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The combination of increased training tempo due to military base closures and the reduction in military budgets have placed a severe burden on the infrastructure at many military installations and emphasized the need for an integrated facility management support system. This research involved linking existing facility, environmental, and operational data within an off the shelf portable geographic information system (GIS) to produce an integrated facility management support system. Presently, no known military installations have an integrated facility management support system linking these systems together within a GIS. An unconstrained theoretical model was first developed using a flowchart logic network to design the system. A detailed application model was then developed using FieldNotes as an application model portable GIS package, and Camp Rilea, Oregon, as the application model military installation. The application model was then tested on the military installation at Camp Rilea, to validate the theoretical concept behind the system. The testing conducted on the integrated facility management support system demonstrated the potential for improving the efficiency of facility management operations, and assisting in the prevention of carrying capacity threshold violations on military installations. The results of this research allow for possible implementation of an integrated facility management support system at Camp Rilea and other military installations in the State of Oregon, and the U.S. Army at large.

A Portable Geographic Information System used to Develop an Integrated Facility Management Support System for a Military Installation

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David R. Kennedy, Author

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A PORTABLE GEOGRAPHIC INFORMATION SYSTEM USED TO DEVELOP AN INTEGRATED FACILITY MANAGEMENT SUPPORT SYSTEM FOR A MILITARY INSTALLATION

Introduction

The large number of military base closures in recent years have placed an increasing burden on the surviving installations, such as Camp Rilea, Oregon. Usage rates at Camp Rilea have been increasing dramatically. In 1973, installation usage was estimated at only 3,000 person days, in 1982 at 70,557 person days, and for 1996 at 177,000 person days annually (Oregon Military Department, 1994). This dramatic increase is not uncommon and has placed a severe burden on the entire infrastructure at many military installations. The combination of increased training tempo due to base closures and the reduction in military budgets, have emphasized the need for an integrated facility management support system.

Problem Definition

In the past, poor facility management practices on military installations could be ignored and absorbed by swollen budgets and a generally noncompetitive environment. However in this era of shrinking military budgets, inefficiencies in facility management procedures can no longer be tolerated, so easily. It is not uncommon today on military installations to find the facility maintenance, billeting office, and operations center systems to each be functioning independently from one another. This often results in confusion due to poor communication, wasted man hours, and higher operating costs for military installations. The linkage of these areas to form an integrated facility management support system within a portable GIS has not yet been attempted (Rosenfeld, 1997), and may allow for dramatic improvements in the efficiency of facility management operations.

In response to the concerns of increasing training tempos and budget reductions, as well as the high costs associated with violating federal environmental regulations, the U.S. Army is establishing programs such as the Integrated Training Area Management (ITAM) program. ITAM seeks to improve the environmental stewardship of military lands by not exceeding predetermined installation carrying capacities. When carrying capacity thresholds are unnecessarily violated, costly facility maintenance and environmental mitigation must be performed. Several U.S. Army installations including Fort Lewis, Washington, are complying with the ITAM program and have developed geographic information systems (GIS) to monitor environmental and facility issues (Whelan, 1996). However, at the present time no known U.S. Army installations have an integrated facility management support system linking facility, environmental, and operational data within a portable GIS to assist them in preventing carrying capacity threshold violations (Rosenfeld, 1997).

Research Approach

The initial step after conducting a literature survey for this project was to develop an unconstrained theoretical model of an integrated facility management support system. This was done using a flowchart logic network diagram to lay out the design of the integrated facility management support system. Next, this theoretical model was transformed into an application model. A suitable portable GIS package and military installation were selected for application of the system. Three extended trips were then made to the application model military installation to properly develop the integrated facility management support system. After the application model was developed, the system was then tested using the actual personnel and data from the application model military installation. The final step in the project was capturing the lessons learned and recording the results.

Goals and Objectives

The primary goal of this research project is to link existing facility, environmental, and operational data within a portable GIS to produce an integrated facility management support system. The primary objective to be accomplished leading to this goal is to validate the theoretical concept of the system to allow for possible future implementation at Camp Rilea and other U.S. Army installations in the State of Oregon, and the U.S. Army at large. The secondary goal is to test the integrated facility management support system on several different facility types at Camp Rilea. The secondary objectives to be accomplished leading to this goal, are to demonstrate possible improvements in the efficiency of facility management operations and to assist in the prevention of carrying capacity threshold violations.

