Business Case Analysis Report
for
O'Hare Modernization Program (OMP)

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1.0 Executive Summary

1.1 Background and Rationale

The Federal Aviation Act charges the Federal Aviation Administration (FAA) with providing for a safe and efficient National Airspace System (NAS). O'Hare International Airport (herein O'Hare) is a critical part of the NAS and must operate efficiently to meet this Federal mandate. Capacity and delay issues at O'Hare have created an urgent need for FAA to address those issues in both the near-term and long-term.

O'Hare is owned and operated by the City of Chicago (Sponsor) and is located on 6,804 acres of land primarily in Cook County, although approximately 1,400 acres on the west side of the Airport are located in DuPage County. The Airport is located in northeastern Illinois, within the city limits of Chicago, Des Plaines, Schiller Park, and Rosemont, approximately 17 miles northwest of the Chicago Central Business District.

O'Hare has for decades been numbered among the busiest airports in the world and in 2003 was number one in terms of total annual operations (931,422 in calendar year (CY) 2003); operations defined as total number of arrivals and departures. As our nation's commercial aviation industry experienced a marked increase in activity throughout the 1990's, O'Hare experienced a 15% increase in operations between the years 1990 and 2003. Following the events of September 11, 2001, while commercial aviation activity in general declined and experienced a slow recovery, O'Hare rebounded to pre-September 11 levels by late 2003. During calendar year 2004, O'Hare handled 992,471 operations, second only to Atlanta-Hartsfield airport.

O'Hare commenced commercial service activity in 1962, and the last new runway was added at in 1971. Since that time, local/state political differences and restrictions imposed by court orders resulting from litigation prevented further expansion or reconfiguration of the airfield. As operations increased throughout the 1980s and 1990s with no substantial airfield expansion, delays at O'Hare increased. Various efforts on the part of the City of Chicago and FAA to implement delay reduction measures not involving new runways were undertaken throughout that time, including the O'Hare Delay Task Force initiatives of 1991 and 2001. More recently, FAA has implemented various efficiency enhancement initiatives, including Collaborative Decision Making and the "Growth without Gridlock" initiative, intended to address delays at O'Hare and throughout the nation's aviation system. Finally, in 2004, FAA worked with airlines serving O'Hare to agree upon voluntary limitations to scheduled arrivals at O'Hare during peak hours, to maintain an arrival rate in line with O'Hare's' current capacity.

Concerning longer-term efforts to address capacity and delays at O'Hare, in 2001 the Governor of Illinois and Mayor of Chicago agreed in principle to pursue the modernization of O'Hare to address future aviation demand. At present, FAA is assessing the Airport Layout Plan and Master Plan it has received from the City for the O'Hare Modernization Program (OMP). Since receipt of the proposal, FAA has undertaken a technical and environmental analysis of the plan. FAA's projected schedule targets issuance of an Environmental Impact Statement (EIS) Record of Decision (ROD) concerning the OMP in September 2005.

1.2 OMP Status and Program Cost, Schedule and Benefits

The Sponsor's proposed full-build program will result in a major reconfiguration of the current O'Hare airfield, should the OMP EIS be approved. The end-state configuration (calendar year (CY) 2013) will have a total of eight runways: six parallel east-west runways, and two crosswind northeast-southwest runways. The Sponsor will fund on-airfield developments including two new Air Traffic Control Towers (ATCT), Navaids, Communication and Surveillance Facilities. The FAA will fund OMP-related airspace redesign. OMP will be completed in two major phases (see below) and spans a ten-plus year implementation.

The two major phases of OMP consist of the following:

- Phase 1 is segmented into three sub-phases to include construction of two new runways, a new north satellite air traffic control tower, extension of an existing runway, and construction of the initial portion of the new West Terminal Complex, and decommissioning of an existing runway.

- Phase 2 includes extension of an existing runway, construction of two new runways decommissioning of two existing runways, and completion of the new West Terminal and new south satellite air traffic control tower.

This Business Case supports development and implementation of Phase 1 only.

The Sponsor's Phase 2 funding is not yet finalized. The vast majority, however, of FAA's OMP capital costs occur in Phase 1. If this Business Case is funded as requested for Phase 1, there are currently no known Phase 2 costs for additional FAA airspace or surveillance investments, or costs at associated Chicago area facilities. The only additional known FAA costs for Phase 2 will be Operational and Maintenance (O&M) costs, additional positions and frequencies at the Chicago Terminal Radar Approach Control [TRACON] (C90), staffing for both Air Traffic Organization Terminal Services (ATO-T) and Air Traffic Organization, Central Service Area, Engineering Services, Facilities and Equipment (ATO-W), and possible capital costs associated with the planned new south satellite control tower.

The proposed full OMP also involves relocation of most existing navigation aids, placement of new navigation aids, revision to existing air traffic control procedures, provision of a new western access to the Airport, terminal and gate facilities, and relocation of various roadways and rail lines. As required or requested by the Sponsor, FAA participation in the non-recurring aspects of most of these activities will be covered under reimbursable agreements with the Sponsor. Figure 1.2-1 below depicts the present airport layout and proposed layout for OMP Phase 1.

The City of Chicago's Airport Layout Plan (ALP) for the redevelopment of O'Hare International Airport involves the reconfiguration of the existing airfield to essentially an East/West orientation, while at a minimum maintaining the current capacity at O'Hare during the construction. In order to achieve the stated capacity gains projected with the reconfigured airfield, essential airspace and infrastructure needs must be addressed. If the OMP is built, and no airspace infrastructure improvements are made, with traffic continuing to increase at the projected rate, delays will continue to increase. Utilizing the Total Airspace and Airport

Modeller (TAAM) modeling done for the OMP EIS, average annual delays are projected to be slightly more than 16 minutes per operation by 2013 even with the schedule capped at 974,000 annual operations, without airspace and infrastructure improvements. Chicago O'Hare Tower (ORD) handled 931,422 annual operations in 2003. This number has increased to 992,471 annual operations in 2004. Average annual delay (for all aircraft, across all configurations and weather conditions) for 2003 was 15 minutes. Average annual delay for 2004 has increased to 18.4 minutes. Every additional minute of average annual delay equates to roughly a $20-40 million direct operational cost to the users. Compared to 2002 (922,817 annual operations) and based on TAF 2002 data, traffic is projected to increase by 11.2% in 2007 (1,026,300 annual operations), 14.6% in 2009 (1,057,200 annual operations), 21.4% in 2013 (1,120,600 annual operations), and 29.4% in 2018 (1,194,000 annual operations – 5 years after full build, as required for environmental analysis).

In order to increase departure capacity, the OMP airspace redesign plan (also see Appendix E.1 OMP Airspace Redesign Plan Details) creates two additional routes to the east and two additional routes to the south. In order to accommodate the increased number of arrivals, an independent arrival stream from each direction, east and west, will be established outside of the existing four cornerposts. This stream and the arrival procedure have been labeled "High and Wide", wherein aircraft are routed above (higher) and outside (wider) than the cornerpost arrival stream. Chicago Air Traffic Control Center (ZAU) would establish the arrivals on the high and wide arrival outside Chicago's C90 current airspace; thus C90's airspace would require expansion, with concurrent expanded radar coverage. Additionally, the threshold of the first new OMP runway on the north side of the airport, is obscured by several hangar buildings, and therefore requires the building of a satellite control tower to be in compliance with current FAA directives.

1.3 Issues to Focus On

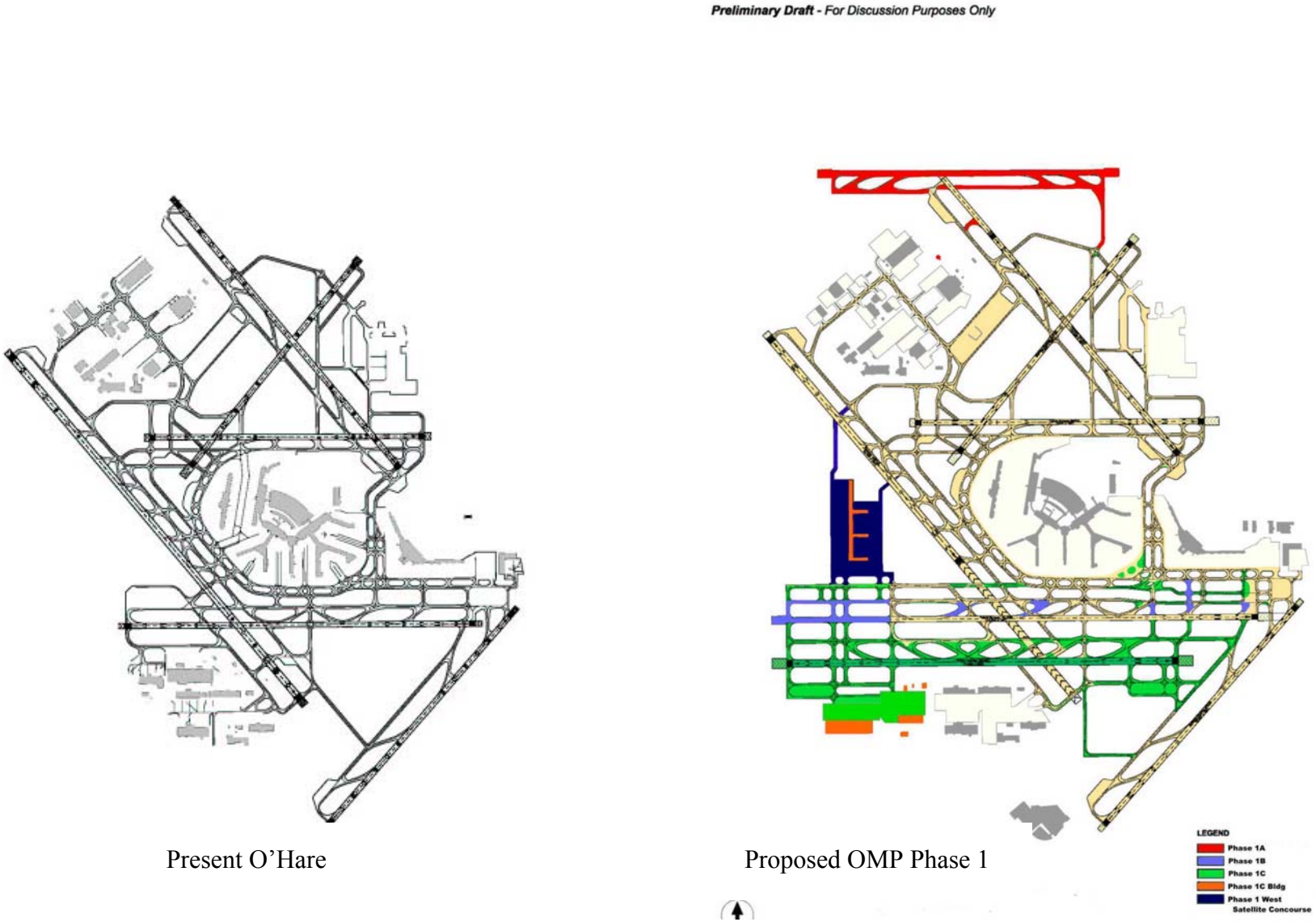
This document addresses planning work being undertaken by the Air Traffic Organization (ATO) for National Airspace System (NAS) requirements associated with the O'Hare Modernization Program (OMP) proposal, submitted to the Federal Aviation Administration (FAA) by the City of Chicago. The OMP has not been approved by FAA and can only be approved through issuance, by FAA, of a favorable Environmental Impact Statement (EIS) Record of Decision (ROD) and FAA's approval of an Airport Layout Plan (ALP) reflecting the OMP. It is acknowledged, however, that planning for NAS requirements in advance of the EIS ROD must be undertaken in order for FAA to be in a position to implement all necessary NAS changes in a timely manner (in conjunction with projected runway commissioning dates), should the OMP be approved by FAA. Information contained in this document reflects such planning work. Actual implementation of OMP-driven NAS requirements will not commence until after the EIS ROD. Any NAS implementation work reflected in this document that is in advance of the projected EIS ROD date is driven by NAS requirements that are separate and distinct from the OMP.

1.4 Program Interdependencies/Impacts

Aircraft into and out of ORD today are constrained by not only the airfield layout, which dictates the configuration (and thus the Airport Arrival Rate (AAR)), but also by the number of departure routes by which aircraft can access the overhead stream (and thus the Airport Departure Rate

(ADR)). Depending on the configuration, the theoretical balanced airport arrival acceptance rate can be as high as 100 per hour, or as low as 72, depending on weather. Currently, traffic out of O'Hare is restricted to two departure routes to the east and three routes to the south. In addition, this traffic must share these routes with traffic outbound from Chicago Midway Airport (MDW), and all other airports within the Chicago area. The majority of departure delays are encountered by traffic departing in these two directions. Departing eastbound, this means that during specific periods of the day, all traffic departing ORD and other Chicago-area airports with destinations to the east coast are required to be in-trail with all other traffic, even if there are no restrictions at their destination.

Thus, the 2004 limitation on terminal traffic mentioned in Section 1.1 will remain in place, to keep delays within manageable levels. The restrictions will slow all traffic from the Chicago metropolitan area, not just O'Hare. With the expected rate of traffic growth, both private and commercial, the limitation will more severely impact air traffic as time goes on.



Present O'Hare

Proposed OMP Phase 1

Figure 1.2-1 Present Airport Layout Plan (ALP) and Proposed OMP Phase 1

2.0 Program Description

2.1 Purpose

This document presents the Business Case for FAA's OMP Phase 1 for fiscal years 2005 through 2010.

- Sponsor's OMP Phase 1 work includes construction of two new/relocated runways: 9L/27R and 10C/28C; a new north satellite Air Traffic Control Tower (ATCT); extension of Runway 10L-28R (currently existing runway designated 9R-27L) and the initial portion of the new west terminal Gate Complex.

2.2 Scope

As discussed in the Executive Summary, both the Sponsor's OMP airfield and FAA OMP airspace reconfiguration need to take place in order to fully realize meaningful increases in current ORD capacity, reduce current delays, and avert future delays.

For the purposes of the Business Case, the focus will be on the FAA related efforts of the Phase 1 work, which is primarily airspace reconfiguration and FAA infrastructure changes to be completed by CY2009.

This Business Case will also be assessing three FAA operating alternatives regarding OMP. Alternative 1 is No Airspace Changes: OMP airport changes evolve without FAA airspace or procedural changes. Alternative 2 is Compressed Arrival Procedures (CAPS): implementation of procedures to increase traffic flows over existing four cornerposts. Alternative 3, the preferred alternative, is High and Wide procedures: this combines both airspace and procedural changes to optimize traffic flows to new OMP runways. See Section 7.1 Alternative Solutions for Accomplishing Agency Strategic Goals for details on the alternatives.

Many of the preferred alternative's airspace issues have been identified in the National Airspace Redesign (NAR) Plan, as outlined in the Great Lakes Integrated Design Plan (IDP). The Air Traffic Organization (ATO) has taken advantage of the NAR design and extracted those elements that are essential to maximizing the gains of the OMP. These redesign requirements are identified for each of the Chicago facilities; ZAU, C90, and ORD. The preferred alternative changes and associated requirements are outlined below.

2.2.1 Airspace Changes (Also see Appendix E.1 Chicago O'Hare OMP Redesign Plan Details and Appendix F. Air Traffic Operating Concept for OMP)

2.2.1.1 En Route Airspace Enhancements

- Create four new departure routes to support increased capacity (two East and two South)

- Create four new sectors at ZAU to support new departure routes and High and Wide procedures (two East and two South sectors)

- Divest airspace to adjacent TRACONs (Milwaukee, Wisconsin (MKE) and South Bend, Indiana (SBN)) and reconfigure the remaining airspace to support arrival procedures and release resources for new sectors

2.2.1.2 Terminal Airspace Enhancements

- Expand C90 airspace to accommodate OMP East/West runway re-configuration and associated High and Wide procedures
- Increase terminal radar coverage for C90 to accept control of aircraft at both a higher altitude and farther out than for the currently configured O'Hare

2.2.2 NAS Equipment Requirements

These requirements are not all inclusive, but are those FAA is responsible for funding. For the total list of equipment requirements, see Appendix B. Total List of Equipment.

2.2.2.1 En Route equipment requirements

- Four new Remote Communication Air/Ground (RCAG) channels
- Four new Back-Up Emergency Communication (BUEC) channels
- RCAG and BUEC Telco, and ZAU Traffic Management Unit (TMU) phone line

2.2.2.2 Terminal equipment requirements

- One Rapid Deployment Voice Switch (RDVS), Model 3080H, sized for C90
- Two Remote Transmitter/Receiver Channels (RTR) (MKE and SBN)
- Two Air/Ground Communications Backups Channels (MKE and SBN)
- Two Standard Terminal Automation Replacement System (STARS) Displays (MKE)
- Develop and implement Advanced Electronic Flight Strip system (AEFS) for ORD
- Establish five additional RTR frequencies and expand service volume of eight existing frequencies (C90)
- Increase Digital Voice Recorder System (DVRS) capacity (C90)
- Develop and procure Gateway Switch to interface Airport Surveillance Radar (ASR)-11 with C90 Automated Radar Tracking System (ARTS)-IIIE, for scheduled Rockford (RFD) upgrade to ASR-11 to provide required coverage for High and Wide operations

2.2.3 NAS Surveillance Requirements

2.2.3.1 Terminal surveillance requirements (Also see Appendix E.3 On-Field Surveillance Radar Justification/Requirements and Appendix E.4 Off-Field Surveillance Radar Justification/Requirements)

- Provide the OMP runway threshold radar coverage required for Category (CAT) II/III Instrument Landing System (ILS) approach capabilities on all east/west reconfigured runways
- Provide required ASR coverage west of airfield to implement OMP High and Wide approach procedures (Coverage is dependent on ASR-11 authorization for terminal

separation to 60 miles and TRACON software and hardware implementation. See Section 8.0 Risk Inventory, risk item "High and Wide Radar Coverage Availability" and Appendix E.4 Off-Field Surveillance Radar Justification/Requirements)

2.2.3.2 Staffing Requirements

- **Air Traffic Organization Terminal Services (ATO-T) Staffing**
  - ORD ATCT (both current and north satellite) - 16 Full-time Equivalents (FTEs)
  - MKE TRACON - Six FTEs
  - SBN TRACON - Two FTEs
  - C90 TRACON - 16 FTEs
  - ZAU- No additional staffing (net-zero changes)
- **Air Traffic Organization Technical Operations Services (ATO-W) Staffing (Also see Appendix C. ATO-W Staffing Requirements)**
  - Airway Facilities (AF) Staffing Requirements
    - ORD Communications System Support Center (SSC) - 3.64 FTE
    - ORD Navigation SSC - 2.06 FTEs
    - ORD Radar SSC - 2.29 FTEs
    - ORD Environmental SSC - 3.64 FTEs
  - ATO-W Engineering Services Staffing Requirements
    - Projected ATO-W (Central Service Area, Engineering Services, Facilities and Equipment (legacy NAS Implementation/ANI) Staffing Requirements Generated by Airspace Redesign

      FY2005 - 1 FTE

      FY2006 - 11 FTEs

      FY2007 - 3 FTEs

      FY2008 – 1 FTE
    - Projected ATO-W Engineering Services Staffing Requirements Generated by Reimbursable Agreements

      FY2005 - 1 FTE

      FY2006 - 17 FTEs

FY2007 - 18 FTEs

FY2008 - 5 FTEs

FY2009 - 1 FTE

FY2010 - 1 FTE

- Aviation System Standards (AVN) Staffing Requirements
  - Chicago Flight Procedures Office (FPO) - 1 FTE
  - Oklahoma City - 1 FTE

2.3 Assumptions

2.3.1 Programmatic Assumptions

- The City of Chicago will deliver facilities as scheduled in accordance with the EIS.
- The City of Chicago will fund all Navigation, Communications, and Surveillance projects on the airfield through reimbursable agreements.
- The EIS will be completed and ROD issued by the end of September 2005.
- Airspace changes for selected National Airspace Redesign (NAR) initiatives, i.e., Midwest Airspace Enhancements (MASE), will be completed by the end of CY 2007.
- The first new runway, 9L/27R, will be completed in 2nd Quarter FY 2008 and the second new runway, 10C/28C, in 2nd Quarter FY 2010.
- The program costs are broken down into the OMP "Reimbursable" work, which is the responsibility of the City of Chicago and the "FAA" work, which is the responsibility of the FAA.
- The current ORD Air Traffic Control Tower will require reconfiguration to support OMP. This reconfiguration will be funded through a reimbursable agreement with the City of Chicago. The cost of this reconfiguration is still to be determined and is not included in this Business Case.
- The North Satellite Tower will be constructed by the City of Chicago and subsequently transferred over to the FAA via an Other Transactional Agreement (OTA) at not cost to the FAA.

2.3.2 Preferred Alternative Assumptions

- With the exception of the AEFS, existing NAS equipment will be used to support OMP.
- En Route airspace changes will be completed at Chicago Air Route Traffic Control Center (ZAU) by the end of CY 2007.

- Airspace changes will be completed and radar coverage issues resolved at Chicago TRACON (C90) to support east High and Wide (landing to the west) by the end of CY 2007, to support west High and Wide (landing to the east) by the end of CY 2009.

- The Rockford ASR-11 designated for OMP High and Wide west coverage will be authorized for the use of terminal separation to 60 nautical miles (NM) by the end of CY 2009.

- TRACON Fully Digital ARTS Displays (FDAD) will be replaced with the next generation display by 2nd Quarter FY 2008.

- ASR-11 to ARTS interface software/hardware will be available for C90 by the end of CY 2009.

- Existing ASR-9/Mode S assets from sites upgrading to ASR-11/ATCBI-6 will be available to support on-field surveillance requirements. Transportable ASR (TASR) assets will be available to facilitate ASR-9/Mode S implementation scenarios at ORD. On-field surveillance assets will be in place by the end of CY 2007.

- An Integrated Control and Monitoring System (ICAMS) system will be installed at the main and north satellite towers.

- Coverage for OMP arrivals, departures and west High and Wide operations will be provided using existing and/or planned surveillance assets. This assumption will be periodically assessed by the OMP Team for validity as the program matures.

2.4 Constraints

2.4.1 Programmatic Constraints

- City of Chicago's aggressive schedule and FAA schedule are not in concert, e.g., budget cycle

- FAA effort is restricted by the EIS ROD issuance planned for September 2005

- FAA ability to deliver staffing, equipment and airspace changes

2.4.2 Preferred Alternative Constraints

- FAA's ability to deliver its requirements within the City of Chicago's aggressive schedule

Other Supporting Information

The capacity and delay issues at Chicago O'Hare International Airport are high on the Agency/Administrator's Priorities. In her prepared statement before the Aviation Subcommittee of the House, the Administrator said, "we all recognize the key part O'Hare plays in our National Airspace System. It is the world's busiest airport, and is literally a barometer for the whole system. Delays in Chicago can trigger delays at as many as 40 airports across the country. We know that the long-term solution to delays at Chicago is more capacity at O'Hare and in the

region". "As goes O'Hare, so goes the NAS", was also stated by the Administrator in a recent interview.

The FAA had recently implemented various efficiency enhancement initiatives, including Collaborative Decision Making and the "Growth without Gridlock" initiative, intended to address delays at O'Hare and throughout our nation's aviation system. Finally, in 2004, FAA worked with airlines serving at O'Hare to agree upon voluntary limitations to scheduled arrivals at O'Hare during peak hours, to maintain an arrival rate in line with O'Hare's current capacity. These are near-term delay reduction initiatives.

In late 2002, the City of Chicago developed and submitted to the FAA, a long-term initiative; a plan to reconfigure and modernize O'Hare Airport to reduce delays and accommodate anticipated future aviation demand. Since the receipt of the proposal, the FAA has undertaken an extensive technical and environmental analysis of the City's OMP plan. The FAA Administrator, along with the Great Lakes Regional Administrator established the Chicago Area Modernization Program Office to provide FAA corporate oversight and to ensure FAA commitments are met. Specifically, this office will provide oversight for the integration of all necessary FAA activities associated with the O'Hare Modernization work, to assure that facilities, equipment, airspace changes, procedures, and staffing are appropriately addressed.

Political Considerations

On August 6, 2003, the State of Illinois endorsed the OMP proposal via the enactment of the "O'Hare Modernization Act." This state legislation emphasizes the importance of accomplishing the OMP (OMP designated as the State's #1 airport development priority), directs all state agencies to facilitate its accomplishment, and eliminates many state-level legal impediments to the project.

The City of Chicago has been active in lobbying on behalf of the OMP, including continual requests for the FAA to complete its EIS as quickly as possible. The City sought an earlier EIS ROD than September 2005, to provide a more substantial 2005 construction season. The City's efforts have included meetings with FAA Headquarters, Office of the Secretary of Transportation, and the White House, as well as with key Congressional representatives.

The City of Chicago has taken significant steps to facilitate the OMP. The City gained approval and sold approximately $1 billion in general airport revenue bonds to partially finance the initial phase of OMP work (the City estimates the entire OMP at $6.6 billion). The City intends to use the bond financing in combination with Airport Improvement Program (AIP) and Passenger Facility Charge (PFC) funds to cover the project's first phase. In regard to potential future AIP funding for OMP, in March 2004 the City submitted to the FAA a Letter of Intent (LOI) application requesting $300M in AIP discretionary funding over a 10 year period, to cover approximately 10% of Phase 1 costs. In February 2005, the City updated their LOI to include Cost-Benefit Analysis (CBA) data. (No FAA decision regarding this application can be made prior to issuing an EIS Record of Decision.) Lastly, the City reached agreement with the tenant airlines at O'Hare whereby the airlines will provide $2.9 billion to fund a portion of the overall OMP.

The OMP proposal has received bipartisan support at the state level and at the Congressional level. House Speaker Hastert (Republican-Illinois), Congressman Lipinski (Democrat-Illinois), and Senator Durbin (Democrat-Illinois), have expressed strong support for the OMP. Conversely, Senator Fitzgerald (Republican-Illinois) and Congressman Hyde (Republican-Illinois) have consistently opposed the OMP. Congressman Lipinski and Senator Fitzgerald vacated their Congressional seats in January 2005.

Correspondence has been received by the FAA from Congressman Lipinski, Senator Durbin, and Senators Harkin and Grassley of Iowa. All of this correspondence requested that FAA expedite its EIS schedule to provide a more substantial construction season for the City of Chicago in 2005 and ultimately decrease the time required to implement new runways at O'Hare.

During 2004, the Administrator attended two separate meetings with Senator Durbin (at the Senator's request) to discuss the status of FAA's OMP work. Additionally, FAA Great Lakes Region and Headquarters representatives attended meetings with the staff of Speaker Hastert and the House Aviation Subcommittee on FAA's OMP work.

On February 11, 2004, Senator Fitzgerald and Congressman Hyde jointly issued a letter to the Department of Transportation Office of Inspector General (OIG) requesting that the OIG review FAA's work on the OMP proposal. In response to this letter, the OIG initiated a review of FAA's work on the OMP in March 2004. The OIG review included not only extensive discussions between the OIG and various FAA representatives/offices on all aspects of FAA's OMP work, but also direct discussions between the OIG and the City of Chicago primarily focused on the City's financing plan for the OMP. The OIG final report was issued on July 21, 2005.

3.0 Key Milestones and Target Completion Dates

Key Milestones/Activities	Target Completion Date
Sponsor's OMP Master Plan Submitted to FAA	February 2004
EIS	September 2005
EIS Record of Decision (ROD)	September 2005
Terminal Airspace Redesign	February 2007
En Route Airspace Redesign	February 2007
New North ATCT Construction Complete	October 2007
On-Field Radars Installed (1 Relocate, 1 New)	October 2007
New Runway 9L/27R	January 2008
Runway Extension, 10L/28R	November 2008
New Runway 10C/28C	January 2010

4.0 Justification

4.1 Support to FAA's Mission and Strategic Goals and Objectives

The OMP goals and objectives are in direct line with the *Federal Aviation Administration Flight Plan, 2005-2009*, the *Air Traffic Organization Fiscal Year 2005 Business Plan*, *Regions and Center Operations Fiscal Year 2005 Business Plan, Strategic Management Process (SMP) ATO En Route and Oceanic Objectives, 2005,* and *Capacity Needs in the National Airspace, June 2004*. The objective of the OMP directly feeds into these FAA Plans by developing concepts to address the capacity overload. The OMP is looking to address the performance gap to increase capacity for both arrivals and departures under all weather conditions for today's traffic needs and projecting out into the future.

FAA Flight Plan 2005-2009

The FAA Flight Plan is a multi-year strategic effort, setting a course for the FAA through 2009. The plan addresses four major goal areas: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence. Under Greater Capacity, two objectives are included for Chicago. These include Objective 1: "Increase capacity to meet projected demand", and Objective 2: "Increase or improve aviation capacity in the eight major metropolitan areas and corridors that most affect total system delay". OMP has several initiatives that clearly support these objectives. These include: evaluation of existing airport capacity levels and set investment and infrastructure priorities, improve airway access to existing capacity through operational and procedural changes, and improve bad-weather departure and landing capacity with new technologies and procedures. The OMP is also identifying airport improvements that are most likely to reduce the major causes of system delay and redesign the airspace and traffic flows.

Air Traffic Organization 2005 Business Plan

The ATO Business Plan is in direct support of the FAA Flight Plan. Under Greater Capacity, there are two initiatives that support increased capacity. These include the "Metropolitan Airspace Redesign" and the implementation of "MASE" (Midwest Airspace Enhancement). These initiatives include the redesign of airspace of eight major metropolitan areas including Chicago and the redesign of routes to optimize arrival/departure capacity for the new runways at Chicago O'Hare airport. Another strategic activity that is being worked is the incremental benefits assessment of the Chicago Airspace Plan being done by MITRE. This assessment will focus on the need for and prioritization of the sectors outside the four identified as OMP sectors. This assessment is anticipated to be completed by September 2005.

Regions and Center Operations 2005 Business Plan

The Assistant Administrator for Regions and Center Operations (ARC) has developed a Business Plan that is in direct line with the ATO Business Plan and the FAA Flight Plan. Under Greater Capacity, the O'Hare Modernization Program is a direct core activity. This includes completing the Environmental Impact Study without compromising the OMP Implementation. It also includes developing a plan and schedule for implementation of NAS changes required to support OMP implementation.

Strategic Management Process (SMP) ATO En Route and Oceanic Objectives, 2005

The ATO En Route and Oceanic Services (ATO-E) strategic map for Pathway 3 includes Strategic Objective 3.3: Increase Capacity. The O'Hare Modernization Program is consistent with National Airspace Redesign initiative and associated activities. The effort is also consistent with Pathway 4, Ensure a Viable Future. Specifically, the OMP addresses Strategic Objective 4.2: Deliver a future air traffic system that meets customer's operational needs.

Capacity Needs in the National Airspace, June 2004

The *Capacity Needs in the National Airspace, June 2004* is a recent report undertaken by the FAA to assure that the long-term capacity of the aviation system matches forecasts of demand. The Future Airport Capacity Task (FACT) identified O'Hare as one of the five airports where additional capacity is necessary today. Additionally, FACT stated that given planned improvements contained in the Operational Evolution Plan (OEP) version 5.0 (which did not include the OMP effects on capacity), O'Hare was listed as one of the 15 airports identified as needing additional capacity in 2013. Given aggressive assumptions for airfield reconfiguration under OMP, O'Hare was not listed in the FACT analysis of 2020; however Chicago Midway International Airport was identified.

O'Hare is currently not included as an OEP airport because the proposed OMP does not have an approved EIS ROD. If the Sponsor's OMP receives EIS approval, ORD will be included in the OEP. In the meantime, ORD is designated one of the benchmark airports and is considered a "pacer" airport under the OEP. ORD is currently ranked as the airport with the highest delay rates in the US. The fact remains that the decrease in efficiency at ORD directly affects throughput at other OEP sites.

Performance Gap

A performance gap currently exists at O'Hare between airfield capacity and demand. This gap only widens as the demand increases through CY 2018. In CY 2004, O'Hare processed 992,471 total operations and was the number one delayed airport in the NAS. The average delay could be higher than 30 minutes per operation by 2013, if nothing is done to improve the capacity at O'Hare. The City of Chicago consultants (with FAA review and approval) estimated an annual average delay of approximate 14 minutes per operation in 2013. The ATO Planning Services Unit (ATO-P) assessed delay in support of this business case, and estimated an annual average delay of approximately 20 minutes per operation. To address these delays, the FAA worked with the airport users, which resulted in the enactment of voluntary limitations on scheduled arrivals during peak hours. As long as these voluntary limitations are kept in place, the projected growth rate cannot be met, and the difference between what the airport can accommodate and the forecast demand will continue to widen.

Based on the FAA 2002 Terminal Area Forecast (TAF) projections, which were used in the production of the Draft Environmental Impact Statement (DEIS), O'Hare annual operations are forecast to grow to approximately 1,026,300 in 2007, to 1,057,200 in 2009, 1,120,600 in 2013, and 1,194,000 by 2018. These projections were used in the TAAM analysis of delay and for the environmental consequences analysis for the proposed OMP. This analysis demonstrated that not only will the proposed OMP provide the necessary capacity enhancement, but average annual delays will also be reduced to an average annual of 5.8 minutes per operation by 2018.

Conversely, the TAAM analysis demonstrated that without the proposed OMP build, and continuing to constrain the number of operations at levels approximately equal to those of today, average annual delays would be approximately 16 minutes per operation. The TAAM results are depicted below in Figure 4.1 Average Annual Delay Estimates. Note: This business case is only addressing OMP Phase 1 implementations through 2010. At the completion of Phase 1, delays will decrease to be approximately 10.3 minutes per operation. During Phase 2, continuing forecasted growth in operations will cause delays to again increase to approximately 14 minutes per operation. However, after completion of Phase 2 in 2013, delays will decrease to 5.8 minutes per operation.

Also, the above results are representative of unconstrained demand growth at O'Hare per TAF projections and without taking into consideration airlines' initiatives to modify their schedules in order to reduce delays. Delays analysis in this document (further described in Appendix D. OMP Benefits Calculations) took a more conservative approach by adjusting delay values considering the various strategies that the airlines are taking in order to reduce delays based on traffic demand, de-peaking, constraining, etc. Results of this risk adjusted analysis are presented in Section 7.3.1.

OMP substantially improves the performance gap between O'Hare current airfield/airspace capacity and projected future demand.

4.2 Agencies and Organizations Affected by OMP

Concerning longer-term efforts to address capacity and delays at O'Hare, in 2001 the Governor of Illinois and Mayor of Chicago agreed in principle to pursue the modernization of O'Hare to address future aviation demands. The FAA Administrator, in April 2003, established the Chicago Area Modernization Program Office to serve as the focal point and provide oversight of FAA activities associated with major Chicago area airport development initiatives. There is currently a draft Planning Document for the Proposed OMP that delineates the responsibilities of both the City of Chicago Department of Aviation and the FAA. It is intended that this document form the basis for a future Memorandum of Agreement (MOA) should a Record of Decision be issued approving the OMP. The funding responsibility is also addressed in this document. The funding is broken down into the OMP "On-Airfield" work, which is the responsibility of the City of Chicago and the "Off-Airfield" work, which is the responsibility of the FAA. Also, see Section 9.1 Reimbursable Acquisition.

4.3 Efficiency and Integration

Increased operational efficiency will be realized from reduced frequency congestion and a smoother, simplified Air Traffic (AT) operation. The AT operational environment is simplified by the addition of High and Wide procedures, as each controller can focus on a specific function (e.g. arrival, departure), which then enables greater capacity. Complex operations by their very nature reduce capacity; streamlining the operation reduces conflict points and accommodates greater capacity. Less holding at the outer fixes would occur due to the greater capacity of the airfield and the airspace to accommodate more aircraft more efficiently.

Operational efficiency is also enhanced due to increased airport runway "configuration" predictability. The way the airport is configured today, there are about ten commonly used

arrival/departure configurations; with the new runways, this will be reduced to basically two, east and west. This will provide more predictability for the arrivals and departures since the runways are basically "dedicated"; this means that the airlines know what their block-to-block time will be. The taxi times themselves are actually slightly longer overall because the airport is larger, but the airlines agree that a smoother operation and better predictability is preferable. The more accurately the airlines can estimate what the block-to-block times are going to be, the better they can preplan the fuel loads.

Efficiency enhancements will also be realized with Chicago Midway International Airport (MDW) operations. MDW arrivals from the southeast actually fly a little further, but they are not mixed in with the ORD traffic, and the departures to the east have their own independent departure stream. Currently, they share routes with ORD and experience restrictions during times of high volume.

The controller workload at the local control position in the ATCT is reduced with the transition from a crossing-runway to a parallel-runway operation. With the elimination of crossing runway operations, the complexity is reduced and efficiency increased since there would now exist the ability to utilize each runway for one specific operation (either arrivals or departures). This then provides the ability to handle more aircraft.

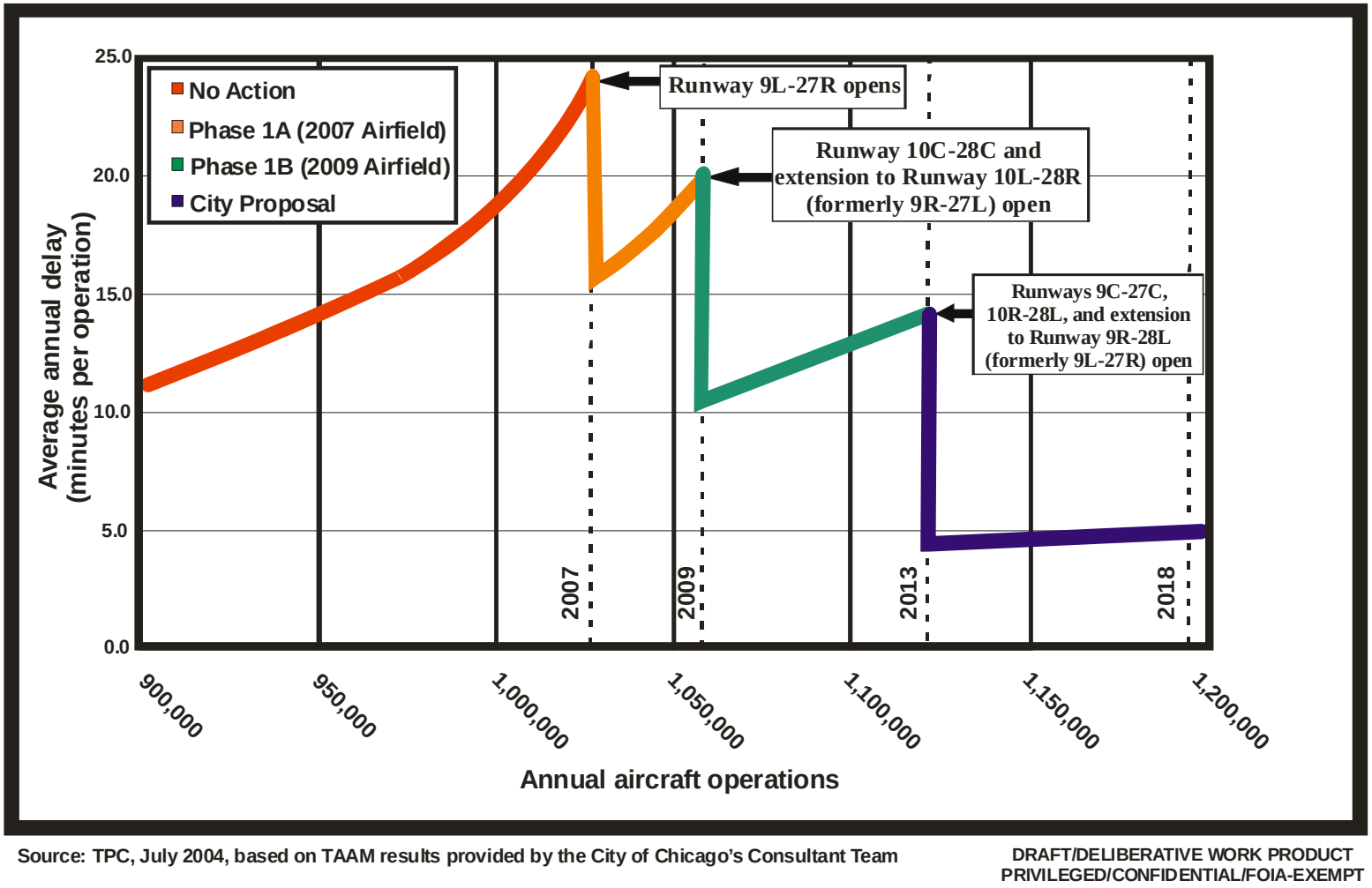


Figure 4.1 Average Annual Delay Estimates (Unconstrained Demand per TAF 2002 Projections – O'Hare Modernization Program

5.0 Summary of Spending

Table 5.0 summarizes the FAA costs for Alternative 3 (High and Wide), the preferred OMP Phase 1 Business Case alternative. Costs are presented in Then-Year (inflated) dollars, in millions, and have been risk-adjusted. These values do not include any costs associated with activities that are expected to be reimbursed by the City of Chicago.

Table 5.0 Summary Of Spending For Project Stages
(Then-Year In Millions)
(BY+1 and Beyond estimates are for planning purposes only and do not represent budget decisions)

	PY-1 and Earlier	PY 2004	CY 2005	BY 2006 Projected	BY+1 2007 Projected	BY+2 2008 Projected	BY+3 2009 Projected	BY+4 and Beyond Projected	Total
Planning:									
Budgetary Resources									
Outlays									
Acquisition:									
Budgetary Resources			1.381	7.690	1.971	1.401	1.427	0.943	14.813
Outlays									
TOTAL, Sum of Stages:									
Budgetary Resources			1.381	7.690	1.971	1.401	1.427	0.943	14.813
Outlays									
Maintenance:									
Budgetary Resources			2.831	7.562	11.426	11.200	11.638	52.458	97.114
Outlays									
TOTAL, ALL Stages:									
Budgetary Resources			4.212	15.253	13.396	12.601	13.065	53.401	111.927
Outlays									

6.0 Performance Goals and Measures

Table 6.0 Performance Goals and Measures

Fiscal Year	Strategic Goal(s) Supported	Existing Baseline	Planned Performance Improvement Goal	Planned Performance Metric
FY2011	Increased Capacity	Arrival Rate 100/hour Departure Rate 100/hour	Increased Arrival and Departure Rates	Arrival Rate 120/hour Departure Rate 140/hour

Note: Arrival and departure rates are based on optimal configurations.

7.0 Alternatives Analysis

7.1 Alternative Solutions for Accomplishing Agency Strategic Goals

In order to accommodate the anticipated increase in demand at ORD, the Air Traffic (AT) workgroup examined numerous options for increasing the number of arrivals. The three most viable options are detailed below. Further detail on the background work done to arrive at these alternatives is outlined in Appendix F., Air Traffic Operating Concept for the O'Hare Modernization Program.

Table 7.1 Alternatives Solutions

Alternatives	Description
Alternative 1 – **No Airspace Changes**	Working within the current four cornerpost arrival system, fix balancing would have to be employed. Based on the schedule developed for the EIS, arriving traffic will continue to follow the same pattern as today, therefore, excess aircraft from the heavy arrival fix(es) would have to be rerouted to the lighter fix(es); this could be done one of two ways. The aircraft would either have to be rerouted essentially from their departure airport, or rerouted approximately 200-300 miles out from ORD in the high altitude airspace structure. Either option adds almost 200 flying miles to the approximately 20 aircraft per hour that must be rerouted. Once aircraft are handed off to C90, all aircraft will fly longer downwinds and finals, adding approximately another 100 flying miles for each aircraft, not just the ones rerouted, further congesting C90 airspace. If aircraft are rerouted even closer to ORD (approx. 80 miles out), arriving aircraft would be required to be routed through the departure corridors. This would have the effect of imposing restrictions on departures to manage the sector workload and complexity. The fix balancing technique could be utilized regardless of airport configuration, but the Class B airspace would likely have to be modified to accommodate the longer finals. Because of the added flying miles and increased congestion in already complex and congested airspace, this alternative was not deemed practical.
Alternative 2 - **Compressed Arrival Procedures (CAPS)** (See Figure 7.1-1)	The second approach explored to feeding more arrivals to ORD utilizing the current cornerpost system is a modification of the Compressed Arrival Procedure. (CAPS). Aircraft arriving over the "far" arrival fix would be fed by ZAU to C90 in two arrival streams separated by altitude. This would alleviate the issue of ZAU rerouting aircraft to the light(er) arrival fix, and would eliminate the additional flying miles for those approximately 20 aircraft per hour (as per the 2002 TAF projections of future demand). However, once inside C90 airspace, all aircraft would still be required to fly longer downwinds and finals, adding approximately 100 flying miles for each aircraft. Utilizing CAPS results in "double" downwinds; meaning that there are two streams of arrivals on each downwind separated by altitude. CAPS is also configuration-dependent; the ability to utilize CAPS from a certain fix is constrained by congested airspace and the landing runways at ORD (i.e., if the "heavier" fix is the close fix, CAPS is not viable). Since CAPS is configuration-dependent, it is difficult to establish a consistent arrival rate, and therefore plan for the number of arrivals over each cornerpost. Airborne holding would result at the arrival fixes to meter the arrivals, so the users would also not have the information to preplan their fuel loads. Because of the added flying miles, inability to set a consistent arrival rate, congestion and complexity added to already congested and complex airspace, this alternative was

Table 7.1 Alternatives Solutions	
Alternatives	**Description**
	deemed not acceptable.
Alternative 3 - **High and Wide** (See Figure 7.1-2)	The third approach explored is the concept of establishing an additional arrival stream, independent of configuration and one that did not exacerbate the congestion or complexity. The concept developed is termed "High and Wide". ZAU would establish aircraft from the "near" fix on a separate track approximately 80 miles from the airport. C90 would assume responsibility for aircraft on base approximately 60 flying miles from the airport. The "High and Wide" would be the primary arrival stream and feed the center runway(s). "Overload" aircraft, those approximately 20 additional aircraft per hour projected, would be routed over the current cornerpost and blended with traffic from the far fix and worked as they are today. This would eliminate the congestion issue within C90 airspace, since the "High and Wide" arrivals are fed outside the current airspace. This concept has been tested in the facility and can adequately handle projected traffic through 2018. This option entails expansion of C90 airspace to both the east and the west to accommodate these independent arrival streams. This expanded airspace requires expanded radar coverage at C90 to enable the acquisition and control of these aircraft. Because of the ability to efficiently feed the airport with the additional number of arrivals, minimal increase in complexity and, congestion in C90 airspace and, minimal additional flying miles for the users, this is the preferred option.

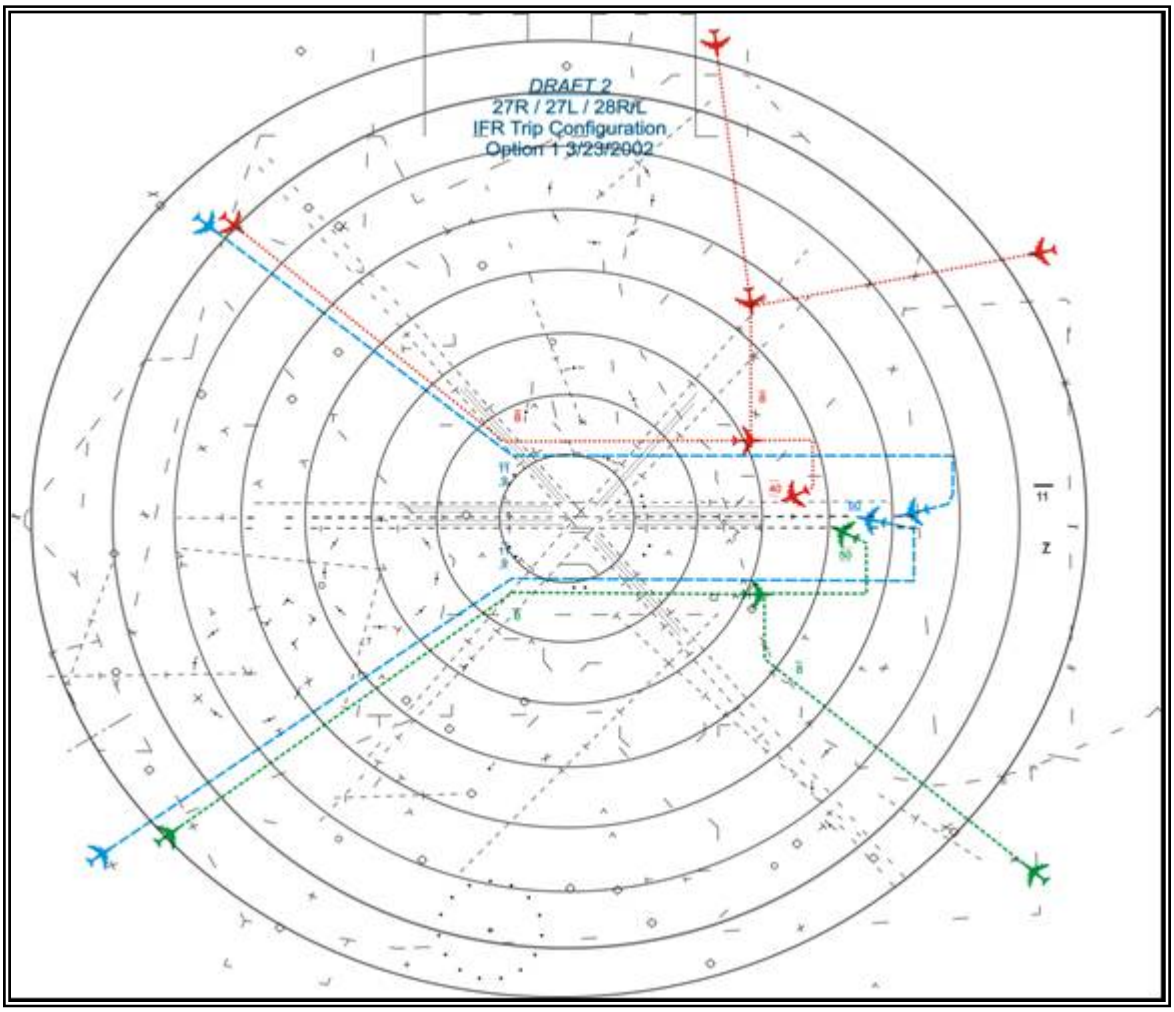


Figure 7.1-1 Alternative 2 - Compressed Arrival Procedures (CAPS) West Flow

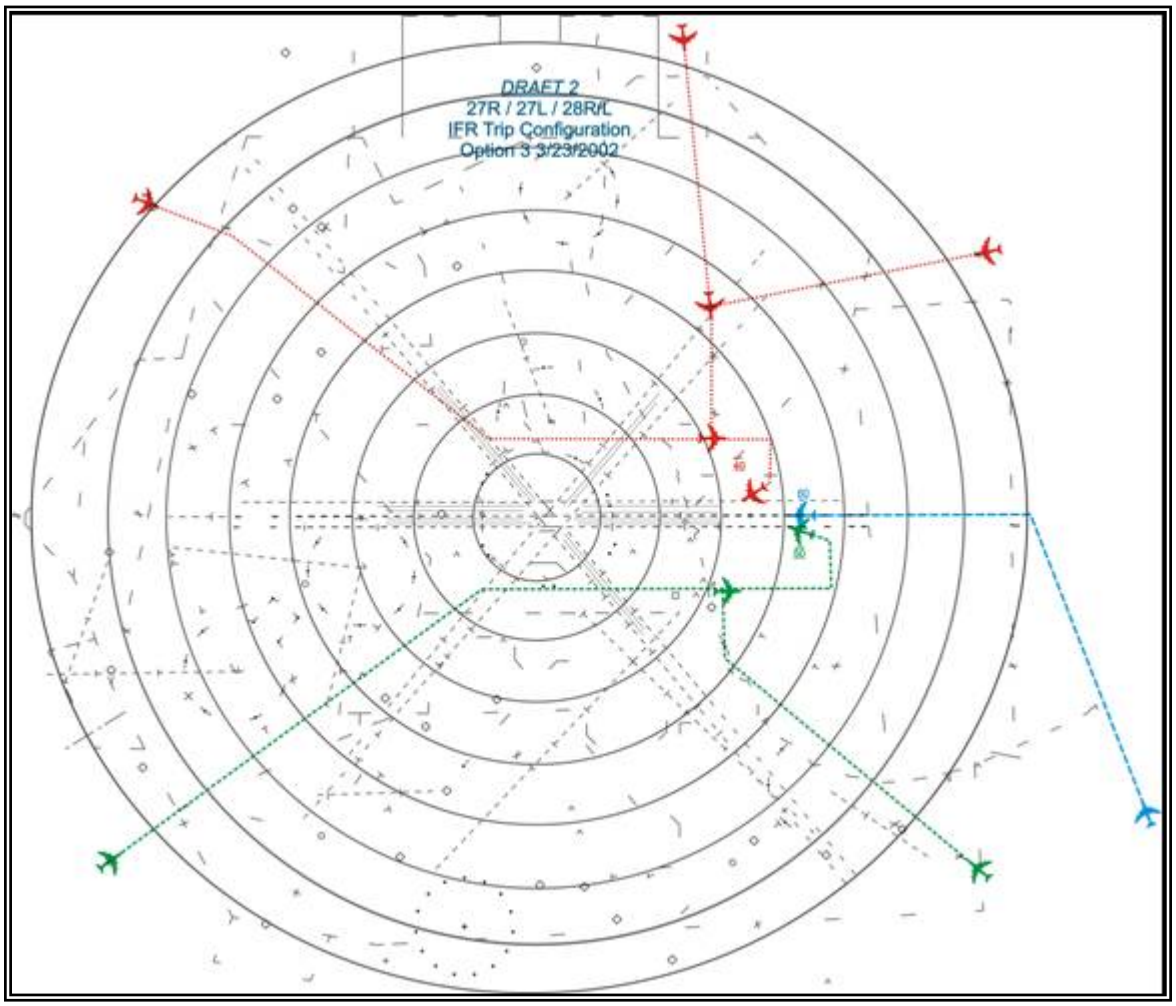


Figure 7.1-2 Alternative 3 - High and Wide West Flow

7.2 Phase 1 Cost Analysis

Table 7.2 presents the total estimated costs of each of the OMP Phase 1 alternatives. Costs are presented as Then-Year 2005 dollars, in millions, and are risk-adjusted. In addition, costs are broken out by those expected to be incurred by the FAA versus those to be reimbursed by the City of Chicago.

Table 7.2 Alternatives Analysis(All Assets, Then-Year-Risk Adjusted, $M)

Cost Elements	Alternative 1	Alternative 2	Alternative 3
FAA Costs	**$63.298**	**$72.079**	**$111.927**
Facilities and Equipment	**$10.906**	**$11.232**	**$14.813**
WBS 3.0 Solution Development	$5.436	$5.436	$8.065
WBS 4.0 Implementation	$5.469	$5.795	$6.747
WBS 5.0 In-Service Management (F&E)	$0.000	$0.000	$0.000
WBS 6.0 Disposition	$0.001	$0.001	$0.001
Operations and Maintenance	**$52.392**	**$60.847**	**$97.114**
WBS 5.0 In-Service Management	$52.392	$60.847	$97.114
Reimbursable Costs	**$52.994**	**$53.023**	**$53.010**
Facilities and Equipment	**$52.275**	**$52.305**	**$52.291**
WBS 3.0 Solution Development	$33.691	$33.691	$33.691
WBS 4.0 Implementation	$17.608	$17.635	$17.624
WBS 5.0 In-Service Management (F&E)	$0.312	$0.312	$0.312
WBS 6.0 Disposition	$0.665	$0.667	$0.664
Operations and Maintenance	**$0.718**	**$0.719**	**$0.718**
WBS 5.0 In-Service Management	$0.718	$0.719	$0.718
Total	**$116.292**	**$125.102**	**$164.937**

Alternative 1 is No Airspace Changes: OMP airport changes evolve without FAA airspace or procedural changes. Alternative 2 is Compressed Arrival Procedures (CAPS): implement procedures to increase traffic flows over existing four cornerposts. Alternative 3, the preferred alternative, is High and Wide procedures: this combines both airspace and procedural changes to optimize traffic flows to new OMP runways. Essentially, Alternatives 1 and 2 are subsets of Alternative 3.

The cost differences between alternatives can be attributed to two factors: the scope of the airspace redesign and associated equipment necessary to implement the redesign, and the additional controller staffing to operationally support the airspace changes. Facility and Equipment costs for Alternatives 1 and 2 are very similar. Alternative 3, however, requires additional equipment to be installed. Each of the four new sectors at ZAU will require new RCAG and BUEC channels. The divestiture of airspace to the adjacent MKE and SBN TRACONs will require a new RTR channel for both SBN and MKE. The Milwaukee TRACON will also need two new STARS displays. The hardware procurement costs for this equipment, including spares, account for the differences in Work Breakdown Structure (WBS) 3.0 Solution Development costs. Since more site survey and design, environmental compliance, construction, site preparation and installation, commissioning, and telecommunication efforts will be necessary under Alternative 3, it follows that WBS 4.0 Implementation is also more costly in this alternative than in the other two.

However, the greatest difference in costs is attributable to the level of air traffic controller staffing, found under Operations and Maintenance. Staffing costs at ORD ATCT are identical for all three Alternatives. However, Alternatives 2 and 3 require additional staffing at the Chicago TRACON. To run the new procedures, Alternative 2 requires four additional controllers and three additional Traffic Management Coordinators (TMC) while Alternative 3 requires 16 additional controllers and three additional TMCs. In addition, Alternative 3 includes the divestiture of airspace to SBN and MKE, resulting in increased air traffic controller staffing at these locations.

Reimbursable costs are essentially the same under each of the three alternatives. The differences seen in the table can be attributed to random variances generated through Monte Carlo simulation performed for cost risk analysis.

7.3 Preferred Alternative Selection

In this section, a standard cost-benefit analysis (CBA) approach has been utilized. This involves comparing FAA investment to the corresponding user benefits or Airline Direct Operational Costs (ADOC) and Passenger Value of Time (PVT) in this case. Further discussion of user benefits will be provided in Section 7.3.1.1 User Benefits and Appendix D. OMP Benefits Calculations.

7.3.1 Financial Summary of Alternatives

In providing for cost-benefits assessment of alternatives the following assumptions and approach have been employed:

- Total Airspace and Airport Modeller (TAAM) analysis results supporting the EIS have been used with minor adjustments to extract delay data for various operational configurations and timelines. These results are presented in detail in Appendix D.
- Only user benefits have been considered. These benefits include Airline Direct Operating Costs (ADOC) and Passenger Value of Time (PVT).
- Calendar year benefits have been adjusted to fiscal year to provide for a cost-benefits calculations and comparison in terms of fiscal years.
- Constrained (2,750 daily operations) and unconstrained (per TAF 2002) scenarios were considered to provide for a potential range of benefits.
- Benefits have been adjusted for risk and 20^{th} percentile benefits data have been considered as project's benefits to conservatively account for the risks in accruing of the corresponding benefits.
- Only OMP airspace changes increment benefits have been considered, i.e. benefits due to runway construction have been excluded.
- Both FAA reimbursable and non-reimbursable risk-adjusted costs (80^{th} percentile) have been included in a cost component of the cost-benefits assessment.
- Benefits have been calculated for FY2005-2013 due to the benefits uncertainty significantly increasing beyond FY2013 in lieu of additional runways construction according to the City of Chicago plan. In this case additional significant benefits can be realized beyond FY2013 with a minor investment of FAA funds in that timeframe.
- To convert annual benefits into Net Present Value, the Executive Office of the President, Office of Management and Budget (OMB) recommended using an annual discount factor of 7%.

The final results of the cost-benefit assessment of "CAPS" and "High and Wide" alternatives are summarized below in the Tables 7.3.3 and 7.3.4 respectively. Both tables show Economic Analysis results considering only ADOC and a combination of ADOC and PVT as user benefits. In "No Airspace Changes" alternative no airspace changes are provided, thus OMP airspace changes increment benefits are considered to be zero.

Table 7.3.3 Cost-Benefits Summary of CAPS Alternative

CAPS: All Costs	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
Costs (Then-Year $M), Risk Adjusted (80th percentile)										
F&E	$2.3	$31.2	$11.5	$11.5	$5.4	$1.7	$0.0	$0.0	$0.0	$63.5
O&M	$2.9	$4.6	$7.6	$7.1	$7.4	$7.5	$7.8	$8.2	$8.6	$61.6
Total	$5.1	$35.8	$19.0	$18.6	$12.8	$9.2	$7.8	$8.2	$8.6	$125.1
Benefits (Then-Year $M), Risk Adjusted (20th percentile)										
Airline Direct Operating Costs	$0.0	$0.0	$0.0	$22.7	$31.2	$56.2	$64.7	$64.4	$64.7	$304.0
Passenger Value of Time	$0.0	$0.0	$0.0	$44.4	$60.7	$109.8	$126.4	$125.8	$126.2	$593.4
Total	$0.0	$0.0	$0.0	$67.2	$91.9	$166.1	$191.2	$190.2	$190.9	$897.4
Net Cash Flow (Then-Year $M)	-$5.1	-$35.8	-$19.0	$48.6	$79.1	$156.9	$183.3	$182.0	$182.3	$772.3
Economic Analysis	**ADOC+PVT**		**ADOC Only**							
NPV ($M)	$447.1		$90.9							
B/C Ratio	5.9		2.0							
IRR	83%		32%							
Payback	4 years		7 years							

Table 7.3.4 Cost-Benefits Summary of High and Wide Alternative

High and Wide: All Costs	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	Total
Costs (Then-Year $M), Risk Adjusted (80th percentile)										
F&E	$2.3	$34.4	$11.8	$11.6	$5.4	$1.7	$0.0	$0.0	$0.0	$67.1
O&M	$2.9	$7.7	$11.6	$11.3	$11.9	$12.2	$12.8	$13.4	$14.0	$97.8
Total	$5.1	$42.1	$23.4	$22.9	$17.3	$13.9	$12.8	$13.4	$14.0	$164.9
Benefits (Then-Year $M), Risk Adjusted (20th percentile)										
Airline Direct Operating Costs	$0.0	$0.0	$0.0	$47.8	$66.2	$120.0	$139.4	$141.2	$143.0	$657.6
Passenger Value of Time	$0.0	$0.0	$0.0	$93.3	$129.3	$234.2	$272.0	$275.5	$279.0	$1,283.4
Total	$0.0	$0.0	$0.0	$141.1	$195.5	$354.3	$411.4	$416.7	$422.0	$1,940.9
Net Cash Flow (Then-Year $M)	-$5.1	-$42.1	-$23.4	$118.2	$178.2	$340.4	$398.6	$403.3	$408.0	$1,776.0
Economic Analysis	**ADOC+PVT**		**ADOC Only**							
NPV ($M)	$1,046.4		$277.7							
B/C Ratio	10.0		3.4							
IRR	122%		57%							
Payback	3 years		6 years							

The Economic Analysis summary results for both alternatives ("CAPS" and "High and Wide") show that the cost-benefit ratio is greater than one in both cases, with and without PVT. These results also demonstrate why the High and Wide alternative has been selected as preferred.

7.3.1.1 User Benefits

This section provides a summary of the user benefits including ADOC and PVT. This summary includes results of both: point estimate and risk-adjusted analysis. Detailed analysis and assumptions are presented in Appendix D. OMP Benefits Calculations.

Table 7.3.5

ORD Annual ADOC Benefits (in Baseline FY05 $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$55,623,810	$83,360,555	$117,901,185
2009	$78,789,911	$118,078,404	$167,004,451
2010	$124,062,640	$201,848,189	$301,444,391
2011	$149,227,481	$242,712,421	$360,021,034
2012	$163,623,904	$261,337,211	$380,160,204
2013	$178,392,801	$280,419,799	$400,747,092

Table 7.3.6

ORD Annual ADOC Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$45,405,598	$68,047,044	$96,242,487
2009	$60,108,446	$90,081,449	$127,406,896
2010	$88,454,948	$143,914,969	$214,925,685
2011	$99,436,571	$161,729,534	$239,897,216
2012	$101,896,744	$162,747,681	$236,744,669
2013	$103,826,234	$163,206,876	$233,238,456

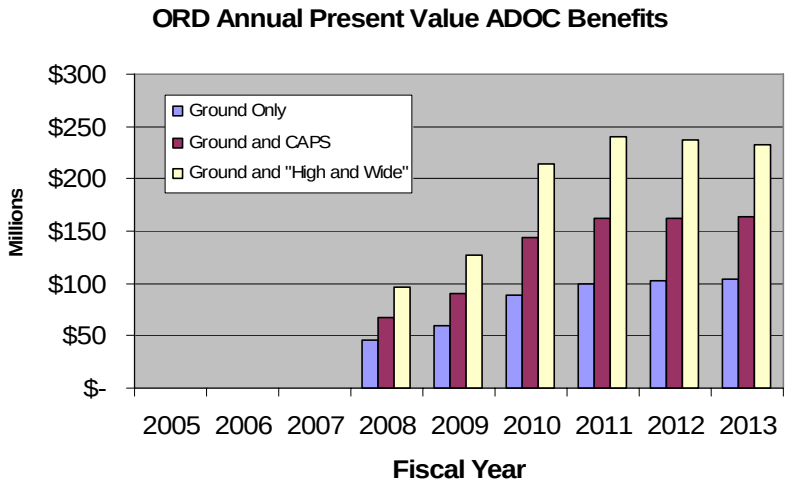
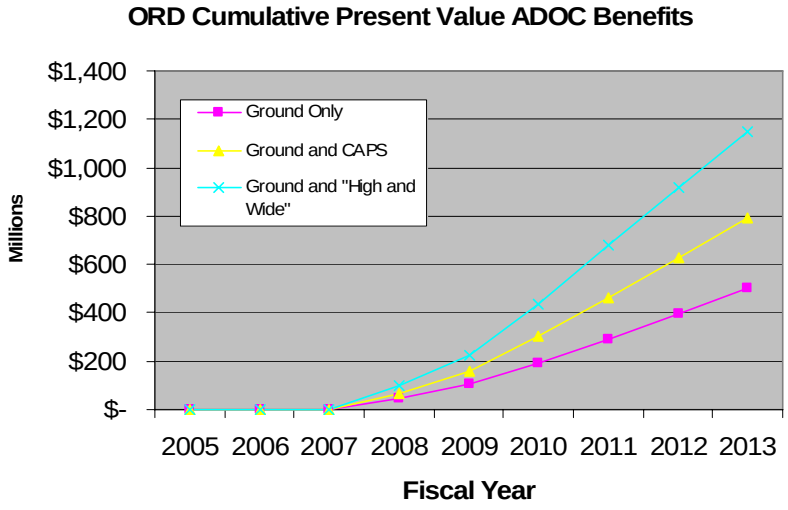


Table 7.3.7

ORD Cumulative ADOC Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$45,405,598	$68,047,044	$96,242,487
2009	$105,514,044	$158,128,494	$223,649,383
2010	$193,968,992	$302,043,463	$438,575,068
2011	$293,405,563	$463,772,997	$678,472,284
2012	$395,302,307	$626,520,678	$915,216,953
2013	$499,128,541	$789,727,554	$1,148,455,410



Tables 7.3.8 through 7.3.10 provide a summary of PVT benefits.

Table 7.3.8

ORD Annual PVT Benefits (in Baseline FY05 $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$108,563,476	$162,698,521	$230,113,011
2009	$153,777,791	$230,458,897	$325,950,049
2010	$242,138,598	$393,956,130	$588,342,488
2011	$291,253,942	$473,712,677	$702,669,139
2012	$319,352,085	$510,063,512	$741,975,658
2013	$348,177,200	$547,307,853	$782,156,007

Table 7.3.9

ORD Annual PVT Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$88,620,135	$132,810,457	$187,840,763
2009	$117,316,340	$175,815,989	$248,665,732
2010	$172,641,474	$280,885,276	$419,480,063
2011	$194,074,799	$315,654,759	$468,218,116
2012	$198,876,428	$317,641,920	$462,065,149
2013	$202,642,300	$318,538,153	$455,221,917

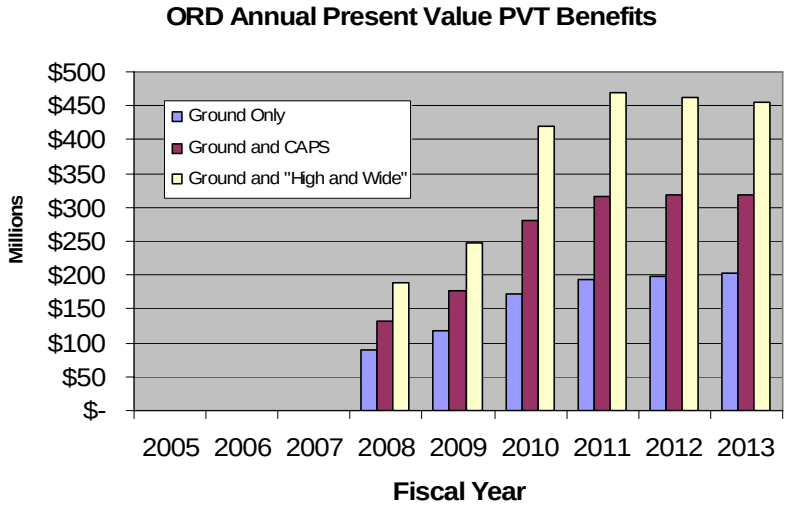
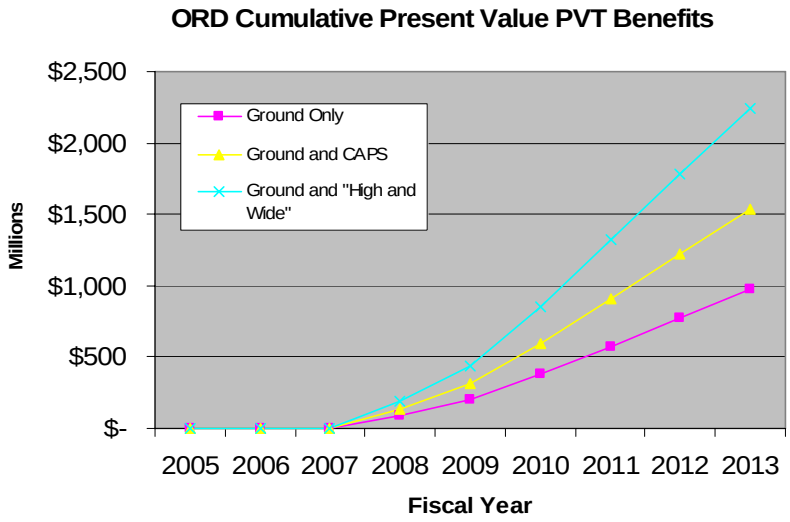


Table 7.3.10

ORD Cumulative PVT Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$88,620,135	$132,810,457	$187,840,763
2009	$205,936,475	$308,626,447	$436,506,495
2010	$378,577,949	$589,511,723	$855,986,557
2011	$572,652,748	$905,166,482	$1,324,204,674
2012	$771,529,177	$1,222,808,402	$1,786,269,823
2013	$974,171,477	$1,541,346,555	$2,241,491,741



In accordance with the ATO-F guidelines risk-adjusted benefits analysis have been provided to conservatively estimate the benefits accounting for uncertainties in the future demand (constrained vs. unconstrained demand growth). Final results of this analysis are summarized in Tables 7.3.11 through 7.3.15.

Table 7.3.11

ORD User Benefits: Ground Changes Only ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$41.5	$81.1	$122.6	$43.7	$85.3	$129.1	$33.9	$66.2	$100.1
2009	$56.2	$109.6	$165.8	$60.3	$117.8	$178.1	$42.8	$83.6	$126.5
2010	$81.5	$159.1	$240.6	$89.4	$174.4	$263.8	$58.1	$113.4	$171.6
2011	$93.0	$181.6	$274.6	$104.0	$203.0	$307.1	$62.0	$121.0	$183.0
2012	$97.6	$190.5	$288.1	$111.3	$217.2	$328.5	$60.8	$118.6	$179.4
2013	$102.0	$199.0	$301.0	$118.6	$231.5	$350.1	$59.3	$115.8	$175.2

Table 7.3.12

ORD User Benefits: Ground Changes and CAPS ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$63.1	$123.2	$186.4	$66.5	$129.8	$196.2	$51.5	$100.6	$152.1
2009	$85.1	$166.1	$251.2	$91.5	$178.5	$270.0	$64.9	$126.7	$191.7
2010	$132.9	$259.3	$392.2	$145.6	$284.2	$429.8	$94.7	$184.9	$279.6
2011	$151.0	$294.7	$445.7	$168.8	$329.5	$498.3	$100.6	$196.4	$297.0
2012	$154.1	$300.8	$454.9	$175.7	$343.0	$518.8	$96.0	$187.3	$283.3
2013	$157.6	$307.5	$465.1	$183.3	$357.7	$541.0	$91.7	$179.0	$270.7

Table 7.3.13

ORD User Benefits: Ground Changes and "High and Wide" ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$86.9	$169.7	$256.6	$91.5	$178.6	$270.2	$71.0	$138.5	$209.4
2009	$117.8	$229.9	$347.7	$126.6	$247.1	$373.7	$89.9	$175.4	$265.3
2010	$191.0	$372.8	$563.9	$209.4	$408.7	$618.1	$136.2	$265.8	$402.0
2011	$217.7	$424.9	$642.6	$243.4	$475.1	$718.5	$145.1	$283.1	$428.2
2012	$221.4	$432.1	$653.5	$252.5	$492.8	$745.2	$137.9	$269.1	$407.0
2013	$224.9	$438.9	$663.7	$261.5	$510.5	$772.0	$130.9	$255.4	$386.3

Table 7.3.14

ORD User Benefits: CAPS ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$21.6	$42.2	$63.8	$22.8	$44.4	$67.2	$17.6	$34.4	$52.1
2009	$29.0	$56.5	$85.5	$31.1	$60.7	$91.8	$22.1	$43.1	$65.2
2010	$51.3	$100.2	$151.5	$56.3	$109.8	$166.1	$36.6	$71.4	$108.0
2011	$57.9	$113.1	$171.0	$64.8	$126.4	$191.2	$38.6	$75.4	$114.0
2012	$56.5	$110.3	$166.8	$64.4	$125.8	$190.2	$35.2	$68.7	$103.9
2013	$55.6	$108.5	$164.2	$64.7	$126.3	$190.9	$32.4	$63.2	$95.5

Table 7.3.15

ORD User Benefits: "High and Wide" ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$45.4	$88.6	$134.0	$47.8	$93.3	$141.1	$37.1	$72.3	$109.4
2009	$61.6	$120.3	$182.0	$66.2	$129.3	$195.5	$47.0	$91.8	$138.8
2010	$109.5	$213.7	$323.2	$120.0	$234.3	$354.3	$78.1	$152.4	$230.5
2011	$124.7	$243.3	$368.0	$139.4	$272.0	$411.4	$83.1	$162.1	$245.2
2012	$123.8	$241.6	$365.4	$141.2	$275.5	$416.7	$77.1	$150.5	$227.6
2013	$122.9	$239.9	$362.8	$142.9	$279.0	$422.0	$71.5	$139.6	$211.1

7.3.1.2 Safety Benefits

The replacement of an aging NAS infrastructure as a result of the OMP project will result in fewer facility outages and an increased reliability factor. The mean time between NAS failures will decrease, thus resulting in a safer aviation platform for all users at O'Hare**.**

7.3.1.3 Non-quantified Benefits

NAS facility reliability will increase as a result of the replacement of direct burial power cables and communications cables. In addition, maintenance costs for the future NAS facilities will be less than current maintenance costs. The costs incurred to purchase outdated and hard to find replacement parts will be mitigated once the newer NAS facilities are established. Overtime for facility restoration will decrease as a result of the projected NAS reliability increases.

Additional indirect benefits accrue from the OMP in terms of reduced frequency congestion and a smoother Air Traffic operation. The AT operation is simplified by the addition of High and Wide, as each controller can focus on a specific function (e.g. arrival, departure), which then enables greater capacity. Complex operations by their very nature reduce capacity; streamlining the operation reduces conflict points and accommodates greater capacity. Less holding at the outer fixes would occur due to the greater capacity of the airfield and the airspace to accommodate more aircraft more efficiently.

The operation is also enhanced due to increased airport runway "configuration" predictability. The way the airport is configured today, there are about ten commonly used arrival/departure configurations; with the new runways, this will be reduced to basically two, east and west. This will provide more predictability for the arrivals and departures since the runways are basically "dedicated"; this means that the airlines know what their block to block time will be. The taxi times themselves are actually slightly longer overall because the airport's bigger, but the airlines agree that a smoother operation and better predictability is preferable. The more accurately the airlines can estimate what the block to block times are going to be, the better they can preplan the fuel loads.

Another benefit, although not studied in the OMP EIS, is the effect on MDW operations. MDW arrivals from the southeast actually fly a little further, but they are not mixed in with the ORD traffic, and the departures to the east have their own independent departure stream. Currently, they share routes with ORD and experience restrictions during times of high volume.

The controller workload at the local control position in the ATCT is reduced with the transition from a crossing-runway to a parallel-runway operation. With the elimination of crossing runway operations, the complexity is reduced and efficiency increased since there would now exist the ability to utilize each runway for one specific operation (either arrivals or departures). This then provides the ability to handle more aircraft.

7.3.2 Facilities and Equipment (F&E) Cost Estimate

The following are the list of ground rules and assumptions used to generate the cost estimate for the preferred alternative.

Programmatic:

- Estimate includes costs for Phase I only (FY2005-FY2013) for both Facilities & Equipment (F&E) and Operations & Maintenance (O&M)
- Estimate includes FAA only and reimbursable costs
- Cost model based upon Version 4.0 of the FAA Work Breakdown Structure (WBS)
- Cost model utilizes Automated Cost Estimating Integrated Tools (ACE-IT) (Version 6.1a) as an estimating tool
- Costs are presented in FY2005 constant and current year dollars
- Current year (Then-Year) costs are derived by applying the Office of Management and Budget (OMB) inflation indices (dated February 2004) provided in ACE-IT 6.1a to the constant year costs
- Current year (Then-Year) costs for FAA labor-related cost elements are derived by applying a five percent (5%) inflation factor and not the OBM inflation indices

Facilities & Equipment (F&E):

- Only ATO personnel dedicated to OMP have been included in Program Management Support
- Costs for Prime Mission Equipment (PME) are included in the year of procurement
- ATO Central Service Area, Engineering Services, Facilities and Equipment (legacy NAS Implementation/ANI) will be the primary source for implementation efforts on a reimbursable
- Technology refresh costs are not included in this estimate
- FAA Salaries include a fringe benefit rate of 32.8%
- Estimate includes delta O&M costs. Costs for new equipment procured by the OMP and maintained by the FAA are included. However equipment currently maintained by the FAA (and/or relocated) will not be included

Operations & Maintenance (O&M):

- Site-Level Maintenance is based on organic ATO-W (Central Service Area, Engineering Services, Facilities and Equipment (legacy NAS Implementation/ANI) hardware maintenance
- Depot Maintenance is based on organic hardware maintenance
- No additional Second Level Engineering Support will be provided by AOS

7.3.3 Facilities and Equipment (F&E) and Operations and Maintenance (O&M) Cost Risks

1. Sponsor does not agree to reimburse FAA for OMP equipment items currently being assumed as non-FAA costs in this Business Case. The following are those items currently deemed to be at cost risk:
    a. The second on-field ASR-9 is especially vulnerable to Sponsor scrutiny due to past FAA Delay Task Force recommendation and one-time inclusion in FAA CWP, both of which were pre-OMP. (Estimated additional FAA cost, $2.5M.)
    b. North ATCT ASDE-X. (Estimated additional FAA cost range from $3-6M.)
    c. Acquisition and installation of ICAMS for the ORD main and north satellite towers. (Rough Order Magnitude (ROM) estimated additional cost $1.2M).
2. Congressional mandates requiring FAA to fund the installation and/or acquisition of OMP NAS equipment; especially navigation and landing aids facilities, which are historically more vulnerable to such mandates.
3. FAA AF/ATO-W (Central Service Area, Engineering Services, Facilities and Equipment (legacy NAS Implementation/ANI) design or installation costs if Sponsor changes schedule or construction phasing and such cost is not reimbursable (see item 2 above).
4. FAA work-force resources not adequately trained to support OMP requirements. (This cost risk is independent of item's reimbursable status.)
5. FAA En Route Program Operations Service (ATO-E) automation development and/or implementation problems.

