Master Address Repository Proposal

City of Delray Beach, Forida

October 15, 2018

Spatial Focus

Geo Data Architects

www.spatialfocus.com

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1 About Spatial Focus

1.1 Corporate Description

Spatial Focus LLC is a Georgia Limited Liability Corporation, founded originally as Spatial Focus, Inc. in 1998. We are a GIS consulting firm, specializing in street addressing in the local government arena. Our background is in GIS, strategic and implementation planning, transportation, utilities, urban planning, database design and data modeling in the GIS and relational database environment, and organizational and business process analysis and improvement. Our principals share over 80 years of experience in the field, and are internationally recognized subject matter experts in the field of addressing. We believe in working as our clients' partners in achieving their objectives successfully, within the schedule and budget expected.

1.1.1 Comprehensive Street Addressing Focus

Street addressing is the central core of the geospatial data used and managed by most local government agencies. Addresses provide a well-known and well-understood aid to navigation and reference a specific location within the community. Addresses are used for an extremely wide variety of business purposes within a local government, and because of this, are embedded in virtually all data sets. Unfortunately, most government agencies have not standardized address data content, so these address data cannot be formatted for various uses throughout the enterprise. The result is wasteful duplication of effort and inability to link information about locations easily.

Spatial Focus has made address management a key part of our consulting practice because we believe that it is the core of successful GIS project implementations, and the critical key to a fully functional enterprise information management solution in government. As a part of this, two of our original principals participated as co-authors of the Address Standard Working Group of the Urban and Regional Information Systems Association (URISA) to develop the United States Thoroughfare, Landmark and Postal Address Data Standard (FGDC Address Data Standard). As co-authors, their responsibilities included development of the Address Data Content part of the Standard, and the Address Data Quality part of the Standard. The FGDC Address Data Standard was endorsed by the Federal Geographic Data Committee in 2011, and has been adopted by numerous states and local governments, and implemented in federal, state and local agencies in the United States. It has been used as a model for other countries that are developing addressing programs as well.

Spatial Focus has undertaken a number of Address Repository projects with local governments throughout the United States. These projects have included

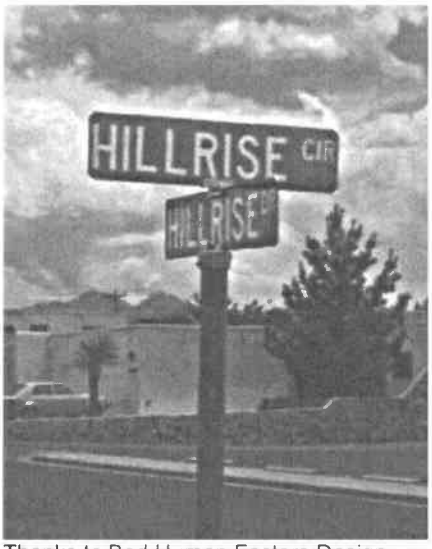
comprehensive reviews of existing data (both tabular and geospatial), evaluation of existing addressing patterns and issues as they exist "on the street", and development of robust data models that are used to support long-term address management and maintenance, as well as providing address data to other users throughout the organization. Our projects have ranged from urban areas (Washington, DC, City of Atlanta, Cambridge, MA) to suburban (Raleigh, NC, Boulder, CO, Bellevue, WA, Fairfax County, VA, Wake County, NC) to rural (St. Louis County, MN, Park County, CO). In each of these projects, we have worked to incorporate the structure of the Address Standard, and to assist the government agencies in developing a comprehensive Address Repository.

Data quality is a significant issue with addresses. Address data is found in many different formats in many separate data holdings. Many of these addresses have never been mapped or geo-located. Parsing and formatting of the data is quite different from system to system. Spelling variations are rife. Being able to standardize and review these data, determining how many versions of the same address really refer to the same location, is critical to assembling a Master Address Repository and identifying all of the addresses within a given area. Additionally we work with specialized geospatial and tabular data quality tests to insure the highest quality data in terms of all of the ISO Data Quality standard parameters.

Addresses are used for many purposes in government: to identify taxable properties, to describe a service location for utilities, to undertake building inspections, to issue licenses and permits. Perhaps one of the most critical uses of addresses is for the dispatching of emergency services such as fire, police and medical (ambulance). When seconds count, it s absolutely essential to have a correct address with a defined and known location. It is a matter of life and death.