Literature Review

This literature review provides a brief synopsis of some of the major facility management programs currently attempting to use GIS technologies. This review will touch briefly on how GIS technologies are now being leveraged across a vast array of facility management applications. However, the focus will be on the major programs currently ongoing within the U.S. Army. These programs are in various phases of development and are intended to meet the Army's challenge of sustaining environmental stewardship while improving the efficiency of it's facility management procedures. In the past, the Army's GIS based facility management tools have focused on the requirements for off-post housing (Forgionne, 1996). More recently, it seems the emphasis has shifted to using GIS based tools to improve environmental stewardship and federal regulation compliance.

GIS Facility Management Applications

The facility management applications of GIS are virtually unlimited. GIS based technologies are enabling facility managers to increase the effectiveness of their infrastructure in the short term and allowing organizations to save money in the long term. The Boston Logan International Airport has established a GIS which is enabling the facility managers to manipulate and virtually represent a wide range of data easily and effectively (Condon, 1991). GIS is also yielding benefits for long range facilities planning. In Sherburne County, Minnesota, the Sherburne County Highway Department effectively used a GIS to develop an unbiased, fiscally responsible long-range facilities plan to present to their constituents (Pieper, 1996). Further applications are being developed to track detailed facilities usage and operating costs. Researchers at the Massachusetts Institute of Technology have developed a model using GIS technology that links cost accounting, engineering, and facilities functions for decision support (Cyros, 1997). The facility management applications of GIS and associated technologies offer exciting new opportunities for both management efficiencies and cost savings.

Integrated Training Area Management

The U.S. Army effort to apply GIS technologies to facility management programs begins with the Integrated Training Area Management (ITAM) program. The ITAM program is a key part of the U.S. Army commitment toward maintaining environmentally sensitive and realistic training areas. The ITAM program encourages proactive, rather than reactive, solutions to conservation and facility management challenges. ITAM is an added function of the Range Facility Management Support System (RFMSS) (Chenkin, 1997). RFMSS is an automation tool designed to assist range facility managers in improving the efficiency of their range scheduling, firing desk operations, and utilization analysis. ITAM envisions a GIS linked to RFMSS allowing spatial display of RFMMS information. ITAM will use this GIS/RFMSS linkage as a vehicle for information integration and decision support (Chenkin, 1997).

Currently, the linkage between GIS and RFMSS is in the design stage (Chenkin, 1997). Other ITAM work plans in various design phases include linking RFMSS to facilities, work orders, and locating attributes by grid coordinates (Chenkin, 1997). Since the U.S. Army can not afford duplicative systems for determining similar requirements, studies are underway to determine the correct balance between system requirements and GIS/RFMSS asset capabilities (Chenkin, 1997).

ITAM program developers envision many additional functions for the GIS/RFMSS linkage. One application is presenting and integrating current spatial information in digital formats. Another is to provide easy access to training utilization data and other tabular information. An additional function is to develop Army Training and Testing Area Carrying Capacity (ATTACC) condition and land curves, as well as to develop ATTACC thresholds and targets (Chenkin, 1997). ITAM program developers see the GIS/RFMSS linkage forming a bridge between the ranges and training land program and the natural resource management program (Chenkin, 1997) on each installation Army wide.

Army Training and Testing Area Carrying Capacity

The ATTACC team defines carrying capacity as "the amount of training which a given parcel of land can accommodate in a sustainable manner" (Anderson, 1997). ATTACC recommends that facility management programs strike a balance of use, condition, and maintenance. They have shown through testing that land condition deteriorates over time as a function of increased training loads. Although the shape of this deterioration curve can not be changed without unacceptable reductions in training loads, with proper environmental and facility management its position can. The ATTACC team recommends using erosion status as an indicator of training land condition (Anderson, 1997).

The ATTACC team has found that using erosion status as an indicator of training land condition incorporates most of the factors influencing land condition. They have developed a scientifically based model for determining the carrying capacity of an installation, called land condition (Anderson, 1997). Their top level objective is to estimate the cost to maintain and sustain installation land condition at specific environmental levels, called measures of effectiveness (Anderson, 1997). ATTACC plans to determine this measure of effectiveness for each installation using a parametric equation to estimate the total costs to maintain and sustain an installation at a given erosion status. This program is to be executed at each installation using a GIS and Land Condition Trend Analysis (LCTA) data to determine a predicted erosion status for the installation (Anderson, 1997). This predicted erosion status will be determined by the installations current erosion status, plus any changes due to training, minus any changes due to natural land recovery.