8.0 Risk Inventory and Assessment

The OMP Business Case team assessed fifteen potential risks in the areas of cost, technical, and schedule. Nine were identified as impacts to OMP. Of the nine, there were three High, four Medium and one Low risk. The risks are described below in the Table 8.0.

Table 8.0 Risk Inventory and Assessment

Date Identified	Area of Risk	Description	Probability of Occurrence	Strategy for Mitigation	Exposure Level
12/04	Schedule	**High and Wide Radar Coverage Availability**: The availability of expanded western radar coverage for OMP High & Wide requires: 1) utilization of planned Rockford (RFD) ASR-11 to also provide OMP west High and Wide coverage, 2) approach procedures dependent on multiple lines of business to change the authorized use of the ASR-11, and 3) technical interface of ASR-11 to C90 ARTS IIIE system. The nationally planned Rockford upgrade to an ASR-11 can only provide OMP required expanded western coverage if all FAA regulatory organizations authorize use of an ASR-11 for terminal separation to 60 NM. (The ASR-11 is currently authorized terminal separation to only 40 NM.). Authorization must be obtained from Flight Standards and ATO-T, in coordination with the AOSC. ASR-11 interface with the Chicago C90 TRACON ARTS IIIE system requires the software and hardware interfaces recently developed for the Northern California TRACON (interfaces previously known as a 'Gateway Switch'). These software interfaces are scheduled for Common ARTS revision #32, however C90 is frozen on revision #30 due to FDAD display memory constraints. There are two possible resolutions; 1) Attempt to retro-fit this software fix into ARTS revision #30, or the less problematic solution, 2) Replace all existing FDADs with the next generation display.	80%	1. Expedite the following: 1) Planned installation of ASR-11 at Rockford, 2) Authorization of ASR-11 terminal separation to 60 NM. 2. Expedite procurement process to acquire the next generation display (to be determined) to replace existing FDADs at C90.	High
	Schedule, Cost	**FAA Resources May be at Risk if OMP is Delayed** OMP start may be delayed due to	60%	1. Develop ATO-W Corporate Work Plan (CWP) options for reallocation of OMP resources should OMP resource requirements be placed on-hold due to delayed start (options for staffing, contractor	High

Table 8.0 Risk Inventory and Assessment

Date Identified	Area of Risk	Description	Probability of Occurrence	Strategy for Mitigation	Exposure Level
		environmental schedule or litigation delays. FAA contracts and/or resource plans may be at risk if OMP start is delayed.		support and/or equipment). 2. Contractually include "possible delay" no-default clauses in initial contracts prepared for OMP ROD start.	
8/15/05	Schedule	**OMP Schedule at risk if proposed North ATCT is not ready by January 2008** The proposed North ATCT commissioning is a critical path element of the proposed runway 9L/27R implementation schedule. There will be limited use of the north runway if the North ATCT is not commissioned, therefore capacity gains will not be realized. Line of site restrictions from the existing ATCT makes it inefficient to control air traffic on the north runway from the existing tower. The first runway is expected to commission the 2nd quarter of FY-2008. The City of Chicago plans to begin construction in 7/06 and the projected duration for construction is 15 months (10/07). The FAA duration for equipment installation and testing is 15 months (1/09)	50%	1. Once base building has reached substantial completion the FAA can begin site prep and installation work while tower construction is completed. 2. Assign multiple crews for equipment installation to decrease duration. 3. Begin AT training as soon as equipment is available to decrease the required 6 month training duration.	High
12/04	Cost	**OMP Funding Assumptions**: FAA OMP Business Case cost basis makes certain assumptions defining OMP Sponsor funding responsibilities. These definitions are stated in this Business Case; Sections 9.1 and 9.2. However, there is non-mitigated risk associated with some equipment currently assumed to be Sponsor funded. The amount of risk depends both on the item and on factors outside Agency control. The following are the items currently deemed to be at cost risk: a) Second on-field ASR-9 is especially vulnerable to Sponsor scrutiny due to past FAA Delay Task Force recommendation and its prior inclusion in FAA CWP, both of which were pre-OMP and communicated to Sponsor.	30%	Process and sign Memorandum of Agreement (MOA) with Sponsor as soon as possible after EIS approval.	Medium

Table 8.0 Risk Inventory and Assessment

Date Identified	Area of Risk	Description	Probability of Occurrence	Strategy for Mitigation	Exposure Level
		(Estimated additional cost, $2.5M). b) Congressional mandates requiring FAA to fund the installation and/or acquisition of OMP NAS equipment; especially navigation and landing facilities, which are historically more vulnerable to such mandates. (Estimated range of additional cost, $ 2M to $13M; pending number of such facilities mandated). c) North ATCT ASDE-X (Estimated additional cost, $3M - $6M). d) Replace and upgrade the currently inadequate capacity ORD ATCT control and monitoring system with the new FAA Integrated Control and Monitoring System (ICAMS). ICAMS is a requirement for both the current airfield and the future OMP airfield (ROM estimated additional cost, $1.2M). e) New North ATCT construction is not funded by the City of Chicago in accordance with MOA. f) Although the modifications to the current ORD ATCT required by OMP are intended to be covered under the MOA with the City of Chicago, there is the possibility that FAA may have to bear the cost. The final costs have not been determined, nor hav the costs been included in the budget request.			
12/04	Schedule, Cost	**FAA Ability to Support OMP due to Staffing Shortages**: The City of Chicago has implemented very aggressive OMP design and construction schedules. Qualified ATO-W staffing levels may not be sufficient to adequately meet Sponsor's design and construction schedules. Limited FAA ATO-W resources may have difficulty staffing-up and supporting the multitude of concurrent program tasks, especially at start-up and the first year or two.	30%	1. Early identification of potential work overloads, via advanced planning, e.g., COPS meetings, etc. 2. Develop project schedules and load staffing requirements. 3. Identify staffing shortfalls, and management approve and implement hiring or reallocating existing FAA personnel. 4. Acquire additional FAA or contracted staffing via timely processing or reimbursable agreements with City of Chicago. 5. Coordinate potential FAA scheduling delays for hand-off to City of Chicago contractors. 6. Management implements above mitigations	Medium

Table 8.0 Risk Inventory and Assessment

Date Identified	Area of Risk	Description	Probability of Occurrence	Strategy for Mitigation	Exposure Level
				and/or contingencies, monitor workload status, and prioritize FAA resources.	
12/04	Cost, Schedule	**Adequate Controller Staffing On-board at C90 and ORD**: FAA AT controller hiring/selection process is not compatible with the Sponsor's aggressive construction schedule. Typical controller training pipeline is 18-24 months, leaving the probability open that OMP required facilities will not be sufficiently staffed.	60%	1. Develop coordinated staffing plans for facilities as outlined in the Business Case. 2. Prioritize hiring/staffing plans for affected facilities. 3. Develop alternate staffing plan if OMP new Advanced Electronic Flight Strip system will not be operational for new North ATCT commissioning. (Also see risk, "New Advanced Electronic Flight Strip system Availability")	Medium
12/04	Technical, Cost,	**New Advanced Electronic Flight Strip System Availability**: Technical and Cost Risk: Efficient OMP two tower operations require the development and implementation of a new Advanced Electronic Flight Strip system. The current system utilizes paper strips, which will not be efficient when information has to be shared between two ATCTs. If AT must support existing electronic flight strip transmission technology, additional AT controller staffing and equipment will be required above what is planned to support OMP.	50%	1. Team formed to develop concept, test and implement system. 2. Management prioritizes development of new Advanced Electronic Flight Strip system. 3. FAA fund development and implementation of new Advanced Electronic Flight Strip system.	Medium
12/04	Cost. Schedule	**OMP Capacity During Construction**: The implementation of OMP will challenge existing airfield operations throughout the 10+ year timeframe of the full OMP. O'Hare capacity may be jeopardized by OMP construction; e.g., unscheduled or extensive outages, phasing irregularities, runway incursions, etc.	60%	1. Use risk management principals and management review processes to minimize impact to existing operations. 2. Plan and phase all construction activities to minimize impacts with safety as first goal. 3. Coordinate and implement safety-first goals via joint FAA/City of Chicago planning meetings, feasibility studies and reimbursable planning projects. 4. Request Sponsor to provide training for OMP contractors (to include, but not be limited to, runway incursion training). 5. Request Sponsor to add contractual clauses that require contractor to have runways or taxiways available for use, or returned to use, as specified to minimize impact, and assess liquidated damages if contractor fails to comply.	Medium
12/04	Schedule	**Radio Frequency Availability**: OMP/Chicago radio frequency	40%	1. Document requirements and attempt to minimize change perturbations.	Low

Table 8.0 Risk Inventory and Assessment					
Date Identified	Area of Risk	Description	Probability of Occurrence	Strategy for Mitigation	Exposure Level
		environment is very limited and may require extensive spectrum engineering efforts and time to identify, process and reserve OMP required additional frequencies.		2. Request FAA Headquarters (HQ) assistance for additional spectrum analysis and processing resources. 3. Obtain required resources to implement new frequencies and/or frequency changes (e.g., crystals, receivers, etc.).	

8.1 Risk Management Plan

The basic risk management strategy is intended to identify critical areas and risk events, both technical and non-technical, and take necessary action to handle them before they become problems, causing serious cost, schedule or performance impacts. Risk management will be accomplished using an integrated Government-Contractor integrated team organization. The O'Hare Modernization Program (OMP) Team will document risk information using a standard Risk Information Form (RIF) and that information will be incorporated in the risk management database.

The OMP Team will use a decentralized risk organization for risk management. The risk organization is *not* a separate organization; risk management is a team function and not an additional or separate function to perform. Hence, separate personnel are not designated to manage risk but rather all individuals are required to consider risk management as a part of their jobs. The OMP risk program and process is documented in the *Draft O'Hare Modernization Risk Management Plan*, dated September 20, 2005.

9.0 Acquisition Strategy

The O'Hare Modernization Program will use a two-strategy approach to procure this program. The strategies are described in the subsections below.

9.1 Reimbursable Acquisition

The OMP Sponsor, the City of Chicago, is responsible for funding all changes required by OMP that take place inside of or in the required vicinity of the Sponsor's OMP Airport Layout Plan (ALP) airfield (e.g., NAS airfield installations, LLWAS relocations, etc). If the Sponsor requests FAA acquisitions or utilizes FAA procurement processing, the costs of all such activities will be reimbursed and agreed to in accordance with current FAA reimbursable Policies and Orders.

The Sponsor is responsible for the cost for the relocation, replacement, modification or installation of FAA air traffic control and navigation facilities or components thereof made necessary by airport improvements or changes when required by construction of new runways and taxiways, the extension of or changes to runways or taxiways, or other improvements to existing airport facilities, buildings and parking or service areas.[Reference: FAA Orders 5100.38B *Airport Improvement Program Handbook* and 6030.1; *FAA Policy on Facility Relocations Occasioned by Airport Improvement Changes*]

These defined responsibilities are being presented to the Sponsor in a pre-EIS ROD Planning Document titled, "*Identification of Program Responsibilities for Proposed OMP*". If the OMP ROD is approved, it is intended that this document be the basis for a future Memorandum of Agreement (MOA) between the FAA and the OMP Sponsor.

9.2 Non-Reimbursable Acquisition

Per the proposed Planning Document addressed in 9.1 above, the FAA is responsible for funding NAS supporting airspace changes driven by OMP at FAA facilities that are currently wholly outside the boundaries of the City's OMP ALP airfield (e.g., FAA Center, TRACON, etc.). This defined responsibility is being presented to the Sponsor in the OMP pre-EIS ROD Planning Document as referenced above.

The Non-Reimbursable acquisition strategy will use several procurement contracts over the length of the program. Funding of equipment to meet en route and terminal requirements will be the responsibility of the appropriate ATO organization (i.e., ATO-E, ATO-T, and ATO-W).

10.0 Project and Funding Plan

The costs presented in this section of the Business Case support the preferred alternative, High and Wide.

Section 3.0 of this document provided the breakdown of the OMP Phase 1 project by key milestone and target completion date. This section presents Section 3.0 milestones and other supportive milestones. Together, these milestones will be used to evaluate the cost and schedule performance of OMP Phase 1. Table 10.0-1 provides a breakdown of OMP Phase 1 costs based on the milestones. The risk-adjusted cost estimate (Then-Year, $K) was used to allocate funding against each milestone. The OMP team reviewed each line of the cost estimate and determined which milestone the activity supports. These milestone costs were further broken down into F&E and O&M costs for the two funding sources, the FAA and the City of Chicago. In addition, the table lists the anticipated start and completion dates, the total duration (in days) and the applicable funding agency. The ATO Service Units responsible for the work is also listed in the Funding Agency column. This is applicable to whether the costs will be incurred by the FAA or be reimbursed by the City of Chicago.

Table 10.0-1 Milestone Summary

Description of Milestone	Planned				
	Schedule		Duration		
	Start Date	End Date	(In Days)	Planned Cost (Thousands)	Funding Agency
1. Pre-ROD EIS Support Reimbursables	10/1/2004	2/28/2006	516		
Facilities and Equipment-City of Chicago				$771.2	City of Chicago (ATO-W)
2. Studies & Analyses	1/2/2005	3/31/2006	454		
Operations and Maintenance-FAA				$2,830.7	FAA (ATO-T)
3. Runway 14L Threshold Relocate	3/1/2006	7/31/2006	153		
Operations and Maintenance-FAA				$20.7	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$34.9	City of Chicago (ATO-W)
Operations and Maintenance-City of Chicago				$7.1	City of Chicago (ATO-W)
4. En Route Airspace Redesign	10/1/2005	2/28/2007	516		
Facilities and Equipment-FAA				$4,246.5	FAA (ATO-E/T/W)
Operations and Maintenance-FAA				$416.5	FAA (ATO-T/W)
5. Terminal Airspace Redesign	10/1/2005	2/28/2007	516		
Facilities and Equipment-FAA				$3,203.8	FAA (ATO-T/W)
Operations and Maintenance-FAA				$845.8	FAA (ATO-T/W)
Facilities and Equipment-City of Chicago				$1,220.4	City of Chicago (ATO-T)
6. New North ATCT	10/1/2005	10/31/2007	761		
Operations and Maintenance-FAA				$48.7	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$8,989.1	City of Chicago (ATO-T/W)
Operations and Maintenance-City of Chicago				$0.4	City of Chicago (ATO-W)
7. On-Field Radars (1 relocate and 1 new)	4/1/2006	10/31/2007	579		
Operations and Maintenance-FAA				$48.5	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$8,216.2	City of Chicago (ATO-T/W)
Operations and Maintenance-City of Chicago				$14.9	City of Chicago (ATO-W)
8. New Runway 9L/27R	1/1/2006	1/31/2008	761		
Operations and Maintenance-FAA				$51.7	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$9,132.0	City of Chicago (ATO-W)
Operations and Maintenance-City of Chicago				$16.4	City of Chicago (ATO-W)

Description of Milestone	Planned				
	Schedule		Duration		
	Start Date	End Date	(In Days)	Planned Cost (Thousands)	Funding Agency
9. Runway Extension, 10L/28R	10/1/2005	11/30/2008	1157		
Operations and Maintenance-FAA				$31.1	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$3,770.6	City of Chicago (ATO-W)
Operations and Maintenance-City of Chicago				$12.5	City of Chicago (ATO-W)
10. Site and Depot Spares Acquisition	10/1/2005	9/30/2009	1461		
Facilities and Equipment-FAA				$2,109.6	FAA (ATO-T)
11. FOT Installations, Field-wide	1/27/2006	10/31/2009	1374		
Operations and Maintenance-FAA				$31.9	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$1,262.0	City of Chicago (ATO-W)
12. New Runway 10C/28C	1/1/2006	1/31/2010	1492		
Operations and Maintenance-FAA				$79.7	FAA (ATO-W)
Facilities and Equipment-City of Chicago				$15,262.5	City of Chicago (ATO-T/W)
Operations and Maintenance-City of Chicago				$18.2	City of Chicago (ATO-W)
13. Program Office Support (Level of Effort)	10/1/2004	9/30/2013	3287		
Facilities and Equipment-FAA				$7,362.5	FAA (ATO-T/W)
Facilities and Equipment-City of Chicago				$1,522.5	City of Chicago (ATO-W)
14. In-Service Management (Recurring)	10/1/2004	9/30/2013	3287		
Operations and Maintenance-FAA				$92,709.0	FAA (ATO-T/W)
Operations and Maintenance-City of Chicago				$649.1	City of Chicago (ATO-W)
Completion Date: 9/30/2013			**Total Cost Estimate at Completion (Thousands):**	**164,936.9**	

Table 10.0-2 provides the time phasing of costs in thousands ($K) by fiscal year and according to the anticipated funding source, the FAA or the City of Chicago.

Table 10.0-2 All Costs Then-Year Risk-Adjusted

WBS #	Cost Total (Then Year, Risk Adjusted, $K)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
	FAA Costs	**$4,212.1**	**$15,252.2**	**$13,396.4**	**$12,601.4**	**$13,064.5**	**$13,163.8**	**$12,792.6**	**$13,402.3**	**$14,041.9**	**$111,927.2**
	Facilities and Equipment Costs	**$1,381.4**	**$7,690.1**	**$1,970.8**	**$1,401.0**	**$1,426.8**	**$942.8**	**$0.0**	**$0.0**	**$0.0**	**$14,812.9**
3.0	Solution Development	$1,348.4	$5,011.7	$676.6	$505.9	$522.1	$0.0	$0.0	$0.0	$0.0	$8,064.7
4.0	Implementation	$33.0	$2,677.7	$1,294.2	$895.2	$904.6	$942.8	$0.0	$0.0	$0.0	$6,747.5
5.0	In-Service Management (F&E)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
6.0	Disposition	$0.0	$0.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.7
5.0	**In-Service Management**	**$2,830.7**	**$7,562.1**	**$11,425.6**	**$11,200.4**	**$11,637.8**	**$12,221.0**	**$12,792.6**	**$13,402.3**	**$14,041.9**	**$97,114.3**
	Reimbursable Costs	**$934.6**	**$26,802.1**	**$10,024.5**	**$10,300.5**	**$4,211.6**	**$736.4**	**$0.0**	**$0.0**	**$0.0**	**$53,009.7**
	Facilities and Equipment Costs	**$914.6**	**$26,708.3**	**$9,804.2**	**$10,158.3**	**$3,969.4**	**$736.4**	**$0.0**	**$0.0**	**$0.0**	**$52,291.2**
3.0	Solution Development	$914.6	$18,267.4	$5,552.9	$8,178.8	$777.0	$0.0	$0.0	$0.0	$0.0	$33,690.7
4.0	Implementation	$0.0	$8,368.1	$4,021.1	$1,836.8	$2,755.1	$643.2	$0.0	$0.0	$0.0	$17,624.2
5.0	In-Service Management (F&E)	$0.0	$70.5	$155.7	$85.9	$0.0	$0.0	$0.0	$0.0	$0.0	
6.0	Disposition	$0.0	$2.4	$74.5	$56.8	$437.3	$93.2	$0.0	$0.0	$0.0	$664.2
5.0	**In-Service Management**	**$20.0**	**$93.8**	**$220.3**	**$142.2**	**$242.2**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$718.5**
	Total Costs	**$5,146.6**	**$42,054.3**	**$23,421.0**	**$22,901.9**	**$17,276.2**	**$13,900.2**	**$12,792.6**	**$13,402.3**	**$14,041.9**	**$164,936.9**

Table 10.0-3 summarizes the ATO Service Unit responsible for implementing the various OMP activities. F&E and O&M costs have been broken out by ATO Service Unit and phased by fiscal year. Costs in this table are presented in millions ($M).

Table 10.0-3 FAA-only Costs by ATO Service Unit

Service (FAA Costs)	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	Total
ATO-E										
F&E	$0.000	$0.029	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.029
O&M	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
Total (TY Risk-Adjusted, $M)	$0.000	$0.029	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.029
ATO-T										
F&E	$1.115	$1.810	$1.174	$1.021	$1.056	$0.651	$0.000	$0.000	$0.000	$6.827
O&M	$2.831	$6.266	$9.776	$9.129	$9.586	$10.065	$10.569	$11.097	$11.652	$80.970
Total (TY Risk-Adjusted, $M)	$3.946	$8.075	$10.950	$10.151	$10.642	$10.716	$10.569	$11.097	$11.652	$87.797
ATO-W										
F&E	$0.266	$5.851	$0.797	$0.380	$0.370	$0.292	$0.000	$0.000	$0.000	$7.956
O&M	$0.000	$1.296	$1.650	$2.071	$2.052	$2.156	$2.224	$2.305	$2.390	$16.144
Total (TY Risk-Adjusted, $M)	$0.266	$7.148	$2.447	$2.451	$2.422	$2.447	$2.224	$2.305	$2.390	$24.101
F&E Total	$1.381	$7.690	$1.971	$1.401	$1.427	$0.943	$0.000	$0.000	$0.000	$14.813
O&M Total	$2.831	$7.562	$11.426	$11.200	$11.638	$12.221	$12.793	$13.402	$14.042	$97.114
Total Costs (TY Risk-Adjusted, $M)	$4.212	$15.252	$13.396	$12.601	$13.065	$13.164	$12.793	$13.402	$14.042	$111.927

Table 10.0-4 summarizes the ATO Service Unit reimbursable costs for implementing the various OMP activities. F&E and O&M costs have been broken out by ATO Service Unit and phased by fiscal year. Costs in this table are presented in millions ($M).

Table 10.0-4 Reimbursable Costs by ATO Service Unit

Service (Reimbursable Costs)	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	Total
ATO-E										
F&E	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**
O&M	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**
Total (TY, $M)	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**
ATO-T										
F&E	**$0.000**	**$8.542**	**$3.804**	**$0.363**	**$0.435**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$13.143**
O&M	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**
Total (TY, $M)	**$0.000**	**$8.542**	**$3.804**	**$0.363**	**$0.435**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$13.143**
ATO-W										
F&E	**$0.915**	**$18.167**	**$6.000**	**$9.795**	**$3.535**	**$0.736**	**$0.000**	**$0.000**	**$0.000**	**$39.148**
O&M	**$0.020**	**$0.094**	**$0.220**	**$0.142**	**$0.242**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.718**
Total (TY, $M)	**$0.935**	**$18.260**	**$6.220**	**$9.937**	**$3.777**	**$0.736**	**$0.000**	**$0.000**	**$0.000**	**$39.866**
F&E Total	$0.915	$26.708	$9.804	$10.158	$3.969	$0.736	$0.000	$0.000	$0.000	$52.291
O&M Total	$0.020	$0.094	$0.220	$0.142	$0.242	$0.000	$0.000	$0.000	$0.000	$0.718

Table 10.0-5 summarizes the total costs for the ATO Service Units implementing the various OMP activities. F&E and O&M costs have been broken out by ATO Service Unit and phased by fiscal year. Costs in this table are presented in millions ($M).

Table 10.0-5 Total Costs by ATO Service Unit

Service (Total Costs)	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	Total
ATO-E										
F&E	**$0.000**	**$0.029**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.029**
O&M	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**
Total (TY, $M)	**$0.000**	**$0.029**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.000**	**$0.029**
ATO-T										
F&E	**$1.115**	**$10.351**	**$4.978**	**$1.384**	**$1.491**	**$0.651**	**$0.000**	**$0.000**	**$0.000**	**$19.971**
O&M	**$2.831**	**$6.266**	**$9.776**	**$9.129**	**$9.586**	**$10.065**	**$10.569**	**$11.097**	**$11.652**	**$80.970**
Total (TY, $M)	**$3.946**	**$16.617**	**$14.754**	**$10.514**	**$11.077**	**$10.716**	**$10.569**	**$11.097**	**$11.652**	**$100.941**
ATO-W										
F&E	**$1.181**	**$24.018**	**$6.797**	**$10.175**	**$3.905**	**$1.028**	**$0.000**	**$0.000**	**$0.000**	**$47.104**
O&M	**$0.020**	**$1.390**	**$1.870**	**$2.213**	**$2.294**	**$2.156**	**$2.224**	**$2.305**	**$2.390**	**$16.863**
Total (TY, $M)	**$1.201**	**$25.408**	**$8.667**	**$12.388**	**$6.199**	**$3.184**	**$2.224**	**$2.305**	**$2.390**	**$63.967**
F&E Total	$2.296	$34.398	$11.775	$11.559	$5.396	$1.679	$0.000	$0.000	$0.000	$67.104
O&M Total	$2.851	$7.656	$11.646	$11.343	$11.880	$12.221	$12.793	$13.402	$14.042	$97.833

11.0 Environmental Impact Statement

Airport development involving federal funds or federal approvals is subject to an environmental evaluation in accordance with the National Environmental Policy Act (NEPA) of 1969. An EIS is the most comprehensive level of environmental review performed by the FAA on airport development projects. The document evaluates the proposed development in terms of consistency with applicable laws and regulations and ensures that the proposed development meets requirements of the NEPA. An EIS is a document that discloses and evaluates the impacts, both positive and negative, of a project with potential significant impacts to the environment.

According to the Council of Environmental Quality (CEQ) Regulations for Implementing NEPA, "The primary purpose of an environmental impact statement is to serve as an action forcing device to ensure that the policies and goals defined in the Act [NEPA] are infused into the ongoing programs and actions of the Federal Government."

The necessary review and analysis of the proposed Program is being overseen by the FAA who on July 17, 2002 published a Notice of Intent (NOI) in the Federal Register to prepare an EIS. Similar Notices were published in the Chicago Tribune, Chicago Sun-Times, Daily Herald, and Daily Southtown on July 5, 2002.

The Preliminary Draft Purpose and Need for the OMP EIS includes the following:

- Increase capacity and reduce delay (including peak periods and in all weather conditions) at O'Hare
- Provide terminal, landside, and support facilities to efficiently accommodate existing and future passenger and cargo demand and sufficient land for such facilities
- Provide an efficient surface access system for existing and future airport users

Also, the City of Chicago submitted a draft ALP depicting the OMP proposal to the FAA in December 2002. This ALP delineates the City of Chicago's proposed projects contained within the OMP. Concurrent with the environmental analysis, FAA is conducting a comprehensive review of the draft ALP to ensure that it meets the FAA criteria for safety and efficient use of airspace. Ultimately, the FAA must issue a favorable EIS ROD and grant approval of the ALP before the City can begin OMP construction.

In April 2004, FAA formally conveyed its projected EIS schedule to the City of Chicago. The following milestones and associated dates define the projected EIS schedule published in April 2004:

Notice of Availability of Draft EIS (DEIS)	January 2005
Public Hearings on DEIS	March 2005
Close of Public Comment Period	April 2005
Notice of Availability of Final EIS	July 2005

EIS Record of Decision September 2005

Status of EIS Progress

Through an intensive effort by FAA and its EIS contractor, the FAA has been able to advance the progress of its EIS work such that currently projecting availability of the DEIS in mid-January 2005 (vs. the February 2005 DEIS availability date reflected in FAA's published schedule). The precise date of the DEIS Notice of Availability (Federal Register) is targeted for January 21, 2005, with the complete DEIS document distributed to cooperating governmental agencies and other specified parties by January 14, 2005 (one week in advance of the Federal Register Notice, per procedural requirement).

Summary of DEIS Content

- Purpose and Need – The "Purpose and Need" statement of an EIS briefly specifies the underlying purpose and need to which the agency is responding in proposing the alternatives, including the proposed action. In the case of the O'Hare Modernization EIS, the purpose and need is as follows:

  "To address the projected needs of the Chicago region by reducing delays at O'Hare, thereby enhancing capacity of the NAS, and ensuring that future terminal facilities and supporting infrastructure can efficiently accommodate airport users."

  The purpose and need statement places focus on reduction of delays at O'Hare as the primary purpose of the proposed action, while at the same time acknowledging future capacity enhancement of the NAS as a beneficial result of such delay reduction efforts. The purpose and need statement was carefully crafted to allow a full range of potentially viable alternatives (including the use of other existing or proposed airports) to be considered without overly broadening the scope of the environmental study to well beyond that of the proposal being evaluated.

- Alternatives Screening Process and Alternatives Considered – A two-tiered alternative screening process was employed to assess the viability of alternatives considered. The initial screening phase assessed whether each potential alternative met the Purpose and Need of the EIS. The secondary screening phase examined the feasibility and prudence of alternatives that were successfully carried beyond the initial screening phase. A total of 15 separate alternatives (both on-airport and off-airport alternatives, including a "No Action" alternative) were assessed in the initial screening phase, with six alternatives carried forward to secondary screening, and four of these remaining alternatives passing the secondary screen and proceeding into full environmental analysis.

- Simulation Modeling of Alternative Airfield Configurations – The various O'Hare airfield development alternatives that successfully passed the above screening process subsequently underwent an intensive computer simulation modeling process involving substantial time and resources from the FAA and support contractors. This simulation modeling effort is unparalleled in terms detail and accuracy, with approximately 1400 hours of FAA Air Traffic staff time spent reviewing and validating simulated aircraft movements (both air and ground) for the various airfield alternatives and under various operating conditions. The simulation modeling results provide not only a sophisticated

projection of airfield operating capabilities, but also provide the basis for environmental assessment of each alternative (for example, noise and air quality impacts generated by the activity depicted in the model results).

It is relevant to note that, while all airfield configuration alternatives that were analyzed fall within a similar range in terms of overall environmental impacts, the City of Chicago's preferred O'Hare airfield option (the proposal submitted by the City for consideration by FAA) proved to be the superior alternative in terms of its operational capabilities (number of operations vs. projected delay rates).

- Environmental Consequences – For the alternatives that passed the two-tiered screening process, the FAA evaluated environmental consequences in 21 separate environmental areas as required by the NEPA. The following points highlight environmental consequence issues associated with the O'Hare Modernization EIS that the FAA sees as the most substantial, unique, or noteworthy:

  Noise – Due to the substantial reorientation of runways under the City of Chicago's proposal, O'Hare's noise impacted area would change in terms of specific areas affected. Whereas the overall size of the noise impacted area (defined by Federal standards as 65 DNL (Day/Night average Noise Level) or greater) would not be appreciably different than what exists today, some 2,000 additional residences (over future No Action number) would be encompassed within the shifted area of noise impact under the City's proposal. It is important to note, however, that since the last ALP update and associated EIS performed at O'Hare in 1984, the number of noise impacted residences around O'Hare has decreased by approximately 91% (from approximately 94,000 in 1982 to 8,500 in 2002) due to Federal government and industry noise reduction initiatives .

  Air Quality – Implementation of the City's proposal, and the associated increase in air traffic activity that would result, would generate up to a 30% increase in the presence of certain emissions contributing to reduced air quality, as compared to the option of leaving the airfield in its present configuration. However, increased Federal air quality standards scheduled to take effect in future years will result in out-year air quality levels, with or without implementation of the City of Chicago's OMP proposal, that are better than today's existing air quality levels at O'Hare.

  Property Acquisition – The City of Chicago's proposal includes the acquisition of 539 residences and 164 businesses from suburban communities adjacent to O'Hare, to facilitate construction of proposed runways. Approximately 2,630 residents would be impacted by this acquisition.

  Environmental Justice – Regarding the areas targeted for acquisition under any of the airfield development alternatives, impacts associated with acquisition would be felt by a predominantly Hispanic population. The FAA and its contractors have conducted significant outreach efforts within the affected community to assess impacts and provide pertinent information to members of the community regarding the airport development proposal and the rights and entitlements of affected residents throughout the EIS process and beyond.

Cemeteries – Encompassed within the footprint of the proposed airfield development are two cemeteries that have been in place since the mid-1800s, containing some 1600 graves. These cemeteries would require relocation.

- Mitigation of Environmental Impacts – All identified environmental impacts, including those highlighted above, could potentially be reduced by mitigation efforts. Although initial consideration of appropriate mitigation actions is currently underway, the DEIS document does not contain detailed and final information regarding mitigation of environmental impacts. Rather, the FAA will seek full public input, through the upcoming DEIS public hearing and comment process, before formulating final information concerning mitigation of environmental impacts, for inclusion in the Final EIS and EIS Record of Decision.

- Selection of Preferred Alternative – The DEIS does not reflect the selection of a preferred alternative. Such a determination will await full public input via the upcoming public hearings and comment period. At this point, the purpose of the DEIS is to provide a body of environmental analysis information to the public for review and comment. Ultimately, the FAA will combine the DEIS information with relevant public input to generate a Final EIS that includes a preferred alternative.

12.0 Recommendations

The ATO/Chicago Area Modernization Program Office (CMP) Business Case Team recommends:

- The ATO Executive Council approves implementation of Alternative 3.
- ATO Services should prioritize OMP Phase 1 activities to ensure implementation is properly scheduled and funded to meet the Sponsor's very aggressive schedule.
- ATO-T should manage/synchronize planning and execution activities across all ATO Services and act as the coordination point within ATO for the Chicago Area Modernization Program Office.
- FAA Acquisition Executive requests from the Joint Resources Council delegation of final investment decision to the ATO Executive Council.

Appendix A. Acronyms

A

A/G	Air-to-Ground
AAR	Airport Arrival Rate
ACE-IT	Automated Cost Estimating Integrated Tools
ADOC	Airline Direct Operational Cost
ADR	Airport Departure Rate
AEFS	Advanced Electronic Flight Strip
AF	Airway Facilities
AGL	FAA Great Lakes Region; Also, Above Ground Level
AIP	Airport Improvement Program
ALP	Airport Layout Plan
ALSF	Approach Lighting System with Sequenced Flashers
ANI	FAA NAS Implementation
ANMS	Airport Noise Management System
AOSC	Airport Obstruction Standards Subcommittee
ARC	Assistant Administrator for Regions and Center Operations
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Tracking System
ARTS IIIE	Automated Radar Tracking System IIIE
ASDE-X	Airport Surface Detection System (Model X)
ASPM	Aviation System Performance Metrics
ASR	Airport Surveillance Radar
ASR-11	Airport Surveillance Radar 11
ASR-9	Airport Surveillance Radar 9

AT	Air Traffic
ATA	Air Transport Association of America
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATO	Air Traffic Organization
ATO-E	Air Traffic Organization En Route Operations and Oceanic Services
ATO-F	Air Traffic Organization Finance Services
ATO-P	Air Traffic Organization Operations Planning Services
ATO-T	Air Traffic Organization Terminal Services
ATO-W	Air Traffic Organization, Central Service Area, Engineering Services, Facilities and Equipment
AVN	Aviation System Standards

B

BRITE	Bright Radar Indicator Tower Equipment
BUEC	Back-up Emergency Communication
BWM	Bandwidth Manager

C

C90	Chicago TRACON
CAPS	Compressed Arrival Procedures
CAT I/II/III	Category I/II/III Instrument Landing System
CBA	Cost-Benefit Analysis
CCT	City Consulting Team
CEQ	Council on Environmental Quality

CGT	Chicago Heights Very High Frequency Omnidirectional Range (VOR)
CMP	Chicago Area Modernization Program Office
COPS	Construction Operations Phasing Subcommittee
COTS	Commercial-off-the-Shelf
CPC	Certified Professional Controller
CWP	Corporate Work Plan
CY	Calendar Year

D

DEIS	Draft Environmental Impact Statement
DME	Distance Measuring Equipment
DNL	Decibel Noise Level
DVRS	Digital Voice Recorder System

E

EFSTS	Electronic Flight Strip Transfer System
EIS	Environmental Impact Statement
ESU	Environmental Support Unit
ETG	Electronic Target Generator

F

F&E	Facilities and Equipment
FAA	Federal Aviation Administration
FACT	Future Airport Capacity Task
FDAD	Fully Digital ARTS Display

FDIO	Flight Data Input/Output
FOT	Fiber Optic Telecommunications
FPO	Flight Procedures Office
FSEP	Facility/Services/Equipment Profile
FST	Federal Flight Segment Tax
FTT	Federal Ticket Tax
FTE	Full-time Employee
FY	Fiscal Year
FWA	Fort Wayne, Indiana

H

HQ	Headquarters
HITL	Human-in-the-loop
HOCSR	Host and Oceanic Computer System Replacement

I

ICAMS	Integrated Control and Monitoring System
IDP	Integrated Design Plan
IDS	Information Display System
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IOC	Initial Operating Capability
IRR	Internal Rate of Return

J

JAI	Joint Acceptance Inspection
JON	Job Order Number

L

LAHSO	Land and Hold Short Operations
LLWAS	Low Level Wind Shear Alert System
LMS	Logistics Management Position
LOC	Localizer
LOE	Level of Effort
LOI	Letter of Intent

M

MASE	Midwest Airspace Enhancement
MDW	Chicago Midway International Airport
MKE	Milwaukee, Wisconsin TRACON, also MKE VOR
MOA	Memorandum of Agreement
MOA	Military Operations Area
Mode-S	Mode-Select Secondary Radar System

N

NAR	National Airspace Redesign
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NATCA	National Air Traffic Controllers Association

NDI	Non-Developmental Item
NEPA	National Environmental Policy Act
NM	Nautical Miles
NOI	Notice of Intent
NPV	Net Present Value

O

O&M	Operations and Maintenance
OEP	Operational Evolution Plan
OIG	Office of the Inspector General
OMB	Office of Management and Budget
OMP	O'Hare Modernization Program
OPS	Operations
ORD	Chicago O'Hare International Airport, also, Chicago O'Hare Tower, also O'Hare VOR
OS	Operations Supervisor
OTA	Other Transactional Agreement

P

PAPI	Precision Approach Path Indicator
PCS	Power Conditioning System
PEM	Position Equipment Module
PFC	Passenger Facility Charge
PFF	Pre-commissioned Facility File
PVT	Passenger Value of Time

Q

QXM	Tinley Park, Illinois

R

RCAG	Remote Communication Air-to-Ground
RDVS	Rapid Deployment Voice Switch
RFD	Rockford Airport
RIF	Risk Information Form
ROD	Record of Decision
ROM	Rough Order Magnitude
RSS	Radar Support System
RTCA	Radio Technical Commission for Aeronautics
RTP	Regional Tracking Program
RTR	Remote Transmitter/Receiver Site
RVR	Runway Visual Range

S

SBN	South Bend TRACON
SSA	Petone/South Suburban Airport
SE	System Engineering
SSC	System Support Center
SSCM	System Support Center Manager
SMO	Systems Management Office
STARS	Standard Terminal Automation Replacement System
SW	Software

SX	Engine Generator

T

TAAM	Total Airspace and Airport Modeller
TACAN	Tactical Aircraft Control and Navigation
TAMR	Terminal Automation Modernization/Replacement
TAF	Terminal Area Forecast
TASR	Transportable Airport Surveillance Radar
TBD	To Be Determined
TED	Touch Entry Display
TMC	Traffic Management Coordinator
TMO	Traffic Management Officer
TMU	Traffic Management Unit
TOL	Toledo, Ohio
TRACON	Terminal Radar Approach Control
TY	Then-Year

U

UHF	Ultra High Frequency
UPS	Uninterruptible Power System
US	United States

W

WBS	Work Breakdown Structure

V

VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Range
VORTAC	VOR collocated with TACAN
VSCS	Voice Switching Control System
VTABS	VSCS Training and Backup Switch

W

WBS	Work Breakdown Structure

Z

ZAU	Chicago Air Traffic Control Center

Appendix B. Total List of Equipment

OMP On-Airfield Equipment (Reimbursable))

14L ILS
RVR Relocation
14L ALSF 2
14L DME

9L ILS
9L/27R RVR
9L ALSF-2
9L/27R DME

27R ILS
27R ALSF-2
22R LOC

10ILS
10l/28R RVR
10L ALSF-2
10L/28R DME
10L PAPI

ASDE-X

10C ILS
10C/28C RVR
10C ALSF-2
10C/28C DME
10C PAPI

28C ILS
28C ALSF-2
28C PAPI

RTR P
RTR S
RTR Q
RTR R
RTR T
Temp RTR

LLWAS

Fiber Optic Transmission System

North ATCT

North RADAR

South RADAR

Equipment for Airspace Redesign FAA Funded

Elgin RDVS
Elgin DVRS Expansion
Elgin Position Redesignation
ASR-11 Gateway Capability (MOD 32)

MKE RTR (1 Frequency)
MKE STARS Displays (2)

SBN RTR (1 Frequency)

ZAU Position Reconfiguration
RCAG (8 Frequencies) to support new ZAU sectors
BUEC (4 Frequencies) to support new ZAU sectors

North ATCT Equipment (Reimbursable)

IDS-4 (5)
BRITE Displays (4)
Emergency Receivers (4)
Tower Voice Switch (RDVS Interface)
Flight Data Input/Output (FDIO)
Power Conditioning System (PCS)
Engine Generator (SX)
Voice Bypass Switch
Advanced Electronic Flight Strip System

Appendix C. ATO Technical Operations Services (ATO-W) Staffing Requirements

The implementation of the O'Hare Modernization Program (OMP) poses a significant challenge to the Air Traffic Organization Technical Operations Services (ATO-W). The project scope realigns and constructs new runways and taxiways while keeping existing operations intact at the Nation's busiest airport. For the ATO-W organization, providing the necessary human capital to implement and relocate NAS facilities and services required to support OMP is critical. OMP will impact 270 existing commissioned National Airspace System (NAS) facilities and services along with the installation of over 50 new facilities. As a result, the generated workload for both NAS Implementation and Operations workgroups will be significantly increased. Human resources must be available to engineer, install, and oversee the numerous project phases. Critical job elements required to support OMP include: risk management, implementation oversight, testing and integration, equipment cutover, joint acceptance inspections (JAI), facility decommissioning and commissioning, and capitalization activities. To better understand the impact this project will create on existing human resources, a pre-commissioned facility (PFF) model was developed for the Operations workgroup. In addition, a NAS Implementation Resource Impact Report was generated using Regional Tracking Program (RTP) networks. The resource requirements generated for both the NAS Implementation and Operations workgroups are contained in the following paragraphs.

ATO-W Engineering Services Resource Impact

Engineering Services resources will be required to engineer, install, and relocate navigational, surveillance, radar and communications systems for Phase 1 of OMP. The projects will be both FAA and reimbursable funded. Staffing requirements for the NAS implementation group were generated by developing an RTP network for reimbursable and non-reimbursable projects for O'Hare and OMP driven projects at associated facilities. The project start dates are based on the earliest date reimbursable agreements can be established after issuance of an EIS record of decision. Staffing requirements identified prior to an EIS Record of Decision are generated by reimbursable agreements establish for planning associated with OMP.

The following bar charts, (A-B) identify staffing requirements for Phase 1 of OMP; figure (A) identifies full time employees (FTE's) required to engineer and install equipment necessary to support the proposed airspace redesign; and figure (B) identifies FTE's required to support the reimbursable projects that will be generated on the airfield for phase 1 of OMP.

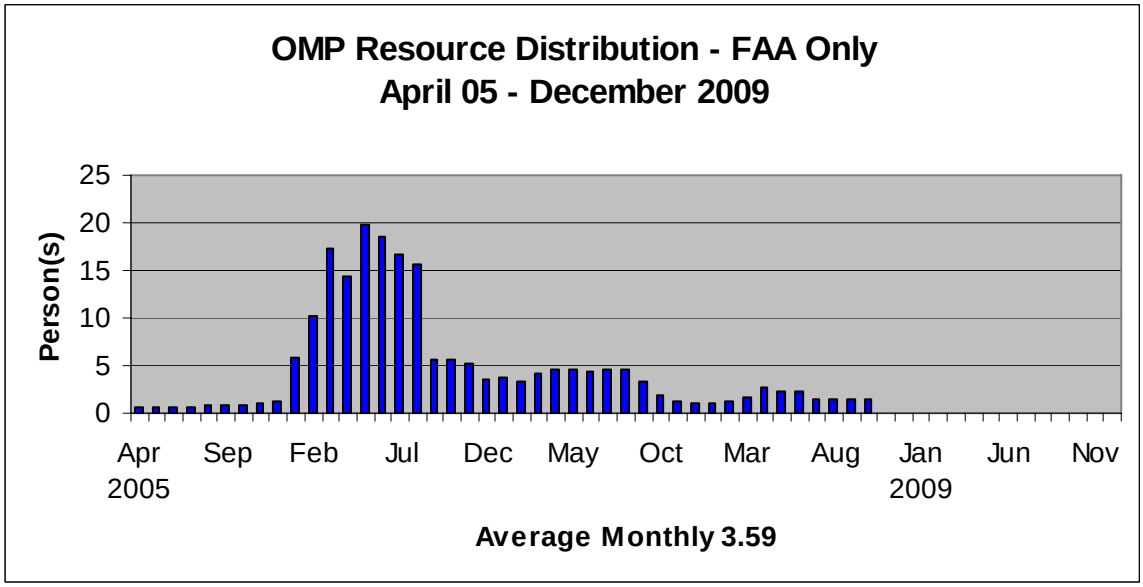


Figure A.

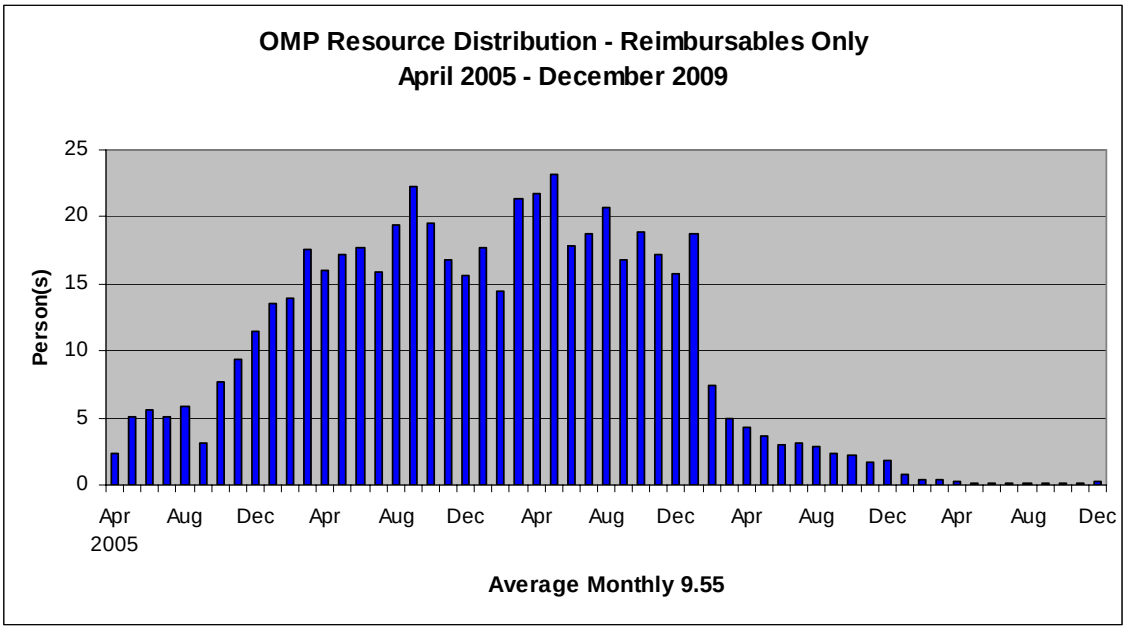


Figure B.

ATO-W Technical Services Workgroup Resource Model

Utilizing the project schedule and information from the Airport Layout Plan (ALP), a report was generated from the PFF model for each of the System Support Centers (SSC) located at O'Hare Airport. Further analysis was conducted for each SSC based upon current staffing levels, projected retirements, and projected staffing as a result of the OMP project. The results of the analysis were plotted (see Figures C-F) to determine the gaps between available human resources and overall generated workload. A summary of the analysis for each SSC is shown below.

- The Communications SSC experiences a staffing resource peak of almost 16 employee years based upon OMP project generated work hours. Subtracting the gap between existing workload and OMP generated staffing, plus factoring in the retirement eligible employees, the model projects a deficit of 3.64 employee years. Employee years are based upon 100% PFF generated values.

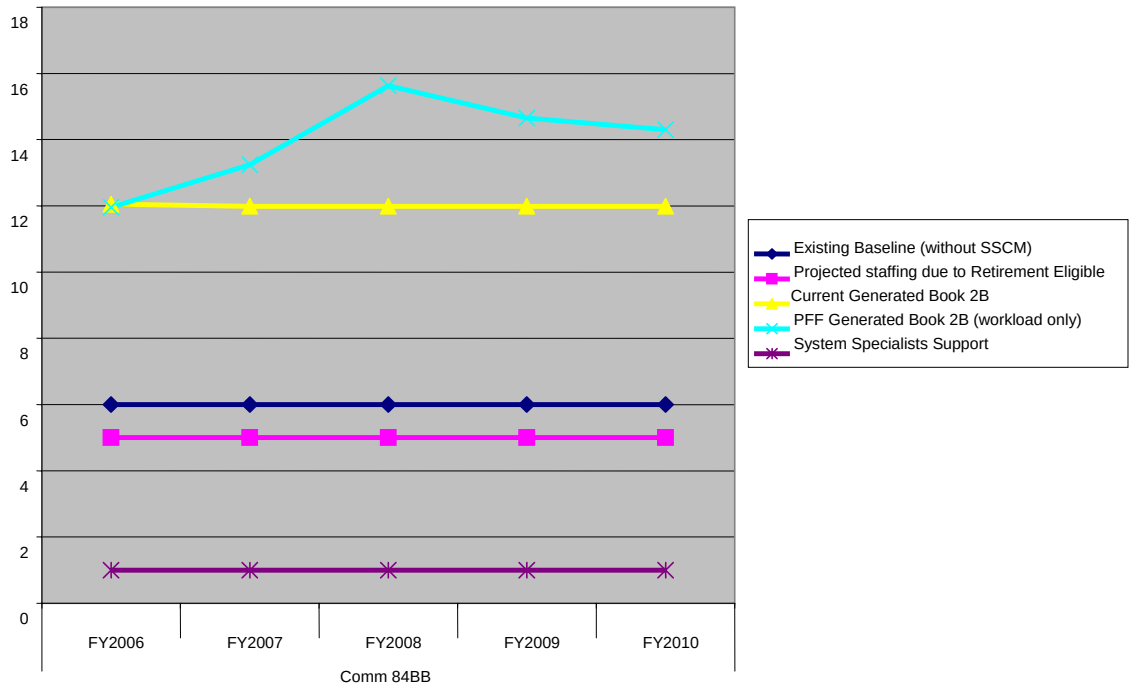


Figure C. Communications SSC

- The Navigation SSC experiences a staffing resource peak of almost 8 employee years based upon OMP project generated work hours. Subtracting the gap between existing workload and OMP generated staffing, plus factoring in the numerous retirement eligible employees, the model projects a deficit of 2.06 employee years. Employee years are based upon 100% PFF generated values.

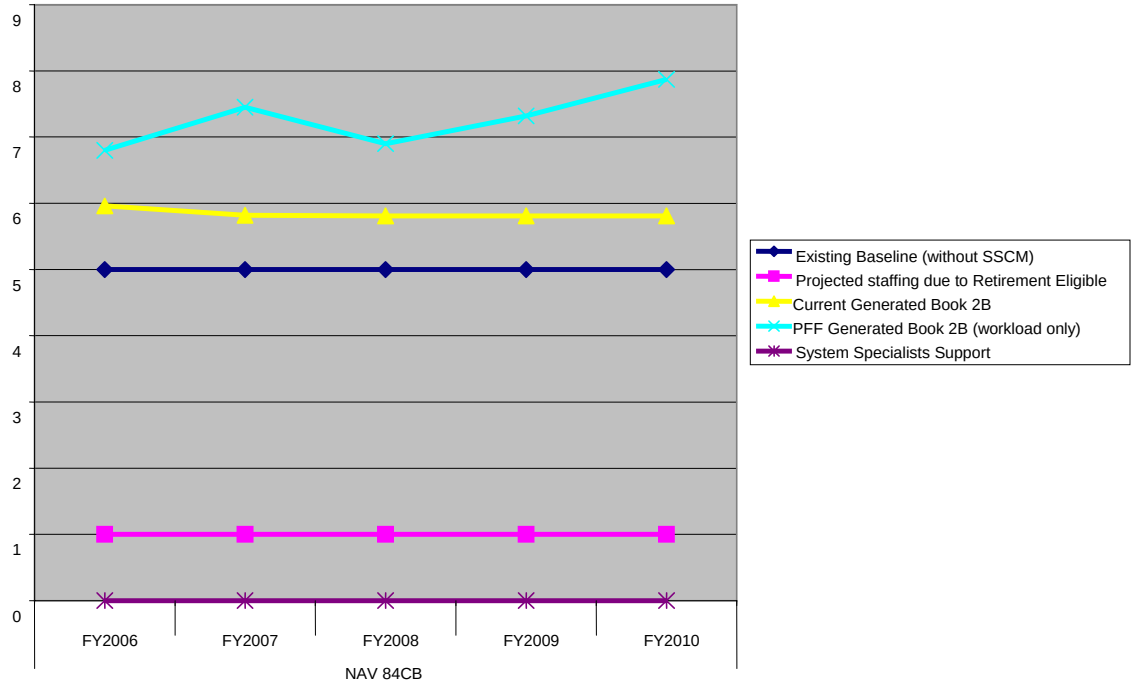


Figure D. Navigation SSC

- The Radar SSC experiences a staffing resource peak of almost 6.5 employee years based upon OMP project generated work hours. Subtracting the gap between existing workload and OMP generated staffing, plus factoring in the retirement eligible employees, the model projects a deficit of 2.29 employee years. Employee years are based upon 100% PFF generated values.

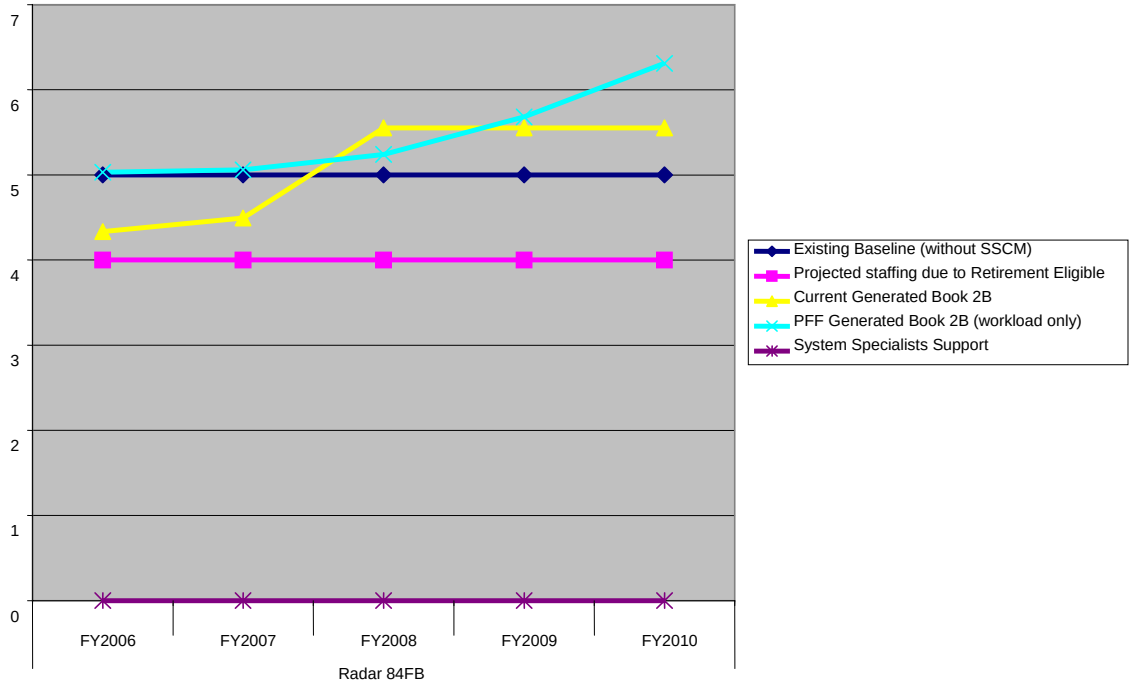


Figure E. Radar SSC

- The Environmental SSC experiences a staffing resource peak of almost 18 employee years based upon OMP project generated work hours. Subtracting the gap between existing workload and OMP generated staffing, plus factoring in the retirement eligible employees, the model projects a deficit of 3.64 employee years. Employee years are based upon 100% PFF generated values.

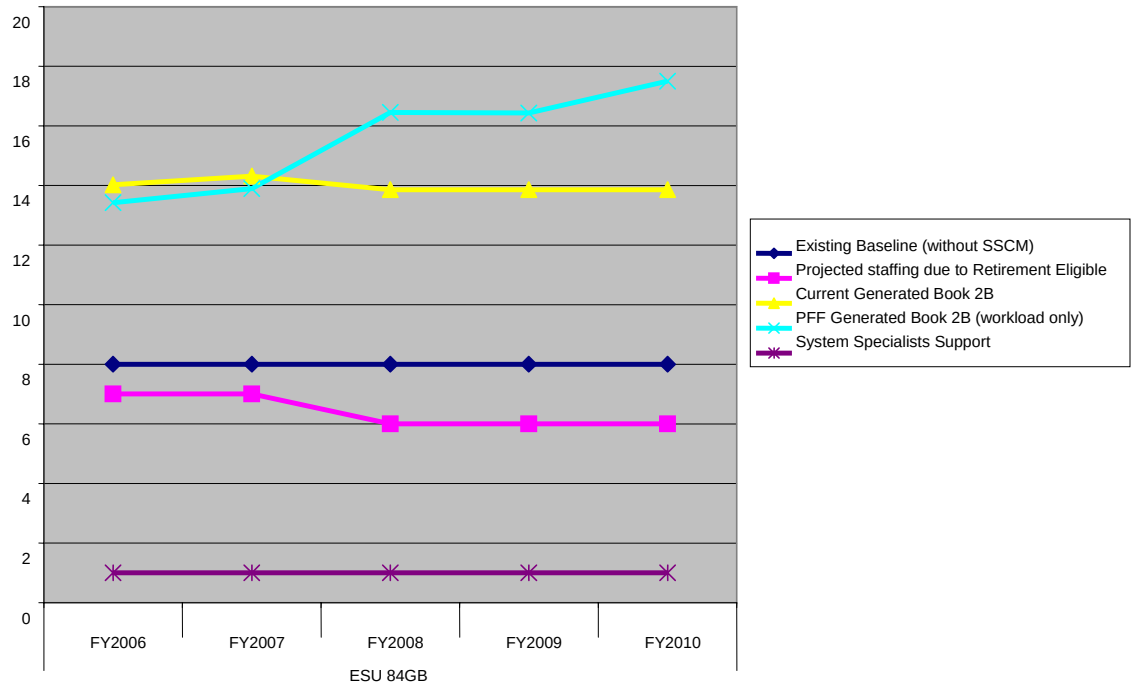


Figure F. Environmental SSC

In addition to the technical positions required to support OMP, a significant logistics workload will develop. Once implementation begins, several facilities will be relocated and decommissioned to vacate land required for new runways and taxiways. As new areas of pavement are completed, their associated NAS facilities will be installed and commissioned. These tasks require numerous hours initiating commissioning, decommissioning, and excessing facility equipment orders. This significant additional logistics workload will create the requirement for an additional Logistics Management Position (LMS).

Conclusions

The OMP project is one of the largest upgrades and modifications to the overall NAS and O'Hare International Airport since the inception of aviation. The City of Chicago plans for modernizing O'Hare International Airport called for the investment of $6.6 billion dollars. This plan is supported by many politicians, dignitaries, and members of local industry. The significance of this project is extremely political to the point that it is national in scope. The

ATO-W Technical Operations Organization must stand ready to support the challenges that OMP will pose. To properly prepare for its implementation, Technical Operations and the Agency must provide the human resources identified in this report in order to implement the many facets of this project in a successful and organized manner.

Appendix D. O'Hare Modernization Program (OMP) Benefits Calculations

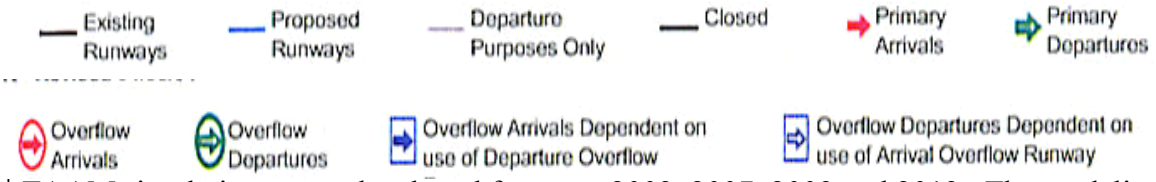
This appendix presents detailed analyses of OMP benefits for various alternatives developed in support of the OMP Business Case. Results of the Total Airspace and Airport Modeler (TAAM) analysis supporting EIS have been used as a base for calculating these benefits. The baseline year for all TAAM simulations[1] in support of the OMP Environmental Impact Statement (EIS) was 2002, and the traffic for the future years has been obtained by projecting baseline demand of 2002 using data from the 2002 Terminal Area Forecast (TAF).

Adjustments to the TAAM analysis results have been provided to reflect on airspace changes separately from the changes on the ground. All underlying assumptions are listed in corresponding sections of this Appendix and/or in the footnotes of the tables with intermediate and final analysis results.

Given the timeframe associated with the preparation of the OMP Business Case, the Federal Aviation Administration (FAA) Air Traffic Organization Operations Planning, Finance area (ATO-P) limited its review to the available analysis and could not validate the results of the TAAM model. Furthermore, changes to key assumptions such as the schedule of the proposed airspace sector implementation and/or the available frequency to support it, could erode some of the estimated benefits presented in this analysis[2] [3].

D.1 Chicago O'Hare International Airport (ORD) Runway Operating Configurations

ORD runway configurations for existing airfield (prior to 2007) and future (2007 and 2009) operations correspond to the ones used in TAAM simulations to support EIS. These configurations are shown in Tables D.1-D.3 for baseline, 2007, and 2009 operations correspondingly. Below is the key to the diagrams in these tables.



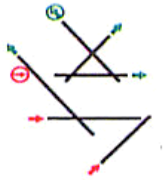
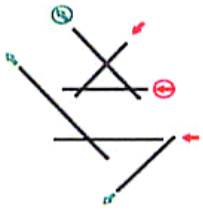
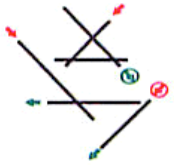
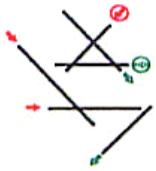
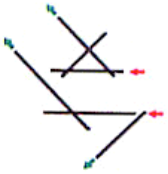
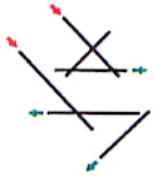
[1] TAAM simulations were developed for years 2003, 2007, 2009 and 2013. The modeling was conducted by the City of Chicago consultant Ricondo and Associates at the direction, review, oversight, and approval of the FAA. Leigh Fisher was an FAA contractor (through CMT), which assisted the Air Traffic Work Group and the FAA in the direction, review, oversight, and approval.

[2] See "Airspace Redesign Efforts Are Critical to Enhance Capacity But Need Major Improvements" Federal Aviation Administration, Report No. AV-2005-059, May 13, 2005.

[3] See "Chicago O'Hare Modernization Program" Federal Aviation Administration, Report No. AV-2005-67, July 2005.

Table D.1

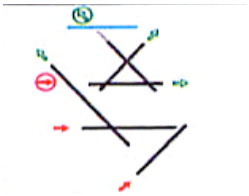
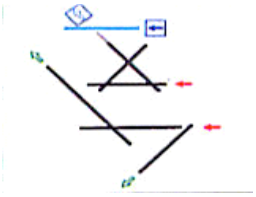
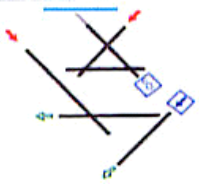
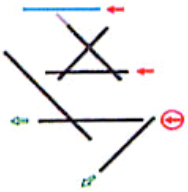
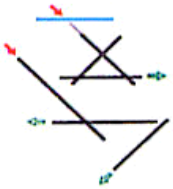
Baseline Operating Configurations

Runway Option	Weather	Flow	Runway Configuration	Runway Diagram
No Action	VFR	East	Plan X	
No Action	VFR	West	Plan W	
No Action	VFR	South	Plan B	
No Action	VFR	South	Plan B Modified	
No Action	IFR	West	Parallel 27s	
No Action	IFR	East	Parallel 14s	

Source: OMP-EIS Operating Configurations
VFR conditions assume visibility is greater than or equal to 3 miles and cloud ceiling is greater or equal to 1,000 feet
IFR conditions assume visibility is less than 3 miles and/or cloud ceiling is less than 1,000 feet

Table D.2

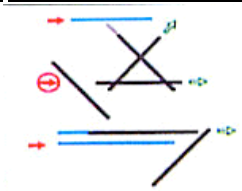
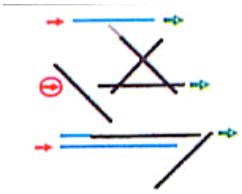
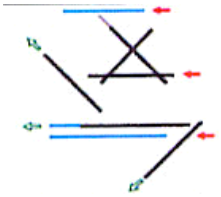
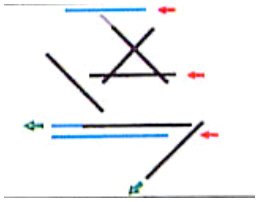
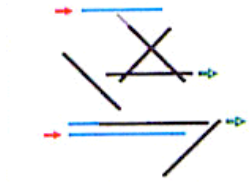
2007 Operating Configurations

Runway Option	Weather	Flow	Runway Configuration	Runway Diagram
2007 North Runway	VFR	East	Plan X	
2007 North Runway	VFR	West	Parallel 27s	
2007 North Runway	VFR	South	Plan B	
2007 North Runway	IFR	West	Parallel 27s	
2007 North Runway	IFR	South	Parallel 14s	

Source: OMP-EIS Operating Configurations
VFR conditions assume visibility is greater than or equal to 3 miles and cloud ceiling is greater or equal to 1,000 feet
IFR conditions assume visibility is less than 3 miles and/or cloud ceiling is less than 1,000 feet

Table D.3

2009 Operating Configurations

Runway Option	Weather	Flow	Runway Configuration	Runway Diagram
2009 Closely Spaced South Runway	VFR-3	East	Parallel 9s	
2009 Closely Spaced South Runway	VFR-4	East	Parallel 9s	
2009 Closely Spaced South Runway	VFR	West	Parallel 27s	
2009 Closely Spaced South Runway	IFR	West	Parallel 27s	
2009 Closely Spaced South Runway	IFR	East	Parallel 9s	

Source: OMP-EIS Operating Configurations
VFR conditions assume visibility is greater than or equal to 3 miles and cloud ceiling is greater or equal to 1,000 feet
IFR conditions assume visibility is less than 3 miles and/or cloud ceiling is less than 1,000 feet
VFR-3 conditions assume visibility is greater than or equal to 5 miles and cloud ceiling is greater or equal to 3,000 feet
VFR-4 conditions assume visibility is less than or equal to 3 miles and cloud ceiling is less than 3,000 feet but greater than or equal to 1,000 feet

D.2 ORD Fleet Mix

EIS fleet mix data for 2002 (extracted from Airport Noise Management System (ANMS) data), 2009 (with and without project provided by Leigh Fisher Associates in support of EIS), as well as 2004 fleet mix data extracted from Aviation System Performance Metrics (ASPM) have been used to derive an average fleet mix for calculating benefits. The following aircraft categories have been considered for a fleet mix breakdown: 2 and 3 engine narrow body jets (2N and 3N); 2, 3, and 4 engine wide body jets (2W, 3W, and 4W); regional jets (2JM) with seating capacity greater than 70 passengers. All other aircraft including smaller jet airplanes, as well as turboprop and piston engine types were included in one "Other" category.

An example of aircraft category assignment per aircraft type derived from ASPM data for 2004 is shown in Table D.4.

Table D.4

Chicago O'Hare International Airport
Fleet Mix Data

Aircraft Type	Category	Percentage	Cummulative
CRJ2	2JM	14.92%	14.92%
MD80	2N	9.33%	24.25%
E145	2JM	9.24%	33.49%
A320	2N	7.37%	40.86%
B733	2N	7.32%	48.18%
E135	2JM	6.34%	54.52%
F100	2JM	6.34%	60.86%
B735	2N	5.91%	66.77%
B752	2N	5.91%	72.68%
A319	2N	5.60%	78.28%
B738	2N	2.92%	81.20%
BA46	2JM	2.31%	83.51%
MD82	2N	2.10%	85.61%
CARJ	2JM	1.88%	87.49%
B772	2W	1.74%	89.23%
B763	2W	1.68%	90.91%
B744	4W	0.67%	91.58%
MD83	2N	0.62%	92.20%
CRJ1	2JM	0.60%	92.80%
DC9	2N	0.58%	93.38%
DC93	2N	0.52%	93.90%
B734	2N	0.44%	94.34%
B742	4W	0.37%	94.71%
MD10	3W	0.36%	95.07%
B73Q	2N	0.31%	95.38%
A306	2W	0.29%	95.67%
A343	4W	0.26%	95.93%
DC8Q	4W	0.25%	96.18%
DC95	2N	0.22%	96.40%
MD11	3W	0.18%	96.58%
MD90	2N	0.18%	96.76%
A332	2W	0.16%	96.92%
B737	2N	0.14%	97.06%
B762	2W	0.13%	97.19%
B743	4W	0.12%	97.31%
B732	2N	0.11%	97.42%
DC94	2N	0.10%	97.52%
A30B	2W	0.08%	97.60%
A333	2W	0.08%	97.68%
Other	NA	2.32%	100.00%
Total		100.00%	

Source: ASPM 2004 Data

Table D.5 summarizes corresponding fleet mixes for 2002, 2004 and 2009 and their average used for the benefits analysis.

Table D.5

Chicago O'Hare International Airport
Fleet Mix Data (Summary)

Category	2002	2004	2009 (no action)	2009 (with project)	Average
2JM (RJ>70)	34.30%	41.63%	31.17%	36.16%	35.82%
2N	54.71%	49.68%	58.74%	54.69%	54.46%
3N	0.46%	0.00%	0.00%	0.00%	0.12%
2W	4.45%	4.16%	6.83%	6.19%	5.41%
3W	0.59%	0.54%	0.33%	0.28%	0.44%
4W	2.32%	1.67%	2.50%	2.30%	2.20%
Other	3.17%	2.32%	0.43%	0.38%	1.58%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Source: EIS Data (2002, 2009), ASPM Data (2004)

D.3 Airline and Passenger Costs

Airline costs were derived based on the airline direct operational costs (ADOC). This includes crew, fuel and oil, and total maintenance costs. Passenger costs were derived based on passenger value of time (PVT). Both, ADOC and PVT, were derived using Economic Values for FAA Investment and Regulatory Decisions taking into consideration ORD fleet mix derived in Section D.2.

Tables D.6 and D.7 show ADOC per block hour and PVT based on the seating capacity and average NAS load factors for corresponding aircraft categories.

Table D.6

Airline Direct Operational Costs (ADOC) Cost per Block Hour

Category	Crew	Fuel and Oil	Total Maintenance	Total ADOC
2N	$674	$616	$589	$1,879
2W	$1,120	$1,225	$941	$3,286
3N	$1,196	$807	$496	$2,499
3W	$1,369	$1,753	$1,363	$4,485
4W	$1,941	$2,455	$1,655	$6,051
2JM	$353	$443	$343	$1,139

Source: Economic Values for FAA Investment and Regulatory Decisions
Draft Final Report, March 31, 2004
Prepared for: FAA Office of Aviation Policy and Plans

Table D.7

Passenger Value of Time (PVT) Aircraft Capacity and Load Factors

Category	Aircraft Capacity	Load Factor	PVT per Passenger per Hour
2N	142	0.7	$28.60
2W	226	0.75	$28.60
3N	139	0.67	$28.60
3W	278	0.75	$28.60
4W	368	0.82	$28.60
2JM	79	0.62	$28.60

Source: Economic Values for FAA Investment and Regulatory Decisions
Draft Final Report, March 31, 2004
Prepared for: FAA Office of Aviation Policy and Plans

Further consideration is given to the variation of ADOC per flight phase, so that the block hour numbers in Table D.6 can be adjusted accordingly. Based on the analysis of the Air Transport Association of America (ATA) reports data the following coefficients to the block hour costs are applied (see Table D.8)

Table D.8

Airline Direct Operational Costs (ADOC) Block Hour Cost Adjustments

Category	Gate	Taxi Out	Airborne	Taxi In	Total
Flight Deck Crew	1.00	1.01	1.00	0.95	1.00
Fuel	0.11	0.39	1.54	0.26	1.00
Maintenance	0.18	0.79	1.42	0.76	1.00
Equipment Charges	1.00	1.01	1.00	0.97	1.00
Other	1.00	1.00	1.00	0.97	1.00
Total Aircraft Operating	0.56	0.78	1.25	0.71	1.00

Source: Approaching Gridlock. Air Traffic Control Delays.
Report, October 14, 1999
Air Transport Association of America

Finally, based on the average fleet mix (Table D.5), ADOC (Table D.6), PVT (Table D.7), and ADOC block hour cost adjustments (Table D.8), the following costs were derived per block hour as well as per a phase of flight (See Table D.9).

Table D.9

Chicago O'Hare International Aiport Airline and Passenger Weighted Costs

Category	Cost
ADOC Cost per Block Hour	$1,775
PVT Cost per Block Hour	$2,547
Airborne Cost per Hour	$2,220
Gate Cost per Hour	$988
Taxi In Cost per Hour	$1,258
Taxi Out Cost per Hour	$1,386

D.4 ORD Delay Data

Delay data has been calculated based on unconstrained demand scenarios, which reflect traffic growth as represented in TAF 2002. The baseline data included in the simulations are considered to be in the high end. First, it is well known that the two major airlines (American and United) have successfully implemented a de-peaking[4] strategy by spreading their flights over a longer period of time without detriment to service or flight frequency. The benefits associated with the airlines successful capacity management approach were not included in the TAAM modeling developed by the city of Chicago in support of EIS.

Second, the City of Chicago's TAAM modeling timeframes used for the calculations of benefits did not take into consideration the "operational constraints" of the relocation of the runways and associated navigation aids and the transition impact to ongoing operations (only end-state scenarios were modeled[5]). During the review process and the preparation of this business case, the benefits were adjusted to minimize the impact of the inflated baseline by taking the 20th percentile of the two TAAM scenarios (constrained and unconstrained), based on ATO-P's guidance.

According to the most recent TAF 2004 projected traffic will increase on average by about 5-7% by 2009 compared to TAF 2002.

The following TAAM scenarios from EIS have been used to support delay data analysis:

- Existing Airfield (2003)
- No Airspace Changes (2007)
- No Airspace Changes (2009)
- With project (ground and "High and Wide") (2007)
- With project (ground and "High and Wide") (2009)

Furthermore, the following TAAM scenarios from EIS have been used for more accurate extrapolating of delay data into the future:

- With 2009 project (ground and "High and Wide") (2013)

To reflect on airspace design alternatives for OMP BCA, the following scenarios have been derived from the existing TAAM scenarios described above:

- Ground changes only (2007)
- Ground changes only (2009)
- Ground changes and CAPS (2007)
- Ground changes and CAPS (2009)

Also, since TAAM simulations supporting EIS assume all nine proposed new departure sectors, delay data for scenarios both with Compressed Arrival Procedures (CAPS) and "High and Wide"

[4] De-peaking is defined as the reduction in the number of arrivals and departures over a specified timeframe (peak hour).

[5] During the relocation and construction of the airfield at ORD, operations will be affected, as ground movement will be impacted by the number of crews operating at the secure area of the airfield. Interim ground movement procedures will have to be implemented to ensure a minimal impact on ORD'

has been adjusted to consider only four new departure sectors (two to the East and two to the South), per OMP.

The following subsections will describe scenarios in further detail. Runway configurations are described in more detail in Section D.1. Percent utilization has been derived from ASPM data for a baseline year and projected for future scenarios based on the input from operational staff. Delay data is broken down by phase of flight and average delay is calculated based on delays per specific runway configuration and runway utilization.

D.4.1 Baseline

In "Baseline" scenario for 2003 with the total daily demand of 2,694 operations, the average delay per all ORD operations has been calculated to be 15.2 minutes (see Table D.10).

Table D.10

2003 Existing Airfield
(Unconstrained Demand: 2,694 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	27.0%	198	1.1	9.2	0.5	4.5	3.6	9.5
Plan W	46.6%	197	0.5	7.0	0.3	4.0	2.9	7.4
Plan B	17.1%	181	1.2	26.0	0.5	9.8	11.3	24.4
IFR Parallel 27s	6.0%	157	0.5	53.2	0.2	1.9	31.0	43.4
IFR Parallel 14s	3.3%	141	0.4	98.9	0.2	2.4	44.6	73.3
Annualized		190	0.8	16.6	0.4	4.9	7.6	15.2

Source: OMP EIS TAAM Simulation Output Files

D.4.2 No Airspace Changes

In the "No Airspace Changes" scenario, delay data has been calculated for both 2007 (2,898 daily operations) and 2009 (2,987 daily operations) and is estimated at 22.7 minutes per operation in 2007 and 25.7 minutes per operation in 2009 (see Tables D.11 and D.12). To calculate delays for the years beyond 2009, the data has been extrapolated to 2013 to arrive at 31.7 minutes per operation in 2013 with a daily number of operations standing at 3,169.

Table D.11

2007 Existing Airfield
(Unconstrained Demand: 2,898 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	27.0%	208	0.9	20.6	0.4	3.9	5.6	15.7
Plan W	46.6%	210	0.9	15.0	0.5	6.3	2.0	12.4
Plan B	17.1%	182	0.5	52.6	1.2	7.4	8.0	34.9
IFR Parallel 27s	6.0%	161	0.5	85.6	0.4	1.9	28.1	58.3
IFR Parallel 14s	3.3%	142	0.4	144.3	0.4	3.4	49.9	99.2
Annualized		199	0.8	31.4	0.6	5.5	7.1	22.7

Source: OMP EIS TAAM Simulation Output Files

Table D.12

2009 Existing Airfield
(Unconstrained Demand: 2,987 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	27.0%	210	1.0	25.5	0.5	4.3	6.2	18.8
Plan W	46.6%	212	0.8	17.6	0.4	7.6	2.0	14.2
Plan B	17.1%	185	0.6	58.6	1.2	9.7	9.0	39.6
IFR Parallel 27s	6.0%	164	0.6	92.9	0.6	2.7	28.5	62.7
IFR Parallel 14s	3.3%	143	0.3	157.2	0.3	4.4	50.2	106.2
Annualized		202	0.8	35.9	0.6	6.7	7.5	25.7

Source: OMP EIS TAAM Simulation Output Files

D.4.3 With Project (Ground Changes and "High and Wide")

Since existing TAAM simulations used in EIS assume all nine new proposed departure sectors, the adjustment to the delay data has been done to reflect only four proposed departure sectors under OMP. These four sectors (two to the South and two to the East) will handle 60-65% of all departing traffic from ORD. This is based on the quick analysis of ASPM data from 2002 derived for the city-pairs served by ORD departing traffic. Tables D.13 and D.14 show original TAAM results for 2007 and 2009 (considering all nine new proposed departure sectors) and adjusted to four departure sectors per OMP.