While the process of developing an address repository is significant, the results are of major benefit to a local government in terms of efficiency, economy, and improved service to citizens.

1.1.2 Addressing and Spatial Records Integration



Thanks to Bad Human Factors Design
by Michael J. Darnell, used by permission.

Addresses are the most common links to location. They are everywhere: in mailing lists, databases -- in every record for "keeping track". Creating ways to cross-reference all those resources--spatial records integration-- is a part of every Spatial Focus project. Every organization has geographic information: addresses, maps, records of ownership, easement, and rights-of-way are some common examples.

The base information used to assemble a map ages quickly. Any connections that originally existed between the map itself and tabular data used in daily operations lose synchronization. As a result, the value of the spatial data is seriously undermined. Spatial records integration is no more nor less than effective stewardship of an organization's information resources.

How can spatial records integration be achieved and maintained? Integrating spatial records requires that address data that exists in a variety of systems and databases be standardized and parsed so that the geocoding engines in GIS software can determine its geographic coordinates, based on a set of rules. The expense of achieving spatial records integration has put it out of reach to many organizations in the past. Most frequently, unstructured addresses must be parsed into standardized data fields. Traditionally, this task has been handled "manually," using word processors to create standardized ASCII files. Spatial Focus LLC has developed techniques to automate this costly, labor-intensive process.

EAST PARK CIR 129
MASON AV SW 906
3RD AV N 1701
3RD FLR 9TH CT S 2701 MAIN HOSP
1ST FLR POBII MAM 10TH AV S 2700

Figure 1: Addresses before cleaning

The examples shown in Figures 1 and 2 are from a project in the city of Birmingham, Alabama to spatially integrate building permit data. As the examples illustrate, the address fields have little standardization, and include comments and other information that is important to the organization. Some permits reference specific floors of a building, or an office or apartment unit.

Automated processing by Spatial Focus LLC retains all of the original information. Abbreviations, used inconsistently throughout the file, are spelled out. This will allow consistent standardization at a later stage in the process. Following the standardization process, addresses can be geocoded to specific locations. Linking the address to a property parcel that is found on the maps, or to specific building footprints can do this, or to a street centerline segment that contains the correct range of addresses.

N		ALBANY	STREET		328		
N	EAST	PARK	CIRCLE		129		
N		MASON	AVENUE	SOUTHWEST	906		
N		3RD	AVENUE	NORTH	1701		
N		9TH	COURT	SOUTH	2701	FLOOR	3RD
N		10TH	AVENUE	SOUTH	2700	FLOOR	1ST

Figure 2: Parsed and standardized addresses

Once addresses have been parsed, standardized and located on the maps, they must be maintained. Addressing is a dynamic function. New permits are issued, licenses granted, complaints received, and information developed that create new records in data containing addresses. These new addresses must be managed, so that the same problems are not simple created again. Development of a Master Address Repository, which contains the master address database, as well as tools that permit other applications to be updated with correct addresses, and to verify addresses that have been entered into other databases, provides a basis for the management and maintenance of addresses throughout the organization. Spatial Focus has developed methodologies of creating the Master Address Repository, and re-engineering work flows for address assignment, address verification and validation, and address maintenance and management. For our clients, we develop appropriate automated functions within the Repository to assist the staff to maintain a complete, accurate and up-to-date set of addresses.

2 Background

Earlier this year The City of Delray Beach engaged Spatial Focus to assist with the 2020 Census LUCA Operation where address data provided by Census was compared to various City and Palm Beach County address data sources. This effort resulted in approximately 9,800 addresses found in the City/County sources that were not contained in the Census data. In an effort to complete the LUCA project in the most efficient manner, Spatial Focus created a spatial database and performs many of the quality control operations that lay the groundwork for of Master Address Repository (MAR). This approach also provided the City with the foundation of a MAR, if the decision was to develop a fully operational MAR.

3 Project Objectives

The City of Delray Beach is interested in addressing three issues:

1. Development of a usable Master Address Repository (MAR) including tools to maintain the MAR.
2. Providing support through training.
3. Development of a street-addressing checklist that utilizes the strengths of the MAR.

The first issue (Phase 1) will provide the City with a functional MAR and appropriate tools to efficiently maintain the MAR.

