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Defense Information Infrastructure (DII) Common Operating Environment (COE)

Database Design Document (DBDD) for the Tactical Environmental Data System (TEDS)

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1 SCOPE

1.1 Identification

This Database Design Document (DBDD) describes the database schema for the Tactical Environmental Data System (TEDS), Release 4.3. TEDS operates in a heterogeneous network environment and manages environmental data and products to support analyses and applications that serve tactical end-users.

1.2 Database Overview

This document describes the meteorological and oceanographic (METOC) database component of the Navy Integrated Tactical Environmental Subsystem (NITES). On 29 October 1996, the Oceanographer of the Navy issued a TESS Program Policy statement in letter 3140 Serial 961/6U570953, modifying the Program by calling for five seamless software versions that are DII COE compliant, preferably to level 5.

The five versions are:

- NITES Version I — The local data fusion center and principal METOC analysis and forecast system
- NITES Version II — The subsystem on the Joint Maritime Command Information System (JMCIS) or Global Command and Control System (GCCS) (NITES/Joint METOC Segment (JMS))
- NITES Version III — The unclassified aviation forecast, briefing, and display subsystem tailored to Naval METOC shore activities (currently satisfied by the Meteorological Integrated Data Display System (MIDDS))
- NITES Version IV — The Portable subsystem composed of independent Personal Computers (PCs)/workstations and modules for forecaster, satellite, communications, and Integrated Command, Control, Communications, Computer, and Intelligence Surveillance Reconnaissance (IC4ISR) functions (currently the Interim Mobile Oceanographic Support System (IMOSS))
- NITES Version V — Foreign Military Sales (currently satisfied by the Allied Environmental Support System (AESS))

NITES I acquires and assimilates various METOC data for use by US Navy and Marine Corps weather forecasters and tactical planners. NITES I provides these users with METOC data, products, and applications necessary to support the warfighter in tactical operations and decision making. NITES I provides METOC data and products to NITES I and II applications, as well as other systems requiring METOC data, in a heterogeneous, networked computing environment.

The NITES Concept of Operations and system architecture require that TEDS be distributed both in terms of application access to METOC data and products and in terms of physical location of the data repositories. The organizational structure of the database is influenced by these requirements, and the components of this distributed database are described below.

In accordance with DII COE database concepts, TEDS is composed of six DII COE-compliant *shared database* segments. Associated with each shared database segment is an API segment. The segments are arranged by data type as follows:

Data Type	**Data Segment**	**API Segment**
Grid Fields	MDGRID	MAGRID
Latitude-Longitude-Time (LLT) Observations	MDLLT	MALLT
Textual Observations and Bulletins	MDTXT	MATXT
Remotely Sensed Data	MDREM	MAREM
Imagery	MDIMG	MAIMG
Climatology Data	Segments will be provided for each type of climatology data.	

A typical client-server installation is depicted in Figure 1-1. This shows the shared database segments residing on a DII COE database server, with a NITES I or II client machine hosting the API segments. Communication between API segments and shared database segments is accomplished over the network using ANSI-standard Structured Query Language (SQL).

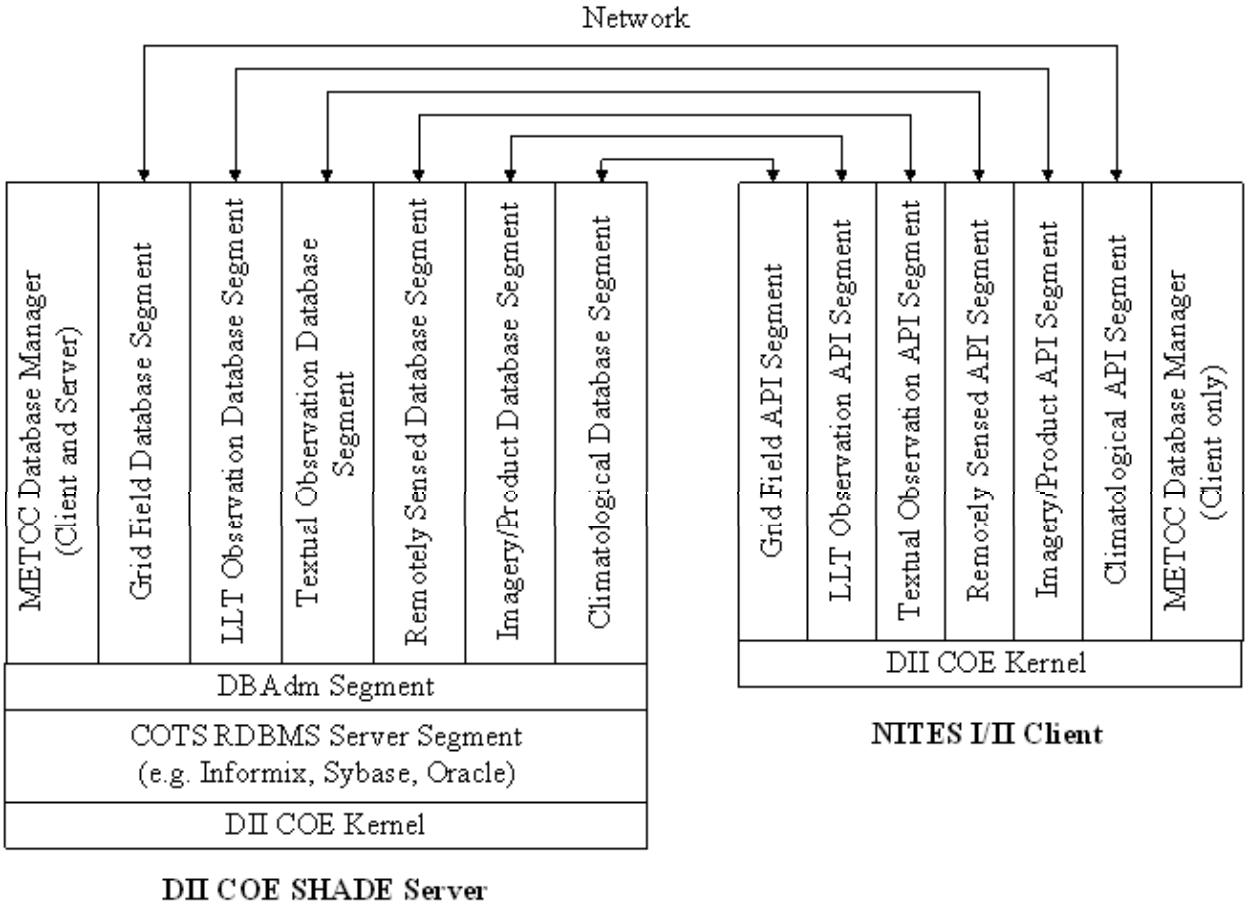

Figure 1-1. TESS(NC) METOC Database Conceptual Organization

1.2.1 Document Overview

The remainder of this document is organized as follows:

Section 2	Lists referenced documents.
Section 3	Discusses decisions about the database's behavioral design and other decisions affecting further design of the database.
Section 4	Describes the detailed design of the database.
Section 5	Describes the detailed design of software units used for database access or manipulation.
Section 6	Provides requirements traceability to applicable requirements documents.
Section 7	Provides notes, including a glossary of acronyms.

2 REFERENCED DOCUMENTS

2.1 Government Documents

2.1.1 Military Specifications

Space and Naval Warfare Systems Command, Environmental Systems Program Office (SPAWAR PMW-185), Washington, DC

Unnumbered 30 September 1997	*Software Requirements Specification (SRS) for the Tactical Environmental Support System/Next Century [TESS(3)/NC] Meteorological/Oceanographic (METOC) Database*

2.1.2 Military Standards

DII COE I&RTS July 1997	*Defense Information Infrastructure (DII) Common Operating Environment (COE) Integration and Runtime Specification, Version 3.0*

2.1.3 Other Military Documents

DII.COE.DocReqs-5 29 April 1997	*Defense Information Infrastructure (DII) Common Operating Environment (COE) Developer Documentation Requirements, Version 1.0*

Naval Research Laboratory, Marine Meteorology Division, Monterey, CA

ipd4600magridrmTES-10 29 January 1999	*Application Program Interface Reference Manual (APIRM) for the Grid Field API (MAGRID) Segment of the Tactical Environmental Support System Next Century [TESS(NC)] METOC Database*
ipd4600magridpmTES-10 29 January 1999	*Programming Manual (PM) for the Grid Field API (MAGRID) Segment of the Tactical Environmental Support System Next Century [TESS(NC)] METOC Database*
ipd4200maimgrmTES-10 9 October 1998	*Application Program Interface Reference Manual (APIRM) for the METOC Imagery API (MAIMG) Segment of the Tactical Environmental Support System Next Century [TESS(NC)] Meteorology and Oceanography (METOC) Database*
ipd4200maimgpmTES-10 9 October 1998	*Programming Manual (PM)) for the METOC Imagery API (MAIMG) Segment of the Tactical Environmental Support System Next Century [TESS(NC)] Meteorology and Oceanography (METOC) Database*

ipd4200malltrmTES-10 5 February 1999	*Application Program Interface Reference Manual (APIRM) for the Latitude-Longitude-Time (LLT) API (MALLT) Segment of the TESS(NC) METOC Database*
ipd4400malltpmTES-10 5 February 1999	*Programming Manual (PM) for the Latitude-Longitude-Time (LLT) API (MALLT) Segment of the TESS(NC) METOC Database*
ipd4300matxtrmTES-10 15 October 1998	*Application Program Interface Reference Manual (APIRM) for the Textual Observations API (MATXT) Segment of the TESS(NC) METOC Database*
ipd4300matxtpmTES-10 15 October 1998	*Programming Manual (PM) for the Textual Observations API (MATXT) Segment of the TESS(NC) METOC Database*

3 DATABASE BEHAVIORAL DESIGN

3.1 Database Components

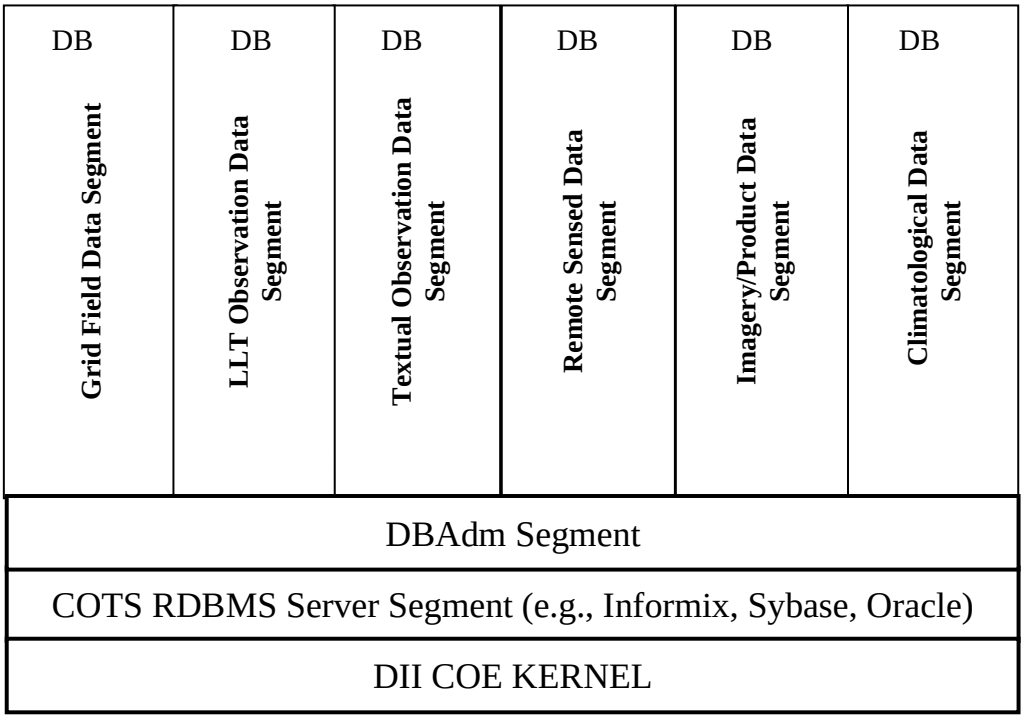

Figure 3.1-1. METOC Database Organization – Conceptual View

3.2 Database Organization

The NITES Concept of Operations and system architecture require that TEDS be distributed both in terms of application access to METOC data and products and in terms of physical location of the data repositories. The organizational structure of the database is influenced by these requirements and the components of this distributed database are described in the following paragraphs.

3.2.1 NITES I METOC Database

The NITES I METOC Database serves as the primary source of METOC data and products for NITES I and II applications. METOC data and products distributed from the Central Sites via METCAST and HPSL; local external interface decode/filter processing, and local application processing (e.g., COAMPS) populate the database with grid field, observation, imagery, and climatological METOC data. The NITES I METOC Database is located at shipboard, regional centers, and detachment level METOC sites.

In accordance with DII COE and SHADE database concepts, the METOC Database is composed of six or more DII COE Level 5 compliant *shared database* segments. These segments' names and prefixes are:

1. Grid Field Data Segment (MDGRID)

2. LLT Observation Data Segment (MDLLT)

3. Textual Observation Data Segment (MDTXT)

4. Remotely Sensed Data Segment (MDREM)

5. Imagery Data Segment (MDIMG)

6. Climatological Data Segments. At present, one Oceanographic and Atmospheric Master Library (OAML) database (Digitized Bathymetric Data Base – Variable Resolution or DVBDB-V, version 1.0) has been distributed as database and API segments. Other OAML databases are currently undergoing segmentation for DII COE distribution.

These database segments are data type specific and independently installable. Each segment is designed to support multiple applications and can be installed together to support applications requiring METOC data of different types. Applications in NITES I and II systems access the database through published application programming interfaces (APIs). Each of the database segments will be implemented as a shared database segment as defined by the DII COE. The decomposition of the METOC Database into these segments is based on the following criteria:

- Data objects conveniently managed as a unit.

- Data objects needed together to support a functional area.

- Common sources or providers of data.

- Data interdependencies.

- Frequency of update.

Each segment provides the software scripts required to create the database schema, allocate storage, seed data, and extend DBA services. The database segment development methodology and structure is defined in Version 3.0 of the DII COE I&RTS. The METOC Database organization is conceptually represented in Figure 3.1-1.

3.2.2 Central Site METOC Database

A version of the NITES I METOC Database will reside at both FNMOC and NAVOCEANO central sites and serve as the primary data distribution points for central site generated METOC data and products. The Central Site METOC Database will support requests from and distribute data to shipboard, regional, and detachment level METOC sites. The distribution mechanism is

implemented above the COTS DBMS layer in application software (i.e. METCAST/HPSL) applications). The central site database is architecturally identical to the NITES I METOC Database but will be scaled, in terms of storage space and processing capability, to meet the data distribution requirements levied by the NITES Concept of Operations.

3.2.3 NITES II METOC Database

Applications in the NITES II system will use the NITES I METOC Database as their primary source of environmental data. Distribution of data from the NITES I METOC Database to NITES II applications will rely on METCAST or the client/server capabilities of the COTS DBMS product and the METOC Database APIs identified in section 3.4. For those NITES II systems not co-located with a NITES I system or NITES II systems with limited or no access to the METOC LAN, existing JMCOMS capabilities will be used.

3.2.4 Satellite Analysis and Viewer Database

The AN/SMQ-11 Upgrade is an external system that ingests, processes, and displays satellite imagery and sensor data from polar orbiting and geostationary satellites. The system has implemented a physically and logically separate database to store satellite pass data, sensor data, and imagery product data generated by the system. Through the ***TBD*** interface, the METOC Database receives and maintains descriptive and referential data about the data and products stored in the AN/SMQ-11 Upgrade system and makes that data available to NITES I and II client applications through the MDREM and MDIMG database segments.

3.2.5 Database Management System

The METOC Database relies on a DII COE approved COTS RDBMS to manage the storage and manipulation of the logically related data in the database. The specific DII COE RDBMS used by the METOC Database is Informix Version 7.22 or above. The METOC Database minimizes the dependency on vender specific or extended features of the COTS DBMS to support change out and portability of the database to new or upgraded versions of the DBMS.

3.3 Database Access

The METOC Database is a dynamic database populated with perishable environmental data ingested, updated, and deleted on a regular and real time basis. External interfaces, external systems, and local applications provide METOC data and products to the database. The management of the data into and out of the database is performed by the COTS DBMS and NITES I data management applications. The data management applications rely on database operations to store, update, retrieve, and delete the data. Access to the database and these operations is implemented according to mode, discretionary access mechanisms, and portable distributed METOC APIs.

3.3.1 Modes

NITES I and II applications can establish a connection to the METOC Database and perform *granted* database operations when the METOC Database is in On-line Mode only. Privileged

system administration activities by the DBA are permitted when the database is in On-line or Maintenance Mode.

3.3.2 Discretionary Access

The METOC Database, by DII COE definition, will be a *public* database and generally available to all users of the system. Database client applications that use METOC Data to generate products will be provided with read (select) access to the required database segments. Data management applications or user applications that store, update, or delete data in the database will be granted those privileges on an as-required basis per agreement between the application developer and the TESS(NC) Chief Engineer. The *grants* and *roles* functionality provided by the COTS DBMS will be the implementation mechanism used to define application level discretionary access to the database.

3.3.3 METOC Database APIs

The METOC Database supports application access to data through a set of layered APIs. The APIs will be public and consist of:

1. ANSI standard Structured Query Language (SQL)

2. Tactical Environmental Data System (TEDS) APIs

3. Operating system File System Services.

These APIs provide access to the database for storage, retrieval, maintenance, and distribution of METOC data and products. The APIs are used by NITES I data management applications, NITES I and II user interface applications, and non-TESS(NC) systems requiring METOC data. The APIs rely on the COTS DBMS client/server capabilities to facilitate local and distributed access to the data. The APIs are portable to the DII COE HP-UX, Sun Solaris, and Windows/NT platforms.

3.3.3.1 ANSI Standard SQL

Direct access to the database is managed by the COTS DBMS through ANSI standard SQL-92 (ANSI X3.135-1992). The COTS DBMS provides support for ANSI SQL statements that implement basic database operations through the SQL calling mechanism. The basic operations are:

1. Logically connecting to the database (connect)

2. Storing data in the database (insert)

3. Updating data in the database (update)

4. Retrieving data from the database (select)

5. Deleting data from the database (delete).

The following paragraphs discuss the behavior of the database in general terms.

3.3.3.2 Connect Operation

User application programs must first establish a logical connection to the METOC Database before any subsequent data access operations can be performed. Because the METOC Database is a federation of up to six separate databases, user applications must establish a separate connection to each database used during the session. To establish the logical connection, the user application executes a *connect* statement with the appropriate database name input argument. Upon completion of the operation, the user application will interrogate the SQLSTATE status variable updated by the database server. If the connect is successful, transaction-oriented data access operations can proceed. At the conclusion of the transaction(s), the user application should terminate the connection to the METOC Database.

3.3.3.2.1 Data Transaction Operations

The METOC Database will behave in similar fashion for the transaction-oriented data manipulation operations of *insert*, *update*, *select*, and *delete*. Once connected to a database, user applications with the appropriate grants can prepare input arguments, execute the required SQL statements, and block (i.e. wait on) the SQL call. Upon completion of the operation, the user application will interrogate the SQLSTATE status variable. If the operation is successful, data access processing can continue. Otherwise, error processing will proceed.

3.3.3.3 TEDS APIs

The TEDS APIs provide a programming convenience layer for application developers and abstract the data management and implementation details of the METOC Database away from the developer. The TEDS APIs are a set of application callable C Language routines implemented as static and shared libraries. Section 5 discusses the TEDS APIs in detail. Note: There is no requirement to use the TEDS API and developers can elect to use the ANSI SQL interface to the database.

3.3.3.4 Operating System File System Services

The operating system file system is used by the RDBMS to implement the relational database.

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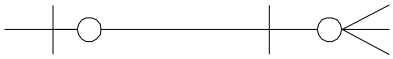
4 DATABASE DESIGN DETAILS

The following paragraphs describe the METOC Database in terms of its component database segments. As described in Section 3, the METOC Database has been broken out into 6 shared database segments. Because the segments are intended to be functionally independent shared database segments, conceptual level, logical level, and physical level designs are presented for each of the segments.

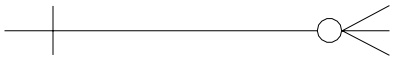
The figures in this section show the symbology used in the entity-relationship diagrams in the subsections that follow. Figure 4-1 shows the symbols used to describe relationships. Figure 4-2 shows the parent and child entity definitions in the physical level models. Figure 4-3 shows the relationships used in the logical level models.

This figure depicts the symbols used in the physical data and logical data models for Model Data, Observation Data, Remotely Sensed Data, Text Observations, and Images.



