LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-CONF-412832

Optics Supply Planning System

J. Gaylord

May 6, 2009

Optic Supply Planning system Design Specification Part 1
Chico, CA, United States
May 5, 2009 through May 6, 2009

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

Optics Supply Planning System

Design Specification

Part I

April 2009

LLNL-CONF-412832

Jessie Gaylord

CSCI 330

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

TABLE OF CONTENTS

1. Introduction 2
   1.1 Problem Description 2
   1.2 Target Groups 2
   1.3 Scope 3

2. Design Considerations 4
   2.1 Functionality 4
   2.2 Usability 4
   2.3 Performance 5
   2.4 Supportability 5

3. Design Models 6
   3.1 Architectural Design 6
      3.1.1 Context Level Design 6
      3.1.2 Component Architecture 7
   3.2 Component Design 8
      3.2.1 Component Hierarchy 8
      3.2.2 System Executive 9
      3.2.3 Plan Manager 10
      3.2.4 Forecast Calculator 12
      3.2.5 System I/O 15
      3.2.6 Report Views 156
   3.3 Data Design 18
      3.3.1 Entity Relationship Diagram 18
      3.3.2 Data Dictionary 19
   3.4 Interface Design 23

4. QA Plan 23

5. Test Plan 23

6. Deployment 23

1. INTRODUCTION

The purpose of this study is to specify the design for an initial optics supply planning system for NIF, and to present quality assurance and test plans for the construction of the system as specified.

1.1 PROBLEM DESCRIPTION

The National Ignition Facility (NIF) is a large laser facility that is just starting operations. Thousands of specialized optics are required to operate the laser, and must be exchanged over time based on the laser shot plan and predictions of damage. Careful planning and tracking of optic exchanges is necessary because of the tight inventory of spare optics, and the long lead times for optics procurements and production changes. Automated inventory forecasting and production planning tools are required to replace existing manual processes.

1.2 TARGET GROUPS

The optics group members who are expected to use the supply planning system are the stakeholders for this project, and are divided into three groups. Each of these groups participated in a requirements specification that was used to develop this design.

1. **Optics Management** – These are the top level stakeholders, and the final decision makers. This group is the interface to shot operations, is ultimately responsible for optics supply, and decides which exchanges will be made.

2. **Work Center Managers** – This group manages the on site optics processing work centers. They schedule the daily work center operations, and are responsible for developing long term processing, equipment, and staffing plans.

3. **Component Engineers** – This group manages the vendor contracts for the manufacture of new optics and the off site rework of existing optics. They are responsible for sourcing vendors, negotiating contracts, and managing vendor processes.

1.3 SCOPE

The scope of this analysis is to describe the structure and design details of a system that will meet all requirements that were described by stakeholders and documented in the analysis model for this project. The design specifies the architecture, components, interfaces, and data stores of the system at a level of detail that can be used for construction and deployment. Test and quality assurance plans are also included to insure that the system delivers all requirements when it is built.

The design is for an automated forecasting prototype that allocates inventory and processing resources in response to potentially daily changes in the forecasted optics exchanges required to operate NIF. It will automatically calculate future inventory levels and processing rates based on current inventory and projected exchanges, procurements, and capacities. It will include screens that allow users to readily assess the feasibility of the forecast, identify failures to meet the demand, revise input data, and re-run the automated forecast calculation.

In addition, the system will automatically retrieve the current exchange demand from an external database. Approved forecasts from the system will automatically update work order plans and procurement plans in the existing inventory and production control database. The timing of optics exchanges affects the forecast of damage and future exchanges, so an approved exchange plan will be fed back to the demand database and be used to calculate the next demand projection. The system will read the demand data and update the forecast and output files daily.

This specification has been divided into two parts. This document, Part I, lays out the major design decisions and specifies the architectural, component, and data structure designs. Part II will add interface designs, quality assurance and testing plans, and deployment details.

2. DESIGN CONSIDERATIONS

The optics supply planning system is planned to be a module in the existing Production Optics Reporting and Tracking (PORT) MS Access database. The rapid development features of MS Access and existing database structures in PORT make possible the short implementation schedule that is required for the prototype system. This design specification is driven by information from the Feasibility Study, the Requirements Specification, and the following quality considerations.

2.1 FUNCTIONALITY

PORT is a data mining tool for the optics group, with some limited data input and processing functions. The functional requirements of the optics supply planning system prototype fit well with existing PORT functions, data structures, and reporting capabilities. In addition, the existing PORT architecture already includes modules that are very similar and adaptable to some of the reporting modules required for the optics supply planning system. The functional adequacy of PORT for this type of application is already proven and the limitations are understood.

PORT is on a secure server in the NIF network. The server has security access controls that are enforced by NIF's IT team and are designed to meet NIF and LLNL security requirements. These security features will be inherited by the optics supply planning system as part of PORT. In addition, PORT read and write privileges are assigned by user group. User groups and access privileges will be tailored to the requirements of the optics supply planning system.

2.2 USABILITY

PORT is already used on a daily basis by all of the target groups for this project. The optics supply planning system user screens and reports will have the same look and feel and navigation features as PORT screens they already use and are familiar with. PORT's aesthetics are also consistent with other NIF applications.

The reports developed for this prototype are expected to be used after the prototype forecast calculator is replaced by a module in Glovia, NIF's enterprise resource planning system. Since

users will already be using the PORT reports, this change in the data sources for the reports will have a limited effect on business processes, and should not disrupt operations.

2.3 PERFORMANCE

PORT database links are currently refreshed daily. Relevant data from NIF source schemas are copied to PORT tables, and PORT users only access the copies. This dramatically improves performance and substantially limits the load of PORT queries on database resources. This meets the business specifications of the optics supply planning system for synchronization with other NIF systems.

The processing requirements of the prototype forecast calculation fall well within PORT performance abilities. Response times for the forecast calculation and report displays will be verified to meet requirements during testing.

2.4 SUPPORTABILITY

PORT is structured in a tiered framework that includes a front end user interface application and a separate back end application for data processing. In addition, data is copied from source databases and cannot be directly accessed by PORT users. This layered architecture promotes the localization of problems and ease of maintenance. The modular structure of PORT functions is intended to enhance extensibility and scalability.

In preparation for this project, stakeholders reviewed existing PORT functional modules for their relevance to NIF operations. Obsolete modules have been archived and removed, and others will be adapted to the optics supply planning system module. The resultant PORT system, including the processing and reporting components for this project, is supportable by the existing PORT development staff.

All user groups already have the MS Access client installed on their office computers. No new hardware or software installations will be required to support this new PORT functionality.