The second issue (Phase 2) will provide the City with initial staff training related to assigning and maintaining addresses, and on maintenance of the MAR.

The final issue (Phase 3) will provide the City with a checklist, based on procedures recommend to maximize the benefits of the MAR.

4 Tasks

4.1 Introduction

The City of Delray Beach has recognized that addresses are the most well known identifiers of location. Virtually all of the activities of local government require the delivery of services to specific locations, and for both the providers of those services

(city employees) and the citizen, the address is the key that can link a myriad of other data throughout the City to a specific place.

However, due to the way in which address information has been historically recorded, it is often incomplete, in different formats, and not standardized. This makes the sharing of information linked to an address very difficult in a digital world.

Spatial Focus approaches addressing from a business process and data focus, working to create a Master Address Repository (MAR) that serves the business needs of the departments and other customers, as well as ensuring that address data is standardized and quality assured.

The MAR database and geospatial components are created from multiple datasets and business systems currently in use. Through the use of automated, proprietary data processing routines, Spatial Focus prepares the data and creates an FGDC standards compliant database. The data within the database is then quality controlled, reviewed with the City, and made available for use with the maintenance tools.

Once the database and on-going maintenance processes are in place, integration with other business systems can be completed. This is accomplished through the use of "views". A view is a presentation of the MAR data for a specific purpose. Columns may be rearranged, street names or other elements may be abbreviated, numbers may be summed or otherwise manipulated, and the MAR data may be sorted in a specific way to be utilized in other business applications.

Spatial Focus will build on the efforts from the LUCA project to build the City of Delray Beach MAR database. While LUCA focused on strictly residential addresses, the MAR will incorporate all addresses within the City. In addition to developing the complete database, Spatial Focus will work closely with City staff to define the requirements for business integration views.

4.2 MAR Data Goals, Objectives and Tasks

Address data is made up of many elements and attributes. Some of these are spatial in nature, and are best displayed and stored within GIS. These include an address identifier, the x, y and z coordinates of the address, and street centerline geometry. Some of the MAR will reside in GIS.

Much address data is tabular in nature, and incorporates many relationships among the elements and attributes. These are best stored and managed in a relational database environment. The majority of the MAR data will be stored in a Relational Database Management (RDBMS) Environment. The creation of a MAR begins with the design of the relational and geospatial components of the database.

4.2.1 Design the MAR Database/GIS Interface

Address data must be stored in a relational database that is compliant with the FGDC Address Standard. A FGDC compliant data model will be created using the relational database that the City has chosen. Scripts to create the database and for loading of data into it will be created.

Deliverable: *Database documentation, scripts for creation and loading.*

4.2.2 Test Data Connections

Address data must operate in disparate GIS and RDBMS environments. Procedures for using the data in different environments will be tested. Any changes in database design or the larger system environments required to make data connections work effectively will be documented. Where table joins are required, the Address Identifier element will be the key where appropriate. Note that UUID/GUID values will be used for Address Identifiers.

Deliverable: *Test results.*

4.2.3 Collect data to be included in the MAR

Data will be collected and inventoried for inclusion in the MAR. The inventory process will include:

- Identifying the data set
- Counting records included
- Constructing metadata describing the data set, including a comprehensive listing of field names, their meanings and domains of values for them.

Delray Beach will provide Spatial Focus with the most recent update of the following address data:

- HTE Data
    - LMABREP (address data)

  - LMACREP (parcel data)
  - LMATREP (street dictionary)
  - LMBBREP (street alias file)
  - LMBMREP (cross street file)
  - LMASREP (zip codes file)
  - LMBCREP (miscellaneous data)
- ESRI LGIM Address data
- 911 Address data
- Provide any group quarter data, spreadsheets, or information currently maintained, and not in the Consolidated address list

Deliverables: *Itemized data inventory with metadata*

4.2.4 Create Geometry for Address Reference System included in MAR

Address Reference Systems (ARS) will be described by geometries. These will be used in both address assignment and quality control.

Examples include:

- Polygons delimiting the extents of each ARS
- ARS axes
- Address quadrants
- Points of beginning
- Grids

Deliverables: *Digital spatial data describing Address Reference System (ARS) geometry.*

4.2.5 Build and Review Street Name Data

Building a Master Address Repository begins with street names. Street names from all the collected address data sources will be parsed and standardized. Street name domain tables will be filled from the results, and a comprehensive street name table will be built with them. Spatial Focus will deliver a draft street name list with identified anomalies. The City will review and resolve as many anomalies as possible. A final street name list will be generated after Spatial Focus receives the corrected street name list back from the City.

