the Last Planner Schedule, discussion of field issues, and communicating relevant information to the foreman. The second half of the meeting is only for those who need to be there and is focused mostly on project costs, schedule and design progress under review.

Communication and decision-making also occurred outside the weekly meeting schedule. When team members judged an issue arising in the field too urgent to wait for resolution at the weekly Wednesday meeting, an ad-hoc conference call with the integrated team members would be assembled. Simply having a conversation among the diverse array of team members often resulted in a quick decision. Another communication tool, a SMART Board, was installed in a conference room within the hospital but at the time of this study has not yet been put into action. The Implementation Team believes the SMART Board will facilitate remote communication by allowing review and mark-up of photos or drawings that can be shared immediately with the off-site team members.
### Culture

For this team, the biggest change from a traditional delivery was the elimination of silos. Team members observed that although some of their colleagues initially tried to stay within familiar roles, after a few meetings all team members became accustomed to sharing information and communicating openly. The trade contractors commented that IPD empowered them to work directly with the engineers to develop solutions together. Instead of just sending an RFI telling the designers and engineers to fix it, sub-contractors used their experience to help suggest solutions. According to one of the mechanical contractors, “typically decisions are one-sided, but in this case we have a real reciprocal working relationship.”

Early involvement, aligned goals, and transparency were the primary contributing factors in creating an effective collaborative culture. As the owner’s representative said, “The team worked for months without a contract. The team got paid without a contract. The commitment, collaboration and communication were the outstanding pieces of this overall process.” The team agreed that early involvement was one of the most important IPD strategies for achieving collaborative attitudes across the board. The team refers to the resulting culture as, “everybody has some skin in the game.”

Comments from several team members emphasize that successful implementation of IPD requires flexibility, adaptability to new roles, and evolution as an organization.

#### Contractor

The contractor observed that early involvement created the biggest change, eliminating silos within the construction trades. In a conventional project, the key sub-contractors would be brought on late in the project through a competitive bid process. Shortly after award, they would be expected to put the work in place with limited time to familiarize themselves with the documents. The conventional bid process for sub-contractors often results in major challenges such as a significant breakdown or disconnection in project knowledge and lack of team building. The early involvement of key subs has had a tremendous impact on the culture of the team – it helped build trust and respect among team members, eliminated the knowledge transfer disconnection and achieved buy-in from the entire team.

#### Owner

To become an equal member in the IPD team, the owner had to adapt. As an organization, they had to transparently acknowledge their own strengths and weaknesses. To ensure qualified team members were present at the table, they modified roles for existing personnel and hired an IPD consultant to act as the Owner’s Representative. Changes also had to be made to their in-house Quality Assurance and Quality Control (QAQC) processes, redefining the intentions for QAQC to align with the new delivery phases of IPD.

Some of the owner’s facility managers had reservations going into IPD because it was new and required some changes in roles, but they have now fully embraced IPD. Construction in any working hospital environment has a significant impact on facility operations. Working as part of a transparent team has created the opportunity for the facility managers to provide input, greatly reducing their stress compared to previous renovation experiences, see Implementation for more information on Daily Huddles. Transparency provides a higher level of awareness and trust between the facility managers and the construction team. Plus, the increase in communication allows the design and construction team to plan work more intelligently and coordinate work with the facility managers, giving them more time to prepare the hospital staff for interruptions.

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LOCATION</th>
<th>BUILDING TYPE</th>
<th>CONTRACT</th>
<th>OWNER</th>
<th>ARCHITECT</th>
<th>CONTRACTOR</th>
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<tbody>
<tr>
<td>MERCY Health Partners Masterplan</td>
<td>Lorain, Ohio</td>
<td>Hospital</td>
<td>Single Multi-party Contract - AIA C-191</td>
<td>Mercy Health Partners Regional Medical Center/ Community Health Partners</td>
<td>Array Healthcare Facilities Solutions, Inc.</td>
<td>Donley’s Inc.</td>
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</table>
### Workplace

**Not co-located, but shared workspace available**

The project team was not co-located. The option was discussed but the team felt they could coordinate effectively through regular team meetings. The team set up an easily accessible "hub" within the hospital. The team uses this space to review and work with documents and to conduct user meetings. The furniture is laid out in a doughnut configuration with pin-up space on three of the walls and a SMART Board, see Information Sharing, on the fourth. Network connectivity is also provided for individual laptops.
Information Sharing

Tools
- SMART Board
- Conference calls
- Emails
- Networked Project Management Site

One of the new technologies the team will be implementing to communicate with off-site team members and to conduct user meetings is a SMART Board. A SMART Board is a large-scale interactive tool that allows people in distant locations to look and manipulate the same document in real time. There is one located in the “hub,” a conference room at the hospital.

Meeting Frequency
- Daily Huddles (Implementation Team and Project Managers as needed)
- Weekly Last Planner Meetings (Project Management & Implementation Teams)
- Weekly Cost Review Meetings (Project Management & Implementation Teams)
- Monthly Project Executive Meetings
- Conference calls as needed

When the team compared the project meetings for this project against their previous experience with non-IPD projects, they found a much more diverse group of people attended and the information shared was at a higher level. They also noted that project decisions were made immediately, whereas in their previous experience issues raised in project meetings typically took 2-3 days to resolve.

From the facilities management standpoint, the IPD process has increased meeting frequency and interdisciplinary communication. This has been incredibly valuable in terms of increasing the construction team’s awareness of the special requirements of constructing within an actively operational healthcare environment. The daily huddles (see Implementation) have been instrumental in facilitating effective communication between the construction team, the facility manager, and hospital staff in order to maintain uninterrupted and safe hospital operations during construction.
BIM

Model Manager
- Architect (Array HFS)

Management Protocol
- AIA E202 Building Information Modeling Protocol Exhibit

AIA E202 BIM Protocol Exhibit was used in this project. According to the AIA E202 document, the architect was assigned as the manager of the model beginning at the inception of the project. This made Array responsible for establishing protocols for modeling standards, file storage, model access, and clash detection. They were also responsible for ongoing model management and maintenance.

For each project phase, the E202 requires the team to assign a five-level progressive scale to determine the Level of Development (LOD) of model elements. The scale moves from LOD 100, which is general massing, up to LOD 500, which requires accurately modeled construction assemblies. The team hoped to achieve LOD 400, which would include fabrication, assembly and detailing information. However, due to the lack of accurate as-builts of the existing facility the team realized the maximum they could achieve would be LOD 300. Therefore, LOD 300 was the highest level they specified in the E202 to be achieved by the Implementation Documents phase.

The team has spent a great number of hours modeling, but is not confident their efforts will pay off in the end. Many team members concluded that BIM may not be appropriate for complex renovation projects and Revit was the wrong tool for this project. They experienced difficulty accurately inputting complex existing conditions and excess rework due to in situ site discoveries. As the team struggled with BIM, they scaled back their expectations for the model’s use. The model will be used for 100% of Detail Design and Implementation Documents as planned but other functions have been dropped. In particular, the contractor’s use of the model for scheduling (4D) has become less important and the goal of sharing the model with the entire project team has been scaled back so that it is now only shared between the architect, Array, and engineers at Osborn. The goal of using the model for sub-contractor fabrication, LOD 400, has been abandoned.
**Project Description**

**PROJECT**
Lawrence & Schiller Interior Office Remodel

**LOCATION**
Sioux Falls, South Dakota

**BUILDING TYPE**
Office–Renovation

**CONTRACT**
Multiparty–Custom series of contracts

**OWNER**
Lawrence & Schiller

**ARCHITECT**
RS Architects

**CONTRACTOR**
Mark Luke Construction

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**Project Characteristics**

**PRIVATE**

**PROFIT**

**OWNER OCCUPIED**

**SPECULATIVE**

**NEW CONSTRUCTION**

**RENOVATION**

**RURAL**

**URBAN**

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**Team Size**

10 individuals

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**Building Size**
7,000 sq. ft.