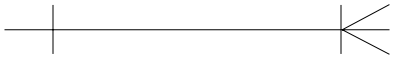
Zero or One to Zero, One, or Many; Identifying Relationship

Zero or One to Zero, One, or Many; Non-Identifying Relationship



One to Zero, One, or Many; Identifying Relationship

One to Zero, One, or Many; Non-Identifying Relationship

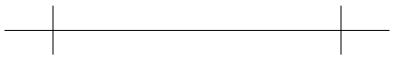


One to One or Many; Identifying Relationship

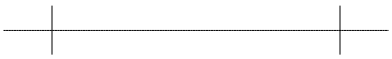
One to One, or Many; Non-Identifying Relationship

One to One or Zero; Identifying Relationship

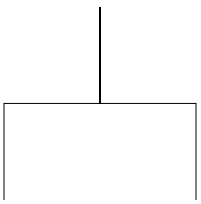
One to One or Zero; Non-Identifying Relationship



One to One ; Identifying Relationship



One to One ; Non-Identifying Relationship



Subtype

Figure 4-1. Symbols Used in Entity-Relationship Diagrams

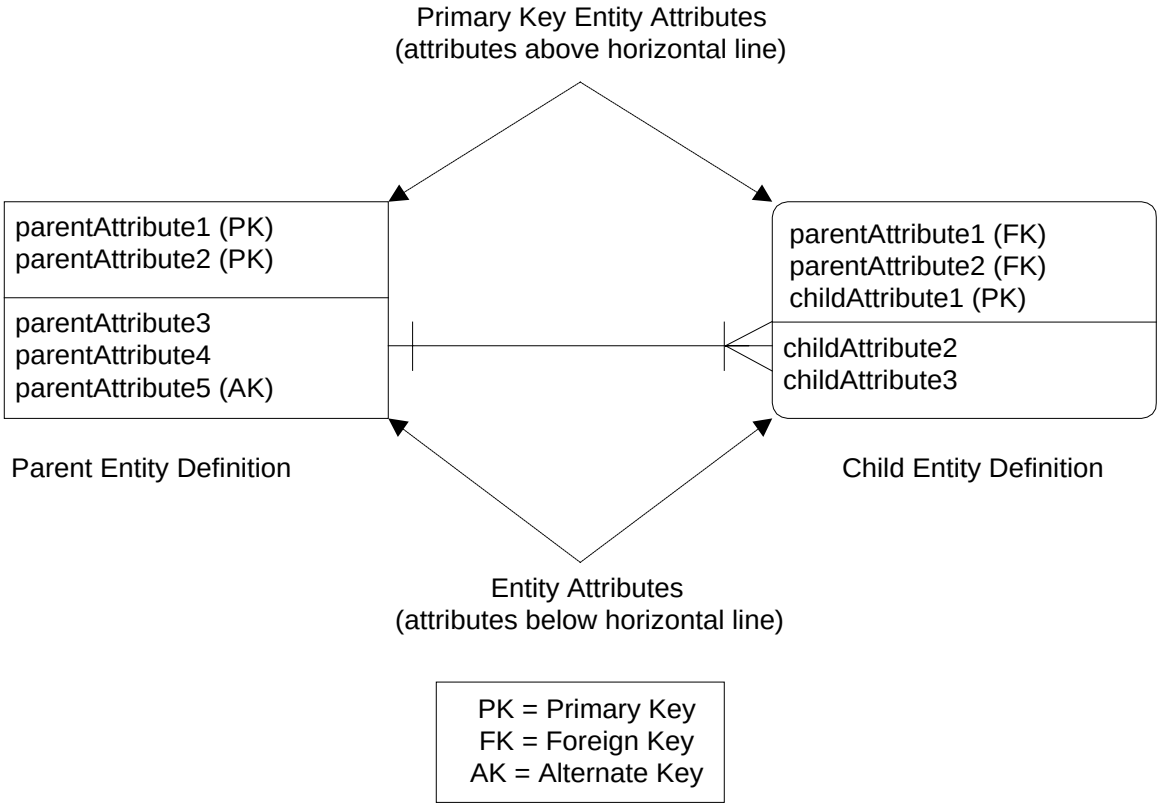


Figure 4-2. Entity Conventions for Physical Models

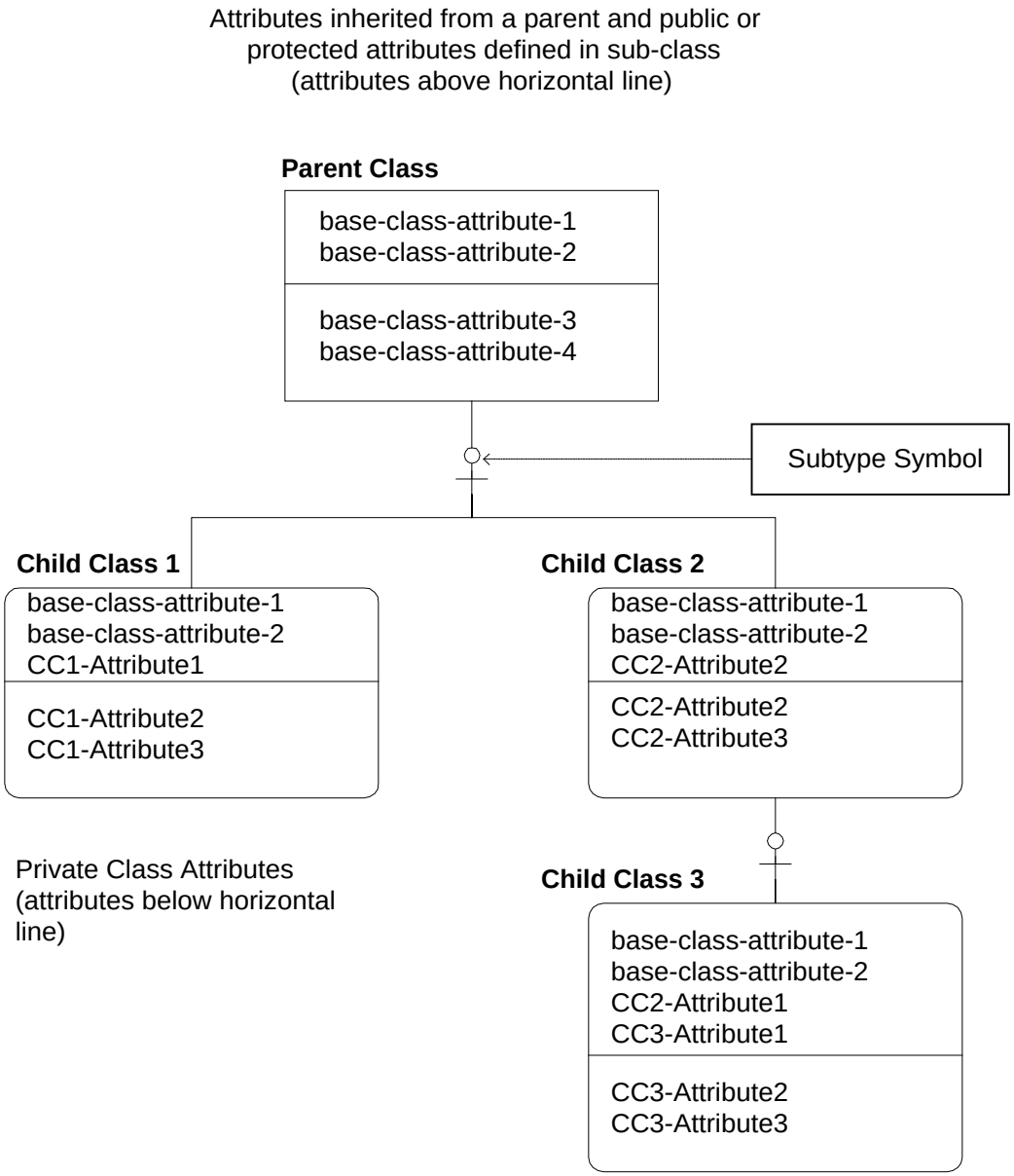


Figure 4-3. Logical Model E-R Diagram Conventions

4.1 Grid Field Data Segment (MDGRID) Design

4.1.1 MDGRID Conceptual Level Design

Grid field data is received from the FLTALT CSCI and stored in MDGRID as datasets organized by data type, time, and geographic area. A dataset is a logical collection of grid field records where each record represents a set of homogeneous grid element values (e.g., temperature), at a particular level (e.g., 500 MB), and for a specific forecast period (e.g., 24 hours). Conceptually, there are two tables used to organize the datasets: the *grid dataset directory* table and the *grid dataset detail* table.

The grid dataset directory table maintains descriptive information about the datasets and supports catalog type queries. Each entry (or row) in the directory table provides descriptive information for a single dataset detail table. Descriptive information includes grid model name, base time associated with the grid dataset, and geographical bounds of the grid dataset.

The grid dataset detail table represents a logical collection of discrete grid field data records and stores additional descriptive information about the individual geophysical data records stored in the dataset. These data records are logically associated with each other by grid model type and base time. A detail table row, for example, would store the descriptive information about a specific grid field parameter (e.g., Temperature), at a specific level (e.g., 500 MB), for a specific forecast period (e.g., 24z). The detail table row also contains the actual geophysical grid values.

To facilitate access both on ingest and retrieval, the geophysical grid values are stored as Binary Large Objects (BLOB).

4.1.2 MDGRID Logical Level Design

The entity-relationship diagram in Figure 4.1-1 depicts the logical model of the Grid Field Data Segment.

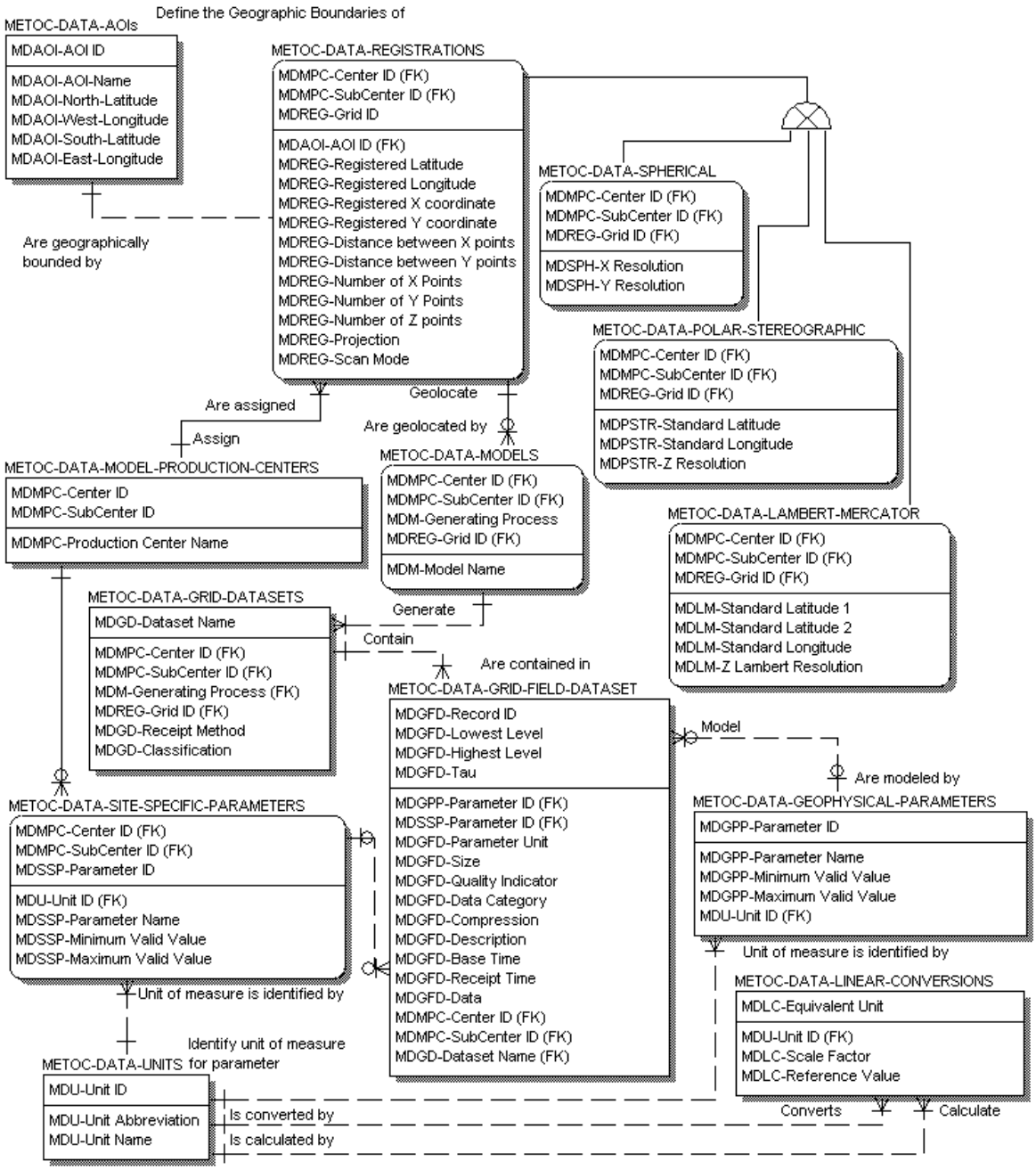


Figure 4.1-1. Logical Level Design of the MDGRID

4.1.3 MDGRID Physical Level Design

Figure 4.1-2 presents the physical level design of the MDGRID in entity-relationship diagrams.

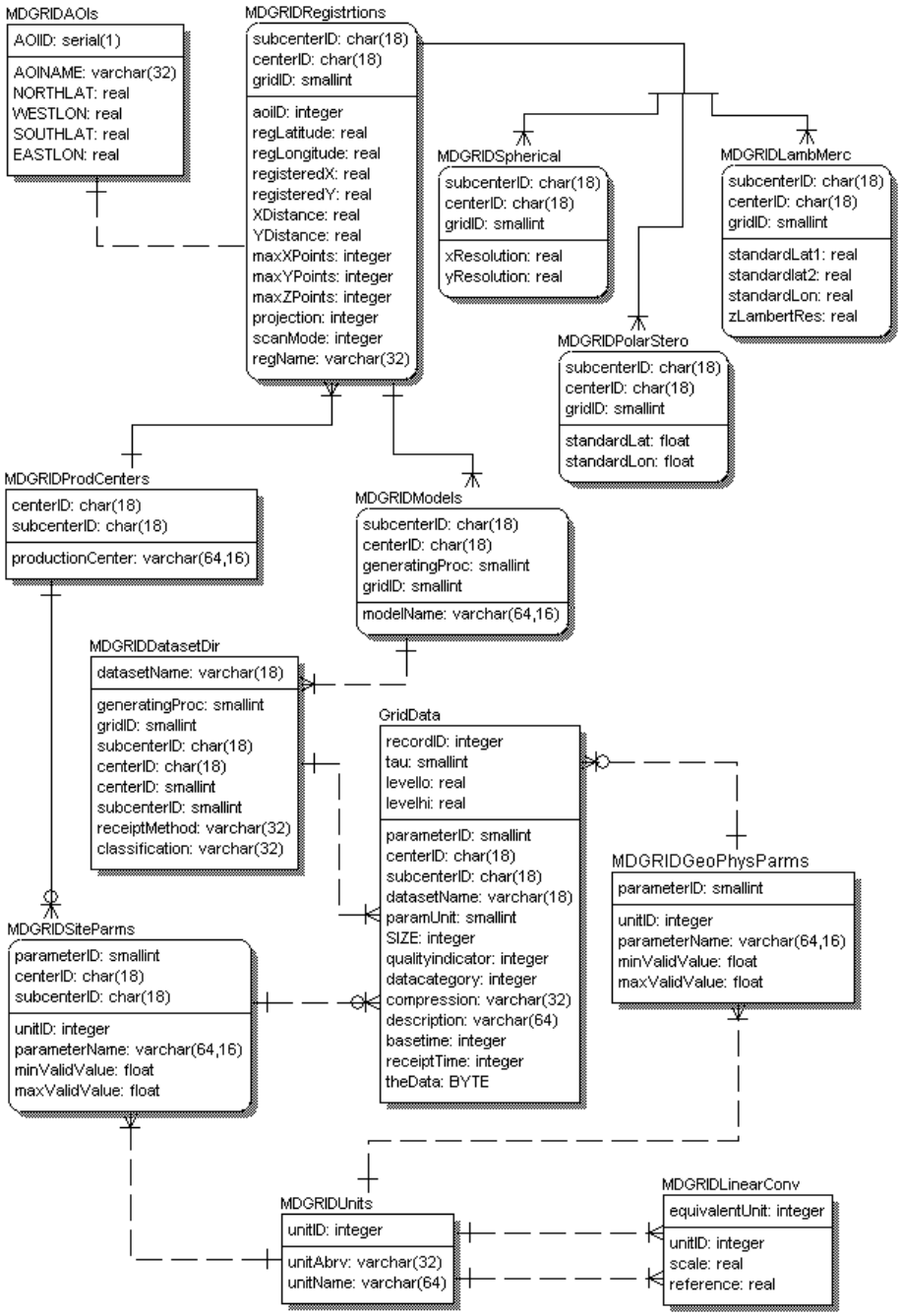


Figure 4.1-2. Physical Level Design of the MDGRID

The remainder of this section presents the designs of the individual tables that make up the MDGRID.

4.1.3.1 Area of Interest Table

Table Name: MDGRIDAOIs

Description: Names of areas of interest mapped to a unique ID and type.

Primary Key: AOIID

Table 4.1-1. AOIs Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
AOIID	serial(1)	NOT NULL	1	2^{31}-1	Unique numeric identifier for the AOI.
AOINAME	varchar(32)	NOT NULL	N/A	N/A	Alpha/Numeric name of AOI.
NORTHLAT	real	NOT NULL	-90.0	90.0	Northernmost bounding vector of AOI.
WESTLON	real	NOT NULL	-180.0	180.0	Westernmost bounding vector of AOI.
SOUTHLAT	real	NOT NULL	-90.0	90.0	Southernmost bounding vector of AOI.
EASTLON	real	NOT NULL	-180.0	180.0	Easternmost bounding vector of AOI.

4.1.3.2 Geophysical Parameters Table

Table Name: MDGRIDGeoPhysParms

Description: Normalized table storing information about environmental parameters storable in the database.

Primary Key: parameterID

Foreign Key: unitID

Table 4.1-2. GeoPhysicalParms Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
parameterID	smallint	NOT NULL	1	127	Unique Parameter Identifier
parameterName	varchar (64,16)	NOT NULL	N/A	N/A	Alphanumeric name of a geophysical parameter.
minValidValue	float	NOT NULL	MIN_FLOAT	MAX_FLOAT	Minimum valid value for parameter
maxValidValue	float	NOT NULL	MIN_FLOAT	MAX_FLOAT	Maximum valid value for parameter
unitID	smallint	NOT NULL	1	32767	Identifier for default unit in which parameter is measured. Overridden by the unit actually assigned to the data item.

4.1.3.3 Site-Specific Parameters Table

Table Name: MDGRIDSiteParms

Description: Normalized table storing information about site-specific environmental parameters storable in the database.

Primary Key: centerID/subcenterID/parameterID

Foreign Key: centerID, subcenterID, parameterID

Table 4.1-3. Site-Specific Parameters Table

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	Numeric identifier of generating production center per WMO-306 Section C Table C-1
subcenterID	smallint	NOT NULL	0	255	Numeric identifier of generating production subcenter
parameterID	smallint	NOT NULL	128	999	Unique identifier for parameter
parameterName	varchar (64.16)	NOT NULL	N/A	N/A	Alphanumeric name of parameter
minValidValue	float	NOT NULL	N/A	N/A	Minimum valid value of parameter
maxValidValue	float	NOT NULL	N/A	N/A	Maximum valid value of parameter
unitID	smallint	NOT NULL	1	32767	Identifier for units in which parameter value is expressed

4.1.3.4 Grid Data Detail Table

Table Name: GridData

Description: The Grid Data Detail Table stores detail information for a gridded data set. There will be many instantiations of this table. The table structure is shown in Table 4.1-4.

Primary Key: recordID/parameterID/ tau/levello/levelhi

Foreign Key: parameterID, paramUnit

Table 4.1-4. gridData Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
recordID	integer	NOT NULL	1	2^{31}-1	Record identifier
levello	real	NOT NULL	MIN_FLOAT	MAX_FLOAT	Lowest vertical Level at which parameter is modeled
levelhi	real	NOT NULL	MIN_FLOAT	MAX_FLOAT	Highest vertical Level at which parameter is modeled
parameterID	smallint	NOT NULL	1	127	Identifier for parameter contained in grid data
paramUnit	smallint	NOT NULL	1	32767	Identifier for unit in which parameter is represented
tau	smallint	NOT NULL	0	240	Forecast period
size	integer	NOT NULL	0	2^{31}-1	Size of data in bytes
qualityindicator	integer	NOT NULL	0	32767	Quality indicator
datacategory	smallint	NOT NULL	0	2	Data category: 0 = base, 1 = edited, 2 = derived
compression	varchar(32)	NOT NULL	N/A	N/A	Compression indicator
description	varchar(64)	NOT NULL	N/A	N/A	Alphanumeric description of the data
basetime	integer	NOT NULL	0	2^{31}-1	Base time of the data (epoch time)
receiptTime	integer	NOT NULL	0	2^{31}-1	Epoch time at which data were received
theData	byte	NOT NULL	Parameter specific		Gridded data values

4.1.3.5 2D Grid Dataset Directory

Table Name: MDGRIDDatasetDir

Description: This table is a directory of 2D data sets. It stores summary information about each data set. The data set directory provides a quick way to determine which grids and which model from which center are in a data set, without having to query each individual grid dataset table. The table structure is shown in Table 4.1-5.

Primary Key: datasetName

Foreign Key: generatingProc, centerID, subcenterID, gridID

Table 4.1-5. Grid Data Set Directory Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	Numeric identifier of generating production center per WMO-306 Section C Table C-1
subcenterID	smallint	NOT NULL	0	255	Numeric identifier of generating production subcenter
dataSetName	varchar(18)	NOT NULL	N/A	N/A	Alphanumeric name of grid dataset, also used as name of detail table that stores the grid.
generatingProc	smallint	NOT NULL	1	255	ID of generating process for model data
gridID	smallint	NOT NULL	1	9999	ID of geographic area covered by model
receiptMethod	varchar(32)		N/A	N/A	Alphanumeric name of circuit over which data were received
classification	varchar(32)		N/A	N/A	Classification of the data

4.1.3.6 3D Grid Dataset Directory

Table Name: MDGRID3DDatasetDir

Description: This table is a directory of 3D data sets. It stores summary information about each data set. The data set directory provides a quick way to determine which grids and which model from which center are in a data set, without having to query each individual grid dataset table. The table structure is shown in Table 4.1-6.

Primary Key: datasetName

Foreign Key: generatingProc, centerID, subcenterID, gridID

Table 4.1-6. Grid Data Set Directory Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	Numeric identifier of generating production center per WMO-306 Section C Table C-1
subcenterID	smallint	NOT NULL	0	255	Numeric identifier of generating production subcenter
dataSetName	varchar(18)	NOT NULL	N/A	N/A	Alphanumeric name of grid dataset, also used as name of detail table that stores the grid.
generatingProc	smallint	NOT NULL	1	255	ID of generating process for model data
gridID	smallint	NOT NULL	1	9999	ID of geographic area covered by model
receiptMethod	varchar(32)		N/A	N/A	Alphanumeric name of circuit over which data were received
classification	varchar(32)		N/A	N/A	Classification of the data

4.1.3.7 Lambert/Mercator Projection Table

Table Name: MDGRIDLambMerc

Description: Contains Lambert Conformal or Mercator projection information for models.

Primary Key: centerID/subcenterID/gridID

Foreign Key: gridID, centerID, subcenterID

Table 4.1-7. LambertMercator Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	ID of center that defined projection
subcenterID	smallint	NOT NULL	0	255	ID of subcenter that defined projection
gridID	smallint	NOT NULL	1	9999	Grid ID assigned by center
standardLat1	real	NOT NULL	-90.0	90.0	Northern standard latitude
standardlat2	real	NOT NULL	-90.0	90.0	Southern standard latitude
standardLon	real	NOT NULL	-180.0	180.0	Longitude on central meridian of projection
zLambertRes	real	NOT NULL	MIN_FLOAT	MAX_FLOAT	Number of vertical levels in data

4.1.3.8 Linear Conversion Table

Table Name: MDGRIDLinearConv

Description: Stores scale and reference factors to convert data from one unit of measure to another.

Primary Key: unitID/equivalentUnit

Foreign Key: unitID, equivalentUnit

Table 4.1-8. LinearConversions Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
unitID	integer	NOT NULL	1	32767	ID of unit to be converted to equivalent unit
equivalentUnit	integer	NOT NULL	1	32767	ID of unit to which unit identified by unitID will be converted
scale	real	NOT NULL	MIN_FLOAT	MAX_FLOAT	Scale for conversion
reference	real	NOT NULL	MIN_FLOAT	MAX_FLOAT	Reference value for conversion

4.1.3.9 Model Reference Table

Table Name: MDGRIDModels

Description: Provides definitions of geophysical models that generate grid data.

Primary Key: generatingProc/centerID/ subcenterID/gridID

Foreign Keys: centerID, subcenterID, gridID

Table 4.1-9. Models Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	Production center ID from WMO-306, Vol. 1, Section C, Table C-1
subcenterID	smallint	NOT NULL	0	255	Production subcenter ID
generatingProc	smallint	NOT NULL	1	255	Identifier of Computer process that generated the grid.
gridID	smallint	NOT NULL	1	9999	Identifier for geographic area for which data are modeled
modelName	varchar(64,16)	NULL	N/A	N/A	Alphanumeric name of model

4.1.3.10 Polar Stereographic Projection Table

Table Name: MDGRIDPolarStereo

Description: Contains polar stereographic projection information for model data.

Primary Key: centerID/subcenterID/gridID

Foreign Key: none

Table 4.1-10. PolarStereographic Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
gridID	smallint	NOT NULL	1	9999	Grid ID assigned by center
centerID	smallint	NOT NULL	1	255	ID of center that defined the projection
subcenterID	smallint	NOT NULL	0	255	ID of subcenter that defined the projection
standardLat	float	NOT NULL	-90.0	90.0	Standard latitude for projection
standardLon	float	NOT NULL	-180.0	180.0	Standard longitude for projection
zResolution	float	NOT NULL	MIN_FLOAT	MAX_FLOAT	Vertical resolution

4.1.3.11 Production Centers Table

Table Name: MDGRIDProdCenters

Description: Holds information about data production/transmission centers.