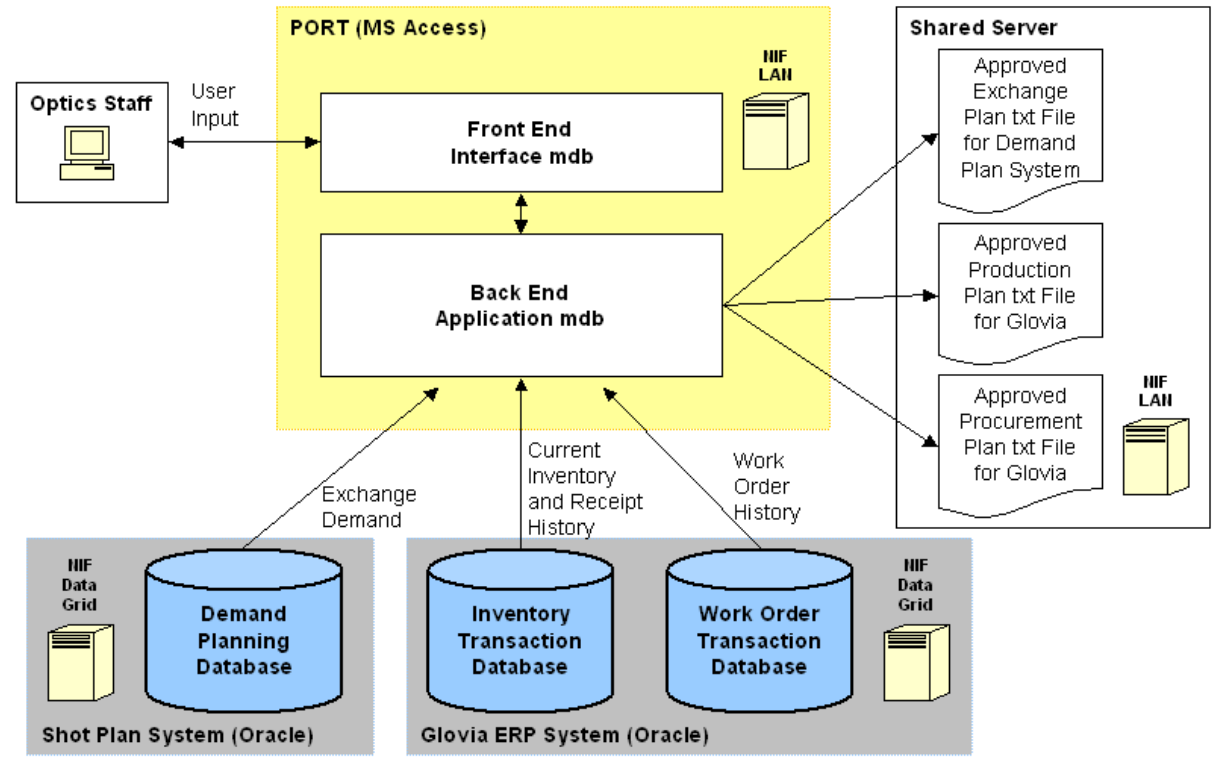
3. DESIGN MODELS

3.1 ARCHITECTURAL DESIGN

3.1.1 CONTEXT LEVEL DESIGN

This top level architectural diagram shows the interaction of PORT layers with external entities. The front end mdb file will contain all user interfaces for the optics supply planning system, and the back end mdb file will contain all data and processing functions. PORT will copy data from external Oracle data stores, and export txt files to be read by external applications to a shared server location.

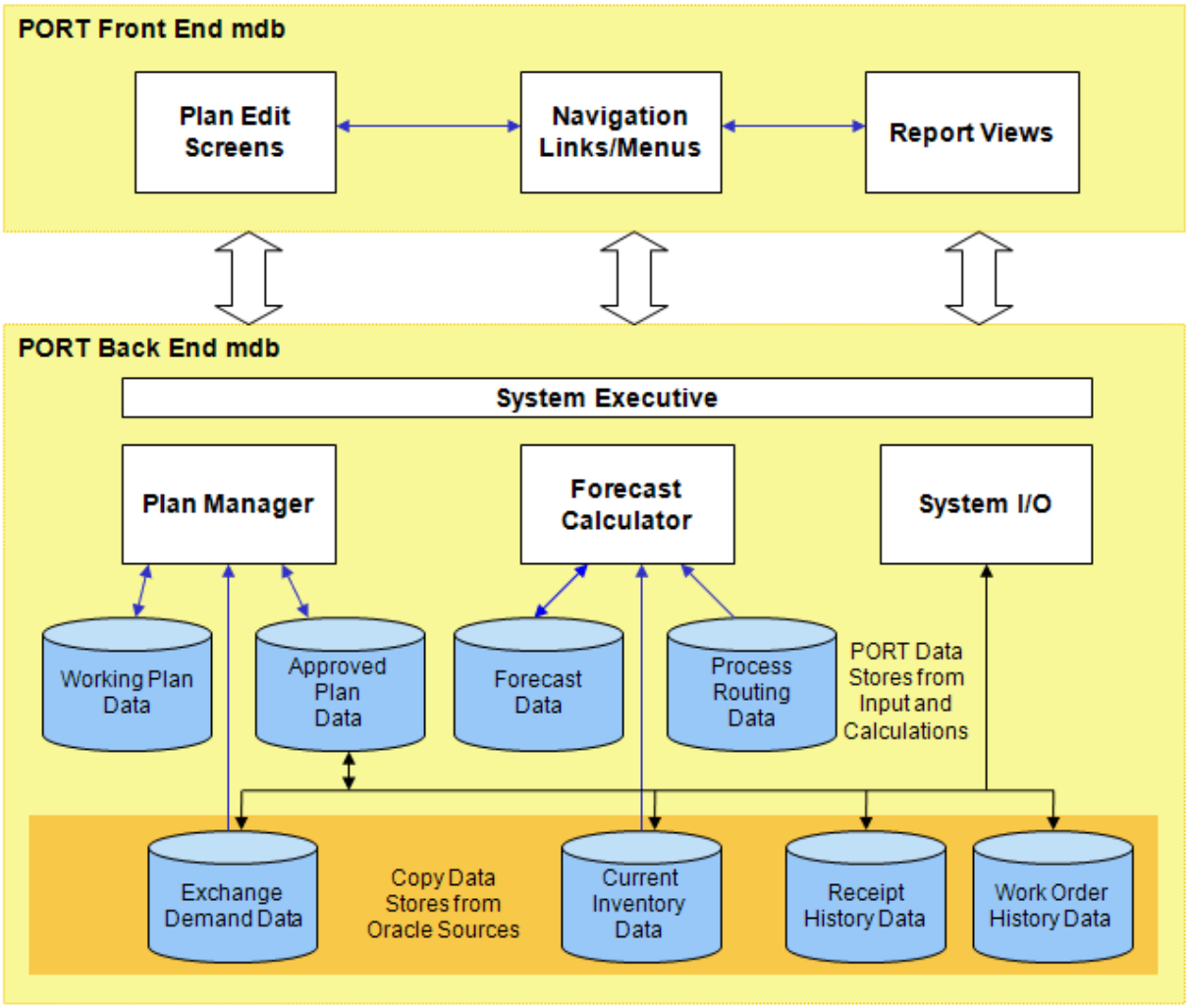
Top Level Architectural Diagram



3.1.2 COMPONENT ARCHITECTURE

This diagram shows how the major components of the optics supply planning system fit within the layered PORT architecture. The front end mdb includes the navigation menus, user entry screens, and reports. The back end mdb includes the PORT data stores and data processing components.