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**Project Cost**
$500,000

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**Schedule**
6 months design
3 months construction
In spring 2010, Lawrence & Schiller, a marketing firm in Sioux Falls, South Dakota, was seeking interior design services for the remodeling of their 7,000 square foot office. They had a relationship with an interior design firm, Canfield Business Interiors. Canfield identified the project as an ideal opportunity to test out an integrated delivery approach with several long-time collaborators. The project team partners that were assembled by Canfield worked through a limited liability company (LLC) company called Innovative Solutions Group (ISG) and together they proposed an Integrated Project Delivery approach to Lawrence & Schiller. The client agreed to support the team in this IPD endeavor because as a marketing firm, they felt an innovative, collaborative approach was well aligned with their values and identity.

ISG is a Limited Liability Corporation. Typically in IPD, LLCs are formed to join together the architect, contractor and owner for short durations, or one specific project. In this case the LLC is not project specific but rather a new company, formed and solely owned by the owner of Canfield Business Solutions, Larry Canfield. Lawrence & Schiller, the project owner, contracted with ISG. The integrated team partners included: Canfield Business Interiors (interior designers), RS Architects, Mark Luke Construction, Electric Supply (electrical contractor), and Midwest Mechanical (mechanical contractor).

The Lawrence & Schiller remodel was the first IPD project for all of the parties involved, however they had all been working together for years following primarily design-build delivery.
Market Position was the critical driver for forming Innovative Solutions Group (ISG) and proposing an Integrated Project Delivery approach. In a tight economy, all parties determined that gaining experience in this fast growing delivery process would provide them a significant market advantage, allowing them to deliver a better product to owners.

Cost Predictability was a huge factor in deciding to try IPD primarily because they needed to reduce the original design estimate of $700k to $500k.

Schedule predictability was not a critical driver of IPD. The owner had a great deal of flexibility and pushed back some deadlines. Finalizing the design was put on hold until after the November 2010 elections. May 2011 is the critical path deadline because that is when Lawrence & Schiller brings on new interns that will need workspace.
Survey Data

Data analysis to come in phase two of study.
Contract

Contract Type
- Custom series of contracts between Lawrence & Schiller and Innovative Solutions Group, LLC

Contract Issued
- Phase 1 (Feasibility Study) – May, 2010
- Phase 2 (Design Development) – August, 2010
- Phase 3 (Construction) - TBD

On this project the contract did not play a central role in driving the integrated process. The team considered a standard form IPD contract, but for this scale of project and the clients they work with, all of the currently available standard documents seemed overly complex. According to the contractor, “the existing [AIA] contract is 120 pages long, put that in front of a client and they are going to laugh at you and walk away.” The team agreed they are ideally looking for an IPD contract less than 20 pages.

On this project, in lieu of using a standard form agreement, the team developed proposals for each phase of work, broken down into three phases: 1) Feasibility; 2) Design Development; and 3) Construction. The owner signed off on each phase separately as the price became more defined. The team estimated that they would have the Guaranteed Maximum Price established at 75% DD and the signoff for Phase 3 Construction would occur before 99% deliverables were issued. At the time this study was conducted the final contract arrangement had not been decided.

Given the size of the project and abbreviated form of the custom agreements, the terms of the IPD process were not extensively defined.

Commercial Terms
The agreements for each project phase were between the owner and Integrated Solutions Group (ISG), tying all collaborating parties, except the owner, into one entity. The team proposed a shared risk and incentive structure, but this was not well defined in the agreements that had been issued at the date of this case study (see Risk/Reward). There were no references to limitations on liability or special insurance requirements.

Relational Expectations
The IPD approach was outlined in the Phase 1, Feasibility proposal to the owner that stated that this project would use “trust based relationships to design and implement with better outcomes for all parties involved.”

Implementation Tools
No unique collaborative tools were referenced in the custom agreements.
## Goals

**Process and Alignment**

The programmatic and design goals for the project were relatively conventional compared to the innovation expected from an integrated delivery process. Some innovation was apparent in establishing project goals, through a collaborative programming session between the owner and the entire ISG team. This programming session included the GC and sub-contractors and helped ensure that everyone on the team was aligned with the owner’s desired outcomes. See more about this in the **Early Involvement** section.

**Goals**

The design goals for the project were to achieve a work environment that supports creative collaboration and interaction between the Lawrence & Schiller marketing teams and for the aesthetics to reflect the identity of the owner as the “idea company.”
Risk/Reward

Establishing the risk reward structure was the most challenging aspect of IPD for this team. The Innovative Solutions Group (ISG) Alliance Manager said, “as we are getting into the shared risk/reward, we are all are scratching our head. What does it mean and how far do we take it? We want to make sure we are not making decisions that ultimately will make this an unsuccessful project for us. There is no manual.”

The owner had very little involvement with the incentive layer. ISG estimated their direct time and materials cost and put their profits at risk. This pricing structure was outlined in their fee proposal to Lawrence & Schiller. The proposal broke out each party’s allowable cost (their direct compensation, materials and direct burden costs), and an incentive compensation cost (their profit). The fee structure was transparent; however metrics or goals tied to the incentive payments were not established.

To clarify the cost benefits of this delivery method, the contractor put together a cost analysis that estimated the owner would save 10% using IPD instead of design-build delivery. The contractor planned to validate these estimates as the process unfolds. At the time this study was conducted, the team attributed cost savings to the transparency gained through early involvement of sub-contractors, who were able to better understand the project and influence design and product/system selection decisions. This allowed cost estimates to be more accurate and product/system selection to be more thoroughly considered in terms of design, installation, and operation. The team expects this will reduce field coordination and construction time that in the end eliminate “headache money” and provide the owner better value.

The team anticipates that the completion of this project will give them a better understanding of the cost savings and value of IPD, which will help ISG better define a risk-reward structure and incentive criteria for future clients.
<table>
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<th>Liability</th>
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<tr>
<td>The contracts did not include a “no sue” clause, however the Phase 3 contract had yet to be developed at the time of this study.</td>
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**Dispute Resolution**
There was no Alternate Dispute Resolution procedure identified in the custom agreements.
### Insurance

No unique characteristics, standard professional liability products used.
Leadership

Champion
- Integrated Team (not including Owner)

Team Structure
- Integrated Team (Innovative Solutions Group, LLC)

Canfield Business Interiors promoted the idea of IPD. The owner of Canfield, Larry Canfield, is involved with the collaborative project delivery movement. He provided Rex Miller with input for his book “The Commercial Real Estate Revolution,” which became an influential resource for the ISG team. Canfield was also responsible for establishing the Innovation Solutions Group (ISG), LLC. The motivations for ISG were primarily from a business strategy and marketing perspective to separate Canfield Business Interiors, who are often referred to as the “furniture people,” to a company that could manage the entire delivery process. From there they selected partners from the design and construction community in Sioux Falls to build the integrated team. See more in Firm Selection.

The Innovative Solutions Group (ISG) Alliance Manager was responsible for facilitating the IPD process, however all members agreed that it was truly a team effort with everyone fully engaged, they speculated that this was perhaps because they were learning about the process together.

ISG parties had been working together in a collaborative capacity for six years and had done other projects as the entity ISG, primarily following a design-build method. ISG proposed the IPD process to several of their clients and Lawrence & Schiller (L&S) was the first to agree to be “guinea pigs” and “ride the ride” with them. Lawrence & Schiller is the marketing firm for Canfield, so they were familiar with the business goals of ISG and sympathetic to their philosophy. L&S was a seasoned client, familiar with the design-bid-build delivery. Some of their experiences had been successful and others not, so they were very interested in testing this new approach to better manage cost and schedule.
Firm Selection

Canfield Business Interiors and Innovative Solutions Group (ISG) had conversations with various members of the design and construction community in Sioux Falls. They selected partners who were willing to read “The Real Estate Revolution,” embrace the collaborative aspirations of ISG, and were passionate about moving their respective practices in this collaborative and integrated direction. All the partner members had previously established professional and personal relationships.

Architect
The architect was selected because of an interest and philosophical alignment with IPD. The individual architect is employed at RSArchitects, but contracted separately with ISG for this project. The owner of RSArchitects signed off on this arrangement.