Deliverables: *Draft and final Street Name List*

4.2.6 Build MAR addresses

Standardized street names and other components will be used to record the addresses from the collected data. Criteria for abbreviations, data content and other design considerations captured in previous tasks will be incorporated. Each address record will be traceable to one or more data sources. Formal quality control of the data will be conducted to insure consistency, based on the FGDC Address Standard.

Deliverables: *Completed draft and final MAR addresses*

4.2.7 Quality Control and Matching of Street Names from List and GIS

Street names often differ in address data from a variety of sources, and from what is provided in the GIS street centerline. Quality testing is needed to verify that the street names in the spatial data match those found in the source data.

Deliverables: *Anomalies List identifying discrepancies found.*

4.2.8 Quality Control of Address Ranges

The address ranges presently contained in the MSAG and also in GIS must be quality controlled to ensure that they represent the address points that are associated with individual road segments. Often, there are missing or incorrect segments that must be reviewed before final QC of individual address data is completed.

Deliverables: *List of street segments with range anomalies (parity, sequence, missing or incomplete data)*

4.2.9 Data views for business applications

Data from the MAR can be provisioned to business applications throughout the enterprise using web-services, and views. These need to be specified, and the necessary elements of each interface identified and documented for future development. It is likely that there will be some commonality among the needed interfaces, which can be easily managed through the web-services. It is also likely that some prioritization of these interfaces may be necessary to assist staff in the best use of resources.

Spatial Focus will develop up to eight views, which will include views to support ESRI's Local Government Model, ongoing quality control, CLDFX and USPS formatting.

Deliverables: *Up to eight views, including views to support ESRI's Local Government Model, ongoing quality control, CLDFX and USPS formatting will be developed.*

4.2.10 Final MAR Data, Data Views, and Public Access Version for Web

The final MAR database will include the following features:

- All addresses provided by the City in standardized format.
- Views of the data that are compliant with either CLDXF and USPS formatting standards.
- View of the data to support the ESRI Local Government Model.
- Views to support ongoing quality control routines.
- Four additional views to support existing business functions, such as Business Licenses, Code Enforcement, Utility Billing, and Permitting.
- Facilities to accommodate multiple abbreviations set by users.
- The MAR will be FGDC, NENA and USPS Standards compliant.
    - Life cycle status, anomaly status, and official status of every address.

The following aspects of the MAR structure and internal processes will be provided:

- Database Structure
- Stored procedures
- Triggers
- Domains of values
- Views that can form a part of the specifications for new or replacement business systems.
- UUID/GUID identifiers that can be transferred to other business systems to maintain a permanent and persistent link to the MAR.

The final MAR documentation should be placed on a secure location that only City employees can access, or made available to City employees in another way. This documentation should be updated with each change in structure, stored procedures, triggers, or new or amended tables, field names, or additional data components. The MAR documentation also contains the geometries and the written rules for using the Address Reference Systems.

Deliverables: *Documentation on final MAR.*

4.2.11 Implement Data Maintenance Tools

Maintaining the Address Repository is essential if it is to be the authoritative source of address data. Maintenance tools provide a way to update address information both in the relational database and in GIS. The goal of this task is to implement maintenance tools that provides users the ability to add, edit or query addresses. The tools will are user friendly and built in such a way that human errors are minimized.

The workflow for maintenance of addresses (recording new streets and addresses, managing changes and retirement of addresses and street names, and researching and correcting anomalies or errors) will be defined and documented.

Deliverables:

1) *Implement Maintenance Tools, including*
   a) *Customization for City environment,*
   b) *Linkages with MAR database*
2) *Full documentation.*

4.3 Training and Support

Training is a critical factor in the success of any MAR project. Training starts at the beginning of the project to familiarize the staff with MAR concepts and terms, and continues throughout the project to help build capabilities for maintenance and on-going support for the MAR. This ensures that when this project is complete, Delray staff is completely able to operate and maintain the MAR going forward.