Component Level Architectural Diagram



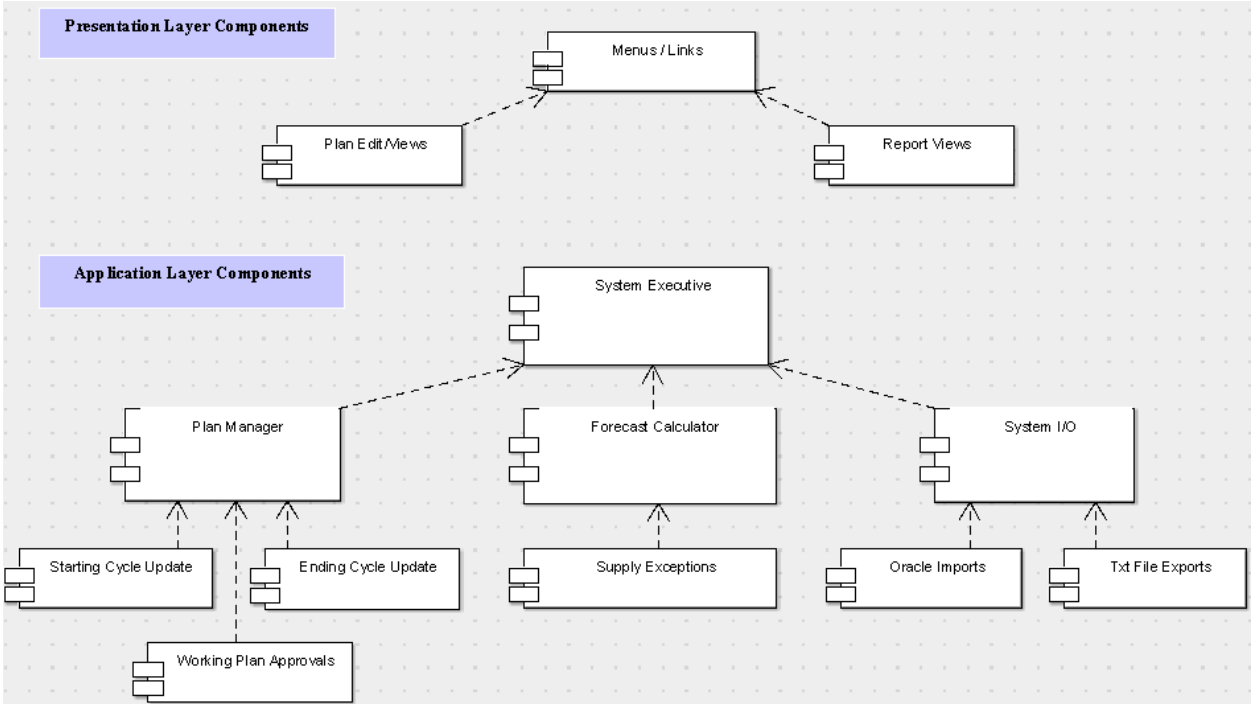
3.2 COMPONENT DESIGN

Components with independent functional characteristics were taken from the analysis specification. Additional components have been added where required to support data processing and system operations. The components and their data interfaces are described in this section. Algorithms for the components are represented at a low level of abstraction.

3.2.1 COMPONENT HIERARCHY

This diagram shows the functional components in the presentation and application layers of the Optics Supply Planning System. The presentation layer contains the user screens, menus, and report views. The application layer contains the system executive, which controls the update cycles and exports through three subsystems that handle the major information transformation functions of the system: plan management, the forecast calculation, and system input/output.

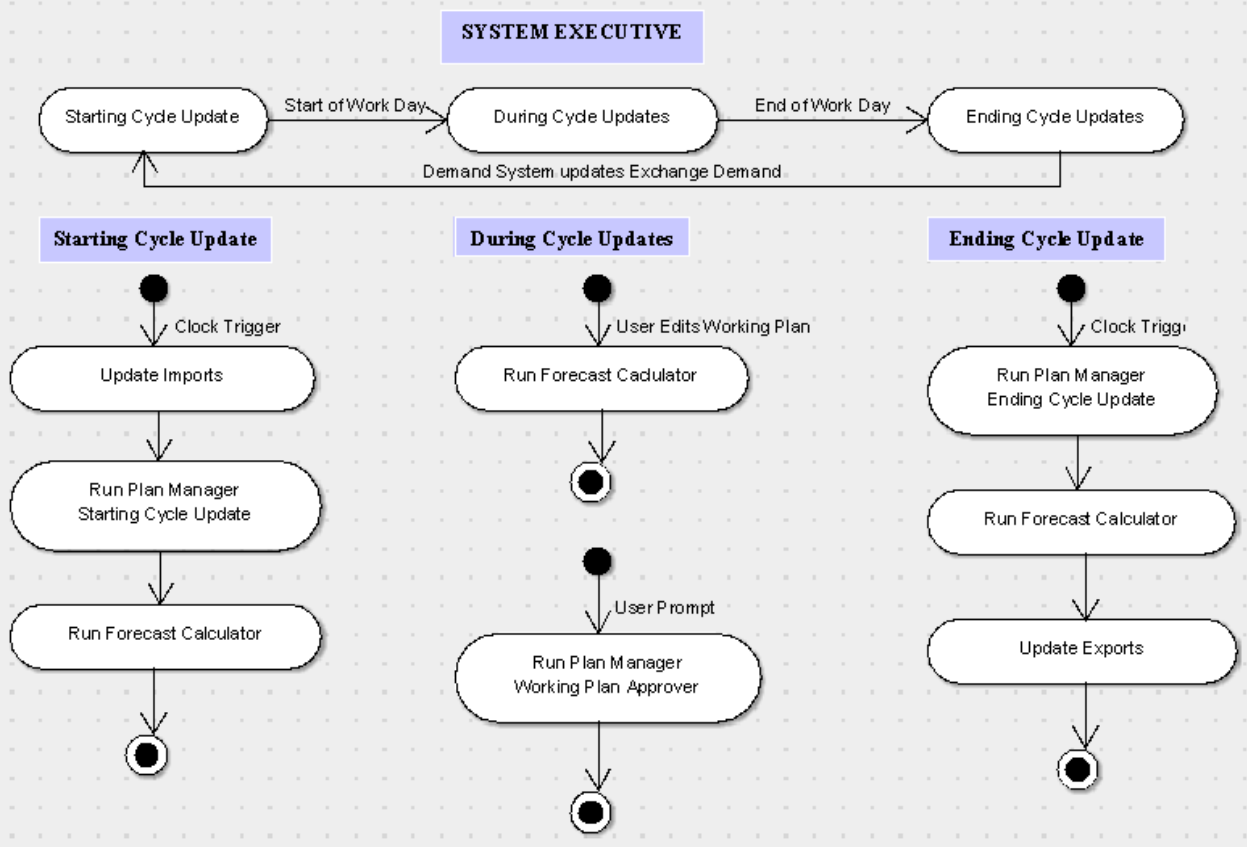
In MS Access, the components will be implemented as groups. Each group will contain the local data tables, data transformations, and control scripts relevant to the function of the component. This modularization is intended to facilitate abstraction, organization, and maintenance of the code. The presentation layer components will be implemented in the front end mdb and the application layer components will be implemented in the back end mdb.