CM/GC
Mark Luke Construction was selected due to their pre-existing relationship with Canfield Business Interiors and strong interest in pursuing an integrated delivery philosophy.

Trades
Unique to the IPD process, the team selected subcontractors based on expertise rather than initial pricing. Selection also came down to past working experience and trust.
**Team Selection**

Because the design and construction community in Sioux Falls is small, there was overlap in criteria for Firm Selection and individual team member selection (see Firm Selection).

In some cases individual team members were hand picked, for example the architecture firm was not selected for participation, but the individual architect within that firm working on the project has independently committed to the process.

The team agreed that selected individuals had to have the right attitude – one committed to change and learning from the process. Canfield Business Interiors had unsuccessfully attempted an IPD approach on other projects but found the team members were not committed and reverted to business as usual.
Early Planning

Resources Referenced
- “The Commercial Real Estate Revolution”
- Discussions with IPD Experts
- Various online resources

The team considered education to be critical to prepare for the IPD process. To define expectations of the process and align motivations, all partners of Innovative Solutions Group (ISG) were required to read “The Commercial Real Estate Revolution.” Key members of the owner’s team were also given a copy of the book.

To help the team better understand the process and discuss the team’s comfort level with the project’s shared risk/reward component, they held a round table discussion and brought in an experienced IPD professional for advice. All team members attended this meeting (the owner was invited but was not able to attend).

The contractor also developed a cost analysis of IPD vs Design-Build based on their experience over the past 8 years in conceptual estimating. This analysis was used to better understand the potential value of IPD and communicate with the owner. The analysis will serve as a benchmark for the team to compare outcomes of the IPD process with anticipated timesaving, reduction of rework, and increased efficiencies.
Implementation

There were no unique IPD tools used in this project to facilitate collaborative behavior.
Early Involvement

CM/GC  Feasibility/Programming
Trade Contractors  Feasibility/Programming

The team found that early involvement by key players created enormous value. Cost model estimates indicating the integrated process would save 10% over design-build were greeted with skepticism since many felt the design-build delivery was equally collaborative and effective as IPD. But, as savings appeared attributable to earlier involvement of the subs, team members became convinced of the value of IPD.

There are several benefits of early sub-contractor involvement that translate to cost savings and better value for the owner. First, bringing the subs in during programming meetings helped them understand the goals of the owner and project. This deeper understanding helped them fully engage in the project and motivated them to work hard on reducing costs while still achieving the aesthetic goals of the project. Second, during an early programming meeting with the owner, the subs walked through the space and identified potential issues that may have previously been overlooked without their expertise. This made them able to participate in early design discussions where they asked questions and made suggestions to the designers that led to cost savings in system selection and coordination. And third, because the subs, who will be executing the construction, more fully understand the project, they expect to reduce construction time by 20%.

Officially there are constructability reviews at 40%, 75% and 99% construction completion, but issues are flagged and corrected on an ongoing basis within the team.
## Transparency

The team operated in a very transparent manner, see Risk/Reward.
Decision Making

The team felt that collaborative decision-making coupled with early involvement of contractors created the most valuable aspect of the IPD process: instilling buy-in from the team. As the contractor said, “all parties own this project.” Most decisions were made during the weekly design meeting. The owner was brought into these meetings on an as needed basis to ensure design decisions aligned with the owner’s priorities. The process was more collaborative within the integrated team, but owner involvement was not significantly different than design-build projects the team had worked on previously.
Culture

The learning curve for the team was relatively conflict free, however cultural shifts were required to break free of ingrained roles and responsibilities. Some team members felt there was attitude differences between generations, the older generation wanted control and the younger generation recognized the advantages of collaboration. As the Alliance Manager stated, “A lot of times when you have been in the business for so long, you want the easy button – and this is not the easy button.”

One of the most difficult cultural changes was to move away from a hierarchical structure to a distributed structure where experts are utilized to lead the process as needed. There is no dictator, which has been a shift for team members accustomed to having a project manager (PM) in design-build delivery. Normally, the PM would identify conflicts, address complaints, and dictate the course of action. In the integrated approach, the team talks to each other and collectively identifies solutions.

Periodically team members had to remind their colleagues not to fall back into familiar roles. For example, there were instances when team members had to be prevented from making decisions in their individual silos apart from the team. Overall, the team was very successful at coming to the table and making suggestions.
### Workplace

**Not co-located**

The team was not co-located. Meetings were primarily held in Canfield Business Interior's conference room, which could be reached within a 10 minutes drive for all the team members.
### Information Sharing

#### Tools
- Email
- Face-to-face exchange – weekly meetings
- FTP site

The contractor, Mark Luke Construction, has an ftp site to share plans, but most of the communication and coordination happened through email, phone or in the weekly design meetings.

#### Meeting Frequency
- Weekly design meetings

The project team was not very large, approximately 10 people including the architects, interior designers, general contractors, mechanical contractor and electrical contractor. Everyone knew each other well and were comfortable communicating as needed, often emailing in the middle of the night.

Formally, the team held a 2-hour weekly design meeting for the Lawrence & Schiller remodel project. Early on, meetings were formal with the Alliance Manager issuing an agenda and meeting minutes, but this quickly developed into a more casual structure with quick emails to notify the team of topics for which to be prepared.

Given the relatively small size of the design and construction community in Sioux Falls, team members often interacted three or four times per week throughout the course of normal business, providing many opportunities to discuss issues in-between the regular meeting time.
### BIM

**Model Management**
Not Applicable

**Management Protocol**
Not Applicable

The architect used BIM software on this project, but primarily for executing work and visual communication with the owner, not as a collaborative working tool.

BIM has not been widely adopted in the Sioux Falls market and therefore, on this scale of project, it was cost prohibitive for the entire team to implement the tool.

Everyone on the team recognized that this is where the industry is moving and are all working on preparing to transition to this tool.
### Project Description

**PROJECT**
Spaw Glass Austin Regional Office

**LOCATION**
Austin, Texas

**BUILDING TYPE**
Office - New Construction

**CONTRACT**
Single Multi-party Contract - ConsensusDOCS 300

**OWNER**
SpawGlass Real Estate

**ARCHITECT**
Barnes Gromatzky Kosarek

**CONTRACTOR**
SpawGlass Contractors

### Project Characteristics

<table>
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<tr>
<th>Category</th>
<th>Description</th>
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<tr>
<td><strong>RURAL</strong></td>
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### Team Size
16 individuals

- **OWNER**
- **IPD COORDINATOR**
- **ARCHITECT**
- **DESIGN CONSULTANTS**
- **PRIME CONSTRUCTOR**
- **TRADE CONTRACTORS**
- **SUPPLIERS**
- **AGENCIES**

### Building Size
15,370 sq. ft.

### Project Cost
$2,800,000

### Schedule
- 8 months design
- 10 months construction
In early 2010, SpawGlass companies decided to build a new regional office for SpawGlass Contractors in Austin, Texas. The office was planned to be new construction and approximately 15,000 sf. SpawGlass Contractors acted as both the general contractor and owner, on behalf of SpawGlass Real Estate. They desired that the building have an "Austin feel" and began looking for an architect. They considered several architecture firms in the Austin area before awarding the design to Barnes Gromatzky Kosarek (BGK). BGK Architect’s portfolio matched well with project design goals and SpawGlass had a positive relationship with BGK, based both on past professional and personal experiences.

After BGK was selected, SpawGlass was approached by a local attorney who introduced them to the concept of Integrated Project Delivery (IPD). SpawGlass decided to use the project as an opportunity to try IPD. They felt a completed IPD project could position them as an industry leader. After research comparing standard form IPD contracts, SpawGlass opted to use ConsensusDOCS 300, a tri-party contract for collaborative project delivery developed by the Associated General Contractors of America (AGC) and partners.
**Market Position** was the greatest motivator for SpawGlass to push for IPD. The contractor desired to be on the cutting edge with the “best tools, equipment and innovation.” They saw there weren’t many IPD projects being done in the market and decided they should explore the process on their own office building because it was a low risk way to test IPD.