Table D.13

2007 With Project
(Unconstrained Demand: 2,898 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	23.1%	217	0.9	20.3	0.5	4.3	4.8	15.4
VFR Parallel 27s	57.0%	218	0.6	3.5	0.3	4.2	2.5	5.6
Plan B	10.6%	192	0.7	52.5	1.1	7.3	6.6	34.1
IFR Parallel 27s	6.0%	187	6.9	38.6	0.3	7.9	7.5	30.6
IFR Parallel 14s	3.3%	149	0.4	146.1	0.3	3.8	51.9	101.3
Annualized		211	1.1	19.4	0.4	4.8	5.4	15.5
Adjusted per OMP			1.1	19.4	0.4	5.0	5.4	15.7

Source: OMP EIS TAAM Simulation Output Files

Table D.14

2009 With Project
(Unconstrained Demand: 2,987 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
VFR-3 Parallel 9s	17.9%	225	0.6	8.9	0.9	5.2	2.5	9.1
VFR-4 Parallel 9s	5.2%	217	0.9	9.2	1.1	9.7	5.5	13.2
VFR Parallel 27s	67.6%	236	0.5	3.7	0.4	3.1	2.3	5.0
IFR Parallel 27s	4.8%	196	5.9	25.0	0.6	15.8	10.6	29.0
IFR Parallel 9s	4.5%	165	1.4	78.7	0.4	15.3	49.6	72.7
Annualized		228	0.8	9.3	0.5	5.0	5.0	10.3
Adjusted per OMP			0.8	9.3	0.5	5.7	5.0	10.7

Source: OMP EIS TAAM Simulation Output Files

D.4.4 With Project (Ground Changes Only, No Airspace Changes)

As it has been described already in the beginning of Section D.4, TAAM simulation data has not been readily available to support detailed modeling of this alternative. Engineering judgment based on the notion that airfield operations are driven by queuing theory, as well as further consultations with operational staff to adjust for more appropriate hourly traffic rates were used to modify delays data derived in original TAAM simulations. These adjustments are based on the lack of the airspace capacity to fit simultaneous parallel approaches under VFR conditions without causing significant delays provided new airfield configurations for ORD. In such cases airport hourly traffic rates had been adjusted to address airspace limitations and corresponding airfield configurations were replaced with the ones representing manually-adjusted traffic rates.

For example, in the airfield simulation results for 2007, (see Table D.2), Visual Flight Rules (VFR) Parallel 27s configuration cannot be efficiently utilized without changes to the airspace without causing significant airborne delays, as controllers attempt to fit these approaches using the current procedures. The most appropriate configuration to utilize instead of VFR Parallel 27s would be Plan W as reflected (along with corresponding delays calculation) in the Table D.15

Table D.15

Adjusted results for 2009 are shown in Table D.16.

2007 With Project (Ground Only, No Airspace Changes)
(Unconstrained Demand: 2,898 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	23.1%	217	0.9	20.3	0.5	4.3	4.8	15.4
Plan W	57.0%	210	0.9	15.0	0.5	6.3	2.0	12.4
Plan B	10.6%	192	0.7	52.5	1.1	7.3	6.6	34.1
IFR Parallel 27s	6.0%	187	6.9	38.6	0.3	7.9	7.5	30.6
IFR Parallel 14s	3.3%	149	0.4	146.1	0.3	3.8	51.9	101.3
Annualized		206	1.2	25.9	0.5	6.0	5.1	19.4

Source: Adjusted OMP EIS TAAM Simulation Output Files

Table D.16

2009 With Project (Ground Only, No Airspace Changes)
(Unconstrained Demand: 2,987 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	17.9%	210	1.0	25.5	0.5	4.3	6.2	18.8
Plan B	5.2%	185	0.6	58.6	1.2	9.7	9.0	39.6
Plan W	67.6%	212	0.8	17.6	0.4	7.6	2.0	14.2
IFR Parallel 27s	4.8%	196	5.9	25.0	0.6	15.8	10.6	29.0
IFR Parallel 9s	4.5%	165	1.4	78.7	0.4	15.3	49.6	72.7
Annualized		207	1.1	24.3	0.5	7.9	5.7	19.7

Source: Adjusted OMP EIS TAAM Simulation Output Files

D.4.5 With Project (Ground Changes and CAPS)

Using the same approach and logic described in the beginning of Section D.4.4, results of existing TAAM simulations have been adjusted to represent CAPS alternative for the airspace changes. Also taken into account is the fact that even with CAPS, projected traffic in excess of the baseline demand will be subject to approximately 100 additional flying miles in the terminal airspace in order to fly longer downwinds and finals. This will translate in additional flying time of about 30 minutes per flight. The results are shown in Tables D.17 and D.18 for 2007 and 2009 respectively.

Table D.17

2007 With Project (Ground, CAPS)
(Unconstrained Demand: 2,898 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	23.1%	217	0.9	20.3	0.5	4.3	4.8	15.4
Plan W	28.5%	210	0.9	15.0	0.5	6.3	2.0	12.4
VFR Parallel 27s	28.5%	218	0.6	3.5	0.3	4.2	4.4	6.5
Plan B	10.6%	192	0.7	52.5	1.1	7.3	6.6	34.1
IFR Parallel 27s	6.0%	187	6.9	38.6	0.3	7.9	7.5	30.6
IFR Parallel 14s	3.3%	149	0.4	146.1	0.3	3.8	51.9	101.3
Annualized		209	1.1	22.7	0.5	5.4	5.8	17.7

Source: Adjusted OMP EIS TAAM Simulation Output Files

Table D.18

2009 With Project (Ground, CAPS)
(Unconstrained Demand: 2,987 Daily Ops)

Configuration	Percent Utilization	Total Peak Hour Total Ops	ORD Departure gate delay at ORD	ORD Arrival predeparture ground delay at origin	ORD Arrival ground delay at ORD	ORD Departure ground delay at ORD	ORD Arrival sequencing and vectoring air delay	Average Delay per All Airport Operations (minutes)
Plan X	17.9%	210	1.0	25.5	0.5	4.3	6.2	18.8
Plan X	5.2%	210	1.0	25.5	0.5	4.3	6.2	18.8
Plan W	33.8%	210	0.9	15.0	0.5	6.3	2.0	12.4
VFR Parallel 27s	33.8%	218	0.7	4.0	0.3	4.8	5.5	7.6
IFR Parallel 27s	4.8%	196	5.9	25.0	0.6	15.8	10.6	29.0
IFR Parallel 9s	4.5%	165	1.4	78.7	0.4	15.3	49.6	72.7
Annualized		210	1.1	17.0	0.4	6.2	6.7	15.7

Source: Adjusted OMP EIS TAAM Simulation Output Files

D.5 ORD ADOC and PVT Benefits Summary

Table D.19 contains delays summary for various alternatives described in Section D.4. The data is interpolated between the years 2003, 2007, 2009, and 2013 which causes minor adjustments in daily demand and delay data (on the order of 0.2%). Note: Table D.19 OMP delay figures for 2009 (10.7 minutes) and 2013 (14.2 minutes) are higher than EIS generated delays in Section 4.0 Figure 4.1 of the Business Case. These increases were made to conservatively compensate for the fact the Business Case proposes to add four new ZAU departure sectors, whereas EIS' TAAM analysis assumed unconstrained airspace of nine new sectors.

Table D.19

ORD Average Delay per All Airport Operations (min)
Unconstrained Demand (TAF 2002)

Year	Total Daily Operations	Do Nothing	Ground Only	Ground and CAPS	Ground and "High and Wide"
2003	2,700	15.2	NA	NA	NA
2004	2,747	17.1	NA	NA	NA
2005	2,795	18.9	NA	NA	NA
2006	2,842	20.8	NA	NA	NA
2007	2,890	22.7	19.4	17.7	15.7
2008	2,937	24.2	20.7	18.9	16.7
2009	2,984	25.7	19.7	15.7	10.7
2010	3,032	27.2	20.7	16.6	11.6
2011	3,079	28.7	21.6	17.5	12.4
2012	3,127	30.2	22.6	18.3	13.3
2013	3,174	31.7	23.6	19.2	14.2

Tables D.20 through D.22 provide a summary of ADOC benefits derived using delay data from Table D.19 and corresponding economic values described in Section D.3. To convert benefits into Present Value dollars, an annual discount factor of 7% recommended by the Executive Office of the President, Office of Management and Budget (OMB) has been utilized.

Table D.20

ORD Annual ADOC Benefits (in Baseline FY05 $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$55,623,810	$83,360,555	$117,901,185
2009	$78,789,911	$118,078,404	$167,004,451
2010	$124,062,640	$201,848,189	$301,444,391
2011	$149,227,481	$242,712,421	$360,021,034
2012	$163,623,904	$261,337,211	$380,160,204
2013	$178,392,801	$280,419,799	$400,747,092

Table D.21

ORD Annual ADOC Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$45,405,598	$68,047,044	$96,242,487
2009	$60,108,446	$90,081,449	$127,406,896
2010	$88,454,948	$143,914,969	$214,925,685
2011	$99,436,571	$161,729,534	$239,897,216
2012	$101,896,744	$162,747,681	$236,744,669
2013	$103,826,234	$163,206,876	$233,238,456

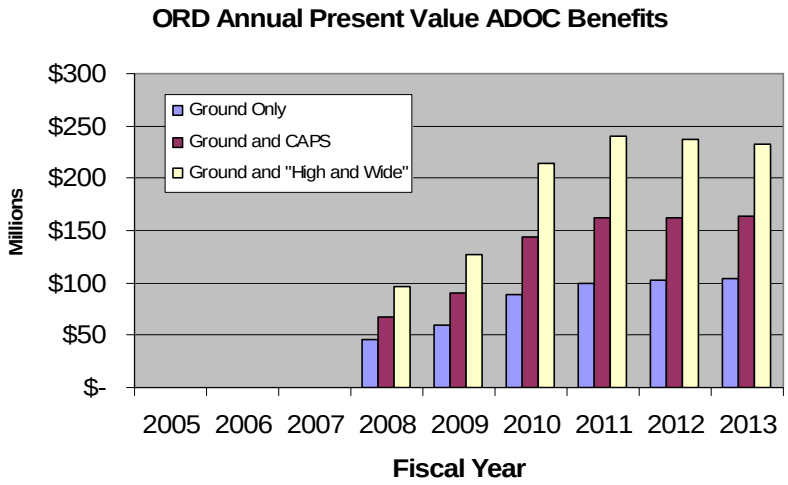
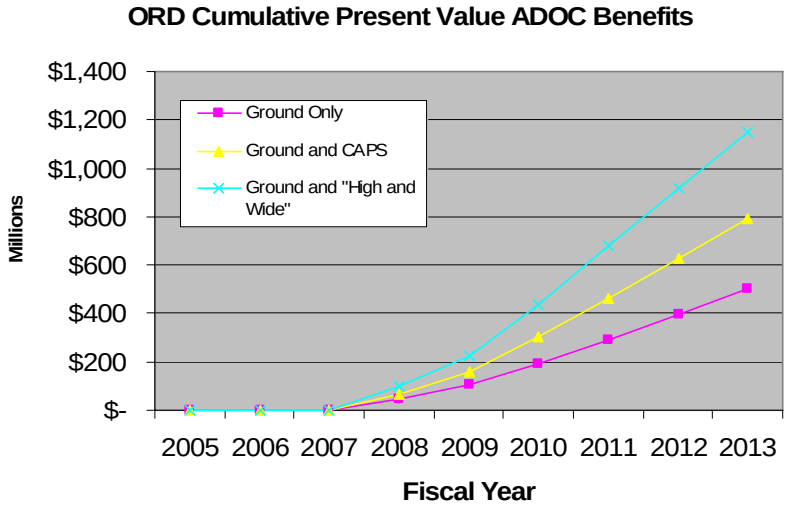


Table D.22

ORD Cumulative ADOC Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$45,405,598	$68,047,044	$96,242,487
2009	$105,514,044	$158,128,494	$223,649,383
2010	$193,968,992	$302,043,463	$438,575,068
2011	$293,405,563	$463,772,997	$678,472,284
2012	$395,302,307	$626,520,678	$915,216,953
2013	$499,128,541	$789,727,554	$1,148,455,410



Tables D.23 through D.25 provide a summary of PVT benefits derived using delay data from Table D.19 and corresponding economic values described in Section D.3.

Table D.23

ORD Annual PVT Benefits (in Baseline FY05 $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$108,563,476	$162,698,521	$230,113,011
2009	$153,777,791	$230,458,897	$325,950,049
2010	$242,138,598	$393,956,130	$588,342,488
2011	$291,253,942	$473,712,677	$702,669,139
2012	$319,352,085	$510,063,512	$741,975,658
2013	$348,177,200	$547,307,853	$782,156,007

Table D.24

ORD Annual PVT Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$88,620,135	$132,810,457	$187,840,763
2009	$117,316,340	$175,815,989	$248,665,732
2010	$172,641,474	$280,885,276	$419,480,063
2011	$194,074,799	$315,654,759	$468,218,116
2012	$198,876,428	$317,641,920	$462,065,149
2013	$202,642,300	$318,538,153	$455,221,917

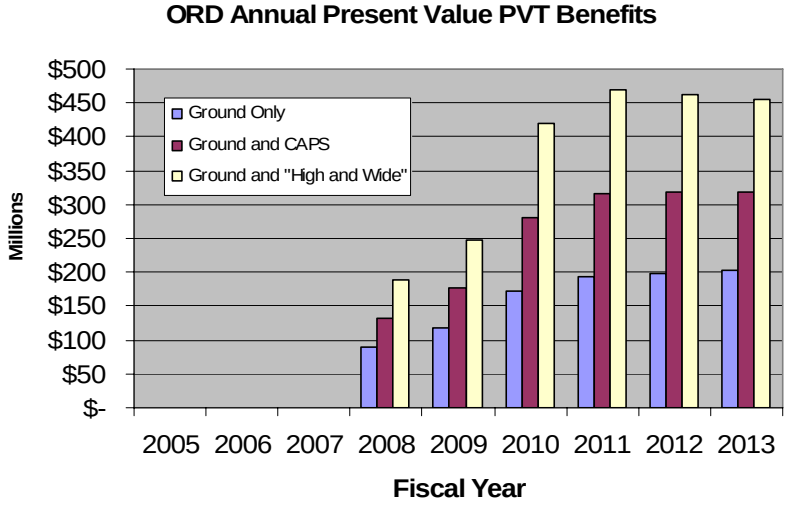
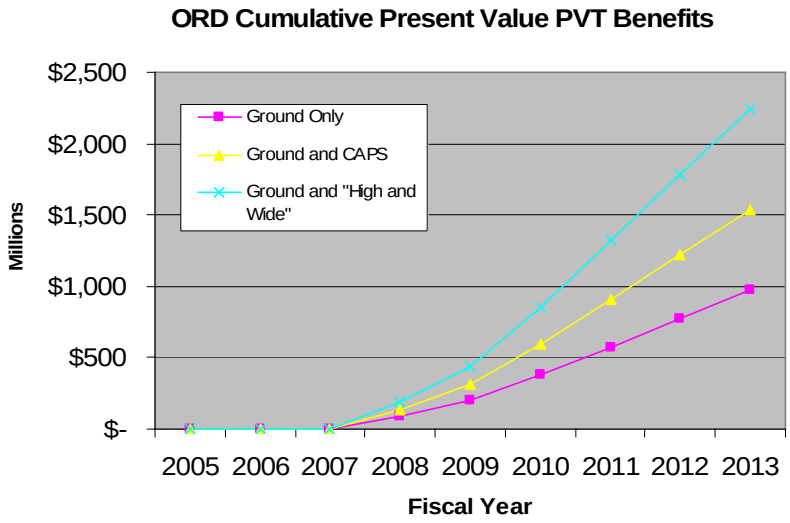


Table D.25

ORD Cumulative PVT Benefits (in Present Value $)

FY	Ground Only	Ground and CAPS	Ground and "High and Wide"
2005	$0	$0	$0
2006	$0	$0	$0
2007	$0	$0	$0
2008	$88,620,135	$132,810,457	$187,840,763
2009	$205,936,475	$308,626,447	$436,506,495
2010	$378,577,949	$589,511,723	$855,986,557
2011	$572,652,748	$905,166,482	$1,324,204,674
2012	$771,529,177	$1,222,808,402	$1,786,269,823
2013	$974,171,477	$1,541,346,555	$2,241,491,741



D.6 Risk-Adjusted Benefits

Projected demand at ORD has been considered based on TAF 2002 data considering unconstrained traffic growth in accordance with TAF. In reality, airlines are less likely to "tolerate" or "afford" extended delays approaching more than 31 minutes in a Do Nothing scenario by 2013. To mitigate extensive delays, airlines will opt for adjusting their schedules by means of "peak shaving" or "de-peaking"; some carriers may opt to canceling some of the flights or constraining the traffic growth.

TAAM simulations supporting EIS scenarios have included scenarios with constrained traffic growth limiting it at 2,750 daily operations and bringing the average delay per flight to about 15 minutes. Two major airlines operating at ORD, American and United, are already stretching their peaks to reduce delays; this strategy has not resulted in constrained growth at ORD, but has improved the utilization of the current capacity. As traffic increases as projected in the future timeframe (2007-2013), it is expected that demand will be constrained. To account for this more realistic scenario, another point estimate for the benefits is considered. This point estimate involves analysis of delay reduction in constrained demand scenarios. Analysis and logic

employed in these calculations is identical to the one described in the previous sections of Appendix D and corresponding delay data is summarized in Table D.26.

Table D.26

ORD Average Delay per All Airport Operations (min)
Constrained Demand (2,750 Daily Ops)

Year	Total Daily Operations	Do Nothing	Ground Only	Ground and CAPS	Ground and "High and Wide"
2003	2,700	15.2	NA	NA	NA
2004	2,747	17.1	NA	NA	NA
2005	2,750	16.8	NA	NA	NA
2006	2,750	16.5	NA	NA	NA
2007	2,750	16.2	13.8	12.6	11.2
2008	2,750	16.1	13.7	12.5	11.1
2009	2,750	15.9	12.2	9.8	7.2
2010	2,750	15.9	12.1	9.8	7.2
2011	2,750	15.9	12.0	9.8	7.2
2012	2,750	15.9	11.9	9.8	7.2
2013	2,750	15.9	11.8	9.8	7.2

Using two point estimates from Tables D.19 and D.26 "High" (with unconstrained demand assumption) and "Low", estimates (with constrained demand assumption) of delay reduction are produced by taking a difference between "Do Nothing" delays and corresponding delays in analyzed alternatives. Following the Air Traffic Organization Finance Services (ATO-F) guidelines for the risk-adjusted benefits assessment, 20th percentile values between "Low" and "High" estimates are used to conservatively estimate reduction in delays. These results are summarized in Table D.27.

Table D.27

ORD Delay Savings (min)

Year	Ground Only			Ground and CAPS			Ground and "High and Wide"		
	Low	High	20th percentile	Low	High	20th percentile	Low	High	20th percentile
2003	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0
2007	2.4	3.3	2.6	3.6	5.0	3.9	5.0	7.0	5.4
2008	2.4	3.5	2.6	3.6	5.3	4.0	5.0	7.5	5.5
2009	3.7	6.0	4.2	6.1	10.0	6.9	8.7	15.0	10.0
2010	3.8	6.5	4.3	6.1	10.6	7.0	8.7	15.6	10.1
2011	3.9	7.1	4.5	6.1	11.2	7.1	8.7	16.3	10.2
2012	4.0	7.6	4.7	6.1	11.9	7.3	8.7	16.9	10.3
2013	4.1	8.1	4.9	6.1	12.5	7.4	8.7	17.5	10.5

Note that the results presented in Table D.27 were derived using TAAM simulation results for specific years: 2003, 2007, 2009, and 2013. For the rest of the years, ORD delay savings have been interpolated between the known simulation results. Because the final delay savings data have been rounded to the nearest decimal point, the 20th percentile numbers in Table D.27 (between 2009 and 2013) are not necessarily equally spaced when shown to one significant decimal.

Applying 20th percentile delay reduction values final ADOC and PVT benefits are calculated and summarized in the Tables D.28-30 for all alternatives. These benefits are presented in Base-Year, Then-Year and Present Value dollars and given for Fiscal Years.

Table D.28

ORD User Benefits: Ground Changes Only ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$41.5	$81.1	$122.6	$43.7	$85.3	$129.1	$33.9	$66.2	$100.1
2009	$56.2	$109.6	$165.8	$60.3	$117.8	$178.1	$42.8	$83.6	$126.5
2010	$81.5	$159.1	$240.6	$89.4	$174.4	$263.8	$58.1	$113.4	$171.6
2011	$93.0	$181.6	$274.6	$104.0	$203.0	$307.1	$62.0	$121.0	$183.0
2012	$97.6	$190.5	$288.1	$111.3	$217.2	$328.5	$60.8	$118.6	$179.4
2013	$102.0	$199.0	$301.0	$118.6	$231.5	$350.1	$59.3	$115.8	$175.2

Table D.29

ORD User Benefits: Ground Changes and CAPS ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$63.1	$123.2	$186.4	$66.5	$129.8	$196.2	$51.5	$100.6	$152.1
2009	$85.1	$166.1	$251.2	$91.5	$178.5	$270.0	$64.9	$126.7	$191.7
2010	$132.9	$259.3	$392.2	$145.6	$284.2	$429.8	$94.7	$184.9	$279.6
2011	$151.0	$294.7	$445.7	$168.8	$329.5	$498.3	$100.6	$196.4	$297.0
2012	$154.1	$300.8	$454.9	$175.7	$343.0	$518.8	$96.0	$187.3	$283.3
2013	$157.6	$307.5	$465.1	$183.3	$357.7	$541.0	$91.7	$179.0	$270.7

Table D.30

ORD User Benefits: Ground Changes and "High and Wide" ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$86.9	$169.7	$256.6	$91.5	$178.6	$270.2	$71.0	$138.5	$209.4
2009	$117.8	$229.9	$347.7	$126.6	$247.1	$373.7	$89.9	$175.4	$265.3
2010	$191.0	$372.8	$563.9	$209.4	$408.7	$618.1	$136.2	$265.8	$402.0
2011	$217.7	$424.9	$642.6	$243.4	$475.1	$718.5	$145.1	$283.1	$428.2
2012	$221.4	$432.1	$653.5	$252.5	$492.8	$745.2	$137.9	$269.1	$407.0
2013	$224.9	$438.9	$663.7	$261.5	$510.5	$772.0	$130.9	$255.4	$386.3

Since user benefits considered in this Business Case are only due to the changes to support efficient utilization of new runways by adjusting airspace and not due to the new runways themselves, benefits from Table D.28 are subtracted from those summarized in Tables D.29 and D.30. Final user benefits due to airspace changes only are presented in Tables D.31 and D.32.

Table D.31

ORD User Benefits: CAPS ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$21.6	$42.2	$63.8	$22.8	$44.4	$67.2	$17.6	$34.4	$52.1
2009	$29.0	$56.5	$85.5	$31.1	$60.7	$91.8	$22.1	$43.1	$65.2
2010	$51.3	$100.2	$151.5	$56.3	$109.8	$166.1	$36.6	$71.4	$108.0
2011	$57.9	$113.1	$171.0	$64.8	$126.4	$191.2	$38.6	$75.4	$114.0
2012	$56.5	$110.3	$166.8	$64.4	$125.8	$190.2	$35.2	$68.7	$103.9
2013	$55.6	$108.5	$164.2	$64.7	$126.3	$190.9	$32.4	$63.2	$95.5

Table D.32

ORD User Benefits: "High and Wide" ($M)

FY	Base-Year $			Then-Year $			Present Value $		
	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL	ADOC	PVT	TOTAL
2005	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2006	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2007	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2008	$45.4	$88.6	$134.0	$47.8	$93.3	$141.1	$37.1	$72.3	$109.4
2009	$61.6	$120.3	$182.0	$66.2	$129.3	$195.5	$47.0	$91.8	$138.8
2010	$109.5	$213.7	$323.2	$120.0	$234.3	$354.3	$78.1	$152.4	$230.5
2011	$124.7	$243.3	$368.0	$139.4	$272.0	$411.4	$83.1	$162.1	$245.2
2012	$123.8	$241.6	$365.4	$141.2	$275.5	$416.7	$77.1	$150.5	$227.6
2013	$122.9	$239.9	$362.8	$142.9	$279.0	$422.0	$71.5	$139.6	$211.1

Appendix E. Mini Cases

E.1 Chicago O'Hare Modernization Program (OMP) Airspace Redesign Plan Details

Background

The OMP is a major redesign and expansion of O'Hare International Airport (ORD) proposed by the City of Chicago, and involves impacts to such major Federal Aviation Administration (FAA) facilities as the Chicago Air Route Traffic Control Center (ZAU) and the Chicago Terminal Radar Approach Control (TRACON) (C90), as well as local area TRACONs at Milwaukee (MKE) and South Bend (SBN).

It is agreed that for the OMP to reduce current delays and to realize meaningful increases in current ORD capacity, some measure of airspace redesign is required in addition to the Sponsor's proposed OMP airfield reconfiguration and expansion. FAA Air Traffic (AT) has developed a National Airspace Redesign Plan, and FAA Great Lakes Region (AGL) AT has further detailed airspace initiatives in various planning documents.

AGL OMP AT has prioritized the ZAU new sector redesign recommendations and identified the four airspace sectors that most directly optimize OMP benefits, at a minimal cost to the NAS ('the most bang-for-the-buck'). The Chicago Area Modernization Program Office (CMPO) has utilized contracted MITRE resources to study the National Airspace System (NAS) benefits derived from these OMP four new sectors / incremental NAS airspace redesigns. The MITRE study, as well as the Environmental Impact Statement Total Airspace and Airport Modeller simulation results, have supported the need for implementing the OMP proposed NAS airspace redesign plan.

Airspace Redesign Plan

The OMP NAS Airspace Redesign Plan involves ZAU Center airspace and C90 TRACON airspace. (Also see Appendix F. Air Traffic Operating Concept for the O'Hare Modernization Program.)

ZAU Center Airspace: The OMP Airspace Redesign Plan is to create four new ZAU sectors, two east and two south. The new east sectors are; SWEET, a low altitude sector created by a north/south split of the current CRIBB sector, but with current boundaries extended to the north and east, and GIPPER, a high altitude sector created by a north/south split of the current KEELER sector with current boundaries extended to the north. The two new south sectors are; NEWTT, a low sector created by an east/west split of the current PEOTONE sector with current boundaries extended to the south and east; and GLANT, a super high sector created by a lateral split of the current ROBERTS sector. The creation of these four new airspace sectors requires the reallocation of existing ZAU Voice Switching Control System Training and Backup Switch (VTABS) Position Equipment Module (PEM) resources because there are no additional ZAU VTABS PEM resources available, nor is any redesigned/VTABS solution planned before at least 2012.

The OMP Plan utilizes both the divestiture and combining of current ZAU sectors in order to create four new ZAU sectors as follows:

1. Divest a portion of current OSHKOSH sector airspace to Milwaukee (MKE) TRACON.

2. Divest a portion of current BOONE sector airspace to South Bend (SBN) TRACON.

3. Combine the PONTIAC sector with the BURLINGTON sector.

4. Reallocate the current Traffic Management Unit (TMU) VTABS PEM. The TMU VTABS functionality will be replaced by the installation of new phone lines.

The proposed OSHKOSH partial airspace hand-off splits the existing airspace as follows; Ground to FL130 handed-off to MKE, with ZAU to retain FL140 to FL230. This portion of OSHKOSH airspace ZAU retains will be combined into the current LONE ROCK sector.

The ZAU proposed BOONE sector airspace hand-off is also only a partial hand-off, an east-west split. The east portion of BOONE would go to SBN, while the west portion will be retained by ZAU and a small portion acquired by C90. This split is due to a lack of adequate SBN western radar coverage (SBN does not have Standard Terminal Automation Replacement System (STARS) capability). The portion of airspace ZAU retains from the current BOONE sector will be combined with the existing KANKAKEE sector airspace.

Existing OSHKOSH and BOONE Remote Communication Air-to-Ground (RCAG) and Back-up Emergency Communication (BUEC) equipment cannot be reallocated to the new sectors, since these resources will still be required to control the ZAU airspace sector-portions remaining after divestiture. The existing PONTIAC and BURLINGTON RCAG and BUEC equipment will also still be required to provide communication capabilities for the enlarged coverage area of this new combined ZAU sector.

The four new OMP sectors will require new RCAG and BUEC equipment and new frequencies. Frequency re-licensing or possible new frequencies may be required for the airspace changes affected by the combining/realigning of existing sectors. (Spectrum Engineering analysis may also identify the need to relocate existing RCAG and/or BUEC equipment to provide coverage as a result of both new sectors and/or realigned boundaries of existing sectors, since the creation of four new OMP sectors affects a number of existing neighboring airspace sector boundaries).

There is no additional staffing needed at ZAU to support the OMP sectors; however training will be required for the new sectors and procedures.

Terminal Airspace: The OMP airspace redesign involves changes and requirements for the Chicago C90 TRACON terminal area environment as well. These are primarily driven by air traffic procedure changes referred to as "High and Wide", and necessitated by reconfiguring the current O'Hare airfield to a primarily east/west orientation and the potential to run triple or quadruple parallel approaches. In brief, High and Wide is an OMP-proposed ZAU/C90 procedure for routing aircraft into C90 airspace. This procedure routes aircraft to a central point outside the current C90 airspace (i.e. aircraft inbound on this route remain at a "higher" altitude

and on a "wider" route than aircraft coming in from the current corner-posts). Since this procedure routes aircraft outside the current airspace, increased terminal radar coverage is required to allow C90 to accept control of the aircraft.

The OMP High and Wide coverage requirement to the east is potentially available from existing Airport Surveillance Radar (ASR) coverage. However, currently there is not adequate OMP high and wide coverage available to the west to conduct the operation as previously envisioned. C90 has proposed modifications to their operating positions to utilize RFD radar at its planned location. The current airspace redesign plan is to obtain required western coverage via the following:

1. Proceed to upgrade of the current Rockford (RFD) ASR-8 to an ASR-11; a current nationally funded and scheduled program.

2. Authorize ASR-11 use of terminal separation to 60 nautical miles.

3. Develop and provide automated Gateway Switch for C90 Automated Radar Tracking Subsystem (ARTS) IIIE interface.

If required, a second option for western coverage would be to reallocate an existing ASR-9 to RFD from a candidate AGL site, replacing it with an ASR-11. (An ASR-9 is already authorized terminal separation to 60 nautical miles and does not require a Gateway Switch.)

The C90 TRACON will need to hire to authorized levels and to train on new OMP procedures, as well as upgrade the existing Rapid Deployment Voice Switch (RDVS) (see Appendix G. ATO Terminal Services (ATO-T) Staffing), add and modify existing frequencies, add capacity to existing Digital Voice Recorder System (DRVS) and reconfigure the current control floor.

NOTE: The proposed OMP reconfigurations and runway expansion at O'Hare also requires changes to existing on-airfield terminal airspace radar coverage. See Appendix E. E-3, On-Field Surveillance Radar Justification/Requirements for terminal radar details and analysis. In summary, O'Hare requires the relocation of the existing ASR-9 and the addition of a second on-field ASR-9.

Airspace Redesign Actions

To date, in addition to this ATO-T Business Case submittal, the AGL Corporate Work Plan (CWP) submitted the following Job Order Number (JON) requests into the Fiscal Year 2006 Budget Call for Estimate, and for entry into the FAA Corporate Work Plan (CWP):

JON 64132, RCAG for new SWEET sector

JON 64252, BUEC for new SWEET sector

JON 64142, RCAG for new GIPPER sector

JON 64262, BUEC for new GIPPER sector

JON 64152, RCAG for new NEWTT sector

JON 64272, BUEC for new NEWTT sector

JON 64162, RCAG for new GLANT sector

JON 64282, BUEC for new GLANT sector

JON 64432, ZAU Telco, Interface Cards, Reconfiguration, etc. to support new sectors

JON 60994, Remote Transmitter/Receiver Site (RTR) and Air-to-Ground (A/G) Backup for airspace divested to MKE TRACON

JON 61014, Radar Displays for airspace divested to MKE TRACON

JON 60974, RTR and A/G Backup for airspace divested to SBN TRACON

JON 61004, RDVS Upgrade at C90 TRACON

JON 61059, RTR Frequency add/modify at C90 TRACON

JON 64442, DVRS, Increase capacity

E.2 Rapid Deployment Voice Switch (RDVS) Replacement Justification/Requirements

Introduction

The replacement of the current Rapid Deployment Voice Switch (RDVS), Model 3080E with an updated RDVS, Model 3080H, "split-backplane" system, is critical for both future requirements and current operational issues at the Chicago TRACON (C90) and the Chicago O'Hare International Airport (ORD) Air Traffic Control Tower (ATCT). A replacement RDVS is requested as soon as possible. The earlier the transition to a new RDVS the better to avoid potential issues related to the O'Hare Modernization Program's (OMP's) future increased traffic and greater number of controller positions.

The following summarizes these requirements and issues.

Background

The ORD and C90 RDVS system uses a "split-backplane" version of the RDVS. The term "split-backplane" indicates that the system was designed, installed and functions as one voice switch with components installed at both locations (C90 and ORD) connected via T1 circuits between the two facilities, which are about 35 miles apart. This avoids the need/cost for two stand-alone systems and expedites communications.

The current system bus (or "backplane") of the 3080E is only a 16 channel bus, the 3080H has the greater capacity and flexibility of a 24 channel bus system.

Future Operations Requirements

Insufficient Capacity of Current RDVS: The proposed OMP includes the construction of two new satellite ATCTs at ORD (a new South and North ATCT) plus additional positions at the current ORD ATCT. Also proposed is a new Chicago area airport, the Peotone / South Suburban Airport (SSA). The SSA is also currently in the FAA Environmental Impact Statement (EIS) process, which will require additional positions at C90. The current RDVS does not have the capacity to support all the existing positions, frequencies and phone lines at C90 and ORD plus all the expansion that is anticipated due to OMP and SSA.

Touch Entry Display (TED): The current 3080E system design does not allow the installation of TED positions. The requested RDVS 3080H fully supports TED capabilities. C90 is a candidate location for near term deployment of new displays such as the Automated Radar Tracking Subsystem (ARTS) Color Displays (ACD) or Standard Terminal Automation Replacement System (STARS) displays, both of which have TED capabilities.

OMP Design, New Satellite ATCTs: The new ATCT Cab is being designed around the Touch Entry Display's space-saving reduced size requirements.

Future STARS Deployment at C90: The existing RDVS cannot support STARS technology nor provide a parallel-operations STARS transition. Even though C90 is "to be determined" on

the national STARS schedule, C90 will eventually be implementing some type of new equipment and technology that will require this capability.

Other Related Requirements/Issues: The installation of Bandwidth Manager (BWM) or similar equipment should be included in the design of the new RDVS to reduce Telco costs.

Current Operations Issues:

Map Limitations: The mapping capacity of the current RDVS system does not allow for the storage of all necessary maps. Currently, only 29 maps can be reliably stored. The Chicago TRACON uses 34 Maps. The remaining five maps are stored on floppy disks which require removal of existing maps prior to installing maps stored on a floppy. A TED-capable system would reduce the number of maps needed, and a new RDVS 3080H allows 99 maps to be stored on the City Consulting Team (CCT) eliminating the need to store emergency and special event maps on a floppy disk.

Reconfiguration Failures: The current RDVS 3080E will occasionally fail reconfiguration changes due to operating at capacity. A new larger capacity RDVS 3080H system would not have this problem. (Also, TED capability will reduce the need for as many reconfigurations as the current RDVS).

Space Savings: Space is limited at ORD. There are 18 Air Traffic Control (ATC) positions in the tower at this time. The ability to replace the current "hard key" displays with Touch Entry Displays would free space in the ATCT needed for other systems.

Bridge Control Space Maximized: The system's split-backplane allows ORD and C90 to communicate as if on one switch. The current backplane is full, so when additional bridge controllers have been added since initial installation it requires removal of other bridge controllers. The circuits on these removed bridge controllers cannot communicate between C90 and ORD positions.

Circuit Removal/Mapping Problems: There are often problems within the existing system which require the removal of outside telephone circuits from positions that should have circuits. The problem is that the circuit will ring at all positions where it happens to be installed regardless of the mapping. To date, this problem cannot be corrected.

Training Impacts: There has never been an RDVS 3080E split-backplane Airway Facility training class developed since there are only five such systems in the US.. Thus, when technicians return from RDVS training at the FAA Academy, they are only partially trained.

Upgrade Time-lines: All other large TRACONs already have the RDVS 3080H. The RDVS 3080H program is nearing its end, but C90 is not currently on the list to be upgraded. Per the Program Office, there will not be additional systems developed and fielded that are sized for C90 for at least 10 to 15 years into the future.

E.3 On-Field Surveillance Radar Justification/Requirements

Introduction

The O'Hare Modernization Program (OMP) is a major redesign and expansion of O'Hare International Airport (ORD) proposed by the City of Chicago, and involves major redesigns to current runways as well as the addition of new runways. With the inception of the OMP by the City of Chicago in 2001, proposed changes in runway length and numbers, along with the relocation of facilities on the airfield, will create "shadows" in radar coverage for the current single Airport Surveillance Radar (ASR). Coverage analyses were performed using the FAA's Radar Support System (RSS) that validated the shadows in radar coverage for the proposed OMP configuration. For this reason, an additional ASR is necessary to ensure the coverage of all current and proposed runways.

Background

The existing ASR-9 at ORD was installed and commissioned in 1992. A second ASR-9 was also installed approximately 30 miles southeast in Tinley Park, Illinois (QXM) primarily to serve Midway Airport (MDW) located on the south side of Chicago. The QXM ASR-9 provides the only backup radar service to ORD. However, due to the distance and associated obstructions relative to ORD, its capability is limited and does not satisfy surveillance requirements as a primary source for radar data on the current or future airport.

A comprehensive evaluation of the capabilities of the ORD and QXM systems was accomplished using the RSS tool. The prime parameter for the evaluation was that the proposed radar provides coverage for aircraft down to 50 feet above all runway (existing and proposed) thresholds to satisfy Air Traffic monitoring requirements. The evaluation addressed all 16 proposed thresholds comparing the current ASR-9 with an ASR-9/Mode Select Secondary Radar System (Mode S) system sited on the north side of ORD. The location of the candidate site along with the threshold coordinates for the future runways were evaluated with the RSS. The City provided the locations of buildings that are currently on site and will remain in place and proposed future buildings that could potentially affect coverage of the runways. A zero degree tilt of the radar antenna was used for the evaluation.

The results of the RSS, utilizing the current location and antenna tilt, indicate that the existing on-field ASR-9 would not provide coverage for the threshold of proposed new runway 9L as well as other runways at ORD. (See Attachment 1 Current ORD Coverage for Future Runways) This is the first new runway to be constructed. The current ASR-9 only provided coverage to 114 feet above runway threshold, exceeding the 50-foot requirement by 64 feet. To provide the required coverage, an additional ASR located on the north side of the airfield is required for the proposed airport runway configuration at ORD. The proposed additional north ASR-9 provided coverage within the 50-foot requirement.

Additional considerations for required radar coverage on the south side of the airfield are necessary due to OMP construction activity as well as the proposed building of a new west airport terminal at the current ASR-9 site. The southern side of the airfield would require a

second radar, as the proposed north radar site cannot provide the required coverage to the south-side runways due to current and future building obstructions. No single site on the airfield provides the required coverage for all runways. This is also documented in Attachment 1, future ORD ASR-9 siting.

Considerations/Risk Assessment

Numerous options were evaluated as to how to acquire the second asset needed to fulfill the radar requirements of the new airport configuration. These included evaluating alternatives with respect to the ongoing ASR-11 replacement schedule. The intent under the ASR-11 option would be to leapfrog an ASR-11 to an ASR-9 location, thus freeing an ASR-9 for the ORD coverage requirement. Two sites were identified for this scenario: Ft. Wayne, Indiana (FWA) and Toledo, Ohio (TOL). FWA was chosen due to the past history of being a donor site under previous analyses that had relocation and survey activities already completed, thus allowing that site as a source. TOL was proposed because the existing ASR-9 has presented line-of-sight problems for siting a new air traffic control tower. Lastly, the ASR-9 at QXM was reviewed as a possible source. All of these options were reviewed from a risk and cost analysis and the findings can be found in Attachment 2.

Recommended Action

Recommend that a permanent ASR-9 be installed on the north side of ORD. The action will provide ORD with the coverage needed to remove the deficiencies that will occur with the current system when operations start on the new proposed runway 9L. Commonality of ASR systems will minimize the need for additional SSC personnel, training and inventory of spare parts.

Recommend that a permanent ASR-9 be installed on the south side of ORD. The action will provide ORD with the coverage needed to remove the deficiencies that will occur in the current system when the existing radar is removed due to terminal development. This will also address the issue of one site's ability to provide all the required coverage. Commonality of ASR systems will minimize the need for additional SSC personnel, training and inventory of spare parts.

The donor radars for the surveillance requirements are recommended to be the transition of the two available temporary ASR (TASR) assets and installing them as permanent installations at ORD. The first TASR would be installed at the proposed north site and the second TASR would be installed at the proposed south site. The existing (original) ASR-9 would then be returned to the national inventory. The Air Traffic Organization Terminal Services (ATO-T) Planning Office concurs with this alternative.

The federal costs associated with this on-airfield activity recommendation are being pursued as a reimbursable project. As such, payments for these activities are expected to be borne by the Sponsor. These costs are further explained in Attachment 2.

Equipment Availability

Based upon the assessment of service impacts, schedule, and costs, there are currently two TASR systems available. One system is located at Seattle, Washington, and the other is located at Columbia, Missouri. Both systems are scheduled for the Great Lakes Region upon release from their respective sites, the first being scheduled for release in March-April 2005. If the OMP Environmental Impact Statement (EIS) and Record of Decision (ROD) are approved, construction of proposed runway 9L will start at ORD in September 2005. A TASR will be required concurrently with the construction start in order to be installed and certified prior to the first runway completion; currently projected no earlier than mid-2007. Acquisition and installation of the first available TASR as a permanent facility will accommodate runway 9L requirements.

Due to the need to move the existing ASR-9, the second TASR will be used to establish the south site ASR-9 that will then return the existing ASR-9 to national inventory.

Both TASRs will require the addition of Mode-S technology. The expectation is that these resources will become available as a result of the ongoing ASR-11 modernization program whereby Mode-S equipment will become available as a result of ASR-11 installations.

Land Acquisition

The proposed sites for the additional ASR-9 on the north side of the airfield as well as the south side of the airfield is on airport property set aside in the Airport Layout Plan submitted by the City of Chicago. These sites will be made available at no additional cost to the FAA.

FAA Resource Availability

A full-time complement of system support personnel (SSC) is already assigned to ORD. Within the SSC, personnel are certified on the ASR-9 and will be available to support the additional ASR-9. Minimal impacts to existing staffing levels are anticipated to support the second system.

To the extent allowable by law, FAA costs will be recovered via a reimbursable agreement with the City of Chicago. City funding will be accomplished through two primary sources: local funds and Federal funds. Local funds include general airport revenue bonds, passenger Facility Charges, and third party financing. Federal funds include facilities and equipment appropriations, AIP entitlement and discretionary funds.

Non-FAA Costs

Non-FAA costs will be recovered via a reimbursable agreement with the City of Chicago.

Equipment Connectivity

NAS: New telecommunications lines will be required to connect the additional ASR-9 to the NAS. The current fiber optic loop at ORD is not routed to the proposed site. Interim fiber optic connections will be necessary until a permanent extension to the current fiber optic loop is established. This can be achieved by using fiber optics provided by a local telco provider, e.g. SBC, Inc.

Power: Primary power will be provided similarly as the current system, from a local commercial utility. An UPS and engine generator will provide back-up.

Equipment Sustainment

Significant additional technical training will not be required. The proposed system for the north side of ORD will be the same configuration as the current system. There is an anticipated incremental increase in the number of spares required to support the additional system. The number and type of spares is to be determined dependent upon spares on hand and priorities with QXM, which shares the local spares supply.

Appendix E.3 On-Field Surveillance Radar Justification/Requirements - Attachment 1

Current ORD ASR-9 Coverage for Future Runways

RADAR LOCATION DATA : **EXISTING ORD**

LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	ELEVATION (FT MSL)	ANTENNA HT (FT)
41:58:48.58	-87:55:39.95	751.1	85.0

FIX DATA :

NO.	NAME	LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	RNG (nmi)	AZ (DEG-TRUE)	SCREEN ANGLE (DEG)	REQ ALT (FT MSL)	SCREEN ALT (FT MSL)	VISIBLE	PD*
1	Future 4L	41:58:53.88	-87:54:50.19	0.62	81.87	-1.221	675.	671.	YES	0.436
2	Future 22R	41:59:51.21	-87:53:46.85	1.75	53.40	-0.540	658.	653.	YES	0.736
3	Future 4R	41:57:11.90	-87:53:58.00	2.05	141.79	-0.358	671.	676.	NO	0.000
4	Future 22L	41:58:11.76	-87:52:47.03	2.23	105.91	-0.391	667.	662.	YES	0.794
5	Future 9R	41:59:02.02	-87:55:53.65	0.28	322.75	-2.960	668.	663.	YES	0.003
6	Future 27L	41:59:02.04	-87:53:24.55	1.70	82.40	-0.571	655.	650.	YES	0.718

7	Future 10L	41:58:08.38	-87:55:53.47	0.69	194.09	-0.976	673.	680.	NO	0.000
8	Future 28R	41:58:08.65	-87:53:01.38	2.08	108.63	-0.432	661.	659.	YES	0.772
9	Future 9L	42:00:10.20	-87:55:36.03	1.36	2.05	-0.136	669.	733.	NO	0.000 **
10	Future 27R	42:00:10.19	-87:53:56.70	1.87	43.34	-0.549	650.	645.	YES	0.723
11	Future 9C	41:59:17.89	-87:55:53.66	0.52	340.76	-1.564	671.	666.	YES	0.194
12	Future 27C	41:59:17.92	-87:53:24.75	1.75	73.77	-0.569	650.	648.	YES	0.714
13	Future 10C	41:57:56.53	-87:55:53.44	0.88	190.95	-0.484	696.	706.	NO	0.000
14	Future 28C	41:57:56.76	-87:53:30.48	1.83	118.20	-0.624	637.	632.	YES	0.680
15	Future 10R	41:57:25.92	-87:55:40.30	1.38	180.18	-0.538	674.	674.	YES	0.700
16	Future 28L	41:57:26.09	-87:54:01.04	1.84	138.17	-0.446	668.	666.	YES	0.772

- * PROBABILITY OF DETECTION (PD) OF 80% OR BETTER IS INDICATIVE OF RADAR COVERAGE
- ** THIS IS THE FIRST RUNWAY PROJECT OF OMP, PROPOSED TO BEGIN IMMEDIATELY AFTER A RECORD OF DECISION IS ISSUED.

Future ORD North ASR-9 Coverage for Future Runways

RADAR LOCATION DATA: **FUTURE ORD-N**

LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	ELEVATION (FT MSL)	ANTENNA HT (FT)
42:00:17.80	-87:54:09.80	733.0	85.0

FIX DATA :

NO.	NAME	LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	RNG (nmi)	AZ (DEG-TRUE)	SCREEN ANGLE (DEG)	REQ ALT (FT MSL)	SCREEN ALT (FT MSL)	VISIBLE	PD*
1	Future 4L	41:58:53.88	-87:54:50.19	1.48	199.75	-0.405	675.	670.	YES	0.791
2	Future 22R	41:59:51.21	-87:53:46.85	0.53	147.22	-1.435	658.	653.	YES	0.277
3	Future 4R	41:57:11.90	-87:53:58.00	3.10	177.29	-0.145	671.	692.	NO	0.000
4	Future 22L	41:58:11.76	-87:52:47.03	2.34	153.89	-0.301	667.	662.	YES	0.827
5	Future 9R	41:59:02.02	-87:55:53.65	1.80	225.64	-0.085	668.	719.	NO	0.000
6	Future 27L	41:59:02.04	-87:53:24.55	1.38	155.98	-0.573	655.	650.	YES	0.718
7	Future 10L	41:58:08.38	-87:55:53.47	2.51	210.87	-0.247	673.	671.	YES	0.836

8	Future 28R	41:58:08.65	-87:53:01.38	2.31	158.43	-0.191	661.	690.	NO	0.000
9	Future 9L	42:00:10.20	-87:55:36.03	1.08	263.27	-0.402	669.	688.	NO	0.000
10	Future 27R	42:00:10.19	-87:53:56.70	0.21	127.91	-4.020	650.	645.	YES	0.003
11	Future 9C	41:59:17.89	-87:55:53.66	1.63	232.30	-0.174	671.	705.	NO	0.000
12	Future 27C	41:59:17.92	-87:53:24.75	1.14	150.69	-0.481	650.	675.	NO	0.000
13	Future 10C	41:57:56.53	-87:55:53.44	2.68	208.70	-0.093	696.	711.	NO	0.000
14	Future 28C	41:57:56.76	-87:53:30.48	2.40	168.25	-0.359	637.	645.	NO	0.000
15	Future 10R	41:57:25.92	-87:55:40.30	3.07	201.46	-0.080	674.	713.	NO	0.000
16	Future 28L	41:57:26.09	-87:54:01.04	2.86	177.82	-0.043	668.	725.	NO	0.000

* PROBABILITY OF DETECTION (PD) OF 80% OR BETTER IS INDICATIVE OF RADAR COVERAGE

Future ORD South ASR-9 Coverage for Future Runways

RADAR LOCATION DATA: **FUTURE ORD-S**

LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	ELEVATION (FT MSL)	ANTENNA HT (FT)
41:57:11.50	-87:54:49.40	749.3	85.0

FIX DATA :

NO.	NAME	LATITUDE (DEG MIN SEC)	LONGITUDE (DEG MIN SEC)	RNG (nmi)	AZ (DEG-TRUE)	SCREEN ANGLE (DEG)	REQ ALT (FT MSL)	SCREEN ALT (FT MSL)	VISIBLE	PD*
1	Future 4L	41:58:53.88	-87:54:50.19	1.70	359.67	-0.448	675.	671.	YES	0.772
2	Future 22R	41:59:51.21	-87:53:46.85	2.77	16.29	0.106	658.	786.	NO	0.000
3	Future 4R	41:57:11.90	-87:53:58.00	0.64	89.40	-1.199	671.	668.	YES	0.396
4	Future 22L	41:58:11.76	-87:52:47.03	1.82	56.57	-0.465	667.	662.	YES	0.761
5	Future 9R	41:59:02.02	-87:55:53.65	2.01	336.55	-0.420	668.	663.	YES	0.787
6	Future 27L	41:59:02.04	-87:53:24.55	2.12	29.80	-0.369	655.	669.	NO	0.000
7	Future 10L	41:58:08.38	-87:55:53.47	1.24	319.95	-0.436	673.	693.	NO	0.000

8	Future 28R	41:58:08.65	-87:53:01.38	1.65	54.66	-0.544	661.	656.	YES	0.732
9	Future 9L	42:00:10.20	-87:55:36.03	3.03	348.99	-0.129	669.	714.	NO	0.000
10	Future 27R	42:00:10.19	-87:53:56.70	3.05	12.41	-0.332	650.	649.	YES	0.801
11	Future 9C	41:59:17.89	-87:55:53.66	2.25	339.23	-0.364	671.	666.	YES	0.798
12	Future 27C	41:59:17.92	-87:53:24.75	2.35	26.54	-0.319	650.	674.	NO	0.000
13	Future 10C	41:57:56.53	-87:55:53.44	1.09	313.30	-0.508	696.	691.	YES	0.765
14	Future 28C	41:57:56.76	-87:53:30.48	1.24	52.46	-0.762	637.	650.	NO	0.000
15	Future 10R	41:57:25.92	-87:55:40.30	0.68	290.79	-0.729	674.	697.	NO	0.000
16	Future 28L	41:57:26.09	-87:54:01.04	0.65	67.99	-1.248	668.	664.	YES	0.476

* PROBABILITY OF DETECTION (PD) OF 80% OR BETTER IS INDICATIVE OF RADAR COVERAGE

Appendix E.3 On-Field Surveillance Radar Justification/Requirements – Attachment 2

Analysis of Donor Sites for Second ASR-9

	TASR	FWA	TOL	QXM
TASR				
Site Development	N/A	$120K	$120K	$120K
Installation	N/A	$40K	$40K	$40K
Flight Check	N/A	$15K	$15K	$15K
ORD-N ASR-9				
Site Survey	$60K	$60K	$60K	$60K
Land Acquisition	0	0	0	0
Site Development	$1.45M	$1.45M	$1.45M	$1.45M
EG/UPS	$410K	$410K	$410K	$410K
Installation	$200K	$200K	$200K	$200K
Flight Check	$15K	$15K	$15K	$15K
ASR-9 Transportation	$60K	$60K	$60K	$60K
ASR-11				
Site Survey/Design	0	Incurred by ASR-11 Program	Incurred by ASR-11 Program	0
Land Acquisition	0	$150K	$0 On Airport $150K Off Airport	0
Site Development	0	$1.2M	$1.2M	0
Installation	0	ASR-11 Program	ASR-11 Program	0
Flight Check	0	$15K	$15K	0

	TASR	FWA	TOL	QXM
Estimated Totals	**~$746.45K**	**~$2,786.45K***	**~$2,286.45K**	**~$921.45K**
	TASR	**FWA**	**TOL**	**QXM**
Cost Incurred (Past Work)	N/A	~$500K for ASR-11 site survey & site design 100% (1/11/05)	N/A	N/A
Cost Avoidance	N/A	N/A	~$4M (100' reduction in ATCT height by relocating existing ASR-9 to alternate site)**	N/A
Risks	Minimal, as the TASR is defined for the purpose of use as an asset to relocate existing ASR equipment.	Sustaining existing project schedule to accommodate the needed service (timeframe) for ORD. Siting for ASR-11 has occurred but property acquisition has not.	Surveillance funding availability to re-site new ASR-11	Impact to existing services provided to Midway Airport, Chicago, IL (MDW)
Assumptions	ATO-T has concurred with establishing the TASR inventory as a permanent installation	Surveillance funding would not be reprioritized and would continue to allow ASR-9 to be leapfrogged to ORD	Cost Avoidance in Facilities Program would be measured against and recognized as + value relative to additional costs to Surveillance Program	This donor is viable because it is already within the physical jurisdiction of ATO-W and thus is available w/o significant coordination. Requires TASR

*****The total cost for FWA includes $500K already expended for the ASR-11 site survey and site design.

** The cost avoidance identified @ TOL is not calculated as part of a cost reduction to the overall costs to ATO-T across program areas, i.e., those costs associated to the Facilities Program in constructing a new tower at an elevation greater than if the TOL ASR-9 were to be relocated. Additionally, costs represent installation only, not life cycle, which are expected to be static regardless of the source selected as a donor.

E.4 Off-Field Surveillance Radar Justification/Requirements

Introduction

The O'Hare Modernization Program (OMP) is a major redesign and expansion of O'Hare

International Airport (ORD) proposed by the City of Chicago, and involves major redesign to current runways as well as the addition of new runways. The OMP, with its proposed changes in runway length and number and the relocation of facilities on the airfield, will physically enable ORD to manage the projected growth rate. Any future growth, however, would be constrained by the current structure of the airspace surrounding O'Hare. To support the planned reconfiguration of ORD, an Air Traffic workgroup was established to determine the air traffic operating concept for the future airport and surrounding airspace. The OMP airspace redesign benefits from changes and improvements to both the Chicago (C90) Terminal Radar Approach Control (TRACON) terminal airspace and modifications to the Chicago Air Route Traffic Control Center (ZAU) environment. As part of the redesign, the current and planned radar surveillance infrastructure in the Chicago area was taken into account in determining the future requirements. Originally, two additional radar resources were envisioned to support the future operating concept. A detailed analysis of the radar coverage was undertaken to assess the coverage options and determine the most feasible alternative.

Background

The airspace surrounding O'Hare can easily handle the current arrival demand. With the advent of the OMP and the projected increase in air traffic, the Air Traffic workgroup developed the concept of an additional, independent arrival stream as the most efficient use of airspace to handle the projected increase in demand. This arrival stream needed to be independent of configuration and one that did not exacerbate the congestion or complexity of the airspace, while still being able to accommodate the anticipated increase in demand. The concept developed is termed "High and Wide", wherein arriving aircraft are routed above (higher) and outside (wider) the current "cornerpost" arrival stream. (See Attachment 1 OMP High and Wide Coverage Diagram for a depiction of the airspace and routes). This change is necessitated by the proposed reconfiguration of the current O'Hare airfield to a primarily east/west orientation with the potential to run triple or eventually quadruple parallel approaches. "High and Wide" is a ZAU/C90 procedure for routing aircraft into C90 airspace. This procedure routes aircraft to a central point outside the current C90 airspace.

Since this proposed procedure routes aircraft outside the current airspace, increased terminal radar coverage is required to allow C90 to accept control of the aircraft. The OMP High and Wide coverage requirement to the east is potentially available from the existing Airport Surveillance Radar (ASR) located at Tinley Park (QXM), IL. There is not adequate radar coverage to the west to support the preferred procedures for High and Wide. To support the OMP High and Wide arrival procedure from the west utilizing current practices, the Chicago TRACON identified the following radar coverage requirements. Radar coverage is required to encompass a point ten miles east of ORD, extending north and south to the current airspace boundaries and to include the west High and Wide expansion box. Vertical coverage is required

within a ten-mile radius of ORD from 200 feet above ground level (AGL) to 15,000 feet AGL; from 10 to 25 miles from ORD 2,000 to 15,000 feet AGL, and from 25 miles to the outer lateral limits of the airspace- 4,000 to 15,000 feet AGL. (See Attachment 1). To support the OMP High and Wide arrival procedure from the west, the following coverage requirements were identified. Radar coverage is required to encompass a point ten miles east of ORD, extending north and south to the current airspace boundaries, and to include the west High and Wide expansion box (See Attachment 1). Vertical coverage limits are required within a ten-mile radius of ORD from 200 feet AGL to 15,000 feet AGL; from 10 to 25 miles from ORD 2,000 to 15,000 feet, and from 25 miles to the outer lateral limits of the airspace- 4,000 to 15,000 feet AGL (See Attachment 1).

To run the most efficient high and wide procedures, the radar site(s) that provide coverage for the High and Wide extensions would also need to provide coverage to include ORD as stated above. The rationale behind this is that the operation has the control position working departures to the west or to the east also responsible for separating departure traffic vertically when crossing the arrival stream. Complementary to this, the control position working arrival aircraft would be responsible from the time of hand-off from ZAU until the aircraft was sequenced on final and transfer of control is made to ORD tower. To enable this operation, both the arrival and departure controllers would need to be utilizing the same radar source or have adequate overlapping coverage from two sites. Currently, the Rockford Airport (RFD) planned site and the on-field ORD site(s) do not provide sufficient overlap to support this, thus an alternate operation has been proposed.

While the most efficient option from the Air Traffic standpoint is to utilize a single source of radar for both control positions, it also carries significant risk. It requires an additional radar asset be deployed; either an ASR-9 from current national inventory or an ASR-11 through the national program. Either option requires a 3.5-4 year timeline and would cost approximately $5.9 to $7.3 M (See Attachment 2 OMP West High and Wide Option Considerations). It is also dependent on ZAU reconfiguring the sectors to the southwest to enable High and Wide. Because of the transition the airfield will undergo during construction, High and Wide from the west (landing to the east) would not be required until planned Runway 10C/28C is commissioned. The current schedule for this runway commissioning was contingent on the OMP Environmental Impact Statement (EIS) Record of Decision (ROD) being issued in Spring 2004, and was then planned for 2009. The current schedule for the OMP ROD is September 2005, so the commissioning date for the runway would be expected to slip as well.

There is also the potential to slightly realign the High and Wide arrival path so it would be within existing coverage, and therefore not require an additional radar source. This would have to be evaluated environmentally, but as the change would take place above 10,000 AGL, it is not anticipated that the OMP EIS would be impacted. The potential also exists that technological advances (e.g. radar fusion) would enable the most efficient procedure without additional radar resources.

Considerations and Personnel Requirements

Alternatives were developed (See Attachment 2), evaluated, and cost estimates developed for each radar coverage solution. Evaluation factors included cost, availability of equipment, and

personnel requirements. A portion of the evaluation was part of an on-going national program that will upgrade RFD to an ASR-11. The current preferred site for RFD was selected through analysis and coordination with the local Airport Authority, and chosen to provide optimal coverage for RFD. This planned site was recently evaluated as potentially providing coverage for the west High and Wide operation. Radar Site Survey (RSS) analysis of the planned RFD site (site 11) indicates that this location would not support the preferred OMP High & Wide procedures, even if procedures were implemented using terminal separation standards out to 60 nautical miles.

Further analysis of the sites evaluated for RFD was undertaken with the intent of determining if any single site could provide coverage for both RFD and the OMP west High and Wide. Since the land for the planned site of the RFD ASR-11 had not yet been acquired, an opportunity existed to potentially relocate the radar and provide coverage for both facilities' requirements. A progressive approach was taken; 1) could one site provide the required coverage for both RFD and OMP, 2) what would the potential coverage for OMP be with no degradation in coverage for RFD, and 3) at what point would the required coverage for OMP degrade the coverage for RFD to an unacceptable level. Eleven additional sites were reviewed for their potential to provide the required coverage for both RFD and OMP. Unfortunately, no one site was found to be capable of providing the required coverage for both RFD and OMP, and the decision was made to proceed with acquiring the land for the preferred RFD site so as not to jeopardize the commissioning timeline.

Alternatives to re-siting the RFD radar were also examined, but each would be significantly more expensive. One alternative would be to acquire an additional ASR-9 from national inventory (e.g. the current ORD ASR-9 when it is relocated due to airfield construction), and relocate that resource somewhere to the west of ORD to provide the required High and Wide coverage. Approximate cost over 10 years of this option would be $5.9M, depending on the land acquisition costs (see Attachment 2). Another option would be to acquire a new ASR-11 from national inventory under the ASR-11 program, which would cost approximately $7.7M over 10 years. The third option examined was to alter the proposed air traffic operation and use planned radar sources (i.e. RFD located at its present planned site). This option would require staffing additional controller positions as well as a reconfiguration of the C90 control room. The additional controller staffing would be in addition to that outlined in the OMP Business Case, as those numbers presupposed the most efficient operation (i.e. a single controller responsible for traffic from ZAU handoff to ORD Air Traffic Control Tower (ATCT) handoff. This option is estimated to cost approximately $8.6M due to the recurring controller salary costs. While Option 4 is the most expensive, it is determined to be the preferred alternative due to its lower relative risk and greater possibility for migration through technological advances or procedure modification.

Equipment Availability

The implementation of Option 4would entail reallocating two current radar positions at C90 and dedicating one to the arrival position responsible for aircraft inbound on the west High and Wide, and sharing one position with a south departure position. This option would also require authorizing four additional controllers in C90's staffing.

The radar controller displays are currently available within the C90 resources. The planned upgrade of the Fully Digital ARTS Displays (FDADs) to the next generation display (to be determined) already includes the necessary number of displays, and no additional spares would be required.

The current automation platform located at C90 is an Automated Radar Tracking System (ARTS) IIIE running Common ARTS software revision 30. This version of software currently does not support an interface between an ASR-11 and the ARTS IIIE. There have been national fixes to this issue (upgrading hardware to a PowerPC, which has already been accomplished at C90, and the continuing enhancement of software, now on rev. 32). This solution would be acceptable as long as C90 receives next generation displays. The existing FDAD technology is constrained by equipment memory problems and cannot accept an interface from the ASR-11. The solution is to install the next generation display. This action would be required for any radar coverage solution that involves an ASR-11, as it is an ASR/ARTS IIIE interface issue. Currently, C90 is slated to receive the next generation display in the 2007 timeframe.

Using currently planned and existing coverage will require reconfiguration of the Chicago TRACON, and some ancillary position equipment, as well as two additional frequencies (1 Very High Frequency (VHF), 1 Ultra High Frequency (UHF)). The equipment is available, but the funding for the reconfiguration would need to be identified.

Land Acquisition

The current proposed site for the RFD ASR-11 is on privately owned property. Funding for land acquisition is provided under the national ASR-11 program. No additional land acquisition would be required for using the planned site and existing coverage. As stated above, the land acquisition process is continuing, and the FAA is beginning condemnation proceedings to acquire the land at the proposed RFD ASR-11 site.

FAA Resource Availability

Support of FAA equipment at RFD is the responsibility of the Chicago Systems Management Office (SMO), whose radar technicians would require system support training for the RFD ASR-11 as part of the national ASR-11 deployment schedule. Training is authorized and funded by the national program.

Radar position equipment at C90 is already on site and would be available to support the reconfiguration. Tech support for the additional equipment is available with minimal impacts to existing SMO staffing levels.

FAA Costs

The upgrade of the RFD ASR-8 to ASR-11 is a current, nationally funded and scheduled program. Associated activities include, but are not limited to, site survey, design, land acquisition, site development, installation, and checkout.

The cost of authorizing additional controller staff at C90 is factored into the cost of the preferred option. Significant risk is currently carried in the OMP Business Case regarding controller staffing, but since this option is not needed until the 2009-2010 timeframe at the earliest, and the potential exists to modify the operation, no additional risk was assigned to this option. It must be stated, however, that significant hurdles exist to acquiring and maintaining the required staffing at C90.

Equipment Connectivity

NAS: New telecommunications lines will be required to connect the planned RFD ASR-11 radar system to C90. Fiber optic lines are projected to be used to connect the ASR-11 to the C90 TRACON. Installation of the new lines for RFD is provided under the national program. Recurring costs become part of the Operations budget baseline.

Power: Primary power would be provided similarly to the current system, from a local commercial utility. An UPS and engine generator will provide back-up.

Equipment Sustainment

Additional technical training will be required (See FAA Resource Availability above). Initial spares are the responsibility of the national program.

Recommended Action

Recommend that the current airspace redesign plan provide the High and Wide operation utilizing the following:

1. Proceed with the ongoing upgrade of the current RFD ASR-8 to an ASR-11; a current nationally funded and scheduled program.

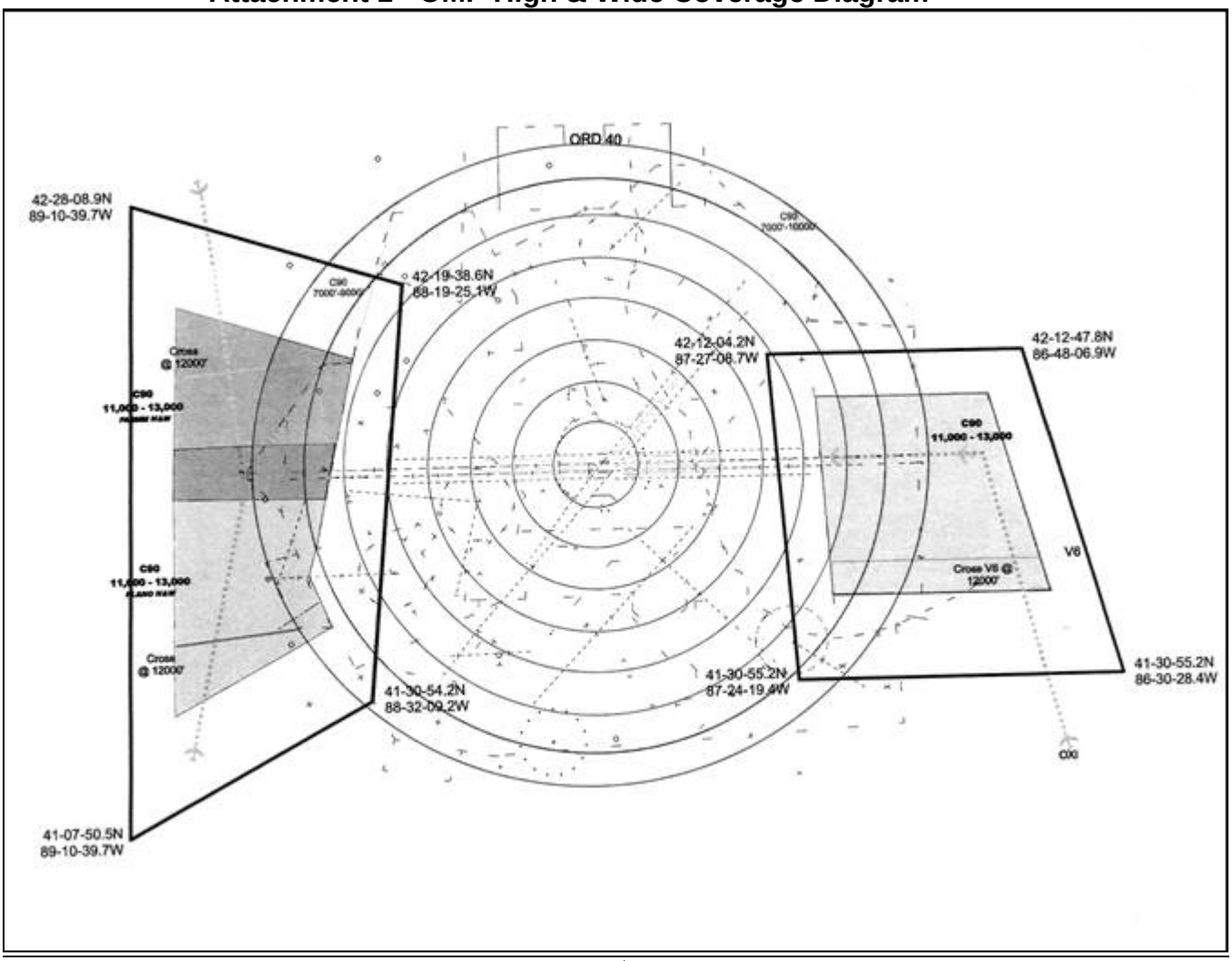
2. Authorize ASR-11 use of terminal separation standards out to 60 nautical miles.

3. Reconfigure and redesignate current C90 radar positions to utilize planned RFD ASR-11 coverage to conduct west High and Wide.

4. Authorize additional staffing for C90 to allow staffing of two additional radar positions for the modified operation.

Appendix E.4 Off-Field Surveillance Radar/Justification –

Attachment 1 - OMP High & Wide Coverage Diagram



The above graphic represents the OMP High and Wide proposed airspace changes to the east and west of O'Hare International Airport.

Appendix E.4 Off-Field Surveillance Radar/Justification –

Attachment 2 - OMP West High and Wide Option Considerations

Options	Cost Deltas: ANI, Contract &/or Eqmt.	Cost Deltas: Staffing (AT or O&M)	Cost Deltas: 10 Year Projection	Availability
1 Re-site RFD ASR-11 Preferred Option				
Survey (Site for both RFD & OMP Requirements)				
- Raytheon "Quick Look"	$25,000		$25,000	
- Raytheon Full Survey Report (**if** justified by "Quick-look)	$225,000		$225,000	
Radar Equipment	Funded			BLI
Land, Construct & Install	Funded			BLI
O&M Cost		Neglible Delta		
Radar Sparing & Telco (ASR-11 vs. current ASR-8)	Neglible Delta			
Schedule Duration				w/i 2 years
Option 1 Subtotal	$250,000		**$250,000**	
2 New West Radar Site - GFE Inventory (ASR-9)				
Siting Survey	$250,000		$250,000	
Radar Equipment	n.a.			Leapfrog
Land, Construction & Install	$3,000,000		$3,000,000	TBD
Telco (ROM estimate, recurring cost)	$40,000		$400,000	
O&M Cost (assumes existing SSC) *		$198,000	$1,980,000	
Radar Sparing & Repairs (ROM Estimate) *	$35,000		$350,000	
Schedule Duration				3.5 - 4 Yrs.
Option 2 Subtotal	$3,325,000	$198,000	**$5,980,000**	
3 New West Radar Site - Purchase New ASR-11				
Siting Survey	$250,000		$250,000	
Radar Equipment	$1,750,000		$1,750,000	No BLI
Land, Construction & Install	$3,000,000		$3,000,000	TBD
Telco (ROM estimate, recurring cost)	$40,000		$400,000	
O&M Cost (assumes existing SSC) *		$198,000	$1,980,000	
Radar Sparing & Repairs (ROM Estimate) *	$35,000		$350,000	
Schedule Duration				3.5 - 4 Yrs.
Option 3 Subtotal	$5,075,000	$198,000	**$7,730,000**	
4 TRACON Using Planned & Existing Coverage				
Siting Survey	n.a.			
AT Rqmts: 2 new positions & 4 FTE staffing *		$800,000	$8,000,000	
Console Mods, as req'd. (no added displays req'd)	$15,000		$15,000	
Reconfigure Control Room Floor	$105,000		$105,000	
2 new Frequencies (& 10 yrs. recurring Telco)	$260,000		$510,000	
O&M Cost		Neglible Delta		
Schedule Duration (ROM)				1.5 Yrs.
Option 4 Subtotal	$380,000	$800,000	**$8,630,000**	

* Controller PC&B; $200K / yr.
Radar Electronics Tech; 2,300 Hrs./yr., PC&B @ $60/hr.
Radar Environmental Tech; 1,000 Hrs./yr., PC&B @ $60/hr.
Radar Sparing ROM estimate @ $35K/ yr. (assumes no rotary joint failure)

E.5 Advanced Electronic Flight Strip (AEFS) System Justification/Requirements

Introduction

The replacement of the current Electronic Flight Strip Transfer System (EFSTS) with the proposed Advanced Electronic Flight Strip (AEFS) system is critical for both current operational issues and future requirements at the Chicago O'Hare (ORD) Air Traffic Control Tower (ATCT).

The current EFSTS, which has been fully operational since March 2005, is labor intensive in a facility such as ORD ATCT, due to the level of activity at O'Hare airport. EFSTS requires the local controller to make multiple computer entries for each aircraft that departs. This diverts the controller's attention away from visually scanning the runway(s) and airspace. This is not the most effective and efficient process, today, and it will be even less so in the future environment of the proposed O'Hare Modernization Program (OMP).

This document focuses on the future requirements for improved electronic flight strip capability at both the current ORD ATCT as well as the future satellite ATCTs (both north and south) proposed for the reconfigured and expanded O'Hare Airport. It is intended to supplement the information in the OMP Business case and Appendix F. The Air Traffic Organization Terminal Services (ATO-T) proposed replacement system is called the Advanced Electronic Flight Strip (AEFS) System, as specified in the document, *Advanced Electronic Flight Strip (AEFS) Interim System Baseline Requirements for Chicago O'Hare (ORD) Air Traffic Control Tower Version 1.0,* April 1, 2005. While the specific needs identified in this document primarily address ORD requirements, the goal has been to develop functionalities that may serve as a model for future implementation at other ATC facilities throughout the National Airspace System (NAS). (See Attachment 1 *Advanced Electronic Flight Strip Baseline Requirements Document*.)

In 2004, Chicago O'Hare International Airport handled 992,471 air traffic operations. The projected traffic associated with the OMP is 1.2 million operations. This increase in traffic will require a corresponding increase in the efficiency of air traffic control (ATC) operations, and must be accomplished without compromising existing levels of safety.

Given the inherent inefficiencies associated with the handling of paper-based flight strips, it is difficult to envision how these goals will be met without the introduction of an electronic alternative. The nature of air traffic control requires that controllers respond quickly and consistently to high traffic demands, adverse weather conditions, and/or emergencies. With paper-based flight strips, this complex operation is exacerbated by the necessity of physically moving the paper strips from controller position to controller position. This problem can easily be resolved with the introduction of an electronic alternative. Providing ORD ATCTs with the AEFS capability will eliminate the need for paper flight data strip operations.

Background

Paper-based flight strips provide air traffic controllers with a physical representation of aircraft information and are used by ATC throughout the NAS to coordinate and plan operations

regarding individual flights. Within the ATCT at ORD, these operations are predominantly concerned with arrivals, departures, and surface movement of aircraft and vehicles. As flights are processed through their arrival/departure/surface movement sequences, their corresponding flight strips are passed from one controller to the next – each of whom is concerned with a specialized segment of the overall sequence to be completed.

Currently, paper flight strips are automatically introduced into the ATCT by the Flight Data Input/Output (FDIO) printer based on flight data provided by the Host and Oceanic Computer System Replacement (HOCSR) system. In addition, controllers may prepare flight strips manually for managing aircraft movements that do not require the filing of a flight plan (i.e. the movement of aircraft between two locations on the ground). Once an aircraft is processed through an operation, its corresponding flight strip is discarded.

The proposed OMP requires the construction of two new ATCTs to be operated in conjunction with the existing tower facility. In the highly complex ATC operating environment that will result, the use of paper-based flight strips will not be practical since the controllers will no longer have a means for accomplishing paper flight strip hand-offs between the existing main ATCT and the 2 proposed satellite ATCTs. All flight data functions are planned to be managed out of the main tower to maintain efficiency and cohesion, while simultaneously reducing equipment and staffing requirements in each facility. The physical size of the north ATCT can also be kept to a minimum by not introducing additional equipment.

Considerations and Personnel Requirements

The OMP proposed north satellite ATCT is intended to control operations for the northern-most runway and associated taxiways, ramps and aircraft parking areas north of the future runway 9C. However, the possibility remains that during periods of unusual activity (e.g. weather, construction, disabled aircraft, etc.), the north ATCT could handle a significantly larger amount of traffic than planned during routine operations. Current projections of anticipated aircraft handled by the north ATCT are 105,000 operations (arrivals and departures) when the north runway becomes operational. Not included in this total are the aircraft relocations on the airfield; the approximately 60,000 hangar flights (air carrier relocations to/from the maintenance hangars and the terminals) and the 24,000 general aviation aircraft taxing to and from the runways and ramp. Also not included in aircraft traffic counts, but are still operations the tower must control, are hundreds of vehicle operations; runway inspections, fire department responses during emergencies, vehicle escort operations, to name a few. All of these myriad operations must be coordinated and tracked.

The operation developed for the OMP airfield allows aircraft operations to continue with the same efficiency as today, with no "paper-stops" for transfer of control other than those inherent in any tower operation. Unimpeded movement through the core of the airport is a necessity to handle the anticipated increased volume of traffic, as well as today's steadily increasing traffic.

Currently, the cost for the constructing the proposed north satellite ATCT is being funded by the City of Chicago under a reimbursable agreement, with the exception of an FAA-developed and implemented AEFS. Eventually at the full build of the OMP, another south satellite ATCT will

be required to control traffic on the southern-most runway (10R/28L) and adjacent taxiways, so the AEFS is intended to be deployed at that facility as well.