3.2.2 SYSTEM EXECUTIVE

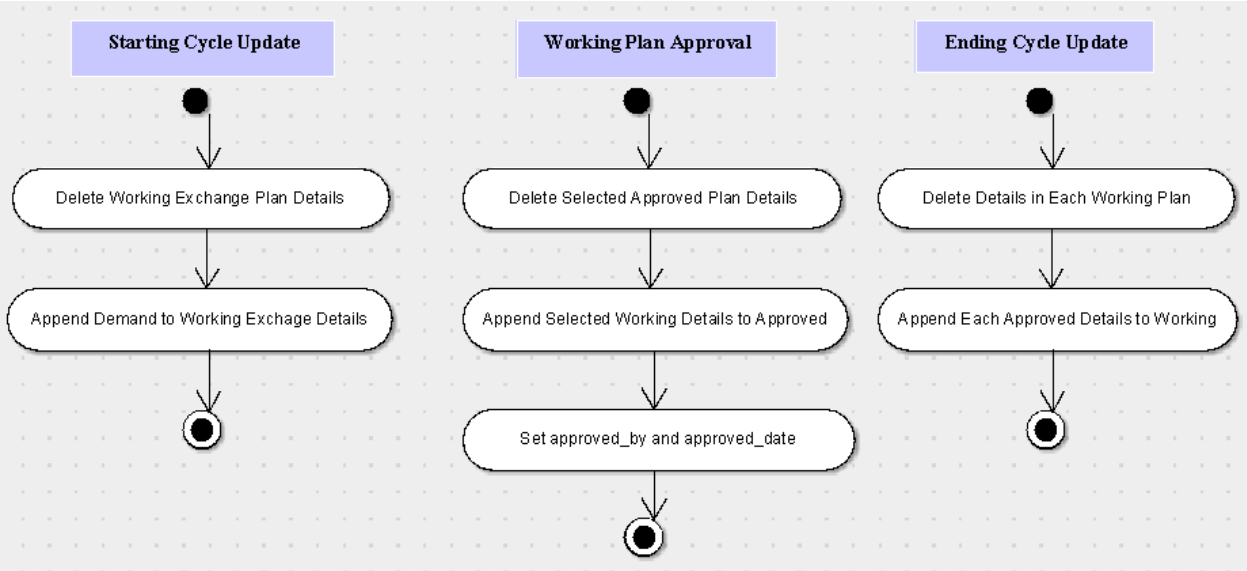
The system executive is the main control module for the optics exchange planning system. It manages the start and end of the planning cycles, and any forecast updates during the planning cycle. The system executive will be implemented as scripts in MS Access. The start and end cycles are scheduled, and the updates during the day are triggered by user edits to working plans.

The start of the planning cycle will be after the Exchange Demand System has updated, but before the start of the business day. At this time a forecast calculation is run based on the new exchange demand. During the day users have the option of revising and approving plans. The end of the planning cycle is after business hours but before the Exchange Demand System updates. At this time the forecast calculation is run based on the approved exchange plan, and the data exports are updated.



3.2.3 PLAN MANAGER

The plan management component of the system includes three functions. It resets the working plans at the start and end of each planning cycle, and provides capabilities for the user to approve a working plan. Working plan data is used for the forecast calculation and reports. Approved plan data is exported to external systems.



Starting Cycle Update

This Plan Manager activity is called by the System Executive at the start of each planning cycle prior to the forecast calculation. The current Working Exchange Plan details are replaced with the imported Demand Exchange Plan details.

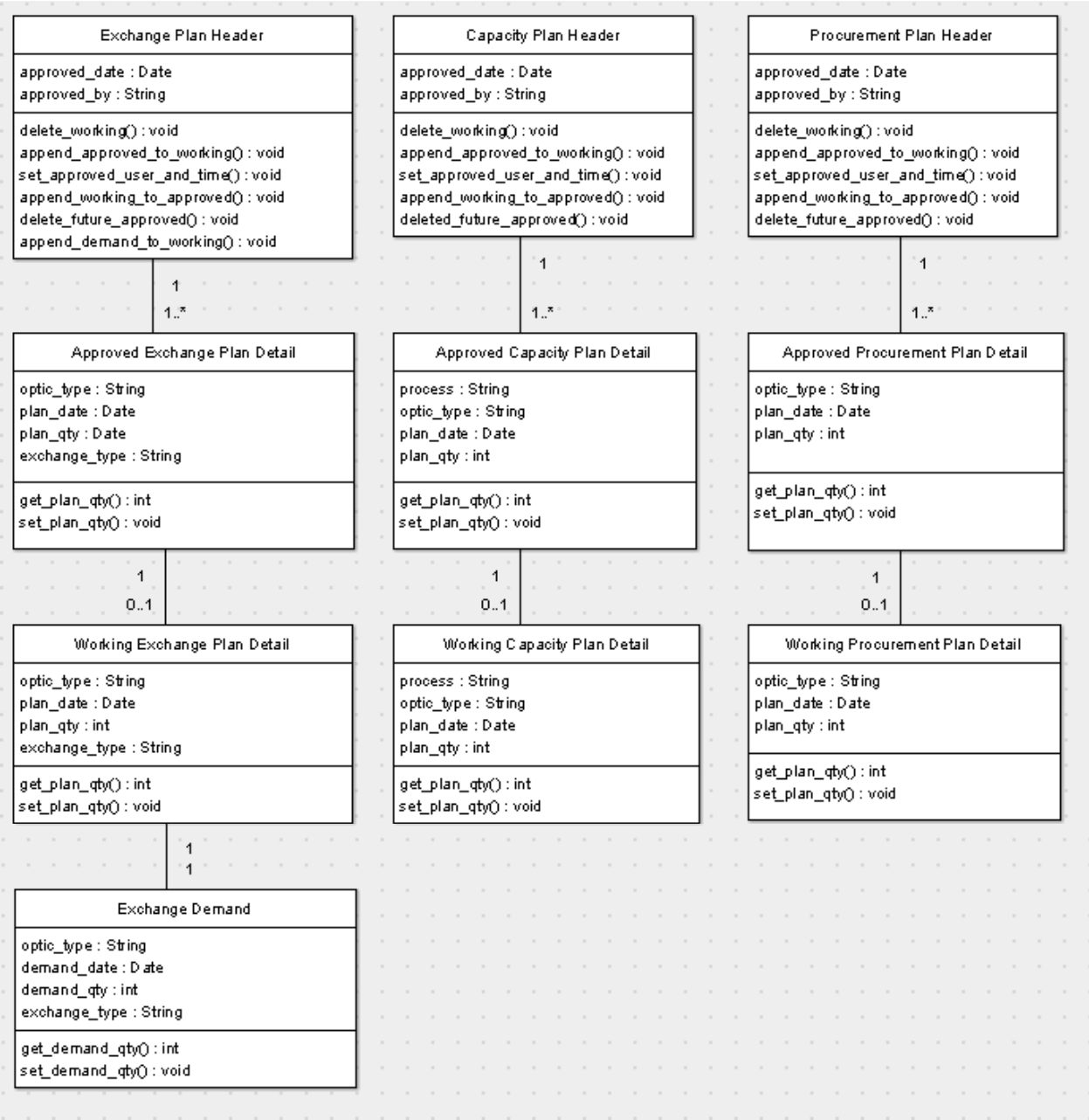
Working Plan Approval

This Plan Manager activity is called by the user during the planning cycle. The current Working Plan details for the Exchange, Capacity, or Procurement Plan are replaced with the corresponding Approved Plan details.