**Cost Predictability** was important but not a major driver in the decision to try IPD.

**Schedule Predictability** was not a critical driver for this team to pursue IPD.

**Reduced Risk** was not a primary driver. Risk was relatively low on this project because the owner and contractor were the same entity. The owner already had a great deal of control of the project.

**Design Complexity** of the design, a 15,000 sf single level office building, was not a driving motivator in the selection of IPD.

“You never feel like there is an issue or an adversarial side of this process. Monetary rewards are fine, but at the end of the day, the biggest lesson learned is that we went through this process together. [We can] share the story and take away some ideas on how to communicate, work together and strengthen that [relationship].” — Project Manager, SpawGlass
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<th>Survey Data</th>
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Data analysis to come in phase two of study.
Spaw-Glass Austin Regional Office

At a Glance

Project Description

Spaw-Glass Austin Regional Office

Abutment Location

Austin, Texas

Building Type

Office - New Construction

Contract

Single Multi-party Contract - ConsensusDOCS 300

Spaw-Glass chose to use the ConsensusDOCS 300, Standard Form of Tri-party Agreement for Collaborative Project Delivery. They considered the AIA multi-party contract, but found the language in ConsensusDOCS more accessible. There was no negotiation or customization of the contract, they went through the form and checked the appropriate boxes. The contract was also used as the primary resource for educating the team on the process of IPD.

As a standard form, multi-party IPD agreement, Consensus Docs 300 includes the commonly referenced collaborative characteristics of IPD summarized below into three categories: commercial terms, relational expectations, and implementation tools.

Commercial Terms

Collaborative commercial terms were present in the agreement, such as shared risk and reward, release from liability or “Safe Harbor Decisions,” and the option to obtain project-specific professional liability insurance. The contracting parties did agree to the shared risk/reward and release of liability, but opted to obtain traditional professional liability insurance products.

Relational Expectations

The standard form contract contains some relatively soft relational language under Article 3, Collaborative Principles. The agreement required that each party commit to mutual trust, good faith and fair judgment in their relationships with the other contracting parties. Expectations were that each party cooperates with each other to make decisions in the best interest of the project.

Implementation Tools

Several process tools and strategies are referenced in the contract such as Lean Project Delivery Strategies (Last Planner System) and Target Value Design; however actual implementation of these tools has yet to occur on this project.
### Goals

**Process**
SpawGlass defined the goals of the project. Market positioning drove the innovation goals for this project.

**Goals**
SpawGlass, as the owner and GC/CM, had a great deal of control over this project, which made it an ideal opportunity to take some risks and invest in learning industry innovations such as IPD, Revit, and LEED.

SpawGlass would like to reach LEED Gold, but LEED Silver was stated as the contractual goal. Innovative use of BIM was another goal for the team because SpawGlass wanted to use this project to develop a proprietary facility maintenance program that links equipment maintenance and warranty information to the project’s BIM model. They saw this as a product they would be able to offer future clients that would set them apart in the marketplace.

IPD became a goal for the team after the architect was selected, see Firm Selection.

As typical of most building projects, meeting budget and staying on schedule were goals for the owner.

**Communication and Alignment**
Some project goals were tied to financial incentives, intending to align the interests of the contracting partners with the owner’s goals. Team performance was not tied to financial incentives. Some additional education was needed to get the team on board and familiar with the ConsensusDOCS requirements.
## Risk/Reward

ConsensusDOC’s Article 11 defined the Incentive and Risk Sharing structure for the project and outlined the process for establishing the budget, cost models and a Project Target Cost Estimate (PTCE). The agreement required that the owner first establish a Project Budget, based on the Design Budget and Construction Budget as estimated by BGK Architects and SpawGlass Contractors respectively. The team was then required to use “diligent efforts to design the Project so that it may be constructed without exceeding the Construction Budget.” Achieving this required ongoing Target Value Pricing and Cost Modeling by SpawGlass Contractors in collaboration with BGK Architects. Cost models were to be reviewed on an ongoing basis and when the models were not in conformance with the Project budgets, the Management Group was to determine the Collaborative Project Delivery (CPD) team's course of action. The PTCE was to be established “at such a time as the Management Group determines that the project design is sufficiently complete.”

Although the contract outlined a Project Target Cost Estimate, the CPD actually followed more of a Guaranteed Maximum Prices (GMP) costing structure. An unforeseen site condition arose – too much fill on the site required mass amounts of excavation. The team didn’t know how to adjust the PTCE to account for this unforeseen condition and for the sake of expediency, reverted to a more familiar cost model.

SpawGlass conducted regular cost reviews, providing the architect immediate pricing feedback on design decisions. The contract specified that the contractor should get cost modeling input from the trade contractors in the “Preliminary Cost Model,” “Schematic Design Cost Model” and the “Design Development Cost Model,” however, the trades were not brought onto the CPD team until Construction Documents. This is an indication that the CPD did not take full advantage of early involvement of expertise when feedback could have provided the maximum cost savings.
### Liability

As a standard form contract, ConsensusDOCS Article 21, Indemnity, Insurance, Waivers and Bonds, includes provisions that limit liability, or indemnity, between contracting parties for claims that may arise in connection to the project, but “only to the extent caused by the negligent acts or omissions of the [owner, contractor, and designer] or anyone for whose acts or omissions [the owner, contractor, or designer] may be liable.”

**Dispute Resolution**

Article 23, Dispute Resolution of the contract defines the procedures for resolving disputes or claims that may arise in connection with the project. The procedure follows four stages of resolution: 1) Direct Discussion and engagement of the project Management Group, 2) Mitigation with a Project Neutral mitigator, 3) Mediation and lastly 4) Arbitration or Litigation. The team opted out of litigation and agreed to arbitration should any dispute reach level 4.
Insurance

No unique characteristics, standard professional liability products used.
Leadership

Champion
• Owner/GC

Team Structure
• Collaborative Project Delivery Team (CPD)

In this case the person advocating for IPD was the Regional President of SpawGlass Contractors, who was periodically involved in the process. There was no real need for an IPD team facilitator or champion of the process as all parties felt their collaborative relationships were already well established. As the contractor’s PM stated, “I don’t know that there is one direct person that is heading the IPD concept; it is all of us just working through it together.”

The architect did have to invest effort in educating their consultants on IPD. Because of a lack of familiarity with the contract “there was some hesitancy on their part.” Ultimately, the architect got them to agree, primarily based on their previously established relationships.

The Collaborative Project Delivery (CPD) team members did little to no preparatory research to familiarize themselves with the process, see Early Planning for more information.
### Firm Selection

The firm selection process was not motivated by IPD. SpawGlass had not decided to use IPD when they issued the RFQ for the project. Although not motivated by IPD, the owner’s selection of the architect was relationship-based, factoring their positive past working experience and trust. Austin is a small design and construction community and all parties assumed collaborative process would be followed regardless of delivery method. As described by the contractor’s PM, “In the end it became more of a relationship thing than anything else; a comfort level with someone we had worked with.”

SpawGlass discussed the BIM and LEED goals in the selection process. IPD was not discussed.

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<td>SpawGlass Contractors</td>
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</table>
### Team Selection

Like the firm selection process, team member and consultant selection was primarily based on familiarity and past working experience. When the idea of using IPD was introduced, there was some reluctance from the architect’s consultants, but eventually everyone accepted this approach. The team held an all-project team member kick-off meeting where they discussed IPD and use of BIM. At that meeting all team members committed to the goals of the project.

SpawGlass did not have any specific team member criteria except to ensure their BIM manager was assigned to the project.
Early Planning

Resources Referenced
- ConsensusDOCS 300 Agreement
- Discussion with IPD Attorney

A local attorney specializing in IPD introduced the idea of IPD to SpawGlass and helped to spur the initial IPD interest. The attorney offered to consult on the contract, but SpawGlass had a strong relationship with the architect and felt comfortable working through the contract with them without hiring an attorney.

In general, the Collaborative Project Delivery (CPD) team did not do any preparatory research to plan for differences in the IPD process as compared to more familiar methods such as design-build or design-bid-build. As one team member stated, “we did not sit down and lay out a plan based on the contract. We all just jumped in.”