Primary Key: centerID

Foreign Key: none

Table 4.1-11. ProductionCenters Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	1	255	Unique Numeric Identifier of Generating Production Center as identified in WMO-306 V 1 Section C table C-1.
subcenterID	smallint	NOT NULL	0	255	Unique Numeric Identifier of Generating Production Subcenter
productionCenter	varchar (64,16)	NOT NULL	N/A	N/A	Alphanumeric (ASCII) Identifier of Generating Production Center as identified in WMO-306 V 1 Section C table C-1.

4.1.3.12 Registrations Table

Table Name: Registrations

Description: Contains information relating to the geographic registration of grids.

Primary Key: centerID/subcenterID/gridID

Foreign Key: centerID, subcenterID, gridID, aoiID

Table 4.1-12. Registrations Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
regLatitude	real	NOT NULL	-90.0	90.0	Latitude of grid that maps to registeredY
regLongitude	real	NOT NULL	-180.0	180.0	Longitude of grid that maps to registeredX
registeredX	real	NOT NULL	1	10,000	X Point on grid which maps to Registered Longitude
registeredY	real	NOT NULL	1	10,000	Y Point on grid which maps to Registered latitude
xDistance	real	NOT NULL	1	10,000	Distance between points in the x direction
yDistance	real	NOT NULL	1	10,000	Distance between points in the y direction
maxXPoints	integer	NOT NULL	2	10,000	Number of points along a line of longitude.
maxYPoints	integer	NOT NULL	2	10,000	Number of points along a line of latitude
maxZPoints	integer	NULL	1	10,000	Number of vertical points.
projection	integer	NOT NULL	1	29	Geographic projection of the data
scanMode	integer	NOT NULL	1	7	Layout of points in a grid.
aoiID	integer	NOT NULL	1	2^{31}-1	Unique numeric identifier of AOI which bounds the grid
centerID	smallint	NOT NULL	1	255	Unique Numeric Identifier of Generating Production Center as identified in WMO-306 V 1 Section C table C-1.
subcenterID	smallint	NOT NULL	0	255	ID for production subcenter
gridID	smallint	NOT NULL	1	9999	Center-assigned identification of registration.
regName	varchar(32)	NOT NULL	N/A	N/A	Alpha/Numeric Name of the registration.

4.1.3.13 Spherical Projection Table

Table Name: MDGRIDSpherical

Description: Contains spherical projection information about models.

Primary Key: centerID/subcenterID/gridID

Foreign Key: gridID, centerID, subcenterID

Table 4.1-13. Spherical Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
centerID	smallint	NOT NULL	0	255	WMO-306 ID of center that defined projection
subcenterID	smallint	NOT NULL	1	255	WMO-306 ID of subcenter that defined projection
gridID	smallint	NOT NULL	1	9999	Center-assigned ID of grid
xResolution	real	NOT NULL	0.0	90.0	Grid spacing between X points measured in degrees.
yResolution	real	NOT NULL	0.0	90.0	Grid spacing between Y points measured in degrees.

4.1.3.14 Units Table

Table Name: MDGRIDUnits

Description: Stores identifiers for units of measure.

Primary Key: unitID

Table 4.1-14. Units Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
unitID	integer	NOT NULL	1	32767	Numeric identifier for a unit of measure
unitAbrv	varchar(32)	NOT NULL	N/A	N/A	Abbreviated name of the unit
unitName	varchar(64)	NOT NULL	N/A	N/A	Alphanumeric name of a unit

4.2 LLT Observation Data Segment (MDLLT) Design

4.2.1 MDLLT Conceptual Design

Observational data is viewed as a class hierarchy. This class hierarchy is documented in Figure 4.2-1 through Figure 4.2-4. The Root class MDLLT-CLASS contains information that is common to all observation. All observations inherit these attributes from the root class. Each Sub-class contributes it's own attributes, which in turn, may also be inherited by it's sub-classes.

The rationale behind the design is that application requirements for observation data are varied and observation data are received from specific meteorological formatted messages. The best way to accommodate application requirements is to provide different views into the database. The best way to accommodate ingestion of messages is to provide structures based on groupings of fields within messages. The class hierarchy establishes these views, in the logical model. Leaf level classes support message level structures, while higher level classes support common views of observations fields that are more useful to applications that aren't concerned with what message a particular datum was transmitted in, or want to look at conditions that are within several different messages.

The physical observation data model maps the class hierarchy on to a relational data model. The same structural requirements exist as were noted in the logical model, however several pragmatic issues must be addressed with the physical model. The first issue is how to map an object model onto a relational model. The second is managing the perishability of the data. This involves purging data when it is no longer useful as well as managing the sizes of tables so they do not become unruly. The final requirement is to provide logical groupings of data with regard to space and time so as to optimize the storage and retrieval of data.

The first issue, mapping an object oriented design onto a relational database, was solved using techniques outlined in the paper "Object-Oriented Technology for Integrating Distributed Heterogeneous Database Systems"[1]. The techniques outlined in the paper suggest "object identifiers of the instances can be used as primary keys … Object classes can be arranged into a class hierarchy." A "Vehicle class has Ship as its subclass. Similarly, SHIP has SURFACE SHIP and SUBMARINE as object subclasses. A domain exists for each class and subclass. Depending on the degree of normalization, the relation variable generated for the subclass may contain only the attributes that distinguish the subclass from other subclasses or it could include additional attributes also found in the superclass."[2].

In order to implement this, five classes are defined:

---

[1] Object Oriented Technology For Integrated Distributed Heterogeneous Database System, Dr. Marion Ceruti, Dr Magdi N. Kamel, Dr. Bhavani M. Thuraisingham.

[2] Ibid.

1. Surface Synoptic Observations
2. Aerodrome Observations
3. Aircraft Observations
4. Ocean Observations
5. Upper Air Observations.

These classes are derived from a common parent class: MDLLT-CLASS. The MDLLT-CLASS domain is SURFACE-SYNOPTIC-OB, AERODROME-OB, OCEAN-OB and UPPER-AIR-OBS. OCEAN-OB's domain is BUOY-CLASS, BATHY-CLASS, and OCEAN-PROFILE-CLASS. SURFACE-OB-CLASS, AERODROME-OB-CLASS, AIRCRAFT-OB-CLASS, and UPPER-AIR-OB-CLASS have domains as well.

Tables are defined with the primary key being an object-id. Alternate Keys are defined with attributes that would otherwise be the primary key. Instantiation of an object will be done through the use of queries within the API. Message level queries would be more complex since they would span several tables.

4.2.2 MDLLT Logical Level Design

The entity-relationship diagrams on the pages that follow depict the logical model of the LLT Observation Data Segment. Separate entity relationship diagrams are provided for each observation type; note, however, that all types share a common root.

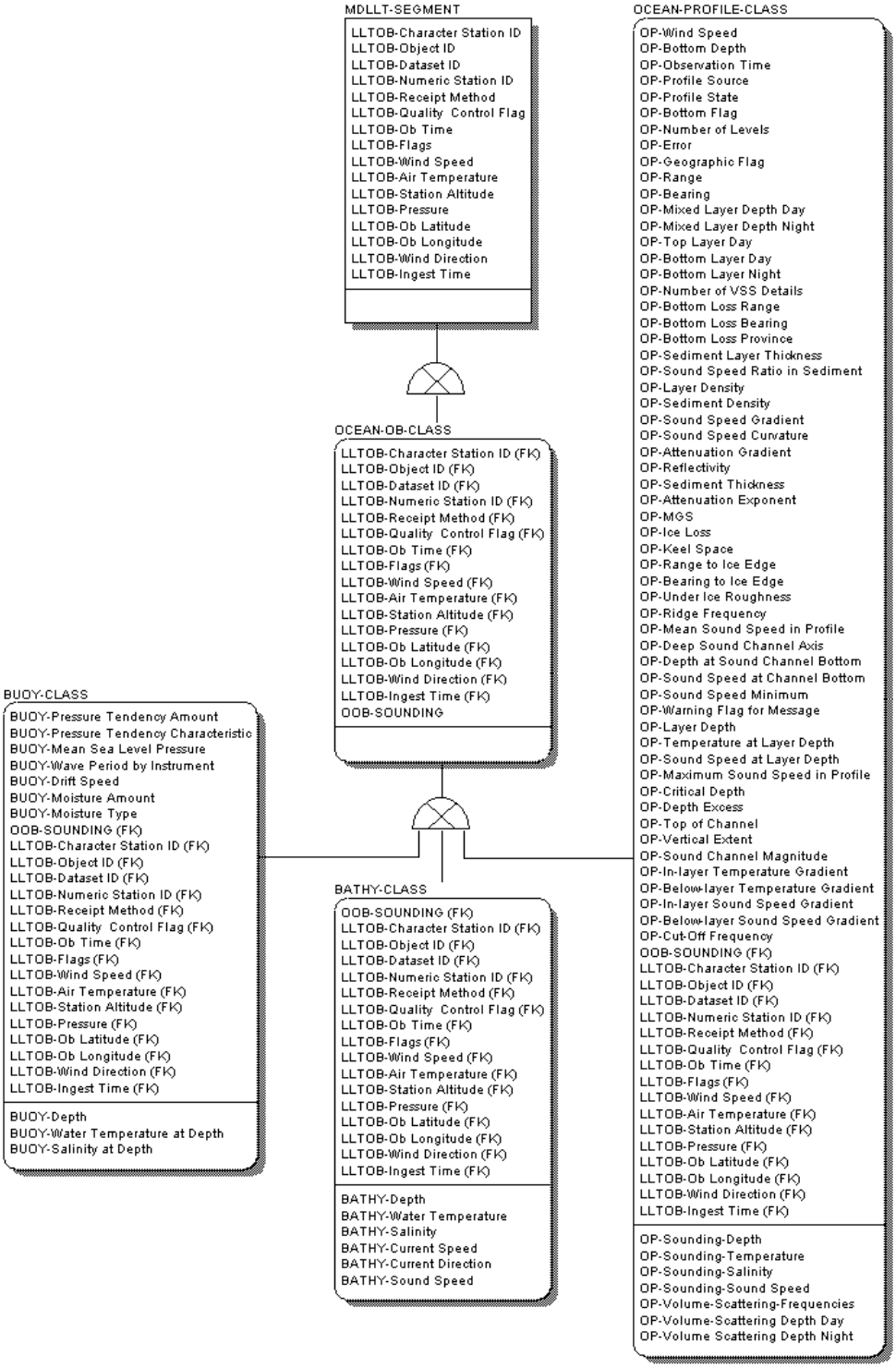


Figure 4.2-1. Ocean Observation Data Logical Model

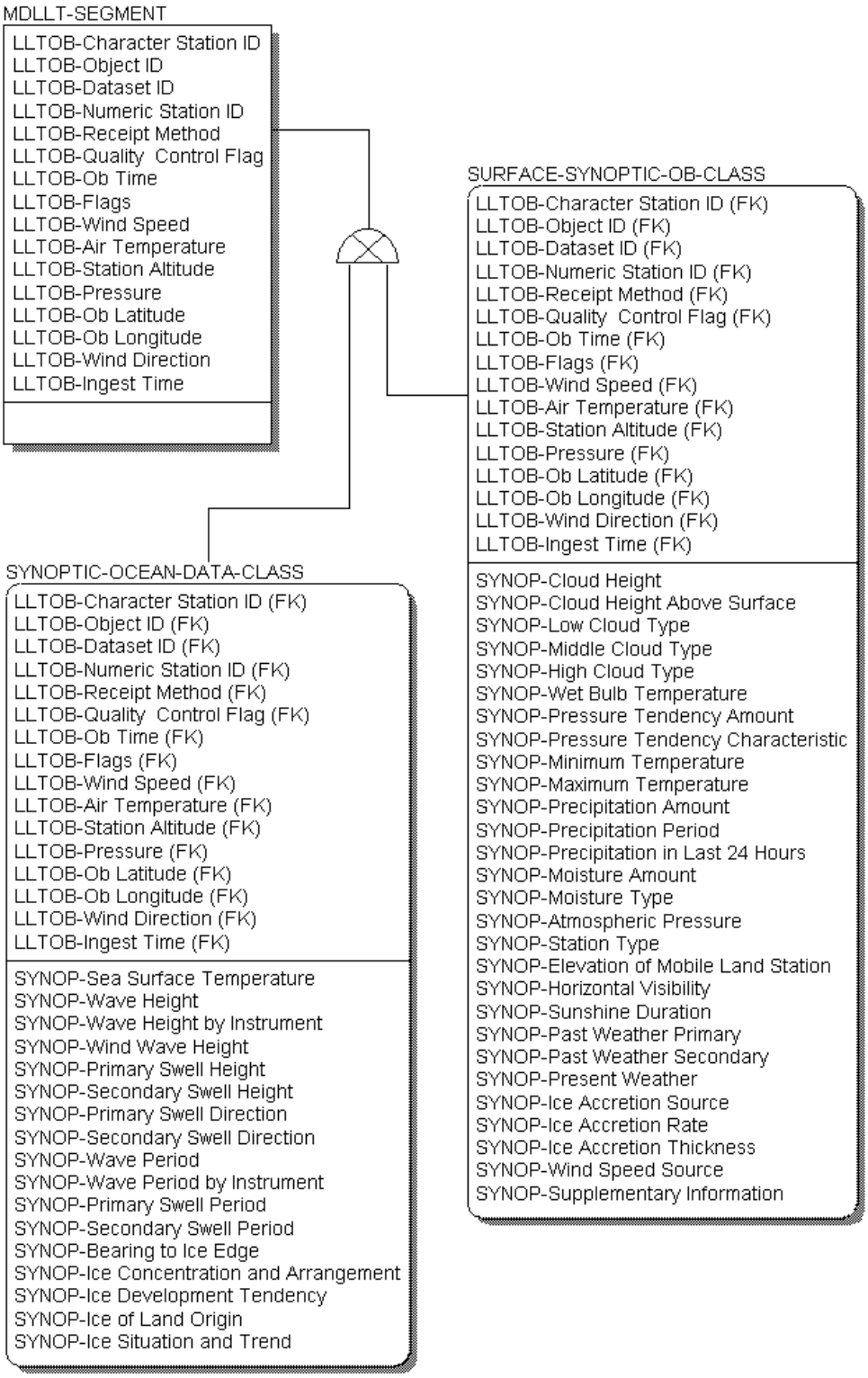


Figure 4.2-2. Surface Synoptic Observation Data Logical Model

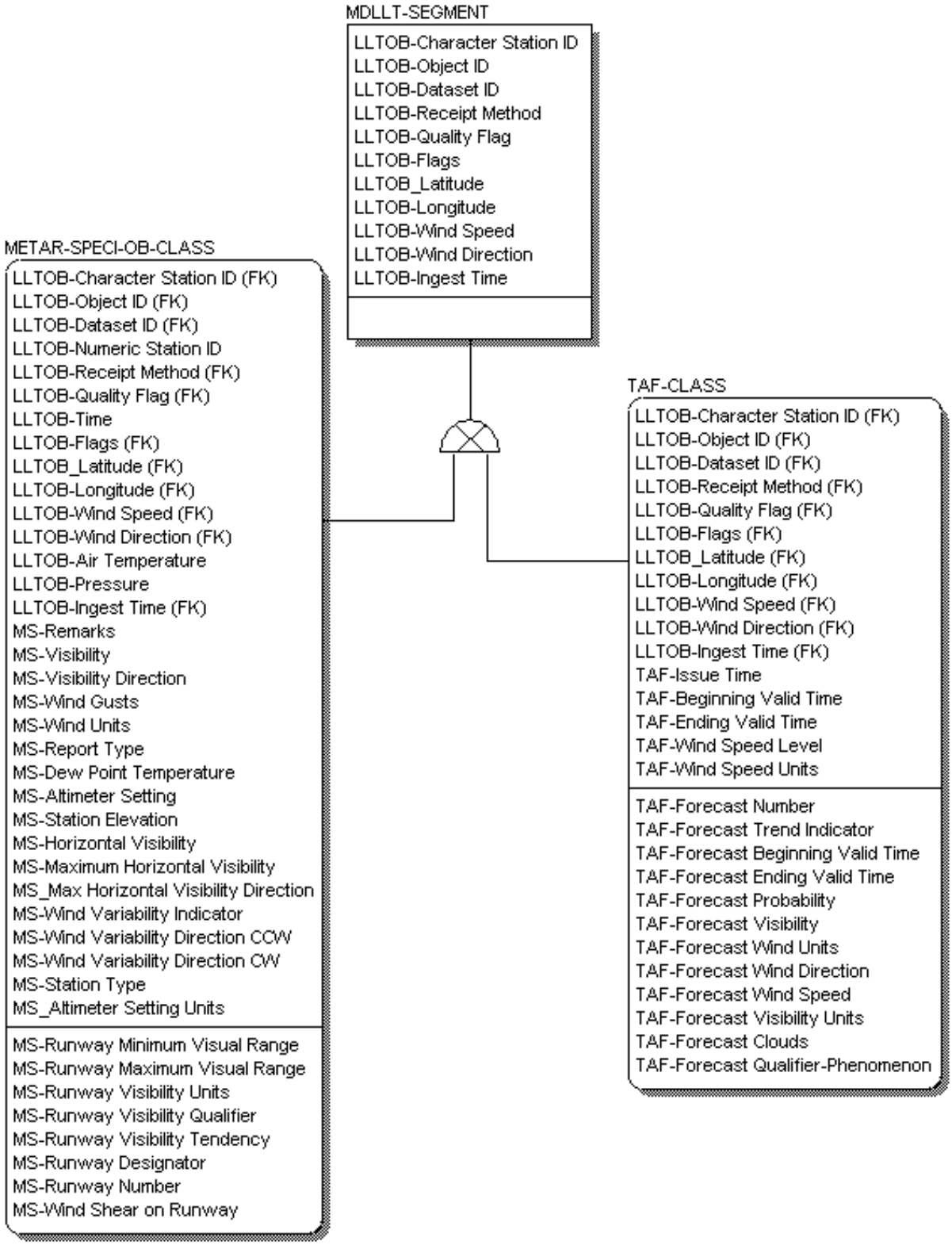


Figure 4.2-3. Aerodrome Observation Data Logical Model

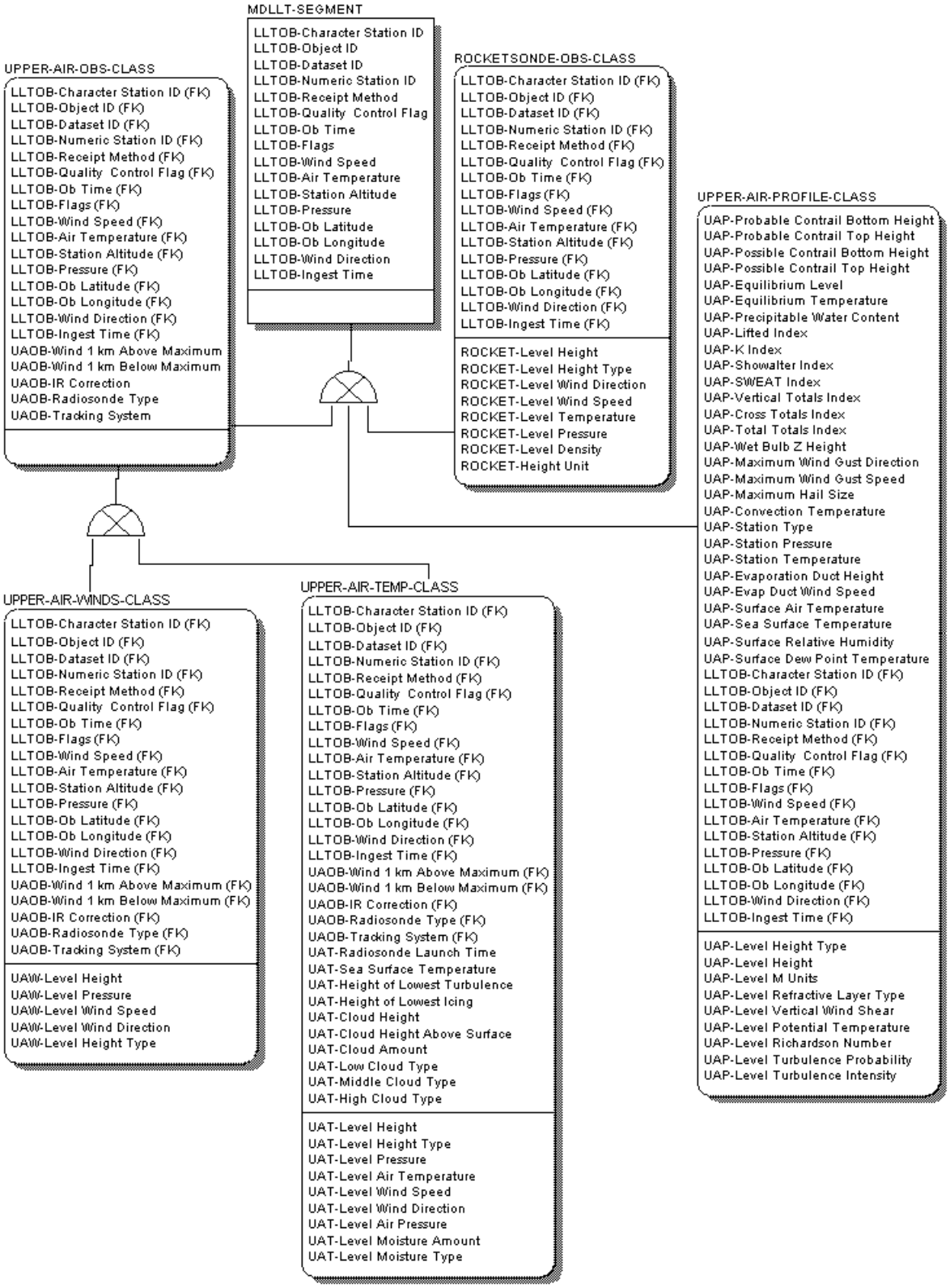


Figure 4.2-4. Upper Air Observation Data Logical Model

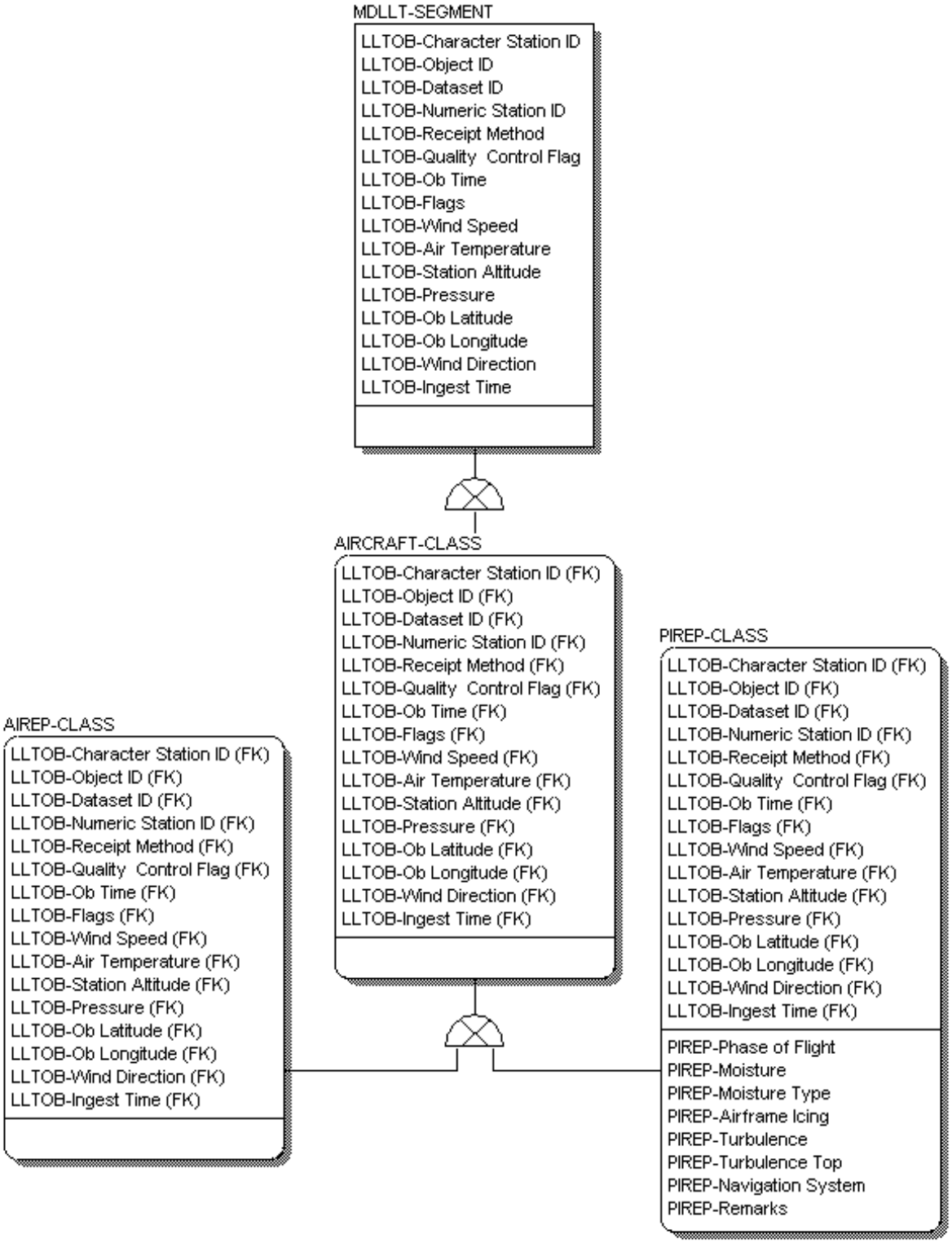


Figure 4.2-5. Logical Level Design for Aircraft Observations

4.2.3 MDLLT Physical Level Design

This section presents the designs of the individual tables that make up the MDLLT. The design is broken out by type of observation. The objective of the physical design of the database is to optimize access to data and to take advantage of RDBMS capabilities. In order to do this, like parameters have been grouped together. Section 4.2.3.1 discusses database tables common to all observation types; the remaining subsections describe the physical level design for each observation type separately.