Ending Cycle Update

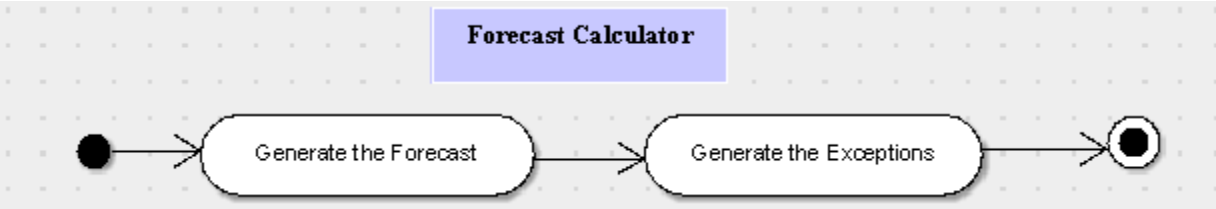
This Plan Manager activity is called by the System Executive at the end of each planning cycle prior to the forecast calculation. The current Exchange, Capacity, and Procurement Working Plan details are overwritten with the corresponding Approved Plan details.

The Plan Manager processes require the data and functions in the class diagram below. In MS Access the attributes will be implemented as tables and the functions will be implemented as scripts containing one or more transform queries.

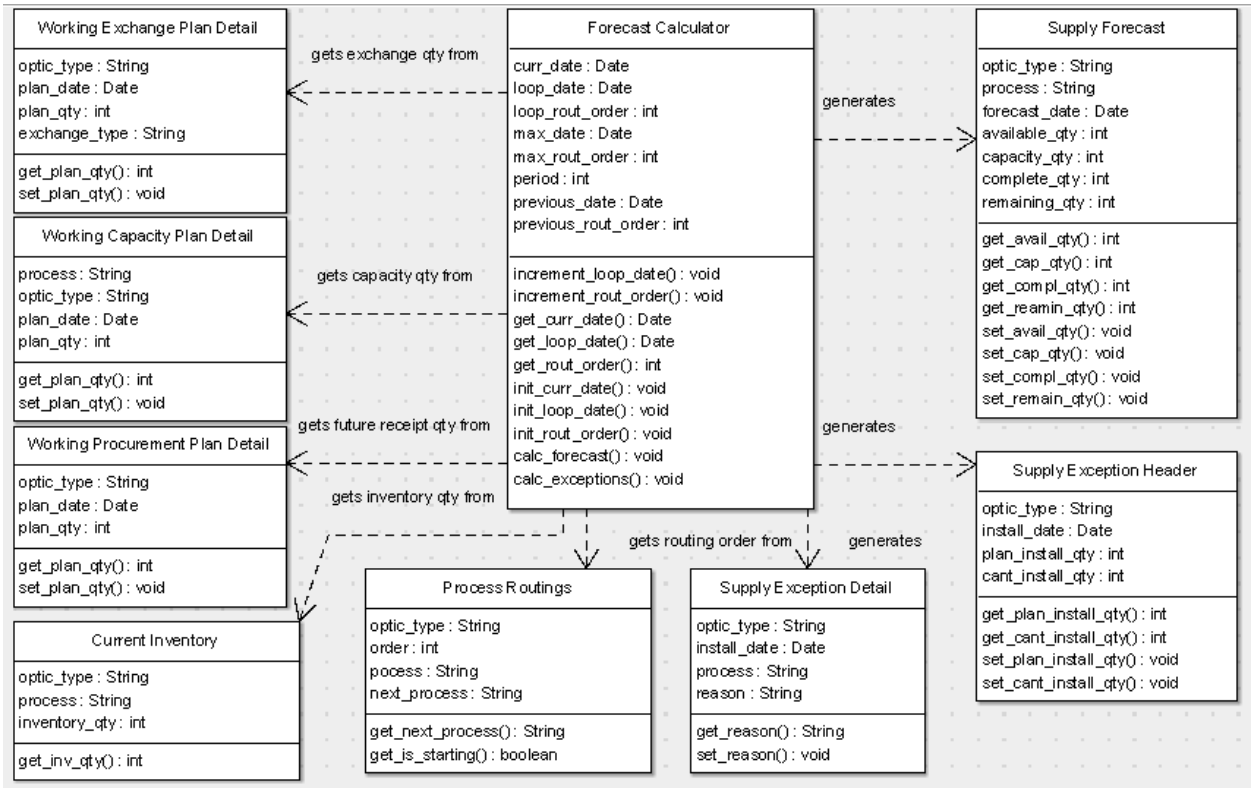


3.2.4 FORECAST CALCULATOR

The forecast calculator is called by the system executive at the start of each planning cycle, at the end of each planning cycle, and after the user has made a change to the Exchange, Capacity, or Procurement Working Plan. Each time the calculator runs, the forecast and supply exceptions are generated. The ending cycle update saves the forecast to the approved production plan.



The forecast calculator requires the data and functions in the class diagram below. Pseudo-codes for the forecast and exception calculations are given on the following pages. The algorithms were designed from descriptions of the current manual calculations in the requirements specification. In MS Access each function will be implemented as a group of action queries and scripts.



Pseudo Code for calc_forecast( ):

```
delete all forecast rows;
select all process routings by optic_type                    //add starting inventory to forecast
{                                                            // for current period
    insert into the forecast:
        optic_type, process,
        forecast_date = current_date,                        //current_date is current period
        available_qty = inventory_qty for last process,
        complete_qty = inventory_qty for this process,
        remaining_qty = 0;
}
select all process = 'receipt' or 'remove' by optic type     //add new receipts and exchanges
{                                                            // for periods after current period
    select working procurement plan rows with plan_date > current_date
    select working exchange plan rows with plan_date > current_date
            and exchange_type = 'recycle'
    insert into the forecast:
        optic_type, process,
        forecast_date = plan_date,
        available_qty = null,
        complete_qty = procurement.plan_qty + exchange.plan_qty,
        remaining_qty = 0;
}
select all routings != 'receipt' or 'remove' by optic_type   //add forecast rows for remaining routings
{                                                            // for periods after current period
    loop_date = current_date;                                // initialize date index
    for all loop_dates < max_date
    {
        loop_date = loop_date + period;                      //increment date index
        loop_rout_order = 0;                                 //initialize routing order index
        for all loop_rout_orders < max_rout_order
        {
            loop_rout_order ++;                              //increment routing index
            insert into the forecast:
                optic_type, process,
                forecast_date = loop_date,
                available_qty = complete_qty for last process + remaining_qty
                    from last period for this process,
                complete_qty = less of available_qty and working capacity.plan_qty,
                remaining_qty = available_qty – complete_qty;
        }
    }
}
```

A comparison of the forecast to exchange plans and capacity plans gives supply exceptions. Periods where installations fall short of the plan generate an exception. If there was a remaining quantity in the period then there was a capacity limitation in that process. If the total available inventory is less than the requested installations for the period, then there are too few optics on order. Multiple reasons may occur for one exception by optic type.