The team did not consider any kind of redistribution of project effort in anticipation of the IPD process. At the time this study was conducted the team, especially the architect, had found that more hours were required in schematic and design development phases. It was difficult for anyone to distinguish if the additional time and effort was attributable to IPD or the implementation of BIM, which was relatively new to both architect and contractor.
Implementation

Although the ConsensusDOC 300 makes reference to using Lean Construction processes, such as the Last Planner System, this team has not implemented unique IPD tools in this project to facilitate collaborative behavior.
Early Involvement

CM/GC Feasibility/Programming
Trade Contractors Construction Documents

The owner/contractor and architect worked together from the beginning of the project, with ongoing constructability and cost estimating reviews. Constructability reviews were done on a weekly basis with SpawGlass and BGK Architects from schematic design phase through construction documentation. Cost estimating occurred multiple times throughout the project at major phase milestones.

The MEP consultants and contractors were not brought on until construction documentation phase (CD), indicating that in this project their involvement was similar to projects using design-build delivery. However, unique to this IPD project, SpawGlass eliminated the bid process for selection of the MEP sub-contractors. The MEP consultants contracted during CDs will carry the project through construction.

Both SpawGlass Construction and BGK Architects agreed that in the future they would bring sub-contractors on earlier in the process, before the CD phase.
### Transparency

Contract section 8.2.8 Accounting Records required the contractor and trade contractors to maintain cost accounting for all work performed under unit cost, actual costs for labor and materials. The agreement assured the Management Group access to the records.
**Decision Making**

The Management Team met once a week. The team consisted of two managers from SpawGlass, a manager and a principal from BGK architects, and occasionally the Regional President from SpawGlass who also makes decisions on behalf of the owner, SpawGlass Real Estate. During the times when the owner’s rep was not available for the weekly meeting, the team reports that their decision making process is slowed. Depending on the issues discussed, other consultants were brought into the weekly meeting as needed. Because the owner and contractor were essentially the same entity, most project decisions could be made between the contractor and architect. SpawGlass had a Board of Directors responsible for approving final costs.
Culture

Early and ongoing constructability reviews between SpawGlass Contractors and BGK Architect provided opportunities for team members to understand each other’s processes and hold discussions more detailed than any they had previously experienced. As the contractor’s PM stated, “it forces you to go over every little nook and cranny of what you are looking at to a certain degree and figure things out together.”

Though the degree of interaction was intense, team members agreed that traditional roles remained unchanged compared to teams in conventional delivery methods.
### Workplace

**Not co-located**

The team was not co-located. The team used the weekly meeting (see [Decisions Making]) for face-to-face interaction. Shared BIM viewing was productive but limited by conventional arrangement of individual computer screens and lack of co-location (see [Information Sharing]).
Information Sharing

Tools
- Email
- Conference Calls
- Networked Project Management Site (document sharing)

SpawGlass maintained a project ftp portal that gave everyone access to the Revit model and information.

Meeting Frequency
- Weekly Team Meeting
- Topic meetings as required

In the weekly meeting, the team reviewed project drawings and addressed other issues and concerns as needed. Weekly meetings are not unique to the IPD process and the team commented that these meetings would have occurred regardless of delivery method. Some of the most valuable meetings were held around the computer screen of the project architect, which allowed the team to review in real time and assist with team design decisions.

In this project, similar to conventional projects, documentation of the meetings and distribution of minutes and action items was the responsibility of the architect. The weekly meetings were the most formal means of Collaborative Project Delivery (CPD) team interaction. Other interactions were informally documented and consisted of phone calls and email between all team members including design consultants.
BIM

Model Manager
- Contractor (SpawGlass)

Management Protocol
- ConsensusDOCS 301, Building Information Modeling (BIM)

This project used ConsensusDOCS 301, Building Information Modeling (BIM) Addendum, to allocate BIM responsibilities among the Collaborative Project Delivery (CPD) team. SpawGlass Contractors was identified as the BIM Information Manager, which made them responsible for regulating access to the model and linking together individual models into a Federated Model. Each model provided to SpawGlass by consultants and trades were linked to the base model but each maintained its own identity and integrity. Each party was therefore responsible for their individual contributions to the Federated Model.

The CPD team used Revit. SpawGlass had been using Revit in exploratory ways in the 2 years preceding this project; this was the first project that they fully incorporated BIM. BGK Architects had used Revit on two projects before the SpawGlass Regional Office.

The BIM Execution Plan (BEP) was developed as a separate addendum as required by ConsensusDOCS 301, and it defined the modeling protocols for the CPD team. The BEP defined which models were needed and described their intended use. Certain design models were chosen to serve as contract documents, the expected level of detail (LOD) at various project milestones was outlined, schedule and procedures for delivering the models to the Information Manager were determined, and dimensional accuracy requirements established. The CPD worked through the development of the BIM Execution Plan and collaboratively established responsibilities, protocols, and deliverable requirements.

According to the team, the Federated Model will meet construction needs. They intend to use the model in construction for layout and the subs will use the model for production and fabrication. However, according to the contract, the individual model authors are not held to a certain level or accuracy and states that the “model can be used for reference only and all dimensions must be retrieved from the drawings.”

At the time this study was conducted, the team had found the model to be most valuable for project visualization. It improved team communication and ability to make design decisions collaboratively. The team was not using the model for schedule, quantity take-offs or cost estimating at the time of this study. The CPD team planned to use the model for clash detection.

SpawGlass was also working to develop proprietary building management software to assist in building operation. They intend for this project to be a test case they can use to demonstrate this software to future clients. The software will link the BIM model to facility maintenance schedules, energy management, and equipment information to assist in facility management.
## Project Description

**PROJECT**
Edith Green Wendell Wyatt Federal Building Modernization

**LOCATION**
Portland, Oregon

**BUILDING TYPE**
Office - Renovation

**CONTRACT**
Multiple independent contracts–Custom (modified P-100)

**OWNER**
General Services Administration (GSA)

**ARCHITECT**
SERA Architects

**CONTRACTOR**
Howard S Wright (HSW)

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## Project Characteristics

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## Team Size

114 individuals

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## Building Size

525,421 sq. ft.

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## Project Cost

$123,151,653

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## Schedule

11 months design  
30 months construction
In 2006 General Services Administration Region 10 (GSA-R10) hired SERA Architects to complete design services on an extensive modernization of an existing 18 level government building housing 16 different federal tenant groups. The modernization project consists of two packages to be designed concurrently: 1. Base Building - Core/Shell and 2. Tenant Improvements. The original contract called for a traditional design-bid-build delivery model, but funding was not approved and the project was put on hold.

In 2009 the project was reinstated under the American Recovery and Reinvestment Act (ARRA, also known as Stimulus Funding), which required the scope of the project be revised to align with the High Efficiency Green Building requirements. In order to procure ARRA funds, a Guaranteed Maximum Price (GMP) was required by September 2010. GSA renewed their contract with SERA Architects but to meet the 2010 deadline, GSA recognized they would not be able follow their traditional P100 contract process. SERA estimated using the P100 would require 27 months to establish GMP, but a modified version using integrated delivery processes could meet the required timeline. Howard S. Wright Companies (HSW) was selected as the CMC (Construction Manager as Constructor) and was awarded the contract in December 2009, leaving approximately 8 months to revise the project scope and design and establish the GMP.
**Market Position** was a primary driver for GSA to implement IPD on this project. GSA Region 10 is using this project to measure the advantages of the process in order to transition their organization to using IPD exclusively. There goal is to position themselves as long-term leaders of innovation within the industry, helping to ensure that as the owner, they will have their pick of the best teams in the market.

**Cost Predictability** was an important motivator in general for GSA to use IPD.

**Schedule Predictability** was the primary motivator to pursue IPD in this project. The project needed to establish the Guaranteed Maximum Price (GMP) within an 8-month period. Achieving this required early input of expertise, including the CM and trade contractors; this deadline would not have been possible with a tradition GSA delivery approach.