4.2.3.1 Database Tables Common to All Observation Types

4.2.3.1.1 Observation Areas of Interest Table

Table Name: mdllt_obAOIs

Description: Stores information about area of interest boundaries for observations.

Primary Key: aoiID

Indexes: aoiName

Table 4.2-1. mdllt_obAOIs Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
aoiID	serial(1)	NOT NULL	1	2^{32}-1	Unique numeric identifier for the AOI.
aoiName	varchar(64)	NOT NULL	N/A	N/A	Alphanumeric name of AOI.
northLat	smallfloat	NOT NULL	-90.00	90.00	Northernmost bounding vector of AOI.
southLat	smallfloat	NOT NULL	-90.00	90.00	Southernmost bounding vector of AOI.
eastLon	smallfloat	NOT NULL	-180.00	180.00	Easternmost bounding vector of AOI.
westLon	smallfloat	NOT NULL	-180.00	180.00	Westernmost bounding vector of AOI.

4.2.3.1.2 Observation Collection Areas Table

Table Name: mdllt_CollectAreas

Description: Contains information about the areas and times over which groups of observations were collected.

Primary Key: obTypeID/obSubType

Foreign Key: obTypeID, obSubType, aoiID

Table 4.2-2. mdllt_CollectAreas Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obTypeID	smallint	NOT NULL	1	65535	Type of observation into which data is to be ingested
obSubType	smallint	NOT NULL	1	200	Observation data subtype
aoiID	integer	NOT NULL	1	2^{32}-1	Unique identifier for AOI
maxOpenTime	integer	NOT NULL	1	240	Maximum time in minutes for which a dataset will be opened for ingestion of data.
maxObs	integer	NOT NULL	1	2^{32}-1	Maximum number of observations to ingest into dataset.
purgeIncr	integer		1	999999999	Purge increment in seconds (determines how long data is retained for the area)

4.2.3.1.3 Observation Dataset Directory Table

Table Name: mdllt_datasetDir

Description: Stores information about an observation dataset. This table is used for all observation types except PIREPS, METAR, SPECI, and TAF reports.

Primary Key: datasetID

Foreign Key: aoiID

Indexes: minObTime, maxObTime, obType, obSubType

Table 4.2-3. mdllt_datasetdir Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
datasetID	serial(1)	NOT NULL	0	2^{32}-1	Unique Identifier of a dataset.
aoiID	integer	NOT NULL	1	2^{32}-1	ID of AOI used as the bounding area of the dataset.
obType	smallint	NOT NULL	1	65535	Type of observation being stored in the dataset.
obSubType	smallint	NOT NULL	1	200	Observation subtype stored in dataset.
dataSetName	varchar(32)	NOT NULL	N/A	N/A	Alphanumeric name of Ob dataset, also used as name of detail table which stores the grid.
minObTime	integer	NULL	0	2^{32}-1	Minimum report time of an observation in dataset.
maxObTime	integer	NULL	0	2^{32}-1	Maximum report time of an observation in dataset.
purgeTime	integer	NULL	0	2^{32}-1	Time at which to purge the dataset.
createTime	integer	NULL	0	2^{32}-1	Time at which dataset was created.

Note: Times are epoch times (seconds since 0000Z 01 January 1970)

4.2.3.1.4 Observation Types Table

Table Name: mdllt_obtypes

Description: Stores observation types and the associated type identifiers.

Primary Key: obTypeID

Foreign Key: None

Table 4.2-4. mdllt_obtypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obTypeID	smallint	NOT NULL	1	65535	Identifier for type of observation being stored in the dataset.
ObTypeName	char(16)	NOT NULL	N/A	N/A	Alphanumeric name of observation type

4.2.3.1.5 Observation Subtypes Table

Table Name: mdllt_obsubtypes

Description: Stores observation subtypes and the associated observation types.

Primary Key: obTypeID, obSubType

Foreign Key: obTypeID

Table 4.2-5. mdllt_obsubtypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obTypeID	smallint	NOT NULL	1	65535	Identifier for type of observation being stored in the dataset.
obSubType	smallint	NOT NULL	1	200	Identifier for observation subtype.
obSubTypeName	char(32)	NOT NULL	N/A	N/A	Alphanumeric name of observation subtype.

4.2.3.1.6 Observation Detail Table

Table Name: <type prefix><DTG>

Description: This table provides identifying information and station conditions for most observation types.

Primary Key: objectid

Foreign Key: None

Table 4.2-6. Observation Detail Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
charid	char(8)	NULL	N/A	N/A	ICAO station call sign, ship call sign, or aircraft call sign
objectid	serial	NOT NULL	1	2^{32}-1	Unique object identifier
datasetid	integer	NOT NULL	0	2^{32}-1	Unique identifier for dataset of which observation is a member
numericid	integer	NULL	0	999999	WMO block station number or other numeric identifier
receiptMethod	varchar (32,4)	NULL	N/A	N/A	Name of circuit over which data were received
qc	integer	NULL	0	5	Flag set if data does not pass quality checks
time	integer	NOT NULL	0	2^{32}-1	Epoch time of observation (seconds from 0000Z 1/1/70)
flag	integer	NULL	0	2^{32}-1	Observation flags
windSpeed	smallfloat	NULL	0.0	300.0	Wind speed at station
airTemperature	smallfloat	NULL	-110.0	63.0	Air temperature at station in degrees Celsius
altitude	smallfloat	NULL	-500.0	28000.0	Altitude of observing station
pressure	smallfloat	NULL	450.0	1100.0	Air pressure at station in hectopascals
lat	smallfloat	NOT NULL	-90.0	90.0	Latitude of station
lon	smallfloat	NOT NULL	-180.0	180.0	Longitude of station
windDirection	smallint	NULL	0	359	Wind direction at station
ingestTime	integer	NOT NULL	0	2^{32}-1	Time at which observation was ingested into the database

4.2.3.1.7 Cloud Data Table

Table Name: <type prefix><DTG>c

Description: Contains information concerning amount, height, and type of clouds reported in a surface synoptic or upper air temperature observation.

Primary Key: objectID/cloudHeightType

Foreign Key: objectID

Table 4.2-7. Cloud Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique identifier for the object.
height	smallfloat	NULL	> 0		Altitude of upper surface of clouds whose base is below the level of the station, in hundreds of meters
heightAboveSfc	smallfloat	NOT NULL	> 0		Height of cloud bases above surface.
cloudAmount	char(2)		‘0’-‘9’, ‘/’		Code figure for total cloud cover from WMO-306 Table 2700
lowCloud	char(2)	NOT NULL	'0'-'9','/'		Code figure for low cloud type from WMO-306 Table 0513
midCloud	char(2)	NOT NULL	'0'-'9','/'		Code figure for middle cloud type from WMO-306 Table 0515
highCloud	char(2)	NOT NULL	'0'-'9','/'		Code figure for high cloud type from WMO-306 Table 0509

4.2.3.1.8 Station Identification Tables

Table Name: mdllt_icaostations, mdllt_wmostations

Description: Stores station information for land stations. There are two tables, one for stations with ICAO call signs and one for stations identified by WMO block station numbers. The table structures are identical.

Primary Key: callSign

Foreign Key: None

Indexes: mdllt_icaostations: icaoloc, stationLat
mcllt_wmostations: wmoid, stationLat

Table 4.2-8. mdllt_icaostations and mdllt_wmostations Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
wmoid	integer	NOT NULL	0	999999	WMO Block Station Number
icaoloc	char(8)	NOT NULL	N/A	N/A	International Civil Aviation Organization (ICAO) station call sign
placeName	char(64)		N/A	N/A	Name of station location
state	char(4)		N/A	N/A	State in which station is located
country	char(4)		N/A	N/A	Country in which station is located
stationLat	smallfloat	NOT NULL	-90.0	90.0	Latitude of station
stationLon	smallfloat	NOT NULL	-180.0	180.0	Longitude of station
uaLat	smallfloat		-90.0	90.0	Latitude of upper air sounding
uaLon	smallfloat		-180.0	180.0	Longitude of upper air sounding
stnElev	smallfloat		-1000.0	10000.0	Station elevation in meters
uaElev	smallfloat		-1000.0	10000.0	Elevation in meters of upper air sounding launch point
RBSN	char(4)				

4.2.3.2 Physical Level Design for Surface Synoptic Observations

Figure 4.2-6 presents the physical level design for surface synoptic observations as entity-relationship diagrams.

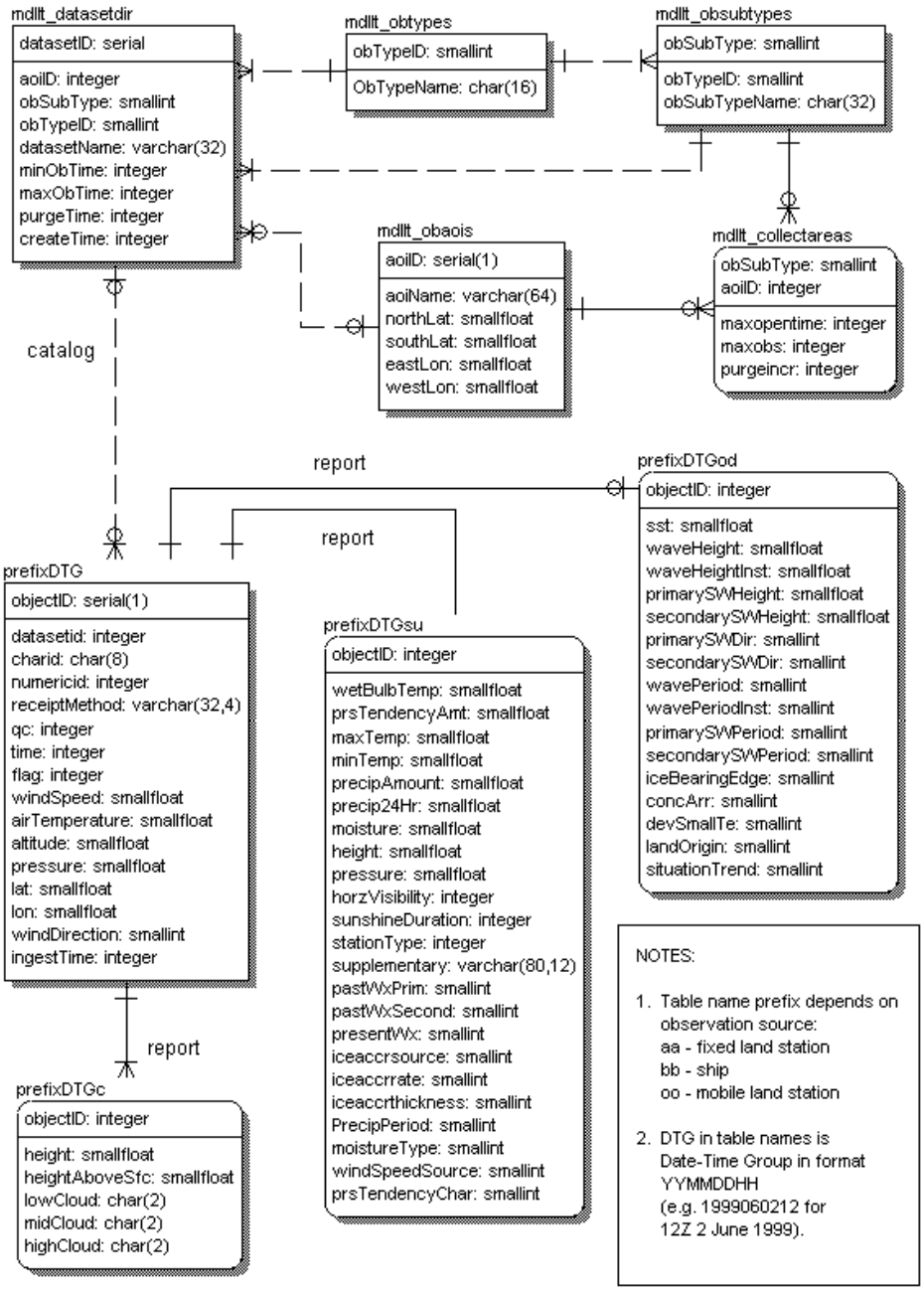


Figure 4.2-6. Physical Level Design for Surface Synoptic Observations

The remainder of this section presents the detailed design of the tables used for surface synoptic observations.

4.2.3.2.1 Synoptic Summary Table

Table Name: <type prefix><DTG>su

Primary Key: objectID

Foreign Key: objectID

Table 4.2-9. Synoptic Summary Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
wetBulbTemp	smallfloat	NULL	-5.0	63.0	Wet bulb temperature (°C)
prsTendencyAmt	smallfloat	NULL	0.0	650.0	Net pressure change over last 3 hours in hectopascals
maxTemp	smallfloat	NULL	-110.0	63.0	Maximum temperature during period (°C)
minTemp	smallfloat	NULL	-110.0	63.0	Minimum temperature during period (°C)
precipAmount	smallfloat	NULL	0	1000	Precipitation during period (millimeters)
precip24Hr	smallfloat	NULL	0	1000	Precipitation during last 24 hours (millimeters)
moisture	smallfloat	NULL	-110.0 (dew pt) 0 (RH)	(dew pt) 100 (RH)	Moisture; type of moisture is indicated by moistureType.
height	smallfloat	NULL	-500.0	10000.0	Elevation of mobile land station (meters)
pressure	smallfloat	NULL	450.0	1100.0	Air pressure at station (hectopascals)
horzVisibility	integer	NULL	00	99	Horizontal visibility code from WMO-306 Code Table 4377
sunshineDuration	integer	NULL	0	10	Sunshine duration during past hour, in tenths of an hour
stationType	integer	NULL	0	1	Station type (0=manual, 1=automated)
supplementary	varchar (80,12)	NULL	N/A	N/A	Supplementary information (WMO-306 Code Table 3778)

Table 4.2-9. Synoptic Summary Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
pastWxPrim	smallint	NULL	0	9	Past weather (primary) (WMO-306 Code Table 4561)
pastWxSecond	smallint	NULL	0	9	Past weather (secondary) (WMO-306 Code Table 4561)
presentWx	smallint	NULL	00	99	Present Weather (WMO-306 Code Table 4677)
iceaccrsource	smallint	NULL	1	5	Ice accretion source (WMO-306 Code Table 1751)
iceaccrrate	smallint	NULL	1	4	Ice accretion rate (WMO-306 Code Table 3551)
iceaccrthickness	smallint	NULL	0	120	Ice accretion thickness in centimeters
PrecipPeriod	smallint	NULL	0	24	Period over which reported precipitation occurred
moistureType	smallint	NULL	0	1	Type of moisture reported, relative humidity (0), or dewpoint temperature (1)
windSpeedSource	smallint	NULL			Wind speed source
prsTendencyChar	smallint	NULL	0	8	Indicator for characteristic of pressure tendency change over last 3 hours (WMO-306 Code Table 0200)

4.2.3.2.2 Synoptic Observation Ocean Data Structure

Table Name: <type prefix><DTG>od

Description: Stores ocean surface information for a surface synoptic observation from a ship.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-10. Synoptic Observation Ocean Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
sst	smallfloat	NULL	-20.0	63.0	Sea surface temperature °C
waveHeight	smallfloat	NULL	0.0	50.0	Wave height (half-meters)
waveHeightInst	smallfloat	NULL	0.0	50.0	Wave height measured by instrument (half-meters)
primarySWHeight	smallfloat	NULL	0.0	50.0	Primary swell height
secondarySWHeight	smallfloat	NULL	0.0	50.0	Secondary swell height
primarySWDir	smallint	NULL	0	359	Direction from which primary swell originates
secondarySWDir	smallint	NULL	0	359	Direction from which secondary swell originates
wavePeriod	smallint	NULL	0	14	Wave period
wavePeriodInst	smallint	NULL	0	14	Wave period measured by instrument
primarySWPeriod	smallint	NULL	0	14	Primary swell wave period
secondary SWPeriod	smallint	NULL	0	14	Secondary swell wave period
iceBearingEdge	smallint	NULL	0	359	Bearing to principle ice edge
concArr	smallint	NULL	0	9	Concentration or arrangement of sea ice (WMO-306 Code Table 0639)
devSmallTe	smallint	NULL	0	9	Stage of development of sea ice (WMO-306 Code Table 3739)

Table 4.2-10. Synoptic Observation Ocean Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
landOrigin	smallint	NULL	0	9	Ice of land origin (WMO-306 code table 0439)
situationTrend	smallint	NULL	0	9	Present ice situation and trend (WMO-306 Code Table 5239)

4.2.3.3 Physical Level Design for Upper Air Observations

Figure 4.2-7 through Figure 4.2-10 present the physical level design for upper air observations as entity-relationship diagrams.