Land Condition Trend Analysis

The LCTA program provides the technical assistance and expertise an installation needs to determine its predicted erosion status. The installation can determine this by using its own unique environmental data. The major objectives of the LCTA program are to provide current and predictive resource information, identify impacts on resources, and prioritize resource restoration, rehabilitation, and revegitation areas (Army National Guard Bureau, 1997). The U.S. Army Environmental Center (USAEC) Conservation Branch has made LCTA support available to all installations providing ITAM program management (CEMML, 1997). The Center for Ecological Management of Military Lands (CEMML) offers no-cost assistance in the following areas: inventory and monitoring methods; hardware, software, and networking; data management and integrity; and data analysis and documentation (CEMML, 1997).

Erosion status is the key indicator at installations of training land condition. The LCTA program provides access to a Windows based database server known as LCTA Program Manager, to assist client installations in determining their erosion status. The LCTA Program Manager uses the Universal Soil Loss Equation (USLE), [A = R x K x LS x C x P], to estimate erosion (Sprouse, 1997). The variables in the USLE are: R = rainfall erosivity; K = inherent soil erodibility; LS = topographic factor; C = cover factor; and P = conservation factor. The results yielded from this parametric equation can then be used to determine which areas of an installation may require restoration and erosion control measures. Erosion loss estimates can also be used to monitor changes in erosion status over time (Sprouse, 1997).

Planning Level Survey and Integrated Natural Resources Management Plan

Another program the U.S. Army has developed to manage installations on an ecosystem basis is the Planning Level Survey (PLS) and Integrated Natural Resources Management Plan (INRMP). The purpose of the PLS and INRMP is to ensure that natural resource conservation measures are integrated with federal stewardship requirements on Army lands (House, 1997). The PLS are installation-wide inventories to characterize essential components of an installations natural resources including: landform, soil, water, and biota. The results from the extensive PLS are then used as a foundation for environmental planning and preparation of the INRMP (House, 1997). The INRMP is the Installation Commander's comprehensive plan for deliberately managing the natural resources present on his installation.

The relationship between PLS and LCTA is complementary. The LCTA erosion status data is obtained using a spot survey and monitoring program focusing on the USLE variables. The PLS program covers all mission lands on a military installation, focusing on more extensive and comprehensive survey data. The PLS methods and procedures are controlled through the Conservation component of the U.S. Army's Environmental Program. The LCTA program is controlled through the ITAM component of the U.S. Army's Training Program (House, 1997). The programs are intended to work together to form an integrated, comprehensive environmental stewardship program for U.S. Army installations.

As this literature review has shown, GIS technologies are actively being used to both improve the efficiency of facility management procedures and sustain environmental stewardship and regulation compliance. The facility management applications of GIS are just beginning to be explored.

Methods, Materials, and Equipment

This chapter will outline the systems and equipment used during the application model phase of this research project. The chapter begins by providing a brief overview and description of Camp Rilea, Oregon. Camp Rilea is the application model military installation where the integrated facility management support system was applied and tested. Next, an introduction of FieldNotes and the existing Camp Rilea GIS is given. FieldNotes is the portable GIS package used in the application model of the research project. The chapter concludes by explaining the installation management systems and carrying capacities currently being used upon the facilities at Camp Rilea. This chapter should provide the reader the necessary background information to aid in the understanding of the theoretical and applied models of the integrated facility management support system detailed in future chapters.

Camp Rilea

The Camp Rilea National Guard Training Facility is located in the town of Warrenton, Oregon, approximately ten miles south of Astoria, Oregon, and 91 miles west of Portland, Oregon. Camp Rilea is bordered by the Pacific Ocean on the west, Highway 101 and the Burlington Northern Railroad on the east, Delaura Beach Road on the north, and private land on the south (Figure 1). Historically, Camp Rilea has been in continual operation as a military training facility since 1927. It is currently being used as a training facility for units of the Oregon Army National Guard, The Air National Guard, U.S. Army active duty forces, and the Oregon State Police Academy.