**Reduced Risk** was a primary motivator in general for GSA to pursue IPD. As a large government system with multiple facilities and building projects, implementing delivery processes that can be applied across multiple projects to reduce their risk exposure in terms of cost, schedule, and subcontractor claims is well worth the investment in IPD.

**Design Complexity** was a factor but not the primary motivator. As a modernization (renovation) of an existing building, the additional coordination between designers and trade contractors provided by IPD is considered a significant advantage and helps address unknown field conditions before construction.

“What is missing in the IPD narrative today, in all literature, is the whole issue of who is going to train people. The idea that you can take on IPD and the whole elephant in day one is not going to be successful. [We] have been talking about breaking down IPD in a series of pieces and having the owner digest features over a period of years because it is going to take a decade to get used to all the tools and aspects of IPD. It is not just a pick it up and go [process].” – Architectural PM, SERA Architects
Survey Data

Data analysis to come in phase two of study.
### Contract

#### Contract Type
- Multiple independent contracts – Custom (modified P-100)

#### Contract Issued
- May 1, 2009 - Architect/Engineer Contract Re-issued
- December 11, 2009 - CMc Contract

#### Procurement Method
CMc (Construction Manager as General contractor) Guaranteed Maximum Price with Construction contingency allowance and option shared savings.

As a federal organization, GSA strictly requires all projects follow their standard P100 contract; this requirement created obstacles this team had to overcome before they could adopt an integrated approach. GSA Region 10 issued separate A/E and CMc contracts that were adapted from the standard P100 agreement to include some reference to the integrated or collaborative process under the Scope of Work sections.

#### Commercial Terms
GSA's Contracting Officer feels strongly that tri-party arrangements are not necessary for Integrated Project Delivery, especially for public projects, which would require a change in legislation to move away from existing contract structures. He feels multi-party agreements are too much of a "quantum change" and that the financial incentives recommended for IPD can be done with existing contract forms by using award term and milestone payments.

The A/E contract contains some soft language about the collaborative philosophy and behavior expectations. The contract describes the integrated process as relationship based rather than transactional (paper) based and also explains the dynamic nature of IPD, expecting parties to "redefine and reinvent the way the work is done."

The CMc contract contains no reference to relational terms or the dynamic nature of the delivery process.

#### Implementation Tools
The A/E Contract states that this project is a test case for GSA to better understand integrated/collaborative delivery. The primary collaborative strategies referenced included early involvement of constructor (sub-consultants and sub-contractors) and collaboration with the constructor to review cost, schedule, constructability and material selection. The contract also defines decision-making criteria to be in the "best interest of the project" and outlines tools for task management.

The CMc Contract, issued 7 months after the A/E contract, has more specific language describing tasks and commitments required such as: attending bi-weekly design review meetings, ongoing constructability reviews, input on resolving issues identified through constructability reviews, advanced determination of procurement packages, ongoing value engineering, assistance with LEED certification, and development of shared project team management processes and protocols.

To more fully define the IPD process, a separate document was developed by the IPD team, called "CMc+6 Delivery." This document was not referenced in the original contracts but was adopted by the team in January 2010.

To comply with the P100 requirements, the integrated team developed a "P-100 2009 to CMc+ 6 Deliverable Crosswalk", a line-by-line translation of the P100 deliverable requirements to CMc+6 integrated delivery equivalent.

The CMc+6 Delivery document incorporates AIA's definition of IPD, "an approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction." The "+6" refers to six collaborative strategies:

1. GSA providing on-site management
2. First tier sub-contractors are included on the team before contract documents are developed
3. Key first tier sub-contractors were selected as part of the CMc solicitation process
4. Integrated document development
5. Shared co-location facilities
6. Optimized building information modeling

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Goals

Process
GSA took a leadership role in clearly articulating project goals and aligning team members with those goals. Goals included both team and project design performance goals.

Goals
One of the primary drivers for using IPD was schedule. Meeting the September 2010 GMP deadline was critical to securing funds for the project.

The primary design performance goal was meeting the High Performance Green Building design principles. This goal was clearly communicated during a two day High Performance Building Workshop. Attendees included the A/E team, GSA and interested contractors (workshop was held prior to CMc selection).

Communication and Alignment
Because GSA Region 10 would like to move away from the P100 conventional methodology to and integrated delivery process, they outlined specific measures to track metrics throughout the process including: schedule, cost, constructability, document accuracy and reduction of design overwork and rework. These team performance goals were clearly articulated in the CMc+6 Document and data will be used to both improve the process and document the advantages in order to articulate the benefits of this delivery method to Congress.
Due to the start-stop-start history of the project there are several different incentive structures on this project. Standard GSA contracts require quarterly performance evaluation reports that assess approximately fifty elements of effort. Coupling this standard performance evaluation with contract administration allows GSA to monetize performance.

The A/E team does not have any financial incentives tied to project metrics because the original design work was completed under the conventional P100 process. GSA clarified that if they could start this project from scratch they would have negotiated a fixed fee reduction with matched risk/reward. For example, if the architect proposes a 15% fee, the owner would agree to pay 7%, placing an additional 8% at risk. Incentive payments would then be determined by mutually determined performance goals, which would be tracked and measured throughout the delivery process.

The CMc has financial incentives, however the measures had yet to be defined at the time this case study was conducted. GSA indicated they plan to follow their past practice, tying incentives to both a base team performance criteria as well as a percentage of their value added. Value added is based on the amount of value engineering the CMc identifies throughout the process up to a certain cap amount. For this project, a 1% reserve is tied to base team performance and 25% of all the value created limited by a one million dollar cap.

Other incentive strategies GSA typically uses include award term incentive and “Best in Class” recognition. The award term incentive ties into the performance evaluations monitored by the GSA representative. Each time GSA initiates a change order, they have the right to re-contract. This ensures that contractors are aware they “have to earn their right to work.” Additionally, GSA is currently developing a “Best in Class” recognition process to evaluate and catalog sub-contractors that work over a hundred hours on a project and meet performance goals. The CMc follows a formalized process to evaluate sub-contractors established by GSA. The names of these companies are placed on a plaque in a prominent and accessible location in the building and are noted in a GSA catalog, helping recognized contractors secure future work.

The risk/reward mechanisms in this project follow typical GSA evaluation processes but are innovative in their incentive strategies.
**Liability**

There is no specific limit on liability or “no-sue” clause in the contracts.

**Dispute Resolution**
Both the A/E and CMc contract specify use of Alternate Dispute Resolution practices; these procedures include “negotiation, facilitation, mediation, fact-finding mini-trial, arbitration or any combination thereof.” This is standard to GSA projects, but is similar to Dispute Resolution Processes required in standard form IPD contracts, such as the AIA C-191, ConsensusDOCS 300, and Sutter’s IFOA.
**Insurance**

No unique characteristics, standard professional liability products used.
### Leadership

**Champion**
- Owner

**Team Structure**
- Executive Team
- Project Management Team
- Subject Matter Experts (SME)

GSA Region 10 is driven by the philosophy that the owner needs to set the value proposition, i.e., “this is my project, my money, my problems and this is what I expect of you.” The owner is ultimately responsible and therefore can’t sit back in a typical role but needs to take an active role in driving the process and managing risk.

To be an active manager of the process, GSA R10 believes the owner needs to be on-site, engaged in the integrative process and forming relationships, instead of hiring agents to be owner’s representatives. Often this is a challenge, especially on the institutional side where GSA owners are operating in large bureaucracies that are inherently risk adverse.

Currently GSA’s officer is only half time with this project, but believes IPD should require the owner to be on-site full time due to the resource intensive nature of IPD. Investing in IPD is a strategic decision and the owner needs to be prepared to provide the resources around it.

**Team Structure**
Direction comes from the executive team whose members consist of very involved, high-level representatives and project managers from the owner, architect and contractor. The executive team has several lengthy meetings every week and project managers break out from those sessions and distribute information to the integrated team members.