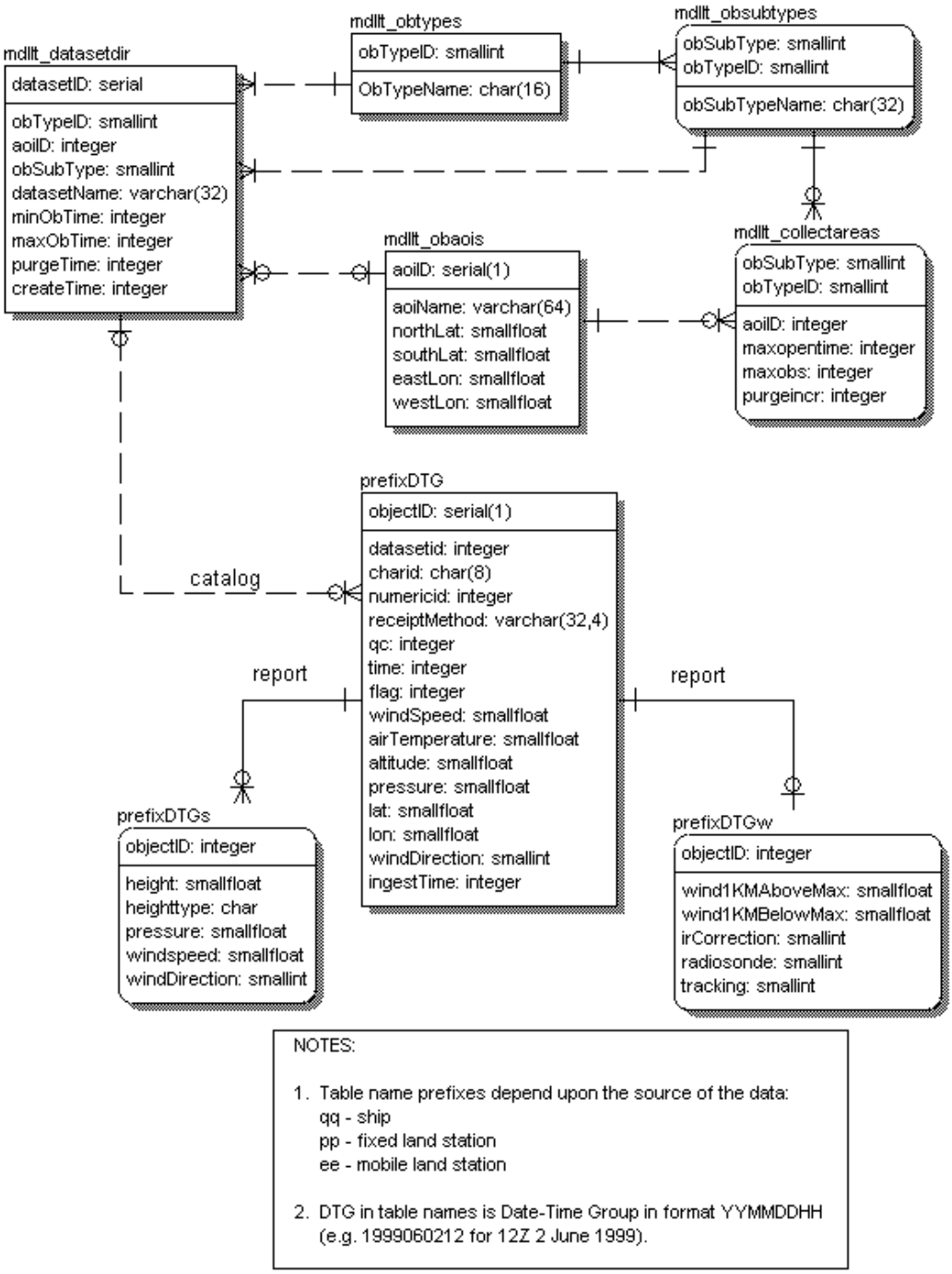


Figure 4.2-7. Physical Level Design for Storage of Upper Air Wind Observations

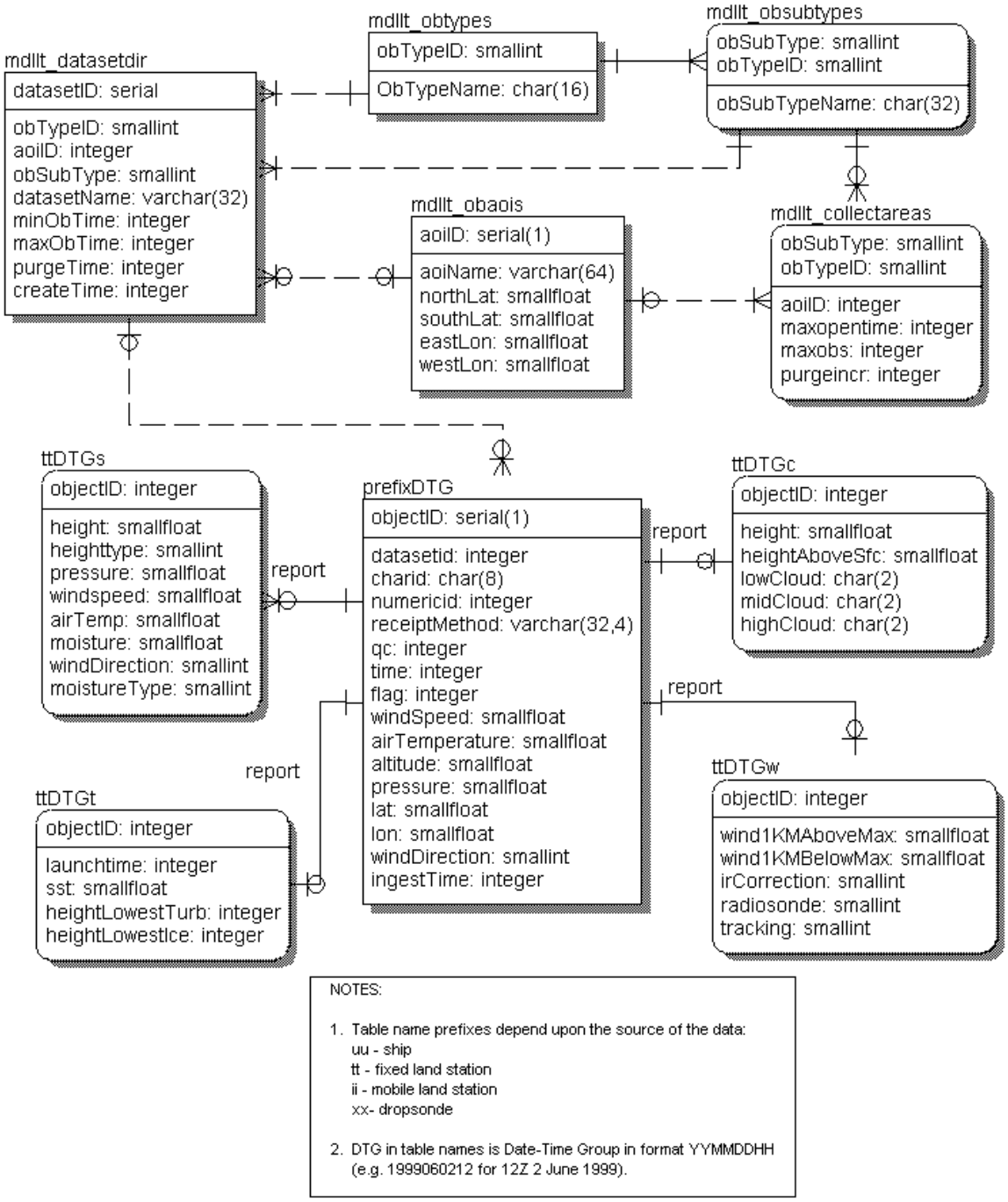
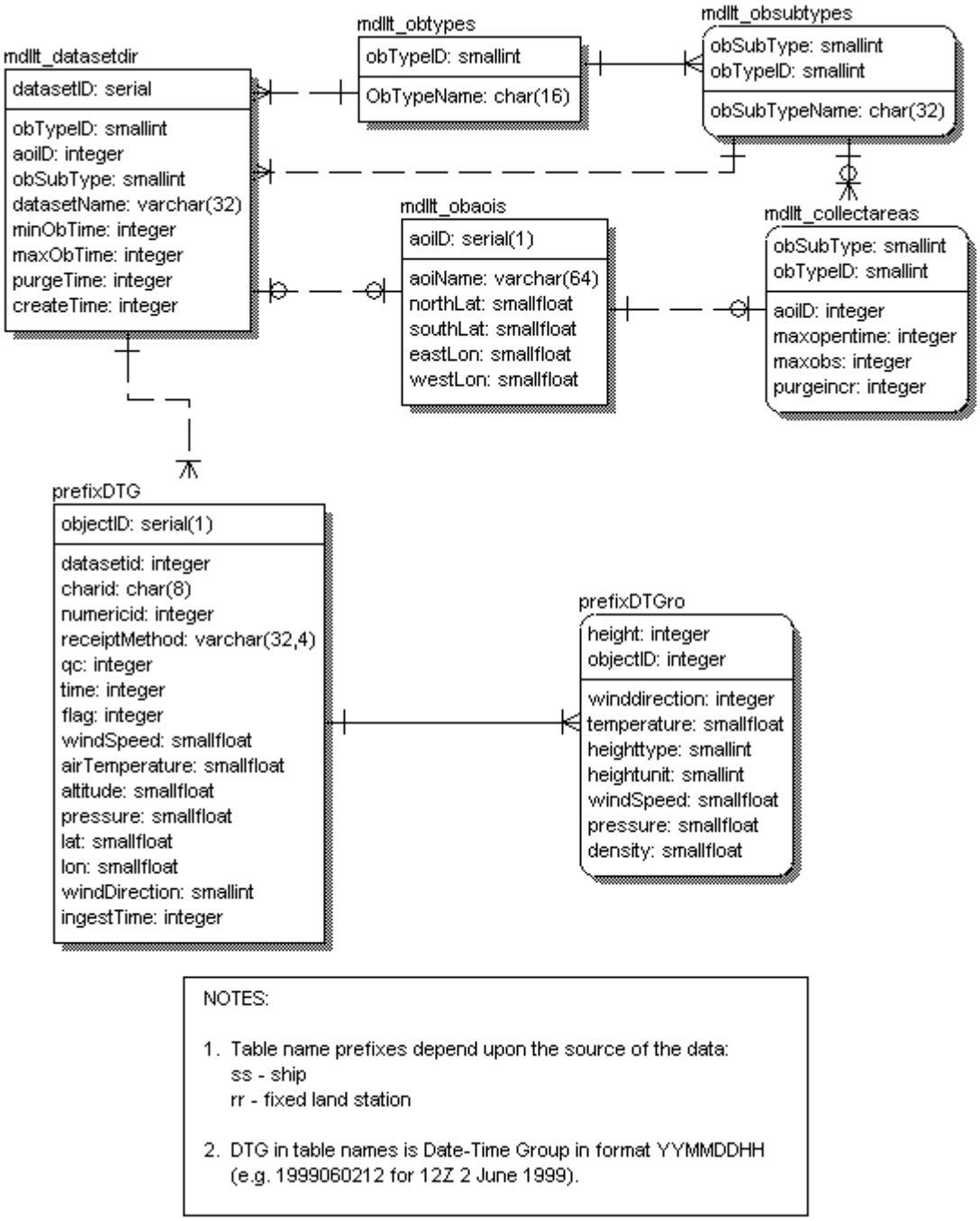


Figure 4.2-8. Physical Level Design for Storage of Upper Air Temperature Observations



NOTES:

1. Table name prefixes depend upon the source of the data:
   ss - ship
   rr - fixed land station

2. DTG in table names is Date-Time Group in format YYMMDDHH
   (e.g. 1999060212 for 12Z 2 June 1999).

Figure 4.2-9. Physical Level Design for Storage of Rocketsonde Observations

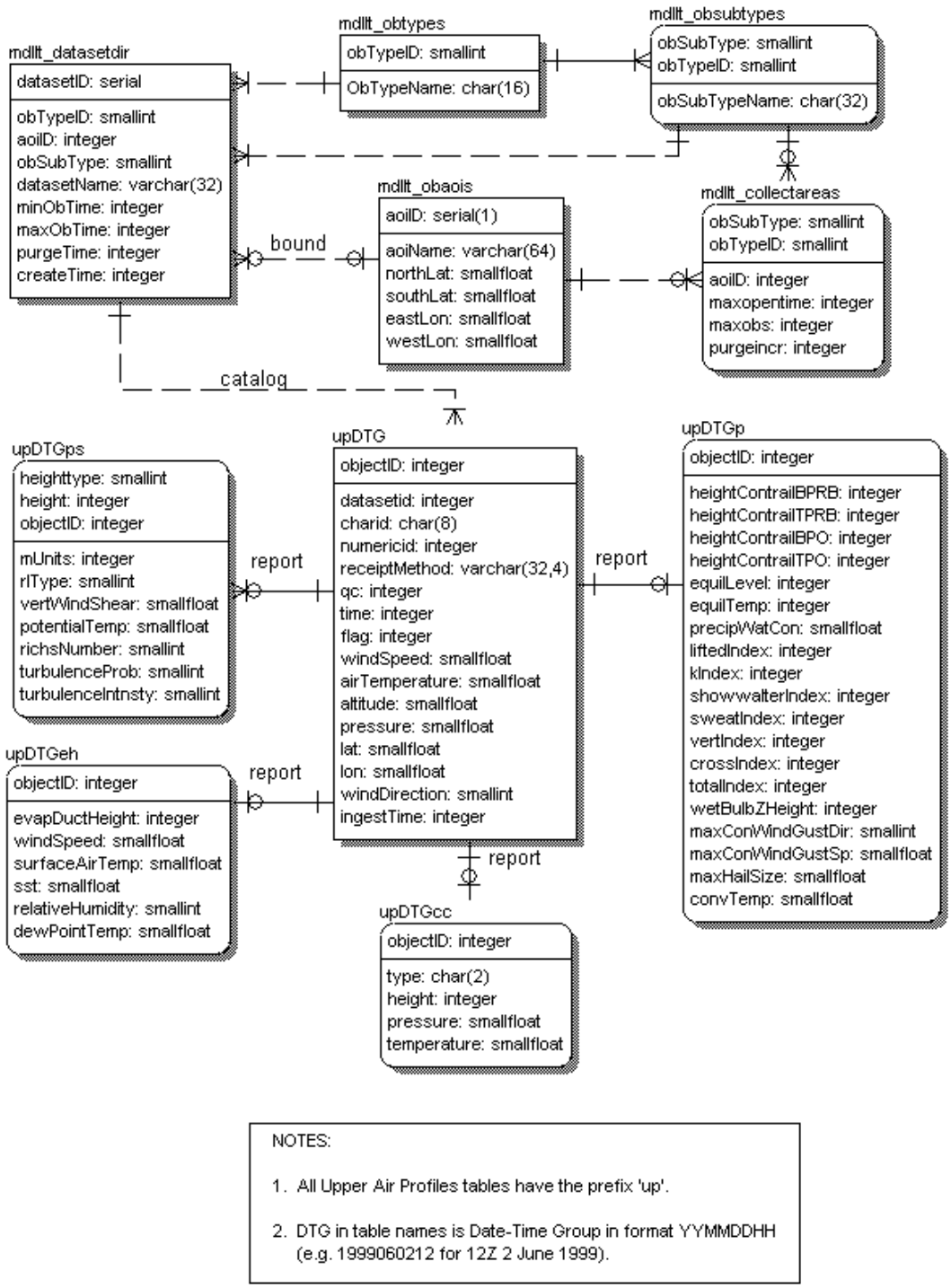


Figure 4.2-10. Physical Level Design for Storage of Upper Air Profiles

The remainder of this section presents the detailed design of the tables used for upper air observations.

4.2.3.3.1 Upper Air Wind Sounding Table

Table Name: <type prefix><DTG>s

Description: Holds wind information for a single level of an upper air wind sounding.

Primary Key: None

Foreign Key: objectID, height, heighttype

Table 4.2-11. Upper Air Wind Sounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectid	integer	NOT NULL	0	2^{32}-1	Unique object identifier
height	smallfloat	NOT NULL	0.0	150000.0	Value of height in meters, millibars, or gpm.
pressure	smallint		.001	1100.000	Air pressure at given height in hectopascals.
windspeed	smallfloat		0.0	300.0	Wind speed at given height.
windDirection	smallint		0	359	Wind direction at given height.
heighttype	char	NOT NULL	-1	6	Type of height

4.2.3.3.2 Upper Air Temperature Sounding Table

Table Name: <type prefix><DTG>s

Description: Holds information for one level of an upper air temperature sounding.

Primary Key: None.

Foreign Key: objectID

Table 4.2-12. UATempSounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
height	smallfloat	NOT NULL	0.0	150000.0	Value of height in meters, hectopascals, or geopotential meters (dependent on heightType)
pressure	smallfloat	NULL	.001	1100.000	Air pressure at given height.
windspeed	smallfloat	NULL	0.0	300.0	Wind speed at the given height.
airTemp	smallfloat	NOT NULL	-110.0	63.0	Air temperature at the given height.
moisture	smallfloat	NULL	-110.0 (dew pt) 0 (RH)	63.0 (dew pt) 100 (RH)	Moisture value (range dependent on moistureType)
windDirection	smallint	NULL	0	359	Wind direction at the given height.
heighttype	char	NOT NULL	-1	6	Type of height.
moistureType	smallint	NOT NULL	0	1	Type of moisture represented by the moisture value (i.e., dewpoint temperature or relative humidity).

4.2.3.3.3 Upper Air Turbulence and Icing Table

Table Name: <type prefix><DTG>t

Description: Holds turbulence and icing data reported in an upper air sounding.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-13. Upper Air Turbulence and Icing Table

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
launchtime	integer	NULL	0	2^{32}-1	Launch time of sensor
sst	smallfloat	NULL	-5.0	45.0	Sea surface temperature
heightLowestTurb	integer	NULL	0, 2, 4, 6		Identifier for lowest level at which turbulence was encountered
heightLowestIce	integer	NULL	400	50000	Lowest height at which icing was encountered

4.2.3.3.4 Rocket Sounding Table

Table Name: <type prefix><DTG>ro

Description: Stores data generated by a rocket sounding.

Primary Key: objectID/height

Foreign Key: objectID

Table 4.2-14. rocketSounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
height	integer	NOT NULL	0	150000	Height at which data are observed; value (dependent on heightType); has a maximum range value large enough to accommodate geopotential meters or hectopascals ranges.
winddirection	smallint	NULL	0-359 or -1		Wind direction at given height.
temperature	smallfloat	NULL	-110.0	63.0	Temperature at given height
heighttype	smallint	NULL	11	66	Indicator of units in which pressure and height are coded
heightunit	smallint	NULL	0	2	Unit of height measurement can be meters, hectopascals, or geopotential meters. (Enumerated as follows: 0 = m, 1 = hP, 2 = gpm)
windSpeed	smallfloat	NULL	0.0	300.0	Wind speed.
pressure	smallfloat	NULL	.001	1100.000	Pressure at given height.
density	smallfloat	NULL	.000001	1.000000	Density at given height.

4.2.3.3.5 Upper Air Profile Table

Table Name: <UP<DTG>p

Description: Stores information computed from an upper air sounding.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-15. UAProfile Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
heightContrailBPRB	integer	NULL	0	150000	Height of the bottom of the layer in which contrail formation is probable
heightContrailTPRB	integer	NULL	0	150000	Height of the top of the layer in which contrail formation is probable
heightContrailBPO	integer	NULL	0	150000	Height of the bottom of the layer in which contrail formation is possible
heightContrailTPO	integer	NULL	0	150000	Height of the top of the layer in which contrail formation is possible
equilLevel	integer	NULL	0	150000	Height at which the temperature of a buoyantly rising parcel again becomes equal to the temperature of the environment
equilTemp	integer	NULL	-110.0	63.0	Temperature of a buoyantly rising parcel as it becomes equal to the temperature of the environment
precipWatCon	smallfloat	NULL	0	80.00	Precipitable water content
liftedIndex	integer	NULL	-10	10	Lifted Index
kIndex	integer	NULL	0	50	K Index
showalterIndex	integer	NULL	-10	10	Showalter Index
sweatIndex	integer	NULL	0	500	Severe Weather Threat (SWEAT) Index
vertIndex	integer	NULL	0	40	Vertical totals Index

Table 4.2-15. UAProfile Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
crossIndex	integer	NULL	0	70	Cross totals index
totalIndex	integer	NULL	9	110	Sum of the vertical and cross totals indexes (Total Totals Index)
wetBulbZHeight	integer	NULL	0	150000	Height of wet bulb temperature measurement
maxConWindGustDir	smallint	NULL	0	359	Maximum convective wind gust direction
maxConWindGustSp	smallfloat	NULL	0	300.0	Maximum convective wind gust speed
maxHailSize	smallfloat	NULL	0	20.0	Maximum diameter of hailstones in cm
convTemp	smallfloat	NULL	-110.0	63.0	Convection temperature

4.2.3.3.6 Convective Conditions Table

Table Name: <UP><DTG>cc

Description: Holds information used to calculate convective conditions for an upper air profile.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-16. convCond Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectid	integer	NOT NULL	0	2^{32}-1	Unique object identifier
type	char(2)	NOT NULL	‘a’, ‘A’, ‘m’, ‘M’		Type of station (automated or manual)
height	integer	NOT NULL	0	150000	Station elevation
pressure	smallfloat	NOT NULL	0.0	1100.0	Atmospheric pressure
temperature	smallfloat	NOT NULL	-110.0	63.0	Temperature (°C)

4.2.3.3.7 Evaporation Duct Height Table

Table Name: UP<DTG>eh

Description: Stores evaporation duct height and information used to calculate it.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-17. evaporationHt Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
evapDuctHeight	integer	NULL	0	150000	Evaporation duct height
windSpeed	smallfloat	NULL	0.0	300.0	Wind speed
surfaceAirTemp	smallfloat	NULL	-110.0	63.0	Surface air temperature
sst	smallfloat	NULL	-5.0	45.0	Sea surface temperature
relativeHumidity	smallint	NULL	0	100	Ratio of water vapor pressure to saturation vapor pressure
dewPointTemp	smallfloat	NULL	-110.0	63.0	Dew point temperature

4.2.3.3.8 Upper Air Profile Sounding Table

Table Name: UP<DTG>ps

Description: Stores vertical profile data computed from an upper air sounding.

Primary Key: objectID/heightType/height

Foreign Key: objectID, heightType, height

Table 4.2-18. uaProfileSounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
heightType	char	NOT NULL	-1	6	Type of level
height	smallint	NOT NULL	0	150000	Height of current level
mUnits	integer	NULL	0	7000	Modified refractivity units
rlType	smallint	NULL	1	5	Refractive layer type (1 = subrefractive, 2 = normal, 3 = superrefractive, 4 = trapping, 5 = undefined)
vertWindShear	smallfloat	NULL	0.0	300.0	Vertical wind shear at this level
potentialTemp	smallfloat	NULL	-110.0	63.0	Potential temperature at level
richsNumber	smallint	NULL	-5	5	Richardson Number
turbulenceProb	smallint	NULL	0	100	Probability of turbulence at level
turbulenceIntsty	smallint	NULL	0	9	Turbulence intensity

4.2.3.4 Physical Level Design for Aircraft Observations

Figures 4.2-11 and 4.2-12 depict the physical level designs for Aircraft Observations as entity-relationship diagrams.

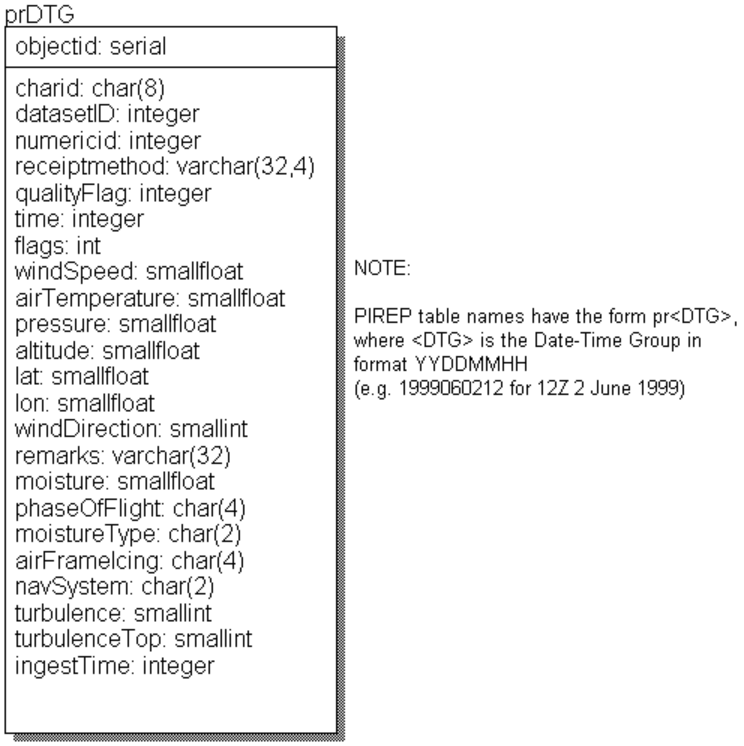


Figure 4.2-11. Physical Level Design for Storage of PIREPS

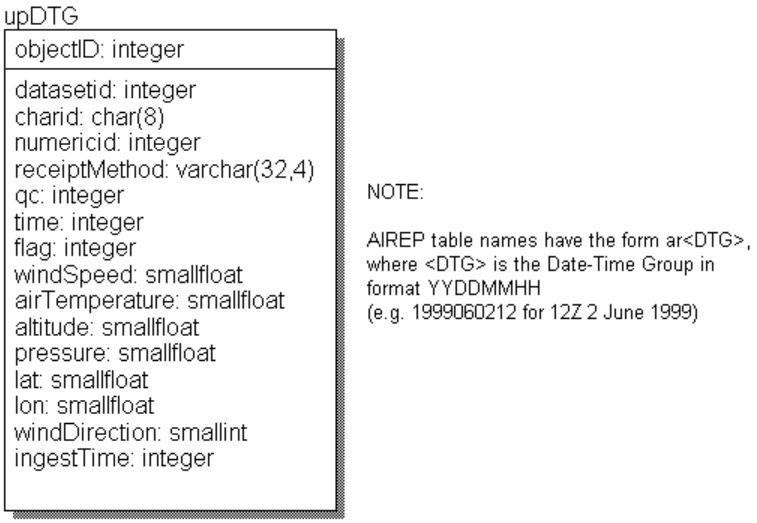


Figure 4.2-12. Physical Level Design for Storage of AIREPS

The remainder of this section presents the detailed design of the tables used for Aircraft Observations.

4.2.3.4.1 Pilot Report (PIREP) Detail Table

Table Name: PR<DTG>

Description: Stores data from a PIREP.

Primary Key: objectID

Foreign Key: None

Table 4.2-19. Pilot Report (PIREP) Detail Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
charid	char(8)	NULL	N/A	N/A	Character identifier of aircraft
objectid	serial	NOT NULL	0	2^{32}-1	Unique object identifier
numericid	integer	NULL	0-999999 or -1		Numeric identifier of aircraft
receiptmethod	varchar (32,4)	NULL	N/A	N/A	Name of circuit over which data were received
qualityFlag	integer	NULL	0	5	Flag indicating whether data passed quality checks
time	integer	NOT NULL	1	2^{32}-1	Epoch time of report, seconds from 0000Z 1/1/70
windSpeed	smallfloat	NULL	0.0	300.0	Wind speed
airTemperature	smallfloat	NULL	-110.0	63.0	Air temperature (°C)
pressure	smallfloat	NULL	100.0	1100.0	Air pressure (hectopascals)
altitude	smallfloat	NULL	0.0	50000.0	Aircraft altitude
lat	smallfloat	NOT NULL	-90.0	90.0	Aircraft latitude
lon	smallfloat	NOT NULL	-180.0	180.0	Aircraft longitude
windDirection	smallint	NULL	0-359 or -1		Direction from which wind is blowing
remarks	varchar (32,0)	NULL	N/A	N/A	Free form text remarks that may have been provided with report.
moisture	smallfloat	NULL	-110.0 (dew point) 0.0 (RH)	63.0 (dew point) 100.0 (RH)	Moisture value (range dependent on moistureType)

Table 4.2-19. Pilot Report (PIREP) Detail Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
phaseOfFlight	char(4)	NULL	LVR, LVW, ASC, DES		Phase of flight
moistureType	char(2)	NULL	‘0’, ‘1’, ‘2’		Moisture type: ‘0’ = dew point, ‘1’ = relative humidity
airFrameIcing	char(4)	NULL	N/A	N/A	Airframe icing indicator
navSystem	char(2)	NULL	‘0’	‘1’	Navigation system indicator
turbulence	smallint	NULL	0	9	Turbulence indicator
turbulenceTop	smallint	NULL	0	255	Highest altitude of turbulence reported
ingestTime	integer	NOT NULL	0	2^{32}-1	Time at which report was ingested into the database

4.2.3.4.2 Upper Air Minimum-Maximum Winds Table

Table Name: <type id><DTG>w

Description: Stores information concerning minimum and maximum winds in an upper air sounding and the levels at which they occur.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-20. Upper Air Minimum-Maximum Winds Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectid	serial	NOT NULL	0	2^{32}-1	Unique object identifier
wind1KMAboveMax	smallfloat	NULL	0.0	300.0	Vector difference between maximum wind and wind blowing 1 km above the level of the maximum wind
wind1KMBelowMax	smallfloat	NULL	0.0	300.0	Vector difference between maximum wind and wind blowing 1 km below the level of the maximum wind
irCorrection	smallint	NULL	0	7	Identifier for the IR correction used
radiosonde	smallint	NULL	0	99	Identifier for the radiosonde type used
tracking	smallint	NULL	0	99	Identifier for the tracking system used

4.2.3.5 Physical Level Design for Ocean Observations

Figure 4.2-13 through Figure 4.2-15 present the physical level design for ocean observations as entity-relationship diagrams.