Alternatives Reviewed

1. Develop / incorporate mechanical means – such as pneumatic tubes – to distribute flight data within or among ATCTs.

    This alternative is at best archaic, and comes with high installation, modification and maintenance costs.

2. Continue with the current operational EFSTS.

    This alternative is labor intensive and not efficient in today's environment, and the future OMP will significantly increase EFSTS generated staffing required (see Attachment 2 EFSTS as OMP Operating System – Additional Staffing Required.)

3. Enhance the existing EFSTS.

    This alternative has been reviewed by the development team but the complexity of Chicago requirements are beyond the scope of this system. The existing EFSTS may be integrated into the AEFS final design, but the AEFS will be able to also function independent of EFSTS.

4. Procure an existing foreign electronic flight strip system and avoid the cost and time to develop an FAA AEFS.

    These alternative systems have been reviewed, and none fully meet all FAA requirements. Foreign procurements will involve additional procurement lead-times and additional approvals, and some systems may also require modifications to be compatible with existing FAA systems.

5. Implement the AEFS system being developed by ATO-T Office of System Engineering (SE)/En Route Program Operations Office (ATO-E).

    This alternative provides the best and most cost effective resolution to both the current and future FAA electronic flight strip issues at O'Hare, as well as potentially at other large capacity ATC facilities throughout the NAS.

Recommended Action

Develop the AEFS system as outlined in the "Advanced Electronic Flight Strip System (AEFS) Interim System Baseline Requirements for Chicago O'Hare Air Traffic Control Tower" document (see Attachment 1). The development of this system minimizes the staffing required for both the main and the north ATCTs. The intent is that all Traffic Management and Flight Data functions will be centrally handled from the current tower to maintain cohesiveness and continuity of staff functions, and minimize the personnel required for the north (and south) ATCT(s). The deployment of an electronic flight strip system will also minimize the physical

size requirements of each facility to accomplish the operation. The AEFS will reduce the operating costs of the facilities over their life-cycle of operation, as additional staff would be required to support a paper-based system.

Equipment and System Availability

ATO-T SE is funded to generate AEFS requirements and to perform analyses to determine optimal user interface design options. ATO-T SE and ATO-E will collaborate to implement design, software code, hardware, test and installation. However, funding is being sought for these AEFS implementation activities. Currently, the first new runway of the OMP is planned for July 2008; this new runway requires the construction and operation of the north satellite ATCT, and therefore the AEFS. The ATO-T AEFS development and implementation schedule is detailed below.

Currently Funded:

- 01/05 Coordinate with ORD ATCT and generate AEFS requirements & perform analyses.

Pending Funding Availability:

- 05/05 Initiate AEFS software (SW) development and implementation
- 04/06 Initiate AEFS SW testing
- 06/06 Complete SW development of initial AEFS release
- 07/06 Initiate interface testing of initial AEFS SW release
- 01/07 Install AEFS initial release at ORD ATCT and initiate dual OPS with EFSTS
- 04/07 Initiate stand alone operation testing of AEFS initial release at ORD ATCT
- 07/07 Initial release and installation of operational AEFS at ORD ATCT(s)
- 09/07 Full capability AEFS SW release installed at ORD ATCT.

FAA Resource Availability

The AEFS will be fully supported by a Configuration Management program developed by the FAA managing Program Office and the Contractor. Training materials will be provided for ATO-T and ATO Technical Operations Services (ATO-W) under the development contract. A full complement of system support personnel (SSC) is already assigned to ORD and these personnel would be trained and certified on the AEFS. Minimal impact to staffing levels is anticipated to support the AEFS system.

Equipment Connectivity

As outlined in the ATO-SE document AEFS Interim System Baseline Requirements for ORD ATCT (V 1.0, 04/01/05) referenced above, the AEFS will be fully integrated with other relevant NAS systems. (See Attachment 1 *Advanced Electronic Flight Strip Baseline Requirements Document*)

FAA Costs and Spend Plan

See Attachment 2 for the ATO-T cost and spend plan for the recommended AEFS action. Attachment 2 also projects increased controller staffing required if the FAA proceeds into OMP operations with the EFSTS, versus implementing AEFS technology.

Appendix E.5 Advanced Electronic Flight Strip (AEFS) System Justification/Requirements

Attachment 1 - Advanced Electronic Flight Strip Baseline Requirements Document

Attachment 1
Federal Aviation Administration (FAA)

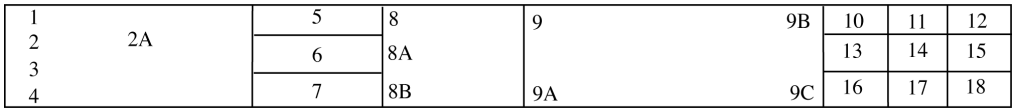
Advanced Electronic Flight Strip System (AEFS)

Interim System Baseline Requirements For

Chicago O'Hare (ORD) Air Traffic Control Tower

Version 1.0
April 1, 2005

Prepared by SAIC
For
FAA ATO-T
System Engineering



1.0 OVERVIEW

This document provides an overview of the existing paper-based flight strip system used within the air traffic control (ATC) tower at Chicago O'Hare International Airport (ORD). The document also identifies the requirements for automating those operations via an electronic system to be referred to herein as the Advanced Electronic Flight Strip (AEFS) system.

1.1 Background

Paper-based flight strips provide air traffic controllers with a physical representation of aircraft and are used by the ATC throughout the NAS to coordinate and plan operations regarding individual flights. Within the ATC tower at ORD, these operations are predominantly concerned with arrivals, departures, and surface movement of aircraft on the airport grounds. As flights are processed through their arrival/departure/surface movement sequences, their corresponding flight strips are passed from one controller to the next – each of whom is concerned with a specialized segment of the overall sequence to be completed.

Currently, flight strips are automatically introduced into the ATC tower by the Flight Data Input/Output (FDIO) printer based on flight data provided by the Host and Oceanic Computer System Replacement (HOCSR) system. In addition, controllers may prepare flight strips manually for managing aircraft movements that do not require the filing of a flight plan (i.e. the movement of aircraft between two locations on the ground). Once an aircraft is processed through an operation, its corresponding flight strip is discarded.

Paper-based flight strips provide basic flight plan information needed by the controllers to efficiently process air traffic for the ORD facility. As a flight strip is passed from one controller to the next, status updates are recorded directly on the strips. These updates are recorded in designated locations via handwritten entries using a system of shorthand notations designed to minimize controller interaction times. This same system is used at ATC facilities throughout the country. However, the exact syntax of notations varies from one facility to the next since flight strip updates are intended only for use within the local facility. When information is to be shared with other facilities, flight strip amendments are submitted via the FDIO interface for transfer to the HOCSR. Whenever a flight strip is amended, whether internally or externally, a new flight strip is automatically printed at the FDIO printer to replace the outdated flight strip which is then discarded.

1.2 Statement of System Need

This year to date Chicago O'Hare International Airport (ORD) handled over 800,000 air traffic operations which are estimated to increase by 28% to approximately 1.0 million operations by next year. In addition, ORD is planning a major modernization of the airport infrastructure to include 3 new runways and numerous new taxiways. It is estimated that these improvements will ultimately accommodate 1.6 million operations per year (approximately double the current traffic flow).

This increase in traffic will require a corresponding increase in the efficiency of ATC operations and must be accomplished without compromising existing levels of safety. Given the inherent inefficiencies associated with the handling of paper-based flight strips, it is difficult to envision how these goals will be met without the introduction of an electronic alternative. The nature of air traffic control requires that controllers respond quickly and consistently to high traffic demands, adverse weather conditions, and/or emergences. With paper-based flight strips, it is common for controllers to be distracted from direct consideration of aircraft operations for several seconds to accomplish flight strip hand-offs. As air traffic increases and decisions become more time critical, these distractions will inevitably lead to an increase in operational errors.

In addition, the ORD modernization plan provides for the construction of two new ATC towers to be operated in conjunction with the existing tower facility. In the highly complex ATC operating environment that will result, the use of paper-based flight strips will not be practical since the controllers will no longer have a means for accomplishing flight strip hand-offs. This problem can easily be resolved with the introduction of an electronic alternative.

1.3 AEFS System Overview

The AEFS system will provide ORD controllers with a real time, secure, efficient and effective means of distributing flight strips electronically. The system will support multiple towers located at a single airport. The system will distribute and manage electronic flight strip operations within a single tower and between multiple towers without affecting ATC operations.

The AEFS system will increase controllers' ability to manage AT operations more effectively thus potentially increasing throughput. Once a flight strip is received from the HOCSR via FDIO, the AEFS system will distribute it electronically to touch screen displays located at Air Traffic Control (ATC) and Traffic Management (TM) positions. With the AEFS, controllers will have all the functionality currently provided by the paper-based system. Controllers will be able to implement flight strip amendments and updates; transfers between control positions; placing on hold; and removal from

operations, to name a few. In addition, the AEFS system will accommodate the printing and viewing of ATC and system performance data. The system will provide electronic messaging (point-click or drop down menus) to facilitate communications between AT controllers and with the traffic management. To further facilitate tower communications, controllers may also write operational information in selective FS data fields on displayed flight strips.

The AEFS will process and distribute electronic flight strips amendments to the respective users (ATC tower personnel) and NAS systems. The AEFS will have the capability to send and receive information from FDIO. AEFS interfaces will also be extensible to include various other NAS systems that support flight planning and operations.

2.0 OPERATIONAL CONCEPT

NOTE: The content of this section is high level. For more detailed information in the form of specific operational scenarios, refer to Appendix B.

2.1 ATC Operational Environment

Each airport has special requirements which dictate local variations in ATC operations and the implementation of their Flight Strip systems. These variations are usually dictated by local traffic loads and airspace restrictions as well as runway and tower configurations. The goal is to develop an extensible electronic flight strip system which will address ORD's present and future requirements and serve as a model for future implementations at other ATC facilities throughout the NAS.

The ORD modernization program has proposed the addition of two new towers (North and South). These towers will be operated in conjunction with the existing tower which will be designated as the main tower. With this new physical airport configuration, centralized operations will also be accommodated by the main tower which will be readily configurable to simultaneously accommodate the North and South tower configurations. The current tower configuration and the proposed configurations are included in Appendix D.

2.2 Flight Strip Movement & Flow

Figure 1 and Figure 2 show the flow and movement of flight strips within the ATC operational environment for departure and arrival sequences and responsibilities at ORD, respectively. These flows are representative of AT operations at most major airports. They also show the division of responsibilities and the interdependent nature of AT control positions. Local facility operational requirements dictate the actual responsibilities and sequence of events within the ATC tower. The departure and arrival operational flow functions which are illustrated in Figure 1 and Figure 2 provide the framework for the development of the AEFS requirements.

2.2.1 Departure Operational Flow Responsibilities

The following provides a list of the major departure operational flow functions which are performed by the ATC and TM positions:

- Traffic Management(TM)/Operational Supervisor (OS)
  - Informs the respective controller of any route changes due to weather/restrictions/special cases
  - Monitors traffic flow
  - Provides directions to the respective controller in case of any changes
  - Amends flight plan in FDIO
  - ATC supervisor monitors the ATC tower operations

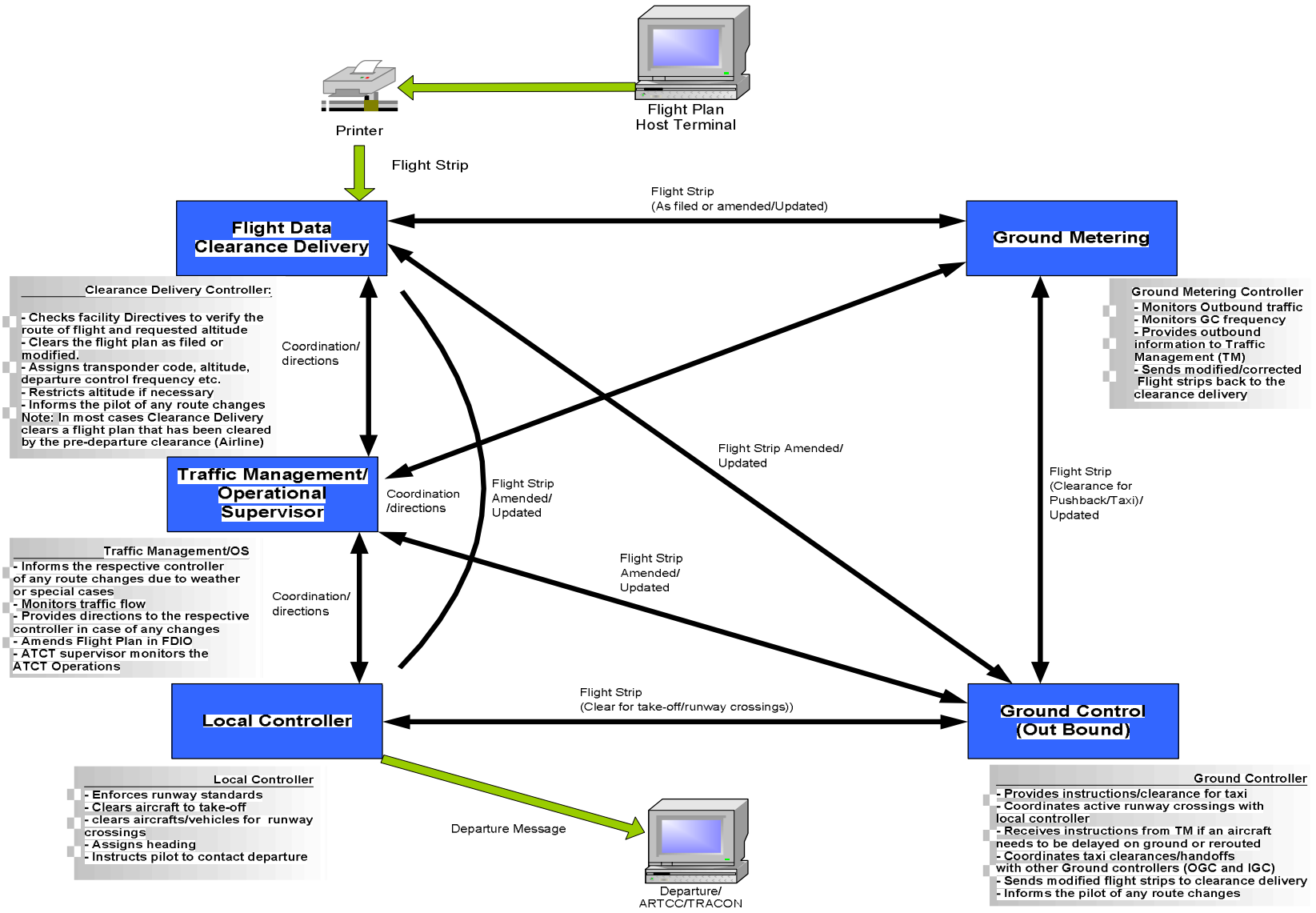
- Flight Data Clearance Delivery (CD)
  - Checks facility Directives to verify the route of flight and requested altitude
  - Clears the flight plan as filed or modified
  - Assigns transponder code, altitude, departure control frequency etc.
  - Restricts altitude if necessary
  - Informs the Pilot of any route changes

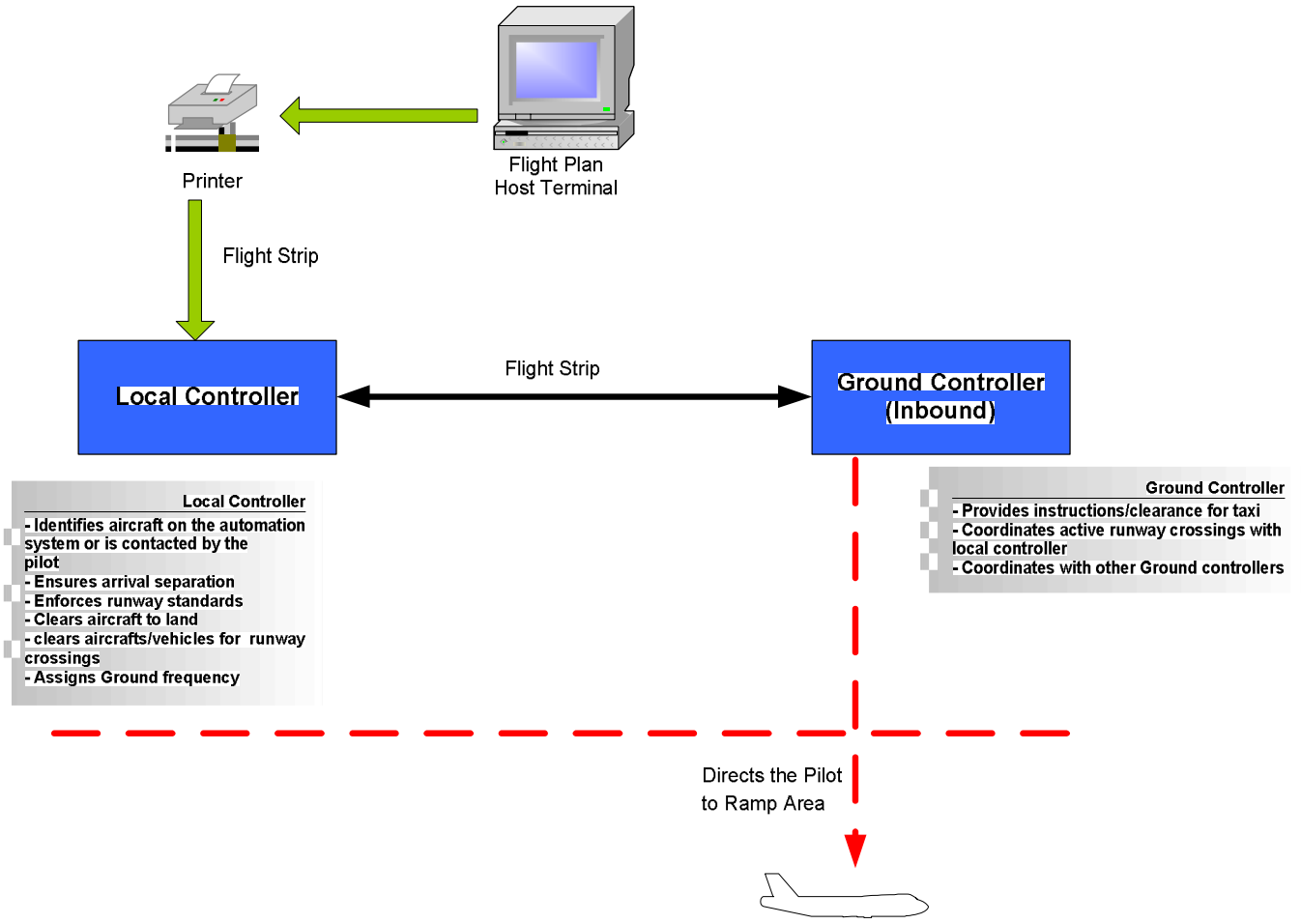
Note: In most cases CD clears a flight plan that has been cleared by the pre-departure clearance (Airlines)

- Ground Metering (GM)
  - Monitors Outbound traffic
  - Monitors Ground Control frequency
  - Provides outbound information to Traffic Management (TM)
  - Sends modified/corrected Flight strips back to the clearance delivery

- Ground Control (GC) - Out Bound
  - Provides instructions/clearance for taxi
  - Coordinates active runway crossings with local controller
  - Receives instructions from TM if an aircraft needs to be delayed on ground or rerouted
  - Coordinates taxi clearances/handoffs with other Ground controllers (outbound and inbound)
  - Request/Relay flight strip modification to clearance delivery/TM
  - Informs the pilot of any route changes

- Local Control (LC)
  - Enforces runway standards
  - Clears aircraft to take-off
  - Clears aircrafts/vehicles for runway crossings
  - Assigns heading
  - Instructs pilot to contact departure


Printer
Flight Plan
Host Terminal
Flight Strip
Flight Strip
(As filed or amended/Updated)
Flight Data
Clearance Delivery
Ground Metering
Clearance Delivery Controller:
- Checks facility Directives to verify the route of flight and requested altitude
- Clears the flight plan as filed or modified.
- Assigns transponder code, altitude, departure control frequency etc.
- Restricts altitude if necessary
- Informs the pilot of any route changes
Note: In most cases Clearance Delivery clears a flight plan that has been cleared by the pre-departure clearance (Airline)
Coordination/
directions
Ground Metering Controller
- Monitors Outbound traffic
- Monitors GC frequency
- Provides outbound information to Traffic Management (TM)
- Sends modified/corrected Flight strips back to the clearance delivery
Traffic Management/
Operational
Supervisor
Coordination
/directions
Flight Strip
Amended/
Updated
Flight Strip Amended/
Updated
Flight Strip
(Clearance for
Pushback/Taxi)/
Updated
Traffic Management/OS
- Informs the respective controller of any route changes due to weather or special cases
- Monitors traffic flow
- Provides directions to the respective controller in case of any changes
- Amends Flight Plan in FDIO
- ATCT supervisor monitors the ATCT Operations
Coordination/
directions
Flight Strip
Amended/
Updated
Flight Strip
(Clear for take-off/runway crossings))
Local Controller
Ground Control
(Out Bound)
Local Controller
- Enforces runway standards
- Clears aircraft to take-off
- clears aircrafts/vehicles for runway crossings
- Assigns heading
- Instructs pilot to contact departure
Departure Message
Departure/
ARTCC/TRACON
Ground Controller
- Provides instructions/clearance for taxi
- Coordinates active runway crossings with local controller
- Receives instructions from TM if an aircraft needs to be delayed on ground or rerouted
- Coordinates taxi clearances/handoffs with other Ground controllers (OGC and IGC)
- Sends modified flight strips to clearance delivery
- Informs the pilot of any route changes


Printer
Flight Plan
Host Terminal
Flight Strip
Local Controller
Flight Strip
Ground Controller
(Inbound)
Local Controller
- Identifies aircraft on the automation system or is contacted by the pilot
- Ensures arrival separation
- Enforces runway standards
- Clears aircraft to land
- clears aircrafts/vehicles for runway crossings
- Assigns Ground frequency
Ground Controller
- Provides instructions/clearance for taxi
- Coordinates active runway crossings with local controller
- Coordinates with other Ground controllers
Directs the Pilot
to Ramp Area

2.2.2 Arrival Operational Flow Responsibilities

The arrival controllers perform the following functions based on the current arrival event sequence illustrated in Figure 2:

- Local Control
  - Identifies aircraft on the automation system or is contacted by the Pilot
  - Ensures arrival separation
  - Enforces runway standards
  - Clears aircraft to land
  - Clears aircrafts/vehicles for runway crossings
  - Assigns ground communications frequency

- Ground Control (GC) - Inbound
  - Provides instructions/clearance for taxi
  - Coordinates active runway crossings with Local controller
  - Coordinates with other Ground controllers
  - Instructs the aircraft to contact the ramp control

2.3 AEFS System Concept

The system concept diagram in Figure 3 shows the information flow across the AEFS system. Regardless of the operational configuration that is used or the physical location of individual controllers, each controller position will have access to the AEFS system to provide seamless integration of ATC operations at ORD. Traffic Management (TMU) and Operational Supervisors (OS) will also have control and monitoring capabilities.

The AEFS will receive data from the Flight Data Input/Output server located in the tower equipment room. The FDIO server receives its data from HOCSR also called the host located at the Enroute center. The system will connect to FDIO via the PC-RCU (Personal Computer- Remote Control Unit) to receive flight strip data. Also, the system will support a two way interface to the FDIO system to transmit flight strip amendments. In the future, this interface may provide the electronic strips directly to AEFS. Future interfaces to external systems may include ARMT and CARTS/STARS.

The system will support standard electronic displays and touch screen display; key-pads and/or key-boards for data entry; and printers. It will directly connect to electronic displays through the Local Area Network connection. Each electronic display will have the same functionality, but the AT functionality may vary by controller position. Additionally, AEFS will have the capability of combining multiple controller positions at each operational control position.

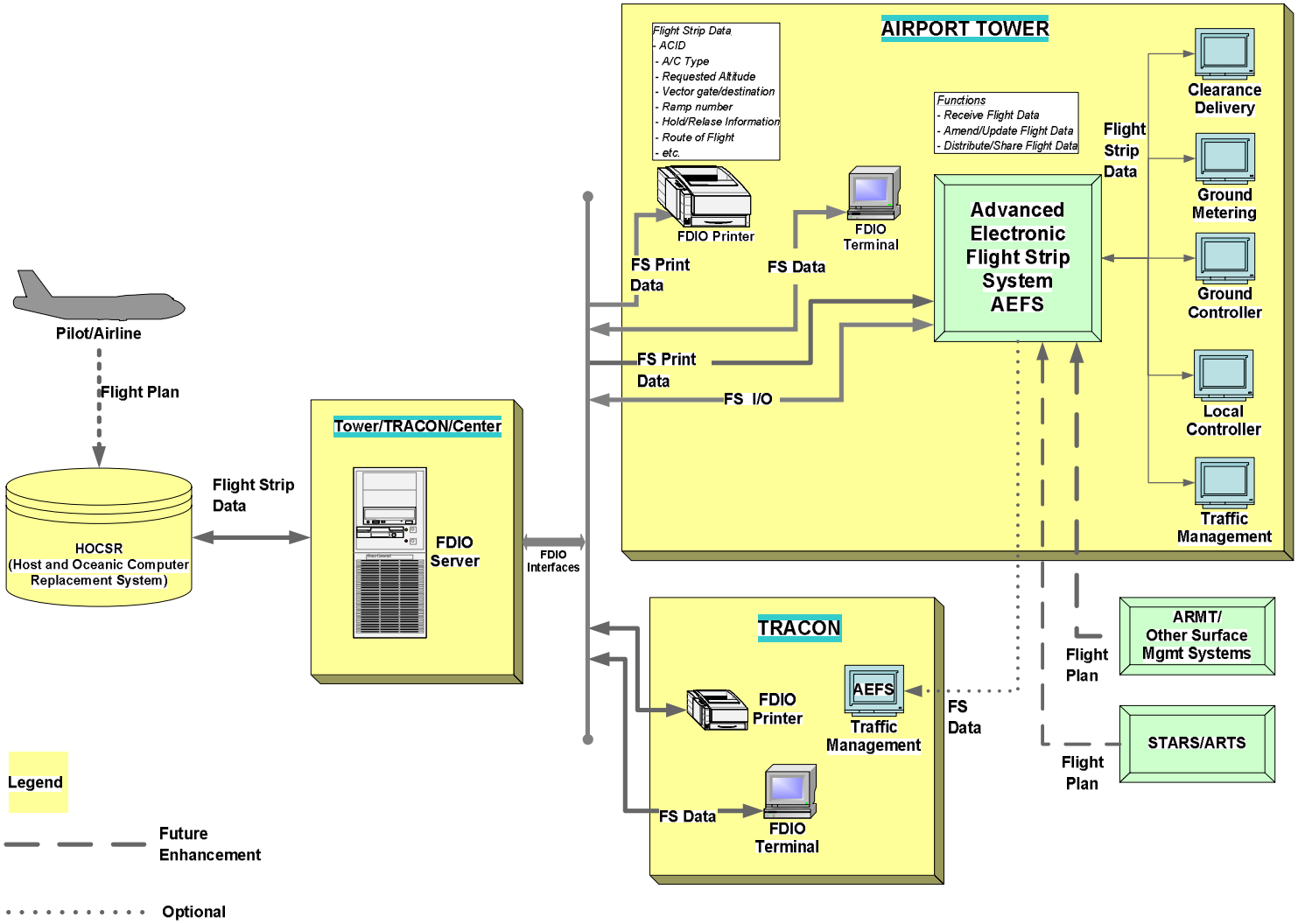


Figure 3: Advanced Electronic Flight Strip System Concept Diagram

3.0 REQUIREMENTS

3.1 Functional Requirements

3.1.1 System Operations

3.1.1.1 The AEFS system *shall* be acquired or developed as a "critical" system in accordance with NAS-SR-1000, NAS System Requirements Specification.

Note: This Requirement may be wavered for the interim system.

3.1.1.2 The AEFS system software and hardware configuration and flight strip processing *shall* be adaptable and configurable based on site requirements.

3.1.1.3 The AEFS system *shall* exchange data with external users/systems in accordance with the requirements in section **4.1.3** System Interfaces.

3.1.1.4 The AEFS system *shall* provide the capability for the ATC tower users to manually generate electronic flight strips.

3.1.1.5 The AEFS system *shall* establish a set of facility Electronic Flight Strip (EFS) Rules to manage the changing, processing, display and distribution of the facility's electronic flight strips.

Note: The AEFS shall provide a rule-based decision support module that uses the Facility EFS Rules to govern the changing, processing, display and distribution of the flight strips' 18 data fields and the full EFS. Aircraft type, characteristics and restrictions will be factored into FS processing based on the EFS Rules.

3.1.1.6 The AEFS Facility AEFS Rules *shall* be adaptable and configurable based on each facility's configuration (multiple towers/number of runways/number of control positions/…) and NAS operating procedures.

3.1.1.7 The AEFS system *shall* use the Facility AEFS Rules to validate and process FS information or changes received from local users and external systems.

3.1.1.8 The AEFS system *shall* organize the FS data for display based on the Facility EFS Rules and the predefined operational categories (arrival/destination/restrictions/ …).

3.1.1.9 The AEFS system *shall* transfer the FS data within the facility (towers and operational positions) and to external interfaces based on the Facility EFS Rules.

3.1.1.10 The AEFS system *shall* distribute flight strip data to ATC and TM.

3.1.1.11 The AEFS shall provide the ability for an authorized user to override FS rules and sequencing criteria to meet immediate operational needs.

Note: These changes can be saved temporarily for future usage.

3.1.1.12 The AEFS *shall* assign a local tracking number to each fight strip for display, internal processing and archiving.

3.1.1.13 The AEFS system *shall* develop operational statistics (e.g., number and type of flights, ATC/TM input/actions, processing time, ….).

3.1.1.14 The AEFS system *shall* provide the capability to generate ATC and system operational reports in display and print formats.

3.1.1.15 The AEFS system *shall* use Coordinated Universal Time (UTC) from a certified FAA or DOD source for internal and external synchronization.

3.1.1.16 The AEFS system shall use UTC time to track the status of each electronic flight strip.

3.1.2 Input Requirements

3.1.2.1 The AEFS system *shall* accept input from Air Traffic Control.

3.1.2.2 The AEFS system *shall* accept input from Traffic Management.

3.1.2.3 The AEFS system *shall* accept hand written FS data entries for ATC and TM.

3.1.2.4 The AEFS system *shall* accept input from the system administrator to support operational configuration and maintenance.

3.1.2.5 The AEFS system *shall* receive flight strip data from HOCSR via FDIO.

Note: AEFS may receive partial or complete progress flight strip [Field 1-30] from FDIO and will process and archive the FS based on the facility's operational rules.

3.1.3 Output/Distribution Requirements

3.1.3.1 The AEFS system *shall* support display of electronic flight strips in a single or multiple ATC Towers (maximum 8) based on the airport's operational needs.

3.1.3.2 The AEFS system *shall* support the electronic display of flight strip status in ATC tower.

Rationale: Flight strip status provides the ATC operational status and the controller position that is currently responsible for the flight - ground control/ ground metering/ clearance delivery/ local control. It also provides a history of control positions that previously processed the flight strip.

3.1.3.3 The AEFS system *shall* support the electronic display of flight strip status in remote facilities, i.e., TRACON.

3.1.3.4 The AEFS system *shall* transmit flight strip amendments to FDIO.

3.1.4 Flight Strip Transfer and Sharing

3.1.4.1 The AEFS system *shall* support transfer and sharing of flight strips between the ATC and TM in multiple towers.

3.1.4.2 The AEFS system *shall* support distribution of flight strip updates, amendments and notations to support local tower operations.

3.1.5 Flight Strip Categorizing and Sequencing

3.1.5.1 AEFS system *shall* support user defined flight strip categories for organizing, sharing, transferring and displaying flight strips.

Note: The category grouping and/or sub-categories will be based on airport operational configuration and AT control needs.

3.1.5.2 The AEFS system *shall* automatically place and sequence flight strips in FS Categories based on the facility's defined criteria/rules (e.g., arrivals, departures, type of aircraft, runway, route, flight status, estimated arrival/departure time, and other ATC tower operational and/or procedural requirements may be used to sequence or sort the flight strips).

3.1.5.3 The AEFS system *shall* support the placement and sequencing of flight strips in predefined *FS categories* via electronic data entry.

3.1.5.4 The AEFS system *shall* provide drag and drop capability on ATC tower electronic displays for organizing and transferring/placing flight strips into the appropriate ATC FS categories.

3.1.5.5 The AEFS system *shall* initiate sequencing of flight strips upon request by the user or automatically by preset criteria.

Rationale: Sequencing is initiated by a user request or pre-planned - sequencing. If TM/ATC amends or updates a flight strip, it will not change the flight strip display sequence.

3.1.6 Flight Restrictions

3.1.6.1 The AEFS system *shall* provide the capability for ATC and TM to introduce TFM initiatives (e.g., restrictions, ground stops, emergencies, …) into the processing and display of flight strips.

3.1.6.2 The AEFS system *shall* include the airport or local ATC tower initiatives in the processing and display of flight strips.

3.1.7 Flight Strip Amendment and Update General Requirements

3.1.7.1 Reserved

3.1.7.2 The AEFS system *shall* provide the capability to visually flag FS updates/amendments on the display for acknowledgement.

3.1.7.3 The AEFS system *shall* receive acknowledgement/verification/approval by the ATC or TM before processing and distributing FS updates/amendments.

3.1.7.4 The AEFS system *shall* display and maintain a FS's sequence at the AT/TM positions while the FS is being amended/updated by another AT position.

Rationale: If a controller requests an amendment, the respective controller shall be able to see the flight strip in the queue on his screen while it is being amended / updated by another controller.

3.1.8 Flight Strip Amendments

3.1.8.1 The AEFS system *shall* provide the capability for authorized users to enter flight strip amendments from menus/lists

Note: Flight strip amendment fields are provided in FAA orders 7110.65 and 7210.3.

3.1.8.2 The AEFS system *shall* provide the capability for TM to approve locally amended flight strips.

3.1.8.3 The AEFS system *shall* provide the capability for an authorized user to simultaneously amend multiple flight strips.

Rationale: Multiple flight strips can be modified by selecting a group of strips on the display.

3.1.8.4 The AEFS system *shall* forward flight strip amendments to FDIO.

3.1.8.5 The AEFS system *shall* process amended flight strips received from FDIO

3.1.8.6 The AEFS system *shall* identify amended flight strips by including FDIO assigned revision numbers.

Rationale: This revision number will indicate whether the change came from FDIO or was initiated by the local AT controller/TM. Question: When the local tower amends its flight strip, is a new flight strip issued by FDIO required to continuing processing?

3.1.9 Flight Strip Updates

3.1.9.1 The AEFS system *shall* provide the capability for authorized users to enter flight strips updates/comments for local tower operations.

Rationale: This field will be used by controllers to make remarks for their record. The comment date field will be stored in the AEFS system but not submitted to FDIO. The notations are identified in FAA orders 7110.65 and 7210.3.

3.1.9.2 The AEFS system *shall* have the ability to select or enter (hand written) ATC FS notations to support local tower operations. *[Reference: FAA order 7110.65 and 7210.3]*

3.1.9.3 Reserved

3.1.9.4 The AEFS system *shall* provide an assigned field for “Tower to TRACON” updates. Note: This field will contain special instructions/comments from the tower to the departure controller.

3.1.9.5 The AEFS system *shall* update flight strip data in real time based on local ATC operational needs and procedures.

3.1.9.6 Reserved

3.1.9.7 The AEFS system *shall* validate the FS data entered against the site operational rules and airport configuration requirements.

Rationale: Data that conflict with site operational rules or airport configurations are flagged. AEFS will prohibit the action and inform the users of the conflict/error.

3.1.9.8 When an updated FS is replaced by a revised FS from FDIO, the AEFS system *shall* include local FS updates with the revised flight strip.

Note: The system will provide the ability for an authorized user to select local update fields to be included on the revised flight strip.

3.1.10 Configuration and Adaptation

3.1.10.1 The AEFS system *shall* be user configurable parameters to accommodate the different operational environments.

3.1.10.2 The AEFS system *shall* support 100 airport operational configurations. (e.g., Runways, headings, departure fixes, altitude requirements, restrictions, etc.)

3.1.10.3 The AEFS system *shall* support site specific user profiles and display parameters for ATC and TM operations.

3.1.10.4 The AEFS system *shall* be scalable to meet various sizes of airport operations.

3.1.10.5 The AEFS system *shall* customize flight strip formats based on facility operational requirements.

3.1.11 AT Controller Positions and Assigned Functions

3.1.11.1 The AEFS system *shall* provide the capability for controllers to view the status of flight strips based on their assigned functions.

Rationale: Controller access will be based on their authorization level and operational position.

3.1.11.2 The AEFS system *shall* prevent the simultaneous manipulation (categorizing, transferring, amending or updating) of a flight strip by multiple users.

3.1.11.3 The AEFS system *shall* have the ability to provide full route clearance data to the controllers.

3.1.11.4 The AEFS system *shall* provide the capability to combine multiple AT controller positions in one operational position.

Rationale: Clearance Delivery, Ground Metering and Outbound Ground Control can be handled at a single position during low demand operations.

3.1.11.5 The AEFS system *shall* provide the capability to combine ATC tower operations from multiple towers into a single tower.

3.1.11.6 The AEFS system *shall* include the controller's operational position identifier with the flight strip data.

3.1.11.7 The AEFS system *shall* report the status of each flight strip and ATC tower operational phase upon request by the user.

3.2 Non-Functional Requirements

3.2.1 Print Requirements

3.2.1.1 The AEFS system *shall* have the capability to print electronic flight strips and ATC statistical and system operational data.

3.2.1.2 The AEFS system *shall* provide the capability for authorized users to submit print requests.

3.2.2 Redundancy Requirement

3.2.2.1 The AEFS system *shall* support redundant systems and communications operations.

3.2.3 Capacity Requirements

3.2.3.1 The AEFS system *shall* have the capability to process at minimum 4000 flight strips simultaneously.

3.2.3.2 The AEFS system *shall* have the capacity to display a minimum of 80 flight strips per controller display.

3.2.4 Data Storage and Retrieval Requirements

3.2.4.1 The AEFS system *shall* have the capability to store flight strip data for a maximum of 45 days for on-line analysis.

3.2.4.2 The AEFS system *shall* provide flight strip status and history to ATC and TM.

3.2.4.3 The AEFS system *shall* have the capability to playback flight strip data in chronological order to support training and problem resolution.

3.2.4.4 The AEFS *shall* archive flight strip data received from FDIO.

3.2.4.5 The AEFS system *shall* time stamp internal data elements and input/output data to support operational functions and archiving.

3.2.4.6 The AEFS system *shall* provide a search capability to retrieve FSs' based on operational parameters.

Note: Operational parameters may include ACID, CID, Beacon Code,.....

3.2.5 Reliability, Maintainability and Availability (RMA)

3.2.5.1 The AEFS system *shall* meet or exceed the RMA requirements specified for the AEFS services, in accordance with NAS System Requirements, NAS-SR-1000 and NAS System Requirements Specification.

3.2.5.2 The AEFS system *shall* protect and maintain the integrity of ATC FS operational data during system failures.

Note: Failures include AEFS malfunction, power failure and/or interface or communications failures.

3.2.5.3 AEFS system reliability *shall* meet its assigned reliability of *TBD* hours MTBF.

3.2.5.4 AEFS functions *shall* not adversely impact the ATC tower operations.

3.2.5.5 The AEFS system functions *shall* be in accordance with the AEFS Maintenance Concept document (*TBD*).

3.2.5.6 The AEFS system components *shall* have a Mean Time to Repair (MTTR) of less than *TBD* minutes as specified in the AEFS Maintenance Concept.

3.2.5.7 The AEFS system *shall* support local and remote reconfiguration/recovery according to the AEFS Maintenance Concept.

3.2.5.8 The AEFS system *shall* allow hardware and software maintenance to be performed without violating NAS system service availability requirements.

3.2.5.9 The AEFS system *shall* meet the required service availability of 0.99999, a critical system element.

3.2.5.10 The AEFS system *shall* be considered to have failed (not available) when the electronic flight strip capability is not available to ATC.

3.2.5.11 The AEFS system *shall* be fully operational 24 hours a day.

3.2.6 Performance Requirements

3.2.6.1 The AEFS system *shall* provide a *TBD* seconds update (refresh) rate for the screens/displays.

3.2.6.2 The AEFS system *shall* complete user/controller's requests in less than *TBD* seconds.

3.2.7 Security Requirements

Note: Applicable Security Policies are included in Appendix E (Reference Documents).

3.2.7.1 The AEFS system *shall* ensure that appropriate technical, administrative, physical, and personnel security requirements are implemented to ensure integrity, availability, and confidentiality throughout the service period of performance and subsequent retirement.

3.2.7.2 The AEFS system *shall* include an Information System Security plan that details the scope and levels of security activities in accordance with FAA policies.

3.2.7.3 The AEFS system security *shall* be certified and approved in accordance with FAA policy and associated directives as identified in the security requirements sections.

3.2.7.4 The AEFS system *shall* be located in a controlled access facility.

3.2.7.5 AEFS system administrative and support personnel *shall* comply with FAA security controls implemented in accordance with FAA policy.

3.2.7.6 AEFS system operations *shall* not interfere with operations of other NAS systems.

3.2.7.7 The AEFS system *shall* provide access control and authentication in a manner that does not disrupt the provision of ATC services.

3.2.7.8 The AEFS system *shall* provide the capability to establish and modify authorization profiles for ATC and TM users.

3.2.7.9 The AEFS system *shall* detect and trace all security relevant information to specific users, devices, or processes for online or offline review.

3.2.7.10 The AEFS system *shall* comply with current versions of the following key federal laws and FAA policies and associated directive which are currently in effect:

- Department of Transportation (DOT) Orders
- DOT H1350.250, Information Systems Security Guide
- DOT H 1350.251, Network Security Guide
- Presidential Decision Directive 63, Critical Infrastructure Protection
- OMB Circular A-130, Management of Federal Information Resources
- FAA Order 1600.1, Personnel Security Program
- FAA Order 1600.8, Communications Security (COMSEC)
- FAA Order 1600.46, Physical Security Review of New Facilities, Offices Space or Operating Areas
- FAA Order 1600.54, FAA Automated Information Systems Security Handbook
- FAA Order 1600.66, Telecommunications and Information Systems Security
- Policy FAA Order 1600.69, FAA Facility Security Management Program.

3.2.8 Display Requirements

3.2.8.1 The AEFS system *shall* present flight strip data including the local update fields on electronic displays.

Note: All FS data fields will be displayed including hand written scratch pad entries.

3.2.8.2 The AEFS system *shall* display the FS data within the facility (towers and operational positions) based on the Facility EFS Rules.

3.2.8.3 The Facility EFS Rules shall include display options (colors/highlighting/fonts/flashing) to provide status information and to request input data or an acknowledgement from the user.

3.2.8.4 The AEFS system *shall* provide a windowing display capability which is configurable and scalable to meet the facility's requirements.

Note: The AEFS will support:

- *All standard windowing functions*
- *Scaling of the overall view and the individual windows to fit the physical screen size*

- *Adherence to meet the minimum display requirements for each window type/category*
- *Independent scrolling and sizing of the individual windows*
- *AEFS displays* will *provide contrast and brightness control capability*

3.2.8.5 The AEFS system *shall* support a minimum of 20 predefined windowing configurations with the flexibility to select a display window configuration from any display.

Note: Display configurations options may be on a drop down menu on the electronic display.

3.2.8.6 The AEFS system *shall* accept user requests to change the default and/or assigned windowing display configuration within 1 second.

3.2.8.7 *Reserved*

3.2.8.8 The AEFS system *shall* support color displays.

3.2.8.9 The AEFS displays *shall* be diagonal of no less than ___ inches.

3.2.8.10 The AEFS system *shall* support touch screen displays.

3.2.8.11 The AEFS system *shall* support touch-select capability for menu driven actions, window control and window movement.

3.2.8.12 The AEFS displays *shall* recover the presentation quality within one second after a screen/window change or refresh occurs.

3.2.8.13 The AEFS system *shall* provide user controls (windowing features) for changing, adjusting and modifying the display of information.

3.2.8.14 The AEFS system *shall* provide the capability to display multiple windows of information simultaneously with each window functioning independently.

3.2.8.15 The AEFS presentation of flight strips data *shall* be in accordance with FAA human factors and ATC guidelines.

Note: Applicable FAA documents are included in Appendix E (Reference Documents).

3.2.8.16 The quality of the AEFS presentation in each window *shall* be consistent throughout the display area, clear of clutter and flicker free.

3.2.8.17 The AEFS displays *shall* be readable in ATC tower cab ambient light conditions and free of reflections and glare.

3.2.9 Quality Assurance

3.2.9.1 The AEFS Quality Assurance Program (QAP) *shall* be established and maintained in accordance with the requirements of ANSI/ASQC-Q-9001, and ISO-9000-3, “Quality Management and Quality Assurance Standards” - Part 3, “Guidelines for the Application of ISO 9001 to the Development, Supply and Maintenance of Software,” and provide at a minimum:

- Procedures and controls to assure adequate configuration management during all operations through final acceptance.
- Controls to assure that all inspection and testing are performed in compliance with contract requirements and that all test data is complete, correct, traceable, repeatable, and acceptable.
- Maintenance of proper record keeping function to provide objective evidence and traceability of operations performed.
- Procedures and controls for assuring that all software products and/or services procured conform to the contract requirements.
- Procedures and controls to assure that all documentation is adequately reviewed and meets contract requirements.
- Procedures and controls for the prevention of software and system deficiencies; detection and analysis of deficiencies (when they do occur), as well as procedures for corrective action.

3.2.10 Verification and Validation

3.2.10.1 The AEFS system requirements *shall* be verified and validated by the FAA and the contractor.

3.2.10.2 The AEFS system verification and validation plan *shall* identify and meet all the system requirements as agreed upon by the FAA and the contractor.

3.2.11 Test and Evaluation

3.2.11.1 The AEFS system *shall* be tested at the contractor facility for verification and validation of the requirements as listed in this document.

3.2.11.2 The contractor *shall* perform the AEFS system integration test and Site Acceptance Test (SAT) on site meeting all the requirements of this document.

3.2.12 Acceptance Plan

3.2.12.1 The AEFS system *shall* meet all the requirements identified in this requirements document.

3.2.13 Training

3.2.13.1 The contractor *shall* provide system training materials for AF/AT.

3.2.14 Configuration Management

3.2.14.1 The FAA Managing Program Office and the contractor *shall* be jointly responsible for developing and providing a configuration management (CM) program for the AEFS to facilitate life cycle system supportability and maintainability.

3.2.14.2 The AEFS configuration management program *shall* be in accordance with applicable agency policies, processes and procedures.

4.0 INTEGRATION REQUIREMENTS

4.1 Functional Integration

4.1.1 Integration with Other NAS Systems

Note: Appendix C: Potential AEFS System Enhancements includes interfaces to other NAS system which may be required in the future.

4.1.1.1 The AEFS system *shall* accept data exchange with other NAS systems to support the AEFS real-time processing and disseminations of flight strip data.

4.1.1.2 The AEFS system Interface Control Documents (ICD) *shall* be developed in accordance with *FAA STD 025, Preparation of Interface Control Documents.*

4.1.2 Standardization

4.1.2.1 The AEFS system software *shall* be developed in accordance with *FAA Standard Software Development for the NAS, FAA-STD-026*, June 1, 2001.

4.1.2.2 The AEFS system data *shall* be processed and managed in accordance with *FAA Order 1375.1*, Data Management.

4.1.2.3 The AEFS system *shall* receive, process, and distribute information utilizing existing FAA and/or standard telecommunications protocols.

4.1.3 System Interfaces

4.1.3.1 The AEFS system interfaces *shall* be developed in accordance with the FAA external systems Interface Requirements Documents (IRDs).

4.1.3.2 The AEFS system *shall* provide maintenance support for the interfaces based on the requirements defined in the AEFS Maintenance Concept document and the IRDs.

4.1.3.3 The AEFS system *shall* initiate user authentication and authorization level verification before enabling an interface.

4.1.3.4 The AEFS system *shall* receive data elements/messages based on the message set defined in the supporting IRDs.

4.1.4 External NAS Interfaces

4.1.4.1 The AEFS system *shall* interface with the FDIO printers.

4.1.4.2 The AEFS system *shall* interface with the FDIO system.

4.1.5 Local and Remote Peripheral Interfaces

4.1.5.1 The AEFS system *shall* interface with the electronic displays and data entry devices within the local and remote towers.

4.1.5.2 The AEFS system *shall* interface with multiple printing devices within the local and remote towers.

4.2 Physical Integration

4.2.1 Facility Space and Electrical

4.2.1.1 Procurement of space within the facility for the AEFS system *shall* be in accordance with *FAA Order 4420.4, Space Acquisition*.

4.2.1.2 The space provided for the AEFS system *shall* include sufficient power, grounding capacity, illumination and heating, ventilation and air conditioning (HVAC) adequate for local climatic conditions to operate and maintain AEFS equipment.

4.2.1.3 The ATC tower facility power systems *shall* be modified (if necessary) to provide power panels, uninterruptible power supply (UPS), switching devices, and other power system components required to interface with AEFS.

4.2.1.4 *FAA-G-2100*, "Electronic Equipment, General Requirements," Appendix I, "Applicability to Procurements for COTS/NDI Equipment" or, "National Electrical Code" and other national standards related to the specific needs of emerging technical requirements for ATC systems, *shall* apply to AEFS.

4.2.1.5 AEFS physical interface requirements *shall* be identified in accordance with *FAA-STD-025, Preparation of Interface Documentation*.

4.2.1.6 A site survey *shall* be completed to verify the facility requirements for AEFS.

4.2.2 Hazardous Materials

4.2.2.1 The AEFS system *shall* minimize the use of hazardous materials requiring special disposal procedures.

Note: Recyclable materials are preferred.

4.2.3 Telecommunications

4.2.3.1 AEFS telecommunications requirements *shall* be identified and acquired in accordance with FAA Order 4441.16, Acquisition of Telecommunications Systems, Equipment and Services.

APPENDIX A: FAA Flight Progress Strip

A.1.0 FAA Standard Flight Progress Strip

Note: For detailed information regarding flight progress strips, please refer to Section 3 of FAA Order 7110.65K and Sections 7.1, 7.2, and 8 of FAA Form 7230. The tables and Figures presented within this appendix were extracted from these documents without modification.

The AEFS system will have the ability to receive, distribute, and archive all data provided for the 30 standard fields of Flight Progress Strips as detailed in Table 1 and shown in Figure 4. The system will support the modifications of the arrival and departure flight strip data fields to meet the facility's NAS and local operational needs. Sections 3.1 Functional Requirements and A.2.0 Arrival-Departure Flight Strips provide details on the FS formats and data field modifications that AEFS will support.

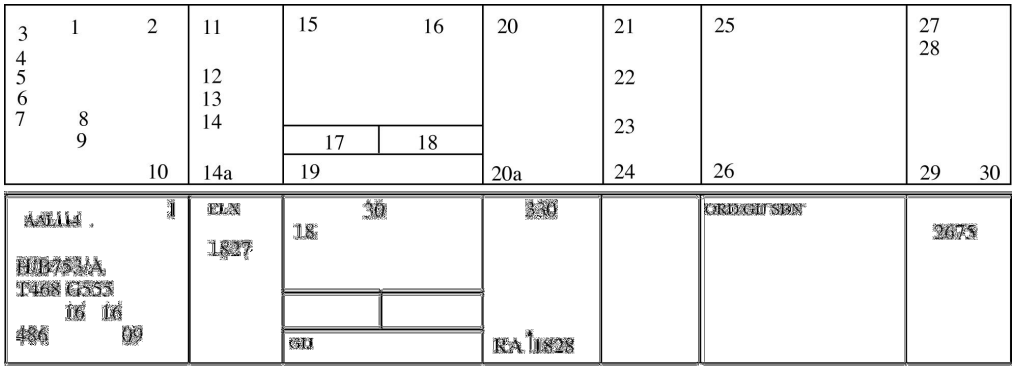


Figure 4: Standard Flight Progress Strip with Example Data

Table 1: Standard Flight Strip

BLOCK	**INFORMATION RECORDED**
1.	Verification symbol if required.
2.	Revision number. DSR-Not used.
3.	Aircraft identification.
4.	Number of aircraft if more than one, heavy aircraft indicator "H/" if appropriate, type of aircraft, and aircraft equipment suffix.
5.	Filed true airspeed.
6.	Sector number.
7.	Computer identification number if required.
8.	Estimated ground speed.
9.	Revised ground speed or strip request (SR) originator.
10.	Strip number. DSR- Strip number/Revision number.
11.	Previous fix.
12.	Estimated time over previous fix.
13.	Revised estimated time over previous fix.
14.	Actual time over previous fix or actual departure time entered on first fix

	posting after departure.
14a.	Plus time expressed in minutes from the previous fix to the posted fix.
15.	Center-estimated time over fix (in hours and minutes), or clearance information for departing aircraft.
16.	Arrows to indicate if aircraft is departing (↑) or arriving (↓).
17.	Pilot-estimated time over fix.
18.	Actual time over fix, time leaving holding fix, arrival time at non-approach control airport, or symbol indicating cancellation of IFR flight plan for arriving aircraft, or departure time (actual or assumed).
19.	Fix. For departing aircraft, add proposed departure time.
20.	Altitude information (in hundreds of feet) or as noted below.
	NOTE-Altitude information may be written in thousands of feet provided the procedure is authorized by the facility manager, and is defined in a facility directive, i.e. FL 330 as 33, 5,000 feet as 5, and 2,800 as 2.8.
20a.	**OPTIONAL USE,** when voice recorders are operational; **REQUIRED USE,** when the voice recorders are not operating and strips are being use at the facility. This space is used to record reported RA events. The letters RA followed by a climb or descent arrow (if the climb or descent action is reported) and the time (hhmm) the event is reported.
21.	Next posted fix or coordination fix.
22.	Pilot's estimated time over next fix.
23.	Arrows to indicate north (↑), south (↓), east (→), or west (←) direction of flight if required.
24.	Requested altitude.
	NOTE-Altitude information may be written in thousands of feet provided the procedure is authorized by the facility manager, and is defined in a facility directive, i.e., FL 330 as 33, 5,000 feet as 5, and 2,800 as 2.8.
25.	Point of origin, route as required for control and data relay, and destination.
26.	Pertinent remarks, minimum fuel, point out/radar vector/speed adjustment information or sector/position number (when applicable in accordance with paragraph 2-2-1, Recording Information), or NRP. High Altitude Redesign (HAR) or Point-to-point (PTP) may be used at facilities actively using these programs.
27.	Mode 3/A beacon code if applicable.
28.	Miscellaneous control data (expected further clearance time, time cleared for approach, etc.).
29-30.	Transfer of control data and coordination indicators.

A.2.0 Arrival-Departure Flight Strips

The flight information associated with departures and arrivals is recorded using the flight progress strip format shown in Figure 5. A detailed listing of the information associated with each field is provided separately for departures and arrivals in Table 2: Departure Flight Strips and Table 3: Arrival Flight Strips respectively. Facility managers can authorize omissions and/or optional use of spaces 2A, 8A, 8B, 9A, 9B, 9C, and 10-18. These omissions and/or optional uses are specified in the site's facility directive.

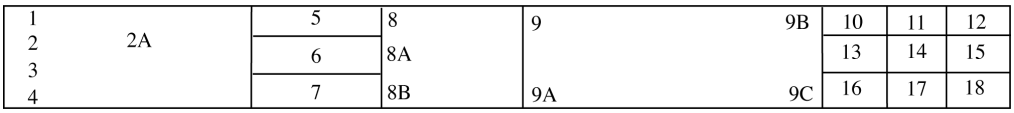


Figure 5: Arrival-Departure Operational Flight Strip

Table 2: Departure Flight Strip

BLOCK	INFORMATION RECORDED
1.	Aircraft identification.
2.	Revision number (FDIO locations only).
2A.	Strip request originator. (At FDIO locations, this indicates the sector or position that requested a printed flight strip.)
3.	Number of aircraft if more than one, heavy aircraft indicator "H/" if appropriate, type of aircraft, and aircraft equipment suffix.
	NOTE- New separation procedures for special equipped aircraft (indicated by equipment suffixes Q and W) are being developed and will be include in the AEFS requirements.
4.	Computer identification number if required.
5.	Secondary radar (beacon) code assigned.
6.	Proposed departure time.
7.	Requested altitude.
	NOTE-Altitude information may be written in thousands of feet provided the procedure is authorized by the facility manager, and is defined in a facility directive, i. e., FL 230 as 23, 5,000 feet as 5, and 2,800 as 2.8.
8.	Departure airport.
8A.	**OPTIONAL USE**
8B.	**OPTIONAL USE**, when voice recorders are operational; **REQUIRED USE,** when the voice recorders are not operating and strips are being used at the facility. This space is used to record reported RA events when the voice recorders are not operational and strips are being used at the facility. The letters RA followed by a climb or descent arrow (if the climb or descent action is reported) and the time (hhmm) the event is reported.
9.	**Computer-generated:** Route, destination, and remarks. Manually enter altitude/altitude restrictions in the order flown, if appropriate, and remarks.
9.	**Hand-prepared:** Clearance limit, route, altitude/altitude restrictions in the order flown, if appropriate, and remarks.
	NOTE- Altitude information may be written in thousands of feet provided the procedure is authorized by the facility manager, and is defined in a facility directive, i. e., FL 230 as 23, 5,000 feet as 5, and 2,800 as 2.8.
9A.	**OPTIONAL USE**
9B.	**OPTIONAL USE**
9C.	**OPTIONAL USE**
10-18.	Enter data as specified by a facility directive. Items, such as departure time, runway used for takeoff, check marks to indicate information forwarded or relayed, may be entered in these spaces.

Table 3: Arrival Flight Strip

BLOCK	INFORMATION RECORDED
1.	Aircraft identification.
2.	Revision number (FDIO locations only).
2A.	Strip request originator. (At FDIO locations, this indicates the sector or position that requested a printed strip.)
3.	Number of aircraft if more than one, heavy aircraft indicator "H/" if

	appropriate, type of aircraft, and aircraft equipment suffix.
4.	Computer identification number if required.
5.	Secondary radar (beacon) code assigned.
6.	(FDIO Locations.) The previous fix will be printed. (Non-FDIO Locations.) Use of the inbound airway. This function is restricted to facilities where flight data is received via interphone when agreed upon by the center and terminal facilities.
7.	Coordination fix.
8.	Estimated time of arrival at the coordination fix or destination airport.
8A.	**OPTIONAL USE.**
8B.	**OPTIONAL USE,** when voice recorders are operational; **REQUIRED USE,** when the voice recorders are not operating and strips are being used at the facility. This space is used to record reported RA events when the voice recorders are not operational and strips are being used at the facility. The letters RA followed by a climb or descent arrow (if the climb or descent action is reported) and the time (hhmm) the event is reported.
9.	Altitude (in hundreds of feet) and remarks.
	NOTE-Altitude information may be written in thousands of feet provided the procedure is authorized by the facility manager, and is defined in a facility directive, i. e., FL 230 as 23, 5,000 feet as 5, and 2,800 as 2.8.
9A.	Minimum fuel, destination airport/point out/radar vector/speed adjustment information. Air Traffic managers may authorize in a facility directive the omission of any of these items, **except minimum fuel,** if no misunderstanding will result.
	NOTE-Authorized omissions and optional use of spaces shall be specified in the facility directive concerning strip marking procedures.
9B.	**OPTIONAL USE**
9C.	**OPTIONAL USE**
10-18.	Enter data as specified by a facility directive. Radar facility personnel need not enter data in these spaces except when non-radar procedures are used or when radio recording equipment is inoperative.

APPENDIX B: ORD Operational Scenarios

The scenarios listed below show the current information flow and interaction among ORD controllers and other systems.

Note: When a flight strip is amended by a controller (CD, GM, GC and LC), it has to be pre-approved by Traffic Management and sent back to clearance delivery for entry into the FDIO system. Each time an amendment is made, the controller has to inform the pilot.

B.1.0 Operational Scenarios

Six operational scenarios are provided below to illustrate flight strip progress in the presence of AEFS. The goal of the AEFS system is to fully support ORD's current and future operational flow in the ATC tower. The AEFS system will also interface with other ATC systems to support flight planning and flight strip operations in the NAS.

B.2.0 Departure Flight Strip Amendments and Updates

B.2.1 Flight Strip Amendments

Flight progress strip amendments can only be made by controllers with prior approval by the TM. These amendments are manually entered in the FDIO system. Electronic transmission of amendments from AEFS to FDIO will eliminate manual entry by the controller. Examples of common amendments to flight progress strips include:

- Flight Route
- Beacon Code
- Altitude

B.2.2 Flight Strip Updates

Flight strip updates are comments and/or notations used to facilitate tower operations. These updates do not require TM approval and are not entered in the FDIO system. The comment fields are identified in the ATC tower facility directive.

B.3.0 Flight Strip (FS) Amendments and Update Scenarios

Table 4 : Operational Scenarios

#	Section	Scenario	Details	Phase
1.	**B.3.1**	**Departure FS Cleared as filed**	AEFS receives FS data from FDIO and processes ATC/TM requests	Departure
2.	**B.3.2**	**Departure FS is Amended by ATC/TM**	ATC/TM amends the departure FS	Departure
3.	**B3.3**	**Departure FS is Updated by AT Controller**	AT Controller makes local updates to the departure FS	Departure
4.	**B.3.4**	**ATC/TM makes invalid Electronic FS amendment**	ATC/TM makes an amendment on the EFS that is not valid	Departure
5.	**B.3.5**	**Unauthorized AT controller amends the Electronic FS**	Electronic FS is amended by unauthorized AT controller position	Departure / Arrival
6.	**B.3.6**	**Arrival FS is updated by ATC/TM for missed approach**	LC enters a comment for missed approach and AEFS updates the Electronic FS	Arrival

B.3.1 Departure Flight Cleared as Filed

- HOCSR sends FS data to FDIO
- FDIO receives flight plan data from HOCSR
- FDIO generates a FS and sends it to the tower printer and AEFS
- AEFS receives the data
- AEFS sends the data to ATC/TM display
- ATC/TM receives the FS and request to send the final FS to departure (ARTCC/TRACON/MILITARY)
- AEFS processes the request and sends departure message to FDIO

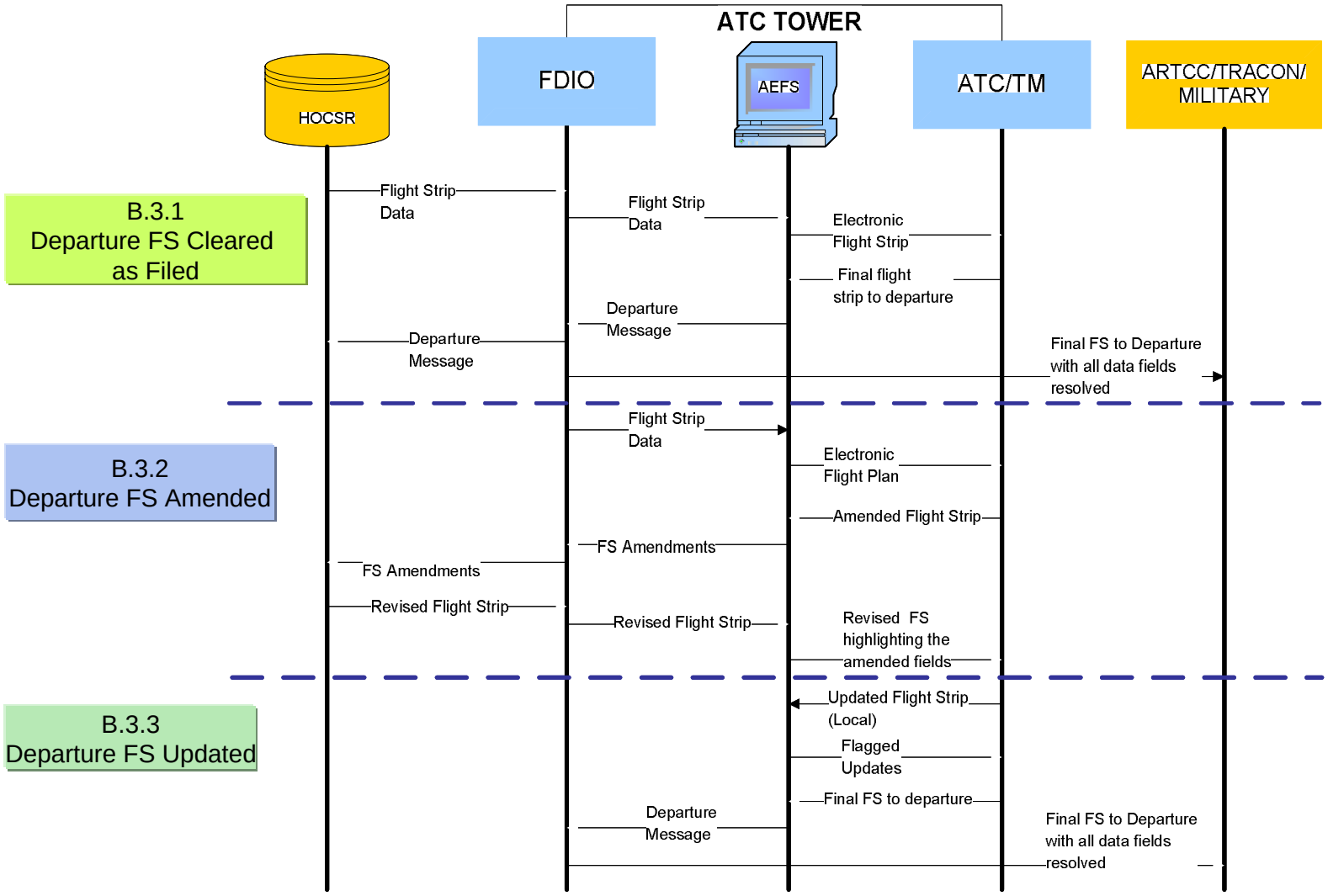


Figure 6: Flight Strip Amendment and Update Scenario Diagram

B.3.2 Departure Flight Strip (FS) Amendment by ATC/TM

- ATC/TM receives a FS.
- ATC/TM amends FS data.
- AEFS processes the request and sends amendments to FDIO
- FDIO receives FS amendments and sends them to HOCSR
- HOCSR receives and processes the amendments and sends the revised FS to FDIO for distribution
- FDIO receives revised FS and sends updates to AEFS and other ATC
- AEFS receives the revised FS and sends updates to ATC/TM displays

B.3.3 Departure Flight Strip (FS) Update by ATC/TM

- FDIO generates a FS and sends the FS to the tower printer and AEFS
- AEFS receives the data
- AEFS sends the data to ATC/TM display
- ATC/TM receives the FS
- ATC/TM updates the FS
- AEFS receives and processes the updates
- AEFS sends updates to ATC/TM displays
- ATC/TM request to send the final FS to departure (ARTCC/TRACON/MILITARY)AEFS processes the request and sends departure message to FDIO without the updatesB.3.4 ATC/TM Makes an Invalid Electronic Flight Strip (FS) Amendment
- ATC/TM makes an amendment to the electronic FS
- AEFS verifies the amendment and sends an invalid entry message to the controller
- ATC/TM revises the FS amendment and resubmits the FS
- AEFS accepts the amended FS and sends the amendment to FDIO

B.3.4 Unauthorized AT controller amends the Electronic Flight Strip (FS)

- AEFS sends the electronic FS to the ATC/TM
- Unauthorized ATC makes an amendment to the FS
- AEFS sends an “Unauthorized User” message
- AT performs the necessary action to gain authorized access

B.3.5 Arrival Flight Strip (FS) is updated by ATC/TM for missed approach

- AEFS receives arrival FS via FDIO
- AEFS processes the data and displays it to the ATC/TM
- AT controller updates the FS for missed approach
- AEFS updates FS entries on all screens and sends the updated FS to ATC/TM

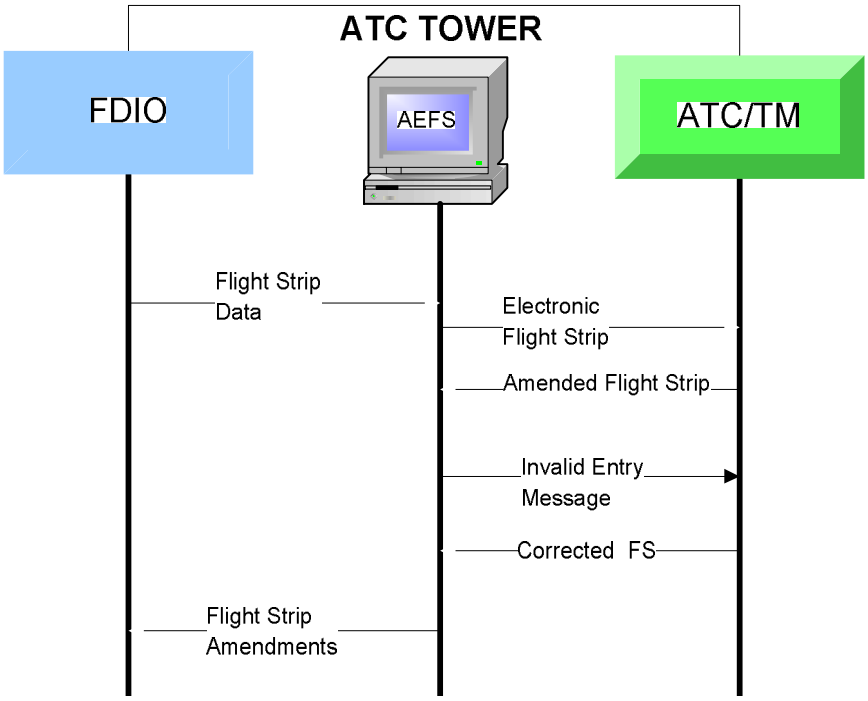


Figure 7: Invalid Flight Strip Amendment

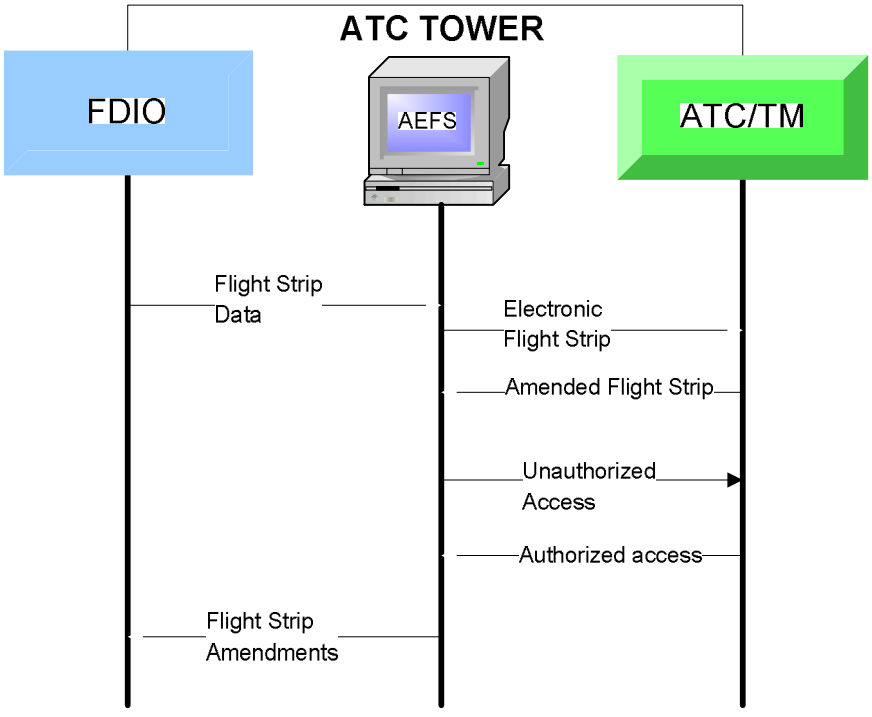


Figure 8: Unauthorized AT Amendment

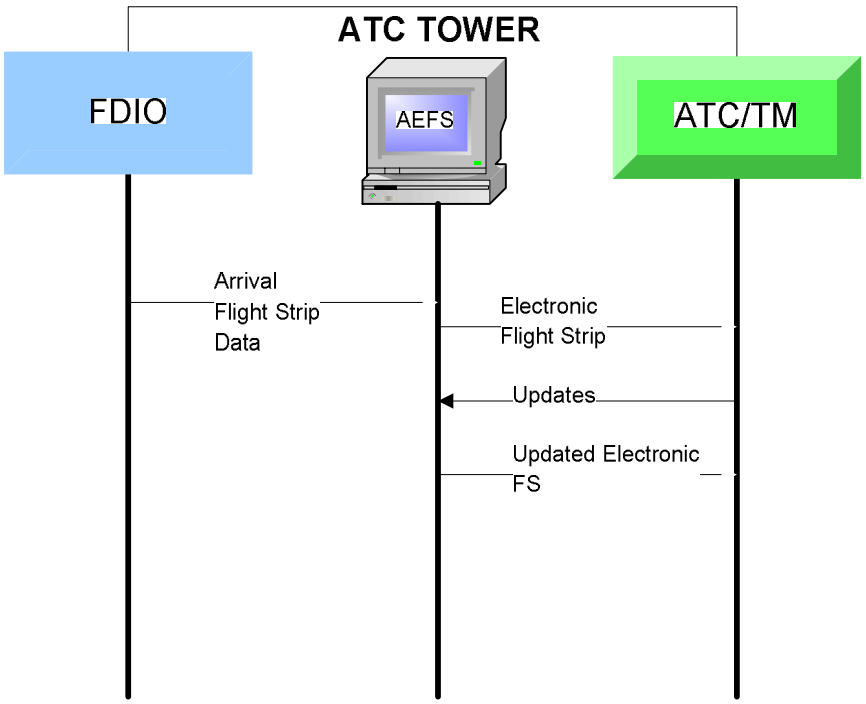


Figure 9: AEFS Updated Arrival Flight Strip

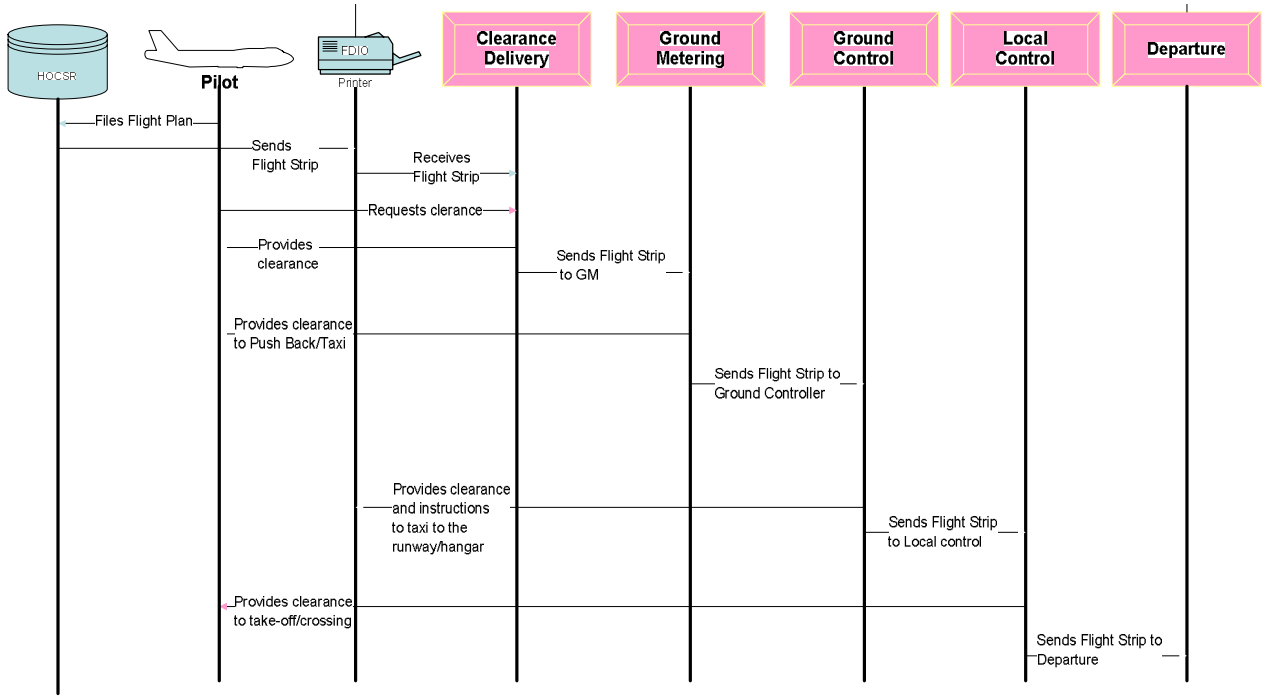
B.4.0 Departure Flight Scenario

Table 5: ORD Operational Scenarios (Current)

#	Section	Scenario	Details	Phase
1.	**B.4.1**	**Departure Flight Cleared as filed**	FS with no Pre-departure clearance is cleared as filed	Departure
2.	**B.4.2**	**Departure FS Amended by Ground Metering**	GM Controller amends the FS by TM approval and sends amendments to CD	Departure
3.	**B.4.3**	**Departure FS Amended by TM**	TM amends FS and sends updates to FDIO	Departure

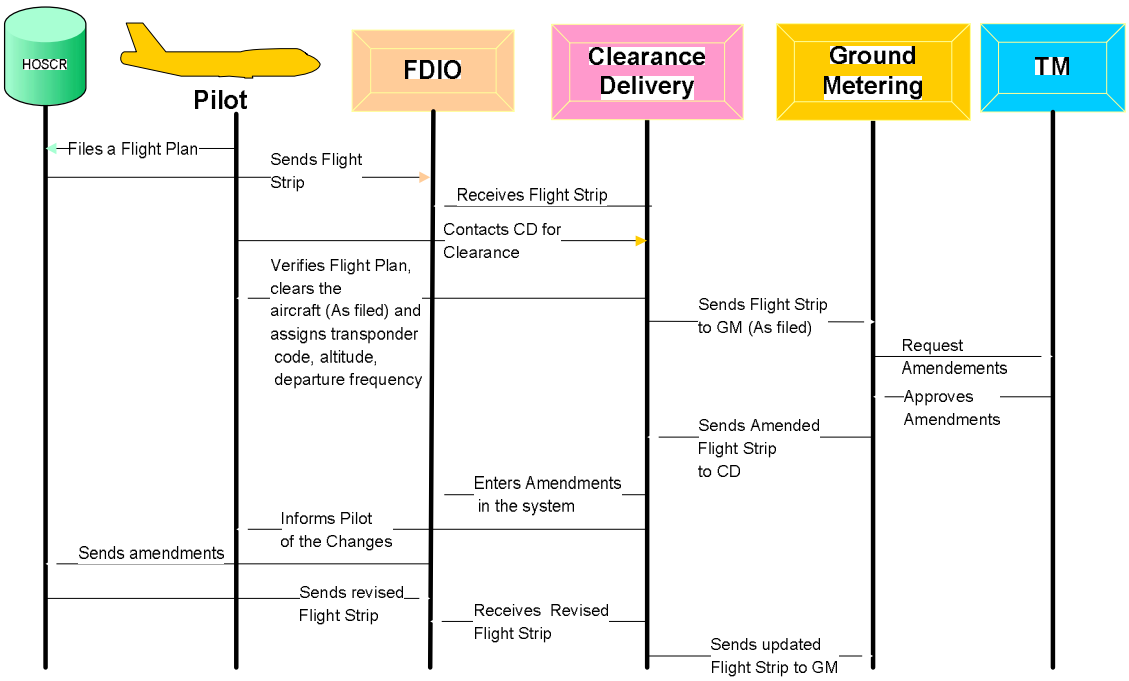
B.4.1 Departure Flight Cleared as filed

- Pilot files a flight plan with HOCSR
- Clearance Delivery (CD) Controller receives the flight plan electronically in the tower via FDIO 30 minutes prior to departure
- Pilot requests clearance from CD
- CD provides clearance to the pilot and sends cleared FS to Ground Metering (GM)
- GM sends the FS to Ground Control (GC)
- GC receives FS and provide taxi instructions to the pilot
- GC sends the FS to Local Controller (LC)
- LC receives the flight plan and provide take-off clearance
- LC sends the final FS to departure



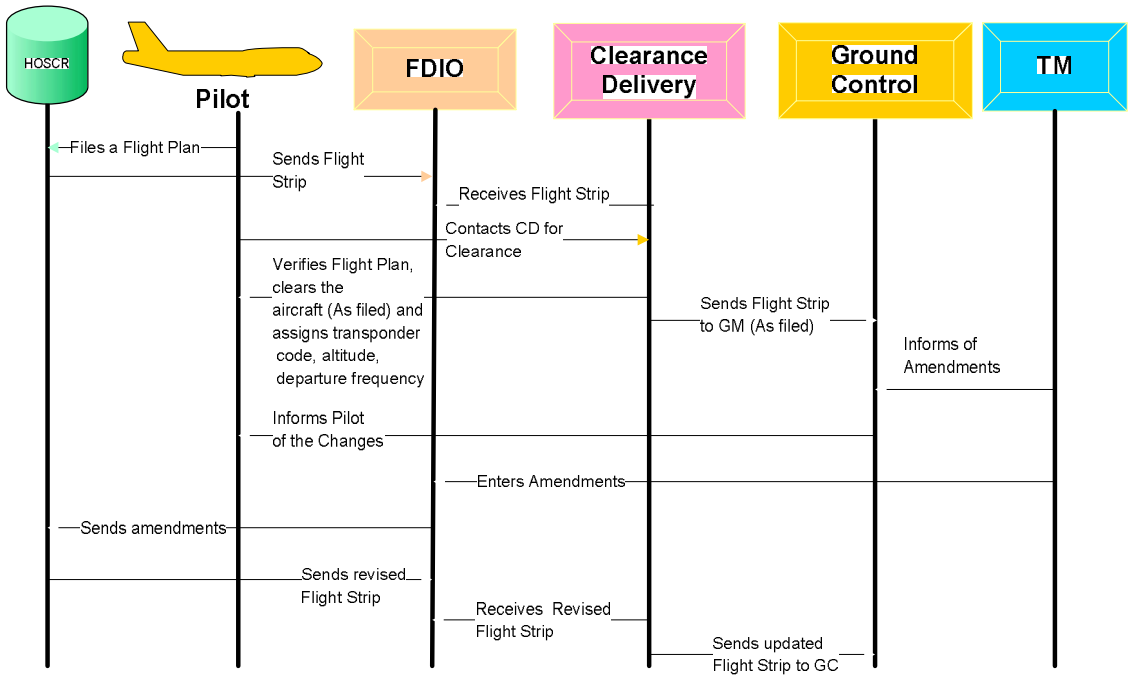
B.4.2 Departure Flight Strip (FS) Amended by Ground Metering

- Pilot files a flight plan with HOCSR
- HOCSR send the flight plan/FS data to FDIO
- FDIO generates a FS and prints it on the FDIO printer in the tower 30 minutes prior to departure
- Clearance Delivery (CD) Controller receives FS
- CD clears the aircraft and sends the FS (as filed) to Ground Metering (GM)
- GM receives the FS
- GM amends the FS by getting approval from TM
- GM sends the amended FS back to CD
- CD enters the amendments in the FDIO system
- FDIO sends the amendments to HOCSR
- HOCSR generates a revised FS
- HOCSR sends revised FS to FDIO
- FDIO receives the FS data and prints the revised FS in the tower
- CD receives the revised FS and sends it to the respective controller



B.4.3 Departure Flight Amended by Traffic Management

- Pilot files a flight plan with HOCSR
- HOCSR sends the FS data to FDIO
- FDIO generates the FS and prints it on the FDIO printer in the tower 30 minutes prior to departure
- Clearance Delivery (CD) Controller receives FS
- CD clears the aircraft and sends the FS (as filed) to Ground Metering (GM)
- GM receives the FS
- GM receives the FS and sends it to GC
- GC receives the FS
- GC receives direction from TM that the flight plan is amended
- GC contacts the pilot to hold and wait for a revised flight plan
- TM amends the FS in the FDIO system
- FDIO sends the amendments to HOCSR
- HOCSR generates a revised FS
- HOCSR sends revised FS to FDIO
- FDIO receives the FS data and prints the revised FS in the tower
- CD receives the revised FS and sends it to the respective controller



APPENDIX C: Potential AEFS Enhancements

C.1.0 Potential Functional Requirements

A list of potential Advance Electronic Flight Strip (AEFS) System enhancements is provided below. This list is provided for information purposes only and should not be considered as comprehensive or mandatory.