Figure 1. Camp Rilea reference map

Some of the major facilities at Camp Rilea include: an armory, a motorpool, sewage treatment plant, a Unit Training Equipment Site, and numerous training areas and

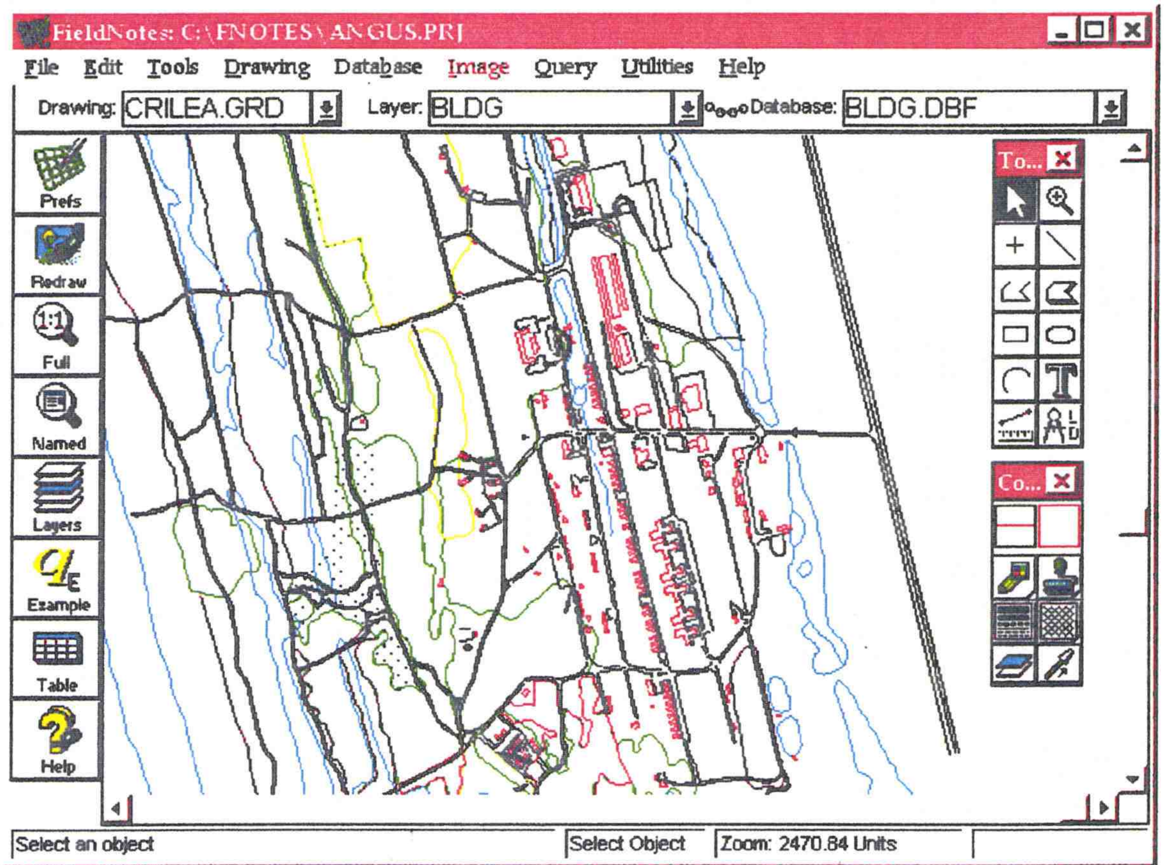


Figure 2. Camp Rilea facilities layout

weapons ranges (Figure 2). A considerable number of new facilities are also being constructed at Camp Rilea including: an Air Assault confidence course and tower, a Small Equipment Test Site theater, a simulation center, a 36,000 square foot storage building and a 4,000 square foot classroom (Wood, 1997). Camp Rilea also serves as a sanctuary for a variety of environmentally sensitive areas and endangered species (Rosenfeld, 1997). With its relatively small size and diverse facility, environmental, and operational issues, Camp Rilea serves as an excellent test location for a GIS based integrated facility management support system with broader Army wide application potential. Figure 2 also displays many of the Windows based applications available for use within FieldNotes including the zoom extents, zoom to named zoom, and query by example icons on the far left of the figure.

FieldNotes

The GIS package currently being used at Camp Rilea is a product called FieldNotes. FieldNotes is produced by a local company in Corvallis, Oregon named Penmetrics. FieldNotes is a portable Windows based GIS and AM/FM (mapping and CAD) package (Penmetrics, 1995). It allows users to work with drawings, images, and database records all in the same environment. FieldNotes enables users to enter and edit both database attribute information and graphical data (normally digitized vectors with X and Y coordinates). It can also perform basic database operations wherever the user happens to be in the program. FieldNotes supports vector, raster, and standard database files in a variety of common formats. Included in the standard FieldNotes package are three main applications; FieldNotes, FieldForms, and FieldPack (Penmetrics, 1995). Fieldforms allows non-programmers to quickly and easily create custom database forms for use during data collection operations. FieldPack is a database access program that allows users to open, view, query, browse, and edit databases used in FieldNotes. This three application system forms the heart of the Camp Rilea GIS (Rosenfeld, 1997).