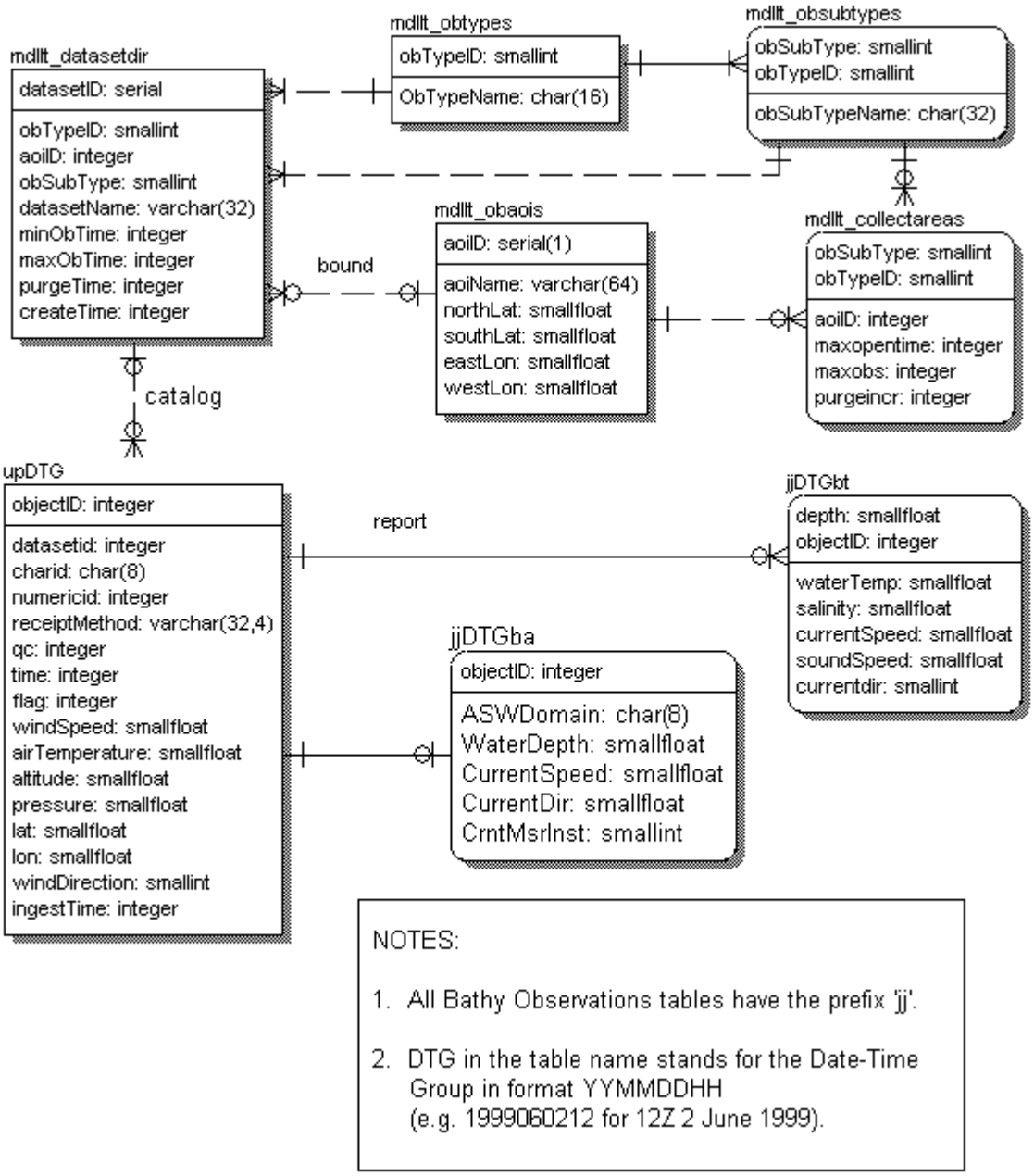


Figure 4.2-13. Physical Level Design of Storage for Bathythermograph Observations

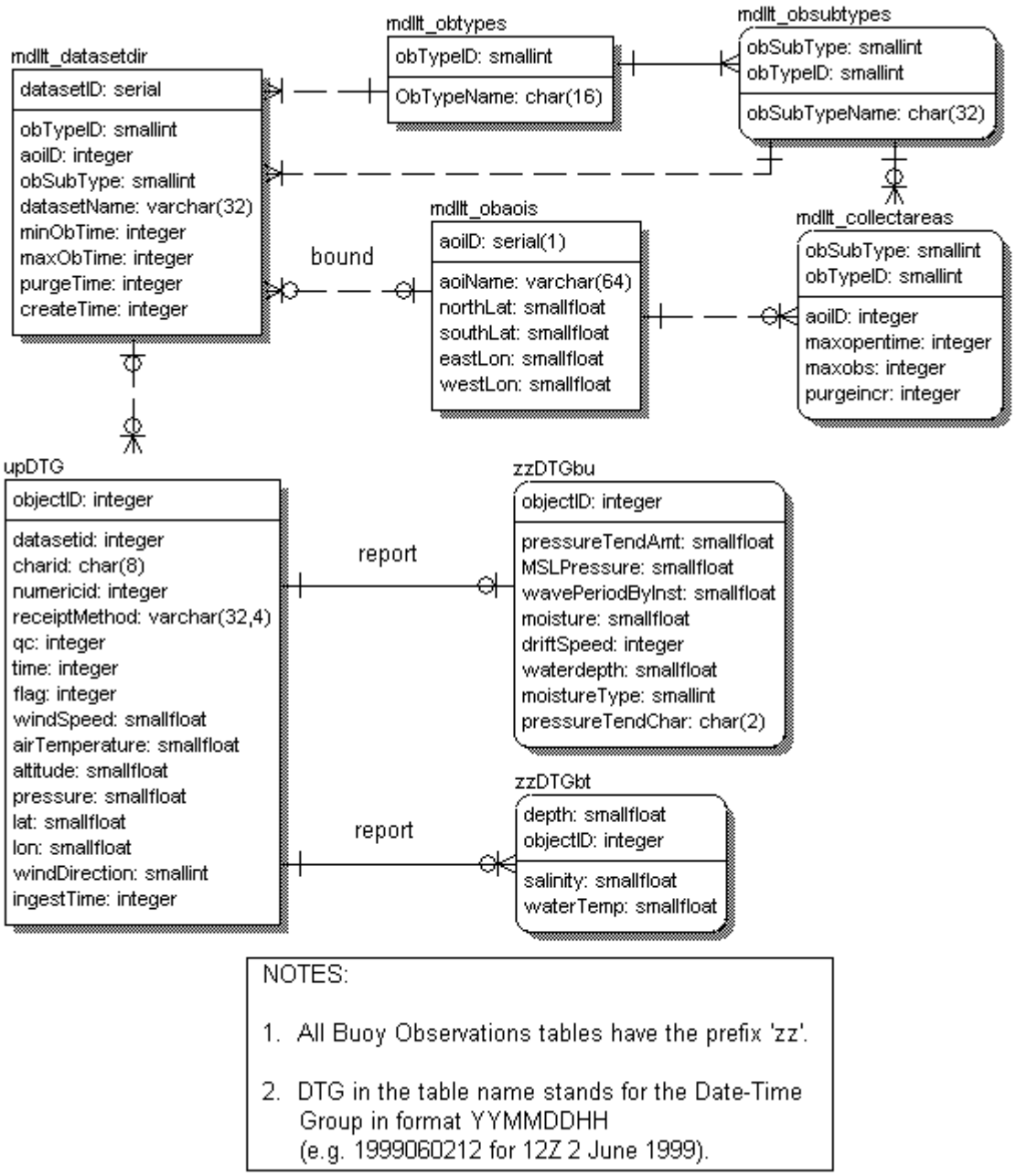


Figure 4.2-14. Physical Level Design of Storage for Buoy Observations

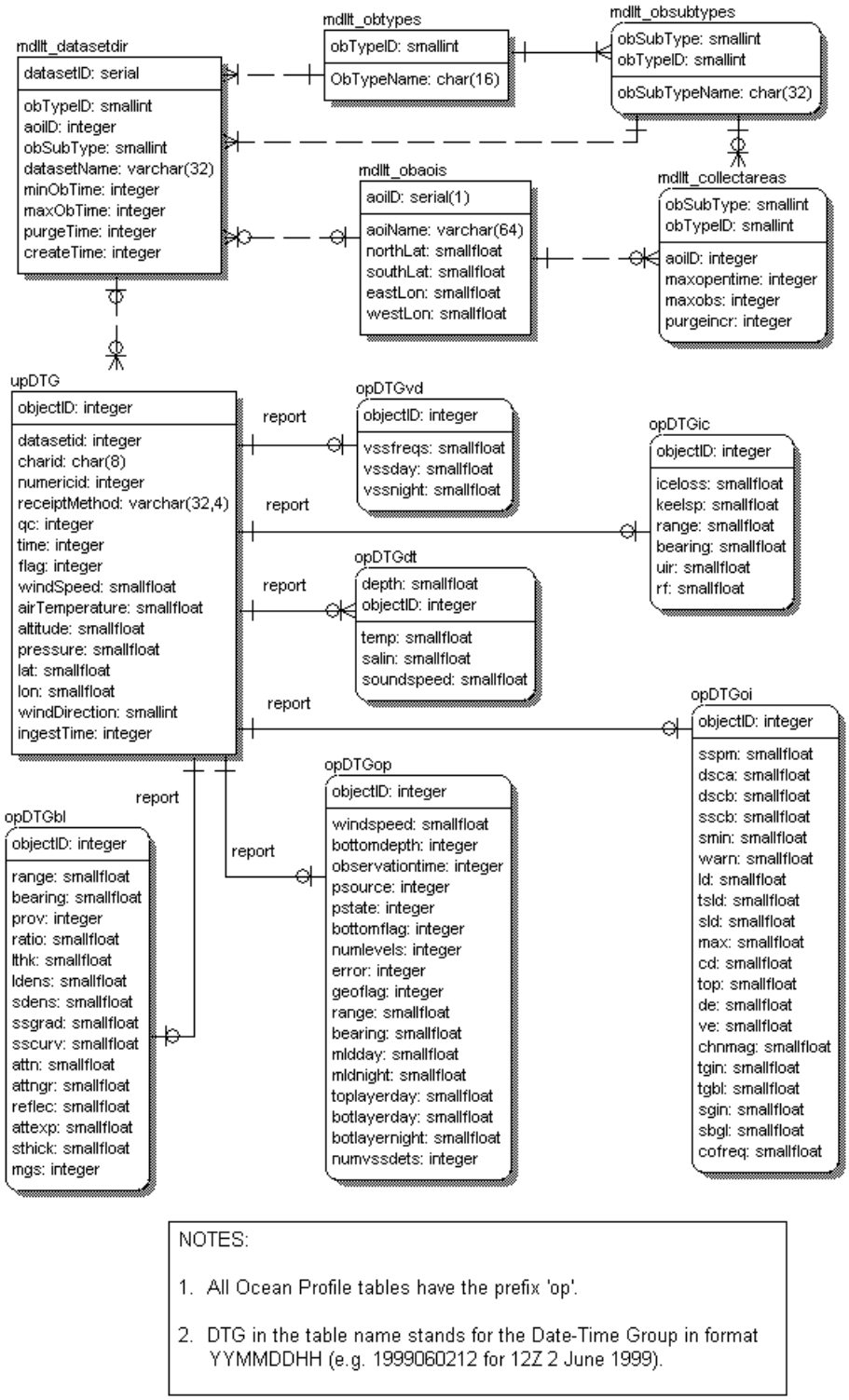


Figure 4.2-15. Physical Level Design of Storage for Ocean Profiles

The remainder of this section presents the detailed design of the tables used for ocean observations.

4.2.3.5.1 Bathythermograph Sounding Table

Table Name: JJ<DTG>bt

Description: Stores information for one level of an ocean sounding.

Primary Key: depth/objectID

Foreign Key: objectID

Table 4.2-21. bathySounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectid	integer	NOT NULL	0	2^{32}-1	Unique object identifier
depth	smallfloat	NULL	-100.000	12000.000	Depth at which data are reported.
waterTemp	smallfloat	NULL	-2.00	40.00	Temperature of water at depth (°C).
salinity	smallfloat	NULL	0.00	45.00	Salinity of water at depth (parts per thousand)
currentSpeed	smallfloat	NULL	0.00	30.00	Speed of current at given depth (meters/second).
soundSpeed	smallfloat	NULL	1400.0	1600.0	Sound speed at given depth (meters/second)
currentDir	smallint	NULL	0	35	Direction of current at depth (tens of degrees).

4.2.3.5.2 Bathythermograph Report Table

Table Name: JJ<DTG>ba

Description: Stores information about a bathythermograph report.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-22. Bathythermograph Report Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectid	integer	NOT NULL	0	2^{32}-1	Unique object identifier
ASWDomain	char(8)	NULL	N/A	N/A	Name of ASW domain
WaterDepth	smallfloat		0.0	12000.0	Depth of water where sounding was taken
CurrentSpeed	smallfloat		0.0	20.0	Current speed in meters/second
CurrentDir	smallfloat		0.0	360.0	Direction of current flow
CrntMsrInst	smallint				Code for current measurement instrument

4.2.3.5.3 Buoy Table

Table Name: zz<DTG>bu

Description: Stores sea surface and drift information from a buoy report.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-23. Buoy Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
pressureTendAmt	smallfloat	NULL	0.0	99.0	Amount of pressure change
MSLPressure	smallfloat	NULL	830.0	1090.0	Mean sea level pressure
wavePeriodByInst	smallfloat	NULL	0.0	99.9	Wave period measured by instrumentation
moisture	smallfloat	NULL	-5.0 (DPT) 0.0 (RH)	63.0 (DPT) 100.0 (RH)	Moisture value: type and range determined by moistureType
waterdepth	smallfloat	NULL	0.0	12000.0	Water depth in meters
driftSpeed	integer	NULL	0	9999	Drift speed of the buoy
moistureType	smallint	NULL	0	1	Moisture type indicator (0 = Dew Point Temperature, 1 = Relative Humidity)
pressureTendChar	char	NULL	0	8	Characteristic of pressure tendency over past 3 hours

4.2.3.5.4 Buoy Sounding Table

Table Name: zz<DTG>bt

Description: Stores data for a single level of a buoy sounding.

Primary Key: depth/objectID

Foreign Key: objectID

Table 4.2-24. Buoy Sounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
depth	smallfloat	NOT NULL	0.00	12000.00	Depth at which data are reported (meters).
salinity	smallfloat	NULL	0.0	45.00	Salinity of water at depth (parts per thousand)
waterTemp	smallfloat	NULL	-2.00	40.00	Temperature of water at depth (°C).

4.2.3.5.5 Ocean Profile Summary Table

Table Name: op<DTG>op

Description: Holds summary data for an ocean profile. Ocean profiles contain sounding data plus data calculated from the sounding.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-25. Ocean Profile Summary Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
ASWDomain	char(8)	NULL	N/A	N/A	Name of ASW domain
windspeed	smallfloat	NULL	0.0	200.0	Wind speed in meters/second
bottomdepth	smallfloat	NULL	0.00	12000.00	Bottom depth in meters
observationtime	integer	NULL	0	2^{32}-1	Time of observation
psource	integer	NULL	1	32	Indicator for source of profile (XBT, XSV, DTS, etc)
pstate	integer	NULL	1	32	Indicator for state of profile: MrgBT, MrgXSV, BT, XSV, Forecast, Hist
bottomflag	integer	NULL	0	1	Flag indicating whether profile extends to the bottom
numlevels	integer	NULL	1	64	Number of levels in the profile
error	integer	NULL	1	2^{32}-1	Flag for error in data received
geoflag	integer	NULL	0	1	Land-sea flag
range	smallfloat	NULL	0.0	50000.0	Range to phenomenon
bearing	smallfloat	NULL	0.0	359.9	Bearing to phenomenon
mldday	smallfloat	NULL	0.0	300.0	Mixed layer depth (day)
mldnight	smallfloat	NULL	0.0	300.0	Mixed layer depth (night)
toplayerday	smallfloat	NULL	0.0	300.0	Top of scattering layer (day)
botlayerday	smallfloat	NULL	0.0	1000.0	Bottom of scattering layer (day)
botlayernight	smallfloat	NULL	0.0	1000.0	Bottom of scattering layer (night)
numvssdets	integer	NULL	0	20	Number of volume scattering detail sets for profile

4.2.3.5.6 Bottom Loss Data Table

Table Name: op<DTG>bl

Description: Holds data needed to calculate bottom loss for sound propagation calculations.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-26. Bottom Loss Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
range	smallfloat	NULL	0.0	50000.0	Range to bottom loss area
bearing	smallfloat	NULL	0.0	359.9	Bearing to bottom loss area
prov	integer	NULL	1	100	Bottom loss province
ratio	smallfloat	NULL	0.0	20.0	Ratio of sound speed in sediment to that in water at the interface
lthk	smallfloat	NULL	0.0	100.0	Thin layer thickness in meters
ldens	smallfloat	NULL	0.0	20.0	Thin layer density in g/cm^3
sdens	smallfloat	NULL	0.0	20.0	Sediment density in g/cm^3
ssgrad	smallfloat	NULL	0.0	10.0	Initial sound speed gradient in dB/m
sscurv	smallfloat	NULL	0.0	100.0	Sound speed profile curvature
attn	smallfloat	NULL	0.0	10.0	Initial attenuation in sediment, dB/m/kHz
attngr	smallfloat	NULL	0.0	20.0	Attenuation gradient, dB/m/kHz/m
reflec	smallfloat	NULL	0.0	1.0	Basement reflection coefficient
attexp	smallfloat	NULL	0.0	20.0	Frequency exponent for BLUG parameters
sthick	smallfloat	NULL	0.0	1000.0	Sediment thickness in meters
mgs	integer	NULL	0	100	MGS region number

4.2.3.5.7 ICECAP Data Table

Table Name: op<DTG>ic

Description: Contains data used in the ICECAP ice prediction program.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-27. ICECAP Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
iceloss	smallfloat	NULL	0.0	20.0	Transmission loss in ice, dB/m
keelsp	smallfloat	NULL	0.0	10000.0	Keel spacing in meters
range	smallfloat	NULL	0.0	50000.0	Range to ice edge
bearing	smallfloat	NULL	0.0	359.9	Bearing to ice edge
uir	smallfloat	NULL	0.0	1000.0	Under Ice Roughness
rf	smallfloat	NULL	0.0	1000.0	Ridge Frequency

4.2.3.5.8 Sound Speed Related Data Table

Table Name: op<DTG>oi

Description: Holds other sound speed related data from an ocean profile.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-28. Sound Speed Related Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
sspm	smallfloat	NULL	1200.0	1600.0	Mean sound speed in profile, m/s
dsca	smallfloat	NULL	0.0	12000.0	Deep sound channel axis depth, meters
dscb	smallfloat	NULL	0.0	12000.0	Depth at sound channel bottom, meters
sscb	smallfloat	NULL	1200.0	1600.0	Sound speed at channel bottom, m/s
smin	smallfloat	NULL	1200.0	1600.0	Minimum sound speed in profile, m/s
warn	smallfloat	NULL	0.0	100.0	Warning flag for message
ld	smallfloat	NULL	0.0	1000.0	Mixed layer depth, meters
tsld	smallfloat	NULL	0.0	50.0	Temperature at sonic layer depth, °C
sld	smallfloat	NULL	0.0	12000.0	Sonic layer depth, meters
max	smallfloat	NULL	1200.0	1600.0	Maximum sound speed in profile, m/s
cd	smallfloat	NULL	0.0	12000.0	Critical depth, meters
top	smallfloat	NULL	0.0	10000.0	Top of channel, meters
de	smallfloat	NULL	0.0	12000.0	Depth excess, meters
ve	smallfloat	NULL	0.0	1600.0	Velocity excess, m/s
chnmag	smallfloat	NULL	0.0	10000.0	Sound channel magnitude
tgin	smallfloat	NULL	-20.0	20.0	In-layer temperature gradient, °C/100 m.

Table 4.2-28. Sound Speed Related Data Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
tgbl	smallfloat	NULL	-20.0	20.0	Below-layer temperature gradient, °C/100 m.
sgin	smallfloat	NULL	-200.0	200.0	In-layer sound speed gradient, m/s/100 m.
sbgl	smallfloat	NULL	-200.0	200.0	Below-layer sound speed gradient, m/s/100 m.
cofreq	smallfloat	NULL	0.0	500.0	Cut-off frequency, m/s

4.2.3.5.9 Ocean Profile Sounding Table

Table Name: op<DTG>dt

Description: Holds data for a single level of an ocean profile sounding.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-29. Ocean Profile Sounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
depth	smallfloat	NOT NULL	0.0	12000.0	Depth of level
temp	smallfloat	NULL	-5.0	50.0	Water temperature at level, °C
salin	smallfloat	NULL	0.0	50.0	Salinity at level, parts per thousand
soundspeed	smallfloat	NULL	1200.0	1600.0	Sound speed at level, m/s

4.2.3.5.10 Volume Scattering Data Table

Table Name: op<DTG>vd

Description: Holds volume scattering information.

Primary Key: objectID

Foreign Key: objectID

Table 4.2-30. Ocean Profile Sounding Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique object identifier
vssfreqs	smallfloat	NULL	N/A	N/A	Volume scattering frequency
vssday	smallfloat	NULL	N/A	N/A	Volume scattering strength (day)
vssnight	smallfloat	NULL	N/A	N/A	Volume scattering strength (night)

4.2.3.6 Physical Level Design for METAR, SPECI, and TAF

Figure 4.2-16 and Figure 4.2-15 below present the physical level design for storing METAR, SPECI, and TAF reports as entity-relationship diagrams.

