THE GSC-I AND GSC-II DATABASES: AN OBJECT-ORIENTED APPROACH

G. GREENE[1], B. MCLEAN[1], B. LASKER[1], D. WOLFE[1],
R. MORBIDELLI[2] AND A. VOLPICELLI[2]
[1]*Space Telescope Science Institute*
[2]*Osservatorio Astronomico di Torino*

1. Introduction

The original GSC-I (Jenkner *et al.* 1990) which contains 25 million entries and requires approximately 1GB of storage was at the edge of technological capability at the time catalogue construction began in 1984. At that time, a custom coded database was built since the relational databases of the era were unsuited to the HST-specific access requirements. A second generation GSC is now being constructed (Lasker *et al.* 1995), with an estimated 10 billion entries and a size of 2 Terabytes. The current generation of object-oriented database (OODB) systems are more suited to the needs of large astronomical catalogues and are being adopted by many large-scale projects. In a joint effort between the Space Telescope Science Institute and Osservatorio Astronomico di Torino, we are currently designing such an OODB for the Guide Star Catalogues and are implementing a prototype using the GSC-I data.

2. GSC-I Object-Oriented Database Project

The unique experience of developing and utilizing the GSC-I database combined with modern computer architectures has lead to an evolution in the requirements for maintaining an all-sky astrometric catalogue. The GSC-I custom database is no longer very large in terms of present-day data volume. Nevertheless, it has inherent complexities not only due to the record and file system dependencies, but also fundamental relationships linking the internal catalogue objects, the underlying calibrations, and their parameters. As improved calibration methods for computing more accurate astrometry become available (Röser *et al.* these proceedings), inflexible data structures with a large number of files associated become tedious, time-consuming, and ultimately forbidding to perform quality assessment. Also, since the GSC-I continues to be an effective reference catalogue for a wide range of astronomical projects, practical solutions for correcting catalogue errors must be considered.

The object-oriented approach provides a robust method for structuring the GSC catalogue objects and parameters such that large or small scale maintainance and recalibration can be performed efficiently. This concept along with Objectivity/DB,'s commercial OODB, was first introduced to us by the SDSS Science Archive project members (Brunner *et al.* 1994). The prototype GSC-I OODB is currently being implemented using a standard C++ language interface to the commercial software based on the Class Object Model shown in Figure 1. Other features of this software which are attractive to the GSC projects are platform-independent data access and scalability. This means the OODB software infrastructure does not place limitation on increasing or rescaling the size of data. These offer a significant advantage in development of access methods from a variety of user levels.

3. GSC-II Database Development

The GSC-I object oriented design can easily be extended for the construction of the second generation GSC-II database by using class inheritance to exploit commonalities between the survey data sets while also providing an intrinsic framework for sharing class structures with enhanced functionality. The GSC-II database is estimated to be 2 Terabytes in size. This also includes in addition to the basic GSC astrometric and photometric data, colors and proper motions. The construction of the GSC-II catalogue is tightly coupled to the development of the database. Single-plate pipeline processed data will be input to the GSCPlateObject containers of the database. Then, using an "object index" scheme which links overlapping survey data, multi-plate proper motion and color index data can be computed efficiently. The final GSC database will also include basic reference catalogues such as PPM, CMC, and Tycho for direct calibrations. Efforts are currently in progress to develop both the SDSS and GSC databases with a common sky-partitioning scheme for faster cross-matching and retrieval rates between two very large scale astronomical survey data sets.

4. Summary

In summary, we have developed a working GSC-I OODB prototype. It has been successfully loaded and tested with a minimum number of lines of