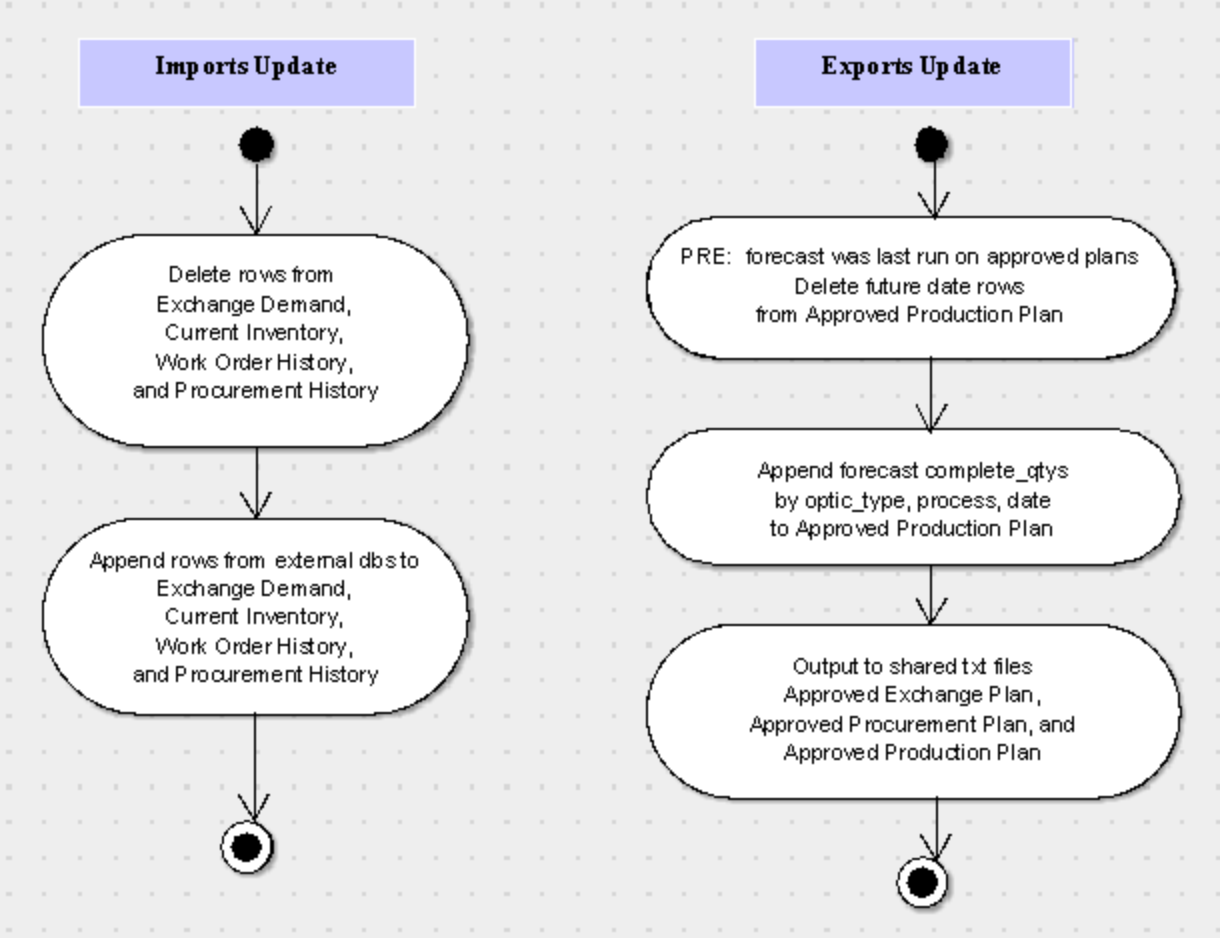
Pseudo Code for calc_exceptions( ):

```
select all forecast_dates by optic_type
{
        select all complete_qty where process = 'install';                    //find exceptions
        select all working exchange plan_qty where same optic_type and forecast_date=plan_date;
        if complete_qty < plan_qty
        {
                Insert into exceptions header:
                        optic_type,
                        install_date = forecast_date,
                        plan_install_qty = plan_qty;
                        cant_install_qty = plan_qty – complete_qty;
                select sum of available_qty for all processes != 'install' for forecast_date;
                if sum of available < plan_qty                                //check procurements
                {
                        insert into exception details:
                                optic_type,
                                install_date = forecast_date,
                                process = 'receipt',
                                reason = 'not enough optics';
                }
                select all process routings with a capacity plan              //check capacity
                {
                        select forecast.remaining_qty for optic_type and forcast_date;
                        if remaining_qty > 0
                        {
                                insert into exception details:
                                        optic_type,
                                        install_date = forecast_date,
                                        process,
                                        reason = 'not enough capacity';
                        }
                }
        }
}
```

3.2.5 SYSTEM I/O

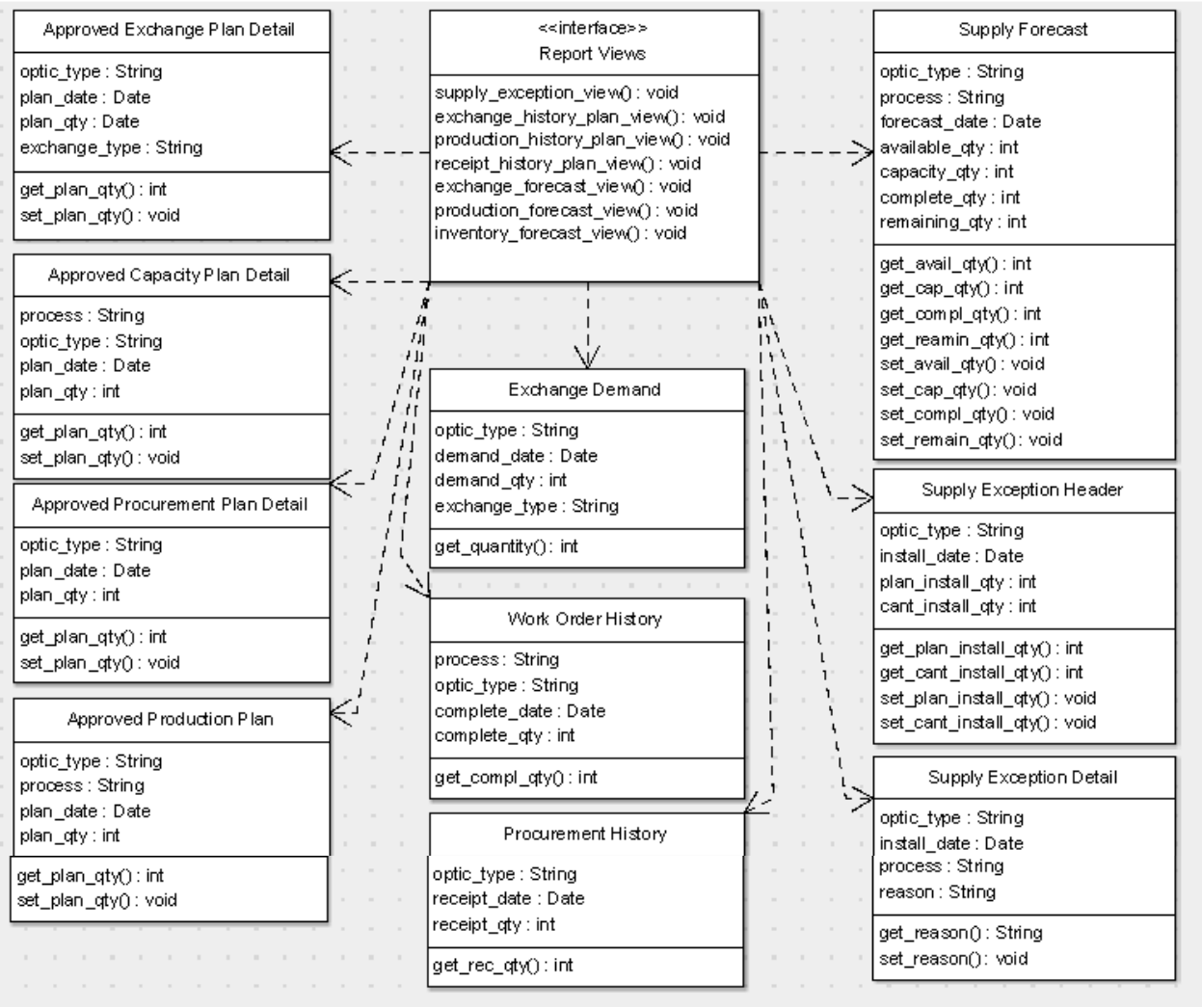
The Optics Supply Planning System requires data from external Oracle databases, and provides text output files to be read by external NIF applications. The system executive calls the system I/O component to update the inputs from external databases at the start of each planning cycle and to update output files at the end of each planning cycle.