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**PROJECT**
**Edith Green Wendell Wyatt Federal Building Modernization**

**LOCATION**
Portland, Oregon

**BUILDING TYPE**
Office - Renovation

**CONTRACT**
Multiple independent contracts – Custom (modified P-100)

**OWNER**
General Services Administration (GSA)

**ARCHITECT**
SERA Architects

**CONTRACTOR**
Howard S Wright (HSW)
Firm Selection

Because of the start-stop-start history on this project, the team selection process was different than GSA’s ideal integrated project. In a more typical situation, GSA would have hired the A/E and the constructor, then helped with the selection for the first tier sub contractors. GSA would bring on the sub-contractors as early as practical, using a source select or best value select.

GSA is in the process of writing criteria for successful team selection; they have identified a few criteria that appear to be critical for IPD teams. One is familiarity among team members, which develops an instinctual dynamic. Another is passion among each team member demonstrated by a real desire and commitment to work with others, learn and innovate for the good of the project.

Architect
SERA was selected for several reasons: they had already done the initial design for GSA, had performed well and were committed to GSA’s integrated collaborative delivery.

CM/GC (or CMc)
An RFP soliciting contractors for the project was posted to GSA’s FedBizOpps (fbo.gov) website in late April 2009. The RFP invited contractors to attend the High Efficiency Green Building re-scoping workshop in May 2009 and indicated that the project would include a 9-month design phase contract with bi-lateral option for a construction phase contract. Unique to the RFP, contractors were required to submit recommendations for the five first tier sub-contractors. Thirteen construction firms participated in Early Exchange meetings with GSA Region 10 where they discussed the project history, design goals, and various site, budget and schedule constraints. The integrated delivery process was a key topic in the Early Exchange meetings; it was made clear all applicants had to strongly support a collaborative approach. The final selection of Howard S Wright (HSW) was based on their high scores on technical factors including qualifications, past performance, and key personnel. GSA also considered their conceptual cost estimate and pricing for design phase services.

Trades/Subs
HSW selected the five first tier sub-contractors, although GSA Region 10 wanted as much input as possible in their selection and retained the last right of refusal. GSA's source selection team had some reservations on HSW's evaluation and selection process; however, GSA awarded the contracts according to HSW's recommendations, conditional on re-evaluation during the design phase. Design phase evaluation assured GSA that the sub-contractors selected indeed offered the best value and had the technical capacities to put the documents together.
Team Selection

The current team observed that integrated/collaborative delivery creates an environment that may not be compatible with every personality. Selection of team members is critical to IPD. For the architects, selected team members met two important criteria beyond the designated skill set: an ability to take input from multiple sources and capacity to keep an open mind.

When team members did not fit in with the culture, project leadership replaced them. GSA characterizes integrated delivery as a dynamic process that is not about solving one problem but rather a series of problems. “When issues arise, the problem may be with scope of the project or could lie within the team composition itself.” The leadership was very deliberate in assessing team members and at the time this study was conducted had replaced the original electrical designer, mechanical designer and landscape designer.

Technical Modelers Selection

BIM modeler team members primarily had to be technically adept; less emphasis was put on relationship building skills. Based on past experience, SERA found that modelers at different levels of experience and techniques created problems and so they developed a bibliography of techniques and abilities expected of each member of the team. They supplemented the selection process with training and orientation, developing rules and guidelines to guide this process.

After the primary technical team was selected, team members were involved in selecting the partnering technical staff, ensuring that modeling techniques and skill sets matched those of the primary team.
## Early Planning

**Resources Referenced**

- Experienced IPD Team Member (Owner Representative)
- AIA IPD Resources
- Sutter Health IFOA
- Peer reviews of process by industry partners

GSA Region 10 (GSA R10) has been maturing their collaborative processes for the past 10 years, with philosophy and strategies rooted in process-based management. Process-based management focuses on designing outcomes, making tradeoffs to optimize time, and uses statistical quality control.

For this project, GSA R10 also incorporated IPD practices based on lessons from AIA and Sutter as well as invited peer review. When DLR and Mortenson were asked to informally review the team’s practices and project execution, this process infused the project team with new ideas.

As noted in the contract section, additional effort was required early in the project adapting the P100 process to align with this integrated/collaborative process. This required the team to review the contract line-by-line, identifying conflicts in the contract and changes that needed to be made.
Implementation

Tools
- Custom
  - Master Schedule
  - miniMaster Schedule
  - Snap Shots
- Co-location
- BIM

Critical to this project is the Master Schedule (MS). The MS is created through a structured decision-making process that documents, sequences and prioritizes all the work and establishes team protocols required to execute the project. The process of developing the MS functioned as a “knowledge capture” tool and helped mature relationships within the team.

Initially, the core team developed the MS. It continued to evolve through each design phase as the team further identified and delineated all the major areas of work. GSA recognized that identifying non-priority items was equally critical to the team’s success as identifying priority items, because no project has the resources to do everything.

Through bi-weekly review at the executive level, this tool helped the owner identify items in which they were willing to “disinvest”. Development of the MS also functioned as a team building process. Working through MS items, the team learned to cooperate with each other and gained a clear understanding of the team dynamic demanded by the owner. This additional planning period provided the team the opportunity to work closely with the owner and each other, developing enough confidence and trust in their relationships and to speak candidly about what was really important to the project.

Based on the Master Schedule several mini Master Schedules (mMS) were developed, detailing how each task would be accomplished. After each MS meeting, the team reviewed the mMS to identify any missing items and prioritize work. The process of developing mMS agendas for breakout meetings helped catch items requiring additional meetings. The MS and mMS were so effective in recording tasks and responsibilities that traditional meeting minutes became unnecessary.

One aspect of the mMS process that helped foster a sense of ownership across the team was the assignment an individual team member to specific task items. Individuals identified as Subject Matter Expert (SME), see Team Structure, were responsible for resolving their assigned items through whatever means necessary. This created a system for decision-making and responsibility that led to distributed leadership. Creating multiple scales of project disciplines will result in coordination issues, review any outstanding engineering required for custom elements, and take time to redefine deliverables for subsequent Snap Shots, see BIM use.

Co-location and BIM worked in tandem with the implementation process described above. Co-location of the team provided significant coordination benefit, enabling informal daily interactions. BIM, coupled with co-location, facilitated design and real time coordination that allowed most issues to be resolved within a matter of minutes.
Early Involvement

**CM/GC**

**Criteria Design**

According to GSA's Senior Contracting Officers: “One of the real values of integrated delivery is the ability to get each team member saturated before we start building. The more we can front load the schedule and the more we can allow the team members to influence the project when we are still on paper, the greater impact we get as owners in terms of change control -- cost, budget etc. Even the trade off we made, allowing HSW to pick the first five sub-contractors, the value of having those people follow the same orientation track as our prime, we felt was a legitimate tradeoff [when compared] to waiting and hiring sub-contractors.”

The architect and CMc were brought onto the project at different times. The CMc, Howard S Wright (HSW), was involved in early meetings and followed the progress of the project prior to being contracted. Toward the end of criteria design, HSW, along with five trades, were brought onto the team, allowing them to participate in detail design and later phases. GSA appreciated the value of involving the contractor early; eliminating the buy out effect of bidding gave GSA better control over performance, cost and schedule risks. They estimated that by bringing on the subcontractors early, over 60% of the owners cost exposure was known before construction started.

Once the team was in place, GSA's priority was to align the team's goals, build relationships and the team support infrastructure. The GSA representative stated, “I am buying that high performing team work.” GSA facilitated the orientation and relationship building of the entire team by using several strategies, many of which are rooted in process-based management such as: designing outcomes, eliminating waste and making the system as efficient as possible.

One of the most unique aspects of this project was the intensified planning of the work. GSA found it challenging to get the team members (contractor, architect and consultants) to slow down and build the team before beginning the work. The team-building step was facilitated by the Master Schedule process, also described in the Implementation section above, which began shortly after SERA's contract was reinstated. The MS process continued for 4 months before the contractors were on board and 2 more months while the contractors went through the orientation phase. The six months of planning, identifying problems, analyzing issues and clarifying the goals was “excruciating” for some members of the team who wanted to begin designing sooner. However in hindsight, most agreed that the longer process allowed the right person to come in and be exceptionally effective at the right time, reducing wasted effort. The GSA representative asserts that as an owner, GSA “can get anybody to do the drawings” but they prefer to pay for a high performing team – one that can define the problems, find alternative solutions and affirm the owner’s requirements.