Camp Rilea GIS

The existing GIS at Camp Rilea consists of thirty six facility and environmental data layers, six aerial videography images, and twenty eight ground videography images. AutoCAD drawing files provided the primary source for the facility management data within the Camp Rilea GIS. The data layers were digitized into the GIS from a wide variety of pre-existing sources including: 24 x 36 inch mylar sheets, National Wetland Inventory maps, and a variety of locally produced resource oriented maps. Source map scales varied widely from very large scale single facility maps to 1:24,000 United States Geological Survey quadrangles (Whelan, 1996). FieldForms was used to input facility management attribute data into the GIS. Some digital scanning was also used to produce input data for layer compilation (Rosenfeld, 1997).

The environmental management data collection procedures were performed by the Oregon Natural Heritage Program (ONHP) in 1993. The ONHP was contracted by the Oregon Military Department to inventory and identify the locations of rare, threatened, and endangered species at Camp Rilea (Whelan, 1996). The ONHP study identified two rare plant species and an endangered butterfly species. The approximate locations of the plant patches and butterfly nesting grounds were identified using Global Positioning System (GPS) receivers, and attribute data was subsequently entered into the GIS using FieldForms.

The aerial videography was taken using an Hi-8 millimeter Sony XC999 color videocamera with a 1/2 inch charge coupled device (CCD), mounted on a Cessna 182 aircraft (Rosenfeld, 1997). Images were obtained along two north-south flightlines at a scale of approximately 1:12,500 and a flying height of 5,000 feet. The 8 bit images were saved as 1.1 Megabyte bitmap files. Each image was mosaiced using Adobe Photoshop and rectified in the GIS drawing layers. Computer Eyes (Digital Vision) image capture software was used to save still images from the video (Whelan, 1996). A local blueprinting company, Fox Blueprinting, was used to scan the mylar sheets produced from the aerial videography images converting the raster digital images into vector format (Whelan, 1996). Figure 3 shows an image obtained by aerial videography. The raster based videographic color image may be draped with any of the 36 attribute layers currently loaded into the portable GIS.

Figure 3. Raster based aerial videography image of Camp Rilea

The twenty eight ground videography images loaded into the portable GIS are profiles of various facilities and structures on Camp Rilea. The 8 bit images were saved as 750 kilobyte TIFF files. Each image was incorporated into an associated facility or structure GIS layer. GPS receivers were used to obtain detailed positional data including elevation, to assist in producing point, line, and area features as well as attribute data within the GIS (Rosenfeld, 1997).

Camp Rilea Facility Management Systems

The existing facility management systems (operations, billeting, maintenance, etc.) at Camp Rilea could be better integrated. Except for some sporadic verbal information exchange, the existing systems all act independently from one another. The people operating these systems are all very proficient in their assigned function, but are constrained by the lack of integration. They are not well informed as to how their facility management system impacts the rest of the installation. Another reason for the facility management inefficiencies at Camp Rilea, is that a local area network is not in place. Prior to establishing a local area network to all the critical nodes of the installation, the required communication hardware and software must first be procured and installed.

The primary document used to drive the existing facility management systems at Camp Rilea is AGO Form 207 (Appendices A1, A2). This is a request for facility usage form that customer units submit to the operations section at Camp Rilea. The data from this form is then input into the Range Facility Management Support System (RFMMS). RFMMS is an automated database tool designed by DOD to enhance the management of range facilities located on military installations. RFMMS is a valuable tool for the monitoring of range statuses, submission of required reports, and range safety procedures. RFMSS serves as the database of record for operations management at Camp Rilea (Safe, 1997).

This request for facility usage is then manually delivered from operations to billeting. Billeting personnel enter the necessary data into Check In. Check In 5.0 is a DOS based scheduling program produced by Inn Soft Corporation, Beaverton, Oregon, and is used primarily by small civilian motels (Nikila, 1997). Camp Rilea currently has 228 building facilities on the installation. The available units for rent or lease are loaded into the billeting program. In addition to housing and storage buildings, these include classrooms, tent sites, and even a gymnasium. The building facilities loaded into Check In are broken down into three categories based on their funding source: federal, state, and Bachelor Officer Quarters. Check In is not capable of interfacing with RFMSS to access the operational information in its database (Nikila, 1997).