C.1.1 The AEFS system *shall* interface with ARMT.

C.1.2 The AEFS system *shall* interface with the TRACON systems (STARS/ARTS/CARTS).

C.1.3 The AEFS system *shall* interface with the ARTCC HOCSR system.

C.1.4 The AEFS system *shall* be capable of forecasting, calculating and reporting departure delays by airport and fix.

C.1.5 The AEFS system *shall* predict real-time departure demand using current flight strip data.

Note: Current FS data includes aircrafts waiting to taxi, taxing aircrafts, departure lineups and first fix for each flight.

C.1.6 The AEFS system *shall* forecast departures fix loading based on the most current flight strip data entries.

C.1.7 The AEFS system *shall* provide the capability for the controllers to balance departure fix flows in conjunction with other airports operational data.

C.1.8 The AEFS system *shall* provide the capability for the controllers to assign and display departure times to support departure-fix balancing.

C.1.9 The AEFS system *shall* display aircraft release times subject to restrictions.

C.1.10 The system *shall* report restrictions by fix and display the air traffic flow over each file.

C.1.11 The AEFS system *shall* provide real-time flight management statistics.

Rationale: Flight management statistics assists the TM controllers in determining fix loading for departure fixes, departure demand and departure delays.

APPENDIX D: ORD Tower Configuration

Figure 10 shows the existing ORD tower configuration and identifies the locations of the Rapid Deployment Voice Switches (RDVS) used for voice communication. In the existing ORD control tower, there are 21 controller positions which are shown in Figure 11. At any given time there are approximately 10 positions in use depending on the flow of traffic, the airport configuration, and the air traffic density and complexity.

Currently, ORD tower operations are run through one central tower as shown in Figure 10. The future central tower configuration is depicted in Figure 11. North and South tower configuration is Figure 12 and Figure 13.

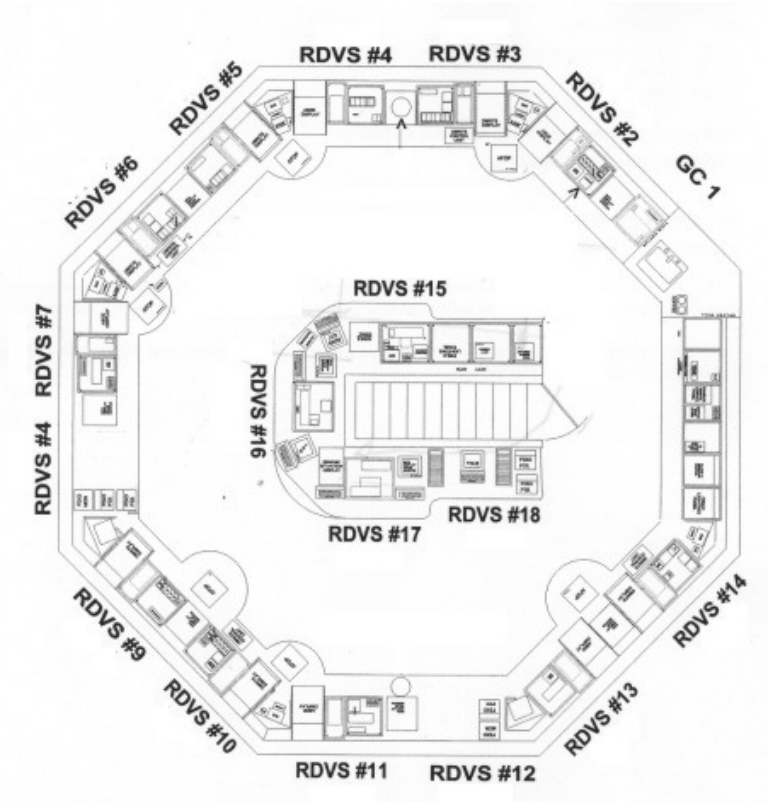


Figure 10: ORD Main Tower Configuration (Current)

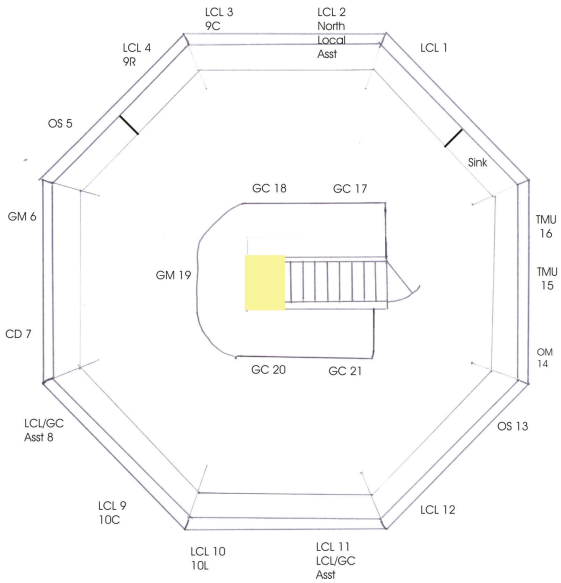


Figure 11: ORD Central Tower Configuration (Proposed)

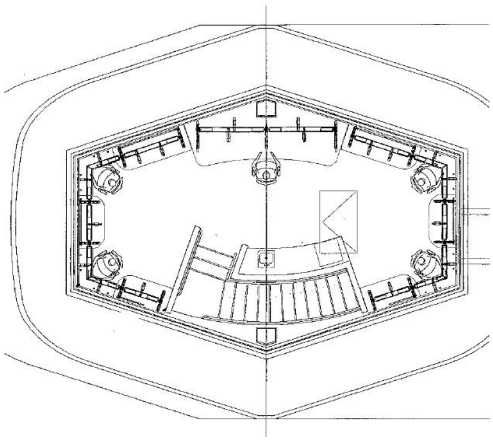


Figure 12: ORD North Tower Configuration (TBD)

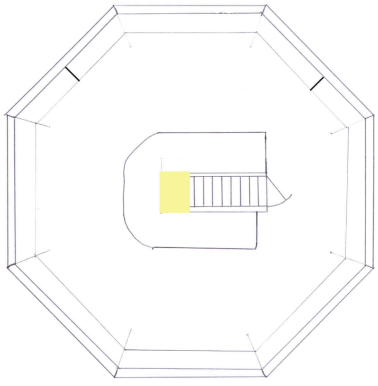


Figure 13: ORD South Tower Configuration (TBD)

APPENDIX E: Reference Documents

E.1.0 Federal Aviation Administration Documents:

- Air Traffic Control, FAA Order 7110.65K Chapter 2 (Section 2 and 3), July 17, 1997
- FAA Order 4441.16, Acquisition of Telecommunications Systems, Equipment and Services
- Facility Operation and Administration, FAA Order 7210.3T Chapter 10, August 5, 2004
- O'Hare Air Traffic Control Tower Standard Operating Procedures, ORD 7110.65E Chapter 3 and 4, February 15, 2004
- FAA Forms 7230 Sections 7.1, 7.2 and 8
- *FAA STD 025*
- *FAA-G-2100,* Electronic Equipment, General Requirements, Appendix I
- Applicability to Procurements for COTS/NDI Equipment
- National Electrical Code
- NAS-SR-1000, NAS System Requirements Specification
- Department of Transportation (DOT) Orders
- DOT H1350.250, Information Systems Security Guide
- DOT H 1350.251, Network Security Guide
- Presidential Decision Directive 63, Critical Infrastructure Protection
- OMB Circular A-130, Management of Federal Information Resources
- FAA Order 1600.1, Personnel Security Program
- FAA Order 1600.8, Communications Security (COMSEC)
- FAA Order 1600.46, Physical Security Review of New Facilities, Offices Space or Operating Areas
- FAA Order 1600.54, FAA Automated Information Systems Security Handbook
- FAA Order 1600.66, Telecommunications and Information Systems Security
- Policy FAA Order 1600.69, FAA Facility Security Management Program.
- ANSI/ASQC-Q-9001
- ISO-9000-3, Quality Management and Quality Assurance Standards - Part 3
- Guidelines for the Application of ISO 9001 to the Development, Supply and Maintenance of Software
- *FAA Order 4420.4, Space Acquisition*

APPENDIX F: ACRONYMS

AEFS	**Advanced Electronic Flight Strip System**
ANSI	**American National Standard Institute**
ARMT	**Airport Resource Management Tool**
ARTCC	**Air Route Traffic Control Center**
ARTS	**Automated Radar Terminal System**
ATC	**Air Traffic Control**
ATC tower	**Air Traffic Control Tower**
CARTS	**Common ARTS**
CD	**Clearance Delivery**
COMSEC	**Communication Security**
DOT	**Department of Transportation**
DSR	**Display System Replacement**
EDCT	**Estimated Departure Control Time**
FDIO	**Flight Data Input/Output**
FL	**Flight Level**
FS	**Flight Strip**
GC	**Ground Control**
GM	**Ground Metering**
HOCSR	**Host and Oceanic Computer System Replacement**
ICAO	**International Civil Aviation Organization**
IGC	**Inbound Ground Control**
LC	**Local Control**
OGC	**Outbound Ground Control**
ORD	**O'Hare International Airport**
OS	**Operational Supervisor**
PCU/RCU	**Power Control Unit/Remote Control Unit**
PDC	**Pre-Departure Clearance**
QAP	**Quality Assurance Program**
RA	**Resolution Advisory**
RDVS	**Rapid Deployment Voice Switch**
STARS	**Standard Terminal Automation System**
TFM	**Traffic Flow Management**
TM	**Traffic Management**
TRACON	**Terminal Radar Approach Control**
UTC	**Universal Time**

The End of

Attachment 1 - Advanced Electronic Flight Strip Baseline Requirements Document

Appendix E.5 Advanced Electronic Flight Strip System Justification/Requirements - Attachment 2

A. ATO-T OMP AEFS Costs & Spend Plan (System Development & Implementation)

FY 2005	Phase 1	Phase 2 *
AEFS Simulation Development	213,000	
AEFS LAB setup	$100,000	
Documentation generation support	$65,000	
Software engineers development support	$160,000	
FY 2005 Subtotal	$538,000	
FY 2006		
Software (S/W) engineers development/test support	$320,000	
O'Hare AEFS hardware equipment (details below)	$145,000	$40,000
Training	TBD	TBD
Documentation generation support	$60,000	
FY 2006 Subtotal	$525,000	
FY 2007		
S/W engineers development, test support & install	$180,000	
Subtotals AEFS	**$1,244,000**	$40,000

Total OMP AEFS Development & Implementation Cost - 10 Yrs. **$1,284,000**

B. EFSTS as OMP Operating System - Additional Staffing Required (versus AEFS)

2008 Requirement - New North Runway	Main ATCT	North ATCT	Phase 1, 10 Yr. Cost (Excludes Ph.2 So. ATCT)
EFSTS Positions / Shifts	3 / 2	1 / 2	
CPCs	11	4	
CPC @ $200,000 / Yr.	$2,200,000	$800,000	
2010 Requirement - 2nd New Runway Complete			
EFSTS Positions / Shifts	1 / 2		
CPCs	4		
CPC @ $200,000 / Yr.	$800,000		

Total OMP EFSTS Operating Cost - 10 Yrs. **$26,900,000**

* Full OMP has 2 Phases. A second new south ATCT is Phase 2, approximately 2012. This Business Case only covers Phase 1.

Appendix F. Air Traffic Operating Concept for the O'Hare Modernization Program

Introduction

This document focuses on the detailed thought processes that led to the development of the O'Hare Modernization Program (OMP) operational concept, and the work necessary at each Air Traffic facility to support that concept. It is intended to supplement the OMP Business Case and provides further detail to Appendix E.1 (Chicago O'Hare Modernization Program (OMP) Airspace Redesign Details).

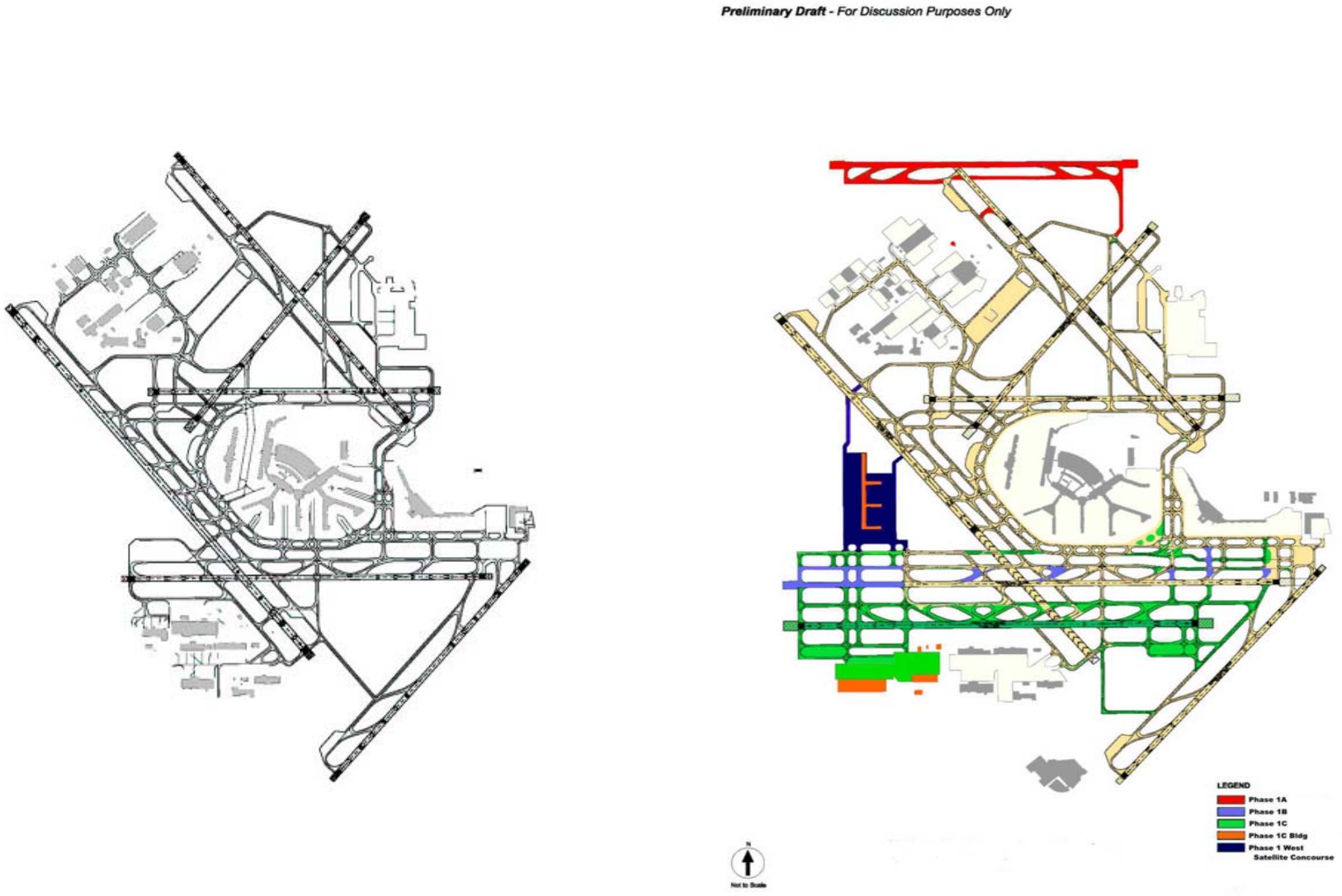
Background

The City of Chicago has developed a concept for the redevelopment of O'Hare International Airport (ORD), a ten-year, $6.6 billion dollar project (in 2001 dollars), called the O'Hare Modernization Program (OMP) (See Figure F.1 Present Airport Layout Plan (ALP) and Proposed OMP Phase 1). The concept involves the reconfiguration of the existing airfield to essentially an East/West parallel runway orientation, while maintaining at least the capacity Chicago O'Hare International Airport (ORD) has today during the construction. In essence, the plan is to build the world's busiest airport on top of the world's busiest airport. The City's stated gains anticipated by the reconfiguration of the airport (including additional terminals and gates) are to provide "…for triple approaches, capable of supporting balanced departure and arrival capacity during all weather conditions, both VMC and IMC."(Visual Meteorological Conditions and Instrument Meteorological Conditions)

A performance gap currently exists at ORD between airfield capacity and demand. This gap only widens as the demand increases through 2018 (planned full-build airport plus five years). In calendar year 2004, ORD handled 992,471 total operations, and was the number one delayed airport in the NAS. To address these delays, the FAA instituted voluntary limitations on scheduled arrivals during peak hours. As long as these limitations are kept in place, the projected growth rate cannot be met, and the performance gap will continue to widen. FAA analysis has shown that significant delay reductions and capacity gains are achievable with the new airfield layout; providing the necessary airspace and infrastructure improvements are made.

Many of the airspace issues have been identified in the National Airspace Redesign (NAR) Plan, as outlined in the Great Lakes Integrated Design Plan (IDP). The Air Traffic Organization (ATO) has taken advantage of the NAR design and extracted those elements that are essential to achieving the gains of the OMP. Numerous alternatives were examined before the final operating concept was determined. Current technologies were assumed, but each component of the total concept is flexible enough to be adapted to future technologies as they become available. Extensive human-in-the-loop (HITL) modeling of the new en route airspace structure was conducted with MITRE to ensure that the forecasted traffic was manageable. Comprehensive Total Airport and Airspace Modeller (TAAM) work has been done in support of the OMP Environmental Impact Statement (EIS), demonstrating the capabilities of the future

airfield and terminal airspace and procedures, while keeping the delays within FAA Cost-Benefit Analysis (CBA)) guidelines.



Present O'Hare

Proposed OMP Phase 1

Figure F.1 Present Airport Layout Plan (ALP) and Proposed OMP Phase 1

In order to support the planned reconfiguration of ORD, a workgroup was established composed of both management and National Air Traffic Controllers Association (NATCA) representatives from; Chicago Air Route Traffic Control Center (ZAU), Chicago Terminal Radar Approach Control (C90) and Chicago O'Hare Tower (ORD), to determine the air traffic operating concept for the future airport. The group has over 135 cumulative years of operational experience in the Chicago area. This is the same workgroup that developed, reviewed and validated the operational scenarios and assumptions used in the TAAM modeling for the Draft EIS. The Air Traffic workgroup examined numerous options for increasing the throughput numbers at ORD consistent with the FAA projections. The three most viable are outlined in Section 7.0 (Alternatives Analysis) of this business case, but further background is provided here. The final operating concept developed utilizes current procedures and technologies, but is flexible and adaptable to future technological improvements.

Aircraft into and out of ORD today are constrained by not only the airfield layout, but also the surrounding airspace, particularly the number of departure routes. Generally, the airspace is well situated to accommodate a large number of arrivals very efficiently, but the departure routes frequently become saturated and departing aircraft are delayed accessing the overhead stream. Arrival rates must be matched to the departure rates to ensure that the airfield does not become gridlocked, and require traffic management initiatives to manage the demand to meet the acceptance rate. Departure traffic from O'Hare today is restricted to two departure routes to the east and three routes to the south, which they must share with traffic outbound from Chicago Midway (MDW) Airport and all other airports within the Chicago area. The majority of departure delays are encountered by traffic departing in these two directions. Approximately 33% of ORD traffic departs to the east, but they account for 45% of the logged delays. Southbound departures account for approximately 31% of the traffic and 30% of the logged delays.

In order to increase departure capacity and reduce departure delays, the airspace plan creates two additional routes to the east (for a total of four), and two additional routes to the south (for a total of five) (See Figure F.2 Depature Routes). Additionally, one of the future east routes is planned to be dedicated solely to MDW departures; currently these aircraft share the departure routes with ORD on certain configurations. ZAU utilized the services of MITRE Corporation to conduct real-time human in the loop (HITL-GRAIL) simulation modeling of the proposed departure routes and their ability to handle the anticipate future demand. Modeling was done of future traffic for each design year (2007, 2009, 2013, and 2018) and beyond, to ensure that the planned structure was adequate. The modeling validated the concept; the airspace structure could handle all the projected traffic, based on the flight schedules developed for the OMP Environmental Impact Statement (EIS), and additional traffic as well. ZAU overstressed the system to ensure that during unusual operations (i.e. weather events) the routes could accommodate increased traffic if necessary. The routes provide adequate capacity as well as flexibility for future operations. To support the increased departure capacity on these routes, ZAU will need to split the current sectors and create two new sectors ("SWEET" and "GIPPER") to the east, and two new sectors to the south ("NEWTT" and "GLANT"). This will enable additional traffic to be handled on these routes while keeping the congestion and workload within acceptable levels. Modeling was not done of the current routes with increased traffic; since such excessive delays are currently encountered there was no reason to believe that any increase could be managed without also increasing delays.

ZAU and C90 then explored options to increase the number of arrivals while maintaining the current four cornerpost airspace structure. Employing minimum separation, no more than 40 aircraft per hour can be delivered over any one cornerpost. Aircraft, however, do not arrive over the four fixes evenly; therefore some type of fix-balancing would have to be employed to continue this structure. This involves routing excess aircraft from the heavy arrival fix(es) to the lighter fix(es). Based on the projected flight schedule developed for the OMP EIS, the relative percentage of arrivals over each fix remains consistent; therefore the fix-balancing techniques used today were assumed for the future. Within the current airspace structure, this would be done one of two ways. The aircraft would either have to be rerouted from their departure airport or rerouted approximately 200-300 miles from ORD in the en route airspace structure. Either option adds almost 200 flying miles to the approximately 20 aircraft per hour that would be rerouted. A consistent arrival rate can be set when utilizing fix-balancing, but there is an added cost in fuel to the user since there is no consistency regarding which aircraft will be off-loaded and fly farther. It is anticipated that this approach would meet with resistance from the users, as this compounds their issues with pre-planning fuel loads.

Another approach explored to delivering more arrivals to ORD utilizing the current cornerpost system was the modification of the procedure called CAPS (Compressed Arrival ProcedureS, see Figure F.3 Compressed Arrival ProcedureS-West Flow). In this procedure aircraft arriving over the "far" arrival fix, as determined by the configuration at ORD, would be fed to C90 in two arrival streams separated by altitude. This would alleviate the issue of ZAU rerouting aircraft to the lighter arrival fix, and would eliminate the additional flying miles for those approximately 20 aircraft per hour that were rerouted. No aircraft would need to be rerouted by ZAU; CAPS is intended to be utilized at the heavier fix, so aircraft would be arriving on their regular routing. CAPS is, however, configuration-dependent; the ability to utilize CAPS from a certain fix is constrained by landing runways at ORD (configuration), meaning this procedure is not always available. If the heavi(er) fix is the "close" fix, C90 does not have sufficient airspace to vector the aircraft; therefore holding at that fix would be employed to manage the volume. Since CAPS is configuration-dependent, it is difficult to establish a consistent arrival rate, not being able to accurately predict the landing configuration at the time traffic management initiatives must be decided. Airborne holding would thus result at the arrival fixes to meter the arrivals, so the users would again not have the information to preplan their fuel loads since there is no way to predict which aircraft would hold. It is anticipated that this approach would also meet with resistance from the users, in terms of their ability to pre-plan fuel loads. There would also be facility controller staffing issues that would have to be resolved, but that is beyond the scope of this business case.

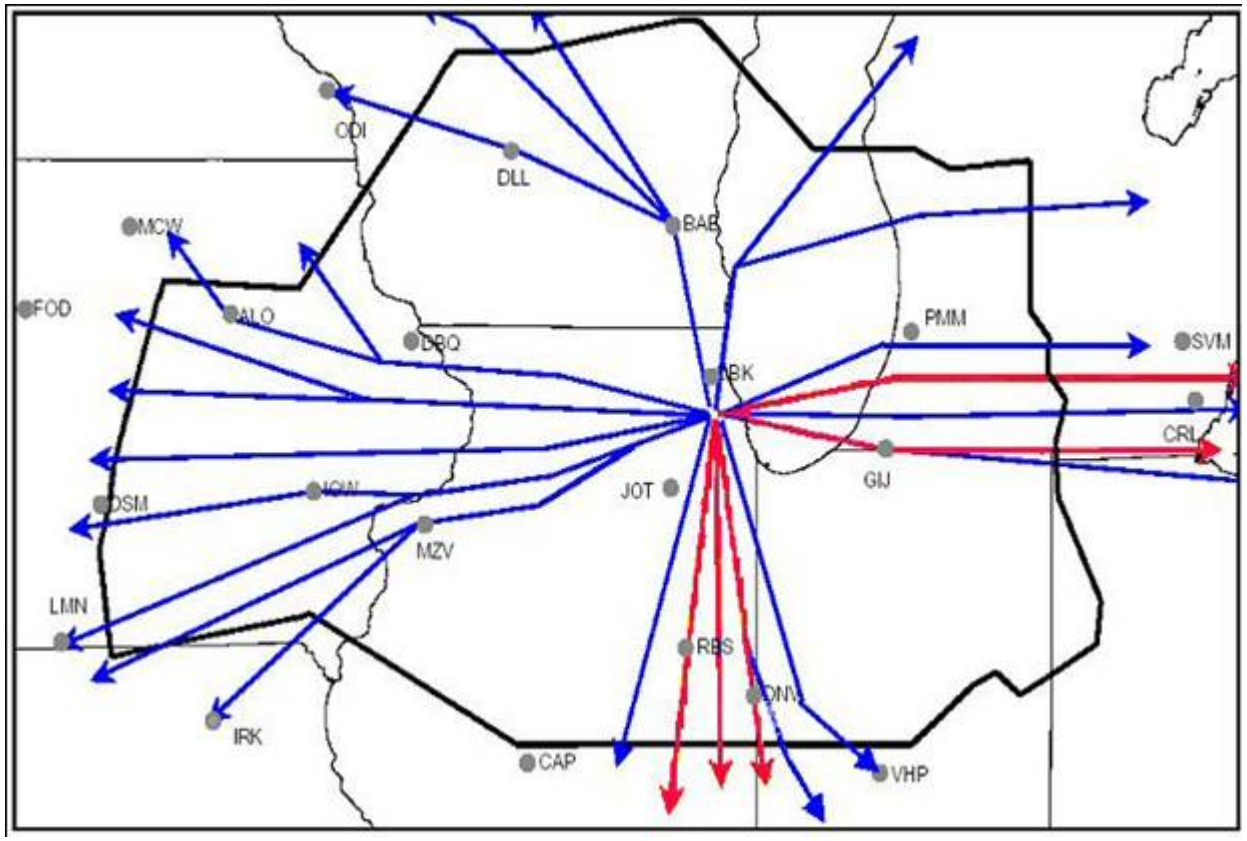


Figure F.2 Departure Routes

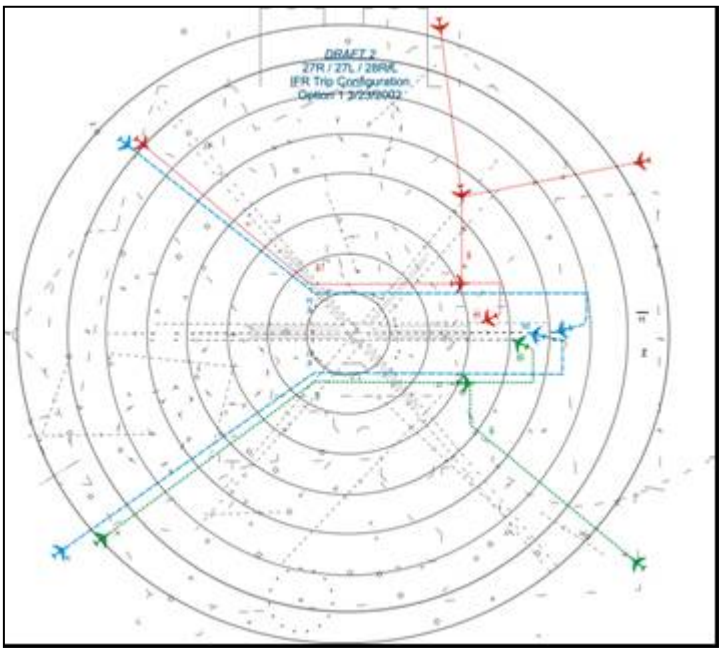


Figure F.3 Compressed Arrival ProcedureS West Flow

In order to alleviate the issues inherent with the current airspace structure, the concept of an independent arrival stream was developed and determined to be the most efficient. This arrival stream needed to be independent of configuration and one that did not exacerbate the congestion or complexity, while still being able to accommodate the anticipated increase in demand. The concept developed is termed "High and Wide", wherein arriving aircraft are routed above (higher) and outside (wider) the cornerpost arrival stream (See Figure F.4 High and Wide). ZAU would establish aircraft from the "near" fix on a separate arrival route approximately 80 miles from the airport (on a modified base leg). C90 would assume responsibility for aircraft approximately 60 flying miles from the airport. The High and Wide arrival would be the primary arrival stream; overload aircraft would be routed over the current cornerpost and blended with traffic from the far fix. Currently, both MDW and ORD arrive in one stream over the fix (the heaviest of the four cornerposts), but the airspace plan separates them into two streams while also accommodating increases in demand. Traffic inbound over the southeast arrival fix (BEARZ) would be slightly reconfigured to accommodate the High and Wide arrival and MDW traffic for greater efficiency. Currently MDW arrivals are routed over BVT (Boiler) VORTAC (VOR collocated with Tactical Aircraft Control and Navigation (TACAN)) direct to Chicago Heights (CGT) VORTAC and vectored to MDW. With the reconfiguration of the airspace, this traffic would be routed to VHP-OKK-BOONE intersection, around the Hilltop MOA (Military Operations Area), and vectored to MDW, which would take these aircraft out of the ORD arrival stream. With the airspace reconfiguration, South Bend (SBN) TRACON would assume a large portion of the current ZAU BOONE sector airspace and work the MDW arrivals. This airspace would be designated to SBN to provide more efficient service to the user. This would free up ZAU to sequence aircraft into ORD over the cornerpost and set traffic up on the High and Wide arrival. Although the MDW arrival traffic would fly slightly further, the efficiencies of establishing them on an independent arrival route (coupled with their independent

departure route out of C90 airspace) are seen as an overall benefit to the users and is expected to be supported. Initial discussions with the users have been favorable.

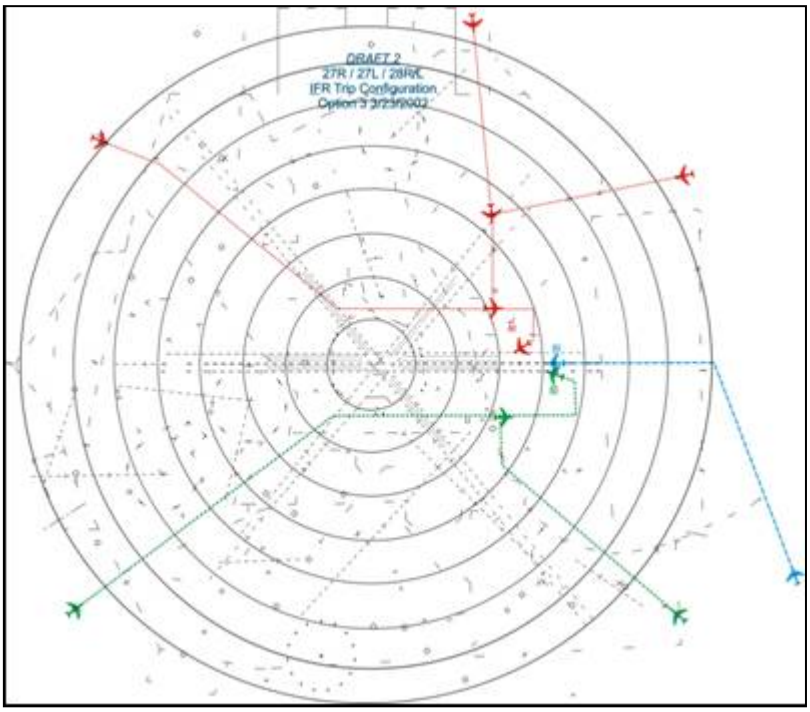


Figure F.4 High and Wide West Flow

The High and Wide arrival would be the primary arrival stream to ORD, and feed the center runway(s). Overload aircraft, those approximately 20 additional aircraft per hour projected, would be routed over the current cornerpost (BEARZ) and blended with traffic from the far fix and worked as they are today. The airspace changes in the southwest area of ZAU are intended to accommodate the High and Wide arrival procedure and the route would mirror the route from the southeast. The route for traffic inbound over the southwest arrival cornerpost (PLANO) would remain unchanged, although the volume would decrease as the High and Wide would be the primary arrival route. MDW traffic from the southwest would remain unchanged, as there is sufficient capacity to handle the MDW traffic and the decreased numbers of ORD arrivals over the cornerpost. It is planned that the ZAU sectors associated with the High and Wide procedures would be operated continuously, based on current and future traffic demand.

Modeling of each of these concepts was done at MITRE's GRAIL laboratory, with the anticipated future traffic levels. The results showed that while increases in traffic could be accommodated working within the current airspace structure using fix-balancing or CAPS, there would be a significant decrease in efficiency due to arrival delays, and increase in cost to the user due to airborne holding and increased fuel consumption. The GRAIL modeling also incorporated the departure routes described above with the anticipated future traffic, as well as the projected future departure demand from MDW. The results showed that the proposed

airspace structure and procedures were able to accommodate the anticipated future demand, while keeping the frequency congestion, airspace congestion and controller workload within acceptable levels. Chicago TRACON also conducted their own Electronic Target Generator (ETG) lab simulations of each of the explored alternatives to determine frequency congestion, controller workload and associated issues such as tag overlap. Only the High and Wide procedure provided all the benefits; increased capacity, decreased frequency congestion, complexity, and workload. The users have been briefed on these procedures through the Radio Technical Commission for Aeronautics (RTCA).

The anticipated operation on the expanded/reconfigured airfield itself would shift from an intersecting runway operation to essentially an east/west, parallel runway operation. During the transition to the full-build airfield, the most efficient configuration is dependent on whether traffic is landing to the east or to the west. When landing to the east, in order to maintain departure capacity and a balanced airfield the currently used configuration (Plan X) remains the most efficient until runway 10C/28C is built (projected for 2010). This is due to the placement of the far north runway (9L/27R) and the resulting geometry of the airfield, and the inability to accommodate departures efficiently. Under Plan X, runway 32L is heavily used as a departure runway; the geometry with future 9L precludes the simultaneous use of both runways. When landing to the west, depending on if the associated ZAU and C90 airspace changes are made, two primary operational configurations would be available. Triple approaches will be conducted to three parallel runways (if the airspace changes are made), or another currently used configuration (Plan W) will be utilized (if the airspace changes are not made). Plan W has some procedural limitations; it assumes LAHSO (Land and Hold Short Operations), which requires uncontaminated runways, a tailwind less than three knots and pilot participation (which complicates the C90 operation). When runway 10C/28C is built, it will be utilized primarily as an arrival runway, thereby enabling the shifting of departures from runway 32L to runway 10L/28R, and de-conflicting the operation for both the east and the west flows. There will also be some other, less often used configurations utilized because of the construction activity and associated airfield closures, but the primary ones were modeled with TAAM for the Draft Environmental Impact Statement (DEIS). The primary configurations were examined as those that place the greatest strain on the airfield and airspace, the assumption being that if the airfield could handle the greatest amount of traffic and still reduce delays, any traffic less than maximum could be handled as well. Again, the proposed operation on the ground at O'Hare is based on current operational principles, and not reliant on future technologies, but fully adaptable when and if they become available.

MITRE was engaged to examine the relative safety of the proposed future operation, both from a runway safety perspective in relation to the current airfield and also in comparison to other large, multi-parallel runway airports, to ensure that all known runway safety best practices were included as appropriate. The results demonstrated a significantly lower risk potential for runway incursions on the future airfield when compared to the other large airports, as well as a rate comparable to today's airfield. Currently, the National Aeronautics and Space Administration (NASA)/Ames Future Flight Central simulation facility is being contracted to conduct real-time HITL simulation modeling for the future airfield to determine workload manageability for the full-build airfield, and determine if mitigations are necessary with the operation of control tower positions. There is no question of whether or not the overall concept is workable, but rather as to the operation of the control tower positions. Due to the placement of the far north runway (9L/27R), approximately one-third of the western portion of the runway would not be visible

from the current Tower, so alternatives were explored to mitigate that as well while adhering to FAA tower siting orders. A further explanation of the avenues explored before a satellite tower was determined to be necessary is below.

In order to achieve the optimal future operation, and working within the current fiscal constraints, each facility has an established set of requirements, as well as a plan to achieve them. ZAU has devised a strategy that allows them to reconfigure their current sectors to accommodate the anticipated growth at O'Hare. Due to the limitations of Voice Switching Control System Training and Backup Switch (VTABS), and the fact that the replacement system is not planned any earlier than 2011, ZAU is prevented from expanding or adding any sectors beyond the number they operate today. ZAU must therefore reconfigure the current sectors to free up some resources to activate the new sectors that directly support the OMP. ZAU currently operates 49 sectors in eight operating areas. Two new sectors can be commissioned by combining two low activity sectors, and utilizing equipment from the Traffic Management Unit (TMU); the other two require divestiture of airspace to two adjacent terminal facilities, Milwaukee TRACON (MKE) and SBN. The two sectors to be combined are Burlington (BRL) and Pontiac (PNT); which will free up a VTAB resource for one of the new sectors. The VTAB position equipment module (PEM) from the TMU will be reallocated to another new sector, and the communication capabilities will be replaced with phone lines. SBN has acquired a portion of the necessary ZAU airspace (BOONE sector) and is planning to take over the remainder in 2006. A small portion of the BOONE sector will also be reallocated to C90, but no additional equipment or control position is required. MKE is planning to assume control of a portion of the ZAU sector airspace over Oshkosh, Wisconsin (OSH sector). In order for MKE to assume control of the airspace surrounding OSH, two additional controller positions will be required. These steps would free up the necessary ZAU equipment resources and allow them to be utilized in the other two new sectors. While these new sectors are departure sectors, the airspace reconfiguration will also support the additional arrival routes (High and Wide) necessary for the OMP. Some minor internal realignment of the remaining ZAU sectors would be required, but there are no additional equipment needs.

The OMP airspace redesign involves changes and requirements for the Chicago TRACON (C90) terminal airspace as well. Since the High and Wide procedure routes aircraft to a point outside the current C90 airspace, increased terminal airspace is required (See Figure F.5 C90 High and Wide). This will require expanded radar coverage. FAA ATO Technical Operations Services (ATO-W) is utilizing the FAA Radar Support System (RSS) to ascertain the current coverage, and aid in determining the solution to the coverage requirements. For the commissioning of the first runway (9L/27R), High and Wide would only be run when on a west configuration; the current configurations on an east flow remain the most efficient until runway 10C/28C is built. C90 will require some slight modification to the existing control room to reconfigure the existing positions, which will accomplish two purposes. The responsibilities of any of the C90 controller positions will not essentially change; but the number of positions staffed will need to increase to accommodate the additional arrival and departure routes. The reconfiguration will support the High and Wide arrival procedures, which will feed the approaches, as well as match up with the new ZAU departure sectors, and feed the additional departure routes. An additional arrival feeder position, arrival controller position, and a final monitor position will be required to support the independent High and Wide arrival stream. These positions are anticipated to be operated on a full-time basis since the High and Wide arrival will be the primary arrival stream. To support the additional departure routes and increased traffic, an additional departure position

will be required each to the east, south and west, bringing the total to seven (two east, two west, two south, and one north). Also, since the departures will now be routed around to the north side and south side of the arrivals based on their route of flight, the volume of airspace to be monitored is unworkable for a single controller; therefore the departure positions cannot be combined.

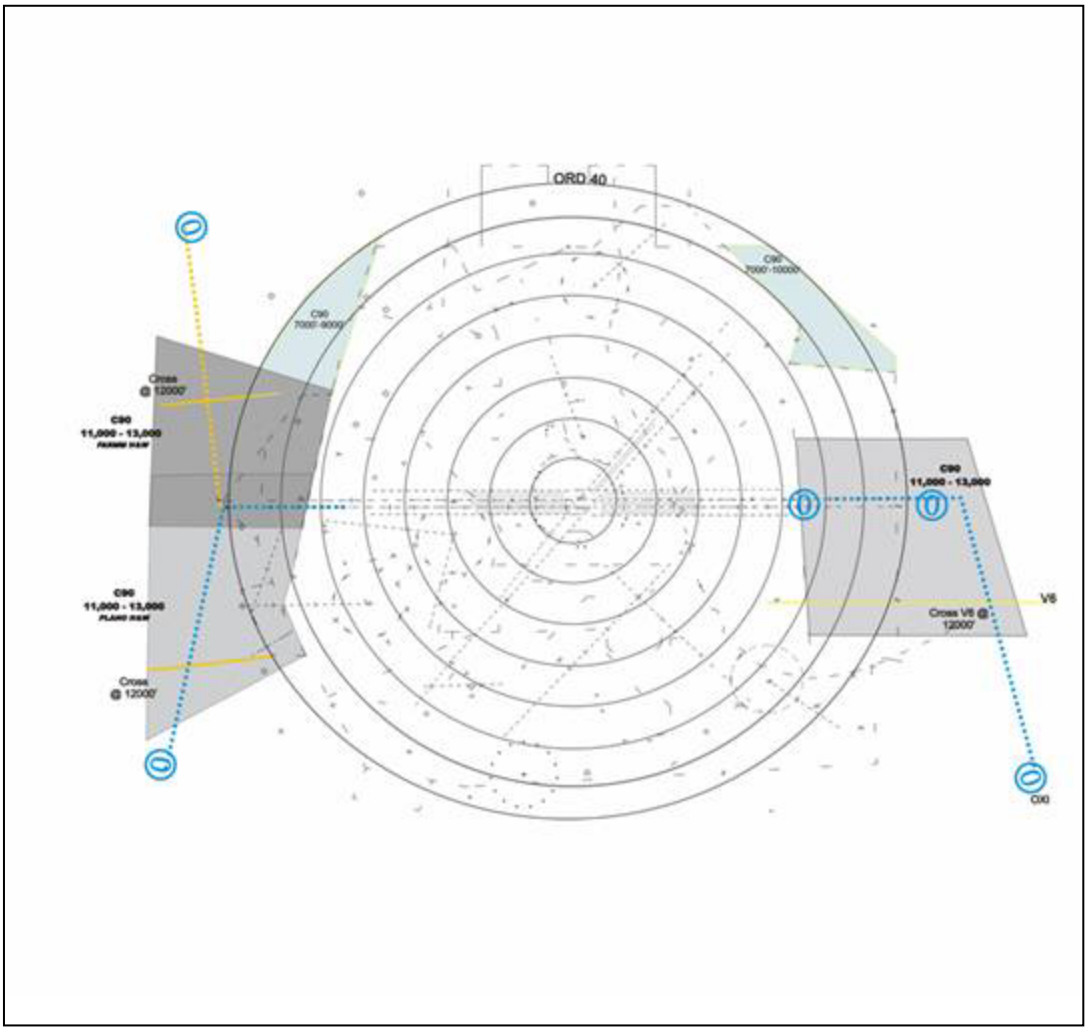


Figure F.5 C90 High and Wide

When the ORD airfield reconfiguration is complete (Full Build - 2013), quadruple approaches will be available. Initially quadruple approaches will only be available during visual flight rules (VFR), but the anticipation is that technology will allow for simultaneous independent instrument flight rules (IFR) approaches sometime in the future. Again, all proposed procedures are fully adaptable to known future technologies. Additional positions will be necessary to feed the fourth arrival stream. This will undoubtedly entail a significant reconfiguration of the control room. The anticipation is that future technologies and equipment (i.e. Standard Terminal Automation Replacement System (STARS)) will determine to what extent, and is beyond the scope of this business case.

As for the O'Hare Air Traffic Control Tower (ATCT), examination has determined that the western one-third of the northern-most runway (9L/27R) and several taxiways that serve it will not be visible from the current ATCT (See Figure F.6 Line of Sight Shadows from Current ORD ATCT). Numerous options were explored before the determination was made that a satellite ATCT needed to be constructed (e.g. Airport Surface Detection Equipment (ASDE) multi-lateration, displacement of the runway threshold, expansion of the current tower, etc.). The north ATCT is intended to only control operations for the northern-most runway and associated taxiways, ramps and aircraft parking areas north of the future runway 9C, but the possibility remains that during periods of unusual activity (e.g. weather, construction, disabled aircraft, etc.), the north ATCT could handle a significantly larger amount of traffic than planned for the routine operation. Current projections of anticipated traffic handled by the north ATCT are 105,000 operations (arrivals and departures) in 2007, which is expected to grow as the overall volume increases. Not included in this total are the aircraft relocations on the airfield; the approximately 60,000 hangar flights (air carrier relocations to/from the maintenance hangars and the terminals) and the 24,000 general aviation aircraft taxing to and from the runways and ramp. The intent is that all Traffic Management and Flight Data functions will be handled from the current tower to maintain cohesiveness and continuity of staff functions, while minimizing the size of the north ATCT and the additional personnel required. It is envisioned that both ATCTs will be considered as a single entity in terms of staffing, but this will be discussed in more detail below. The operation developed allows aircraft operations to continue with the same efficiency as today, with no "paper-stops" for transfer of control other than those inherent in any tower operation. Unimpeded movement through the core of the airport is a necessity to handle the anticipated increased volume of traffic, as well as today's steadily increasing traffic. Currently, the construction of and equipment for the north satellite ATCT is being funded by the City of Chicago under a reimbursable agreement, but the costs have been calculated as part of the total cost for planning purposes. Eventually at the full build of the OMP another south satellite ATCT will be required to control traffic on the southern-most runway (10R/28L) and adjacent taxiways, but that is beyond the scope of this business case.

In addition to the construction of the north ATCT, modification and reconfiguration of the current ORD ATCT will be required to accommodate the operation of the reconfigured airfield. As stated above, the current airfield involves intersecting runway operations, which often necessitates a single controller being responsible for several runways at one time. The future airfield, being primarily a parallel runway operation and with the anticipated increase in traffic, will also mandate a change in the operation of each controller position. Several of the current tower operating positions will no longer be necessary (e.g. local monitor required for intersecting runway operations).

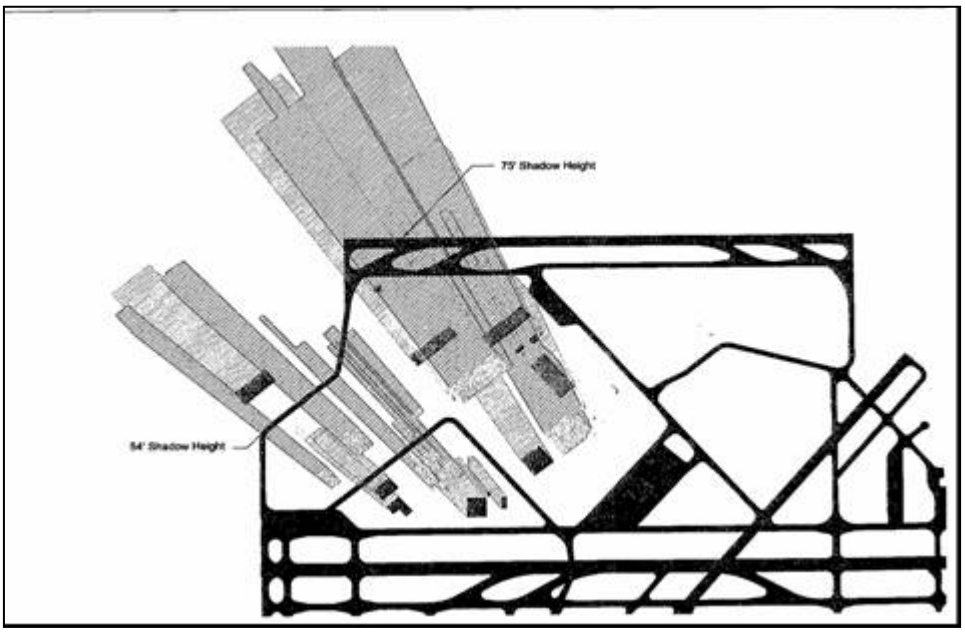


Figure F.6 Line of Sight Shadows from Current ORD ATCT

The physical equipment will be redesignated for the anticipated function as the airfield construction progresses. ORD ATCT contracted with MITRE to examine the controller workload of the current and projected operation to ensure that the proposed operation was feasible. The results of the studies concluded that the anticipated workload is high, but within the bounds of what is worked today. Further refinements to the studies will be conducted at NASA/Ames HITL laboratory to ascertain if further operational mitigations are necessary at the main tower (i.e. ground assist during periods of heavy traffic, or assumption of duties by another control position).

Facility Staffing Requirements

The staffing required to support the anticipated operation at each facility has been examined and projected throughout the life of the OMP project. The current staffing multiplier of 1.76 has been utilized to arrive at the final numbers. The attrition and training times, success rates, and the numbers required to maintain a "pipeline" have been factored in. Currently, the plan to provide the increased staffing at these facilities will be accomplished by decreasing the staffing at other facilities in the Central Terminal Area, either by actually reducing their staffing numbers or by attrition. ZAU currently has no staffing requirements, as the reconfiguration plan is rearranging the current sectors, not actually adding new ones. Since there is no net gain in number of sectors at ZAU, the staffing needs of the facility remain consistent, requiring only that necessary to address attrition (retirements, resignations, etc.), but that is beyond the scope of this business case.

The staffing required for the OMP at C90 factors in the projected attrition rate and the training success rate. Currently, C90 staffs 19 operating positions for two shifts per day, and three positions for one shift per day (the midnight operation). This equates to 41 operating positions per day that must be staffed. In ~2007, when the first OMP runway is commissioned and the six additional C90 operating positions must be staffed (see above), that equates to 53 full-time

positions needed to be staffed per day. Utilizing the 1.76 staffing multiplier, 94 (53 x 1.76 = 93.28) controllers are required to run the operation. In this same timeframe 36 controllers are eligible for retirement (mandatory or otherwise). Currently, C90 has a 37% success rate for incoming controllers, and an average time to facility certification of 24 months. C90 can accommodate six Certified Professional Controllers (CPCs) in training per quarter. This provides meaningful time to train and adequate classroom and laboratory time. Based on the projected schedule for commissioning the first runway in 2007, C90 must be authorized to hire/acquire six controllers in training per quarter starting in the first quarter of calendar 2005. Additional Traffic Management Coordinators (TMCs) will also be required to provide necessary and timely coordination of the High and Wide arrivals, as well as manage the departure flows. To this end, the Chicago Area Traffic Management Officer (TMO) is requesting three additional TMCs. Current authorized supervisory staffing is anticipated to be adequate for the first phase of the OMP. For the full build of the OMP, as stated above, three additional CPC operating positions will be required for two shifts per day, but that is beyond the scope of this business case.

O'Hare tower is a slightly different staffing case, in that there are sub-phases to the runway construction that determine what staffing is required. Additionally, the development and deployment of an Advanced Electronic Flight Strip (AEFS) system is essential to the proposed operation of the two ATCTs. If the system cannot be developed and deployed in the required timeframe, the staffing needs increase substantially for the time the AEFS system is not available. As noted above, as the airfield transitions from an intersecting runway operation to essentially a parallel runway operation, some positions required today will have their duties redesignated (e.g. local monitor), while others will be required to be added to accommodate the increased traffic. In 2007, with the commissioning of the first runway (9L/27R), as stated above, the north satellite tower will need to be staffed from 6:00 a.m. to 11:00 p.m. every day. The anticipated configuration of the tower cab will be one local control, one ground control, one coordinator, and one supervisory position. These positions are anticipated to be staffed for slightly more than two shifts per day (17 hours), which equates to 6.5 positions per day that must be staffed. Utilizing the 1.76 staffing multiplier, 12 (6.5 x 1.76= 11.44) CPCs are required to staff the north ATCT. One supervisory position will be required in the north ATCT for two shifts per day, which equates to a staffing requirement authorization of two Operations Supervisors (OS). The staffing projections for the north ATCT remain constant throughout the remainder of the OMP. The main ATCT current operates 15 positions for slightly more than two shifts per day, and three positions for one shift per day (midnight operation). This equates to slightly more than 33 positions per day that must be staffed. In 2007, the number of operating positions in the main ATCT is not anticipated to increase, but the duties of the current AEFS positions will be eliminated and the staffing reallocated to the additional Local Control Assist/Coordinator positions. The Central Terminal Operations office has dealt with the proposed west airline terminal commissioning (projected for 2008) and the 2nd new runway (10C/28C- projected for 2010) as one set of requirements because of the overlapping construction timelines and commissioning dates. The core airfield operation changes significantly at this time, requiring concurrent changes in the main ATCT position configuration. The number of operating positions in the main ATCT increases slightly, to 16 positions operated slightly more than 2 shifts per day. The reconfigured positions are the ground control and ground metering positions, which absorb the staffing from the monitor positions (see above explanation regarding the crossing vs. parallel runway operation). The planned additional

position will be a local control position necessitated by the new runway. While the number of positions has only increased slightly, the total number of hours the positions are open has increased, which requires increased staffing. In this same timeframe 28 controllers are eligible for retirement (mandatory or otherwise).

Currently ORD has a training success rate of 70%, with an average time to facility certification of 24 months. ORD can accommodate four CPCs (Certified Professional Controllers) in training per quarter. This provides meaningful time to train as well as adequate classroom and laboratory time. Given that for ORD ATCT the facility needs continue throughout the life of the project, there are no "breaks" in the hiring/training requirements timeline. Based on the projected schedule for commissioning the first runway in 2007, ORD must be authorized to hire/acquire four controllers in training per quarter starting in the first quarter of calendar 2005. Staffing needs continue to accrue throughout the remainder of the OMP, but they are beyond the scope of this business case.

A significant note must be made of the staffing regarding the assumption of an electronic flight data transmission system. Currently, the system is under development, with projected deployment six months prior to the first runway commissioning to accomplish training. This is a significant risk to the project (see Section 8.0 Risk Inventory and Assessment section in this business case) if this system cannot be developed and fielded prior to the first runway commissioning. As mentioned above, the design of the north ATCT and reconfiguration of the main ATCT have presupposed this system in staffing requirements. If this system is not in place and the current paper strip system must be utilized, the number of positions increases in each ATCT. In total for the first phase of the OMP, the number of positions for the main tower will be slightly more than 47 positions per day (22 positions for two shifts plus several hours, and three positions for one shift). The number of positions for the north ATCT will increase to four operating positions for slightly more than two shifts per day. Together this amounts to an overall staffing need of 101 CPCs for the two facilities. This is just the raw need, not factoring in training success rate or attrition. This also does also not account for the staffing for the south ATCT, which is beyond the scope of this business case.

In addition to the increased staffing that would be required if the electronic flight strip system is not developed in time, a different reconfiguration of the main ATCT would have to be determined, as the planned work presupposes the system. The planned configuration of the north ATCT assumes the electronic system, so the entire design of the tower cab would have to be examined for modifications if the electronic system were not developed in time for commissioning. The extent of these modifications is unknown at this time, but they would undoubtedly be extensive.

The number of OS positions at ORD ATCT would remain constant with or without paper strips. The need for additional TMCs is generated by the coordination required by the anticipated future operation and remains consistent throughout the life of the project. This increase is due to the increased number of arrival and departure routes, as well as complexity and coordination issues engendered by the construction itself. Currently, ORD ATCT staffs two TMC positions for two shifts today, but it is anticipated that by 2007, that requirement will increase to four TMC positions staffed for two shifts per day. This equates to an additional staffing need of 14 TMCs. Again, staffing needs continue to accrue throughout the remainder of the OMP, but they are beyond the scope of this business case.

Appendix G. Phase 1 Cost Findings

General Scope

This appendix presents the cost findings for Phase 1 of the O'Hare Modernization Program (OMP). The OMP consists of two major phases:

- Phase 1 is segmented into three sub-phases to achieve construction of two new runways, a new north satellite air traffic control tower, extension of an existing runway, and construction of the initial portion of the new West Terminal Complex, and decommission an existing runway

- Phase 2 includes extension of an existing runway, construction of two new runways decommissioning of two existing runways, and completion of the new West Terminal and new south satellite air traffic control tower

Three alternatives were considered for this Business Case:

- Alternative 1 is No Airspace Changes: OMP airport changes evolve without FAA airspace or procedural changes

- Alternative 2 is Compressed Arrival Procedures (CAPS): implement procedures to increase traffic flows over existing four cornerposts

- Alternative 3, the preferred alternative, is High and Wide procedures: this combines both airspace and procedural changes to optimize traffic flows to new OMP runways

For each of the alternatives, costs have been identified as costs funded by the FAA and costs that will be reimbursed by the City of Chicago. The timeframe of the estimate is fiscal year (FY) 2005 through FY 2013. Development and implementation of Phase 1 is targeted for completion in FY 2010. Operations and maintenance costs have been estimated through FY 2013 in order to make a comparison to estimated benefits.

The cost estimates were developed in concert with Air Traffic Organization (ATO) personnel from FAA Headquarters and Great Lakes region: En Route and Oceanic Services (ATO-E), Terminal Services (ATO-T), and Central Service Area/Engineering Services/Facilities and Equipment (ATO-W). The team utilized current contract data, proposal data and subject matter experts to generate the required hours and dollars for individual Work Breakdown Structure (WBS) elements. These values were imported into the cost estimating software tool, Automated Cost Estimating-Integrated Tools (ACE-IT) version 6.1, phased and inflated. Risk values provided by the OMP team were utilized to address the uncertainty of meeting program objectives. Monte Carlo simulation was performed with the Crystal Ball Risk Analysis software to derive risk-adjusted costs.

Cost Analysis Results, Methodologies and Risk Adjustments

Overall Results

Table G.1 below, presents the overall cost results for each of the business case alternatives. Costs are presented in thousands of dollars. Base Year values are in 2005 dollars.

Table G.1 Overall Costs - All Alternatives

Total Costs ($K)	OMP Alternative 1	OMP Alternative 2	OMP Alternative 3
Base Year (2005)	$102,612	$109,610	$141,945
Then Year	$115,249	$123,965	$163,864
Base Year (2005, Risk Adjusted)	$103,537	$110,615	$142,900
Then Year (Risk Adjusted)	$116,292	$125,102	$164,937

Table G.2 further summarizes the estimated budget dollars, in thousands, for each of the alternatives. These costs are represented by the risk-adjusted Then-year cost estimate. Costs are phased by fiscal year, identified by type of funding (Facilities and Equipment (F&E) or Operations and Maintenance (O&M)) and segmented by FAA costs versus expected Reimbursable costs.

Table G.2 Risk-Adjusted, Then Year Cost Estimate – All Alternatives

Cost Total (Then Year, Risk Adjusted)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
Alternative 1	$5,146.5	$34,715.0	$17,951.9	$17,602.8	$11,742.6	$8,090.9	$6,703.6	$7,009.2	$7,329.5	$116,292.0
FAA Total	$4,212.0	$7,920.7	$7,932.5	$7,304.3	$7,531.6	$7,354.9	$6,703.6	$7,009.2	$7,329.5	$63,298.2
F&E-FAA	$1,381.2	$4,288.4	$1,520.9	$1,364.8	$1,417.3	$933.2	$0.0	$0.0	$0.0	$10,905.8
Operations-FAA	$2,830.7	$3,632.3	$6,411.6	$5,939.5	$6,114.3	$6,421.7	$6,703.6	$7,009.2	$7,329.5	$52,392.4
Reimbursable Total	$934.6	$26,794.3	$10,019.4	$10,298.5	$4,211.0	$736.1	$0.0	$0.0	$0.0	$52,993.9
F&E-Reimbursable	$914.6	$26,700.5	$9,799.1	$10,156.4	$3,968.8	$736.1	$0.0	$0.0	$0.0	$52,275.4
Operations-Reimbursable	$20.0	$93.8	$220.3	$142.1	$242.2	$0.0	$0.0	$0.0	$0.0	$718.4

Cost Total (Then Year, Risk Adjusted)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
Alternative 2	$5,146.6	$35,792.2	$19,034.0	$18,584.0	$12,774.7	$9,169.3	$7,832.6	$8,194.6	$8,574.1	$125,102.1
FAA Total	$4,212.0	$8,983.9	$9,008.8	$8,282.2	$8,558.1	$8,432.5	$7,832.6	$8,194.6	$8,574.1	$72,078.7
F&E-FAA	$1,381.3	$4,463.3	$1,665.1	$1,367.1	$1,419.7	$935.6	$0.0	$0.0	$0.0	$11,232.2
Operations-FAA	$2,830.7	$4,520.5	$7,343.6	$6,915.1	$7,138.4	$7,496.9	$7,832.6	$8,194.6	$8,574.1	$60,846.5
Reimbursable Total	$934.6	$26,808.4	$10,025.2	$10,301.8	$4,216.6	$736.8	$0.0	$0.0	$0.0	$53,023.4
F&E-Reimbursable	$914.6	$26,714.6	$9,804.9	$10,159.6	$3,974.3	$736.8	$0.0	$0.0	$0.0	$52,304.7
Operations-Reimbursable	$20.0	$93.8	$220.3	$142.2	$242.3	$0.0	$0.0	$0.0	$0.0	$718.7
Alternative 3	$5,146.6	$42,054.3	$23,421.0	$22,901.9	$17,276.2	$13,900.2	$12,792.6	$13,402.3	$14,041.9	$164,936.9
FAA Total	$4,212.1	$15,252.2	$13,396.4	$12,601.4	$13,064.5	$13,163.8	$12,792.6	$13,402.3	$14,041.9	$111,927.2
F&E-FAA	$1,381.4	$7,690.1	$1,970.8	$1,401.0	$1,426.8	$942.8	$0.0	$0.0	$0.0	$14,812.9
Ops-FAA	$2,830.7	$7,562.1	$11,425.6	$11,200.4	$11,637.8	$12,221.0	$12,792.6	$13,402.3	$14,041.9	$97,114.3
Reimbursable Total	$934.6	$26,802.1	$10,024.5	$10,300.5	$4,211.6	$736.4	$0.0	$0.0	$0.0	$53,009.7
F&E-Reimbursable	$914.6	$26,708.3	$9,804.2	$10,158.3	$3,969.4	$736.4	$0.0	$0.0	$0.0	$52,291.2
Operations-Reimbursable	$20.0	$93.8	$220.3	$142.2	$242.2	$0.0	$0.0	$0.0	$0.0	$718.5

Cost drivers, based on estimated Base Year (BY2005, $K) values, are presented below in table G.3. Base Year values are typically used to identify cost drivers and to focus stakeholders on potential areas of risk. Cost elements making up more than 10% of the overall costs have been highlighted in gray.

			Alternative 1		Alternative 2		Alternative 3	
WBS #	Cost Element	Approp	Cost (BY05 $K)	% of Cost	Cost (BY05 $K)	% of Cost	Cost (BY05 $K)	% of Cost
	OMP PHASE I DELTA LIFE CYCLE COST ESTIMATE		$102,612.2	100%	$109,610.0	100%	$141,944.5	100%
	Facilities & Equipment (F&E)		$59,122.9	58%	$59,418.4	54%	$62,875.6	44%
3	SOLUTION DEVELOPMENT	F&E	$37,968.9	37%	$37,968.9	35%	$40,553.3	29%
3.1	Program Management	F&E	$3,298.5	3%	$3,298.5	3%	$3,298.5	2%
3.2	System Engineering	F&E	$153.2	0%	$153.2	0%	$153.2	0%
3.3	HW/SW Design, Development, Procurement, and Production	F&E	$31,483.0	31%	$31,483.0	29%	$34,067.3	24%
3.4	Physical and Airspace Infrastructure Design and Development	F&E	$770.6	1%	$770.6	1%	$770.6	1%
3.5	Test and Evaluation (captured under other WBS element)	F&E						
3.6	Data and Documentation	F&E						
3.7	Logistics Support	F&E	$2,263.7	2%	$2,263.7	2%	$2,263.7	2%
4	IMPLEMENTATION	F&E	$20,294.7	20%	$20,590.2	19%	$21,463.0	15%
4.1	Program Management	F&E	$5,167.0	5%	$5,187.7	5%	$5,239.9	4%
4.2	Engineering	F&E	$4,799.7	5%	$4,901.5	4%	$5,171.7	4%
4.3	Environmental and Occupational Safety and Health Compliance	F&E	$50.2	0%	$51.1	0%	$52.6	0%
4.4	Site Selection and Acquisition	F&E						
4.5	Construction	F&E	$4,305.4	4%	$4,305.4	4%	$4,471.1	3%
4.6	Site Preparation, Installation, Test, and Checkout	F&E	$5,029.1	5%	$5,184.7	5%	$5,530.5	4%
4.7	Joint Acceptance Inspection/Commissioning/Closeout	F&E	$408.1	0%	$414.9	0%	$432.9	0%
4.8	Telecommunications	F&E	$535.2	1%	$544.9	0%	$564.3	0%
4.9	Implementation Training	F&E						
5	IN-SERVICE MANAGEMENT (F&E)	F&E	$301.8	0%	$301.8	0%	$301.8	0%
6	DISPOSITION	F&E	$557.6	1%	$557.6	1%	$557.6	0%
5	IN-SERVICE MANAGEMENT (OPERATIONS)	OPS	$43,489.3	42%	$50,191.6	46%	$79,068.9	56%

			Alternative 1		Alternative 2		Alternative 3	
WBS #	Cost Element	Approp	Cost (BY05 $K)	% of Cost	Cost (BY05 $K)	% of Cost	Cost (BY05 $K)	% of Cost
5.1	Preventive Maintenance/Certification	OPS	$4,354.4	4%	$4,354.4	4%	$4,354.4	3%
5.2	Corrective Maintenance	OPS	$2,670.5	3%	$2,670.5	2%	$2,670.5	2%
5.3	Modifications	OPS						
5.4	Maintenance Control	OPS						
5.5	Technical Teaming	OPS						
5.6	Watch Standing Coverage	OPS	$1,226.7	1%	$1,226.7	1%	$1,226.7	1%
5.7	Program Support	OPS	$274.4	0%	$280.0	0%	$290.7	0%
5.8	Logistics	OPS	$1,395.0	1%	$1,395.0	1%	$1,446.9	1%
5.9	In-Service Training	OPS	$114.1	0%	$114.1	0%	$114.1	0%
5.10	Second Level Engineering	OPS	$3,441.8	3%	$3,441.8	3%	$3,441.8	2%
5.11	Infrastructure Support	OPS	$3,732.6	4%	$3,732.6	3%	$3,750.9	3%
5.12	Flight Inspections and SIAP Development	OPS	$748.1	1%	$748.1	1%	$748.1	1%
5.13	System Performance Assessment	OPS						
5.14	System Operations	OPS	$25,531.6	25%	$32,228.4	29%	$61,024.8	43%
5.15	Travel To And From Sites	OPS						

Summary of Methodologies

The OMP team utilized multiple methodologies to estimate costs for the three alternatives. Current contract data, actual costs and signed reimbursement agreements were used whenever possible. The team utilized proposal data, FSEP data, analogies to similar programs/efforts and subject experts to generate the required hours and dollars for the remaining WBS cost elements. The following table provides a detailed breakdown, by WBS element, of each methodology used to generate the cost estimate for Alternative 3, the preferred alternative. The type of methodology used to formulate Alternative 3 costs was also used to generate Alternative 1 and 2 costs, since those alternatives are essentially subsets of Alternative 3. More detailed information used to generate Alternative 1 and 2 costs is available upon request.