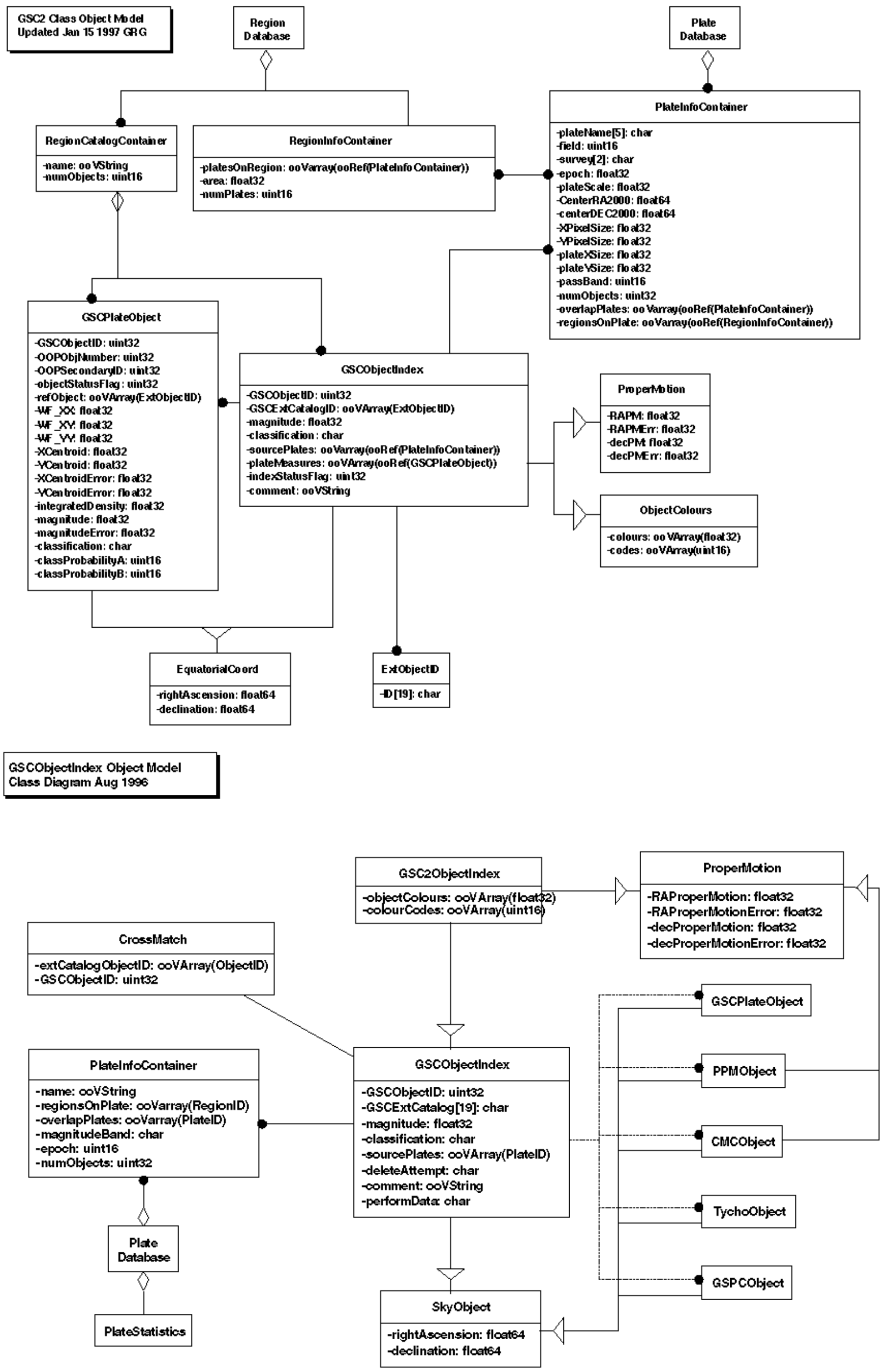

Figure 1. GSC-I Database Object Model

code for GSC 1.1. Quality Assurance applications, loading of GSC1.2, and the expansion for GSC-II data import are underway.

The OODB offers an exciting new capability to rapidly access and maintain 2 Terabytes of sky survey data and the potential for linking more than one large-scale sky survey project, for example, the GSC and SDSS surveys. With this new advance in the database industry, astronomical research with multiple parameter sets for large scale structure will become increasingly easier to perform.

References

Brunner, R. J., Ramaiyer, K., Szalay, A., Connolly, A.J. and Lupton, R.H., 1994 Astron. Soc. Pacific Conference Series 77.

Jenkner, H., Lasker, B. M., Sturch, C.R., McLean, B.J., Shara, M. M. and Russell, J. L., 1990 Astron. J. 99, 2082

Lasker, B.M., McLean, B.J., Jenkner, H., Lattanzi, M.G., 1995 in "Future Possibilites for Astrometry in Space" ESA SP-379 pp.137