4.3.1 Initial Training

Initial training will provide a basis for all involved in any aspect of the MAR. The intent is to provide an introduction to and explanation of basic MAR terminology. Topics included in this training:

- What is a MAR?
- How does a MAR work?
- MAR structure
- Vocabulary
- Address Reference Systems
- Spatial data
- Tabular data
- Components

- Attributes
- Anomalies
- Best practices for data review

This training is recommended for any Delray staff ultimately involved in the daily use and maintenance of addresses and the MAR, including database administrators, IT or GIS systems support staff and city addressing staff. Any technical or business system staff that may ultimately use or integrate with the MAR may also find this overview training useful.

Deliverables: *One day training session*

4.3.2 MAR Users

The MAR user is the daily user of the MAR. This individual is responsible for maintaining the MAR on a daily basis and includes address assignment and creation, editing, and querying. They will primarily interact with the MAR via the maintenance tools but they must also have a basic understanding of the MAR itself and how it is constructed. This session will build upon the Initial Training to provide a more detailed look into how the database and the maintenance tools work together to maintain address quality through domains and business rules, and helps the users understand the connections between the MAR, GIS, and the maintenance tools.

Training will be focused primarily on the use of the maintenance tools and will include how to create, edit and query addresses. The training also includes the activities County staff will perform to review and resolve data anomalies (e.g. an even numbered address on the odd-numbered side of the road, etc.).

Deliverables: *Four days of training*

4.3.3 Understanding the MAR

This training is for the primary support person(s) for the MAR who will need a thorough understanding of the MAR, the maintenance tools, and how they and GIS all work together. In addition, this person will need to understand the on-going update processes and procedures. This training will be fairly technical and will focus more on the database and processes, rather than the maintenance tools themselves – in other words, the critical backend support required for the MAR. In addition, this training will also include the use, set-up and configuration of the tools and users. If the daily users are interested, they should be encouraged to attend to gain a better understanding of the database and processes used to support their daily activities.

This training will be divided into two (2) areas of competence – Supporting and Using the MAR and Maintenance Tools Support. The first will include training on the database, domains, geospatial connections, views, and other components of the MAR itself. The second will cover the installation, configuration, and on-going support of the maintenance tools.

Supporting & Using the MAR

This session will cover the MAR database itself and will help clarify how the database maintains quality through the domains, and how to review existing data to establish these domains and other business rules. In particular:

- Street names
- Street types and directional
- Place names
- Feature types
- Statuses
- Anomalies

One of the most important parts of building a MAR is the creation of a complete street name list. It is important to review all street name lists in light of other data sources, and to be sure that all official names, aliases, and other variants are included. This training will focus on how the Address Standard parses street names, and what work the Delray staff will be doing to resolve street name issues.

Maintenance Tools Support

This session will cover the configuration and on-going support of the maintenance tools, including how to view data, perform the necessary functions for business purposes, and how the MAR will interface with other business applications. The maintenance tools require definition of geo-fences and linkages between the database and GIS which must be configured and maintained as feature classes or users are added or changed.

Deliverables: *One day of training for Supporting and Using the MAR and one day for Maintenance Tools Support*

4.3.4 Database Administrator

A training session specifically designed for the DBA will go over the database documentation, and explore the database schema and associated routines, triggers, stored procedures, and views. Permissions, security, backups, and other related administration activities will be reviewed.

DBA training will also include database tools and tips, which will focus on how the database is organized, and developing a list of basic data views that support other applications or specific purposes of the Counties. This training is suggested primarily for the DBA and other expert users who will be working directly in GIS and the database, however, those primarily using the maintenance tools may also wish to attend.

Training will be provided for the Maintenance Tools. This training will verify that all of the tools are configured properly to work with the MAR (adjustments may be required to the MAR and/or the tools in some cases). This training is geared for those who will be responsible for creating, editing and/or querying addresses. This is a very useful session, and one, which helps the users understand the connections between the MAR, GIS, and the maintenance tools.

Deliverables: *Two ½ day training sessions*

4.4 On-Going Support

Over the first year of implementing a MAR, there are often questions that arise about the specific processes of assignment, or the handling of an address within the database environment. Minor "tweaks" to the database design and new views may also be required. During this initial phase, it is useful to the Address Coordinator to have limited support from the database design team, and from addressing experts in the best response to unfamiliar situations or additional needs. Spatial Focus recommends allocating up to 40 hours for general support. While it is not possible to specify exactly what issues may arise, it has been our experience that this level of support provides the Address Coordinator with a backup and confidence to take on full management of the system over a fairly short period of time. This support may be provided by email, phone, or in-person by a member of the Spatial Focus team and will be billed on an hourly basis.