WBS #	Cost Element	Approp	Funding Source	ATO Org	Alt1	Alt2	Alt3	Methodology/Source	Cost Phasing
	OMP PHASE I DELTA LIFE CYCLE COST ESTIMATE				**$102,612.2**	**$109,610.0**	**$141,944.5**		
	Facilities & Equipment (F&E)				**$59,122.9**	**$59,418.4**	**$62,875.6**		
3	**SOLUTION DEVELOPMENT**	**F&E**			**$37,968.9**	**$37,968.9**	**$40,553.3**		
3.1	Program Management	F&E			$3,298.5	$3,298.5	$3,298.5		
3.1.1	Program Planning, Authorization, Management and Control	F&E			$3,298.5	$3,298.5	$3,298.5		
3.1.1.1	Administrative	F&E	FAA	T	$1,164.1	$1,164.1	$1,164.1	System Hardware Costs * ~ 4% Overhead Factor	fy05 - fy09
3.1.1.2	Product Team Support	F&E			$878.7	$878.7	$878.7		
3.1.1.2.1	FAA FTE	FS-OPS	FAA	T	$476.7	$476.7	$476.7	# FTE *GS-14 (94.26k + 32.8% benefits) + # FTE* GS-15 (110.88k + 32.8% benefits) FY05 FTE = .75, FY06-FY09 FTE = .25	fy05 - fy09
3.1.1.2.2	FFRDC Support	F&E	FAA		$0.0	$0.0	$0.0		-
3.1.1.2.3	Contractor Support	F&E	FAA	T	$385.0	$385.0	$385.0	.5 Contract Staff-Years* Contractor Salary (154k) of FAA HQ ATB-TAC Support (MIAWS, STARS)	fy05 - fy09
3.1.1.2.4	Product Team Travel	F&E	FAA	T	$17.0	$17.0	$17.0	Annual Travel Cost per Year (Cost Throughput'	fy05 - fy09
3.1.1.3	ATO OMP Direct Team (Chicago)	F&E			$1,251.1	$1,251.1	$1,251.1		
3.1.1.3.1	ATO-T	FS-OPS	FAA	T	$290.3	$290.3	$290.3	# FTE*FAA ATO-T & ATO-W, K-Band Mid-Point Salary (100.6k + 32.8% benefits + 18.26% locality), FY05 FTE = .75, FY06-FY09 =.25	fy05 - fy09
3.1.1.3.2	ATO-W	FS-OPS	FAA	W	$533.3	$533.3	$533.3	# FTE*ATO-T & ATO-W, K-Band Mid-Point Salary (100.6k + 32.8% benefits + 18.26% locality) + # FTE*ATO-T & ATO-W, J-Band Mid-Point Salary(84.2k + 32.8% benefits + 18.26% locality) FY05 FTE = .75, FY06-FY09 FTE = .25	fy05 - fy09
3.1.1.3.3	ATO-W AVN	FS-OPS	Reimb	W	$427.5	$427.5	$427.5	# FTE*FAA ATO-W AVN 1 GS-13, 5 (87.5k+ 32.8% benefits) + # FTE*FAA ATO-W AVN 2, GS-14, 5 Salary (96.5k+ 32.8% benefits) FY05 FTE = .75, FY06-FY09 FTE = .25	fy05 - fy09
3.1.1.4	ANI Program Support	FS-OPS			$4.6	$4.6	$4.6		
3.1.1.4.1	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$4.4	$4.4	$4.4	# FTE*FAA ATO-W AVN 1 GS-13, 5 (87.5k+ 32.8% benefits) + # FTE*FAA ATO-W AVN 2, GS-14, 5 Salary (96.5k+ 32.8% benefits) FY05 FTE = .75, FY06-FY09 FTE = .25	fy05
3.1.1.4.2	ATCT (Main & North) - AEFS	FS-OPS	FAA	W	$0.3	$0.3	$0.3	# FTE*FAA ATO-W AVN 1 GS-13, 5 (87.5k+ 32.8% benefits) + # FTE*FAA ATO-W AVN 2, GS-14, 5 Salary (96.5k+ 32.8% benefits) FY05 FTE = .75, FY06-FY09 FTE = .25	fy05
3.1.1.4.3	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		-
3.1.1.5	Contract and Grant Management (captured in other WBS elements)	F&E			$0.0	$0.0	$0.0		
3.2	System Engineering	F&E			$153.2	$153.2	$153.2		
3.2.1	Infosec-Establish ADSE-X	F&E	Reimb	T	$153.2	$153.2	$153.2	Based on ASDE-X Product Team Estimate	
3.3	HW/SW Design, Development, Procurement, and Production	F&E			$31,483.0	$31,483.0	$34,067.3		
3.3.1	Hardware Design and Development	F&E			$1,030.0	$1,030.0	$1,030.0		
3.3.1.1	Advanced Electronic Flight Strip System (AEFS)	F&E	FAA	T	$1,030.0	$1,030.0	$1,030.0	Cost Throughput	
3.3.2	Software Design and Development	F&E			$0.0	$0.0	$0.0		
3.3.3	HW/SW Integration, Assembly, Test and Checkout	F&E			$0.0	$0.0	$0.0		
3.3.4	Production Engineering	F&E			$0.0	$0.0	$25.0		
3.3.4.1	MKE - Establish 2 additional STARS Maps/NG Survey	F&E	FAA	T	$0.0	$0.0	$25.0	Based on STARS Product Team Estimate (Daren Magness)	
3.3.5	Procurement/Production	F&E			$30,453.0	$30,453.0	$33,012.3		
3.3.5.1	System Hardware	F&E			$30,453.0	$30,453.0	$33,012.3		
3.3.5.1.1	Relocate 14L	F&E			$0.0	$0.0	$0.0		
3.3.5.1.1.1	14L ILS	F&E	Reimb	W	$0.0	$0.0	$0.0	Already Sunk Cost	
3.3.5.1.1.2	14L ALSF 2	F&E	Reimb	W	$0.0	$0.0	$0.0	Already Sunk Cost	
3.3.5.1.1.3	14L DME	F&E	Reimb		$0.0	$0.0	$0.0		-
3.3.5.1.2	Establish 9L	F&E			$1,726.0	$1,726.0	$1,726.0		
3.3.5.1.2.1	9L ILS	F&E	Reimb	W	$276.0	$276.0	$276.0	9L ILS Product Hardware Cost	276k/yr , fy06
3.3.5.1.2.2	9L/27R RVR (reuse 14L TD Equipment)	F&E	Reimb	W	$50.0	$50.0	$50.0	9L/27R RVR Product Hardware Cost	50k/yr, fy06
3.3.5.1.2.3	9L ALSF-2	F&E	Reimb	W	$1,400.0	$1,400.0	$1,400.0	9L ALSF 2 Product Hardware Cost	1400k/yr, fy06
3.3.5.1.2.4	9L/27R DME	F&E	Reimb		$0.0	$0.0	$0.0		-
3.3.5.1.3	Establish 27R	F&E			$1,676.0	$1,676.0	$1,676.0		
3.3.5.1.3.1	27R ILS	F&E	Reimb	W	$276.0	$276.0	$276.0	27R ILS Product Hardware Cost	276k/yr , fy06
3.3.5.1.3.2	27R ALSF-2	F&E	Reimb	W	$1,400.0	$1,400.0	$1,400.0	27R ALSF 2 Product Hardware Cost	1400k/yr, fy06
3.3.5.1.4	Relocate 22R LOC	F&E	Reimb	W	$86.5	$86.5	$86.5	27R Relocation of 22R	86.547k/yr, fy06
3.3.5.1.5	Establish 10L (Existing 9R Extension)	F&E			$2,170.7	$2,170.7	$2,170.7		
3.3.5.1.5.1	10L ILS	F&E	Reimb	W	$276.0	$276.0	$276.0	10L ILS Product Hardware Cost	276k/yr, fy06
3.3.5.1.5.2	10L/28R RVR	F&E	Reimb	W	$369.8	$369.8	$369.8	10L/28R RVR Product Hardware Cost	369.825k/yr, fy06
3.3.5.1.5.3	10L ALSF-2	F&E	Reimb	W	$1,400.0	$1,400.0	$1,400.0	10L ALSF 2 Product Hardware Cost	1400k/yr, fy06
3.3.5.1.5.4	10L/28R DME	F&E	Reimb	W	$74.9	$74.9	$74.9	10L/28R DME Prodcut Hardware Cost	74.856k/yr, fy06
3.3.5.1.5.5	10L PAPI	F&E	Reimb	W	$50.0	$50.0	$50.0	10L PAPI Product Hardware Cost	50k/yr, fy06
3.3.5.1.6	Establish 10C	F&E			$2,170.7	$2,170.7	$2,170.7		
3.3.5.1.6.1	10C ILS	F&E	Reimb	W	$276.0	$276.0	$276.0	10C ILS Product Hardware Cost	276k/yr, fy08
3.3.5.1.6.2	10C/28C RVR	F&E	Reimb	W	$369.8	$369.8	$369.8	10C/28CRVR Product Hardware Cost	369.825k/yr, fy08
3.3.5.1.6.3	10C ALSF-2	F&E	Reimb	W	$1,400.0	$1,400.0	$1,400.0	10C ALSF 2 Product Hardware Cost	1400k/yr, fy08
3.3.5.1.6.4	10C/28C DME	F&E	Reimb	W	$74.9	$74.9	$74.9	10C/28C DME Product Hardware Cost	74.856k/yr, fy08
3.3.5.1.6.5	10C PAPI	F&E	Reimb	W	$50.0	$50.0	$50.0	10C PAPI Product Hardware Cost	50k/yr, fy08
3.3.5.1.7	Establish 28C	F&E			$1,726.0	$1,726.0	$1,726.0		
3.3.5.1.7.1	28C ILS	F&E	Reimb	W	$276.0	$276.0	$276.0	28C ILS Product Hardware Cost	276k/yr, fy08
3.3.5.1.7.2	28C ALSF-2	F&E	Reimb	W	$1,400.0	$1,400.0	$1,400.0	28C ALSF 2 Product Hardware Cost	1400k/yr, fy08
3.3.5.1.7.3	28C PAPI	F&E	Reimb	W	$50.0	$50.0	$50.0	28C PAPI Product Hardware Cost	50k/yr, fy08
3.3.5.1.8	LLWAS	F&E	Reimb	T	$1,500.0	$1,500.0	$1,500.0	LLWAS Product Hardware Cost	fy07: 750k, fy08: 345k, fy09 405k, fy07 - fy09
3.3.5.1.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	F&E	Reimb	W	$1,569.5	$1,569.5	$1,569.5	RTR Product Hardware including Construction, Per Jon 61059	1570k/yr, fy06
3.3.5.1.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	F&E	Reimb	W	$1,569.5	$1,569.5	$1,569.5	RTR Product Hardware including Construction, Per Jon 61059	1570k/yr, fy07
3.3.5.1.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	F&E	Reimb	W	$1,569.5	$1,569.5	$1,569.5	RTR Product Hardware including Construction, Per Jon 61059	1570k/yr, fy08
3.3.5.1.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	F&E	Reimb	W	$1,569.5	$1,569.5	$1,569.5	RTR Product Hardware including Construction, Per Jon 61059	1570k/yr, fy08
3.3.5.1.13	Establish RTR "T"	F&E	Reimb	W	$70.0	$70.0	$70.0	RTR Product Hardware including Construction, Per Jon 61059	70k/yr, fy08
3.3.5.1.14	Establish Temp RTR (North ATCT)	F&E	Reimb	W	$70.0	$70.0	$70.0	RTR Product Hardware Cost ; removed telco cost	70k/yr, fy06
3.3.5.1.15	Establish Fiber Optics Transmission System (FOTS)	F&E	Reimb	W	$1,000.0	$1,000.0	$1,000.0	FOTS Product Hardware Cost	250k/yr,
3.3.5.1.16	Establish ADSE-X	F&E	Reimb	T	$1,885.9	$1,885.9	$1,885.9	Based on ASDE-X Product Team Estimate	1886k/yr, fy06
3.3.5.1.17	Establish Integrate Control & Monitor Sys (ICAMS) (ATCTs & C90)	F&E	Reimb	T	$1,200.0	$1,200.0	$1,200.0	ICAMS Product Hardware Cost	1200k/yr, fy06

3.3.5.1.18	North ATCT - Equipment	F&E			$2,074.0	$2,074.0	$2,074.0		
3.3.5.1.18.1	IDS-4 (5)	F&E	Reimb	T	$40.0	$40.0	$40.0	Based on Jon 61014 HW Cost	40k/yr, fy06
3.3.5.1.18.2	BRITE Displays (4)	F&E	Reimb	T	$240.0	$240.0	$240.0	North ATCT - BRITE Displays Product Hardware Cost	240k/yr, fy06
3.3.5.1.18.3	Emergency Transceivers (4)	F&E	Reimb	W	$48.0	$48.0	$48.0	North ATCT - Emergency Transceivers Product Hardware Cost	48k/yr, fy06
3.3.5.1.18.4	Tower Voice Switch	F&E	Reimb	W	$0.0	$0.0	$0.0	North ATCT - Tower Voice Switch Product Hardware Cost	150k/yr, fy06
3.3.5.1.18.5	FDIO	F&E	Reimb	T	$20.0	$20.0	$20.0	North ATCT - FDIO Product Hardware Cost	20k/yr, fy06
3.3.5.1.18.6	Power Conditioning System (PCS)	F&E	Reimb	W	$1,558.5	$1,558.5	$1,558.5	PCS and SX cost per Ralph Lund/Paul Sangha	1559k/yr, fy06
3.3.5.1.18.7	Engine Generator (SX)-Included in PCS	F&E	Reimb	W	$0.0	$0.0	$0.0		-
3.3.5.1.18.8	Voice Switch Bypass	F&E	Reimb	W	$20.0	$20.0	$20.0	North ATCT - Voice Bypass Switch Product Hardware Cost	20k/yr, fy06
3.3.5.1.18.9	Electronic Flight Data Transfer System	F&E	Reimb		$0.0	$0.0	$0.0		-
3.3.5.1.18.10	RDVS Position-Related Hardware	F&E	Reimb	W	$147.5	$147.5	$147.5	Quote from Ed Hand	
3.3.5.1.19	Radar - Establish North On-Field ASR-9/Mode S	F&E	Reimb	T	$2,734.2	$2,734.2	$2,734.2	Includes UPS and EG costs (per Product Team) plus Related Equipment/Construction Materials (O'Hare)	2734k/yr, fy06
3.3.5.1.20	Establish South Field ASR-9/Mode S	F&E	Reimb	T	$2,734.2	$2,734.2	$2,734.2	Includes UPS and EG costs (per Product Team) plus Related Equipment/Construction Materials (O'Hare)	2734k/yr, fy07
3.3.5.1.21	Airspace Redesign	F&E			$1,350.6	$1,350.6	$3,909.9		
3.3.5.1.21.1	TRACON (C90) RDVS	F&E	FAA	W	$1,309.9	$1,309.9	$1,309.9	Per Jon 61004	1301k/yr, fy06
3.3.5.1.21.2	TRACON (C90) DVRS Expansion	F&E	FAA	W	$12.0	$12.0	$12.0	Per JON 64442	12k/yr, fy06
3.3.5.1.21.3	TRACON (C90) Position Redesignation	F&E	FAA		$0.0	$0.0	$0.0		-
3.3.5.1.21.4	ASR-11 Gateway Switch	F&E	FAA		$0.0	$0.0	$0.0		-
3.3.5.1.21.5	MKE - Establish RTR Channel (1 Frequency)	F&E	FAA	W	$0.0	$0.0	$147.7	RTR Product Hardware Cost ; removed telco cost	148k/yr, fy06
3.3.5.1.21.6	MKE - Establish 2 additional STARS Displays	F&E	FAA	T	$0.0	$0.0	$73.2	Based on STARS Product Team Estimate (Daren Magness)	73k/yr, fy06
3.3.5.1.21.7	MKE- Establish IDS-4 (1)	F&E	FAA	T	$0.0	$0.0	$8.0	Based on Jon 61014 HW Cost	
3.3.5.1.21.8	MKE- Establish ETVS TEDs (2)	F&E	FAA	T	$0.0	$0.0	$22.0	Based on Jon 61014 HW Cost	
3.3.5.1.21.9	SBN - Establish RTR Channel	F&E	FAA	W	$0.0	$0.0	$148.9	RTR Product Hardware Cost ; removed telco cost	149k/yr, fy06
3.3.5.1.21.10	ZAU - Position Reconfiguration (4)	F&E	FAA	E	$28.6	$28.6	$28.6	Position Reconfigurations Costs	29k/yr, fy06
3.3.5.1.21.11	RCAGs (New Channels, 4 existing Sector locations)	F&E	FAA	W	$0.0	$0.0	$1,381.0	RCAG Product Hardware Costs	1381k/yr, fy06
3.3.5.1.21.12	BUECs (New Channels, 4 existing Sector locations)	F&E	FAA	W	$0.0	$0.0	$778.6	BUEC Product Hardware Costs	779k/yr, fy06
3.3.5.2	System Software	F&E			$0.0	$0.0	$0.0		
3.3.5.3	Integration, Assembly, Test and Checkout	F&E			$0.0	$0.0	$0.0		
3.3.5.4	System Engineering & Program Management	F&E			$0.0	$0.0	$0.0		
3.3.6	Technology Refresh	F&E			$0.0	$0.0	$0.0		
3.4	Physical and Airspace Infrastructure Design and Development	F&E			$770.6	$770.6	$770.6		
3.4.1	Facility Planning and Design	F&E			$770.6	$770.6	$770.6		
3.4.1.1	ATCT Concept Design (AGL-359)	F&E	Reimb	W	$41.9	$41.9	$41.9	Based on applicable JON	
3.4.1.2	Surveillance (AGL-363)	F&E	Reimb	W	$68.7	$68.7	$68.7	Based on applicable JON	
3.4.1.3	RTR Relocations (AGL-370)	F&E	Reimb	W	$62.5	$62.5	$62.5	Based on applicable JON	
3.4.1.4	ATCT Design Review (AGL-371)	F&E	Reimb	W	$470.3	$470.3	$470.3	Based on applicable JON	
3.4.1.5	Environmental Support (AGL-372)	F&E	Reimb	W	$63.6	$63.6	$63.6	Based on applicable JON	
3.4.1.6	FOTS (AGL-396)	F&E	Reimb	W	$63.6	$63.6	$63.6	Based on applicable JON	
3.4.2	Real Estate	F&E			$0.0	$0.0	$0.0		
3.4.3	Physical Infrastructure	F&E			$0.0	$0.0	$0.0		
3.4.4	Airspace Redesign	F&E			$0.0	$0.0	$0.0		
3.5	Test and Evaluation	F&E			$0.0	$0.0	$0.0		
3.6	Data and Documentation	F&E			$0.0	$0.0	$0.0		
3.7	Logistics Support	F&E			$2,263.7	$2,263.7	$2,263.7		
3.7.1	Logistics Support Planning	F&E			$0.0	$0.0	$0.0		
3.7.2	Test and Measurement Equipment Acquisition	F&E			$0.0	$0.0	$0.0		
3.7.3	Support and Handling Equipment Acquisition	F&E			$0.0	$0.0	$0.0		
3.7.4	Support Facilities Construction/Conversion/Expansion	F&E			$0.0	$0.0	$0.0		
3.7.5	Support Equipment Acquisition / Modification	F&E			$189.3	$189.3	$189.3		
3.7.5.1	Establish ASDE-X	F&E	Reimb	T	$66.5	$66.5	$66.5	Based on ASDE-X Product Team Estimate	
3.7.5.2	Radar - Establish North On-Field ASR-9/Mode S	F&E	Reimb	T	$122.8	$122.8	$122.8	Based on Analogy to ASR-11 Equipment,	
3.7.6	Support Facilities and Equipment Maintenance	F&E			$0.0	$0.0	$0.0		
3.7.7	Initial Spares and Repair Parts Acquisition	F&E			$2,074.4	$2,074.4	$2,074.4		
3.7.7.1	Establish ASDE-X	F&E	Reimb	T	$332.0	$332.0	$332.0	Based on ASDE-X Product Team Estimate	
3.7.7.2	Radar - Establish North On-Field ASR-9/Mode S	F&E	Reimb	T	$1,742.4	$1,742.4	$1,742.4	Full ASR-9 Set of Spares ($1.1M per Westinghouse Document), 50% of Mode S Sites Spares List ($1.2M), Provided by Product Team	
3.7.8	Initial Training	F&E			$0.0	$0.0	$0.0		
4	IMPLEMENTATION	F&E			$20,294.7	$20,590.2	$21,463.0		
4.1	Program Management	F&E			$5,167.0	$5,187.7	$5,239.9		
4.1.1	Program Planning, Authorization, Management and Control	F&E			$5,167.0	$5,187.7	$5,239.9		
4.1.1.1	Administrative	F&E	FAA	T	$605.1	$616.1	$648.9	Site Engineering Costs + Eviornmental/Safety Compliance Costs + Site Acqusition and Construction Costs + Inspection Costs + Telecomuncations Costs)* ~4% Overhead Factor	274k/yr, fy06 - fy10
4.1.1.2	Product Team Support	F&E			$1,431.6	$1,431.6	$1,431.6		
4.1.1.2.1	FAA FTE	FS-OPS	FAA	T	$1,021.6	$1,021.6	$1,021.6	.75*FTE GS-14 (94.26k + 32.8% benefits) + .75*GS-15 (110.88k + 32.8% benefits)	204k/yr, fy06 - fy10
4.1.1.2.2	FFRDC Support	F&E	FAA		$0.0	$0.0	$0.0		-
4.1.1.2.3	Contractor Support	F&E	FAA	T	$385.0	$385.0	$385.0	.5*Annual Salary (154k) of FAA HQ ATB-TAC Support (MIAWS, STARS)	77k/yr, fy06 - fy10
4.1.1.2.4	Product Team Travel	F&E	FAA	T	$25.0	$25.0	$25.0	Cost Throughput	
4.1.1.3	ATO OMP Direct Team (Chicago)	F&E			$2,680.9	$2,680.9	$2,680.9		
4.1.1.3.1	ATO-T	FS-OPS	FAA	T	$622.1	$622.1	$622.1	.75*FAA ATO-T & ATO-W, K-Band Mid-Point Salary (100.6k + 32.8% benefits + 18.26% locality) per year	124k/yr, fy06 - fy10
4.1.1.3.2	ATO-W	FS-OPS	FAA	W	$1,142.8	$1,142.8	$1,142.8	.75*ATO-T & ATO-W, K-Band Mid-Point Salary (100.6k + 32.8% benefits + 18.26% locality) + .75*ATO-T & ATO-W, J-Band Mid-Point Salary(84.2k + 32.8% benefits + 18.26% locality)	229k/yr, fy06 - fy10
4.1.1.3.3	ATO-W AVN	FS-OPS	Reimb	W	$916.0	$916.0	$916.0	.75*ATO-W AVN 1 GS-13, 5 (87.5k+ 32.8% benefits) + .75*ATO-W AVN 2, GS-14, 5 (96.5k+ 32.8% benefits)	183k/yr, fy06 - fy10
4.1.1.4	ANI Program Support	FS-OPS			$449.4	$459.1	$478.5	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.1.1.4.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$127.5	$127.5	$127.5		180 Staff Days, fy06 - fy07
4.1.1.4.2	Relocate 22R LOC	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy06

4.1.1.4.3	LLWAS	FS-OPS	Reimb	W	$6.4	$6.4	$6.4		9 Staff Days, fy07 - fy08
4.1.1.4.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy06 - fy07
4.1.1.4.5	Establish Temp RTR	FS-OPS	Reimb	W	$4.2	$4.2	$4.2		6 Staff Days, fy06 - fy07
4.1.1.4.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy08 - fy09
4.1.1.4.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy07 - fy09
4.1.1.4.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy08 - fy10
4.1.1.4.9	Establish RTR"T"	FS-OPS	Reimb	W	$4.2	$4.2	$4.2		6 Staff Days, fy06
4.1.1.4.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$7.8	$7.8	$7.8		11 Staff Days, fy06 - fy07
4.1.1.4.11	Establish ADSE-X	FS-OPS	Reimb	W	$10.6	$10.6	$10.6		15 Staff Days, fy06 - fy07
4.1.1.4.12	North ATCT - Construction	FS-OPS	Reimb	W	$31.9	$31.9	$31.9		45 Staff Days, fy06 - fy07
4.1.1.4.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$22.7	$22.7	$22.7		32 Staff Days, fy06 - fy07
4.1.1.4.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06 - fy07
4.1.1.4.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$2.9	$2.9	$2.9		15 Staff Days, fy06
4.1.1.4.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$3.4	$3.4	$3.4		7 Staff Days, fy06 - fy07
4.1.1.4.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	W	$1.2	$1.2	$1.2		3 Staff Days, fy06 - fy07
4.1.1.4.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.1.1.4.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$3.4		7 Staff Days, fy06
4.1.1.4.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$4.8		10 Staff Days, fy06 - fy07
4.1.1.4.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$3.4		7 Staff Days, fy06 - fy07
4.1.1.4.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$9.7	$9.7		20 Staff Days, fy07
4.1.1.4.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$3.9		8 Staff Days, fy07 - fy08
4.1.1.4.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$3.9		8 Staff Days, fy06 - fy07
4.1.1.4.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06 - fy07
4.1.1.4.26	Establish 10C	FS-OPS	Reimb	W	$53.1	$53.1	$53.1		75 Staff Days, fy08 - fy10
4.1.1.4.27	Establish 28C	FS-OPS	Reimb	W	$53.1	$53.1	$53.1		75 Staff Days, fy08 - fy10
4.1.1.4.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$42.5	$42.5	$42.5		60 Staff Days, fy06
4.1.2	Contract Management	F&E			$0.0	$0.0	$0.0		
4.1.3	Human Resources Planning and Staffing	F&E			$0.0	$0.0	$0.0		
4.2	Engineering	F&E			$4,799.7	$4,901.5	$5,171.7		
4.2.1	Site Survey & Design	F&E			$4,799.7	$4,901.5	$5,159.3	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.2.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$1,389.5	$1,389.5	$1,389.5		1962 Staff Days, fy06 - fy07
4.2.1.2	Relocate 22R LOC	FS-OPS	Reimb	W	$9.9	$9.9	$9.9		14 Staff Days, fy06
4.2.1.3	LLWAS	FS-OPS	Reimb	W	$43.9	$43.9	$43.9		62 Staff Days, fy07 - fy08
4.2.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$108.4	$108.4	$108.4		153 Staff Days, fy06 - fy07
4.2.1.5	Establish Temp RTR	FS-OPS	Reimb	W	$56.7	$56.7	$56.7		80 Staff Days, fy06 - fy07
4.2.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$108.4	$108.4	$108.4		153 Staff Days, fy08 - fy09
4.2.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$108.4	$108.4	$108.4		153 Staff Days, fy07 - fy09
4.2.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$108.4	$108.4	$108.4		153 Staff Days, fy08 - fy10
4.2.1.9	Establish RTR"T"	FS-OPS	Reimb	W	$92.1	$92.1	$92.1		130 Staff Days, fy06
4.2.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$72.2	$72.2	$72.2		102 Staff Days, fy06 - fy07
4.2.1.11	Establish ADSE-X	FS-OPS	Reimb	W	$28.3	$28.3	$28.3		40 Staff Days, fy06 - fy07
4.2.1.12	North ATCT - Construction	FS-OPS	Reimb	W	$463.2	$463.2	$463.2		654 Staff Days, fy06 - fy07
4.2.1.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$165.0	$165.0	$165.0		233 Staff Days, fy06 - fy07
4.2.1.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$259.9	$259.9	$259.9		367 Staff Days, fy06 - fy07
4.2.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$48.5	$48.5	$48.5		100 Staff Days, fy05 - fy06
4.2.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$9.7	$9.7	$9.7		20 Staff Days, fy06 - fy07
4.2.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.2.1.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.2.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$77.5		160 Staff Days, fy06
4.2.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$33.9		70 Staff Days, fy06 - fy07
4.2.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$77.5		160 Staff Days, fy06 - fy07
4.2.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$101.8	$101.8		210 Staff Days, fy07
4.2.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$34.4		71 Staff Days, fy07 - fy08
4.2.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$34.4		71 Staff Days, fy06 - fy07
4.2.1.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$259.9	$259.9	$259.9		367 Staff Days, fy06 - fy07
4.2.1.26	Establish 10C	FS-OPS	Reimb	W	$502.1	$502.1	$502.1		709 Staff Days, fy08 - fy10
4.2.1.27	Establish 28C	FS-OPS	Reimb	W	$502.1	$502.1	$502.1		709 Staff Days, fy08 - fy10
4.2.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$463.2	$463.2	$463.2		654 Staff Days, fy06
4.2.2	Site Survey & Design-Prime Contractor Support				$0.0	$0.0	$12.5		
4.2.2.1	MKE - Establish 2 additional STARS Displays	F&E	FAA	T	$0.0	$0.0	$12.5	Based on STARS Product Team Estimate (Daren Magness)	
4.2.3	Site Software Adaptation	F&E			$0.0	$0.0	$0.0		
4.3	Environmental and Occupational Safety and Health Compliance	F&E			$50.2	$51.1	$52.6	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.3.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.2	Relocate 22R LOC	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.3	LLWAS	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.5	Establish Temp RTR	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.9	Establish RTR"T"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.11	Establish ADSE-X	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.3.12	North ATCT - Construction	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$2.8	$2.8	$2.8		4 Staff Days, fy06 - fy07
4.3.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06 - fy07
4.3.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$4.8	$4.8	$4.8		10 Staff Days, fy05 - fy06

4.3.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.3.17	ATCT (Main & North) - AEFS	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.3.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.3.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$0.5		1 Staff Days, fy06
4.3.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$0.5		1 Staff Days, fy06 - fy07
4.3.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$0.5		1 Staff Days, fy06 - fy07
4.3.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$1.0	$1.0		2 Staff Days, fy07
4.3.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$0.0		-
4.3.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$0.0		-
4.3.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06 - fy07
4.3.26	Establish 10C	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.27	Establish 28C	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.3.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.4	Site Selection and Acquisition	F&E			$0.0	$0.0	$0.0		
4.5	Construction	F&E			$4,305.4	$4,305.4	$4,471.1		
4.5.1	North ATCT Construction	F&E	Reimb	W	$0.0	$0.0	$0.0	North ATCT Construction Costs to be paid by City (not in business case scope)	
4.5.2	ANI Contruction	FS-OPS			$3,496.5	$3,496.5	$3,662.2	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.5.2.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$888.1	$888.1	$888.1		1254 Staff Days, fy06 - fy07
4.5.2.2	Relocate 22R LOC	FS-OPS	Reimb	W	$23.4	$23.4	$23.4		33 Staff Days, fy06
4.5.2.3	LLWAS	FS-OPS	Reimb	W	$46.7	$46.7	$46.7		66 Staff Days, fy07 - fy09
4.5.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$72.2	$72.2	$72.2		102 Staff Days, fy06 - fy07
4.5.2.5	Establish Temp RTR	FS-OPS	Reimb	W	$40.4	$40.4	$40.4		57 Staff Days, fy06 - fy07
4.5.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$72.2	$72.2	$72.2		102 Staff Days, fy08 - fy09
4.5.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$72.2	$72.2	$72.2		102 Staff Days, fy07 - fy09
4.5.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$72.2	$72.2	$72.2		102 Staff Days, fy08 - fy10
4.5.2.9	Establish RTR"T"	FS-OPS	Reimb	W	$42.5	$42.5	$42.5		60 Staff Days, fy08
4.5.2.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$44.6	$44.6	$44.6		63 Staff Days, fy06 - fy09
4.5.2.11	Establish ADSE-X	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.5.2.12	North ATCT - Construction	FS-OPS	Reimb	W	$793.2	$793.2	$793.2		1120 Staff Days, fy06 - fy07
4.5.2.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$130.3	$130.3	$130.3		184 Staff Days, fy06 - fy07
4.5.2.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$148.7	$148.7	$148.7		210 Staff Days, fy06 - fy07
4.5.2.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.5.2.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.5.2.17	ATCT (Main & North) - AEFS	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.5.2.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.5.2.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$55.2		114 Staff Days, fy06
4.5.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.5.2.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$55.2		114 Staff Days, fy06 - fy07
4.5.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.5.2.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$27.6		57 Staff Days, fy06 - fy07
4.5.2.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$27.6		57 Staff Days, fy06 - fy07
4.5.2.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$148.7	$148.7	$148.7		210 Staff Days, fy06 - fy07
4.5.2.26	Establish 10C	FS-OPS	Reimb	W	$302.4	$302.4	$302.4		427 Staff Days, fy08 - fy09
4.5.2.27	Establish 28C	FS-OPS	Reimb	W	$302.4	$302.4	$302.4		427 Staff Days, fy08 - fy09
4.5.2.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$296.0	$296.0	$296.0		418 Staff Days, fy06 - fy07
4.5.3	Prime Contractor Support	F&E			$808.9	$808.9	$808.9		
4.5.3.1	Establish ASDE-X	F&E	Reimb	T	$808.9	$808.9	$808.9	Based on ASDE-X Product Team Estimate	fy06
4.6	Site Preparation, Installation, Test, and Checkout	F&E			$5,029.1	$5,184.7	$5,530.5		
4.6.1	ANI Support	F&E			$4,127.0	$4,279.6	$4,458.9	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days * times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.6.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$807.4	$807.4	$807.4		1140 Staff Days, fy06 - fy07
4.6.1.2	Relocate 22R LOC	FS-OPS	Reimb	W	$44.6	$44.6	$44.6		63 Staff Days, fy06
4.6.1.3	LLWAS	FS-OPS	Reimb	W	$14.2	$14.2	$14.2		20 Staff Days, fy06 - fy09
4.6.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$93.5	$93.5	$93.5		132 Staff Days, fy06 - fy07
4.6.1.5	Establish Temp RTR	FS-OPS	Reimb	W	$40.4	$40.4	$40.4		57 Staff Days, fy07
4.6.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$93.5	$93.5	$93.5		132 Staff Days, fy08 - fy09
4.6.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$93.5	$93.5	$93.5		132 Staff Days, fy07 - fy08
4.6.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$93.5	$93.5	$93.5		132 Staff Days, fy09 - fy10
4.6.1.9	Establish RTR"T"	FS-OPS	Reimb	W	$47.5	$47.5	$47.5		67 Staff Days, fy08
4.6.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06 - fy09
4.6.1.11	Establish ADSE-X	FS-OPS	Reimb	W	$145.9	$145.9	$145.9		206 Staff Days, fy06 - fy07
4.6.1.12	North ATCT - Construction	FS-OPS	Reimb	W	$645.2	$645.2	$645.2		911 Staff Days, fy06 - fy07
4.6.1.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$77.2	$77.2	$77.2		109 Staff Days, fy06 - fy07
4.6.1.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$373.9	$373.9	$373.9		528 Staff Days, fy06 - fy07
4.6.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$324.7	$324.7	$324.7		670 Staff Days, fy06
4.6.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$9.2	$9.2	$9.2		19 Staff Days, fy06
4.6.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	W	$4.8	$4.8	$4.8		10 Staff Days, fy06 - fy07
4.6.1.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.6.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$55.2		114 Staff Days, fy06
4.6.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$28.1		58 Staff Days, fy06 - fy07
4.6.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$55.2		114 Staff Days, fy06 - fy07
4.6.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$152.6	$152.6		315 Staff Days, fy06
4.6.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$20.4		42 Staff Days, fy06 - fy07
4.6.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$20.4		42 Staff Days, fy06 - fy07
4.6.1.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$373.9	$373.9	$373.9		528 Staff Days, fy07 - fy08
4.6.1.26	Establish 10C	FS-OPS	Reimb	W	$276.9	$276.9	$276.9		391 Staff Days, fy08 - fy10
4.6.1.27	Establish 28C	FS-OPS	Reimb	W	$276.9	$276.9	$276.9		391 Staff Days, fy08 - fy10
4.6.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$269.1	$269.1	$269.1		380 Staff Days, fy06

4.6.2	AF Support	FS-OPS			$346.7	$349.6	$354.8	FAA hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days * times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.6.2.1	Relocate 14L	FS-OPS	Reimb	W	$17.7	$17.7	$17.7		217 Staff Days, fy06
4.6.2.2	Establish 9L	FS-OPS	Reimb	W	$18.3	$18.3	$18.3		225 Staff Days, fy07 - fy08
4.6.2.3	Establish 27R	FS-OPS	Reimb	W	$16.8	$16.8	$16.8		206 Staff Days, fy07 - fy08
4.6.2.4	Relocate 22R LOC	FS-OPS	Reimb	W	$1.4	$1.4	$1.4		17 Staff Days, fy06 - fy07
4.6.2.5	LLWAS	FS-OPS	Reimb	W	$18.5	$18.5	$18.5		228 Staff Days, fy07 - fy08
4.6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$4.0	$4.0	$4.0		49 Staff Days, fy07
4.6.2.7	Establish Temp RTR	FS-OPS	Reimb	W	$10.6	$10.6	$10.6		130 Staff Days, fy07
4.6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$4.0	$4.0	$4.0		49 Staff Days, fy09
4.6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$4.0	$4.0	$4.0		49 Staff Days, fy09
4.6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$4.0	$4.0	$4.0		49 Staff Days, fy10
4.6.2.11	Establish RTR"T"	FS-OPS	Reimb	W	$10.6	$10.6	$10.6		130 Staff Days, fy09
4.6.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$15.6	$15.6	$15.6		192 Staff Days, fy06 - fy10
4.6.2.13	Establish ADSE-X	FS-OPS	Reimb	W	$9.8	$9.8	$9.8		120 Staff Days, fy07
4.6.2.14	North ATCT	FS-OPS	Reimb	W	$33.4	$33.4	$33.4		411 Staff Days, fy07
4.6.2.15	Temporary ASR-9/Mode S	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.6.2.16	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$50.6	$50.6	$50.6		622 Staff Days, fy06 - fy07
4.6.2.17	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$60.0	$60.0	$60.0		738 Staff Days, fy06 - fy07
4.6.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$3.5	$3.5	$3.5		63 Staff Days, fy06
4.6.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$0.9	$0.9	$0.9		16 Staff Days, fy06 - fy07
4.6.2.20	ORD ATCT - AEFS	FS-OPS	FAA	W	$5.1	$5.1	$5.1		92 Staff Days, fy06 - fy07
4.6.2.21	Existing ATCT Mods	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	W	$0.0	$0.0	$3.3		60 Staff Days, fy06
4.6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	W	$0.0	$0.7	$0.7		12 Staff Days, fy06 - fy07
4.6.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	W	$0.0	$2.2	$2.2		40 Staff Days, fy06 - fy07
4.6.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	W	$0.0	$0.0	$1.9		34 Staff Days, fy06 - fy07
4.6.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$19.9	$19.9	$19.9		244 Staff Days, fy08
4.6.2.27	Establish 28C	FS-OPS	Reimb	W	$19.9	$19.9	$19.9		244 Staff Days, fy08
4.6.2.28	Establish 10C	FS-OPS	Reimb	W	$18.3	$18.3	$18.3		225 Staff Days, fy08
4.6.3	Prime Contractor Support				$555.4	$555.4	$716.7		
4.6.3.1	MKE - Establish 2 additional STARS Displays	F&E	FAA	T	$0.0	$0.0	$161.3	Based on STARS Product Team Estimate (Daren Magness)	
4.6.3.2	TRACON (C90) RDVS	F&E	FAA	W	$196.7	$196.7	$196.7	Based on Quote From Ed Hand	
4.6.3.3	Establish ADSE-X	F&E	Reimb	T	$358.8	$358.8	$358.8	Based on ASDE-X Product Team Estimate	
4.7	Joint Acceptance Inspection/Commissioning/Closeout	F&E			$408.1	$414.9	$432.9		
4.7.1	ANI Support	F&E			$191.2	$196.0	$206.7	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.7.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$42.5	$42.5	$42.5		60 Staff Days,
4.7.1.2	Relocate 22R LOC	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy06
4.7.1.3	LLWAS	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy06 - fy08
4.7.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy06
4.7.1.5	Establish Temp RTR	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy07
4.7.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy09
4.7.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy08
4.7.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy10
4.7.1.9	Establish RTR"T"	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy09
4.7.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$0.7	$0.7	$0.7		1 Staff Days, fy06 - fy09
4.7.1.11	Establish ADSE-X	FS-OPS	Reimb	W	$3.5	$3.5	$3.5		5 Staff Days, fy08
4.7.1.12	North ATCT - Construction	FS-OPS	Reimb	W	$21.2	$21.2	$21.2		30 Staff Days, fy07 - fy08
4.7.1.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$11.3	$11.3	$11.3		16 Staff Days, fy07
4.7.1.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy06
4.7.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$6.8	$6.8	$6.8		14 Staff Days, fy06
4.7.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$0.5	$0.5	$0.5		1 Staff Days, fy07
4.7.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	W	$0.5	$0.5	$0.5		1 Staff Days, fy05 - fy07
4.7.1.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.7.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06
4.7.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$1.0		2 Staff Days, fy06 - fy07
4.7.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06
4.7.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$4.8	$4.8		10 Staff Days, fy06
4.7.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06
4.7.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06
4.7.1.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$7.1	$7.1	$7.1		10 Staff Days, fy08
4.7.1.26	Establish 10C	FS-OPS	Reimb	W	$14.9	$14.9	$14.9		21 Staff Days, fy10
4.7.1.27	Establish 28C	FS-OPS	Reimb	W	$14.9	$14.9	$14.9		21 Staff Days, fy10
4.7.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$14.2	$14.2	$14.2		20 Staff Days, fy09
4.7.2	AF Support	F&E			$216.9	$218.9	$226.3	FAA hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days * times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.7.2.1	Relocate 14L	FS-OPS	Reimb	W	$14.6	$14.6	$14.6		180 Staff Days, fy06
4.7.2.2	Establish 9L	FS-OPS	Reimb	W	$16.3	$16.3	$16.3		200 Staff Days, fy08
4.7.2.3	Establish 27R	FS-OPS	Reimb	W	$13.0	$13.0	$13.0		160 Staff Days, fy08
4.7.2.4	Relocate 22R LOC	FS-OPS	Reimb	W	$1.6	$1.6	$1.6		20 Staff Days, fy06
4.7.2.5	LLWAS	FS-OPS	Reimb	W	$3.7	$3.7	$3.7		45 Staff Days, fy06 - fy08
4.7.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy07
4.7.2.7	Establish Temp RTR	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy07
4.7.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy09
4.7.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy09
4.7.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy10
4.7.2.11	Establish RTR"T"	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy09

4.7.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$11.7	$11.7	$11.7		144 Staff Days, fy06 - fy09
4.7.2.13	Establish ADSE-X	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Days, fy07
4.7.2.14	North ATCT	FS-OPS	Reimb	W	$30.1	$30.1	$30.1		370 Staff Days, fy07
4.7.2.15	Temporary ASR-9/Mode S	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.7.2.16	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$13.0	$13.0	$13.0		160 Staff Days, fy07
4.7.2.17	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$13.0	$13.0	$13.0		160 Staff Days, fy08
4.7.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$2.4	$2.4	$2.4		44 Staff Days, fy06
4.7.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$0.3	$0.3	$0.3		5 Staff Days, fy07
4.7.2.20	TRACON (C90) - Electronic Flight Data Transmission System	FS-OPS	FAA	W	$1.1	$1.1	$1.1		20 Staff Days, fy07
4.7.2.21	Existing ATCT Mods	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.7.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	W	$0.0	$0.0	$4.5		80 Staff Days, fy06
4.7.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	W	$0.0	$1.1	$1.1		20 Staff Days, fy07
4.7.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	W	$0.0	$0.9	$0.9		16 Staff Days, fy07
4.7.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	W	$0.0	$0.0	$2.9		52 Staff Days, fy06
4.7.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$17.9	$17.9	$17.9		220 Staff Days, fy09
4.7.2.27	Establish 28C	FS-OPS	Reimb	W	$17.9	$17.9	$17.9		220 Staff Days, fy10
4.7.2.28	Establish 10C	FS-OPS	Reimb	W	$14.6	$14.6	$14.6		180 Staff Days, fy10
4.8	Telecommunications	F&E			$535.2	$544.9	$564.3		
4.8.1	Telecommunication Non-Recurring Costs	F&E			$478.5	$478.5	$478.5		
4.8.1.1	RCAG/BUEC				$174.5	$174.5	$174.5		
4.8.1.1.1	RCAG (JON 64132/42/52/62)	F&E	FAA	W	$122.4	$122.4	$122.4	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.1.1.2	BUEC (JON 64252/62/72/82)	F&E	FAA	W	$52.2	$52.2	$52.2	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.1.2	JON 60994 MKE RTR&ECS	F&E	FAA	W	$67.5	$67.5	$67.5	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.1.3	JON 60974 SBN RTR&ECS	F&E	FAA	W	$113.4	$113.4	$113.4	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.1.4	JON 61004 RDVS	F&E	FAA	W	$34.0	$34.0	$34.0	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.1.5	JON 61059 C90 Freqs	F&E	FAA	W	$89.1	$89.1	$89.1	Cost Throughput based on Applicable JON, includes NRE plus 1st 2 years	
4.8.2	ANI Support	F&E			$56.7	$66.3	$85.7	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
4.8.2.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	W	$12.7	$12.7	$12.7		18 Staff Days, fy06 - fy07
4.8.2.2	Relocate 22R LOC	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.8.2.3	LLWAS	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
4.8.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.5	Establish Temp RTR	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.9	Establish RTR"T"	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.11	Establish ADSE-X	FS-OPS	Reimb	W	$2.8	$2.8	$2.8		4 Staff Days, fy06 - fy07
4.8.2.12	North ATCT - Construction	FS-OPS	Reimb	W	$14.2	$14.2	$14.2		20 Staff Days, fy06 - fy07
4.8.2.13	North ATCT - Establish 5 Positions	FS-OPS	Reimb	W	$14.2	$14.2	$14.2		20 Staff Days, fy06 - fy07
4.8.2.14	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.8.2.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.8.2.17	ATCT (Main & North) - AEFS	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.8.2.18	Existing ATCT Modifications	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
4.8.2.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06
4.8.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA		$0.0	$0.0	$0.0		-
4.8.2.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	W	$0.0	$0.0	$2.4		5 Staff Days, fy06 - fy07
4.8.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	W	$0.0	$9.7	$9.7		20 Staff Days, fy07
4.8.2.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	W	$0.0	$0.0	$7.3		15 Staff Days, fy07 - fy08
4.8.2.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	W	$0.0	$0.0	$7.3		15 Staff Days, fy06 - fy07
4.8.2.25	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$0.0	$0.0	$0.0		-
4.8.2.26	Establish 10C	FS-OPS	Reimb	W	$4.2	$4.2	$4.2		6 Staff Days, fy08 - fy10
4.8.2.27	Establish 28C	FS-OPS	Reimb	W	$4.2	$4.2	$4.2		6 Staff Days, fy08 - fy10
4.8.2.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$4.2	$4.2	$4.2		6 Staff Days, fy06
4.9	Implementation Training	F&E			$0.0	$0.0	$0.0		
5	In-Service Management (F&E)				$301.8	$301.8	$301.8		
5.10	Second Level Engineering (also captured in other WBS elements)	F&E			$301.8	$301.8	$301.8		
5.10.3	Hardware and Software Engineering Support	F&E	FAA		$301.8	$301.8	$301.8		fy06 - fy08
5.10.3.1	Establish ADSE-X	F&E	Reimb	W	$138.6	$138.6	$138.6	Based on ASDE-X Product Team Estimate	
5.10.3.1	Radar - Establish North On-Field ASR-9/Mode S	F&E			$81.6	$81.6	$81.6		
5.10.3.1.1	ASR-9 Support				$46.5	$46.5	$46.5		
5.10.3.1.1.1	Contractor Support	F&E	Reimb	W	$37.5	$37.5	$37.5	Based on email from Al Hopkins dated 8/4/05	
5.10.3.1.1.2	Contractor Travel	F&E	Reimb	W	$9.0	$9.0	$9.0	Based on email from Al Hopkins dated 8/4/05	
5.10.3.1.2	Mode S Support				$35.1	$35.1	$35.1		
5.10.3.1.2.1	Contractor Support	F&E	Reimb	W	$23.1	$23.1	$23.1	Based on email from Joe Yannone dated 8/10/05	
5.10.3.1.2.2	Contractor Travel	F&E	Reimb	W	$12.0	$12.0	$12.0	Based on email from Joe Yannone dated 8/10/05	
5.10.3.2	Radar - Establish South Field ASR-9/Mode S				$81.6	$81.6	$81.6		
5.10.3.2.1	ASR-9 Support				$46.5	$46.5	$46.5		
5.10.3.2.1.1	Contractor Support	F&E	Reimb	W	$37.5	$37.5	$37.5	Based on email from Al Hopkins dated 8/4/05	
5.10.3.2.1.2	Contractor Travel	F&E	Reimb	W	$9.0	$9.0	$9.0	Based on email from Al Hopkins dated 8/4/05	
5.10.3.2.2	Mode S Support				$35.1	$35.1	$35.1		
5.10.3.2.2.1	Contractor Support	F&E	Reimb	W	$23.1	$23.1	$23.1	Based on email from Joe Yannone dated 8/10/05	
5.10.3.2.2.2	Contractor Travel	F&E	Reimb	W	$12.0	$12.0	$12.0	Based on email from Joe Yannone dated 8/10/05	
6	Disposition	F&E			$557.6	$557.6	$557.6		
6.1	Program Management	FS-OPS			$8.5	$8.5	$8.5	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
6.1.1	Decommission ORD RTR	FS-OPS	Reimb	W	$2.1	$2.1	$2.1		3 Staff Days, fy07 - fy08

6.1.2	Decommission RTR C	FS-OPS	Reimb	W	$2.1	$2.1	$2.1		3 Staff Days, fy09
6.1.3	Decommission RTR A	FS-OPS	Reimb	W	$2.1	$2.1	$2.1		3 Staff Days, fy10
6.1.4	Decommmision RTRB	FS-OPS	Reimb	W	$2.1	$2.1	$2.1		3 Staff Days, fy09 - fy10
6.2	Decommissioning	FS-OPS			$120.6	$120.6	$120.6	FAA hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days * times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
6.2.1	Relocate 14L	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.2	Establish 9L	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.3	Establish 27R	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.4	Relocate 22R LOC	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.5	LLWAS	FS-OPS	Reimb	W	$19.6	$19.6	$19.6		241 Staff Days, fy07 - fy08
6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	W	$15.8	$15.8	$15.8		194 Staff Days, fy07
6.2.7	Establish Temp RTR	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	W	$15.8	$15.8	$15.8		194 Staff Days, fy09
6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	W	$15.8	$15.8	$15.8		194 Staff Days, fy09
6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	W	$15.8	$15.8	$15.8		194 Staff Days, fy10
6.2.11	Establish RTR"T"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	W	$11.7	$11.7	$11.7		144 Staff Days, fy06 - fy10
6.2.13	Establish ADSE-X	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.14	North ATCT	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.15	Temporary ASR-9/Mode S	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.16	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.17	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$0.7	$0.7	$0.7		12 Staff Days, fy06
6.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.20	ATCT (Main & North) - AEFS	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.21	Existing ATCT Mods	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA		$0.0	$0.0	$0.0		-
6.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$25.5	$25.5	$25.5		313 Staff Days, fy08
6.2.27	Establish 28C	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.2.28	Establish 10C	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
6.3	Engineering	FS-OPS			$133.1	$133.1	$133.1	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
6.3.1	Decommission ORD RTR	FS-OPS	Reimb	W	$33.3	$33.3	$33.3		47 Staff Days, fy07 - fy08
6.3.2	Decommission RTR C	FS-OPS	Reimb	W	$33.3	$33.3	$33.3		47 Staff Days, fy09
6.3.3	Decommission RTR A	FS-OPS	Reimb	W	$33.3	$33.3	$33.3		47 Staff Days, fy10
6.3.4	Decommmision RTRB	FS-OPS	Reimb	W	$33.3	$33.3	$33.3		47 Staff Days, fy09 - fy10
6.4	Environmental Activities	F&E			$0.0	$0.0	$0.0		
6.5	Dismantle/Removal	FS-OPS			$289.7	$289.7	$289.7	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
6.5.1	Decommission ORD RTR	FS-OPS	Reimb	W	$9.9	$9.9	$9.9		14 Staff Days, fy07 - fy08
6.5.2	Decommission RTR C	FS-OPS	Reimb	W	$9.9	$9.9	$9.9		14 Staff Days, fy09
6.5.3	Decommission RTR A	FS-OPS	Reimb	W	$9.9	$9.9	$9.9		14 Staff Days, fy10
6.5.4	Decommmision RTRB	FS-OPS	Reimb	W	$9.9	$9.9	$9.9		14 Staff Days, fy09 - fy10
6.5.5	Decommission Existing ASR-9/Mode S	F&E	Reimb	W	$250.0	$250.0	$250.0	Based on Product Team Quote for analogy to St. Louis dismantling effort	
6.6	Site Restoration/Closeout	FS-OPS			$5.7	$5.7	$5.7	ANI hourly Labor Rate ((2005 Chicago GS-13, 8 (95.2k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days, times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
6.6.1	Decommission ORD RTR	FS-OPS	Reimb	W	$1.4	$1.4	$1.4		2 Staff Days, fy07 - fy08
6.6.2	Decommission RTR C	FS-OPS	Reimb	W	$1.4	$1.4	$1.4		2 Staff Days, fy09
6.6.3	Decommission RTR A	FS-OPS	Reimb	W	$1.4	$1.4	$1.4		2 Staff Days, fy10
6.6.4	Decommmision RTRB	FS-OPS	Reimb	W	$1.4	$1.4	$1.4		2 Staff Days, fy09 - fy10
5	IN-SERVICE MANAGEMENT	OPS			$43,489.3	$50,191.6	$79,068.9		
5.1	Preventive Maintenance/Certification	FS-OPS			$4,354.4	$4,354.4	$4,354.4		
5.1.1	Preventive Maintenance/Certification	FS-OPS			$4,354.4	$4,354.4	$4,354.4		
5.1.1.1	ORD Communications SSC	FS-OPS	FAA	W	$1,362.9	$1,362.9	$1,362.9	Preventative Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))*(No. of FTE)	170k/yr, fy06 - fy13
5.1.1.2	ORD Navigation SSC	FS-OPS	FAA	W	$771.3	$771.3	$771.3	Preventative Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))*(No. of FTE)	96k/yr, fy06 - fy13
5.1.1.3	ORD Radar SSC	FS-OPS	FAA	W	$857.4	$857.4	$857.4	Preventative Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))*(No. of FTE)	107k/yr, fy06 - fy13
5.1.1.4	ORD Environmental SSC	FS-OPS	FAA	W	$1,362.9	$1,362.9	$1,362.9	Preventative Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))*(No. of FTE)	170k/yr, fy06 - fy13
5.1.2	System Management Office (SMO) Overhead	FS-OPS	FAA	W	$0.0	$0.0	$0.0		fy06 - fy13
5.1.3	FAA Academy Maintenance	FS-OPS			$0.0	$0.0	$0.0		
5.2	Corrective Maintenance	FS-OPS			$2,670.5	$2,670.5	$2,670.5		
5.2.1	Corrective Maintenance	FS-OPS			$2,670.5	$2,670.5	$2,670.5		
5.2.1.1	ORD Communications SSC	FS-OPS	FAA	W	$835.8	$835.8	$835.8	Corrective Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))*(No. of FTE)	104k/yr, fy06 - fy13
5.2.1.2	ORD Navigation SSC	FS-OPS	FAA	W	$473.0	$473.0	$473.0	Corrective Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits)))*(No. of FTE)	59k/yr, fy06 - fy13
5.2.1.3	ORD Radar SSC	FS-OPS	FAA	W	$525.8	$525.8	$525.8	Corrective Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits)))*(No. of FTE)	66k/yr, fy06 - fy13
5.2.1.4	ORD Environmental SSC	FS-OPS	FAA	W	$835.8	$835.8	$835.8	Corrective Maintenance hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits)))*(No. of FTE)	104k/yr, fy06 - fy13
5.2.2	System Management Office (SMO) Overhead	FS-OPS	FAA	W	$0.0	$0.0	$0.0		fy06 - fy13

5.2.3	FAA Academy Maintenance	FS-OPS			$0.0	$0.0	$0.0		
5.3	Modifications	OPS			$0.0	$0.0	$0.0		
5.4	Maintenance Control	OPS			$0.0	$0.0	$0.0		
5.5	Technical Teaming	OPS			$0.0	$0.0	$0.0		
5.6	Watch Standing Coverage	FS-OPS			$1,226.7	$1,226.7	$1,226.7		
5.6.1	Airway Transportation System Specialists	FS-OPS			$99.1	$99.1	$99.1	FAA hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087) * Man Hours*1/3 Backfill Rate	
5.6.1.1	Initial Watch Standing Coverage (BFOT)	FS-OPS		W	$99.1	$99.1	$99.1		
5.6.1.1.1	Radar Training	FS-OPS			$33.7	$33.7	$33.7	One Student taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.6.1.1.1.1	New Hire Training Initiative	FS-OPS	FAA	W	$9.4	$9.4	$9.4	Course # 40056	1440 Staff Hours, fy06
5.6.1.1.1.2	Radar Principles	FS-OPS	FAA	W	$4.7	$4.7	$4.7	Course # 42058	400 Staff Hours, fy06
5.6.1.1.1.3	ASR-9/Mode S Radar	FS-OPS	FAA	W	$8.4	$8.4	$8.4	Course # 40337	200 Staff Hours, fy06
5.6.1.1.1.4	Mode-S Secondary Radar	FS-OPS	FAA	W	$4.7	$4.7	$4.7	Course # 40398	360 Staff Hours, fy06
5.6.1.1.1.5	TDWR	FS-OPS	FAA	W	$3.2	$3.2	$3.2	Course # 40313	200 Staff Hours, fy06
5.6.1.1.1.6	ASDE-3/AMASS	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40609	136 Staff Hours, fy06
5.6.1.1.1.7	DBRITE	FS-OPS	FAA	W	$1.5	$1.5	$1.5	Course # 40373	80 Staff Hours, fy06
5.6.1.1.2	Navigation Training	FS-OPS			$27.0	$27.0	$27.0	Two Students taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.6.1.1.2.1	New Hire TrainingInitiative	FS-OPS	FAA	W	$9.4	$9.4	$9.4	Course # 40056	1152 Staff Hours, fy06
5.6.1.1.2.2	ILS Principles	FS-OPS	FAA	W	$3.4	$3.4	$3.4	Course # 40283	400 Staff Hours, fy06
5.6.1.1.2.3	VOR Principles	FS-OPS	FAA	W	$3.9	$3.9	$3.9	Course # 41284	144 Staff Hours, fy06
5.6.1.1.2.4	Mark 20/20 AILS	FS-OPS	FAA	W	$3.4	$3.4	$3.4	Course # 47717	168 Staff Hours, fy06
5.6.1.1.2.5	Mark 1F ILS	FS-OPS	FAA	W	$2.2	$2.2	$2.2	Course # 47716	144 Staff Hours, fy06
5.6.1.1.2.6	DME	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40258	96 Staff Hours, fy06
5.6.1.1.2.7	VOR	FS-OPS	FAA	W	$2.8	$2.8	$2.8	Course # 40286	80 Staff Hours, fy06
5.6.1.1.3	Communications Training	FS-OPS			$14.1	$14.1	$14.1	One Student taking 5 classes, ATO-F spreadsheet costs from Michael Paul	
5.6.1.1.3.1	New Hire TrainingInitiative	FS-OPS	FAA	W	$9.4	$9.4	$9.4	Course # 40056	600 Staff Hours, fy06
5.6.1.1.3.2	RDVS	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40042	400 Staff Hours, fy06
5.6.1.1.3.3	DVRS	FS-OPS	FAA	W	$0.9	$0.9	$0.9	Course # 40045	80 Staff Hours, fy06
5.6.1.1.3.4	LLWAS NE	FS-OPS	FAA	W	$0.9	$0.9	$0.9	Course # 40290	40 Staff Hours, fy06
5.6.1.1.3.5	FOTS	FS-OPS	FAA	W	$0.9	$0.9	$0.9	Course # 40158	40 Staff Hours, fy06
5.6.1.1.4	Environmental Training	FS-OPS			$24.4	$24.4	$24.4	Two Students taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.6.1.1.4.1	New Hire Training Initiative	FS-OPS	FAA	W	$9.4	$9.4	$9.4	Course # 40056	920 Staff Hours, fy06
5.6.1.1.4.2	Boilers & Chillers	FS-OPS	FAA	W	$2.8	$2.8	$2.8	Course # 40132	400 Staff Hours, fy06
5.6.1.1.4.3	MALSR	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40143	120 Staff Hours, fy06
5.6.1.1.4.4	ALSF-2	FS-OPS	FAA	W	$3.7	$3.7	$3.7	Course # 40148	80 Staff Hours, fy06
5.6.1.1.4.5	PCS Maintenance	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40149	160 Staff Hours, fy06
5.6.1.1.4.6	Kohler Engine Generator	FS-OPS	FAA	W	$1.9	$1.9	$1.9	Course # 40154	80 Staff Hours, fy06
5.6.1.1.4.7	Air Conditioning	FS-OPS	FAA	W	$2.8	$2.8	$2.8	Course # 40156	80 Staff Hours, fy06
5.6.1.2	Recurring Watch Standing Coverage	FS-OPS	FAA		$0.0	$0.0	$0.0		-
5.6.2	Air Traffic Control Specialists	FS-OPS			$1,127.6	$1,127.6	$1,127.6		
5.6.2.1	Initial Watch Standing Coverage (BFOT)	FS-OPS			$1,127.6	$1,127.6	$1,127.6		
5.6.2.1.1	O'Hare Tower (ORD)	FS-OPS	FAA	T	$140.0	$140.0	$140.0	Based on O'Hare Inputs	
5.6.2.1.2	Chicago TRACON (C90)	FS-OPS	FAA	T	$614.6	$614.6	$614.6	Based on O'Hare Inputs	
5.6.2.1.3	Chicago Center ARTCC (ZAU)	FS-OPS	FAA	T	$288.0	$288.0	$288.0	Based on O'Hare Inputs	
5.6.2.1.4	South Bend (SBN)	FS-OPS	FAA	T	$25.0	$25.0	$25.0	Based on O'Hare Inputs	
5.6.2.1.5	Milwaukee (MKE)	FS-OPS	FAA	T	$60.0	$60.0	$60.0	Based on O'Hare Inputs	
5.6.2.2	Recurring Watch Standing Coverage	FS-OPS			$0.0	$0.0	$0.0		
5.7	Program Support	FS-OPS			$274.4	$280.0	$290.7		
5.7.1	Program Planning, Authorization, Management and Control	FS-OPS			$274.4	$280.0	$290.7	FAALabor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087*8) * WBS Cost Element Specific Staff Days	-
5.7.1.1	Relocate 14L	FS-OPS	FAA	W	$18.9	$18.9	$18.9		340 Staff Days, fy06
5.7.1.2	Establish 9L	FS-OPS	FAA	W	$21.2	$21.2	$21.2		380 Staff Days, fy07 - fy08
5.7.1.3	Establish 27R	FS-OPS	FAA	W	$16.7	$16.7	$16.7		300 Staff Days, fy07 - fy08
5.7.1.4	Relocate 22R LOC	FS-OPS	FAA	W	$2.2	$2.2	$2.2		40 Staff Days, fy06 - fy07
5.7.1.5	LLWAS	FS-OPS	FAA	W	$2.5	$2.5	$2.5		45 Staff Days, fy07 - fy08
5.7.1.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy07
5.7.1.7	Establish Temp RTR	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy07
5.7.1.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy09
5.7.1.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy09
5.7.1.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy10
5.7.1.11	Establish RTR"T"	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy09
5.7.1.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	FAA	W	$26.7	$26.7	$26.7		480 Staff Days, fy06 - fy10
5.7.1.13	Establish ADSE-X	FS-OPS	FAA	W	$5.6	$5.6	$5.6		100 Staff Days, fy07
5.7.1.14	North ATCT	FS-OPS	FAA	W	$31.2	$31.2	$31.2		560 Staff Days, fy07
5.7.1.15	Temporary ASR-9/Mode S	FS-OPS	FAA	W	$6.7	$6.7	$6.7		120 Staff Days, fy06
5.7.1.16	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	FAA	W	$13.4	$13.4	$13.4		240 Staff Days, fy06 - fy07
5.7.1.17	Radar - Establish South Field ASR-9/Mode S	FS-OPS	FAA	W	$22.3	$22.3	$22.3		400 Staff Days, fy07 - fy08
5.7.1.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	W	$6.7	$6.7	$6.7		120 Staff Days, fy06
5.7.1.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	W	$0.3	$0.3	$0.3		5 Staff Days, fy06 - fy07
5.7.1.20	TRACON (C90) - Electronic Flight Data Transmission System	FS-OPS	FAA	W	$1.1	$1.1	$1.1		20 Staff Days, fy06 - fy07
5.7.1.21	Existing ATCT Mods	FS-OPS	FAA	W	$0.0	$0.0	$0.0		
5.7.1.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	W	$0.0	$0.0	$7.8		140 Staff Days, fy06
5.7.1.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	W	$0.0	$1.1	$1.1		20 Staff Days, fy06 - fy07
5.7.1.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	W	$0.0	$4.5	$4.5		80 Staff Days, fy06 - fy07
5.7.1.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	W	$0.0	$0.0	$2.9		52 Staff Days, fy06 - fy07
5.7.1.26	Extend 10L (Existing 9R Extension)	FS-OPS	FAA	W	$23.4	$23.4	$23.4		420 Staff Days, fy06
5.7.1.27	Establish 28C	FS-OPS	FAA	W	$23.4	$23.4	$23.4		420 Staff Days, fy08
5.7.1.28	Establish 10C	FS-OPS	FAA	W	$18.9	$18.9	$18.9		340 Staff Days, fy08
5.7.2	Contract Management	FS-OPS			$0.0	$0.0	$0.0		
5.8	Logistics	OPS			$1,395.0	$1,395.0	$1,446.9	Based on inputs from AML-23, ASDE-X Product Team, ASR-9/Mode S Reference Case	
5.8.1	Relocate 14L	OPS			$0.0	$0.0	$0.0		

5.8.1.1	14L ILS	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.1.2	14L ALSF 2	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.1.3	14L DME	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.2	Establish 9L	OPS			$84.9	$84.9	$84.9		
5.8.2.1	9L ILS	OPS	FAA	W	$1.4	$1.4	$1.4	9L ILS Annual Logistics Cost	0.24k/yr, fy08 - fy13
5.8.2.2	9L/27R RVR	OPS	FAA	W	$18.4	$18.4	$18.4	9L/27R RVR Annual Logistics Cost	3k/yr, fy08 - fy13
5.8.2.3	9L ALSF-2	OPS	FAA	W	$65.1	$65.1	$65.1	9L ALSF 2 Annual Logistics Cost	11k/yr, fy08 - fy13
5.8.2.4	9L/27R DME	OPS	FAA		$0.0	$0.0	$0.0		fy08 - fy13
5.8.3	Establish 27R	OPS			$66.5	$66.5	$66.5		
5.8.3.1	27R ILS	OPS	FAA	W	$1.4	$1.4	$1.4	27R ILS Annual Logistics Cost	.24k/yr, fy08 - fy13
5.8.3.2	27R ALSF-2	OPS	FAA	W	$65.1	$65.1	$65.1	27R ALSF 2 Annual Logistics Cost	11k/yr, fy08 - fy13
5.8.4	Relocate 22R LOC	OPS	FAA		$0.0	$0.0	$0.0		fy08 - fy13
5.8.5	Establish 10L (Existing 9R Extension)	OPS			$84.9	$84.9	$84.9		
5.8.5.1	10L ILS	OPS	FAA	W	$1.4	$1.4	$1.4	10L ILS Annual Logistics Cost	0.24k/yr, fy08 - fy13
5.8.5.2	10L/28R RVR	OPS	FAA	W	$18.4	$18.4	$18.4	10L/28R RVR Annual Logistics Cost	3k/yr, fy08 - fy13
5.8.5.3	10L ALSF-2	OPS	FAA	W	$65.1	$65.1	$65.1	10L ALSF 2 Annual Logistics Cost	11k/yr, fy08 - fy13
5.8.5.4	10L/28R DME	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.5.5	10L PAPI	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.6	Establish 10C	OPS			$56.6	$56.6	$56.6		
5.8.6.1	10C ILS	OPS	FAA	W	$1.0	$1.0	$1.0	10C ILS Annual Logistics Cost	0.24k/yr, fy10 - fy13
5.8.6.2	10C/28C RVR	OPS	FAA	W	$12.3	$12.3	$12.3	10C/28CRVR Annual Logistics Cost	3k/yr, fy10 - fy13
5.8.6.3	10C ALSF-2	OPS	FAA	W	$43.4	$43.4	$43.4	10C ALSF 2 Annual Logistics Cost	11k/yr, fy10 - fy13
5.8.6.4	10C/28C DME	OPS	FAA		$0.0	$0.0	$0.0		fy10 - fy13
5.8.6.5	10C PAPI	OPS	FAA		$0.0	$0.0	$0.0		fy10 - fy13
5.8.7	Establish 28C	OPS			$44.3	$44.3	$44.3		
5.8.7.1	28C ILS	OPS	FAA	W	$1.0	$1.0	$1.0	28C ILS Annual Logistics Cost	0.24k/yr, fy10 - fy13
5.8.7.2	28C ALSF-2	OPS	FAA	W	$43.4	$43.4	$43.4	28C ALSF 2 Annual Logistics Cost	11k/yr, fy10 - fy13
5.8.7.3	28C PAPI	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.8	LLWAS	OPS	FAA	W	$24.4	$24.4	$24.4	LLWAS Annual Logistics Cost	4k/yr, fy08 - fy13
5.8.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.8.13	Establish RTR "T"	OPS	FAA	W	$16.6	$16.6	$16.6	RTR Annual Logistics Cost	3k/yr, fy09 - fy13
5.8.14	Establish Temp RTR (North ATCT)	OPS	FAA	W	$23.2	$23.2	$23.2	RTR Annual Logistics Cost ; removed telco cost	3k/yr, fy07 - fy13
5.8.15	Establish Fiber Optics Transmission System (FOTS)	OPS	FAA	W	$1.2	$1.2	$1.2	FOTS Annual Logistics Cost	.3k/yr, fy010 - fy13
5.8.16	Establish ADSE-X	OPS	FAA	W	$231.4	$231.4	$231.4	ASDE-X Annual Logistics Cost	33k/yr, fy07 - fy13
5.8.17	North ATCT - Equipment	OPS	FAA	W	$350.0	$350.0	$350.0		50k/yr, fy07 - fy13
5.8.18	Establish North Field ASR-9/Mode S	OPS	FAA	W	$411.1	$411.1	$411.1	ASR-9/Mode S Radar Annual Logistics Cost	59k/yr, fy07 - fy13
5.8.19	Establish South Field ASR-9/Mode S	OPS	FAA		$0.0	$0.0	$0.0	ASR-9 Radar/Mode S Annual Logistics Cost	-
5.8.20	Airspace Redesign	OPS			$0.0	$0.0	$51.9		
5.8.20.1	TRACON (C90) RDVS	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.20.2	TRACON (C90) DVRS Expansion	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.20.3	TRACON (C90) Position Redesignation	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.20.4	ASR-11 Gateway Switch	OPS	FAA		$0.0	$0.0	$0.0		-
5.8.20.5	MKE - Establish RTR Channel (1 Frequency)	OPS	FAA	W	$0.0	$0.0	$26.5	RTR Annual Logistics Cost ; removed telco cost	3k/yr, fy06 - fy13
5.8.20.6	MKE - Establish 2 additional STARS Displays	OPS	FAA		$0.0	$0.0	$0.0	STARS Display Hardware Product Costs	fy07 - fy13
5.8.20.7	SBN - Establish RTR Channel	OPS	FAA	W	$0.0	$0.0	$23.2	RTR Annual Logistics Cost ; removed telco cost	3k/yr, fy07 - fy13
5.8.20.8	ZAU - Position Reconfiguration (4)	OPS	FAA		$0.0	$0.0	$0.0		fy07 - fy13
5.8.20.9	RCAGs (New Channels, 4 existing Sector locations)	OPS	FAA	W	$0.0	$0.0	$2.2	RCAG Annual Logistics Costs	.3k/yr, fy07 - fy13
5.8.20.10	BUECs (New Channels, 4 existing Sector locations)	OPS	FAA		$0.0	$0.0	$0.0		-
5.9	In-Service Training	FS-OPS			$114.1	$114.1	$114.1		
5.9.1	Airway Transportation System Specialists In-Service Training	FS-OPS			$114.1	$114.1	$114.1		
5.9.1.1	Radar Training	OPS			$24.0	$24.0	$24.0	One Student taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.9.1.1.1	New Hire Training Initiative	OPS	FAA	W	$6.0	$6.0	$6.0	Course # 40056	6k/yr, fy06
5.9.1.1.2	Radar Principles	OPS	FAA	W	$3.3	$3.3	$3.3	Course # 42058	3k/yr, fy06
5.9.1.1.3	ASR-9/Mode S Radar	OPS	FAA	W	$5.5	$5.5	$5.5	Course # 40337	6k/yr, fy06
5.9.1.1.4	Mode-S Secondary Radar	OPS	FAA	W	$3.3	$3.3	$3.3	Course # 40398	3k/yr, fy06
5.9.1.1.5	TDWR	OPS	FAA	W	$2.6	$2.6	$2.6	Course # 40313	3k/yr, fy06
5.9.1.1.6	ASDE-3/AMASS	OPS	FAA	W	$1.8	$1.8	$1.8	Course # 40609	2k/yr, fy06
5.9.1.1.7	DBRITE	OPS	FAA	W	$1.5	$1.5	$1.5	Course # 40373	2k/yr, fy06
5.9.1.2	Navigation Training	OPS			$41.2	$41.2	$41.2	Two Students taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.9.1.2.1	New Hire TrainingInitiative	OPS	FAA	W	$11.9	$11.9	$11.9	Course # 40056	12k/yr, fy06
5.9.1.2.2	ILS Principles	OPS	FAA	W	$5.3	$5.3	$5.3	Course # 40283	5k/yr, fy06
5.9.1.2.3	VOR Principles	OPS	FAA	W	$5.9	$5.9	$5.9	Course # 41284	6k/yr, fy06
5.9.1.2.4	Mark 20/20 AILS	OPS	FAA	W	$5.3	$5.3	$5.3	Course # 47717	5k/yr, fy06
5.9.1.2.5	Mark 1F ILS	OPS	FAA	W	$4.2	$4.2	$4.2	Course # 47716	4k/yr, fy06
5.9.1.2.6	DME	OPS	FAA	W	$3.6	$3.6	$3.6	Course # 40258	4k/yr, fy06
5.9.1.2.7	VOR	OPS	FAA	W	$4.8	$4.8	$4.8	Course # 40286	5k/yr, fy06
5.9.1.3	Communications Training	OPS			$10.9	$10.9	$10.9	One Student taking 5 classes, ATO-F spreadsheet costs from Michael Paul	
5.9.1.3.1	New Hire TrainingInitiative	OPS	FAA	W	$6.0	$6.0	$6.0	Course # 40056	6k/yr, fy06
5.9.1.3.2	RDVS	OPS	FAA	W	$1.8	$1.8	$1.8	Course # 40042	2k/yr, fy06
5.9.1.3.3	DVRS	OPS	FAA	W	$1.0	$1.0	$1.0	Course # 40045	1k/yr, fy06
5.9.1.3.4	LLWAS NE	OPS	FAA	W	$1.0	$1.0	$1.0	Course # 40290	1k/yr, fy06
5.9.1.3.5	FOTS	OPS	FAA	W	$1.0	$1.0	$1.0	Course # 40158	1k/yr, fy06
5.9.1.4	Environmental Training	OPS			$38.1	$38.1	$38.1	Two Students taking 7 classes, ATO-F spreadsheet costs from Michael Paul	
5.9.1.4.1	New Hire Training Initiative	OPS	FAA	W	$11.9	$11.9	$11.9	Course # 40056	12k/yr, fy06
5.9.1.4.2	Boilers & Chillers	OPS	FAA	W	$4.8	$4.8	$4.8	Course # 40132	5k/yr, fy06
5.9.1.4.3	MALSR	OPS	FAA	W	$3.6	$3.6	$3.6	Course # 40143	4k/yr, fy06
5.9.1.4.4	ALSF-2	OPS	FAA	W	$5.7	$5.7	$5.7	Course # 40148	6k/yr, fy06
5.9.1.4.5	PCS Maintenance	OPS	FAA	W	$3.6	$3.6	$3.6	Course # 40149	4k/yr, fy06

5.9.1.4.6	Kohler Engine Generator	OPS	FAA	W	$3.6	$3.6	$3.6	Course # 40154	4k/yr, fy06
5.9.1.4.7	Air Conditioning	OPS	FAA	W	$4.8	$4.8	$4.8	Course # 40156	5k/yr, fy06
5.9.2	Air Traffic Control Specialists In-Service Training	FS-OPS			$0.0	$0.0	$0.0		
5.10	Second Level Engineering (also captured in other WBS elements)	OPS			$3,441.8	$3,441.8	$3,441.8		
5.10.1	Program Management and Infrastructure Support	OPS			$2,830.7	$2,830.7	$2,830.7		
5.10.1.1	Radar Site / Coverage Analysis Surveys	OPS	FAA	T	$13.0	$13.0	$13.0	OMP Product Team Inputs	
5.10.1.2	Frequency Studies	OPS	FAA	T	$90.0	$90.0	$90.0	OMP Product Team Inputs	
5.10.1.3	Human-in-the-Loop Analysis	OPS	FAA	T	$860.0	$860.0	$860.0	OMP Product Team Inputs	
5.10.1.4	Jet-Blast Analysis	OPS	FAA	T	$35.0	$35.0	$35.0	OMP Product Team Inputs	
5.10.1.5	Fiber Loop Transition Study & Analysis	OPS	FAA	T	$60.0	$60.0	$60.0	OMP Product Team Inputs	
5.10.1.6	Electronic Flight Data System Analysis	OPS	FAA	T	$25.0	$25.0	$25.0	OMP Product Team Inputs	
5.10.1.7	OMP Airspace Analysis, both Enroute & Terminal	OPS	FAA	T	$0.0	$0.0	$0.0		-
5.10.1.8	Program Management Analysis	OPS	FAA	T	$187.0	$187.0	$187.0	OMP Product Team Inputs	
5.10.1.9	Explosive Blast Study, New N ATCT	OPS	FAA	T	$0.0	$0.0	$0.0		-
5.10.1.10	ORD requirements documentation analysis	OPS	FAA	T	$120.0	$120.0	$120.0	OMP Product Team Inputs	
5.10.1.11	Advanced Electronic Flight Strip (AEFS) Modeling, Analysis and Simulatio	OPS	FAA	T	$300.0	$300.0	$300.0	OMP Product Team Inputs	
5.10.1.12	Chicago NAR Planning and Studies	OPS	FAA	T	$771.0	$771.0	$771.0	OMP Product Team Inputs	
5.10.1.13	OMP cost/benefit analysis	OPS	FAA	T	$124.7	$124.7	$124.7	OMP Product Team Inputs	
5.10.1.14	Engineering Data Review information analysis	OPS	FAA	T	$125.0	$125.0	$125.0	OMP Product Team Inputs	
5.10.1.15	RDVS Mock-Up	OPS	FAA	T	$0.0	$0.0	$0.0		-
5.10.1.16	Re-site RFD ASR-11 For High & Wide	OPS	FAA	T	$0.0	$0.0	$0.0		-
5.10.1.17	Environmental Testing, Asbestos/PCBs	OPS	FAA	T	$120.0	$120.0	$120.0	OMP Product Team Inputs	
5.10.2	National Airspace System (NAS) Field Support and Restoration	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.3	Hardware and Software Engineering Support	OPS	FAA		$611.1	$611.1	$611.1	OMP Product Team Inputs	
5.10.3.1	FAA FTEs				$285.1	$285.1	$285.1		
5.10.3.1.1	Establish ADSE-X	FS-OPS	FAA	W	$260.2	$260.2	$260.2	Based on ASDE-X Product Team Estimate	33k/yr,
5.10.3.1.2	Establish North Field ASR-9/Mode S	FS-OPS	FAA	W	$12.5	$12.5	$12.5	Based on email from Joe Yannone dated 8/10/05	12k/yr, fy07
5.10.3.1.3	Establish South Field ASR-9/Mode S	FS-OPS	FAA	W	$12.5	$12.5	$12.5	Based on email from Joe Yannone dated 8/10/05	12k/yr, fy08
5.10.3.2	FAA Contractor Support				$308.0	$308.0	$308.0		
5.10.3.2.1	Establish ADSE-X	OPS	FAA	W	$308.0	$308.0	$308.0	Based on ASDE-X Product Team Estimate	fy07: 30k, fy08 - fy13: 46k/yr,
5.10.3.3	FAA Travel				$18.0	$18.0	$18.0		
5.10.3.3.1	Establish North Field ASR-9/Mode S	OPS	FAA	W	$9.0	$9.0	$9.0	Based on email from Joe Yannone dated 8/10/05	9k/yr, fy07
5.10.3.3.2	Establish South Field ASR-9/Mode S	OPS	FAA	W	$9.0	$9.0	$9.0	Based on email from Joe Yannone dated 8/10/05	9k/yr, fy08
5.10.4	Configuration Management	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.5	Process Improvement	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.6	Quality Assurance	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.7	Information System Security	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.8	Recurring NAS System Costs	OPS	FAA		$0.0	$0.0	$0.0		-
5.10.9	Software Licenses	OPS			$0.0	$0.0	$0.0		
5.11	Infrastructure Support	OPS			$3,732.6	$3,732.6	$3,750.9		
5.11.1	Hazardous Materials Handling	OPS			$0.0	$0.0	$0.0		
5.11.2	Utilities, Building and Grounds Upkeep and Maintenance	OPS			$2,145.3	$2,145.3	$2,163.7	Based on Annual System KwHr Usage * Cost per KwHr	
5.11.2.1	Relocate 14L	OPS			$0.0	$0.0	$0.0		
5.11.2.1.1	14L ILS	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.1.2	14L ALSF 2	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.1.3	14L DME	OPS	FAA		$0.0	$0.0	$0.0		-
5.11.2.2	Establish 9L	OPS			$28.9	$28.9	$28.9		
5.11.2.2.1	9L ILS	OPS	FAA	W	$8.9	$8.9	$8.9		1k/yr, fy08 - fy13
5.11.2.2.2	9L/27R RVR	OPS	FAA	W	$2.4	$2.4	$2.4		.4k/yr, fy08 - fy13
5.11.2.2.3	9L ALSF-2	OPS	FAA	W	$17.7	$17.7	$17.7		3k/yr, fy08 - fy13
5.11.2.2.4	9L/27R DME	OPS	FAA		$0.0	$0.0	$0.0		fy08 - fy13
5.11.2.3	Establish 27R	OPS			$26.6	$26.6	$26.6		
5.11.2.3.1	27R ILS	OPS	FAA	W	$8.9	$8.9	$8.9		1k/yr, fy08 - fy13
5.11.2.3.2	27R ALSF-2	OPS	FAA	W	$17.7	$17.7	$17.7		3k/yr, fy08 - fy13
5.11.2.4	Relocate 22R LOC	OPS	FAA		$0.0	$0.0	$0.0		fy08 - fy13
5.11.2.5	Establish 10L (Existing 9R Extension)	OPS			$41.4	$41.4	$41.4		
5.11.2.5.1	10L ILS	OPS	FAA	W	$8.9	$8.9	$8.9		1k/yr, fy08 - fy13
5.11.2.5.2	10L/28R RVR	OPS	FAA	W	$2.4	$2.4	$2.4		.4k/yr, fy08 - fy13
5.11.2.5.3	10L ALSF-2	OPS	FAA	W	$17.7	$17.7	$17.7		3k/yr, fy08 - fy13
5.11.2.5.4	10L/28R DME	OPS	FAA		$0.0	$0.0	$0.0		fy08 - fy13
5.11.2.5.5	10L PAPI	OPS	FAA	W	$12.4	$12.4	$12.4		2k/yr, fy08 - fy13
5.11.2.6	Establish 10C	OPS			$27.6	$27.6	$27.6		
5.11.2.6.1	10C ILS	OPS	FAA	W	$5.9	$5.9	$5.9		1k/yr, fy10 - fy13
5.11.2.6.2	10C/28C RVR	OPS	FAA	W	$1.6	$1.6	$1.6		.4k/yr, fy10 - fy13
5.11.2.6.3	10C ALSF-2	OPS	FAA	W	$11.8	$11.8	$11.8		3k/yr, fy10 - fy13
5.11.2.6.4	10C/28C DME	OPS	FAA		$0.0	$0.0	$0.0		fy10 - fy13
5.11.2.6.5	10C PAPI	OPS	FAA	W	$8.3	$8.3	$8.3		2k/yr, fy10 - fy13
5.11.2.7	Establish 28C	OPS			$26.0	$26.0	$26.0		
5.11.2.7.1	28C ILS	OPS	FAA	W	$5.9	$5.9	$5.9		1k/yr, fy10 - fy13
5.11.2.7.2	28C ALSF-2	OPS	FAA	W	$11.8	$11.8	$11.8		3k/yr, fy10 - fy13
5.11.2.7.3	28C PAPI	OPS	FAA	W	$8.3	$8.3	$8.3		2k/yr, fy10 - fy13
5.11.2.8	LLWAS	OPS	FAA	W	$2.4	$2.4	$2.4		.4k/yr, fy08 - fy13
5.11.2.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	OPS	FAA	W	$0.0	$0.0	$0.0		
5.11.2.13	Establish RTR "T"	OPS	FAA	W	$2.7	$2.7	$2.7		1k/yr, fy09 - fy13
5.11.2.14	Establish Temp RTR (North ATCT)	OPS	FAA	W	$3.8	$3.8	$3.8		1k/yr, fy07 - fy13
5.11.2.15	Establish Fiber Optics Transmission System (FOTS)	OPS	FAA		$0.0	$0.0	$0.0		fy07 - fy13
5.11.2.16	Establish ADSE-X	OPS	FAA	W	$130.9	$130.9	$130.9	Per ASDE-X Product Team Estimate	19k/yr, fy07 - fy13
5.11.2.17	North ATCT - Equipment	OPS	FAA	W	$324.4	$324.4	$324.4		46k/yr, fy07 - fy13