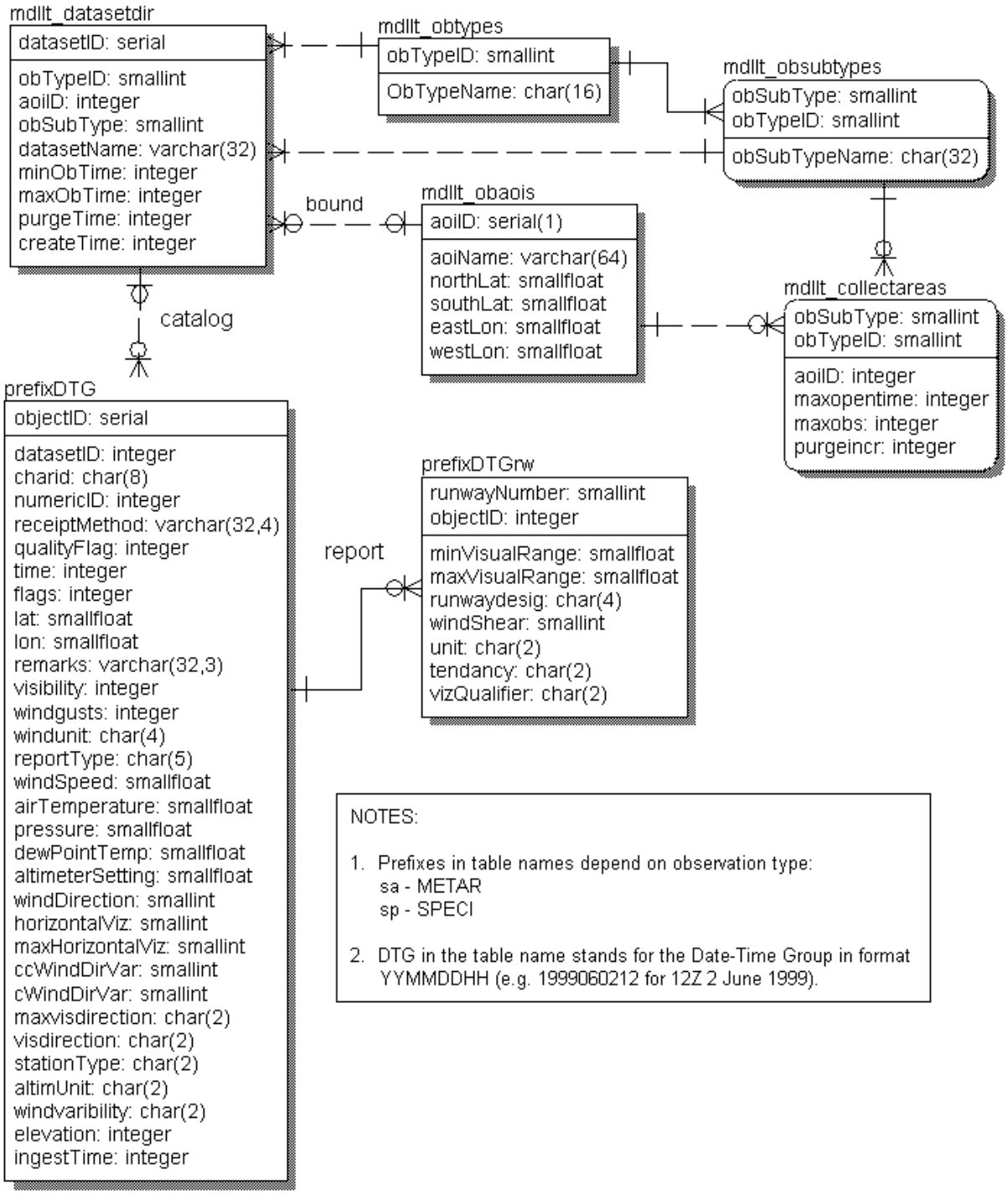


Figure 4.2-16. Physical Level Design for Storage of METAR and SPECI Reports

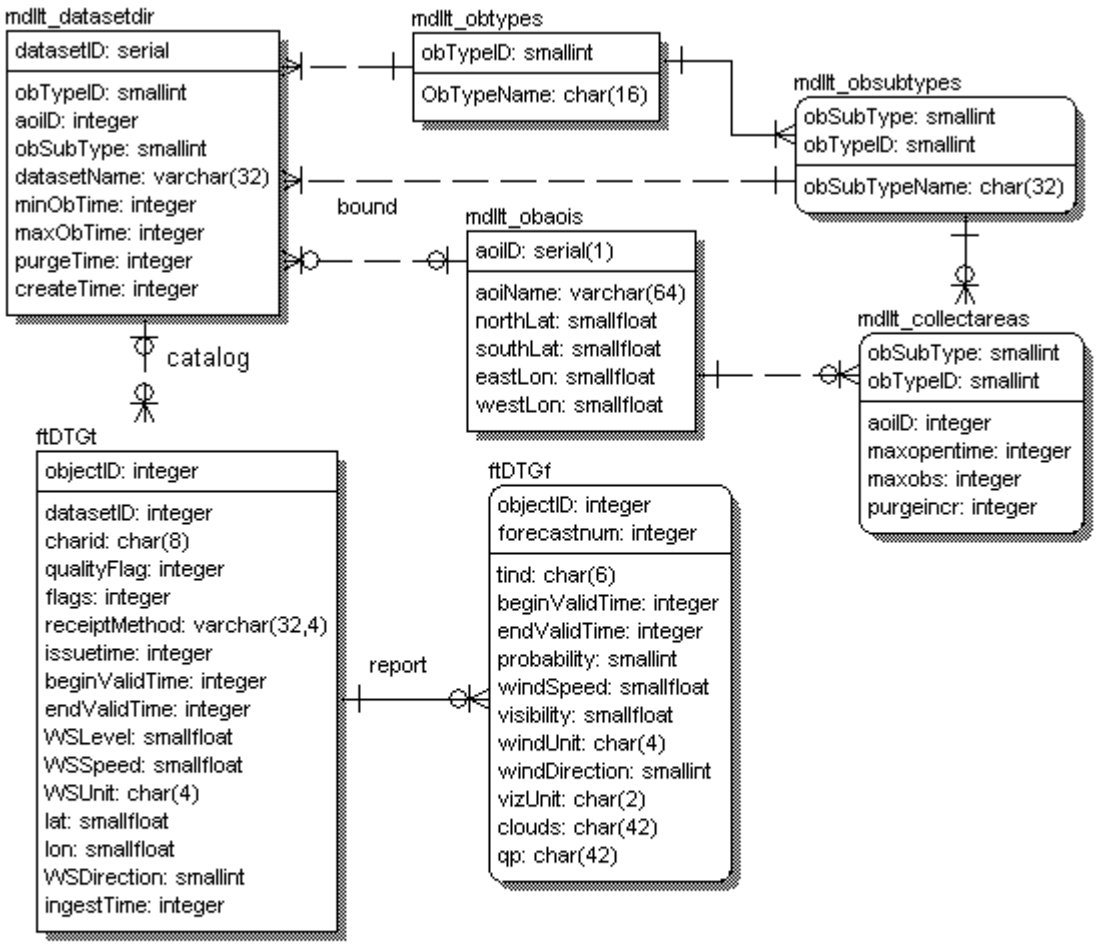


Figure 4.2-17. Physical Level Design of Storage for TAFs

The remainder of this section describes the tables used to store METAR, SPECI, and TAF data.

4.2.3.6.1 METAR/SPECI Report Detail Table

Table Name: <SA or SP><DTG>

Description: Stores detail information for a METAR or SPECI report.

Primary Key: objectID

Table 4.2-31. METAR/SPECI Report Detail Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
charid	char(8)	NOT NULL	N/A	N/A	ICAO station call sign or ship's international call sign, etc.
objectID	serial	NOT NULL	0	2^{32}-1	Unique identifier for report
datasetID	integer	NULL	0	2^{32}-1	Unique Identifier of dataset to which observation belongs.
numericID	integer	NOT NULL	0	999999	Numeric identifier of station (e.g. WMO Block Station Number)
receiptMethod	varchar (32,4)	NULL	N/A	N/A	Name of circuit over which data were received
qualityFlag	integer	NULL	0	5	Flag set if data do not pass quality checks
time	integer	NOT NULL	0	2^{32}-1	Observation time – seconds since 0000Z 1/1/1970
flags	integer	NULL	0	2^{32}-1	Flags
lat	smallfloat	NULL	-90.0	90.0	Latitude of reporting station.
lon	smallfloat	NULL	-180.0	180.0	Longitude of reporting station.
remarks	varchar (32,3)	NULL	N/A	N/A	Remarks
visibility	integer	NULL	0	10000	Visibility at reporting station
windgusts	integer	NULL	0	200	Wind gust speed
windunit	char(4)	NOT NULL	'KT', "MPS', KMH', 'kt', 'mps', kmh'		Indicator of units used for wind speed
reportType	char(5)	NULL	'AUTO', 'COR'		Report type (automated, corrected)
windSpeed	smallfloat	NULL	0.0	200.00	Wind Speed at reporting station.
airTemperature	float	NULL	-110.0	63.0	Air temperature at station
pressure	smallfloat	NULL	450.00	1100.00	Station pressure
dewPointTemp	smallfloat	NULL	-5.0	63.0	Dew point temperature

Table 4.2-31. METAR/SPECI Report Detail Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
altimeterSetting	smallfloat	NULL	600.00	1100.00	Altimeter setting
elevation	integer	NULL	-999	90000	Station elevation
windDirection	smallint	NULL	0-359 or -1		Wind direction at reporting station.
horizontalViz	smallint	NULL	0	9999	Horizontal visibility
maxhorizontalViz	smallint	NULL	0	9999	Maximum horizontal visibility
ccWindDirVar	smallint	NULL	0	359	Counter-clockwise limit of wind direction variability arc
cWindDirVar	smallint	NULL	0	359	Clockwise limit of wind direction variability arc
maxvisdirection	char(3)	NOT NULL	‘ ‘, ‘ ‘, ‘N’, ‘S’, ‘E’, ‘W’, ‘NE’, NW’, SE’, ‘SW’, ‘n’, ‘s’, ‘e’, ‘w’, ‘ne’, ‘nw’, ‘se’, ‘sw’		Direction of maximum visibility
visdirection	char(3)	NOT NULL	‘ ‘, ‘ ‘, ‘N’, ‘S’, ‘E’, ‘W’, ‘NE’, NW’, SE’, ‘SW’, ‘n’, ‘s’, ‘e’, ‘w’, ‘ne’, ‘nw’, ‘se’, ‘sw’		Direction of visibility reported
stationType	char	NOT NULL	‘M’, ‘A’, ‘m’, ‘a’		Type of station (Manual or Automated)
altimUnit	char(2)	NOT NULL	‘a’, ‘A’, ‘q’, ‘Q’		Indicator of units used in altimeterSetting
windvaribility	char(2)	NOT NULL	‘v’, ‘V’		Indicator of wind variability
ingestTime	integer	NOT NULL	0	2^{32}-1	Time at which report was ingested into the database

4.2.3.6.2 Runway Conditions Table

Table Name: <SA or SP or FT><DTG>rw

Description: Stores information about runway conditions from METAR, SPECI, and TAF reports.

Primary Key: runwayNumber/objectID

Foreign Key: objectID

Table 4.2-32. Runway Conditions Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique identifier for report
minVisualRange	smallfloat	NULL	0.0	10000.0	Minimum visual range on runway.
maxVisualRange	smallfloat	NULL	0.0	10000.0	Minimum visual range on runway.
runwaydesig	char(4)	NULL	‘R’, ‘L’, ‘C’, ‘RC’, ‘LC’, ‘r’, ‘l’, ‘c’, ‘rc’, ‘lc’		Runway Designator
runwayNumber	smallint	NULL	00	99	Runway number
windShear	smallint	NULL	0	1	Flag for wind shear on runway
unit	char(2)	NULL	‘FT’, ‘M’, ‘KM’, ‘ft’, ‘m’, ‘km’		Units in which visibility is reported
tendancy	char(2)	NULL	D, N, or U		Tendency of runway visual range values. U = Increasing, D=Decreasing, N=No distinction.
vizQualifier	char(2)	NULL	‘+’, ‘-‘,’ ‘		Qualifier for runway visibility (+ = greater than, - = less than)

4.2.3.6.3 TAF Forecast Table

Table Name: FT<DTG>f

Description: Stores forecast data from a Terminal Aerodrome Forecast (TAF).

Primary Key: objectID/forecastnum

Foreign Key: objectID

Table 4.2-33. TAF Forecast Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique Identifier for record
forecastnum	integer	NOT NULL	0	10	Forecast number
tind	char(6)	NOT NULL	‘PROB’, ‘TEMPO’, ‘BECMG’		Indicator of weather change
beginValidTime	integer	NOT NULL	0	2^{32}-1	Beginning time (seconds since 0000Z 1/1/1970)
endValidTime	integer	NOT NULL	0	2^{32}-1	Ending time (seconds since 0000Z 1/1/1970)
probability	smallint	NOT NULL	0	100	Probability of occurrence
windSpeed	smallfloat	NOT NULL	0.0	300.0	Wind speed
visibility	smallfloat	NOT NULL	0.0	10000.0	Visibility
windunit	char(4)	NOT NULL	‘KT’, ‘MPS’, ‘KMH’, ‘kt’, ‘mps’, ‘kmh’		Units in which wind speed is reported
windDirection	smallint	NOT NULL	0	359	Direction from which wind is blowing
vizUnit	char(2)	NOT NULL	‘SM’, ‘M’, ‘KM’, ‘sm’, ‘m’, ‘km’		Units in which visibility is reported
clouds	char(42)		N/A		Cloud section of report
qp	char(42)		N/A		Qualifier-Phenomenon section of report

4.2.3.6.4 TAF Conditions Table

Table Name: FT<DTG>t

Description: Stores current conditions data from a terminal aerodrome forecast (TAF).

Primary Key: objectID/forecastnum

Foreign Key: objectID

Table 4.2-34. TAF Conditions Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique Identifier for record
datasetID	integer	NOT NULL	0	2^{32}-1	Unique identifier for dataset of which report is a member
charid	char(8)	NOT NULL	N/A	N/A	Character ID of station (e.g. ICAO station call sign, ship's international call sign)
qualityFlag	integer	NOT NULL	0	2^{32}-1	Quality flag
flags	integer		0	2^{32}-1	Flags
receiptMethod	varchar (32,4)		N/A	N/A	Circuit over which data were received
issuetime	integer	NOT NULL	0	2^{32}-1	Time at which forecast was issued
beginValidTime	integer	NOT NULL	0	2^{32}-1	Beginning time (seconds since 0000Z 1/1/1970)
endValidTime	integer	NOT NULL	0	2^{32}-1	Ending time (seconds since 0000Z 1/1/1970)
WSLevel	smallfloat		0.0	120000.0	Level at which wind speed was measured
WSSpeed	smallfloat	NOT NULL	0.0	300.0	Wind speed
WSUnit	char(4)	NOT NULL	'KT', 'MPS', 'KMH', 'kt', 'mps', 'kmh'		Units in which wind speed is reported
lat	smallfloat	NOT NULL	-90.0	90.0	Latitude of station
lon	smallfloat	NOT NULL	-180.0	180.0	Longitude of station

Table 4.2-34. TAF Conditions Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
WSDirection	smallint	NOT NULL	0	359	Direction from which wind is blowing
ingestTime	integer	NOT NULL	0	2^{32}-1	Time at which report was ingested into the database

4.3 Textual Observations Data Segment (MDTXT) Design

4.3.1 MDTXT Conceptual Design

Textual observations are logical groupings of warnings and textually notices, alerts or informational messages that don't fit into WMO formatted messages. Examples of these messages would be tropical cyclone warnings, SIGMETS etc. This information will be stored by type of message, valid times of message and area of coverage.

4.3.2 Physical Level Design for Textual Observations and Bulletins Storage

Figure 4.3-1 below shows the physical level design for storage of textual observations and bulletins as entity-relationship diagrams.

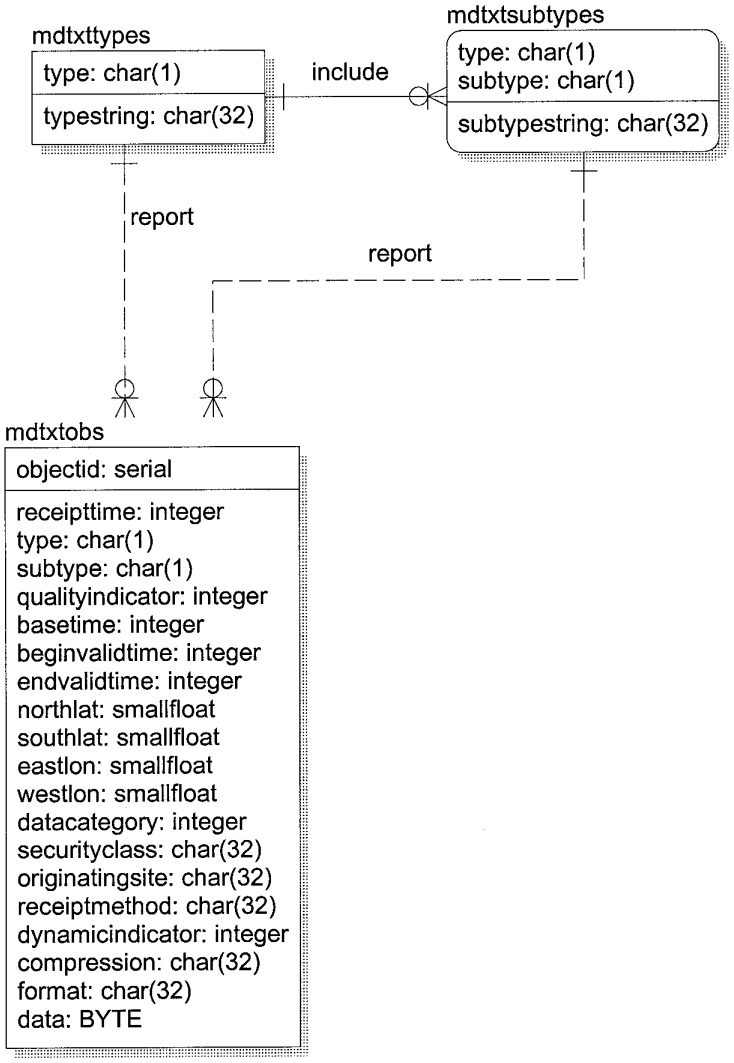


Figure 4.3-1. Physical Level Design for Textual Observations and Bulletins Storage

The remainder of this section describes the tables used to store textual observations and bulletins data.

4.3.2.1 Textual Observations Table

Table Name: mdtxtobs

Description: Stores information from a single textual observation or bulletin.

Primary Key: objectID

Foreign Key: type, type/subType

Table 4.3-1. mdtxtobs Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
objectID	integer	NOT NULL	0	2^{32}-1	Unique identifier for the observation
receiptTime	integer	NOT NULL	0	2^{32}-1	Receipt time (seconds since 0000Z 1/1/1970)
type	char(1)	NOT NULL	Valid value from mdtxttypes table		Type of observation/bulletin
subType	char(1)	NOT NULL	Valid value from mdtxtsubtypes table		Subtype of observation/ bulletin
qualityIndicator	integer	NOT NULL	0	6	Flag set if report data do not pass quality checks
baseTime	integer	NOT NULL	0	2^{32}-1	Base time of bulletin (seconds since 0000Z 1/1/1970)
beginValidTime	integer	NOT NULL	0	2^{32}-1	Beginning valid time of bulletin (seconds since 0000Z 1/1/1970)
endValidTime	integer	NOT NULL	0	2^{32}-1	Ending valid time of bulletin (seconds since 0000Z 1/1/1970)
northLat	smallfloat	NOT NULL	-90.00	90.00	Northernmost latitude covered by bulletin
southLat	smallfloat	NOT NULL	-90.00	90.00	Southernmost latitude covered by bulletin
eastLon	smallfloat	NOT NULL	-180.00	180.00	Easternmost longitude covered by bulletin

Table 4.3-1. mdtxtobs Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
westLon	smallfloat	NOT NULL	-180.00	180.00	Westernmost longitude covered by bulletin
dataCategory	integer	NOT NULL	1	3	Data category (1 = base, 2 = edited, 3 = derived)
securityClass	char(32)	NOT NULL	N/A	N/A	Security classification of the observation/bulletin
originatingSite	char(32)	NOT NULL	N/A	N/A	Name of the site that originated the bulletin
receiptMethod	char(32)	NOT NULL	N/A	N/A	Name of circuit over which the data were received
dynamicIndicator	integer	NOT NULL			
compression	char(32)	NOT NULL	N/A	N/A	Name of compression method used
format	char(32)	NOT NULL	N/A	N/A	Name of data format
data	byte	NOT NULL	N/A	N/A	Data contained in the observation/bulletin

4.3.2.2 Textual Observations Types Table

Table Name: mdtxttypes

Description: Stores types of textual observations and bulletins.

Primary Key: type

Table 4.3-2. mdtxttypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
type	char(1)	NOT NULL	N/A	N/A	1-character identifier for the bulletin type
typeString	char(32)	NOT NULL	N/A	N/A	Descriptive name of the bulletin type

4.3.2.3 Textual Observations Subtypes Table

Table Name: mdtxtsubtypes

Description: Contains a list of textual observation/bulletin subtypes and the types to which they relate.

Primary Key: subtype/type

Foreign Key: type

Table 4.3-3. mdtxtsubtypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
type	char(1)	NOT NULL	N/A	N/A	Identifier for the bulletin type with which this subtype is associated
subtype	char(1)	NOT NULL	N/A	N/A	1-character identifier for the subtype
subTypeString	char(32)	NOT NULL	N/A	N/A	Descriptive name of the subtype

4.4 Image Data Segment (MDIMG) Design

4.4.1 MDIMG Conceptual Design

The Image Data segment supports the storage and retrieval of pixel or bit map images. They may be logical grouped by area and time. However there is no requirement that these items be provided. Conceptually, an image is any logical group of data that a user wants to store in the database. MDIMG supports satellite imagery, with the capability to specify the satellite, sensor, and channel that originated the image and to store the image's calibration table. It also supports other imagery and products that can be stored as binary large objects (BLOBs).

4.4.2 MDIMG Logical Level Design

Figure 4.4-1 below shows the logical level design for storage of satellite imagery in the MDIMG segment in entity-relationship diagrams.

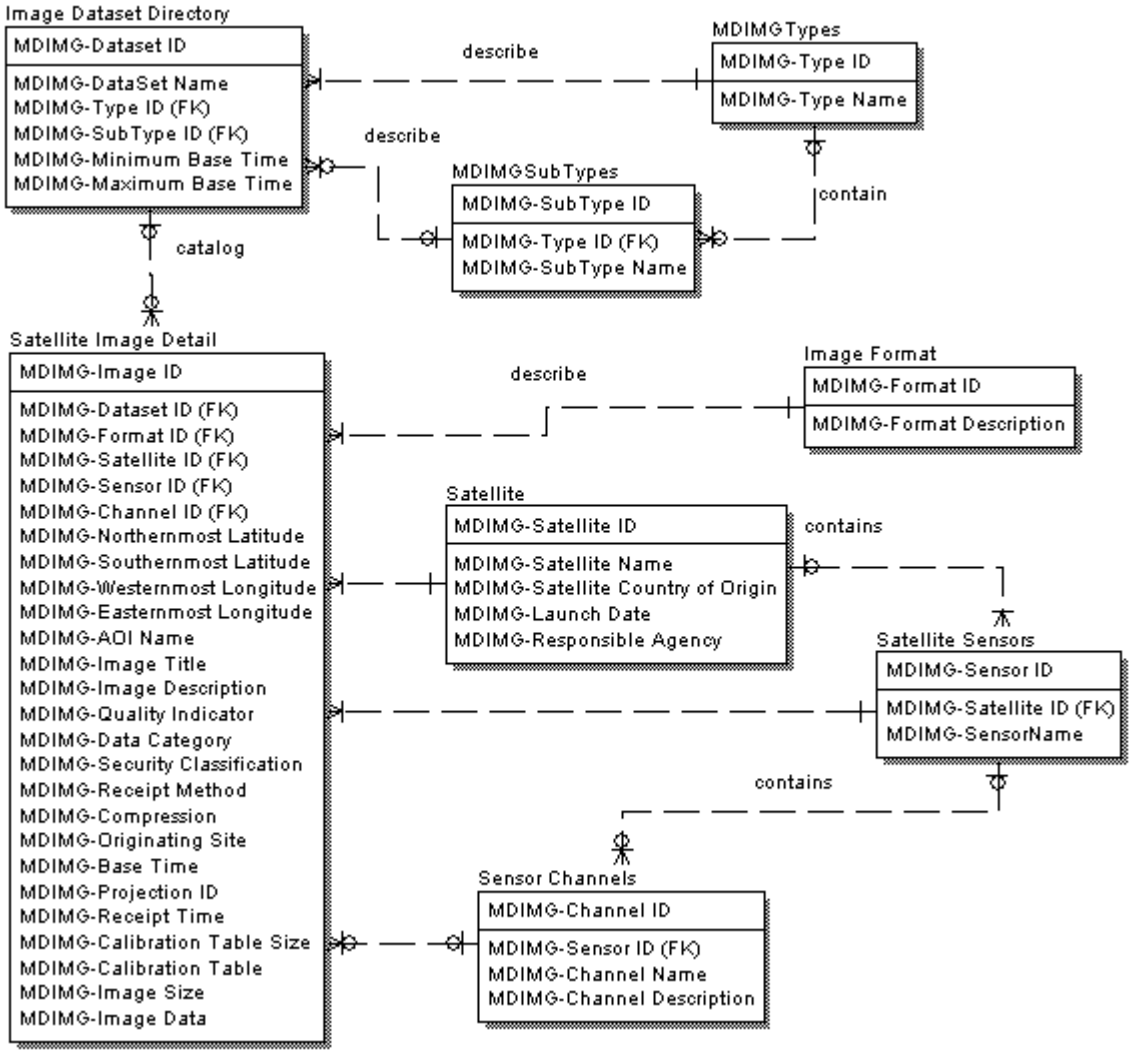


Figure 4.4-1. Logical Level Design for Satellite Imagery Storage in MDIMG

Figure 4.4-2 shows the logical level design for storage of imagery products (other than satellite imagery).