Annual software maintenance and support includes updates to the maintenance tools due to underlying database and ESRI software updates and implementation of new functionality or features. This support also includes necessary MAR database updates that may be required as a result of these updates and enhancements.

4.5 Develop Addressing Procedures

In 2011, Delray Beach engaged Spatial Focus to develop an Address Procedures Manual. The manual is included in Appendix A of this proposal. The Addressing Manual contains information about the assignment of street names, address numbers

and sub-address identifiers for the City. It covers changing of address information when necessary due to changes in land use, errors, or other reasons. Finally, the manual contains information on maintenance of address data in the Master Address Repository, including important quality assurance testing.

This task will provide the City with a checklist, based upon the policies and procedures manual, that will allow the address coordinator the ability to add new addresses, edit existing addresses and communicate all address information to CAD 911 and other departments that utilize address information.

Spatial Focus will deliver an addressing document that includes:

- Process for entering new address assignments
- Process for editing existing addresses
- Process for assigning street names
- Process for editing existing street names

5 Deliverables and Time Schedule

Task Number	Deliverables	Responsible Entity	Time (Business Days)
4.2.1	Database documentation, scripts for creation and loading.	Spatial Focus	60
4.2.2	Test results.	Spatial Focus	30
4.2.3	A. Delivery of identified address datasets B. Itemized data inventory with metadata	A. City B. Spatial Focus	A. 15 B. 30
4.2.4	Digital spatial data describing ARS geometry	Spatial Focus	30
4.2.5	A. Draft Street Name List B. City anomaly review C. Final Street Name List	A. Spatial Focus B. City C. Spatial Focus	A. 10 B. 15 C. 10
4.2.6	A. Draft list of MAR addresses	A. Spatial	A. 15

	B. City anomaly review C. Final list of MAR addresses	Focus B. City C. Spatial Focus	B. 15 C. 30
4.2.7	Anomalies List identifying discrepancies found.	A. Spatial Focus B. City C. Spatial Focus	A. 15 B. 15 C. 15
4.2.8	A. Draft list of street segments with range anomalies (parity, sequence, missing or incomplete data) B. City review and resolution C. Final list of street segments with ranges	A. Spatial Focus B. City C. Spatial Focus	A. 15 B. 15 C. 15
4.2.9	Up to eight views, including views to support ESRI's Government Model, ongoing quality control, CLDFX and USPS formatting will be developed.	Spatial Focus	30
4.2.10	Documentation on final MAR.	Spatial Focus	15
4.2.11	A. Implement Maintenance Tools, including a. Customization for City environment, b. Linkages with MAR database B. Full documentation.	Spatial Focus	A. 30 B. 15
4.3.1	Initial training	Spatial Focus	1
4.3.2	MAR Users	Spatial Focus	5
4.3.3	Understanding the MAR	Spatial Focus	2
4.3.4	Database Administrators	Spatial Focus	1
4.4	On-going support	Spatial Focus	4
4.5	MAR Manual	Spatial Focus	10

6 Cost

Task No.	Cost
4.2.1	$ 1,000.00
4.2.2	$ 5,000.00
4.2.3	$ 4,000.00
4.2.4	$ 3,000.00
4.2.5	$ 3,000.00
4.2.6	$ 4,000.00
4.2.7	$ 4,000.00
4.2.8	$ 4,000.00
4.2.9	$ 10,000.00
4.2.10	$ 2,000.00
4.2.11	$ 17,000.00
4.3.1	$ 1,000.00
4.3.2	$ 7,500.00
4.3.3	$ 2,000.00
4.3.4	$ 2,500.00
4.4	$ 5,000.00 (1)
4.5	$ 5,000.00
Total	**$ 80,000.00**

Task 4.2.11 Details

Windows & ESRI Desktop Tools	$ 5,000.00
Web Editor Tools	$ 10,000.00
Implementation	$ 2,000.00
Sub-Total	$ 17,000.00

Optional

Software Maintenance	$ 6,750.00/year (2)

Notes:
(1) 32 hours of additional training/support
(2) Software maintenance begins in year two