5.11.2.18	Establish North ASR-9/Mode S	OPS	FAA	W	$392.4	$392.4	$392.4	Per ASR-9/Mode S Reference Case	56k/yr, fy07 - fy13
5.11.2.19	Establish South Field ASR-9/Mode S	OPS	FAA	W	$0.0	$0.0	$0.0		-
5.11.2.20	Airspace Redesign	OPS			$0.0	$0.0	$18.3		
5.11.2.20.1	TRACON (C90) RDVS	OPS	FAA		$0.0	$0.0	$0.0		-
5.11.2.20.2	TRACON (C90) DVRS Expansion	OPS	FAA		$0.0	$0.0	$0.0		-
5.11.2.20.3	TRACON (C90) Position Redesignation	OPS	FAA		$0.0	$0.0	$0.0		-
5.11.2.20.4	ASR-11 Gateway Switch	OPS	FAA		$0.0	$0.0	$0.0		-
5.11.2.20.5	MKE - Establish RTR Channel (1 Frequency)	OPS	FAA	W	$0.0	$0.0	$0.9		.1k/yr, fy06 - fy13
5.11.2.20.6	MKE - Establish 2 additional STARS Displays	OPS	FAA	W	$0.0	$0.0	$1.3		.2k/yr, fy06 - fy13
5.11.2.20.7	SBN - Establish RTR Channel	OPS	FAA	W	$0.0	$0.0	$0.8		.1k/yr, fy07 - fy13
5.11.2.20.8	ZAU - Position Reconfiguration (4)	OPS	FAA		$0.0	$0.0	$0.0		fy07 - fy13
5.11.2.20.9	RCAGs (New Channels, 4 existing Sector locations)	OPS	FAA	W	$0.0	$0.0	$9.9		1k/yr, fy07 - fy13
5.11.2.20.10	BUECs (New Channels, 4 existing Sector locations)	OPS	FAA	W	$0.0	$0.0	$5.5		1k/yr, fy07 - fy13
5.11.2.21	North ATCT Building Maintenance	OPS	FAA	W	$1,138.2	$1,138.2	$1,138.2	10,326 Sq Feet * Maintenance per sq. ft ($10.19 in 2003$)* 1.5 risk escalation factor	$162K/yr, fy07-fy13
5.11.3	Telecommunications	OPS			$1,587.3	$1,587.3	$1,587.3		
5.11.3.1	Airspace Redesign-RCAG/BUEC	OPS			$513.3	$513.3	$513.3		
5.11.3.1.1	RCAG (JON 64132/42/52/62)	OPS	FAA	W	$359.9	$359.9	$359.9	Recurring Teleco Cost based on applicable JON	
5.11.3.1.2	BUEC (JON 64252/62/72/82)	OPS	FAA	W	$153.4	$153.4	$153.4	Recurring Teleco Cost based on applicable JON	
5.11.3.2	JON 60994 MKE RTR&ECS	OPS	FAA	W	$173.5	$173.5	$173.5	Recurring Teleco Cost based on applicable JON	
5.11.3.3	JON 60974 SBN RTR&ECS	OPS	FAA	W	$290.3	$290.3	$290.3	Recurring Teleco Cost based on applicable JON	
5.11.3.4	JON 61004 RDVS	OPS	FAA	W	$365.9	$365.9	$365.9	Recurring Teleco Cost based on applicable JON	
5.11.3.5	JON 61059 C90 Freqs	OPS	FAA	W	$212.4	$212.4	$212.4	Recurring Teleco Cost based on applicable JON	
5.11.3.6	Establish ADSE-X	OPS	FAA	W	$32.0	$32.0	$32.0	Recurring Teleco Cost based on applicable JON	
5.11.4	Building and Infrastructure Modernization and Improvements	OPS			$0.0	$0.0	$0.0		
5.11.5	Real Estate Management	OPS			$0.0	$0.0	$0.0		
5.11.6	Physical Security	OPS			$0.0	$0.0	$0.0		
5.12	Flight Inspections and SIAP Development	OPS			$748.1	$748.1	$748.1		
5.12.1	ATO-W AVN Flt Inspection, charting & other OPS	OPS			$690.2	$690.2	$690.2		
5.12.1.1	Flight Inspection, Charting & other Ops-Development	OPS	Reimb	W	$620.0	$620.0	$620.0	Per AVN	
5.12.1.2	Flight Inspection and Charting-Maintenance-Rnwys 9L/27R	OPS	FAA	W	$42.1	$42.1	$42.1	Per AVN Maintenance Cost Estimate (Cindy Allison)	
5.12.1.3	Flight Inspection and Charting-Maintenance-Rnwys 10C/28C	OPS	FAA	W	$28.1	$28.1	$28.1	Per AVN Maintenance Cost Estimate (Cindy Allison)	
5.12.2	Airways Facility	FS-OPS			$57.9	$57.9	$57.9	FAA hourly Labor Rate ((2005 GS-13, 5 (97.8k + 32.8% benefits))/2087) * WBS Cost Element Specific Staff Days * times Reimbursable Local and National O/H Rates (1.16 x 1.26, where applicable)	-
5.12.2.1	Relocate 14L	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		
5.12.2.2	Establish 9L	FS-OPS	Reimb	W	$7.2	$7.2	$7.2		88 Staff Hours, fy07 - fy08
5.12.2.3	Establish 27R	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Hours, fy07 - fy08
5.12.2.4	Relocate 22R LOC	FS-OPS	Reimb	W	$2.6	$2.6	$2.6		32 Staff Hours, fy06 - fy07
5.12.2.5	LLWAS	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.7	Establish Temp RTR	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.11	Establish RTR"T"	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.13	Establish ADSE-X	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.14	North ATCT	FS-OPS	Reimb	W	$0.3	$0.3	$0.3		4 Staff Hours, fy07
5.12.2.15	Temporary ASR-9/Mode S	FS-OPS	Reimb	W	$3.3	$3.3	$3.3		40 Staff Hours, fy06
5.12.2.16	Radar - Establish North On-Field ASR-9/Mode S	FS-OPS	Reimb	W	$3.3	$3.3	$3.3		40 Staff Hours, fy06 - fy07
5.12.2.17	Radar - Establish South Field ASR-9/Mode S	FS-OPS	Reimb	W	$6.5	$6.5	$6.5		80 Staff Hours, fy07 - fy08
5.12.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.20	ORD ATCT - AEFS	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.21	Existing ATCT Mods	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.24	Airspace Redesign - C90 Programming	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	Reimb		$0.0	$0.0	$0.0		-
5.12.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	W	$7.5	$7.5	$7.5		92 Staff Hours, fy09
5.12.2.27	Establish 28C	FS-OPS	Reimb	W	$7.5	$7.5	$7.5		92 Staff Hours, fy09
5.12.2.28	Establish 10C	FS-OPS	Reimb	W	$6.8	$6.8	$6.8		84 Staff Hours, fy09
5.13	System Performance Assessment	OPS			$0.0	$0.0	$0.0		
5.14	System Operations	FS-OPS			$25,531.6	$32,228.4	$61,024.8		
5.14.1	O'Hare Tower (ORD)	FS-OPS	FAA	T	$25,531.6	$25,531.6	$25,531.6	AT FTE Cost (midpoint of paybands, $119.7K) * Locality Rate*Benefits*Night Differential * # FTEs	FY06: 10 FTEs, FY07-out 16 FTEs
5.14.2	Chicago TRACON (C90)	FS-OPS	FAA	T	$0.0	$6,696.8	$26,054.7	AT FTE Cost (midpoint of paybands, $119.7K) * Locality Rate*Benefits*Night Differential * # FTEs	FY06: 12.5 FTEs, FY07-out 16 FTEs
5.14.3	Chicago Center ARTCC (ZAU)	FS-OPS	FAA		$0.0	$0.0	$0.0		FY06: 0 FTEs, FY07-out 0 FTEs
5.14.4	South Bend (SBN)	FS-OPS	FAA	T	$0.0	$0.0	$2,014.0	AT FTE Cost (midpoint of paybands, $77.1K) * Locality Rate*Benefits*Night Differential * # FTEs	FY06: 2 FTEs, FY07-out 2 FTEs
5.14.5	Milwaukee (MKE)	FS-OPS	FAA	T	$0.0	$0.0	$7,424.5	AT FTE Cost (midpoint of paybands, $94.2K) * Locality Rate*Benefits*Night Differential * # FTEs	FY06: 5.5 FTEs, FY07-out 6 FTEs
5.15	Travel To And From Sites	OPS			$0.0	$0.0	$0.0		

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
	OMP PHASE I DELTA LIFE CYCLE COST ESTIMATE				**$5,146.6**	**$42,054.3**	**$23,421.0**	**$22,901.9**	**$17,276.2**	**$13,900.2**	**$12,792.6**	**$13,402.3**	**$14,041.9**	**$164,936.9**
	Facilities & Equipment (F&E)				**$2,295.9**	**$34,398.4**	**$11,775.1**	**$11,559.4**	**$5,396.1**	**$1,679.2**				**$67,104.1**
3	**SOLUTION DEVELOPMENT**				**$2,262.9**	**$23,279.0**	**$6,229.6**	**$8,684.7**	**$1,299.1**					**$41,755.4**
3.1	Program Management				$1,206.6	$540.1	$557.8	$576.6	$596.4					$3,477.4
3.1.1	Program Planning, Authorization, Management and Control				$1,206.6	$540.1	$557.8	$576.6	$596.4					$3,477.4
3.1.1.1	Administrative	FAA	13	T	$379.3	$199.5	$202.9	$206.6	$210.5					$1,198.8
3.1.1.2	Product Team Support				$286.3	$152.9	$157.8	$163.1	$168.6					$928.7
3.1.1.2.1	FAA FTE	FAA	13	T	$204.3	$71.5	$75.1	$78.8	$82.8					$512.5
3.1.1.2.2	FFRDC Support	FAA												
3.1.1.2.3	Contractor Support	FAA	13	T	$77.0	$78.3	$79.6	$81.1	$82.6					$398.6
3.1.1.2.4	Product Team Travel	FAA	13	T	$5.0	$3.1	$3.1	$3.2	$3.2					$17.5
3.1.1.3	ATO OMP Direct Team (Chicago)				$536.2	$187.7	$197.0	$206.9	$217.2					$1,345.0
3.1.1.3.1	ATO-T	FAA	13	T	$124.4	$43.5	$45.7	$48.0	$50.4					$312.1
3.1.1.3.2	ATO-W	FAA	13	W	$228.6	$80.0	$84.0	$88.2	$92.6					$573.3
3.1.1.3.3	ATO-W AVN	Reimb	13	W	$183.2	$64.1	$67.3	$70.7	$74.2					$459.6
3.1.1.4	ANI Program Support				$4.8									$4.8
3.1.1.4.1	TRACON (C90) - RDVS Upgrade	FAA	5	W	$4.5									$4.5
3.1.1.4.2	ATCT (Main & North) - AEFS	FAA	5	W	$0.3									$0.3
3.1.1.4.3	Existing ATCT Modifications	FAA	5	W										
3.1.1.5	Contract and Grant Management (captured in other WBS elements)													
3.2	System Engineering					$155.8								$155.8
3.2.1	Infosec-Establish ADSE-X	Reimb	7	T		$155.8								$155.8
3.3	HW/SW Design, Development, Procurement, and Production				$325.0	$20,241.2	$5,671.8	$8,108.2	$702.8					$35,048.9
3.3.1	Hardware Design and Development				$325.0	$533.9	$186.2							$1,045.1
3.3.1.1	Advanced Electronic Flight Strip System (AEFS)	FAA	5	T	$325.0	$533.9	$186.2							$1,045.1
3.3.2	Software Design and Development													
3.3.3	HW/SW Integration, Assembly, Test and Checkout													
3.3.4	Production Engineering					$25.4								$25.4
3.3.4.1	MKE - Establish 2 additional STARS Maps/NG Survey	FAA	4	T		$25.4								$25.4
3.3.5	Procurement/Production					$19,681.8	$5,485.6	$8,108.2	$702.8					$33,978.3
3.3.5.1	System Hardware					$19,681.8	$5,485.6	$8,108.2	$702.8					$33,978.3
3.3.5.1.1	Relocate 14L													
3.3.5.1.1.1	14L ILS	Reimb	3	W										
3.3.5.1.1.2	14L ALSF 2	Reimb	3	W										
3.3.5.1.1.3	14L DME	Reimb												
3.3.5.1.2	Establish 9L					$1,755.3								$1,755.3
3.3.5.1.2.1	9L ILS	Reimb	6	W		$280.7								$280.7
3.3.5.1.2.2	9L/27R RVR (reuse 14L TD Equipment)	Reimb	6	W		$50.9								$50.9
3.3.5.1.2.3	9L ALSF-2	Reimb	6	W		$1,423.8								$1,423.8
3.3.5.1.2.4	9L/27R DME	Reimb												
3.3.5.1.3	Establish 27R					$1,704.5								$1,704.5
3.3.5.1.3.1	27R ILS	Reimb	6	W		$280.7								$280.7
3.3.5.1.3.2	27R ALSF-2	Reimb	6	W		$1,423.8								$1,423.8
3.3.5.1.4	Relocate 22R LOC	Reimb	9	W		$88.0								$88.0
3.3.5.1.5	Establish 10L (Existing 9R Extension)					$2,207.6								$2,207.6
3.3.5.1.5.1	10L ILS	Reimb	9	W		$280.7								$280.7
3.3.5.1.5.2	10L/28R RVR	Reimb	9	W		$376.1								$376.1
3.3.5.1.5.3	10L ALSF-2	Reimb	9	W		$1,423.8								$1,423.8
3.3.5.1.5.4	10L/28R DME	Reimb	9	W		$76.1								$76.1
3.3.5.1.5.5	10L PAPI	Reimb	9	W		$50.9								$50.9
3.3.5.1.6	Establish 10C							$2,285.5						$2,285.5
3.3.5.1.6.1	10C ILS	Reimb	12	W				$290.6						$290.6
3.3.5.1.6.2	10C/28C RVR	Reimb	12	W				$389.4						$389.4
3.3.5.1.6.3	10C ALSF-2	Reimb	12	W				$1,474.1						$1,474.1
3.3.5.1.6.4	10C/28C DME	Reimb	12	W				$78.8						$78.8
3.3.5.1.6.5	10C PAPI	Reimb	12	W				$52.6						$52.6
3.3.5.1.7	Establish 28C							$1,817.3						$1,817.3
3.3.5.1.7.1	28C ILS	Reimb	12	W				$290.6						$290.6
3.3.5.1.7.2	28C ALSF-2	Reimb	12	W				$1,474.1						$1,474.1
3.3.5.1.7.3	28C PAPI	Reimb	12	W				$52.6						$52.6
3.3.5.1.8	LLWAS	Reimb	12	T			$775.7	$363.3	$434.5					$1,573.5
3.3.5.1.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$1,596.2								$1,596.2
3.3.5.1.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W			$1,623.3							$1,623.3
3.3.5.1.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W				$1,652.6						$1,652.6
3.3.5.1.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W				$1,652.6						$1,652.6
3.3.5.1.13	Establish RTR "T"	Reimb	12	W				$73.7						$73.7
3.3.5.1.14	Establish Temp RTR (North ATCT)	Reimb	7	W		$71.2								$71.2

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
3.3.5.1.15	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$254.3	$258.6	$263.2	$268.2					$1,044.3
3.3.5.1.16	Establish ADSE-X	Reimb	7	T		$1,918.0								$1,918.0
3.3.5.1.17	Establish Integrate Control & Monitor Sys (ICAMS) (ATCTs & C90)	Reimb	5	T		$1,220.4								$1,220.4
3.3.5.1.18	North ATCT - Equipment					$2,109.3								$2,109.3
3.3.5.1.18.1	IDS-4 (5)	Reimb	7	T		$40.7								$40.7
3.3.5.1.18.2	BRITE Displays (4)	Reimb	7	T		$244.1								$244.1
3.3.5.1.18.3	Emergency Transceivers (4)	Reimb	7	W		$48.8								$48.8
3.3.5.1.18.4	Tower Voice Switch	Reimb	7	W										
3.3.5.1.18.5	FDIO	Reimb	7	T		$20.3								$20.3
3.3.5.1.18.6	Power Conditioning System (PCS)	Reimb	7	W		$1,585.0								$1,585.0
3.3.5.1.18.7	Engine Generator (SX)-Included in PCS	Reimb	7	W										
3.3.5.1.18.8	Voice Switch Bypass	Reimb	7	W		$20.3								$20.3
3.3.5.1.18.9	Electronic Flight Data Transfer System	Reimb												
3.3.5.1.18.10	RDVS Position-Related Hardware	Reimb	7	W		$150.0								$150.0
3.3.5.1.19	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	T		$2,780.7								$2,780.7
3.3.5.1.20	Establish South Field ASR-9/Mode S	Reimb	8	T			$2,828.0							$2,828.0
3.3.5.1.21	Airspace Redesign					$3,976.4								$3,976.4
3.3.5.1.21.1	TRACON (C90) RDVS	FAA	5	W		$1,332.2								$1,332.2
3.3.5.1.21.2	TRACON (C90) DVRS Expansion	FAA	5	W		$12.2								$12.2
3.3.5.1.21.3	TRACON (C90) Position Redesignation	FAA												
3.3.5.1.21.4	ASR-11 Gateway Switch	FAA												
3.3.5.1.21.5	MKE - Establish RTR Channel (1 Frequency)	FAA	4	W		$150.2								$150.2
3.3.5.1.21.6	MKE- Establish 2 additional STARS Displays	FAA	4	T		$74.4								$74.4
3.3.5.1.21.7	MKE- Establish IDS-4 (1)	FAA	4	T		$8.1								$8.1
3.3.5.1.21.8	MKE- Establish ETVS TEDs (2)	FAA	4	T		$22.4								$22.4
3.3.5.1.21.9	SBN - Establish RTR Channel	FAA	4	W		$151.4								$151.4
3.3.5.1.21.10	ZAU - Position Reconfiguration (4)	FAA	4	E		$29.1								$29.1
3.3.5.1.21.11	RCAGs (New Channels, 4 existing Sector locations)	FAA	4	W		$1,404.5								$1,404.5
3.3.5.1.21.12	BUECs (New Channels, 4 existing Sector locations)	FAA	4	W		$791.8								$791.8
3.3.5.2	System Software													
3.3.5.3	Integration, Assembly, Test and Checkout													
3.3.5.4	System Engineering & Program Management													
3.3.6	Technology Refresh													
3.4	Physical and Airspace Infrastructure Design and Development				$731.4	$39.9								$771.2
3.4.1	Facility Planning and Design				$731.4	$39.9								$771.2
3.4.1.1	ATCT Concept Design (AGL-359)	Reimb	1	W	$41.9									$41.9
3.4.1.2	Surveillance (AGL-363)	Reimb	1	W	$68.7									$68.7
3.4.1.3	RTR Relocations (AGL-370)	Reimb	1	W	$62.5									$62.5
3.4.1.4	ATCT Design Review (AGL-371)	Reimb	1	W	$431.1	$39.9								$471.0
3.4.1.5	Environmental Support (AGL-372)	Reimb	1	W	$63.6									$63.6
3.4.1.6	FOTS (AGL-396)	Reimb	1	W	$63.6									$63.6
3.4.2	Real Estate													
3.4.3	Physical Infrastructure													
3.4.4	Airspace Redesign													
3.5	Test and Evaluation (captured in other WBS elements) (captured in other WBS elements)													
3.6	Data and Documentation													
3.7	Logistics Support					$2,302.1								$2,302.1
3.7.1	Logistics Support Planning													
3.7.2	Test and Measurement Equipment Acquisition													
3.7.3	Support and Handling Equipment Acquisition													
3.7.4	Support Facilities Construction/Conversion/Expansion													
3.7.5	Support Equipment Acquisition / Modification					$192.5								$192.5
3.7.5.1	Establish ASDE-X	Reimb	7	T		$67.6								$67.6
3.7.5.2	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	T		$124.9								$124.9
3.7.6	Support Facilities and Equipment Maintenance													
3.7.7	Initial Spares and Repair Parts Acquisition					$2,109.6								$2,109.6
3.7.7.1	Establish ASDE-X	Reimb	7	T		$337.7								$337.7
3.7.7.2	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	T		$1,772.0								$1,772.0
3.7.8	Initial Training													
4	**IMPLEMENTATION**				**$33.0**	**$11,045.8**	**$5,315.3**	**$2,732.0**	**$3,659.7**	**$1,586.0**				**$24,371.7**
4.1	Program Management					$1,251.0	$1,164.4	$1,125.0	$1,224.8	$1,194.5				$5,959.6
4.1.1	Program Planning, Authorization, Management and Control					$1,251.0	$1,164.4	$1,125.0	$1,224.8	$1,194.5				$5,959.6
4.1.1.1	Administrative	FAA	13	T		$132.0	$134.2	$136.7	$139.2	$141.9				$684.0
4.1.1.2	Product Team Support					$297.9	$310.1	$322.9	$336.3	$350.4				$1,617.6
4.1.1.2.1	FAA FTE	FAA	13	T		$214.5	$225.3	$236.5	$248.3	$260.8				$1,185.4
4.1.1.2.2	FFRDC Support	FAA												
4.1.1.2.3	Contractor Support	FAA	13	T		$78.3	$79.6	$81.1	$82.6	$84.2				$405.8

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
4.1.1.2.4	Product Team Travel	FAA	13	T		$5.1	$5.2	$5.3	$5.4	$5.5				$26.4
4.1.1.3	ATO OMP Direct Team (Chicago)					$563.0	$591.1	$620.7	$651.7	$684.3				$3,110.9
4.1.1.3.1	ATO-T	FAA	13	T		$130.6	$137.2	$144.0	$151.2	$158.8				$721.9
4.1.1.3.2	ATO-W	FAA	13	W		$240.0	$252.0	$264.6	$277.8	$291.7				$1,326.0
4.1.1.3.3	ATO-W AVN	Reimb	13	W		$192.4	$202.0	$212.1	$222.7	$233.8				$1,063.0
4.1.1.4	ANI Program Support					$258.1	$129.0	$44.8	$97.5	$17.8				$547.1
4.1.1.4.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$100.3	$39.0							$139.3
4.1.1.4.2	Relocate 22R LOC	Reimb	9	W		$7.6								$7.6
4.1.1.4.3	LLWAS	Reimb	9	W			$5.6	$1.9						$7.5
4.1.1.4.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$4.3	$3.6							$7.9
4.1.1.4.5	Establish Temp RTR	Reimb	7	W		$1.4	$3.4							$4.8
4.1.1.4.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W				$5.2	$3.5					$8.7
4.1.1.4.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W			$2.3	$5.7	$0.5					$8.5
4.1.1.4.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W				$1.9	$5.9	$1.1				$8.9
4.1.1.4.9	Establish RTR"T"	Reimb	12	W		$4.6								$4.6
4.1.1.4.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$4.7	$4.2							$8.9
4.1.1.4.11	Establish ADSE-X	Reimb	7	W		$5.9	$6.2							$12.1
4.1.1.4.12	North ATCT - Construction	Reimb	7	W		$28.8	$8.0							$36.8
4.1.1.4.13	North ATCT - Establish 5 Positions	Reimb	7	W		$9.9	$15.6							$25.5
4.1.1.4.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$15.6	$8.1							$23.7
4.1.1.4.15	TRACON (C90) - RDVS Upgrade	FAA	5	W		$3.1								$3.1
4.1.1.4.16	TRACON (C90) - DVRS Expansion	FAA	5	W		$1.4	$2.4							$3.9
4.1.1.4.17	ATCT (Main & North) - AEFS	FAA	5	W		$0.9	$0.5							$1.4
4.1.1.4.18	Existing ATCT Modifications	FAA	5	W										
4.1.1.4.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$3.6								$3.6
4.1.1.4.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA	4	W		$1.7	$3.6							$5.3
4.1.1.4.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$1.7	$2.0							$3.7
4.1.1.4.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W			$11.0							$11.0
4.1.1.4.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W			$2.2	$2.3						$4.5
4.1.1.4.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$1.0	$3.3							$4.3
4.1.1.4.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W		$15.6	$8.0							$23.6
4.1.1.4.26	Establish 10C	Reimb	12	W				$13.9	$43.7	$8.3				$65.9
4.1.1.4.27	Establish 28C	Reimb	12	W				$13.9	$43.8	$8.4				$66.0
4.1.1.4.28	Extend 10L (Existing 9R Extension)	Reimb	12	W		$45.8								$45.8
4.1.2	Contract Management													
4.1.3	Human Resources Planning and Staffing													
4.2	Engineering				$29.9	$2,898.2	$1,323.5	$491.4	$979.6	$175.2				$5,897.9
4.2.1	Site Survey & Design-ANI				$29.9	$2,885.6	$1,323.5	$491.4	$979.6	$175.2				$5,885.3
4.2.1.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$1,093.5	$424.7							$1,518.1
4.2.1.2	Relocate 22R LOC	Reimb	9	W		$10.7								$10.7
4.2.1.3	LLWAS	Reimb	9	W			$38.4	$13.4						$51.8
4.2.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$66.4	$54.8							$121.1
4.2.1.5	Establish Temp RTR	Reimb	7	W		$18.6	$45.5							$64.1
4.2.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W				$79.7	$53.5					$133.2
4.2.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W			$34.9	$86.4	$8.3					$129.6
4.2.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W				$28.8	$90.7	$17.3				$136.8
4.2.1.9	Establish RTR"T"	Reimb	12	W		$98.6								$98.6
4.2.1.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$43.6	$39.0							$82.6
4.2.1.11	Establish ADSE-X	Reimb	7	W		$15.8	$16.5							$32.3
4.2.1.12	North ATCT - Construction	Reimb	7	W		$418.1	$116.7							$534.8
4.2.1.13	North ATCT - Establish 5 Positions	Reimb	7	W		$72.2	$113.7							$186.0
4.2.1.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$190.8	$98.7							$289.5
4.2.1.15	TRACON (C90) - RDVS Upgrade	FAA	5	W	$29.9	$20.9								$50.8
4.2.1.16	TRACON (C90) - DVRS Expansion	FAA	5	W		$4.1	$7.0							$11.1
4.2.1.17	ATCT (Main & North) - AEFS	FAA												
4.2.1.18	Existing ATCT Modifications	FAA	5	W										
4.2.1.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$82.5								$82.5
4.2.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA	4	W		$11.9	$25.4							$37.3
4.2.1.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$38.8	$45.9							$84.7
4.2.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W			$115.2							$115.2
4.2.1.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W			$19.5	$20.4						$39.9
4.2.1.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$9.3	$29.2							$38.5
4.2.1.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W		$190.3	$98.4							$288.8
4.2.1.26	Establish 10C	Reimb	12	W				$131.2	$413.3	$78.9				$623.4
4.2.1.27	Establish 28C	Reimb	12	W				$131.4	$413.9	$79.0				$624.2
4.2.1.28	Extend 10L (Existing 9R Extension)	Reimb	9	W		$499.5								$499.5
4.2.2	Site Survey & Design-Prime Contractor Support					$12.7								$12.7

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
4.2.2.1	MKE - Establish 2 additional STARS Displays	FAA	4	T		$12.7								$12.7
4.2.3	Site Software Adaptation													
4.3	Environmental and Occupational Safety and Health Compliance				$3.0	$35.4	$19.8							$58.2
4.3.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W										
4.3.2	Relocate 22R LOC	Reimb	9	W										
4.3.3	LLWAS	Reimb	12	W										
4.3.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W										
4.3.5	Establish Temp RTR	Reimb	7	W										
4.3.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W										
4.3.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W										
4.3.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W										
4.3.9	Establish RTR"T"	Reimb	12	W										
4.3.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W										
4.3.11	Establish ADSE-X	Reimb												
4.3.12	North ATCT - Construction	Reimb	7	W										
4.3.13	North ATCT - Establish 5 Positions	Reimb	7	W		$1.2	$2.0							$3.2
4.3.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$15.6	$8.1							$23.7
4.3.15	TRACON (C90) - RDVS Upgrade	FAA	5	W	$3.0	$2.1								$5.1
4.3.16	TRACON (C90) - DVRS Expansion	FAA												
4.3.17	ATCT (Main & North) - AEFS	FAA												
4.3.18	Existing ATCT Modifications	FAA	5	W										
4.3.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$0.5								$0.5
4.3.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA	4	W		$0.2	$0.4							$0.5
4.3.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$0.2	$0.3							$0.5
4.3.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W			$1.1							$1.1
4.3.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W										
4.3.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W										
4.3.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W		$15.6	$8.0							$23.6
4.3.26	Establish 10C	Reimb	12	W										
4.3.27	Establish 28C	Reimb	12	W										
4.3.28	Extend 10L (Existing 9R Extension)	Reimb	9	W										
4.4	Site Selection and Acquisition													
4.5	Construction					$2,888.5	$1,087.4	$371.6	$724.0	$11.5				$5,083.0
4.5.1	North ATCT Construction	Reimb	7	W										
4.5.2	ANI Contruction					$2,005.6	$1,087.4	$371.6	$724.0	$11.5				$4,200.1
4.5.2.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$698.9	$271.4							$970.3
4.5.2.2	Relocate 22R LOC	Reimb	9	W		$25.2								$25.2
4.5.2.3	LLWAS	Reimb	9	W			$18.5	$19.4	$19.2					$57.2
4.5.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$44.2	$36.5							$80.7
4.5.2.5	Establish Temp RTR	Reimb	7	W		$13.2	$32.4							$45.7
4.5.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W				$53.1	$35.7					$88.8
4.5.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W			$23.3	$57.6	$5.5					$86.4
4.5.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W				$19.2	$60.5	$11.5				$91.2
4.5.2.9	Establish RTR"T"	Reimb	12	W				$50.2						$50.2
4.5.2.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$12.5	$13.1	$13.8	$14.4					$53.8
4.5.2.11	Establish ADSE-X	Reimb												
4.5.2.12	North ATCT - Construction	Reimb	7	W		$716.0	$199.8							$915.8
4.5.2.13	North ATCT - Establish 5 Positions	Reimb	7	W		$57.0	$89.8							$146.8
4.5.2.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$109.2	$56.5							$165.7
4.5.2.15	TRACON (C90) - RDVS Upgrade	FAA												
4.5.2.16	TRACON (C90) - DVRS Expansion	FAA												
4.5.2.17	ATCT (Main & North) - AEFS	FAA												
4.5.2.18	Existing ATCT Modifications	FAA	5	W										
4.5.2.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$58.8								$58.8
4.5.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA												
4.5.2.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$27.6	$32.7							$60.3
4.5.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA												
4.5.2.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W		$14.9	$15.6							$30.5
4.5.2.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$7.4	$23.5							$30.9
4.5.2.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W		$108.9	$56.3							$165.2
4.5.2.26	Establish 10C	Reimb	12	W				$79.0	$294.2					$373.2
4.5.2.27	Establish 28C	Reimb	12	W				$79.1	$294.6					$373.7
4.5.2.28	Extend 10L (Existing 9R Extension)	Reimb	9	W		$111.7	$217.9							$329.6
4.5.3	Prime Contractor Support					$882.9								$882.9
4.5.3.1	Establish ASDE-X	Reimb	7	T		$882.9								$882.9
4.6	Site Preparation, Installation, Test, and Checkout					$3,338.5	$1,558.6	$624.2	$646.0	$108.5				$6,275.8
4.6.1	ANI Support					$2,652.8	$1,203.8	$504.4	$617.9	$102.0				$5,080.9

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
4.6.1.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$635.3	$246.7							$882.1
4.6.1.2	Relocate 22R LOC	Reimb	9	W		$48.1								$48.1
4.6.1.3	LLWAS	Reimb	12	W		$3.8	$4.0	$4.9	$4.4					$17.0
4.6.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$57.3	$47.2							$104.5
4.6.1.5	Establish Temp RTR	Reimb	7	W			$46.3							$46.3
4.6.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W				$68.8	$46.2					$115.0
4.6.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W			$36.6	$74.6						$111.2
4.6.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W					$104.3	$14.9				$119.3
4.6.1.9	Establish RTR"T"	Reimb	12	W				$56.1						$56.1
4.6.1.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$5.9	$6.2	$6.5	$6.9					$25.6
4.6.1.11	Establish ADSE-X	Reimb	7	W		$81.1	$85.2							$166.3
4.6.1.12	North ATCT - Construction	Reimb	7	W		$582.4	$162.5							$744.9
4.6.1.13	North ATCT - Establish 5 Positions	Reimb	7	W		$33.8	$53.2							$87.0
4.6.1.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$274.5	$142.0							$416.5
4.6.1.15	TRACON (C90) - RDVS Upgrade	FAA	5	W		$350.6								$350.6
4.6.1.16	TRACON (C90) - DVRS Expansion	FAA	5	W		$10.2								$10.2
4.6.1.17	ATCT (Main & North) - AEFS	FAA	5	W		$2.1	$3.7							$5.9
4.6.1.18	Existing ATCT Modifications	FAA	5	W										
4.6.1.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$58.8								$58.8
4.6.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA	4	W		$9.9	$21.0							$30.9
4.6.1.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$27.6	$32.7							$60.3
4.6.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W		$164.6								$164.6
4.6.1.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W		$11.0	$11.5							$22.5
4.6.1.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$5.5	$17.3							$22.8
4.6.1.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W			$287.5	$148.7						$436.2
4.6.1.26	Establish 10C	Reimb	12	W				$72.4	$227.9	$43.5				$343.8
4.6.1.27	Establish 28C	Reimb	12	W				$72.5	$228.2	$43.6				$344.3
4.6.1.28	Extend 10L (Existing 9R Extension)	Reimb	9	W		$290.2								$290.2
4.6.2	AF Support					$97.6	$154.5	$119.9	$28.1	$6.5				$406.5
4.6.2.1	Relocate 14L	Reimb	3	W		$19.1								$19.1
4.6.2.2	Establish 9L	Reimb	6	W			$4.1	$17.4						$21.6
4.6.2.3	Establish 27R	Reimb	6	W			$3.8	$16.0						$19.8
4.6.2.4	Relocate 22R LOC	Reimb	9	W		$0.3	$1.3							$1.6
4.6.2.5	LLWAS	Reimb	6	W			$8.8	$12.8						$21.6
4.6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W			$4.5							$4.5
4.6.2.7	Establish Temp RTR	Reimb	7	W			$12.0							$12.0
4.6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W					$5.0					$5.0
4.6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W					$5.0					$5.0
4.6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W						$5.2				$5.2
4.6.2.11	Establish RTR"T"	Reimb	12	W					$13.2					$13.2
4.6.2.12	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$3.2	$4.4	$4.6	$4.9	$1.2				$18.4
4.6.2.13	Establish ADSE-X	Reimb	7	W			$11.1							$11.1
4.6.2.14	North ATCT	Reimb	7	W			$37.9							$37.9
4.6.2.15	Temporary ASR-9/Mode S	Reimb												
4.6.2.16	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$18.0	$38.4							$56.5
4.6.2.17	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W		$43.4	$22.5							$65.9
4.6.2.18	TRACON (C90) - RDVS Upgrade	FAA	5	W		$3.8								$3.8
4.6.2.19	TRACON (C90) - DVRS Expansion	FAA	5	W		$0.5	$0.4							$1.0
4.6.2.20	ORD ATCT - AEFS	FAA	5	W		$2.2	$3.5							$5.7
4.6.2.21	Existing ATCT Mods	FAA	5	W										
4.6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FAA	4	W		$3.6								$3.6
4.6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FAA	4	W		$0.4	$0.4							$0.7
4.6.2.24	Airspace Redesign - C90 Programming	FAA	5	W		$1.4	$1.1							$2.5
4.6.2.25	Airspace Redesign - RCAGs, BUECs	FAA	4	W		$1.8	$0.3							$2.1
4.6.2.26	Extend 10L (Existing 9R Extension)	Reimb	9	W				$23.6						$23.6
4.6.2.27	Establish 28C	Reimb	12	W				$23.6						$23.6
4.6.2.28	Establish 10C	Reimb	12	W				$21.8						$21.8
4.6.3	Prime Contractor Support					$588.1	$200.4							$788.4
4.6.3.1	MKE - Establish 2 additional STARS Displays	FAA	4	T		$176.1								$176.1
4.6.3.2	TRACON (C90) RDVS	FAA	5	W		$215.0								$215.0
4.6.3.3	Establish ADSE-X	Reimb	7	T		$197.0	$200.4							$397.4
4.7	Joint Acceptance Inspection/Commissioning/Closeout				$0.1	$106.6	$120.0	$113.2	$78.3	$94.9				$513.1
4.7.1	ANI Support				$0.1	$74.7	$40.4	$58.0	$27.0	$43.7				$243.9
4.7.1.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$15.1		$33.8						$49.0
4.7.1.2	Relocate 22R LOC	Reimb	9	W		$22.9								$22.9
4.7.1.3	LLWAS	Reimb	12	W		$1.5	$1.5	$1.1						$4.1
4.7.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W		$3.9								$3.9

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
4.7.1.5	Establish Temp RTR	Reimb	7	W			$4.1							$4.1
4.7.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W					$4.5					$4.5
4.7.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W				$4.3						$4.3
4.7.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W						$4.7				$4.7
4.7.1.9	Establish RTR"T"	Reimb	12	W					$4.4					$4.4
4.7.1.10	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$0.0	$0.2	$0.2	$0.4					$0.9
4.7.1.11	Establish ADSE-X	Reimb	7	W				$4.3						$4.3
4.7.1.12	North ATCT - Construction	Reimb	7	W			$20.1	$5.6						$25.8
4.7.1.13	North ATCT - Establish 5 Positions	Reimb	7	W			$13.0							$13.0
4.7.1.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W		$7.8								$7.8
4.7.1.15	TRACON (C90) - RDVS Upgrade	FAA	5	W		$7.3								$7.3
4.7.1.16	TRACON (C90) - DVRS Expansion	FAA	5	W			$0.6							$0.6
4.7.1.17	ATCT (Main & North) - AEFS	FAA	5	W	$0.1	$0.3	$0.2							$0.6
4.7.1.18	Existing ATCT Modifications	FAA	5	W										
4.7.1.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$2.6								$2.6
4.7.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA	4	W		$0.3	$0.7							$1.1
4.7.1.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$2.6								$2.6
4.7.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W		$5.2								$5.2
4.7.1.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W		$2.6								$2.6
4.7.1.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$2.6								$2.6
4.7.1.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W				$8.5						$8.5
4.7.1.26	Establish 10C	Reimb	12	W						$19.5				$19.5
4.7.1.27	Establish 28C	Reimb	12	W						$19.5				$19.5
4.7.1.28	Extend 10L (Existing 9R Extension)	Reimb	9	W					$17.7					$17.7
4.7.2	AF Support					$31.9	$79.6	$55.3	$51.3	$51.2				$269.2
4.7.2.1	Relocate 14L	Reimb	3	W		$15.8								$15.8
4.7.2.2	Establish 9L	Reimb	6	W				$19.4						$19.4
4.7.2.3	Establish 27R	Reimb	6	W				$15.5						$15.5
4.7.2.4	Relocate 22R LOC	Reimb	9	W		$1.8								$1.8
4.7.2.5	LLWAS	Reimb	6	W		$1.3	$1.4	$1.5						$4.2
4.7.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W			$7.4							$7.4
4.7.2.7	Establish Temp RTR	Reimb	7	W			$7.4							$7.4
4.7.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W					$8.1					$8.1
4.7.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W					$8.1					$8.1
4.7.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W						$8.5				$8.5
4.7.2.11	Establish RTR"T"	Reimb	12	W					$8.1					$8.1
4.7.2.12	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$2.4	$3.3	$3.5	$4.5					$13.7
4.7.2.13	Establish ADSE-X	Reimb	7	W			$7.4							$7.4
4.7.2.14	North ATCT	Reimb	7	W			$34.1							$34.1
4.7.2.15	Temporary ASR-9/Mode S	Reimb												
4.7.2.16	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W			$14.8							$14.8
4.7.2.17	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W				$15.5						$15.5
4.7.2.18	TRACON (C90) - RDVS Upgrade	FAA	5	W		$2.6								$2.6
4.7.2.19	TRACON (C90) - DVRS Expansion	FAA	5	W			$0.3							$0.3
4.7.2.20	TRACON (C90) - Electronic Flight Data Transmission System	FAA	5	W			$1.3							$1.3
4.7.2.21	Existing ATCT Mods	FAA	5	W										
4.7.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FAA	4	W		$4.8								$4.8
4.7.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FAA	4	W			$1.3							$1.3
4.7.2.24	Airspace Redesign - C90 Programming	FAA	5	W			$1.0							$1.0
4.7.2.25	Airspace Redesign - RCAGs, BUECs	FAA	4	W		$3.1								$3.1
4.7.2.26	Extend 10L (Existing 9R Extension)	Reimb	9	W					$22.4					$22.4
4.7.2.27	Establish 28C	Reimb	12	W						$23.5				$23.5
4.7.2.28	Establish 10C	Reimb	12	W						$19.2				$19.2
4.8	Telecommunications					$527.6	$41.6	$6.5	$7.0	$1.3				$584.0
4.8.1	Telecommunication (Non-Recurring Costs + 2 Years Recurring)					$486.7								$486.7
4.8.1.1	RCAG/BUEC					$177.5								$177.5
4.8.1.1.1	RCAG (JON 64132/42/52/62)	FAA	4	W		$124.4								$124.4
4.8.1.1.2	BUEC (JON 64252/62/72/82)	FAA	4	W		$53.0								$53.0
4.8.1.2	JON 60994 MKE RTR&ECS	FAA	4	W		$68.6								$68.6
4.8.1.3	JON 60974 SBN RTR&ECS	FAA	4	W		$115.4								$115.4
4.8.1.4	JON 61004 RDVS	FAA	5	W		$34.6								$34.6
4.8.1.5	JON 61059 C90 Freqs	FAA	5	W		$90.6								$90.6
4.8.2	ANI Support					$40.9	$41.6	$6.5	$7.0	$1.3				$97.4
4.8.2.1	Relocate 14L, Establish 9L, 27R	Reimb	6	W		$10.0	$3.9							$13.9
4.8.2.2	Relocate 22R LOC	Reimb												
4.8.2.3	LLWAS	Reimb												
4.8.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W										

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
4.8.2.5	Establish Temp RTR	Reimb	7	W										
4.8.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W										
4.8.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W										
4.8.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W										
4.8.2.9	Establish RTR"T"	Reimb	12	W										
4.8.2.10	Establish Fiber Optics Transmission System (FOTS)	Reimb		W										
4.8.2.11	Establish ADSE-X	Reimb	7	W		$1.6	$1.7							$3.2
4.8.2.12	North ATCT - Construction	Reimb	7	W		$12.8	$3.6							$16.4
4.8.2.13	North ATCT - Establish 5 Positions	Reimb	7	W		$6.2	$9.8							$16.0
4.8.2.14	Radar - Establish North On-Field ASR-9/Mode S	Reimb	8	W										
4.8.2.15	TRACON (C90) - RDVS Upgrade	FAA												
4.8.2.16	TRACON (C90) - DVRS Expansion	FAA												
4.8.2.17	ATCT (Main & North) - AEFS	FAA												
4.8.2.18	Existing ATCT Modifications	FAA	5	W										
4.8.2.19	Airspace Redesign - Establish RTR @ MKE	FAA	4	W		$2.6								$2.6
4.8.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FAA												
4.8.2.21	Airspace Redesign - Establish RTR @ SBN	FAA	4	W		$1.2	$1.4							$2.6
4.8.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FAA	4	W			$11.0							$11.0
4.8.2.23	Airspace Redesign - Establish 4 RCAG Channels	FAA	4	W			$4.1	$4.3						$8.4
4.8.2.24	Airspace Redesign - Establish 4 BUEC Channels	FAA	4	W		$2.0	$6.2							$8.1
4.8.2.25	Radar - Establish South Field ASR-9/Mode S	Reimb	8	W										
4.8.2.26	Establish 10C	Reimb	12	W				$1.1	$3.5	$0.7				$5.3
4.8.2.27	Establish 28C	Reimb	12	W				$1.1	$3.5	$0.7				$5.3
4.8.2.28	Extend 10L (Existing 9R Extension)	Reimb	9	W		$4.6								$4.6
4.9	Implementation Training													
5	**In-Service Management (F&E)**					**$70.5**	**$155.7**	**$85.9**						**$312.0**
5.1	Second Level Engineering (also captured in other WBS elements)					$70.5	$155.7	$85.9						$312.0
5.10.3	Hardware and Software Engineering Support					$70.5	$155.7	$85.9						$312.0
5.11.3.1	Establish ADSE-X	Reimb	7	W		$70.5	$71.7							$142.2
5.11.3.1	Radar - Establish North On-Field ASR-9/Mode S						$84.0							$84.0
5.11.3.1.1	ASR-9 Support						$48.1							$48.1
5.11.3.1.1.1	Contractor Support	Reimb	8	W			$38.8							$38.8
5.11.3.1.1.2	Contractor Travel	Reimb	8	W			$9.3							$9.3
5.11.3.1.2	Mode S Support						$35.9							$35.9
5.11.3.1.2.1	Contractor Support	Reimb	8	W			$23.9							$23.9
5.11.3.1.2.2	Contractor Travel	Reimb	8	W			$12.0							$12.0
5.11.3.2	Radar - Establish South Field ASR-9/Mode S							$85.9						$85.9
5.11.3.2.1	ASR-9 Support							$49.0						$49.0
5.11.3.2.1.1	Contractor Support	Reimb	8	W				$39.5						$39.5
5.11.3.2.1.2	Contractor Travel	Reimb	8	W				$9.5						$9.5
5.11.3.2.2	Mode S Support							$36.9						$36.9
5.11.3.2.2.1	Contractor Support	Reimb	8	W				$24.3						$24.3
5.11.3.2.2.2	Contractor Travel	Reimb	8	W				$12.6						$12.6
6	**Disposition**					**$3.1**	**$74.5**	**$56.8**	**$437.3**	**$93.2**				**$664.9**
6.1	Program Management						$2.0	$0.4	$4.9	$3.3				$10.5
6.1.1	Decommission ORD RTR	Reimb	6	W			$2.0	$0.4						$2.4
6.1.2	Decommission RTR C	Reimb	12	W					$2.7					$2.7
6.1.3	Decommission RTR A	Reimb	12	W						$2.8				$2.8
6.1.4	Decommmision RTRB	Reimb	12	W					$2.2	$0.5				$2.7
6.2	Decommissioning					$3.1	$30.5	$47.3	$43.1	$21.6				$145.7
6.2.1	Relocate 14L	Reimb												
6.2.2	Establish 9L	Reimb												
6.2.3	Establish 27R	Reimb												
6.2.4	Relocate 22R LOC	Reimb												
6.2.5	LLWAS	Reimb	9	W			$9.3	$13.5						$22.9
6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb	6	W			$17.9							$17.9
6.2.7	Establish Temp RTR	Reimb												
6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb	12	W					$19.7					$19.7
6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb	12	W					$19.7					$19.7
6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb	12	W						$20.7				$20.7
6.2.11	Establish RTR"T"	Reimb												
6.2.12	Establish Fiber Optics Transmission System (FOTS)	Reimb	11	W		$2.4	$3.3	$3.5	$3.7	$0.9				$13.8
6.2.13	Establish ADSE-X	Reimb												
6.2.14	North ATCT	Reimb												
6.2.15	Temporary ASR-9/Mode S	Reimb												
6.2.16	Radar - Establish North On-Field ASR-9/Mode S	Reimb												
6.2.17	Radar - Establish South Field ASR-9/Mode S	Reimb												

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
6.2.18	TRACON (C90) - RDVS Upgrade	FAA	5	W		$0.7								$0.7
6.2.19	TRACON (C90) - DVRS Expansion	FAA												
6.2.20	ATCT (Main & North) - AEFS	FAA												
6.2.21	Existing ATCT Mods	FAA												
6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FAA												
6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FAA												
6.2.24	Airspace Redesign - C90 Programming	FAA												
6.2.25	Airspace Redesign - RCAGs, BUECs	FAA												
6.2.26	Extend 10L (Existing 9R Extension)	Reimb	9	W				$30.3						$30.3
6.2.27	Establish 28C	Reimb												
6.2.28	Establish 10C	Reimb												
6.3	Engineering						$31.3	$6.7	$76.0	$51.0				$165.0
6.3.1	Decommission ORD RTR	Reimb	6	W			$31.3	$6.7						$38.0
6.3.2	Decommission RTR C	Reimb	12	W					$41.6					$41.6
6.3.3	Decommission RTR A	Reimb	12	W						$43.6				$43.6
6.3.4	Decommmision RTRB	Reimb	12	W					$34.4	$7.4				$41.8
6.4	Environmental Activities													
6.5	Dismantle/Removal						$9.3	$2.0	$310.1	$15.2				$336.6
6.5.1	Decommission ORD RTR	Reimb	6	W			$9.3	$2.0						$11.3
6.5.2	Decommission RTR C	Reimb	12	W					$12.4					$12.4
6.5.3	Decommission RTR A	Reimb	12	W						$13.0				$13.0
6.5.4	Decommmision RTRB	Reimb	12	W					$10.3	$2.2				$12.5
6.5.5	Decommission Existing ASR-9/Mode S	Reimb	8	W					$287.5					$287.5
6.6	Site Restoration/Closeout						$1.3	$0.3	$3.2	$2.2				$7.0
6.6.1	Decommission ORD RTR	Reimb	6	W			$1.3	$0.3						$1.6
6.6.2	Decommission RTR C	Reimb	12	W					$1.8					$1.8
6.6.3	Decommission RTR A	Reimb	12	W						$1.9				$1.9
6.6.4	Decommmision RTRB	Reimb	12	W					$1.5	$0.3				$1.8
5	**IN-SERVICE MANAGEMENT**				**$2,850.7**	**$7,655.9**	**$11,645.9**	**$11,342.5**	**$11,880.0**	**$12,221.0**	**$12,792.6**	**$13,402.3**	**$14,041.9**	**$97,832.8**
5.1	Preventive Maintenance/Certification					$589.7	$619.1	$650.1	$682.6	$716.7	$752.6	$790.2	$829.7	$5,630.6
5.1.1	Preventive Maintenance/Certification					$589.7	$619.1	$650.1	$682.6	$716.7	$752.6	$790.2	$829.7	$5,630.6
5.1.1.1	ORD Communications SSC	FAA	14	W		$184.6	$193.8	$203.5	$213.6	$224.3	$235.5	$247.3	$259.7	$1,762.3
5.1.1.2	ORD Navigation SSC	FAA	14	W		$104.4	$109.7	$115.1	$120.9	$127.0	$133.3	$140.0	$147.0	$997.3
5.1.1.3	ORD Radar SSC	FAA	14	W		$116.1	$121.9	$128.0	$134.4	$141.1	$148.2	$155.6	$163.4	$1,108.7
5.1.1.4	ORD Environmental SSC	FAA	14	W		$184.6	$193.8	$203.5	$213.6	$224.3	$235.5	$247.3	$259.7	$1,762.3
5.1.2	System Management Office (SMO) Overhead	FAA	14	W										
5.1.3	FAA Academy Maintenance													
5.2	Corrective Maintenance					$361.6	$379.7	$398.7	$418.6	$439.6	$461.5	$484.6	$508.8	$3,453.2
5.2.1	Corrective Maintenance					$361.6	$379.7	$398.7	$418.6	$439.6	$461.5	$484.6	$508.8	$3,453.2
5.2.1.1	ORD Communications SSC	FAA	14	W		$113.2	$118.8	$124.8	$131.0	$137.6	$144.5	$151.7	$159.3	$1,080.8
5.2.1.2	ORD Navigation SSC	FAA	14	W		$64.1	$67.3	$70.6	$74.2	$77.9	$81.8	$85.8	$90.1	$611.7
5.2.1.3	ORD Radar SSC	FAA	14	W		$71.2	$74.8	$78.5	$82.4	$86.6	$90.9	$95.4	$100.2	$680.0
5.2.1.4	ORD Environmental SSC	FAA	14	W		$113.2	$118.8	$124.8	$131.0	$137.6	$144.5	$151.7	$159.3	$1,080.8
5.2.2	System Management Office (SMO) Overhead	FAA	14	W										
5.2.3	FAA Academy Maintenance													
5.3	Modifications													
5.4	Maintenance Control													
5.5	Technical Teaming													
5.6	Watch Standing Coverage					$258.6	$1,080.9							$1,339.6
5.6.1	Airway Transportation System Specialists					$104.1								$104.1
5.6.1.1	Initial Watch Standing Coverage (BFOT)		14	W		$104.1								$104.1
5.6.1.1.1	Radar Training					$35.4								$35.4
5.6.1.1.1.1	New Hire Training Initiative	FAA	14	W		$9.8								$9.8
5.6.1.1.1.2	Radar Principles	FAA	14	W		$4.9								$4.9
5.6.1.1.1.3	ASR-9/Mode S Radar	FAA	14	W		$8.9								$8.9
5.6.1.1.1.4	Mode-S Secondary Radar	FAA	14	W		$4.9								$4.9
5.6.1.1.1.5	TDWR	FAA	14	W		$3.3								$3.3
5.6.1.1.1.6	ASDE-3/AMASS	FAA	14	W		$2.0								$2.0
5.6.1.1.1.7	DBRITE	FAA	14	W		$1.6								$1.6
5.6.1.1.2	Navigation Training					$28.3								$28.3
5.6.1.1.2.1	New Hire TrainingInitiative	FAA	14	W		$9.8								$9.8
5.6.1.1.2.2	ILS Principles	FAA	14	W		$3.5								$3.5
5.6.1.1.2.3	VOR Principles	FAA	14	W		$4.1								$4.1
5.6.1.1.2.4	Mark 20/20 AILS	FAA	14	W		$3.5								$3.5
5.6.1.1.2.5	Mark 1F ILS	FAA	14	W		$2.4								$2.4
5.6.1.1.2.6	DME	FAA	14	W		$2.0								$2.0
5.6.1.1.2.7	VOR	FAA	14	W		$3.0								$3.0

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
5.6.1.1.3	Communications Training					$14.8								$14.8
5.6.1.1.3.1	New Hire TrainingInitiative	FAA	14	W		$9.8								$9.8
5.6.1.1.3.2	RDVS	FAA	14	W		$2.0								$2.0
5.6.1.1.3.3	DVRS	FAA	14	W		$1.0								$1.0
5.6.1.1.3.4	LLWAS NE	FAA	14	W		$1.0								$1.0
5.6.1.1.3.5	FOTS	FAA	14	W		$1.0								$1.0
5.6.1.1.4	Environmental Training					$25.6								$25.6
5.6.1.1.4.1	New Hire Training Initiative	FAA	14	W		$9.8								$9.8
5.6.1.1.4.2	Boilers & Chillers	FAA	14	W		$3.0								$3.0
5.6.1.1.4.3	MALSR	FAA	14	W		$2.0								$2.0
5.6.1.1.4.4	ALSF-2	FAA	14	W		$3.9								$3.9
5.6.1.1.4.5	PCS Maintenance	FAA	14	W		$2.0								$2.0
5.6.1.1.4.6	Kohler Engine Generator	FAA	14	W		$2.0								$2.0
5.6.1.1.4.7	Air Conditioning	FAA	14	W		$3.0								$3.0
5.6.1.2	Recurring Watch Standing Coverage	FAA												
5.6.2	Air Traffic Control Specialists					$154.6	$1,080.9							$1,235.5
5.6.2.1	Initial Watch Standing Coverage (BFOT)					$154.6	$1,080.9							$1,235.5
5.6.2.1.1	O'Hare Tower (ORD)	FAA	5	T			$154.4							$154.4
5.6.2.1.2	Chicago TRACON (C90)	FAA	5	T			$677.6							$677.6
5.6.2.1.3	Chicago Center ARTCC (ZAU)	FAA	4	T		$154.6	$155.2							$309.8
5.6.2.1.4	South Bend (SBN)	FAA	4	T			$27.6							$27.6
5.6.2.1.5	Milwaukee (MKE)	FAA	4	T			$66.2							$66.2
5.6.2.2	Recurring Watch Standing Coverage													
5.7	Program Support					$87.2	$106.4	$106.4	$29.7	$9.5				$339.2
5.7.1	Program Planning, Authorization, Management and Control					$87.2	$106.4	$106.4	$29.7	$9.5				$339.2
5.7.1.1	Relocate 14L	FAA	3	W		$20.7								$20.7
5.7.1.2	Establish 9L	FAA	6	W			$4.9	$20.4						$25.3
5.7.1.3	Establish 27R	FAA	6	W			$3.8	$16.1						$20.0
5.7.1.4	Relocate 22R LOC	FAA	9	W		$0.5	$2.0							$2.5
5.7.1.5	LLWAS	FAA	9	W			$1.2	$1.8						$3.0
5.7.1.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FAA	6	W			$6.4							$6.4
5.7.1.7	Establish Temp RTR	FAA	7	W			$6.4							$6.4
5.7.1.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FAA	12	W					$7.1					$7.1
5.7.1.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FAA	12	W					$7.1					$7.1
5.7.1.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FAA	12	W						$7.4				$7.4
5.7.1.11	Establish RTR"T"	FAA	12	W					$7.1					$7.1
5.7.1.12	Establish Fiber Optics Transmission System (FOTS)	FAA	11	W		$5.6	$7.7	$8.1	$8.5	$2.1				$31.9
5.7.1.13	Establish ADSE-X	FAA	7	W			$6.4							$6.4
5.7.1.14	North ATCT	FAA	7	W			$35.9							$35.9
5.7.1.15	Temporary ASR-9/Mode S	FAA	8	W		$7.3								$7.3
5.7.1.16	Radar - Establish North On-Field ASR-9/Mode S	FAA	8	W		$4.8	$10.3							$15.1
5.7.1.17	Radar - Establish South Field ASR-9/Mode S	FAA	8	W			$17.2	$8.9						$26.0
5.7.1.18	TRACON (C90) - RDVS Upgrade	FAA	5	W		$7.3								$7.3
5.7.1.19	TRACON (C90) - DVRS Expansion	FAA	5	W		$0.2	$0.1							$0.3
5.7.1.20	TRACON (C90) - Electronic Flight Data Transmission System	FAA	5	W		$0.5	$0.8							$1.3
5.7.1.21	Existing ATCT Mods	FAA	5	W										
5.7.1.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FAA	4	W		$8.5								$8.5
5.7.1.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FAA	4	W		$0.6	$0.6							$1.3
5.7.1.24	Airspace Redesign - C90 Programming	FAA	5	W		$2.8	$2.2							$5.0
5.7.1.25	Airspace Redesign - RCAGs, BUECs	FAA	4	W		$2.7	$0.5							$3.2
5.7.1.26	Extend 10L (Existing 9R Extension)	FAA	9	W		$25.6								$25.6
5.7.1.27	Establish 28C	FAA	12	W				$28.2						$28.2
5.7.1.28	Establish 10C	FAA	12	W				$22.9						$22.9
5.7.2	Contract Management													
5.8	Logistics					$3.4	$157.2	$205.8	$213.3	$245.2	$249.9	$254.7	$259.5	$1,589.0
5.8.1	Relocate 14L													
5.8.1.1	14L ILS	FAA	14	W										
5.8.1.2	14L ALSF 2	FAA	14	W										
5.8.1.3	14L DME	FAA												
5.8.2	Establish 9L							$14.9	$15.2	$15.5	$15.8	$16.1	$16.4	$93.7
5.8.2.1	9L ILS	FAA	14	W				$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$1.6
5.8.2.2	9L/27R RVR	FAA	14	W				$3.2	$3.3	$3.4	$3.4	$3.5	$3.5	$20.3
5.8.2.3	9L ALSF-2	FAA	14	W				$11.4	$11.6	$11.9	$12.1	$12.3	$12.5	$71.8
5.8.2.4	9L/27R DME	FAA												
5.8.3	Establish 27R							$11.7	$11.9	$12.1	$12.3	$12.6	$12.8	$73.4
5.8.3.1	27R ILS	FAA	14	W				$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$1.6
5.8.3.2	27R ALSF-2	FAA	14	W				$11.4	$11.6	$11.9	$12.1	$12.3	$12.5	$71.8

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
5.8.4	Relocate 22R LOC	FAA												
5.8.5	Establish 10L (Existing 9R Extension)							$14.9	$15.2	$15.5	$15.8	$16.1	$16.4	$93.7
5.8.5.1	10L ILS	FAA	14	W				$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$1.6
5.8.5.2	10L/28R RVR	FAA	14	W				$3.2	$3.3	$3.4	$3.4	$3.5	$3.5	$20.3
5.8.5.3	10L ALSF-2	FAA	14	W				$11.4	$11.6	$11.9	$12.1	$12.3	$12.5	$71.8
5.8.5.4	10L/28R DME	FAA												
5.8.5.5	10L PAPI	FAA												
5.8.6	Establish 10C									$15.5	$15.8	$16.1	$16.4	$63.7
5.8.6.1	10C ILS	FAA	14	W						$0.3	$0.3	$0.3	$0.3	$1.1
5.8.6.2	10C/28C RVR	FAA	14	W						$3.4	$3.4	$3.5	$3.5	$13.8
5.8.6.3	10C ALSF-2	FAA	14	W						$11.9	$12.1	$12.3	$12.5	$48.8
5.8.6.4	10C/28C DME	FAA												
5.8.6.5	10C PAPI	FAA												
5.8.7	Establish 28C									$12.1	$12.3	$12.6	$12.8	$49.9
5.8.7.1	28C ILS	FAA	14	W						$0.3	$0.3	$0.3	$0.3	$1.1
5.8.7.2	28C ALSF-2	FAA	14	W						$11.9	$12.1	$12.3	$12.5	$48.8
5.8.7.3	28C PAPI	FAA												
5.8.8	LLWAS	FAA	14	W				$4.3	$4.4	$4.4	$4.5	$4.6	$4.7	$26.9
5.8.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FAA	14	W										
5.8.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FAA	14	W										
5.8.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FAA	14	W										
5.8.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FAA	14	W										
5.8.13	Establish RTR "T"	FAA	14	W					$3.6	$3.6	$3.7	$3.8	$3.8	$18.4
5.8.14	Establish Temp RTR (North ATCT)	FAA	14	W			$3.4	$3.5	$3.6	$3.6	$3.7	$3.8	$3.8	$25.4
5.8.15	Establish Fiber Optics Transmission System (FOTS)	FAA	14	W						$0.3	$0.3	$0.3	$0.4	$1.4
5.8.16	Establish ADSE-X	FAA	14	W			$34.2	$34.8	$35.5	$36.1	$36.8	$37.5	$38.2	$253.2
5.8.17	North ATCT - Equipment	FAA	14	W			$51.7	$52.6	$53.6	$54.7	$55.7	$56.8	$57.8	$383.0
5.8.18	Establish North Field ASR-9/Mode S	FAA	14	W			$60.7	$61.8	$63.0	$64.2	$65.4	$66.7	$67.9	$449.8
5.8.19	Establish South Field ASR-9/Mode S	FAA												
5.8.20	Airspace Redesign					$3.4	$7.2	$7.3	$7.4	$7.6	$7.7	$7.9	$8.0	$56.5
5.8.20.1	TRACON (C90) RDVS	FAA												
5.8.20.2	TRACON (C90) DVRS Expansion	FAA												
5.8.20.3	TRACON (C90) Position Redesignation	FAA												
5.8.20.4	ASR-11 Gateway Switch	FAA												
5.8.20.5	MKE - Establish RTR Channel (1 Frequency)	FAA	14	W		$3.4	$3.4	$3.5	$3.6	$3.6	$3.7	$3.8	$3.8	$28.7
5.8.20.6	MKE - Establish 2 additional STARS Displays	FAA												
5.8.20.7	SBN - Establish RTR Channel	FAA	14	W			$3.4	$3.5	$3.6	$3.6	$3.7	$3.8	$3.8	$25.4
5.8.20.8	ZAU - Position Reconfiguration (4)	FAA												
5.8.20.9	RCAGs (New Channels, 4 existing Sector locations)	FAA	14	W			$0.3	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4	$2.4
5.8.20.10	BUECs (New Channels, 4 existing Sector locations)	FAA												
5.9	In-Service Training					$116.1								$116.1
5.9.1	Airway Transportation System Specialists In-Service Training					$116.1								$116.1
5.9.1.1	Radar Training					$24.4								$24.4
5.9.1.1.1	New Hire Training Initiative	FAA	14	W		$6.1								$6.1
5.9.1.1.2	Radar Principles	FAA	14	W		$3.4								$3.4
5.9.1.1.3	ASR-9/Mode S Radar	FAA	14	W		$5.6								$5.6
5.9.1.1.4	Mode-S Secondary Radar	FAA	14	W		$3.4								$3.4
5.9.1.1.5	TDWR	FAA	14	W		$2.6								$2.6
5.9.1.1.6	ASDE-3/AMASS	FAA	14	W		$1.8								$1.8
5.9.1.1.7	DBRITE	FAA	14	W		$1.5								$1.5
5.9.1.2	Navigation Training					$41.9								$41.9
5.9.1.2.1	New Hire TrainingInitiative	FAA	14	W		$12.1								$12.1
5.9.1.2.2	ILS Principles	FAA	14	W		$5.4								$5.4
5.9.1.2.3	VOR Principles	FAA	14	W		$6.0								$6.0
5.9.1.2.4	Mark 20/20 AILS	FAA	14	W		$5.4								$5.4
5.9.1.2.5	Mark 1F ILS	FAA	14	W		$4.3								$4.3
5.9.1.2.6	DME	FAA	14	W		$3.7								$3.7
5.9.1.2.7	VOR	FAA	14	W		$4.9								$4.9
5.9.1.3	Communications Training					$11.1								$11.1
5.9.1.3.1	New Hire TrainingInitiative	FAA	14	W		$6.1								$6.1
5.9.1.3.2	RDVS	FAA	14	W		$1.8								$1.8
5.9.1.3.3	DVRS	FAA	14	W		$1.1								$1.1
5.9.1.3.4	LLWAS NE	FAA	14	W		$1.1								$1.1
5.9.1.3.5	FOTS	FAA	14	W		$1.1								$1.1
5.9.1.4	Environmental Training					$38.7								$38.7
5.9.1.4.1	New Hire Training Initiative	FAA	14	W		$12.1								$12.1
5.9.1.4.2	Boilers & Chillers	FAA	14	W		$4.9								$4.9

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
5.9.1.4.3	MALSR	FAA	14	W		$3.7								$3.7
5.9.1.4.4	ALSF-2	FAA	14	W		$5.8								$5.8
5.9.1.4.5	PCS Maintenance	FAA	14	W		$3.7								$3.7
5.9.1.4.6	Kohler Engine Generator	FAA	14	W		$3.7								$3.7
5.9.1.4.7	Air Conditioning	FAA	14	W		$4.9								$4.9
5.9.2	Air Traffic Control Specialists In-Service Training													
5.10	Second Level Engineering (also captured in other WBS elements)				$2,830.7	$34.2	$90.8	$110.2	$89.1	$92.0	$95.1	$98.2	$101.5	$3,541.7
5.10.1	Program Management and Infrastructure Support				$2,830.7									$2,830.7
5.10.1.1	Radar Site / Coverage Analysis Surveys	FAA	2	T	$13.0									$13.0
5.10.1.2	Frequency Studies	FAA	2	T	$90.0									$90.0
5.10.1.3	Human-in-the-Loop Analysis	FAA	2	T	$860.0									$860.0
5.10.1.4	Jet-Blast Analysis	FAA	2	T	$35.0									$35.0
5.10.1.5	Fiber Loop Transition Study & Analysis	FAA	2	T	$60.0									$60.0
5.10.1.6	Electronic Flight Data System Analysis	FAA	2	T	$25.0									$25.0
5.10.1.7	OMP Airspace Analysis, both Enroute & Terminal	FAA	2	T										
5.10.1.8	Program Management Analysis	FAA	2	T	$187.0									$187.0
5.10.1.9	Explosive Blast Study, New N ATCT	FAA	2	T										
5.10.1.10	ORD requirements documentation analysis	FAA	2	T	$120.0									$120.0
5.10.1.11	Advanced Electronic Flight Strip (AEFS) Modeling, Analysis and Simulation	FAA	2	T	$300.0									$300.0
5.10.1.12	Chicago NAR Planning and Studies	FAA	2	T	$771.0									$771.0
5.10.1.13	OMP cost/benefit analysis	FAA	2	T	$124.7									$124.7
5.10.1.14	Engineering Data Review information analysis	FAA	2	T	$125.0									$125.0
5.10.1.15	RDVS Mock-Up	FAA	2	T										
5.10.1.16	Re-site RFD ASR-11 For High & Wide	FAA	2	T										
5.10.1.17	Environmental Testing, Asbestos/PCBs	FAA	2	T	$120.0									$120.0
5.10.2	National Airspace System (NAS) Field Support and Restoration	FAA												
5.10.3	Hardware and Software Engineering Support					$34.2	$90.8	$110.2	$89.1	$92.0	$95.1	$98.2	$101.5	$711.0
5.10.3.1	FAA FTEs					$34.2	$49.6	$52.1	$39.5	$41.5	$43.6	$45.8	$48.1	$354.3
5.10.3.1.1	Establish ADSE-X	FAA	14	W		$34.2	$35.9	$37.7	$39.5	$41.5	$43.6	$45.8	$48.1	$326.1
5.10.3.1.2	Establish North Field ASR-9/Mode S	FAA	14	W			$13.7							$13.7
5.10.3.1.3	Establish South Field ASR-9/Mode S	FAA	14	W				$14.4						$14.4
5.10.3.2	FAA Contractor Support						$31.9	$48.6	$49.6	$50.5	$51.5	$52.4	$53.4	$337.9
5.10.3.2.1	Establish ADSE-X	FAA	14	W			$31.9	$48.6	$49.6	$50.5	$51.5	$52.4	$53.4	$337.9
5.10.3.3	FAA Travel						$9.3	$9.5						$18.8
5.10.3.3.1	Establish North Field ASR-9/Mode S	FAA	14	W			$9.3							$9.3
5.10.3.3.2	Establish South Field ASR-9/Mode S	FAA	14	W				$9.5						$9.5
5.10.4	Configuration Management	FAA												
5.10.5	Process Improvement	FAA												
5.10.6	Quality Assurance	FAA												
5.10.7	Information System Security	FAA												
5.10.8	Recurring NAS System Costs	FAA												
5.10.9	Software Licenses													
5.11	Infrastructure Support					$0.3	$296.7	$592.4	$611.1	$637.3	$649.4	$661.8	$674.3	$4,123.2
5.11.1	Hazardous Materials Handling													
5.11.2	Utilities, Building and Grounds Upkeep and Maintenance					$0.3	$296.7	$319.4	$326.1	$346.9	$353.5	$360.2	$367.1	$2,370.2
5.11.2.1	Relocate 14L													
5.11.2.1.1	14L ILS	FAA	14	W										
5.11.2.1.2	14L ALSF 2	FAA	14	W										
5.11.2.1.3	14L DME	FAA												
5.11.2.2	Establish 9L							$5.1	$5.2	$5.3	$5.4	$5.5	$5.6	$32.0
5.11.2.2.1	9L ILS	FAA	14	W				$1.6	$1.6	$1.6	$1.6	$1.7	$1.7	$9.8
5.11.2.2.2	9L/27R RVR	FAA	14	W				$0.4	$0.4	$0.4	$0.4	$0.4	$0.5	$2.6
5.11.2.2.3	9L ALSF-2	FAA	14	W				$3.1	$3.2	$3.2	$3.3	$3.4	$3.4	$19.6
5.11.2.2.4	9L/27R DME	FAA												
5.11.2.3	Establish 27R							$4.7	$4.8	$4.8	$4.9	$5.0	$5.1	$29.4
5.11.2.3.1	27R ILS	FAA	14	W				$1.6	$1.6	$1.6	$1.6	$1.7	$1.7	$9.8
5.11.2.3.2	27R ALSF-2	FAA	14	W				$3.1	$3.2	$3.2	$3.3	$3.4	$3.4	$19.6
5.11.2.4	Relocate 22R LOC	FAA												
5.11.2.5	Establish 10L (Existing 9R Extension)							$7.3	$7.4	$7.5	$7.7	$7.8	$8.0	$45.7
5.11.2.5.1	10L ILS	FAA	14	W				$1.6	$1.6	$1.6	$1.6	$1.7	$1.7	$9.8
5.11.2.5.2	10L/28R RVR	FAA	14	W				$0.4	$0.4	$0.4	$0.4	$0.4	$0.5	$2.6
5.11.2.5.3	10L ALSF-2	FAA	14	W				$3.1	$3.2	$3.2	$3.3	$3.4	$3.4	$19.6
5.11.2.5.4	10L/28R DME	FAA												
5.11.2.5.5	10L PAPI	FAA	14	W				$2.2	$2.2	$2.3	$2.3	$2.3	$2.4	$13.7
5.11.2.6	Establish 10C									$7.5	$7.7	$7.8	$8.0	$31.0
5.11.2.6.1	10C ILS	FAA	14	W						$1.6	$1.6	$1.7	$1.7	$6.6
5.11.2.6.2	10C/28C RVR	FAA	14	W						$0.4	$0.4	$0.4	$0.5	$1.8

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
5.11.2.6.3	10C ALSF-2	FAA	14	W						$3.2	$3.3	$3.4	$3.4	$13.3
5.11.2.6.4	10C/28C DME	FAA												
5.11.2.6.5	10C PAPI	FAA	14	W						$2.3	$2.3	$2.3	$2.4	$9.3
5.11.2.7	Establish 28C									$7.1	$7.2	$7.4	$7.5	$29.2
5.11.2.7.1	28C ILS	FAA	14	W						$1.6	$1.6	$1.7	$1.7	$6.6
5.11.2.7.2	28C ALSF-2	FAA	14	W						$3.2	$3.3	$3.4	$3.4	$13.3
5.11.2.7.3	28C PAPI	FAA	14	W						$2.3	$2.3	$2.3	$2.4	$9.3
5.11.2.8	LLWAS	FAA	14	W				$0.4	$0.4	$0.4	$0.4	$0.5	$0.5	$2.7
5.11.2.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FAA	14	W										
5.11.2.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FAA	14	W										
5.11.2.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FAA	14	W										
5.11.2.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FAA	14	W										
5.11.2.13	Establish RTR "T"	FAA	14	W					$0.6	$0.6	$0.6	$0.6	$0.6	$3.0
5.11.2.14	Establish Temp RTR (North ATCT)	FAA	14	W			$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$4.1
5.11.2.15	Establish Fiber Optics Transmission System (FOTS)	FAA												
5.11.2.16	Establish ADSE-X	FAA	14	W			$19.3	$19.7	$20.1	$20.5	$20.8	$21.2	$21.6	$143.3
5.11.2.17	North ATCT - Equipment	FAA	14	W			$47.9	$48.8	$49.7	$50.7	$51.6	$52.6	$53.6	$355.0
5.11.2.18	Establish North ASR-9/Mode S	FAA	14	W			$58.0	$59.0	$60.1	$61.3	$62.5	$63.6	$64.9	$429.4
5.11.2.19	Establish South Field ASR-9/Mode S	FAA	14	W										
5.11.2.20	Airspace Redesign					$0.3	$2.7	$2.7	$2.8	$2.8	$2.9	$2.9	$3.0	$20.1
5.11.2.20.1	TRACON (C90) RDVS	FAA												
5.11.2.20.2	TRACON (C90) DVRS Expansion	FAA												
5.11.2.20.3	TRACON (C90) Position Redesignation	FAA												
5.11.2.20.4	ASR-11 Gateway Switch	FAA												
5.11.2.20.5	MKE - Establish RTR Channel (1 Frequency)	FAA	14	W		$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.9
5.11.2.20.6	MKE - Establish 2 additional STARS Displays	FAA	14	W		$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$1.4
5.11.2.20.7	SBN - Establish RTR Channel	FAA	14	W			$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.8
5.11.2.20.8	ZAU - Position Reconfiguration (4)	FAA												
5.11.2.20.9	RCAGs (New Channels, 4 existing Sector locations)	FAA	14	W			$1.5	$1.5	$1.5	$1.6	$1.6	$1.6	$1.6	$10.9
5.11.2.20.10	BUECs (New Channels, 4 existing Sector locations)	FAA	14	W			$0.8	$0.8	$0.8	$0.9	$0.9	$0.9	$0.9	$6.0
5.11.2.21	North ATCT Building Maintenance	FAA	14	W			$168.2	$171.2	$174.5	$177.8	$181.2	$184.6	$188.1	$1,245.5
5.11.3	Telecommunications							$272.9	$285.0	$290.4	$295.9	$301.5	$307.3	$1,753.0
5.11.3.1	Airspace Redesign-RCAG/BUEC							$90.1	$91.8	$93.5	$95.3	$97.1	$99.0	$566.8
5.11.3.1.1	RCAG (JON 64132/42/52/62)	FAA	14	W				$63.2	$64.4	$65.6	$66.8	$68.1	$69.4	$397.4
5.11.3.1.2	BUEC (JON 64252/62/72/82)	FAA	14	W				$26.9	$27.4	$28.0	$28.5	$29.0	$29.6	$169.4
5.11.3.2	JON 60994 MKE RTR&ECS	FAA	14	W				$30.4	$31.0	$31.6	$32.2	$32.8	$33.4	$191.5
5.11.3.3	JON 60974 SBN RTR&ECS	FAA	14	W				$50.9	$51.9	$52.9	$53.9	$54.9	$56.0	$320.5
5.11.3.4	JON 61004 RDVS	FAA	$14.000	W				$64.2	$65.4	$66.7	$67.9	$69.2	$70.5	$404.0
5.12.1.3	Flight Inspection and Charting-Maintenance-Rnwys 10C/28C	FAA	$14.000	W						$7.7	$7.8	$8.0	$8.1	$31.6
5.12.2	Airways Facility					$12.4	$13.4	$15.8	$27.7					$69.3
5.12.2.1	Relocate 14L	Reimb	$3.000	W		$7.1								$7.1
5.12.2.2	Establish 9L	Reimb	$6.000	W			$1.6	$6.9						$8.6
5.12.2.3	Establish 27R	Reimb	$6.000	W			$1.5	$6.3						$7.8
5.12.2.4	Relocate 22R LOC	Reimb	$9.000	W		$0.6	$2.4							$3.0
5.12.2.5	LLWAS	Reimb												
5.12.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	Reimb												
5.12.2.7	Establish Temp RTR	Reimb												
5.12.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	Reimb												
5.12.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	Reimb												
5.12.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	Reimb												
5.12.2.11	Establish RTR"T"	Reimb												
5.12.2.12	Establish Fiber Optics Transmission System (FOTS)	Reimb												
5.12.2.13	Establish ADSE-X	Reimb												
5.12.2.14	North ATCT	Reimb	$7.000	W			$0.4							$0.4
5.12.2.15	Temporary ASR-9/Mode S	Reimb	$8.000	W		$3.6								$3.6
5.12.2.16	Radar - Establish North On-Field ASR-9/Mode S	Reimb	$8.000	W		$1.2	$2.5							$3.7
5.12.2.17	Radar - Establish South Field ASR-9/Mode S	Reimb	$8.000	W			$5.0	$2.6						$7.6
5.12.2.18	TRACON (C90) - RDVS Upgrade	Reimb												
5.12.2.19	TRACON (C90) - DVRS Expansion	Reimb												
5.12.2.20	ORD ATCT - AEFS	Reimb												
5.12.2.21	Existing ATCT Mods	Reimb												
5.12.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	Reimb												
5.12.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	Reimb												
5.12.2.24	Airspace Redesign - C90 Programming	Reimb												
5.12.2.25	Airspace Redesign - RCAGs, BUECs	Reimb												
5.12.2.26	Extend 10L (Existing 9R Extension)	Reimb	$9.000	W					$9.5					$9.5
5.12.2.27	Establish 28C	Reimb	$12.000	W					$9.5					$9.5

WBS/Item	Cost Element	Funding Source	Milestone	ATO Org	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
5.12.2.28	Establish 10C	Reimb	$12.000	W					$8.7					$8.7
5.13	System Performance Assessment													
5.14	System Operations					$6,111.1	$8,694.7	$9,129.5	$9,585.9	$10,065.2	$10,568.5	$11,096.9	$11,651.8	$76,903.7
5.14.1	O'Hare Tower (ORD)	FAA	$14.000	T		$2,197.4	$3,691.6	$3,876.2	$4,070.0	$4,273.5	$4,487.2	$4,711.5	$4,947.1	$32,254.5
5.14.2	Chicago TRACON (C90)	FAA	$14.000	T		$2,746.7	$3,691.6	$3,876.2	$4,070.0	$4,273.5	$4,487.2	$4,711.5	$4,947.1	$32,803.9
5.14.3	Chicago Center ARTCC (ZAU)	FAA												
5.14.4	South Bend (SBN)	FAA	$14.000	T		$264.3	$277.5	$291.4	$306.0	$321.3	$337.4	$354.2	$371.9	$2,524.1
5.14.5	Milwaukee (MKE)	FAA	$14.000	T		$902.7	$1,034.0	$1,085.7	$1,139.9	$1,196.9	$1,256.8	$1,319.6	$1,385.6	$9,321.2
5.15	Travel To And From Sites													
5.14	System Operations				$6,111.1	$8,694.7	$9,129.5	$9,585.9	$10,065.2	$10,568.5	$11,096.9	$11,651.8	$76,903.7	
5.14.1	O'Hare Tower (ORD)	14	T		$2,197.4	$3,691.6	$3,876.2	$4,070.0	$4,273.5	$4,487.2	$4,711.5	$4,947.1	$32,254.5	
5.14.2	Chicago TRACON (C90)	14	T		$2,746.7	$3,691.6	$3,876.2	$4,070.0	$4,273.5	$4,487.2	$4,711.5	$4,947.1	$32,803.9	
5.14.3	Chicago Center ARTCC (ZAU)													
5.14.4	South Bend (SBN)	14	T		$264.3	$277.5	$291.4	$306.0	$321.3	$337.4	$354.2	$371.9	$2,524.1	
5.14.5	Milwaukee (MKE)	14	T		$902.7	$1,034.0	$1,085.7	$1,139.9	$1,196.9	$1,256.8	$1,319.6	$1,385.6	$9,321.2	
5.15	Travel To And From Sites													

Cost Risk Analysis

Risk ranges provided by the OMP team were utilized to address the uncertainty of meeting program objectives. Subject matter experts provided inputs for their area of interest and these inputs were used to formulate triangular distributions about the point estimate for the applicable cost elements. Risk-adjusted costs were derived using Monte Carlo simulation within the Crystal Ball Risk Analysis software.