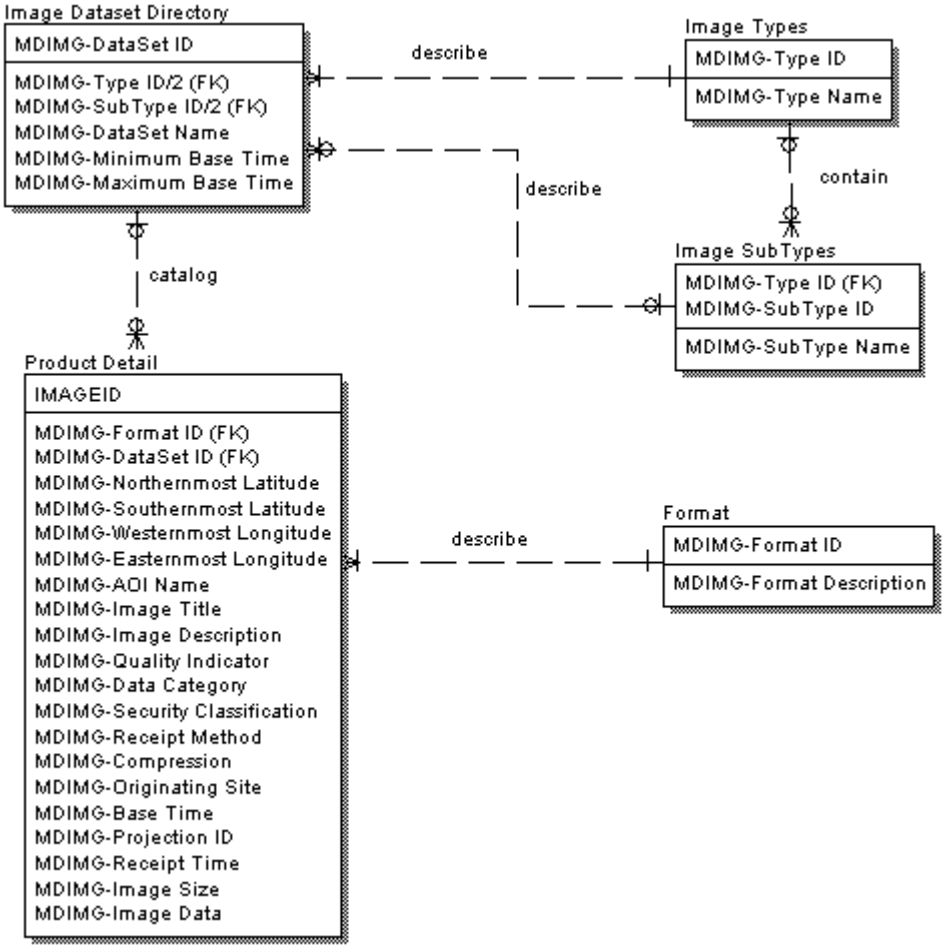


Figure 4.4-2. Logical Level Design for Imagery Product Storage in MDIMG

4.4.3 Physical Level Design of MDIMG

Figures 4.4-3 and 4.4-4 below show the physical level design of MDIMG in entity-relationship diagrams. Figure 4.4-3 shows the physical level design for satellite imagery, Figure 4.4-4 that for non-satellite imagery products.

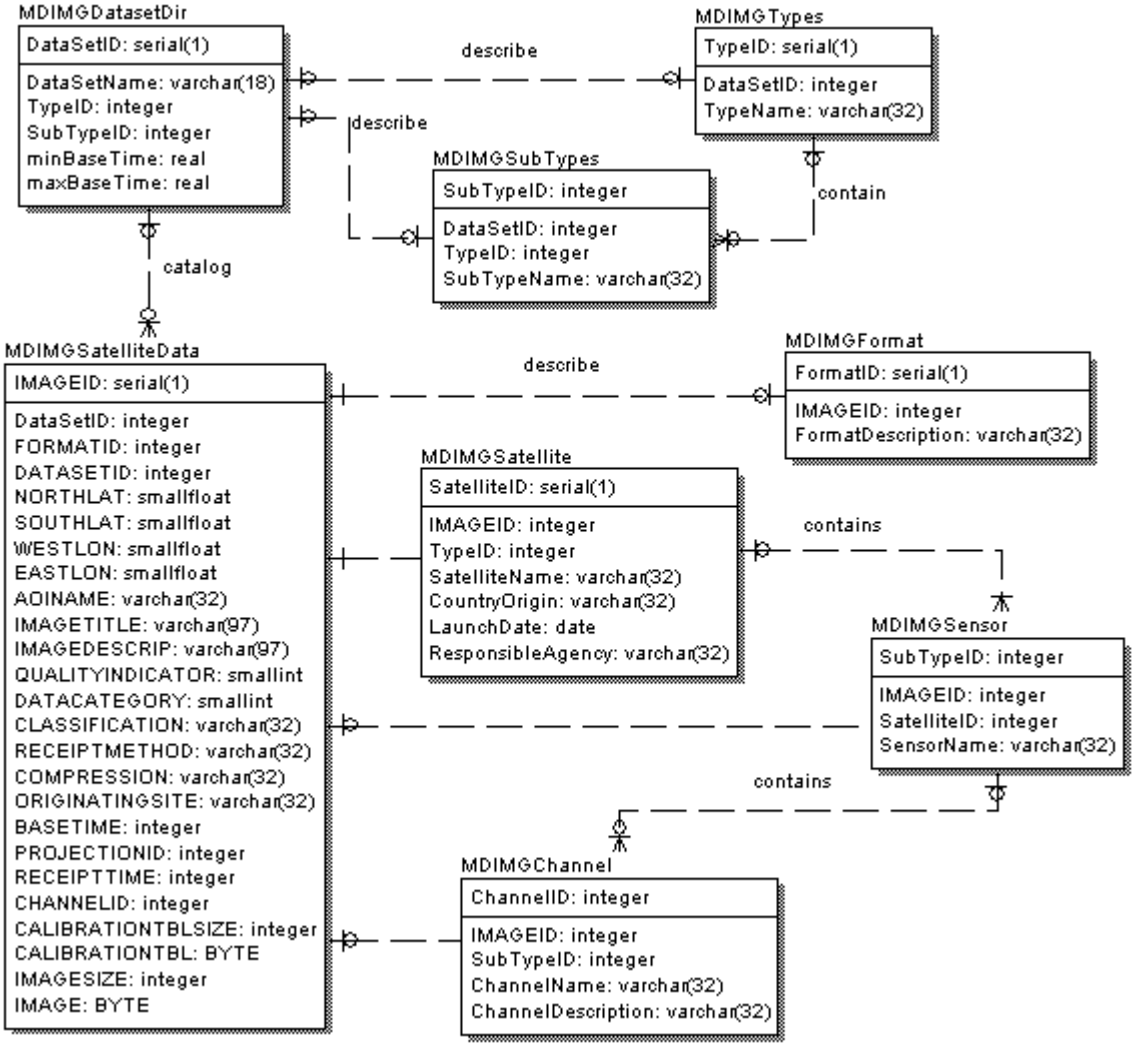


Figure 4.4-3. Physical Level Design for Storage of Satellite Imagery in MDIMG

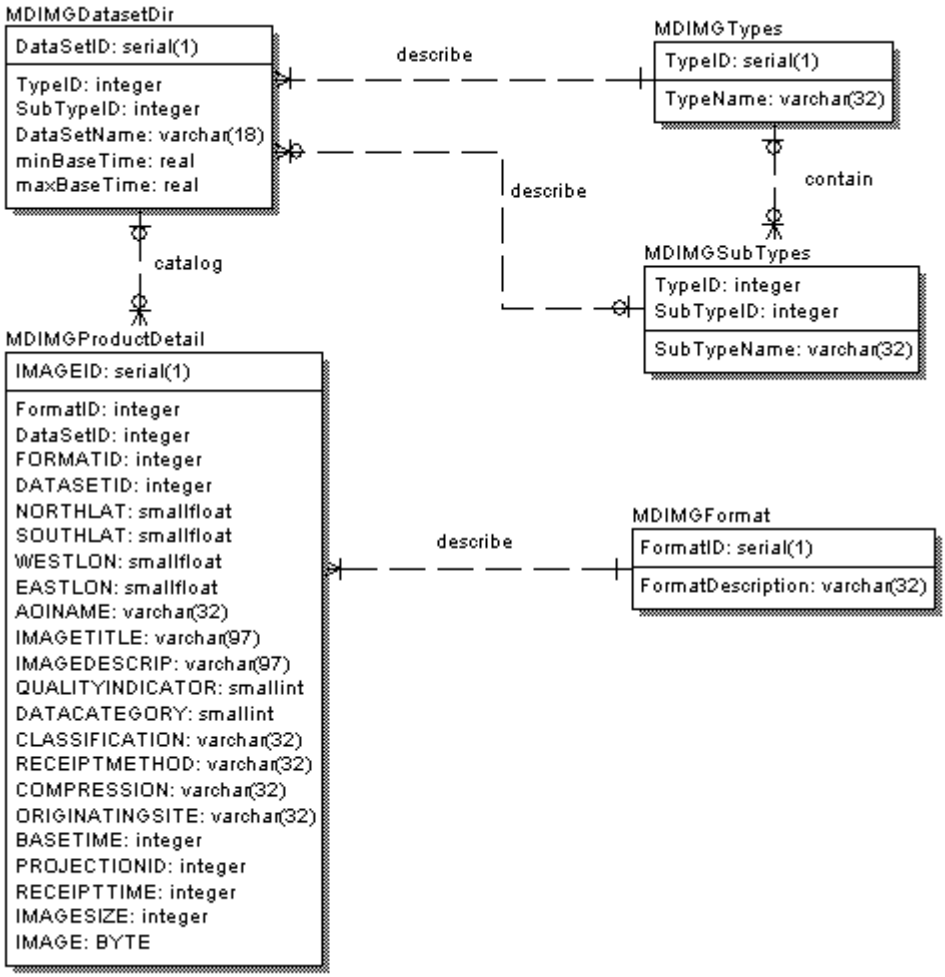


Figure 4.4-4. Physical Level Design for Storage of Imagery Products in MDIMG

The remainder of this section describes the tables used for storage of image data.

4.4.3.1 Image Dataset Table

Table Name: imageDataset

Description: Stores information about an image. NOTE: Rows in italics are used for satellite images only.

Primary Key: IMAGEID

Foreign Key: DATASETID

Table 4.4-1. imageDataset Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
IMAGEID	serial(1)	NOT NULL	0	2^{32}-1	Unique identifier for image
FORMATID	integer	NOT NULL	0	2^{32}-1	Format identifier
DATASETID	integer	NOT NULL	0	2^{32}-1	Unique identifier for dataset
NORTHLAT	integer	NOT NULL	-90.0	90.0	Northernmost latitude in image
SOUTHLAT	integer	NOT NULL	-90.0	90.0	Southernmost latitude in image
WESTLON	integer	NOT NULL	-180.0	180.0	Westernmost longitude in image
EASTLON	integer	NOT NULL	-180.0	180.0	Easternmost longitude in image
AOINAME	varchar (32)	NOT NULL	N/A	N/A	Alphanumeric name of area covered by image
IMAGETITLE	varchar (97)	NULL	N/A	N/A	Alphanumeric title of image
IMAGEDESCRIP	varchar (97)	NULL	N/A	N/A	Alphanumeric description of the image
QUALITYINDICATOR	smallint	NULL	0	2^{32}-1	Quality indicator
DATACATEGORY	smallint	NOT NULL	0	2	Data category; 0 = base, 1 = edited, 2 = derived
CLASSIFICATION	varchar (32)	NOT NULL	N/A	N/A	Security classification of the image
RECEIPTMETHOD	varchar (32)	NULL	N/A	N/A	Name of circuit over which image was received
COMPRESSION	varchar (32)	NULL	N/A	N/A	Name of compression method used

Table 4.4-1. imageDataset Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
ORIGINATINGSITE	varchar (32)	NOT NULL	N/A	N/A	Name of originating site
BASETIME	integer	NOT NULL	0	2^{32}-1	Base time of image
PROJECTIONID	integer	NOT NULL	1	29	Identifier for image map projection
RECEIPTTIME	integer	NOT NULL	0	2^{32}-1	Epoch time at which image was received
CHANNELID	*integer*	*NOT NULL*	*0*	*2^{32}-1*	*Identifier of image channel*
CALIBRATIONTBLSIZE	*integer*	*NOT NULL*	*0*	*2^{32}-1*	*Calibration table size in bytes*
CALIBRATIONTBL	*byte*	*NOT NULL*	*N/A*	*N/A*	*Calibration table*
IMAGESIZE	integer	NOT NULL	0	2^{32}-1	Image size in bytes
IMAGE	byte	NOT NULL	N/A	N/A	Image Data

4.4.3.2 Image Dataset Directory Table

Table Name: imageDatasetDir

Description: Stores information about an image dataset.

Primary Key: DataSetID

Foreign Keys: TypeID, SubTypeID

Table 4.4-2. imageDatasetDir Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
DataSetID	serial(1)	NOT NULL	0	2^{32}-1	Unique identifier for dataset
DataSetName	varchar(18)	NOT NULL	N/A	N/A	Alphanumeric name of dataset
TypeID	integer	NOT NULL	>0		Image type identifier
SubTypeID	integer	NOT NULL	>0		Image subtype identifier
minBaseTime	integer	NOT NULL	0	2^{32}-1	Minimum base time of images in dataset
maxBaseTime	integer	NOT NULL	0	2^{32}-1	Maximum base time of images in dataset

4.4.3.3 Image Types Table

Table Name: MDIMGTypes

Description: Stores information about image types.

Primary Key: TypeID

Table 4.4-3. MDIMGTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
TypeID	serial(1)	NOT NULL	0	2^{32}-1	Image type identifier
TypeName	varchar (32)	NOT NULL	N/A	N/A	Image type name

4.4.3.4 Image Subtypes Table

Table Name: MDIMGSubTypes

Description: Stores information about image subtypes.

Primary Key: TypeID, SubTypeID

Foreign Key: TypeID

Table 4.4-4. MDIMGSubTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
SubTypeID	serial(1)	NOT NULL	0	2^{32}-1	Image type identifier
TypeID	integer	NOT NULL	0	2^{32}-1	Image type identifier
SubTypeName	varchar (32)	NOT NULL	N/A	N/A	Image subtype name

4.4.3.5 Image Format Table

Table Name: MDIMGFormat

Description: Stores information about image formats.

Primary Key: FormatID

Table 4.4-5. MDIMGTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
FormatID	serial(1)	NOT NULL	0	2^{32}-1	Image format identifier
FormatDescription	varchar (32)	NOT NULL	N/A	N/A	Description of format

4.4.3.6 Satellite Table

Table Name: MDIMGSatellite

Description: Stores information about a satellite.

Primary Key: SatelliteID

Foreign Key: TypeID

Table 4.4-6. MDIMGSatellite Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
SatelliteID	serial(1)	NOT NULL	0	2^{32}-1	Unique identifier for satellite
TypeID	integer	NOT NULL	0	2^{32}-1	Image type identifier
SatelliteName	varchar (32)	NOT NULL	N/A	N/A	Name of satellite
CountryOrigin	varchar (32)	NOT NULL	N/A	N/A	Name of country of origin of satellite
LaunchDate	date	NOT NULL	N/A	N/A	Launch date of satellite
ResponsibleAgency	varchar (32)		N/A	N/A	Agency responsible for satellite

4.4.3.7 Sensor Table

Table Name: MDIMGSensor

Description: Stores information about satellite sensors.

Primary Key: SubTypeID

Foreign Key: SubTypeID

Table 4.4-7. MDIMGTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
SubTypeID	integer	NOT NULL	1	2^{32}-1	Image subtype identifier
SensorName	varchar (32)	NOT NULL	N/A	N/A	Name of sensor

4.4.3.8 Channel Table

Table Name: MDIMGChannel

Description: Stores information about satellite sensor channels.

Primary Key: ChannelID, SubTypeID

Foreign Key: SubTypeID

Table 4.4-8. MDIMGChannel Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
ChannelID	integer	NOT NULL	1	2^{32}-1	Unique identifier for channel
SubTypeID	integer	NOT NULL	1	2^{32}-1	Image subtype identifier
ChannelName	varchar(32)	NOT NULL	N/A	N/A	Name of channel
ChannelDescription	varchar(32)	NOT NULL	N/A	N/A	Description of channel

4.5 Remotely Sensed Data Segment (MDREM)

The Remotely Sensed Data Segment is currently under development, and its design has not been finalized.

5 DATABASE SOFTWARE UNITS

5.1 Database Utilities

This section describes utility tables used to perform database administration functions. These tables will be replicated in all segments of the METOC Database.

5.1.1 Create Table Utility Tables

Figure 5.1-1 below shows the physical level design for the tables used to support creation of new tables in the database.

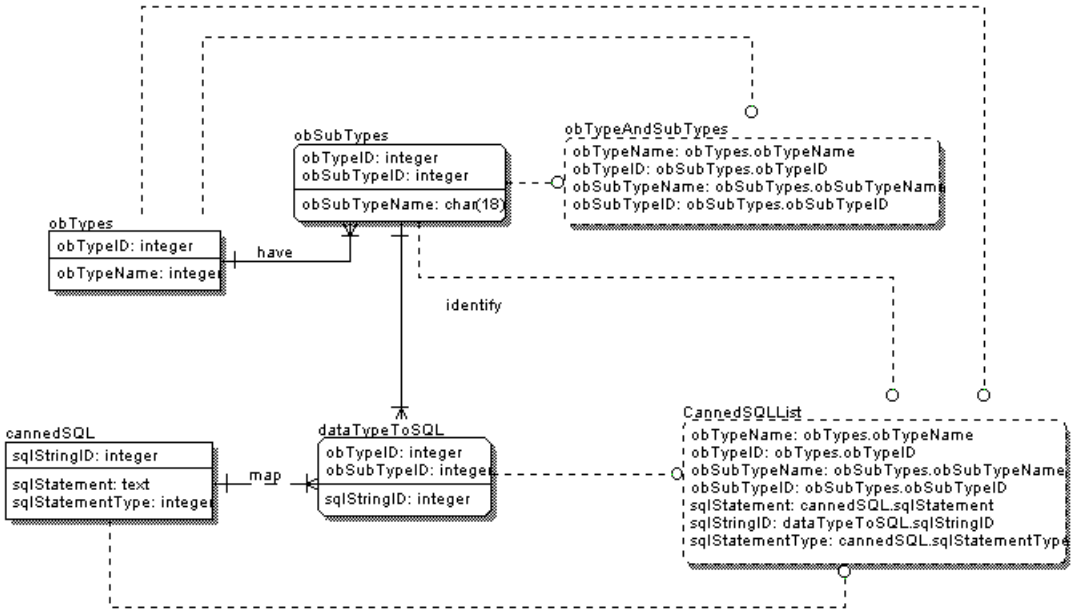


Figure 5.1-1. Physical Design of Create Table Tables

The remainder of this section describes the design of the Create Table tables.

5.1.1.1 Canned SQL Table

Table Name: cannedSQL

Description: Stores SQL statements used to create a table, create an index, grant privilege, or create a stored procedure associated with the tables being created.

Primary Key: sqlStringID

Table 5.1-1. cannedSQL Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
sqlStatement	text	NOT NULL	N/A	N/A	Text of an SQL string to create a table, create an index, or grant privilege, or text for a stored procedure associated with the table(s) being created.
sqlStatementType	integer	NOT NULL	0	232	Type of SQL statement in sqlStatement field. Can be create, index, grant or stored procedure.
sqlStringID	integer	NOT NULL	0	232	Unique Identifier of a create string.

5.1.1.2 Data Type to SQL Table

Table Name: dataTypeToSQL

Description: Stores information required to associate an SQL statement with a data type.

Primary Key: obSubTypeID/obTypeID

Foreign Key: obSubTypeID, obTypeID, sqlStringID

Table 5.1-2. dataTypeToSQL Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obSubTypeID	integer	NOT NULL	0	232	ID of observation subtype
obTypeID	integer	NOT NULL	0	232	ID of observation type
sqlStringID	integer	NOT NULL	0	232	ID of string to be retrieved.

5.1.1.3 Observation Subtypes Table

Table Name: obSubTypes

Description: Stores information relating observation subtypes to observation types.

Primary Key: obTypeID/obSubTypeID

Foreign Key: obTypeID

Table 5.1-3. obSubTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obSubTypeID	integer	NOT NULL	0	232	Unique identifier for observation subtype
obSubTypeName	char(18)	NULL	N/A	N/A	Alphanumeric name of observation subtype
obTypeID	integer	NOT NULL	0	232	Unique identifier for observation type

5.1.1.4 Observation Types Table

Table Name: obTypes

Description: Stores information about observation types.

Primary Key: obTypeID

Table 5.1-4. obTypes Table Structure

Table Column Name	Table Column Datatype	Table Column Null Option	Table Column Validation Min	Table Column Validation Max	Table Column Attribute Definition
obTypeID	integer	NOT NULL	0	232	Unique identifier for observation type
obTypeName	char	NULL	N/A	N/A	Alphanumeric name of observation type

5.2 Application Program Interfaces (APIs)

The APIs used by programs to interface with the database are fully described in the API Reference Manuals (APIRMs) cited in Section 2.

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6 REQUIREMENTS TRACEABILITY

The database design set forth in this document satisfies the applicable portions of the requirements in the *Software Requirements Specification (SRS) for the Tactical Environmental Support System/Next Century [TESS(3)/NC] Meteorological/Oceanographic (METOC) Database*, cited in Section 2.

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7 NOTES

7.1 Glossary of acronyms

API	Application Program Interface
DBDD	Database Design Description
DID	Data Item Description
METOC	Meteorology and Oceanography
RDBMS	Relational Database Management System
SPAWAR	Space and Naval Warfare Systems Command
TEDS	Tactical Environmental Data System

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8 DOCUMENTATION IMPROVEMENT AND FEEDBACK

Comments and other feedback on this document should be directed to the DII COE Hotline:

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