System inputs update the Exchange Demand, Current Inventory, Work Order History, and Procurement History tables from external Oracle databases. System outputs are text files for the Approved Exchange Plan, the Approved Procurement Plan, and the Approve Production Plan. The text files are formatted to be read by the Exchange Demand system and the Glovia enterprise planning system, and are saved to a shared directory on a NIF network server.



3.2.6 REPORT VIEWS

Reports are a major component of the requirements specification. A full description of the reports and other components of the presentation layer will be included in the interface design in part 2. A report view is called to organize the data and perform any required calculations when the user opens a report screen. In MS Access report views will be implemented as select queries in the presentation layer. The reports require access to several classes.



Pseudo Code for Report Views

1. **supply_exception_view():**
   select install_date, optic_type, plan_install_qty, cant_install_qty, process, reason,
   available_qty, capacity_qty, complete_qty, and remaining_qty
   from exception header, exception details, and supply forecast tables
   where same optic_type, same process, forecast_date=install_date
   order by install_date, optic_type, process

2. **exchange_history_plan_view():**
   select optic_type, plan_date, plan_qty, completed_qty
   from approved exchange plan and work order history tables
   where same optic_type, process = 'install', plan_date = complete_date period
   transform optic_types into column series
   order by plan_date

3. **production_history_plan_view():**
   select optic_type, plan_date, production.plan_qty, capacity,plan_qty, completed_qty
   from approved production plan, approved capacity plan, and work order history tables
   where same optic_type, same process, plan_date = complete_date period
   transform optic_types into column series
   group by process
   order by plan_date

4. **receipt_history_plan_view():**
   select optic_type, plan_date, plan_qty, receipt_qty
   from approved procurement plan and inventory receipt history tables
   where same optic_type, plan_date = receipt_date period
   transform optic_types into column series
   order by plan date

5. **exchange_forecast_view():**
   select optic_type, forecast_date, complete_qty, demand_qty, cant_install_qty
   from supply forecast , exception header, and exchange demand tables
   where same optic_type, demand_date=forecast_date=install_date, and process=install
   transform optic_types into column series
   order by plan_date

6. **production_forecast_view():**
   select optic_type, forecast_date, process, available_qty, capacity_qty, completed_qty
   from supply forecast where capacity_qty is not null
   transform optic_types into column series
   group by process
   order by plan_date

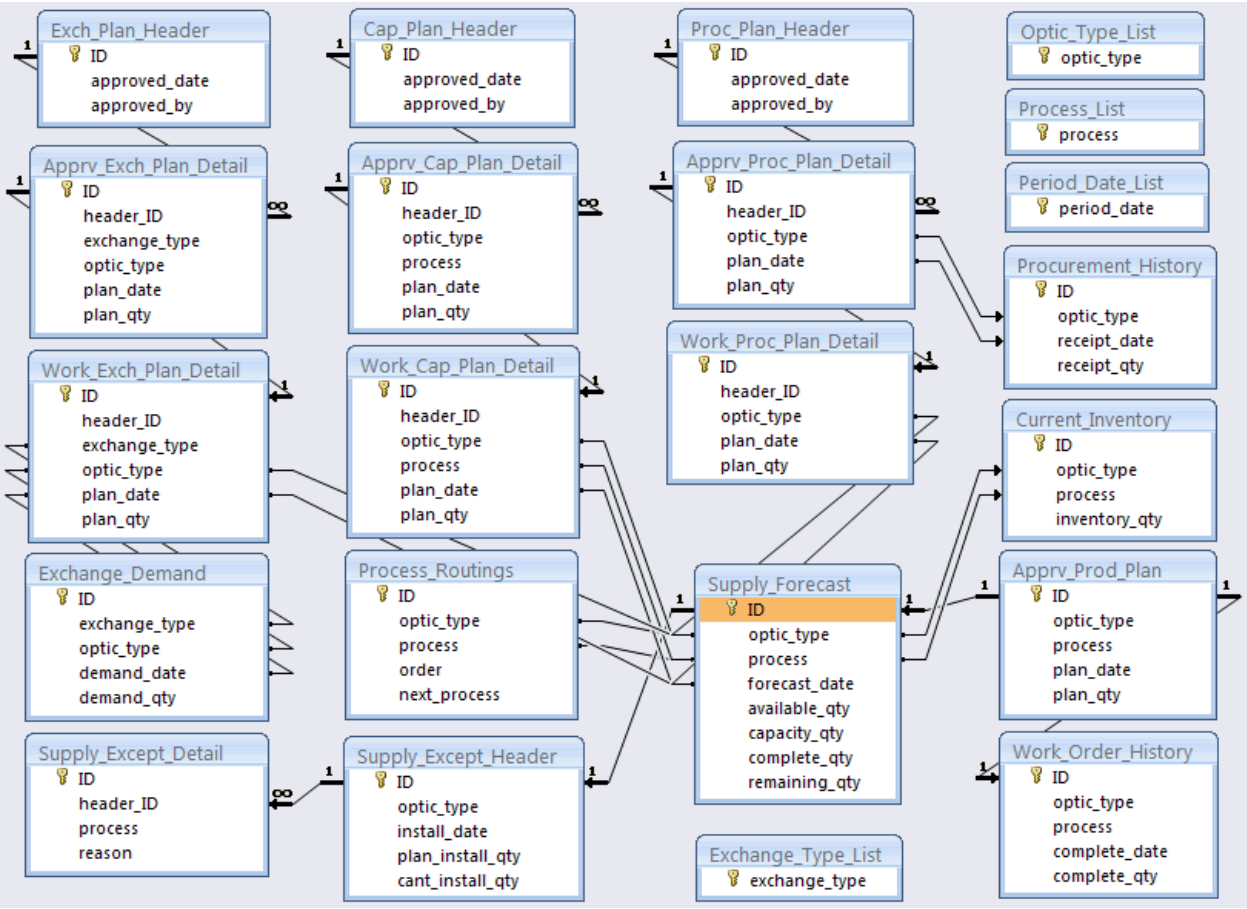
7. **inventory_forecast_view():**
   select remaining_qty from supply forecast qty
   transform process steps into column series
   group by optic_type
   order by forecast_date

3.3 DATA DESIGN

This section describes the data stores required by the Optics Supply Planning System, the data relationships between them, and the specification of each field in them. The data stores will be implemented as tables in MS Access.