The following tables provide a detailed breakdown, by WBS element, of the cost risk adjustments made to the Base Year 2005 point estimate in order to derive the risk-adjusted cost estimate for Alternative 3, the preferred alternative. The same type of methodology used to calculate Alternative 3 cost risk adjustments was also used to generate Alternative 1 and 2 adjustments, where applicable, since those alternatives are essentially subsets of Alternative 3.

WBS #	Cost Element	Approp	Funding Source	Then-Year ($K)	Risk Adjustment ($K)	Then-Year w/ Risk ($K)	Triangular Distribution Minimum	Triangular Distribution Maximum
	OMP PHASE I DELTA LIFE CYCLE COST ESTIMATE			**$163,863.9**	**$1,073.0**	**$164,936.9**		
	Facilities & Equipment (F&E)			**$66,327.5**	**$776.5**	**$67,104.1**		
3	**SOLUTION DEVELOPMENT**	**F&E**		**$41,755.2**	**$0.2**	**$41,755.4**		
3.1	Program Management	F&E		$3,477.2	$0.2	$3,477.4		
3.1.1	Program Planning, Authorization, Management and Control	F&E		$3,477.2	$0.2	$3,477.4		
3.1.1.1	Administrative	F&E	FAA	$1,198.8		$1,198.8		
3.1.1.2	Product Team Support	F&E		$928.7		$928.7		
3.1.1.2.1	FAA FTE	FS-OPS	FAA	$512.5		$512.5		
3.1.1.2.2	FFRDC Support	F&E	FAA					
3.1.1.2.3	Contractor Support	F&E	FAA	$398.6		$398.6		
3.1.1.2.4	Product Team Travel	F&E	FAA	$17.5		$17.5		
3.1.1.3	ATO OMP Direct Team (Chicago)	F&E		$1,345.0		$1,345.0		
3.1.1.3.1	ATO-T	FS-OPS	FAA	$312.1		$312.1		
3.1.1.3.2	ATO-W	FS-OPS	FAA	$573.3		$573.3		
3.1.1.3.3	ATO-W AVN	FS-OPS	Reimb	$459.6		$459.6		
3.1.1.4	ANI Program Support	FS-OPS		$4.6	$0.2	$4.8	95%	110%
3.1.1.4.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$4.4	$0.1	$4.5	90%	140%
3.1.1.4.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	$0.3	$0.0	$0.3	90%	130%
3.1.1.4.18	Existing ATCT Modifications	FS-OPS	FAA					
3.1.1.5	Contract and Grant Management (captured in other WBS elements)	F&E						
3.2	System Engineering (captured in other WBS elements)	F&E		$155.8		$155.8		
3.2.1	Infosec-Establish ADSE-X	F&E	Reimb	$155.8		$155.8		
3.3	HW/SW Design, Development, Procurement, and Production	F&E		$35,048.9		$35,048.9		
3.3.1	Hardware Design and Development	F&E		$1,045.1		$1,045.1		
3.3.1.1	Advanced Electronic Flight Strip System (AEFS)	F&E	FAA	$1,045.1		$1,045.1		
3.3.2	Software Design and Development	F&E						
3.3.3	HW/SW Integration, Assembly, Test and Checkout	F&E						
3.3.4	Production Engineering	F&E		$25.4		$25.4		
3.3.4.1	MKE - Establish 2 additional STARS Maps/NG Survey	F&E	FAA	$25.4		$25.4		
3.3.5	Procurement/Production	F&E		$33,978.3		$33,978.3		
3.3.5.1	System Hardware	F&E		$33,978.3		$33,978.3		
3.3.5.1.1	Relocate 14L	F&E						
3.3.5.1.1.1	14L ILS	F&E	Reimb					
3.3.5.1.1.2	14L ALSF 2	F&E	Reimb					
3.3.5.1.1.3	14L DME	F&E	Reimb					
3.3.5.1.2	Establish 9L	F&E		$1,755.3		$1,755.3		
3.3.5.1.2.1	9L ILS	F&E	Reimb	$280.7		$280.7		
3.3.5.1.2.2	9L/27R RVR (reuse 14L TD Equipment)	F&E	Reimb	$50.9		$50.9		
3.3.5.1.2.3	9L ALSF-2	F&E	Reimb	$1,423.8		$1,423.8		
3.3.5.1.2.4	9L/27R DME	F&E	Reimb					
3.3.5.1.3	Establish 27R	F&E		$1,704.5		$1,704.5		
3.3.5.1.3.1	27R ILS	F&E	Reimb	$280.7		$280.7		
3.3.5.1.3.2	27R ALSF-2	F&E	Reimb	$1,423.8		$1,423.8		
3.3.5.1.4	Relocate 22R LOC	F&E	Reimb	$88.0		$88.0		
3.3.5.1.5	Establish 10L (Existing 9R Extension)	F&E		$2,207.6		$2,207.6		
3.3.5.1.5.1	10L ILS	F&E	Reimb	$280.7		$280.7		
3.3.5.1.5.2	10L/28R RVR	F&E	Reimb	$376.1		$376.1		
3.3.5.1.5.3	10L ALSF-2	F&E	Reimb	$1,423.8		$1,423.8		
3.3.5.1.5.4	10L/28R DME	F&E	Reimb	$76.1		$76.1		
3.3.5.1.5.5	10L PAPI	F&E	Reimb	$50.9		$50.9		
3.3.5.1.6	Establish 10C	F&E		$2,285.5		$2,285.5		
3.3.5.1.6.1	10C ILS	F&E	Reimb	$290.6		$290.6		
3.3.5.1.6.2	10C/28C RVR	F&E	Reimb	$389.4		$389.4		
3.3.5.1.6.3	10C ALSF-2	F&E	Reimb	$1,474.1		$1,474.1		
3.3.5.1.6.4	10C/28C DME	F&E	Reimb	$78.8		$78.8		
3.3.5.1.6.5	10C PAPI	F&E	Reimb	$52.6		$52.6		
3.3.5.1.7	Establish 28C	F&E		$1,817.3		$1,817.3		
3.3.5.1.7.1	28C ILS	F&E	Reimb	$290.6		$290.6		
3.3.5.1.7.2	28C ALSF-2	F&E	Reimb	$1,474.1		$1,474.1		
3.3.5.1.7.3	28C PAPI	F&E	Reimb	$52.6		$52.6		
3.3.5.1.8	LLWAS	F&E	Reimb	$1,573.5		$1,573.5		
3.3.5.1.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	F&E	Reimb	$1,596.2		$1,596.2		
3.3.5.1.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	F&E	Reimb	$1,623.3		$1,623.3		
3.3.5.1.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	F&E	Reimb	$1,652.6		$1,652.6		
3.3.5.1.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	F&E	Reimb	$1,652.6		$1,652.6		
3.3.5.1.13	Establish RTR "T"	F&E	Reimb	$73.7		$73.7		
3.3.5.1.14	Establish Temp RTR (North ATCT)	F&E	Reimb	$71.2		$71.2		

3.3.5.1.15	Establish Fiber Optics Transmission System (FOTS)	F&E	Reimb	$1,044.3		$1,044.3		
3.3.5.1.16	Establish ADSE-X	F&E	Reimb	$1,918.0		$1,918.0		
3.3.5.1.17	Establish Integrate Control & Monitor Sys (ICAMS) (ATCTs & C90)	F&E	Reimb	$1,220.4		$1,220.4		
3.3.5.1.18	North ATCT - Equipment	F&E		$2,109.3		$2,109.3		
3.3.5.1.18.1	IDS-4 (5)	F&E	Reimb	$40.7		$40.7		
3.3.5.1.18.2	BRITE Displays (4)	F&E	Reimb	$244.1		$244.1		
3.3.5.1.18.3	Emergency Transceivers (4)	F&E	Reimb	$48.8		$48.8		
3.3.5.1.18.4	Tower Voice Switch	F&E	Reimb					
3.3.5.1.18.5	FDIO	F&E	Reimb	$20.3		$20.3		
3.3.5.1.18.6	Power Conditioning System (PCS)	F&E	Reimb	$1,585.0		$1,585.0		
3.3.5.1.18.7	Engine Generator (SX)	F&E	Reimb					
3.3.5.1.18.8	Voice Bypass Switch	F&E	Reimb	$20.3		$20.3		
3.3.5.1.18.9	Electronic Flight Data Transfer System	F&E	Reimb					
3.3.5.1.18.10	RDVS Position-Related Hardware	F&E	Reimb	$150.0		$150.0		
3.3.5.1.19	Radar - Establish North On-Field ASR-9	F&E	Reimb	$2,780.7		$2,780.7		
3.3.5.1.20	Establish South Field ASR-9	F&E	Reimb	$2,828.0		$2,828.0		
3.3.5.1.21	Airspace Redesign	F&E		$3,976.4		$3,976.4		
3.3.5.1.21.1	Elgin RDVS	F&E	FAA	$1,332.2		$1,332.2		
3.3.5.1.21.2	Elgin DVRS Expansion	F&E	FAA	$12.2		$12.2		
3.3.5.1.21.3	Elgin Position Redesignation	F&E	FAA					
3.3.5.1.21.4	ASR-11 Gateway Switch	F&E	FAA					
3.3.5.1.21.5	MKE - Establish RTR Channel (1 Frequency)	F&E	FAA	$150.2		$150.2		
3.3.5.1.21.6	MKE - Establish 2 additional STARS Displays	F&E	FAA	$74.4		$74.4		
3.3.5.1.21.7	MKE- Establish IDS-4 (1)	F&E	FAA	$8.1		$8.1		
3.3.5.1.21.8	MKE- Establish ETVS TEDs (2)	F&E	FAA	$22.4		$22.4		
3.3.5.1.21.9	SBN - Establish RTR Channel	F&E	FAA	$151.4		$151.4		
3.3.5.1.21.10	ZAU - Position Reconfiguration (4)	F&E	FAA	$29.1		$29.1		
3.3.5.1.21.11	RCAGs (New Channels, 4 existing Sector locations)	F&E	FAA	$1,404.5		$1,404.5		
3.3.5.1.21.12	BUECs (New Channels, 4 existing Sector locations)	F&E	FAA	$791.8		$791.8		
3.3.5.2	System Software	F&E						
3.3.5.3	Integration, Assembly, Test and Checkout	F&E						
3.3.5.4	System Engineering & Program Management	F&E						
3.3.6	Technology Refresh	F&E						
3.4	Physical and Airspace Infrastructure Design and Development	F&E		$771.2		$771.2		
3.4.1	Facility Planning and Design	F&E		$771.2		$771.2		
3.4.1.1	ATCT Concept Design (AGL-359)	F&E	Reimb	$41.9		$41.9		
3.4.1.2	Surveillance (AGL-363)	F&E	Reimb	$68.7		$68.7		
3.4.1.3	RTR Relocations (AGL-370)	F&E	Reimb	$62.5		$62.5		
3.4.1.4	ATCT Design Review (AGL-371)	F&E	Reimb	$471.0		$471.0		
3.4.1.5	Environmental Support (AGL-372)	F&E	Reimb	$63.6		$63.6		
3.4.1.6	FOTS (AGL-396)	F&E	Reimb	$63.6		$63.6		
3.4.2	Real Estate	F&E						
3.4.3	Physical Infrastructure	F&E						
3.4.4	Airspace Redesign	F&E						
3.5	Test and Evaluation (captured in other WBS elements)	F&E						
3.6	Data and Documentation	F&E						
3.7	Logistics Support	F&E		$2,302.1		$2,302.1		
3.7.1	Logistics Support Planning	F&E						
3.7.2	Test and Measurement Equipment Acquisition	F&E						
3.7.3	Support and Handling Equipment Acquisition	F&E						
3.7.4	Support Facilities Construction/Conversion/Expansion	F&E						
3.7.5	Support Equipment Acquisition / Modification	F&E		$192.5		$192.5		
3.7.5.1	Establish ASDE-X	F&E	Reimb	$67.6		$67.6		
3.7.5.2	Radar - Establish North On-Field ASR-9/Mode S	F&E	Reimb	$124.9		$124.9		
3.7.6	Support Facilities and Equipment Maintenance	F&E						
3.7.7	Initial Spares and Repair Parts Acquisition	F&E		$2,109.6		$2,109.6		
3.7.7.1	Establish ASDE-X	F&E	Reimb	$337.7		$337.7		
3.7.7.2	Radar - Establish North On-Field ASR-9/Mode S	F&E	Reimb	$1,772.0		$1,772.0		
3.7.8	Initial Training	F&E						
4	IMPLEMENTATION	F&E		$23,624.5	$747.2	$24,371.7		
4.1	Program Management	F&E		$5,940.8	$18.8	$5,959.6		
4.1.1	Program Planning, Authorization, Management and Control	F&E		$5,940.8	$18.8	$5,959.6		
4.1.1.1	Administrative	F&E	FAA	$684.0		$684.0		
4.1.1.2	Product Team Support	F&E		$1,617.6		$1,617.6		
4.1.1.2.1	FAA FTE	FS-OPS	FAA	$1,185.4		$1,185.4		
4.1.1.2.2	FFRDC Support	F&E	FAA					
4.1.1.2.3	Contractor Support	F&E	FAA	$405.8		$405.8		
4.1.1.2.4	Product Team Travel	F&E	FAA	$26.4		$26.4		
4.1.1.3	ATO OMP Direct Team (Chicago)	F&E		$3,110.9		$3,110.9		
4.1.1.3.1	ATO-T	FS-OPS	FAA	$721.9		$721.9		

4.1.1.3.2	ATO-W	FS-OPS	FAA	$1,326.0		$1,326.0		
4.1.1.3.3	ATO-W AVN	FS-OPS	Reimb	$1,063.0		$1,063.0		
4.1.1.4	ANI Program Support	FS-OPS		$528.3	$18.8	$547.1		
4.1.1.4.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$135.7	$3.6	$139.3	95%	110%
4.1.1.4.2	Relocate 22R LOC	FS-OPS	Reimb	$7.4	$0.2	$7.6	95%	110%
4.1.1.4.3	LLWAS	FS-OPS	Reimb	$7.1	$0.4	$7.5	90%	120%
4.1.1.4.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$7.6	$0.3	$7.9	95%	115%
4.1.1.4.5	Establish Temp RTR	FS-OPS	Reimb	$4.6	$0.2	$4.8	95%	115%
4.1.1.4.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$8.4	$0.4	$8.7	95%	115%
4.1.1.4.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$8.1	$0.4	$8.5	95%	115%
4.1.1.4.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$8.6	$0.4	$8.9	95%	115%
4.1.1.4.9	Establish RTR"T"	FS-OPS	Reimb	$4.5	$0.1	$4.6	95%	115%
4.1.1.4.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$8.4	$0.5	$8.9	90%	125%
4.1.1.4.11	Establish ADSE-X	FS-OPS	Reimb	$11.4	$0.7	$12.1	95%	120%
4.1.1.4.12	North ATCT - Construction	FS-OPS	Reimb	$33.8	$3.0	$36.8	90%	130%
4.1.1.4.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$24.5	$1.0	$25.5	95%	115%
4.1.1.4.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$22.7	$1.0	$23.7	95%	115%
4.1.1.4.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$3.1	$0.1	$3.1	95%	110%
4.1.1.4.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$3.7	$0.2	$3.9	90%	120%
4.1.1.4.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	$1.3	$0.2	$1.4	90%	140%
4.1.1.4.18	Existing ATCT Modifications	FS-OPS	FAA					
4.1.1.4.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$3.6	$0.1	$3.6	98%	105%
4.1.1.4.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	$5.3	$0.1	$5.3	95%	110%
4.1.1.4.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$3.7	$0.0	$3.7	98%	105%
4.1.1.4.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$10.7	$0.3	$11.0	95%	110%
4.1.1.4.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$4.4	$0.1	$4.5	95%	110%
4.1.1.4.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$4.2	$0.1	$4.3	95%	110%
4.1.1.4.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$22.7	$0.9	$23.6	95%	115%
4.1.1.4.26	Establish 10C	FS-OPS	Reimb	$64.3	$1.7	$65.9	95%	110%
4.1.1.4.27	Establish 28C	FS-OPS	Reimb	$64.3	$1.8	$66.0	95%	110%
4.1.1.4.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$44.6	$1.2	$45.8	95%	110%
4.1.2	Contract Management (captured in other WBS elements)	F&E						
4.1.3	Human Resources Planning and Staffing	F&E						
4.2	Engineering	F&E		$5,693.1	$204.8	$5,897.9		
4.2.1	Site Survey & Design	F&E		$5,680.4	$204.8	$5,885.3		
4.2.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$1,478.7	$39.4	$1,518.1	95%	110%
4.2.1.2	Relocate 22R LOC	FS-OPS	Reimb	$10.4	$0.3	$10.7	95%	110%
4.2.1.3	LLWAS	FS-OPS	Reimb	$49.0	$2.8	$51.8	90%	120%
4.2.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$116.3	$4.8	$121.1	95%	115%
4.2.1.5	Establish Temp RTR	FS-OPS	Reimb	$61.6	$2.5	$64.1	95%	115%
4.2.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$127.9	$5.4	$133.2	95%	115%
4.2.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$124.1	$5.5	$129.6	95%	115%
4.2.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$131.1	$5.7	$136.8	95%	115%
4.2.1.9	Establish RTR"T"	FS-OPS	Reimb	$96.7	$2.0	$98.6	95%	115%
4.2.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$77.6	$5.0	$82.6	90%	125%
4.2.1.11	Establish ADSE-X	FS-OPS	Reimb	$30.5	$1.8	$32.3	95%	120%
4.2.1.12	North ATCT - Construction	FS-OPS	Reimb	$491.4	$43.3	$534.8	90%	130%
4.2.1.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$178.5	$7.5	$186.0	95%	115%
4.2.1.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$277.4	$12.1	$289.5	95%	115%
4.2.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$49.4	$1.4	$50.8	95%	110%
4.2.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$10.5	$0.6	$11.1	90%	120%
4.2.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA					
4.2.1.18	Existing ATCT Modifications	FS-OPS	FAA					
4.2.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$81.4	$1.1	$82.5	98%	105%
4.2.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	$36.8	$0.5	$37.3	98%	105%
4.2.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$83.6	$1.1	$84.7	98%	105%
4.2.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$112.2	$3.1	$115.2	95%	110%
4.2.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$38.9	$1.0	$39.9	95%	110%
4.2.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$37.5	$1.0	$38.5	95%	110%
4.2.1.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$277.4	$11.3	$288.8	95%	115%
4.2.1.26	Establish 10C	FS-OPS	Reimb	$607.6	$15.8	$623.4	95%	110%
4.2.1.27	Establish 28C	FS-OPS	Reimb	$607.6	$16.6	$624.2	95%	110%
4.2.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$486.3	$13.2	$499.5	95%	110%
4.2.2	Site Survey & Design-Prime Contractor Support			$12.7		$12.7		
4.2.2.1	MKE - Establish 2 additional STARS Displays	F&E	FAA	$12.7		$12.7		
4.2.3	Site Software Adaptation	F&E						
4.3	Environmental and Occupational Safety and Health Compliance	F&E		$56.0	$2.2	$58.2		
4.3.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb					
4.3.2	Relocate 22R LOC	FS-OPS	Reimb					
4.3.3	LLWAS	FS-OPS	Reimb					

4.3.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb					
4.3.5	Establish Temp RTR	FS-OPS	Reimb					
4.3.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb					
4.3.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb					
4.3.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb					
4.3.9	Establish RTR"T"	FS-OPS	Reimb					
4.3.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb					
4.3.11	Establish ADSE-X	FS-OPS	Reimb					
4.3.12	North ATCT - Construction	FS-OPS	Reimb					
4.3.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$3.1	$0.1	$3.2	95%	115%
4.3.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$22.7	$1.0	$23.7	95%	115%
4.3.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$4.9	$0.1	$5.1	95%	110%
4.3.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA					
4.3.17	ATCT (Main & North) - AEFS	FS-OPS	FAA					
4.3.18	Existing ATCT Modifications	FS-OPS	FAA					
4.3.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$0.5	$0.0	$0.5	98%	105%
4.3.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	$0.5	$0.0	$0.5	98%	105%
4.3.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$0.5	$0.0	$0.5	98%	105%
4.3.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$1.1	$0.0	$1.1	95%	110%
4.3.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA					
4.3.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA					
4.3.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$22.7	$0.9	$23.6	95%	115%
4.3.26	Establish 10C	FS-OPS	Reimb					
4.3.27	Establish 28C	FS-OPS	Reimb					
4.3.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb					
4.4	Site Selection and Acquisition	F&E						
4.5	Construction	F&E		$4,848.7	$234.4	$5,083.0		
4.5.1	North ATCT Construction	F&E	Reimb					
4.5.2	ANI Contruction	FS-OPS		$4,026.0	$174.1	$4,200.1		
4.5.2.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$945.1	$25.2	$970.3	95%	110%
4.5.2.2	Relocate 22R LOC	FS-OPS	Reimb	$24.5	$0.6	$25.2	95%	110%
4.5.2.3	LLWAS	FS-OPS	Reimb	$54.1	$3.1	$57.2	90%	120%
4.5.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$77.5	$3.2	$80.7	95%	115%
4.5.2.5	Establish Temp RTR	FS-OPS	Reimb	$43.9	$1.8	$45.7	95%	115%
4.5.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$85.3	$3.6	$88.8	95%	115%
4.5.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$82.8	$3.7	$86.4	95%	115%
4.5.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$87.4	$3.8	$91.2	95%	115%
4.5.2.9	Establish RTR"T"	FS-OPS	Reimb	$49.2	$1.1	$50.2	95%	115%
4.5.2.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$50.5	$3.3	$53.8	90%	125%
4.5.2.11	Establish ADSE-X	FS-OPS	Reimb					
4.5.2.12	North ATCT - Construction	FS-OPS	Reimb	$841.6	$74.2	$915.8	90%	130%
4.5.2.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$140.9	$5.9	$146.8	95%	115%
4.5.2.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$158.7	$6.9	$165.7	95%	115%
4.5.2.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA					
4.5.2.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA					
4.5.2.17	ATCT (Main & North) - AEFS	FS-OPS	FAA					
4.5.2.18	Existing ATCT Modifications	FS-OPS	FAA					
4.5.2.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$58.0	$0.8	$58.8	90%	130%
4.5.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA					
4.5.2.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$59.5	$0.8	$60.3	98%	105%
4.5.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA					
4.5.2.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$29.7	$0.8	$30.5	95%	110%
4.5.2.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$30.1	$0.8	$30.9	95%	110%
4.5.2.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$158.7	$6.5	$165.2	95%	115%
4.5.2.26	Establish 10C	FS-OPS	Reimb	$363.7	$9.5	$373.2	95%	110%
4.5.2.27	Establish 28C	FS-OPS	Reimb	$363.7	$10.0	$373.7	95%	110%
4.5.2.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$320.9	$8.7	$329.6	95%	110%
4.5.3	Prime Contractor Support	F&E		$822.6	$60.3	$882.9		
4.6.1.1	Establish ASDE-X	F&E	Reimb	$822.6	$60.3	$882.9	80%	130%
4.6	Site Preparation, Installation, Test, and Checkout	F&E		$6,008.6	$267.2	$6,275.8		
4.6.1	ANI Support	F&E		$4,881.2	$199.7	$5,080.9		
4.6.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$859.2	$22.9	$882.1	95%	110%
4.6.1.2	Relocate 22R LOC	FS-OPS	Reimb	$46.8	$1.2	$48.1	95%	110%
4.6.1.3	LLWAS	FS-OPS	Reimb	$16.0	$0.9	$17.0	90%	120%
4.6.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$100.3	$4.2	$104.5	95%	115%
4.6.1.5	Establish Temp RTR	FS-OPS	Reimb	$44.5	$1.8	$46.3	95%	115%
4.6.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$110.3	$4.6	$115.0	95%	115%
4.6.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$106.5	$4.7	$111.2	95%	115%
4.6.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$114.3	$5.0	$119.3	95%	115%
4.6.1.9	Establish RTR"T"	FS-OPS	Reimb	$54.9	$1.2	$56.1	95%	115%

4.6.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$24.0	$1.6	$25.6	90%	125%
4.6.1.11	Establish ADSE-X	FS-OPS	Reimb	$157.0	$9.3	$166.3	95%	120%
4.6.1.12	North ATCT - Construction	FS-OPS	Reimb	$684.6	$60.3	$744.9	90%	130%
4.6.1.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$83.5	$3.5	$87.0	95%	115%
4.6.1.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$399.1	$17.4	$416.5	95%	115%
4.6.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$340.9	$9.7	$350.6	95%	110%
4.6.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$9.7	$0.5	$10.2	90%	120%
4.6.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	$5.2	$0.6	$5.9	90%	140%
4.6.1.18	Existing ATCT Modifications	FS-OPS	FAA					
4.6.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$58.0	$0.8	$58.8	98%	105%
4.6.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	$30.5	$0.4	$30.9	98%	105%
4.6.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$59.5	$0.8	$60.3	98%	105%
4.6.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$160.3	$4.4	$164.6	95%	110%
4.6.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$21.9	$0.6	$22.5	95%	110%
4.6.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$22.2	$0.6	$22.8	95%	110%
4.6.1.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$419.1	$17.1	$436.2	95%	115%
4.6.1.26	Establish 10C	FS-OPS	Reimb	$335.1	$8.7	$343.8	95%	110%
4.6.1.27	Establish 28C	FS-OPS	Reimb	$335.1	$9.2	$344.3	95%	110%
4.6.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$282.6	$7.6	$290.2	95%	110%
4.6.2	AF Support	FS-OPS		$395.4	$11.1	$406.5		
4.6.2.1	Relocate 14L	FS-OPS	Reimb	$18.5	$0.5	$19.1	95%	110%
4.6.2.2	Establish 9L	FS-OPS	Reimb	$21.0	$0.6	$21.6	95%	110%
4.6.2.3	Establish 27R	FS-OPS	Reimb	$19.2	$0.5	$19.8	95%	110%
4.6.2.4	Relocate 22R LOC	FS-OPS	Reimb	$1.5	$0.0	$1.6	95%	110%
4.6.2.5	LLWAS	FS-OPS	Reimb	$21.0	$0.6	$21.6	95%	110%
4.6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$4.4	$0.1	$4.5	95%	110%
4.6.2.7	Establish Temp RTR	FS-OPS	Reimb	$11.7	$0.3	$12.0	95%	110%
4.6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$4.8	$0.1	$5.0	95%	110%
4.6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$4.8	$0.1	$5.0	95%	110%
4.6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$5.1	$0.1	$5.2	95%	110%
4.6.2.11	Establish RTR"T"	FS-OPS	Reimb	$12.9	$0.4	$13.2	95%	110%
4.6.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$17.9	$0.5	$18.4	95%	110%
4.6.2.13	Establish ADSE-X	FS-OPS	Reimb	$10.8	$0.3	$11.1	95%	110%
4.6.2.14	North ATCT	FS-OPS	Reimb	$36.9	$1.0	$37.9	95%	110%
4.6.2.15	Temporary ASR-9	FS-OPS	Reimb					
4.6.2.16	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$54.9	$1.5	$56.5	95%	110%
4.6.2.17	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$64.1	$1.8	$65.9	95%	110%
4.6.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$3.7	$0.1	$3.8	95%	110%
4.6.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$1.0	$0.0	$1.0	95%	110%
4.6.2.20	ORD ATCT - AEFS	FS-OPS	FAA	$5.5	$0.2	$5.7	95%	110%
4.6.2.21	Existing ATCT Mods	FS-OPS	FAA					
4.6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	$3.5	$0.1	$3.6	95%	110%
4.6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	$0.7	$0.0	$0.7	95%	110%
4.6.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	$2.4	$0.1	$2.5	95%	110%
4.6.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	$2.0	$0.1	$2.1	95%	110%
4.6.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$23.0	$0.6	$23.6	95%	110%
4.6.2.27	Establish 28C	FS-OPS	Reimb	$23.0	$0.6	$23.6	95%	110%
4.6.2.28	Establish 10C	FS-OPS	Reimb	$21.2	$0.6	$21.8	95%	110%
4.6.3	Prime Contractor Support			$732.0	$56.4	$788.4		
4.6.3.1	MKE - Establish 2 additional STARS Displays	F&E	FAA	$164.0	$12.1	$176.1	95%	110%
4.6.3.2	TRACON (C90) RDVS	F&E	FAA	$200.0	$15.0	$215.0	95%	110%
4.6.3.3	Establish ADSE-X	F&E	Reimb	$368.0	$29.4	$397.4	95%	110%
4.7	Joint Acceptance Inspection/Commissioning/Closeout	F&E		$497.0	$16.1	$513.1		
4.7.1	ANI Support	F&E		$235.1	$8.7	$243.9		
4.7.1.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$47.7	$1.3	$49.0	95%	110%
4.7.1.2	Relocate 22R LOC	FS-OPS	Reimb	$22.3	$0.6	$22.9	95%	110%
4.7.1.3	LLWAS	FS-OPS	Reimb	$3.9	$0.2	$4.1	90%	120%
4.7.1.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$3.7	$0.2	$3.9	95%	115%
4.7.1.5	Establish Temp RTR	FS-OPS	Reimb	$3.9	$0.2	$4.1	95%	115%
4.7.1.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$4.3	$0.2	$4.5	95%	115%
4.7.1.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$4.1	$0.2	$4.3	95%	115%
4.7.1.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$4.5	$0.2	$4.7	95%	115%
4.7.1.9	Establish RTR"T"	FS-OPS	Reimb	$4.3	$0.1	$4.4	95%	115%
4.7.1.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$0.8	$0.1	$0.9	90%	125%
4.7.1.11	Establish ADSE-X	FS-OPS	Reimb	$4.1	$0.2	$4.3	95%	120%
4.7.1.12	North ATCT - Construction	FS-OPS	Reimb	$23.7	$2.1	$25.8	90%	130%
4.7.1.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$12.5	$0.5	$13.0	95%	115%
4.7.1.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$7.4	$0.3	$7.8	95%	115%
4.7.1.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$7.1	$0.2	$7.3	95%	110%
4.7.1.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$0.5	$0.0	$0.6	90%	120%

4.7.1.17	ATCT (Main & North) - AEFS	FS-OPS	FAA	$0.5	$0.1	$0.6	90%	120%
4.7.1.18	Existing ATCT Modifications	FS-OPS	FAA					
4.7.1.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$2.5	$0.0	$2.6	98%	105%
4.7.1.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA	$1.1	$0.0	$1.1	98%	105%
4.7.1.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$2.5	$0.0	$2.6	98%	105%
4.7.1.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$5.1	$0.1	$5.2	95%	110%
4.7.1.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$2.5	$0.1	$2.6	95%	110%
4.7.1.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$2.5	$0.1	$2.6	95%	110%
4.7.1.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$8.2	$0.3	$8.5	95%	115%
4.7.1.26	Establish 10C	FS-OPS	Reimb	$19.0	$0.5	$19.5	95%	110%
4.7.1.27	Establish 28C	FS-OPS	Reimb	$19.0	$0.5	$19.5	95%	110%
4.7.1.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$17.2	$0.5	$17.7	95%	110%
4.7.2	AF Support	F&E		$261.9	$7.3	$269.2		
4.7.2.1	Relocate 14L	FS-OPS	Reimb	$15.4	$0.4	$15.8	95%	110%
4.7.2.2	Establish 9L	FS-OPS	Reimb	$18.8	$0.5	$19.4	95%	110%
4.7.2.3	Establish 27R	FS-OPS	Reimb	$15.1	$0.4	$15.5	95%	110%
4.7.2.4	Relocate 22R LOC	FS-OPS	Reimb	$1.7	$0.0	$1.8	95%	110%
4.7.2.5	LLWAS	FS-OPS	Reimb	$4.0	$0.1	$4.2	95%	110%
4.7.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$7.2	$0.2	$7.4	95%	110%
4.7.2.7	Establish Temp RTR	FS-OPS	Reimb	$7.2	$0.2	$7.4	95%	110%
4.7.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$7.9	$0.2	$8.1	95%	110%
4.7.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$7.9	$0.2	$8.1	95%	110%
4.7.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$8.3	$0.2	$8.5	95%	110%
4.7.2.11	Establish RTR"T"	FS-OPS	Reimb	$7.9	$0.2	$8.1	95%	110%
4.7.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$13.4	$0.4	$13.7	95%	110%
4.7.2.13	Establish ADSE-X	FS-OPS	Reimb	$7.2	$0.2	$7.4	95%	110%
4.7.2.14	North ATCT	FS-OPS	Reimb	$33.2	$0.9	$34.1	95%	110%
4.7.2.15	Temporary ASR-9	FS-OPS	Reimb					
4.7.2.16	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$14.4	$0.4	$14.8	95%	110%
4.7.2.17	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$15.1	$0.4	$15.5	95%	110%
4.7.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$2.6	$0.1	$2.6	95%	110%
4.7.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$0.3	$0.0	$0.3	95%	110%
4.7.2.20	TRACON (C90) - Electronic Flight Data Transmission System	FS-OPS	FAA	$1.2	$0.0	$1.3	95%	110%
4.7.2.21	Existing ATCT Mods	FS-OPS	FAA					
4.7.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	$4.7	$0.1	$4.8	95%	110%
4.7.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	$1.2	$0.0	$1.3	95%	110%
4.7.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	$1.0	$0.0	$1.0	95%	110%
4.7.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	$3.0	$0.1	$3.1	95%	110%
4.7.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$21.8	$0.6	$22.4	95%	110%
4.7.2.27	Establish 28C	FS-OPS	Reimb	$22.8	$0.6	$23.5	95%	110%
4.7.2.28	Establish 10C	FS-OPS	Reimb	$18.7	$0.5	$19.2	95%	110%
4.8	Telecommunications	F&E		$580.4	$3.7	$584.0		
4.8.1	Telecommunication Non-Recurring Costs	F&E		$486.7		$486.7		
4.8.1.1	RCAG/BUEC			$177.5		$177.5		
4.8.1.1.1	RCAG (JON 64132/42/52/62)	F&E	FAA	$124.4		$124.4		
4.8.1.1.2	BUEC (JON 64252/62/72/82)	F&E	FAA	$53.0		$53.0		
4.8.1.2	JON 60994 MKE RTR&ECS	F&E	FAA	$68.6		$68.6		
4.8.1.3	JON 60974 SBN RTR&ECS	F&E	FAA	$115.4		$115.4		
4.8.1.4	JON 61004 RDVS	F&E	FAA	$34.6		$34.6		
4.8.1.5	JON 61059 C90 Freqs	F&E	FAA	$90.6		$90.6		
4.8.2	ANI Support	F&E		$93.7	$3.7	$97.4		
4.8.2.1	Relocate 14L, Establish 9L, 27R	FS-OPS	Reimb	$13.6	$0.4	$13.9	95%	110%
4.8.2.2	Relocate 22R LOC	FS-OPS	Reimb					
4.8.2.3	LLWAS	FS-OPS	Reimb					
4.8.2.4	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb					
4.8.2.5	Establish Temp RTR	FS-OPS	Reimb					
4.8.2.6	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb					
4.8.2.7	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb					
4.8.2.8	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb					
4.8.2.9	Establish RTR"T"	FS-OPS	Reimb					
4.8.2.10	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb					
4.8.2.11	Establish ADSE-X	FS-OPS	Reimb	$3.0	$0.2	$3.2	95%	120%
4.8.2.12	North ATCT - Construction	FS-OPS	Reimb	$15.0	$1.3	$16.4	90%	130%
4.8.2.13	North ATCT - Establich 5 Positions	FS-OPS	Reimb	$15.3	$0.6	$16.0	95%	115%
4.8.2.14	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb					
4.8.2.15	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA					
4.8.2.16	TRACON (C90) - DVRS Expansion	FS-OPS	FAA					
4.8.2.17	ATCT (Main & North) - AEFS	FS-OPS	FAA					
4.8.2.18	Existing ATCT Modifications	FS-OPS	FAA					
4.8.2.19	Airspace Redesign - Establish RTR @ MKE	FS-OPS	FAA	$2.5	$0.0	$2.6	98%	105%

4.8.2.20	Airspace Redesign - Establish 2 additional Channels @ SBN	FS-OPS	FAA					
4.8.2.21	Airspace Redesign - Establish RTR @ SBN	FS-OPS	FAA	$2.6	$0.0	$2.6	98%	105%
4.8.2.22	Airspace Redesign - Position Reconfig (ZAU); Redesignation (C90)	FS-OPS	FAA	$10.7	$0.3	$11.0	95%	110%
4.8.2.23	Airspace Redesign - Establish 4 RCAG Channels	FS-OPS	FAA	$8.2	$0.2	$8.4	95%	110%
4.8.2.24	Airspace Redesign - Establish 4 BUEC Channels	FS-OPS	FAA	$7.9	$0.2	$8.1	95%	110%
4.8.2.25	Radar - Establish South Field ASR-9	FS-OPS	Reimb					
4.8.2.26	Establish 10C	FS-OPS	Reimb	$5.1	$0.1	$5.3	95%	110%
4.8.2.27	Establish 28C	FS-OPS	Reimb	$5.1	$0.1	$5.3	95%	110%
4.8.2.28	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$4.5	$0.1	$4.6	95%	110%
4.9	Implementation Training	F&E						
5	In-Service Management (F&E)			$312.0		$312.0		
5.1	Second Level Engineering (also captured in other WBS elements)	F&E		$312.0		$312.0		
5.10.3	Hardware and Software Engineering Support	F&E		$312.0		$312.0		
5.11.3.1	Establish ADSE-X	F&E	Reimb	$142.2		$142.2		
5.11.3.1	Radar - Establish North On-Field ASR-9/Mode S	F&E		$84.0		$84.0		
5.11.3.1.1	ASR-9 Support			$48.1		$48.1		
5.11.3.1.1.1	Contractor Support	F&E	Reimb	$38.8		$38.8		
5.11.3.1.1.2	Contractor Travel	F&E	Reimb	$9.3		$9.3		
5.11.3.1.2	Mode S Support			$35.9		$35.9		
5.11.3.1.2.1	Contractor Support	F&E	Reimb	$23.9		$23.9		
5.11.3.1.2.2	Contractor Travel		Reimb	$12.0		$12.0		
5.11.3.2	Radar - Establish South Field ASR-9/Mode S	F&E		$85.9		$85.9		
5.11.3.2.1	ASR-9 Support			$49.0		$49.0		
5.11.3.2.1.1	Contractor Support	F&E	Reimb	$39.5		$39.5		
5.11.3.2.1.2	Contractor Travel	F&E	Reimb	$9.5		$9.5		
5.11.3.2.2	Mode S Support			$36.9		$36.9		
5.11.3.2.2.1	Contractor Support	F&E	Reimb	$24.3		$24.3		
5.11.3.2.2.2	Contractor Travel	F&E	Reimb	$12.6		$12.6		
6	Disposition	F&E		$635.7	$29.2	$664.9		
6.1	Program Management	FS-OPS		$10.3	$0.3	$10.5		
6.1.1	Decommission ORD RTR	FS-OPS	Reimb	$2.4	$0.1	$2.4	95%	110%
6.1.2	Decommission RTR C	FS-OPS	Reimb	$2.6	$0.1	$2.7	95%	110%
6.1.3	Decommission RTR A	FS-OPS	Reimb	$2.7	$0.1	$2.8	95%	110%
6.1.4	Decommmision RTR B	FS-OPS	Reimb	$2.6	$0.1	$2.7	95%	110%
6.2	Decommissioning	FS-OPS		$141.7	$4.0	$145.7		
6.2.1	Relocate 14L	FS-OPS	Reimb					
6.2.2	Establish 9L	FS-OPS	Reimb					
6.2.3	Establish 27R	FS-OPS	Reimb					
6.2.4	Relocate 22R LOC	FS-OPS	Reimb					
6.2.5	LLWAS	FS-OPS	Reimb	$22.2	$0.6	$22.9	95%	110%
6.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb	$17.4	$0.5	$17.9	95%	110%
6.2.7	Establish Temp RTR	FS-OPS	Reimb					
6.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb	$19.2	$0.5	$19.7	95%	110%
6.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb	$19.2	$0.5	$19.7	95%	110%
6.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb	$20.1	$0.6	$20.7	95%	110%
6.2.11	Establish RTR"T"	FS-OPS	Reimb					
6.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb	$13.4	$0.4	$13.8	95%	110%
6.2.13	Establish ADSE-X	FS-OPS	Reimb					
6.2.14	North ATCT	FS-OPS	Reimb					
6.2.15	Temporary ASR-9	FS-OPS	Reimb					
6.2.16	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb					
6.2.17	Radar - Establish South Field ASR-9	FS-OPS	Reimb					
6.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$0.7	$0.0	$0.7	95%	110%
6.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA					
6.2.20	ATCT (Main & North) - AEFS	FS-OPS	FAA					
6.2.21	Existing ATCT Mods	FS-OPS	FAA					
6.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA					
6.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA					
6.2.24	Airspace Redesign - C90 Programming	FS-OPS	FAA					
6.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA					
6.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$29.5	$0.8	$30.3	95%	110%
6.2.27	Establish 28C	FS-OPS	Reimb					
6.2.28	Establish 10C	FS-OPS	Reimb					
6.3	Engineering	FS-OPS		$160.8	$4.3	$165.0		
6.3.1	Decommission ORD RTR	FS-OPS	Reimb	$37.0	$1.0	$38.0	95%	110%
6.3.2	Decommission RTR C	FS-OPS	Reimb	$40.5	$1.1	$41.6	95%	110%
6.3.3	Decommission RTR A	FS-OPS	Reimb	$42.5	$1.1	$43.6	95%	110%
6.3.4	Decommmision RTR B	FS-OPS	Reimb	$40.8	$1.0	$41.8	95%	110%
6.4	Environmental Activities	F&E						
6.5	Dismantle/Removal	FS-OPS		$316.1	$20.5	$336.6		

6.5.1	Decommission ORD RTR	FS-OPS	Reimb	$11.0	$0.3	$11.3	95%	110%
6.5.2	Decommission RTR C	FS-OPS	Reimb	$12.1	$0.3	$12.4	95%	110%
6.5.3	Decommission RTR A	FS-OPS	Reimb	$12.7	$0.3	$13.0	95%	110%
6.5.4	Decommmision RTRB	FS-OPS	Reimb	$12.2	$0.3	$12.5	95%	110%
6.5.5	Decommission Existing ASR-9/Mode S	F&E	Reimb	$268.2	$19.2	$287.5	95%	110%
6.6	Site Restoration/Closeout	FS-OPS		$6.8	$0.2	$7.0		
6.6.1	Decommission ORD RTR	FS-OPS	Reimb	$1.6	$0.0	$1.6	95%	110%
6.6.2	Decommission RTR C	FS-OPS	Reimb	$1.7	$0.0	$1.8	95%	110%
6.6.3	Decommission RTR A	FS-OPS	Reimb	$1.8	$0.0	$1.9	95%	110%
6.6.4	Decommmision RTRB	FS-OPS	Reimb	$1.7	$0.0	$1.8	95%	110%
5	**IN-SERVICE MANAGEMENT**	**OPS**		**$97,536.4**	**$296.4**	**$97,832.8**		
5.1	Preventive Maintenance/Certification	FS-OPS		$5,457.4	$173.2	$5,630.6		
5.1.1	Preventive Maintenance/Certification	FS-OPS		$5,457.4	$173.2	$5,630.6		
5.1.1.1	ORD Communications SSC	FS-OPS	FAA	$1,708.1	$54.2	$1,762.3	90%	110%
5.1.1.2	ORD Navigation SSC	FS-OPS	FAA	$966.7	$30.7	$997.3	90%	110%
5.1.1.3	ORD Radar SSC	FS-OPS	FAA	$1,074.6	$34.1	$1,108.7	90%	110%
5.1.1.4	ORD Environmental SSC	FS-OPS	FAA	$1,708.1	$54.2	$1,762.3	90%	110%
5.1.2	System Management Office (SMO) Overhead	FS-OPS	FAA					
5.1.3	FAA Academy Maintenance	FS-OPS						
5.2	Corrective Maintenance	FS-OPS		$3,347.0	$106.2	$3,453.2		
5.2.1	Corrective Maintenance	FS-OPS		$3,347.0	$106.2	$3,453.2		
5.2.1.1	ORD Communications SSC	FS-OPS	FAA	$1,047.6	$33.2	$1,080.8	90%	110%
5.2.1.2	ORD Navigation SSC	FS-OPS	FAA	$592.8	$18.8	$611.7	90%	110%
5.2.1.3	ORD Radar SSC	FS-OPS	FAA	$659.0	$20.9	$680.0	90%	110%
5.2.1.4	ORD Environmental SSC	FS-OPS	FAA	$1,047.6	$33.2	$1,080.8	90%	110%
5.2.2	System Management Office (SMO) Overhead	FS-OPS	FAA					
5.2.3	FAA Academy Maintenance	FS-OPS						
5.3	Modifications	OPS						
5.4	Maintenance Control	OPS						
5.5	Technical Teaming	OPS						
5.6	Watch Standing Coverage	FS-OPS		$1,339.6		$1,339.6		
5.6.1	Airway Transportation System Specialists	FS-OPS		$104.1		$104.1		
5.6.1.1	Initial Watch Standing Coverage (BFOT)	FS-OPS		$104.1		$104.1		
5.6.1.1.1	Radar Training	FS-OPS	FAA	$35.4		$35.4		
5.6.1.1.1.1	New Hire Training Initiative	FS-OPS	FAA	$9.8		$9.8		
5.6.1.1.1.2	Radar Principles	FS-OPS	FAA	$4.9		$4.9		
5.6.1.1.1.3	ASR-9/Mode S Radar	FS-OPS	FAA	$8.9		$8.9		
5.6.1.1.1.4	Mode-S Secondary Radar	FS-OPS	FAA	$4.9		$4.9		
5.6.1.1.1.5	TDWR	FS-OPS	FAA	$3.3		$3.3		
5.6.1.1.1.6	ASDE-3/AMASS	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.1.7	DBRITE	FS-OPS		$1.6		$1.6		
5.6.1.1.2	Navigation Training	FS-OPS	FAA	$28.3		$28.3		
5.6.1.1.2.1	New Hire TrainingInitiative	FS-OPS	FAA	$9.8		$9.8		
5.6.1.1.2.2	ILS Principles	FS-OPS	FAA	$3.5		$3.5		
5.6.1.1.2.3	VOR Principles	FS-OPS	FAA	$4.1		$4.1		
5.6.1.1.2.4	Mark 20/20 AILS	FS-OPS	FAA	$3.5		$3.5		
5.6.1.1.2.5	Mark 1F ILS	FS-OPS	FAA	$2.4		$2.4		
5.6.1.1.2.6	DME	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.2.7	VOR	FS-OPS		$3.0		$3.0		
5.6.1.1.3	Communications Training	FS-OPS	FAA	$14.8		$14.8		
5.6.1.1.3.1	New Hire TrainingInitiative	FS-OPS	FAA	$9.8		$9.8		
5.6.1.1.3.2	RDVS	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.3.3	DVRS	FS-OPS	FAA	$1.0		$1.0		
5.6.1.1.3.4	LLWAS NE	FS-OPS	FAA	$1.0		$1.0		
5.6.1.1.3.5	FOTS	FS-OPS		$1.0		$1.0		
5.6.1.1.4	Environmental Training	FS-OPS	FAA	$25.6		$25.6		
5.6.1.1.4.1	New Hire Training Initiative	FS-OPS	FAA	$9.8		$9.8		
5.6.1.1.4.2	Boilers & Chillers	FS-OPS	FAA	$3.0		$3.0		
5.6.1.1.4.3	MALSR	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.4.4	ALSF-2	FS-OPS	FAA	$3.9		$3.9		
5.6.1.1.4.5	PCS Maintenance	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.4.6	Kohler Engine Generator	FS-OPS	FAA	$2.0		$2.0		
5.6.1.1.4.7	Air Conditioning	FS-OPS	FAA	$3.0		$3.0		
5.6.1.2	Recurring Watch Standing Coverage	FS-OPS						
5.6.2	Air Traffic Control Specialists	FS-OPS		$1,235.5		$1,235.5		
5.6.2.1	Initial Watch Standing Coverage (BFOT)	FS-OPS		$1,235.5		$1,235.5		
5.6.2.1.1	Chicago Tower (ORD)	FS-OPS	FAA	$154.4		$154.4		
5.6.2.1.2	Chicago TRACON (C90)	FS-OPS	FAA	$677.6		$677.6		
5.6.2.1.3	Chicago Center ARTCC (ZAU)	FS-OPS	FAA	$309.8		$309.8		
5.6.2.1.4	South Bend (SBN)	FS-OPS	FAA	$27.6		$27.6		

5.6.2.1.5	Milwaukee (MKE)	FS-OPS	FAA	$66.2		$66.2		
5.6.2.2	Recurring Watch Standing Coverage	FS-OPS						
5.7	Program Support	FS-OPS		$325.0	$14.2	$339.2		
5.7.1	Program Planning, Authorization, Management and Control	FS-OPS		$325.0	$14.2	$339.2		
5.7.1.1	Relocate 14L	FS-OPS	FAA	$19.9	$0.9	$20.7	95%	110%
5.7.1.2	Establish 9L	FS-OPS	FAA	$24.3	$1.1	$25.3	95%	110%
5.7.1.3	Establish 27R	FS-OPS	FAA	$19.1	$0.8	$20.0	95%	110%
5.7.1.4	Relocate 22R LOC	FS-OPS	FAA	$2.4	$0.1	$2.5	95%	110%
5.7.1.5	LLWAS	FS-OPS	FAA	$2.8	$0.1	$3.0	95%	110%
5.7.1.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	FAA	$6.1	$0.3	$6.4	95%	110%
5.7.1.7	Establish Temp RTR	FS-OPS	FAA	$6.1	$0.3	$6.4	95%	110%
5.7.1.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	FAA	$6.8	$0.3	$7.1	95%	110%
5.7.1.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	FAA	$6.8	$0.3	$7.1	95%	110%
5.7.1.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	FAA	$7.1	$0.3	$7.4	95%	110%
5.7.1.11	Establish RTR"T"	FS-OPS	FAA	$6.8	$0.3	$7.1	95%	110%
5.7.1.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	FAA	$30.6	$1.3	$31.9	95%	110%
5.7.1.13	Establish ADSE-X	FS-OPS	FAA	$6.1	$0.3	$6.4	95%	110%
5.7.1.14	North ATCT	FS-OPS	FAA	$34.4	$1.5	$35.9	95%	110%
5.7.1.15	Temporary ASR-9	FS-OPS	FAA	$7.0	$0.3	$7.3	95%	110%
5.7.1.16	Radar - Establish North On-Field ASR-9	FS-OPS	FAA	$14.5	$0.6	$15.1	95%	110%
5.7.1.17	Radar - Establish South Field ASR-9	FS-OPS	FAA	$25.0	$1.1	$26.0	95%	110%
5.7.1.18	TRACON (C90) - RDVS Upgrade	FS-OPS	FAA	$7.0	$0.3	$7.3	95%	110%
5.7.1.19	TRACON (C90) - DVRS Expansion	FS-OPS	FAA	$0.3	$0.0	$0.3	95%	110%
5.7.1.20	TRACON (C90) - Electronic Flight Data Transmission System	FS-OPS	FAA	$1.2	$0.1	$1.3	95%	110%
5.7.1.21	Existing ATCT Mods	FS-OPS	FAA					
5.7.1.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	FAA	$8.2	$0.4	$8.5	95%	110%
5.7.1.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	FAA	$1.2	$0.1	$1.3	95%	110%
5.7.1.24	Airspace Redesign - C90 Programming	FS-OPS	FAA	$4.8	$0.2	$5.0	95%	110%
5.7.1.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	FAA	$3.1	$0.1	$3.2	95%	110%
5.7.1.26	Extend 10L (Existing 9R Extension)	FS-OPS	FAA	$24.5	$1.1	$25.6	95%	110%
5.7.1.27	Establish 28C	FS-OPS	FAA	$27.1	$1.2	$28.2	95%	110%
5.7.1.28	Establish 10C	FS-OPS	FAA	$21.9	$1.0	$22.9	95%	110%
5.7.2	Contract Management	FS-OPS						
5.8	Logistics	OPS		$1,589.0		$1,589.0		
5.8.1	Relocate 14L	OPS						
5.8.1.1	14L ILS	OPS	FAA					
5.8.1.2	14L ALSF 2	OPS	FAA					
5.8.1.3	14L DME	OPS	FAA					
5.8.2	Establish 9L	OPS		$93.7		$93.7		
5.8.2.1	9L ILS	OPS	FAA	$1.6		$1.6		
5.8.2.2	9L/27R RVR	OPS	FAA	$20.3		$20.3		
5.8.2.3	9L ALSF-2	OPS	FAA	$71.8		$71.8		
5.8.2.4	9L/27R DME	OPS	FAA					
5.8.3	Establish 27R	OPS		$73.4		$73.4		
5.8.3.1	27R ILS	OPS	FAA	$1.6		$1.6		
5.8.3.2	27R ALSF-2	OPS	FAA	$71.8		$71.8		
5.8.4	Relocate 22R LOC	OPS	FAA					
5.8.5	Establish 10L (Existing 9R Extension)	OPS		$93.7		$93.7		
5.8.5.1	10L ILS	OPS	FAA	$1.6		$1.6		
5.8.5.2	10L/28R RVR	OPS	FAA	$20.3		$20.3		
5.8.5.3	10L ALSF-2	OPS	FAA	$71.8		$71.8		
5.8.5.4	10L/28R DME	OPS	FAA					
5.8.5.5	10L PAPI	OPS	FAA					
5.8.6	Establish 10C	OPS		$63.7		$63.7		
5.8.6.1	10C ILS	OPS	FAA	$1.1		$1.1		
5.8.6.2	10C/28C RVR	OPS	FAA	$13.8		$13.8		
5.8.6.3	10C ALSF-2	OPS	FAA	$48.8		$48.8		
5.8.6.4	10C/28C DME	OPS	FAA					
5.8.6.5	10C PAPI	OPS	FAA					
5.8.7	Establish 28C	OPS		$49.9		$49.9		
5.8.7.1	28C ILS	OPS	FAA	$1.1		$1.1		
5.8.7.2	28C ALSF-2	OPS	FAA	$48.8		$48.8		
5.8.7.3	28C PAPI	OPS	FAA					
5.8.8	LLWAS	OPS	FAA	$26.9		$26.9		
5.8.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	OPS	FAA					
5.8.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	OPS	FAA					
5.8.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	OPS	FAA					
5.8.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	OPS	FAA					
5.8.13	Establish RTR "T"	OPS	FAA	$18.4		$18.4		
5.8.14	Establish Temp RTR (North ATCT)	OPS	FAA	$25.4		$25.4		

5.8.15	Establish Fiber Optics Transmission System (FOTS)	OPS	FAA	$1.4		$1.4		
5.8.16	Establish ADSE-X	OPS	FAA	$253.2		$253.2		
5.8.17	North ATCT - Equipment	OPS	FAA	$383.0		$383.0		
5.8.18	Establish North Field ASR-9	OPS	FAA	$449.8		$449.8		
5.8.19	Establish South Field ASR-9	OPS	FAA					
5.8.20	Airspace Redesign	OPS		$56.5		$56.5		
5.8.20.1	Elgin RDVS	OPS	FAA					
5.8.20.2	Elgin DVRS Expansion	OPS	FAA					
5.8.20.3	Elgin Position Redesignation	OPS	FAA					
5.8.20.4	ASR-11 Gateway Switch	OPS	FAA					
5.8.20.5	MKE - Establish RTR Channel (1 Frequency)	OPS	FAA	$28.7		$28.7		
5.8.20.6	MKE - Establish 2 additional STARS Displays	OPS	FAA					
5.8.20.7	SBN - Establish RTR Channel	OPS	FAA	$25.4		$25.4		
5.8.20.8	ZAU - Position Reconfiguration (4)	OPS	FAA					
5.8.20.9	RCAGs (New Channels, 4 existing Sector locations)	OPS	FAA	$2.4		$2.4		
5.8.20.10	BUECs (New Channels, 4 existing Sector locations)	OPS	FAA					
5.9	In-Service Training	OPS		$116.1		$116.1		
5.9.1	Airway Transportation System Specialists In-Service Training	OPS		$116.1		$116.1		
5.9.1.1	Radar Training	OPS		$24.4		$24.4		
5.9.1.1.1	New Hire Training Initiative	OPS	FAA	$6.1		$6.1		
5.9.1.1.2	Radar Principles	OPS	FAA	$3.4		$3.4		
5.9.1.1.3	ASR-9/Mode S Radar	OPS	FAA	$5.6		$5.6		
5.9.1.1.4	Mode-S Secondary Radar	OPS	FAA	$3.4		$3.4		
5.9.1.1.5	TDWR	OPS	FAA	$2.6		$2.6		
5.9.1.1.6	ASDE-3/AMASS	OPS	FAA	$1.8		$1.8		
5.9.1.1.7	DBRITE	OPS	FAA	$1.5		$1.5		
5.9.1.2	Navigation Training	OPS		$41.9		$41.9		
5.9.1.2.1	New Hire TrainingInitiative	OPS	FAA	$12.1		$12.1		
5.9.1.2.2	ILS Principles	OPS	FAA	$5.4		$5.4		
5.9.1.2.3	VOR Principles	OPS	FAA	$6.0		$6.0		
5.9.1.2.4	Mark 20/20 AILS	OPS	FAA	$5.4		$5.4		
5.9.1.2.5	Mark 1F ILS	OPS	FAA	$4.3		$4.3		
5.9.1.2.6	DME	OPS	FAA	$3.7		$3.7		
5.9.1.2.7	VOR	OPS	FAA	$4.9		$4.9		
5.9.1.3	Communications Training	OPS		$11.1		$11.1		
5.9.1.3.1	New Hire TrainingInitiative	OPS	FAA	$6.1		$6.1		
5.9.1.3.2	RDVS	OPS	FAA	$1.8		$1.8		
5.9.1.3.3	DVRS	OPS	FAA	$1.1		$1.1		
5.9.1.3.4	LLWAS NE	OPS	FAA	$1.1		$1.1		
5.9.1.3.5	FOTS	OPS	FAA	$1.1		$1.1		
5.9.1.4	Environmental Training	OPS		$38.7		$38.7		
5.9.1.4.1	New Hire Training Initiative	OPS	FAA	$12.1		$12.1		
5.9.1.4.2	Boilers & Chillers	OPS	FAA	$4.9		$4.9		
5.9.1.4.3	MALSR	OPS	FAA	$3.7		$3.7		
5.9.1.4.4	ALSF-2	OPS	FAA	$5.8		$5.8		
5.9.1.4.5	PCS Maintenance	OPS	FAA	$3.7		$3.7		
5.9.1.4.6	Kohler Engine Generator	OPS	FAA	$3.7		$3.7		
5.9.1.4.7	Air Conditioning	OPS	FAA	$4.9		$4.9		
5.9.2	Air Traffic Control Specialists In-Service Training	OPS						
5.10	Second Level Engineering (also captured in other WBS elements)	OPS		$3,541.7		$3,541.7		
5.10.1	Program Management and Infrastructure Support	OPS		$2,830.7		$2,830.7		
5.10.1.1	Radar Site / Coverage Analysis Surveys	OPS	FAA	$13.0		$13.0		
5.10.1.2	Frequency Studies	OPS	FAA	$90.0		$90.0		
5.10.1.3	Human-in-the-Loop Analysis	OPS	FAA	$860.0		$860.0		
5.10.1.4	Jet-Blast Analysis	OPS	FAA	$35.0		$35.0		
5.10.1.5	Fiber Loop Transition Study & Analysis	OPS	FAA	$60.0		$60.0		
5.10.1.6	Electronic Flight Data System Analysis	OPS	FAA	$25.0		$25.0		
5.10.1.7	OMP Airspace Analysis, both Enroute & Terminal	OPS	FAA					
5.10.1.8	Program Management Analysis	OPS	FAA	$187.0		$187.0		
5.10.1.9	Explosive Blast Study, New N ATCT	OPS	FAA					
5.10.1.10	ORD requirements documentation analysis	OPS	FAA	$120.0		$120.0		
5.10.1.11	Advanced Electronic Flight Strip (AEFS) Modeling, Analysis and Simulation	OPS	FAA	$300.0		$300.0		
5.10.1.12	Chicago NAR Planning and Studies	OPS	FAA	$771.0		$771.0		
5.10.1.13	OMP cost/benefit analysis	OPS	FAA	$124.7		$124.7		
5.10.1.14	Engineering Data Review information analysis	OPS	FAA	$125.0		$125.0		
5.10.1.15	RDVS Mock-Up	OPS	FAA					
5.10.1.16	Re-site RFD ASR-11 For High & Wide	OPS	FAA					
5.10.1.17	Environmental Testing, Asbestos/PCBs	OPS	FAA	$120.0		$120.0		
5.10.2	National Airspace System (NAS) Field Support and Restoration	OPS	FAA					
5.10.3	Hardware and Software Engineering Support	OPS		$711.0		$711.0		

5.10.3.1	FAA FTEs			$354.3		$354.3		
5.10.3.1.1	Establish ADSE-X	FS-OPS	FAA	$326.1		$326.1		
5.10.3.1.2	Establish North Field ASR-9/Mode S	FS-OPS	FAA	$13.7		$13.7		
5.10.3.1.3	Establish South Field ASR-9/Mode S	FS-OPS	FAA	$14.4		$14.4		
5.10.3.2	FAA Contractor Support			$337.9		$337.9		
5.10.3.2.1	Establish ADSE-X	OPS	FAA	$337.9		$337.9		
5.10.3.3	FAA Travel			$18.8		$18.8		
5.10.3.3.1	Establish North Field ASR-9/Mode S	OPS	FAA	$9.3		$9.3		
5.10.3.3.2	Establish South Field ASR-9/Mode S	OPS	FAA	$9.5		$9.5		
5.10.4	Configuration Management	OPS	FAA					
5.10.5	Process Improvement	OPS	FAA					
5.10.6	Quality Assurance	OPS	FAA					
5.10.7	Information System Security	OPS	FAA					
5.10.8	Recurring NAS System Costs	OPS	FAA					
5.10.9	Software Licenses	OPS						
5.11	Infrastructure Support	OPS		$4,123.2		$4,123.2		
5.11.1	Hazardous Materials Handling	OPS						
5.11.2	Utilities, Building and Grounds Upkeep and Maintenance	OPS		$2,370.2		$2,370.2		
5.11.2.1	Relocate 14L	OPS						
5.11.2.1.1	14L ILS	OPS	FAA					
5.11.2.1.2	14L ALSF 2	OPS	FAA					
5.11.2.1.3	14L DME	OPS	FAA					
5.11.2.2	Establish 9L	OPS		$32.0		$32.0		
5.11.2.2.1	9L ILS	OPS	FAA	$9.8		$9.8		
5.11.2.2.2	9L/27R RVR	OPS	FAA	$2.6		$2.6		
5.11.2.2.3	9L ALSF-2	OPS	FAA	$19.6		$19.6		
5.11.2.2.4	9L/27R DME	OPS	FAA					
5.11.2.3	Establish 27R	OPS		$29.4		$29.4		
5.11.2.3.1	27R ILS	OPS	FAA	$9.8		$9.8		
5.11.2.3.2	27R ALSF-2	OPS	FAA	$19.6		$19.6		
5.11.2.4	Relocate 22R LOC	OPS	FAA					
5.11.2.5	Establish 10L (Existing 9R Extension)	OPS		$45.7		$45.7		
5.11.2.5.1	10L ILS	OPS	FAA	$9.8		$9.8		
5.11.2.5.2	10L/28R RVR	OPS	FAA	$2.6		$2.6		
5.11.2.5.3	10L ALSF-2	OPS	FAA	$19.6		$19.6		
5.11.2.5.4	10L/28R DME	OPS	FAA					
5.11.2.5.5	10L PAPI	OPS	FAA	$13.7		$13.7		
5.11.2.6	Establish 10C	OPS		$31.0		$31.0		
5.11.2.6.1	10C ILS	OPS	FAA	$6.6		$6.6		
5.11.2.6.2	10C/28C RVR	OPS	FAA	$1.8		$1.8		
5.11.2.6.3	10C ALSF-2	OPS	FAA	$13.3		$13.3		
5.11.2.6.4	10C/28C DME	OPS	FAA					
5.11.2.6.5	10C PAPI	OPS	FAA	$9.3		$9.3		
5.11.2.7	Establish 28C	OPS		$29.2		$29.2		
5.11.2.7.1	28C ILS	OPS	FAA	$6.6		$6.6		
5.11.2.7.2	28C ALSF-2	OPS	FAA	$13.3		$13.3		
5.11.2.7.3	28C PAPI	OPS	FAA	$9.3		$9.3		
5.11.2.8	LLWAS	OPS	FAA	$2.7		$2.7		
5.11.2.9	Establish RTR"P", Relocate RTR "ORD, ORD-F"	OPS	FAA					
5.11.2.10	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	OPS	FAA					
5.11.2.11	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	OPS	FAA					
5.11.2.12	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	OPS	FAA					
5.11.2.13	Establish RTR "T"	OPS	FAA	$3.0		$3.0		
5.11.2.14	Establish Temp RTR (North ATCT)	OPS	FAA	$4.1		$4.1		
5.11.2.15	Establish Fiber Optics Transmission System (FOTS)	OPS	FAA					
5.11.2.16	Establish ADSE-X	OPS	FAA	$143.3		$143.3		
5.11.2.17	North ATCT - Equipment	OPS	FAA	$355.0		$355.0		
5.11.2.18	Establish North ASR-9	OPS	FAA	$429.4		$429.4		
5.11.2.19	Establish South Field ASR-9	OPS	FAA					
5.11.2.20	Airspace Redesign	OPS		$20.1		$20.1		
5.11.2.20.1	Elgin RDVS	OPS	FAA					
5.11.2.20.2	Elgin DVRS Expansion	OPS	FAA					
5.11.2.20.3	Elgin Position Redesignation	OPS	FAA					
5.11.2.20.4	ASR-11 Gateway Switch	OPS	FAA					
5.11.2.20.5	MKE - Establish RTR Channel (1 Frequency)	OPS	FAA	$0.9		$0.9		
5.11.2.20.6	MKE - Establish 2 additional STARS Displays	OPS	FAA	$1.4		$1.4		
5.11.2.20.7	SBN - Establish RTR Channel	OPS	FAA	$0.8		$0.8		
5.11.2.20.8	ZAU - Position Reconfiguration (4)	OPS	FAA					
5.11.2.20.9	RCAGs (New Channels, 4 existing Sector locations)	OPS	FAA	$10.9		$10.9		
5.11.2.20.10	BUECs (New Channels, 4 existing Sector locations)	OPS	FAA	$6.0		$6.0		

5.11.2.21	North ATCT Building Maintenance	OPS	FAA	$1,245.5		$1,245.5		
5.11.3	Telecommunications	OPS		$1,753.0		$1,753.0		
5.11.3.1	Airspace Redesign-RCAG/BUEC	OPS		$566.8		$566.8		
5.11.3.1.1	RCAG (JON 64132/42/52/62)	OPS	FAA	$397.4		$397.4		
5.11.3.1.2	BUEC (JON 64252/62/72/82)	OPS	FAA	$169.4		$169.4		
5.11.3.2	JON 60994 MKE RTR&ECS	OPS	FAA	$191.5		$191.5		
5.11.3.3	JON 60974 SBN RTR&ECS	OPS	FAA	$320.5		$320.5		
5.11.3.4	JON 61004 RDVS	OPS	FAA	$404.0		$404.0		
5.11.3.5	JON 61059 C90 Freqs	OPS	FAA	$234.5		$234.5		
5.11.3.6	Establish ADSE-X	OPS	FAA	$35.7		$35.7		
5.11.4	Building and Infrastructure Modernization and Improvements	OPS						
5.11.5	Real Estate Management	OPS						
5.11.6	Physical Security	OPS						
5.12	Flight Inspections and SIAP Development	OPS		$793.7	$2.9	$796.6		
5.12.1	ATO-W AVN Flt Inspection, charting & other OPS	OPS		$727.2		$727.2		
5.12.1.1	Flight Inspection, Charting & other Ops-Development	OPS	Reimb	$649.1		$649.1		
5.12.1.2	Flight Inspection and Charting-Maintenance-Rnwys 9L/27R	OPS	FAA	$46.5		$46.5		
5.12.1.3	Flight Inspection and Charting-Maintenance-Rnwys 10C/28C	OPS	FAA	$31.6		$31.6		
5.12.2	Airways Facility	FS-OPS		$66.4	$2.9	$69.3		
5.12.2.1	Relocate 14L	FS-OPS	Reimb	$6.8	$0.3	$7.1	95%	110%
5.12.2.2	Establish 9L	FS-OPS	Reimb	$8.2	$0.4	$8.6	95%	110%
5.12.2.3	Establish 27R	FS-OPS	Reimb	$7.5	$0.3	$7.8	95%	110%
5.12.2.4	Relocate 22R LOC	FS-OPS	Reimb	$2.8	$0.1	$3.0	95%	110%
5.12.2.5	LLWAS	FS-OPS	Reimb					
5.12.2.6	Establish RTR"P", Relocate RTR "ORD, ORD-F"	FS-OPS	Reimb					
5.12.2.7	Establish Temp RTR	FS-OPS	Reimb					
5.12.2.8	Establish RTR "R", Relocate RTR "ORD-B, ORD-H"	FS-OPS	Reimb					
5.12.2.9	Establish RTR"S", Relocate RTR "ORD-C, ORD-I"	FS-OPS	Reimb					
5.12.2.10	Establish RTR"Q", Relocate RTR "ORD-A, ORD-G"	FS-OPS	Reimb					
5.12.2.11	Establish RTR"T"	FS-OPS	Reimb					
5.12.2.12	Establish Fiber Optics Transmission System (FOTS)	FS-OPS	Reimb					
5.12.2.13	Establish ADSE-X	FS-OPS	Reimb					
5.12.2.14	North ATCT	FS-OPS	Reimb	$0.4	$0.0	$0.4	95%	110%
5.12.2.15	Temporary ASR-9	FS-OPS	Reimb	$3.4	$0.1	$3.6	95%	110%
5.12.2.16	Radar - Establish North On-Field ASR-9	FS-OPS	Reimb	$3.5	$0.2	$3.7	95%	110%
5.12.2.17	Radar - Establish South Field ASR-9	FS-OPS	Reimb	$7.3	$0.3	$7.6	95%	110%
5.12.2.18	TRACON (C90) - RDVS Upgrade	FS-OPS	Reimb					
5.12.2.19	TRACON (C90) - DVRS Expansion	FS-OPS	Reimb					
5.12.2.20	ORD ATCT - AEFS	FS-OPS	Reimb					
5.12.2.21	Existing ATCT Mods	FS-OPS	Reimb					
5.12.2.22	Airspace Redesign - MKE (RTR, Displays); SBN; ZAU Reconfig	FS-OPS	Reimb					
5.12.2.23	Airspace Redesign - RTR, C90/ORD 5 Freq	FS-OPS	Reimb					
5.12.2.24	Airspace Redesign - C90 Programming	FS-OPS	Reimb					
5.12.2.25	Airspace Redesign - RCAGs, BUECs	FS-OPS	Reimb					
5.12.2.26	Extend 10L (Existing 9R Extension)	FS-OPS	Reimb	$9.1	$0.4	$9.5	95%	110%
5.12.2.27	Establish 28C	FS-OPS	Reimb	$9.1	$0.4	$9.5	95%	110%
5.12.2.28	Establish 10C	FS-OPS	Reimb	$8.3	$0.4	$8.7	95%	110%
5.13	System Performance Assessment	OPS						
5.14	System Operations	FS-OPS		$76,903.7		$76,903.7	High Estimate used as Point Estimate	
5.14.1	Chicago Tower (ORD)	FS-OPS	FAA	$32,254.5		$32,254.5		
5.14.2	Chicago TRACON (C90)	FS-OPS	FAA	$32,803.9		$32,803.9		
5.14.3	Chicago Center ARTCC (ZAU)	FS-OPS	FAA					
5.14.4	South Bend (SBN)	FS-OPS	FAA	$2,524.1		$2,524.1		
5.14.5	Milwaukee (MKE)	FS-OPS	FAA	$9,321.2		$9,321.2		
5.15	Travel To And From Sites	OPS						

Listed below is a brief summary of the subject matter experts and their areas of expertise for which they provided data:

WBS #	Cost Element	Approp	Source
	OMP PHASE I DELTA LIFE CYCLE COST ESTIMATE		
	Facilities & Equipment (F&E)		
3.0	**Solution Development**	**F&E**	
3.1	Program Management	F&E	FAA ATO-T & ATO-W & AGL: Irene Langweil & Bill Gunning
3.2	System Engineering	F&E	FAA ATO-T: JC Johns
3.3	HW/SW Design, Development, Procurement, and Production	F&E	FAA ATO-W: Sharon Rushing-Davis
3.4	Physical and Airspace Infrastructure Design and Development	F&E	FAA AGL-Bill Gunning
3.5	Test and Evaluation	F&E	
3.6	Data and Documentation	F&E	
3.7	Logistics Support	F&E	FAA ATO-T: MCR
4.0	**Implementation**	**F&E**	
4.1	Program Management	F&E	FAA ATO-T & ATO-W & AGL: Irene Langweil & Bill Gunning
4.2	Engineering	F&E	FAA ATO-W: Sharon Rushing-Davis
4.3	Environmental and Occupational Safety and Health Compliance	F&E	FAA ATO-W: Sharon Rushing-Davis
4.4	Site Selection and Acquisition	F&E	FAA ATO-T: JC Johns
4.5	Construction	F&E	FAA ATO-W: Sharon Rushing-Davis
4.6	Site Preparation, Installation, Test, and Checkout	F&E	FAA ATO-W: Sharon Rushing-Davis & Mike Paulsen
4.7	Joint Acceptance Inspection/Commissioning/Closeout	F&E	FAA ATO-W: Sharon Rushing-Davis & Mike Paulsen
4.8	Telecommunications	F&E	FAA AGL-Bill Gunning
4.9	Implementation Training	F&E	
5.0	**In-Service Management**	**O&M**	
5.1	Preventative Maintenance/Certification	O&M	FAA AGL & ATO-W: Bill Gunning & Mike Paulsen
5.2	Corrective Maintenance	O&M	FAA AGL & ATO-W: Bill Gunning & Mike Paulsen
5.3	Modifications	O&M	
5.4	Maintenance Control	O&M	
5.5	Technical Teaming	O&M	
5.6	Watch Standing Coverage	O&M	FAA ATO-T, AGL & ATO-W: Suzan McCarthy, Bill Gunning & Mike Paulsen
5.7	Program Support	O&M	FAA AGL & ATO-W: Bill Gunning & Mike Paulsen
5.8	Logistics	O&M	FAA Logistics Center - Joe Fryberger
5.9	In-Service Training	O&M	FAA ATO-T, AGL & ATO-W: Suzan McCarthy, Bill Gunning & Mike Paulsen
5.10	Second Level Engineering	O&M	FAA AGL: Bill Gunning
5.11	Infrastructure Support	O&M	FAA AGL: Bill Gunning
5.12	Flight Inspections and SIAP Development	O&M	FAA AGL & ATO-W: Bill Gunning & Mike Paulsen
5.13	System Performance Assessment	O&M	
5.14	System Operations	O&M	FAA ATO-T: Suzan McCarthy
5.15	Travel To and From Sites	O&M	