**Budgeting Team Effort**

Budgeting for additional involvement and effort up-front is one of the challenges for any IPD project. The IPD process is far more dynamic than the typical GSA delivery methods. The conventional P-100 contract lists tasks for which the architect estimates hours and price. GSA then asks an impartial reviewer to follow the same process and arrive at an independent estimate. The two estimates are compared and price negotiated. IPD tasks and activities did not fit the P-100 list and it was unclear how their normal budgeting processes could be adapted.

GSA adjusted their budgeting process by converting the basis of the planning phases to time and materials (T&M) instead of their typical fixed price. This increased the risk to the owner, but since the technical requirements of the program were not completely understood, this was a more equitable way to budget. GSA increased meeting frequency to mitigate the team’s performance risk. T&M reduced the team member risk since all their time was compensated. This reduced risk and the detailed Master Scheduling process allowed the team to develop very accurate proposals for the fixed price agreements in the Design Development and Implementation phases, ultimately reducing risk to the owner.
## Transparency

The CMc’s contract specified “open book” access to any and all records maintained by the contractor relating to the project, including all subcontracts. This also gave the GSA the right, but not the obligation, to attend all project meetings.

GSA also followed a “reverse open books” strategy. GSA showed their budget and planned allocation to the team. The openness of this communication modeled the transparency the owner expected from each team member and set realistic expectations for GSA’s resource distribution.
### Decision Making

GSA wanted roles and responsibilities to emerge through the development of the Master Schedule, see Implementation. At first, this caused confusion as team members tried to work in their traditional roles. Core areas of responsibility were not assigned until the Master Schedule was complete and scope was clear.

GSA followed the philosophy of “intentional maturation” of the team. Team members who come on board with different expectations based on the way they’ve done it previously need to adapt and adjust to others, thereby calibrating the team. This can be particularly difficult for those team members who have been in the project management role, or sole decision maker, because the integrated team is entirely based on distributed decision-making and exploitation of multiple areas of expertise. The Master Schedule process facilitated distributing leadership. Team members best suited for a particular task item or issues were assigned as Subject Matter Experts (SMEs), responsible for bringing the item to resolution and closure, see more under Leadership and Implementation.
In this project, the team reported that the IPD process reinvented how they thought of the work, redefining their relationships to create a team synergy. They concluded that the goal and value of IPD is innovation, which invigorated their team and kept the energy level high.

The team commented that in IPD, the best value is created when team members free themselves from their traditional roles and responsibilities. To do this, the team requires one member to bring energy and passion, breaking others out of old routines and preventing them from slipping back into traditional roles. In this project, the owner is taking this role, acting as a champion for the IPD process. Because of the time committed to team education and relationship building, GSA's leadership methods rubbed off on the entire executive team and create a distributed network of champions throughout the project team.

Constant reminders were required to eliminate biases formed by past experiences in the design and construction industry. To establish new team norms, the owner maintained a controlled tension that kept team members off guard.

GSA representatives understood that this way of working required significantly more senior and highly qualified people than would typically be used on a traditional project. These staffing decisions did not lead to a scripted top-down project but created an atmosphere where the team scripted the project throughout the whole process. To facilitate the scripting process, expertise needed to be gained incrementally, allowing the members to evolve alongside the process.

The executive and management team used several management and social strategies to achieve the value proposition of IPD. See more about these under Leadership, Implementation, and Early Involvement.
Workplace

Co-located - full time

The integrated team is co-located on the project site, in existing offices of the federal building they are modernizing. In order to assess the outcomes of co-location, GSA periodically required that team members rate their experience compared to previous projects and typical work environments. Members rated: physical plant, team spirit, professional development, productivity, innovation/improvement, and integrated BIM.

Results from the first survey showed very positive evaluations regarding the effect of co-location on professional development, team spirit, and the use of BIM. The majority of the team felt innovation and improvement was equivalent to non co-located experiences, though only 2% felt it was worse while 17% felt co-location improved innovation. Productivity had the least consensus, with 14% of team members ranking productivity in the co-located office worse than non co-located experiences, 28% felt productivity was the same, and 18% felt it was better. The physical work environment itself consistently scored low. The survey process also revealed that certain individuals consistently evaluated their experience as worse than previous experiences. GSA speculated that age and previous private office culture might have been factors, indicating that some personnel do not thrive in a co-located environment.
### Information Sharing

**Tools**
- BIM
- Face to face exchange – co-location
- Networked document management site

**Meeting Frequency**
- Weekly Coordination Meeting
- Monthly Clash Detection and Energy Model Verification Meetings
- Monthly Project Executive Meeting
- Monthly BIM Review Meetings through Criteria Design
- Daily BIM Meetings from Detail Design into Construction
- Daily Information Coordination Meetings
- Specialty Meetings as needed
BIM

Model Manager
• Architect (SERA)

Management Protocol
• Custom Building Information Modeling/Management (BIM/M)

GSA would like to push the use of Building Information Modeling (BIM) to its fullest extent but actual implementation lags behind expectations. The architect and contractor worked to add the schedule dimension (4D) to BIM, however incorporating knowledge from trades’ prefabrication schedule to cost models has proven difficult.

SERA took the lead role in assembling the model. They spent a great deal of time working out the different deliverables for all the major disciplines, architecture, structural, mechanical, electrical, plumbing. The hand off to the builder will occur at logical points in the process. Because of the early involvement of many disciplines, the architect need only to model to conventional levels of detail required to facilitate coordination of shop drawings.

GSA is monitoring and measuring the advantages of BIM and will continue to monitor change order reduction and constructability issues throughout construction. To help make the case for IPD to congress, GSA Region 10 has a target change order rate of less than 3%; typically congress would fund a renovation project at a 9% change order rate.

BIM Use
This project is using the BIM model for coordination, clash detection, constructability reviews and scheduling. To advance the use of the model in design and construction, GSA pushed SERA to use it for tenant communication and virtualization and HSW to use the model for field layout.

Although more scheduling power could be harnessed, this is the first project for GSA Region 10 to achieve 4D with BIM. Eventually, GSA would like HSW to conduct cost estimates (5D) with the model and bill material outputs to each subcontractor using it as a calibration tool.

The model has been very effective at facilitating coordination between the many disciplines and providing confirmation from those who will build it. For example, the owner made a complex change request to revise the ceiling heights from 9’ to 9’-6”. The team was able to effectively communicate with all the affected team members and made the change almost instantly. This flexibility alone provides significant benefits to the owner; however currently there are also major vulnerabilities and risk due to the variety of proprietary software that may cause errors when the model is translated to the different trades. GSA is trying to track interoperability issues as they arise so that they can effectively predict translation issues and mitigate risk for future projects.

The team has found two primary challenges as they use BIM to create implementation documents upon which sub-contractors’ coordination and fabrication drawings are based.

First was learning how to articulate design/model requirements for the different disciplines. The team found that they were being too literal with the requirements for each discipline and phase. They found they couldn’t predict (or expect) that mechanical or electrical follow the same design path as structural or plumbing, and in some cases this was forcing architectural decisions to be fixed earlier than required for contractor buyout. To address this and track each design path, the team used what they called Snap Shots; literally taking pictures of design development status, using Revit to print drawings at particular points in time, see

Implementation. Each Snap Shot was a deliverable package that was increasingly specific by discipline or building system as the project evolved to match the contractor’s need for procurement and buyout. Snap Shots would not have been effective without the intense coordination made possible by co-location and early contributions by the trade contractors.

The second BIM use challenge is determining the deliverables for the project. Traditionally GSA would be provided with a marked up print; however in this project they are receiving a model embedded with a great deal of information including construction photos and digital survey information. Part of the challenge to deliverable definition is they are “still making the sausage” and aren’t exactly sure what it will look like in the end or what use they will require.