3.3.1 ENTITY RELATIONSHIP DIAGRAM

The entity relationship diagram specifies the data stores by their fields and their relationships to each other. Header tables are keyed to detail tables with a header_ID foreign key. All tables are related by an optic_type, process, and/or period_date field. Lookup lists give the valid entries for these keys. Header tables are one-to-many details. All other tables are one-to-one or one-to-zero.



3.3.2 DATA DICTIONARY

The definitions of the tables below give the value types, keys, descriptions, and other specifications of the fields in each table. All optic_type, process, and date keys on all tables will be enforced to be values from the value lists to promote referential integrity.

Value List Tables

Optic_Type_List

Field Name	Value Type	Key Type	Indexing	Dups	Nulls	Description
optic_type	text	primary	indexed	no dups	no nulls	valid optic_type values

Process_List

Process_List	text	primary	indexed	no dups	no nulls	valid process values

Period_Date_List

period_date	date	primary	indexed	no dups	no nulls	valid date values

Exchange_Type_List

exchange_type	text	primary	indexed	no dups	no nulls	valid exchange_type values

Plan Tables

Exch_Plan_Header

ID	integer	primary	indexed	no dups	no nulls	plan identifier (table has one row)
approved_date	date		na	dups OK	nulls OK	date-time stamp of last approval
approved_by	text		na	dups OK	nulls OK	current user of last approval

Cap_Plan_Header

ID	integer	primary	indexed	no dups	no nulls	plan identifier (table has one row)
approved_date	date		na	dups OK	nulls OK	date-time stamp of last approval
approved_by	text		na	dups OK	nulls OK	current user of last approval

Proc_Plan_Header

ID	integer	primary	indexed	no dups	no nulls	plan identifier (table has one row)
approved_date	date		na	dups OK	nulls OK	date-time stamp of last approval
approved_by	text		na	dups OK	nulls OK	current user of last approval

Apprv_Exch_Plan_Detail

ID	text	primary	indexed	no dups	no nulls	concat header_ID, exchange_type, optic_type, plan_date
header_ID	integer	foreign	indexed	no dups	no nulls	Exch_Plan_Header ID
exchange_type	text	foreign	indexed	no dups	no nulls	exchange_type list value
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (all dates)
plan_qty	integer			dups OK	nulls OK	planned qty of exchanges

Field Name	Value Type	Key Type	Indexing	Dups	Nulls	Description
Apprv_Cap_Plan_Detail						
ID	text	primary	indexed	no dups	no nulls	concat header_ID, optic_type, process, plan_date
header_ID	integer	foreign	indexed	no dups	no nulls	Cap_Plan_Header ID
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (all dates)
plan_qty	integer			dups OK	nulls OK	planned capacity qty
Apprv_Proc_Plan_Detail						
ID	text	primary	indexed	no dups	no nulls	concat header_ID, optic_type, plan_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (all dates)
plan_qty	integer			dups OK	nulls OK	planned procurement qty
Work_Exch_Plan_Detail						
ID	text	primary	indexed	no dups	no nulls	concat header_ID, exchange_type, optic_type, plan_date
header_ID	integer	foreign	indexed	no dups	no nulls	Exch_Plan_Header ID
exchange_type	text	foreign	indexed	no dups	no nulls	exchange_type list value
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
plan_qty	integer			dups OK	nulls OK	planned qty of exchanges
Work_Cap_Plan_Detail						
ID	text	primary	indexed	no dups	no nulls	concat header_ID, optic_type, process, plan_date
header_ID	integer	foreign	indexed	no dups	no nulls	Cap_Plan_Header ID
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
plan_qty	integer			dups OK	nulls OK	planned capacity qty
Work_Proc_Plan_Detail						
ID	text	primary	indexed	no dups	no nulls	concat header_ID, optic_type, plan_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
plan_qty	integer			dups OK	nulls OK	planned procurement qty
Apprv_Prod_Plan						
ID	text	primary	indexed	no dups	no nulls	concat optic_type, process, plan_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
plan_date	date	foreign	indexed	no dups	no nulls	period_date list value (all dates)
plan_qty	integer			dups OK	nulls OK	planned capacity qty

Field Name	Value Type	Key Type	Indexing	Dups	Nulls	Description

Forecast Tables

Process_Routings

ID	text	primary	indexed	no dups	no nulls	concat optic_type and process
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
order	integer		indexed	no dups	no nulls	process order by optic type
next_process	text	foreign	indexed	no dups	no nulls	process list value

Supply_Forecast

ID	text	primary	indexed	no dups	no nulls	concat optic_type, process, and forecast_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
forecast_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
available_qty	integer			dups OK	nulls OK	period start unprocessed inventory
capacity_qty	integer			dups OK	nulls OK	period process capacity
complete_qty	integer			dups OK	nulls OK	period processed inventory
remaining_qty	integer			dups OK	nulls OK	period end unprocessed inventory

Supply_Except_Header

ID	text	primary	indexed	no dups	no nulls	concat optic_type and install_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
install_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
plan_install_qty	integer			dups OK	nulls OK	period planned install qty
cant_install_qty	integer			dups OK	nulls OK	forecasted unable to install qty

Supply_Except_Detail

ID	text	primary	indexed	no dups	no nulls	concat header_ID and process
process	text	foreign	indexed	no dups	no nulls	process list value
reason	text			dups OK	no nulls	limitation explanation text

Import Tables

Exchange_Demand

Field Name	Value Type	Key Type	Indexing	Dups	Nulls	Description
ID	text	primary	indexed	no dups	no nulls	concat exchange_type, optic_type, demand_date
exchange_type	text	foreign	indexed	no dups	no nulls	exchange_type list value
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
demand_date	date	foreign	indexed	no dups	no nulls	period_date list value (future)
demand_qty	integer			dups OK	nulls OK	planned qty of exchanges

Procurement_History

ID	text	primary	indexed	no dups	no nulls	concat optic_type and receipt_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
receipt_date	date	foreign	indexed	no dups	no nulls	period_date list value (past + curr)
receipt_qty	integer			dups OK	nulls OK	actual receipt qty

Current_Inventory

ID	text	primary	indexed	no dups	no nulls	concat optic_type and process
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
inventory_qty	integer			dups OK	nulls OK	current period qty on hand at each process step

Work_Order_History

ID	text	primary	indexed	no dups	no nulls	concat optic_type, process, and complete_date
optic_type	text	foreign	indexed	no dups	no nulls	optic_type list value
process	text	foreign	indexed	no dups	no nulls	process list value
complete_date	date	foreign	indexed	no dups	no nulls	period_date list value (past + curr)
complete_qty	integer			dups OK	nulls OK	actual processed qty

3.4 INTERFACE DESIGN

This section will be included in Part 2.

4. QA PLAN

This section will be included in Part 2.

5. TEST PLAN

This section will be included in Part 2.

6. DEPLOYMENT

This section will be included in Part 2.