The maintenance of the 228 building facilities and associated grounds on Camp Rilea is funded by the State of Oregon, and performed by a 10-12 man crew of various skill specialties. Scheduled maintenance work is planned and scheduled manually on a monthly basis by worker skill specialty, rather than by building facility. This is done to maximize worker hours, but makes scheduled maintenance difficult to coordinate with the other systems on the installation. Although scheduled maintenance is planned by month up to a year in advance (Klee, 1997), the billeting office only sends a listing of the building facilities being used one week in advance. The information on this printout listing is continuously changing due to cancellations. The maintenance workers frequently show up at a building to perform work and are surprised to find the building facility occupied (Klee, 1997). The building and grounds crew also have the responsibility of performing environmental maintenance on the 60 acres of butterfly habitat on Camp Rilea. This important environmental maintenance program is not currently integrated with the RFMSS operations database.

The maintenance of the six range and thirteen training area facilities on Camp Rilea is funded by the Federal Government, and is performed by one man. There is no existing scheduled maintenance program for the range and training area facilities (Main, 1997). The maintenance is performed on an emergency basis only as facilities become unusable. The maintenance of the range and training area facilities is not integrated with the RFMMS operations database. The maintenance of these facilities is also not currently linked to any type of carrying capacity thresholds (Main, 1997).

Carrying Capacities

Unfortunately, the sophisticated erosion status model developed by the ATTACC team for measuring an installations overall carrying capacity is not yet in place at Camp Rilea. Therefore, other means of determining individual facility carrying capacities had to be developed for this research project. Carrying capacities for the six different range facility types at Camp Rilea were determined by seasonal maintenance requirements. During the peak vegetation growing season from March to July, carrying capacity thresholds were set at two week intervals. Carrying capacities were reduced to monthly intervals during the August to November period. During the remainder of the year from December to February, only an annual target maintenance is required (Main, 1997).

Obscuration from vegetation is the primary maintenance requirement on the range facilities at Camp Rilea. The length of closure of each range facility type was based upon the number of man days necessary to perform the required maintenance. Past historical data has yielded the following results for each of the range facility types at Camp Rilea: modified record fire range facility - 6 man days; zero range facilities - 1 man day per facility; known distance range facility - 3 man days; pistol/grenade range facility - 1 man day; grenade launcher/antitank weapon range facility - 3 man days; and the infantry squad battle course facility - 3 man days (Main, 1997).

Carrying capacities for the thirteen training area facilities at Camp Rilea were more difficult to determine due to the threatened and endangered species habitating these areas. The State Fish and Wildlife Department monitors these sensitive areas and informs the building and grounds office when to trim the vegetation in these areas based on the butterfly hatch cycle (Klee, 1997). Normally their guidance is to trim in April, June, and October, with no herbicide use after July 15th. Hopefully these somewhat crude facility carrying capacity calculations developed for this research project will soon be enhanced by an ATTACC installation erosion status model for Camp Rilea.

Theoretical Model

This chapter presents a theoretical model of how an integrated facility management support system might be used on a typical military installation. This model is not constrained by the limitations of Camp Rilea as an application model military installation, nor by FieldNotes as a portable GIS package. The chapter begins by using a flowchart logic network to explain the design of an integrated facility management support system. The initial concept of how this system might be implemented using a portable GIS package is then discussed. The chapter concludes by looking at the particular constraints of using FieldNotes as a portable GIS package on this research project, and what improvements might be available if Visual Basic or other object oriented programming languages were incorporated into the application model. This chapter demonstrates the broader application potential of an integrated facility management support system beyond Camp Rilea as an application model military installation, and FieldNotes as an application model portable GIS package.

Flowchart Logic Network

As in the existing facility management systems at Camp Rilea, the request for facility usage (Appendices A1, A2) or some other similar request form, provides the necessary initial input data to begin using an integrated facility management support system. At a minimum, the request form must include the type of facility desired and dates of usage. The initial decision node in the logic network, shown in Figure 4, is based on the type of facility desired for usage. This node is based upon range or training area facilities potentially containing environmentally sensitive habitat areas, while billeting facilities do not have that potential concern.

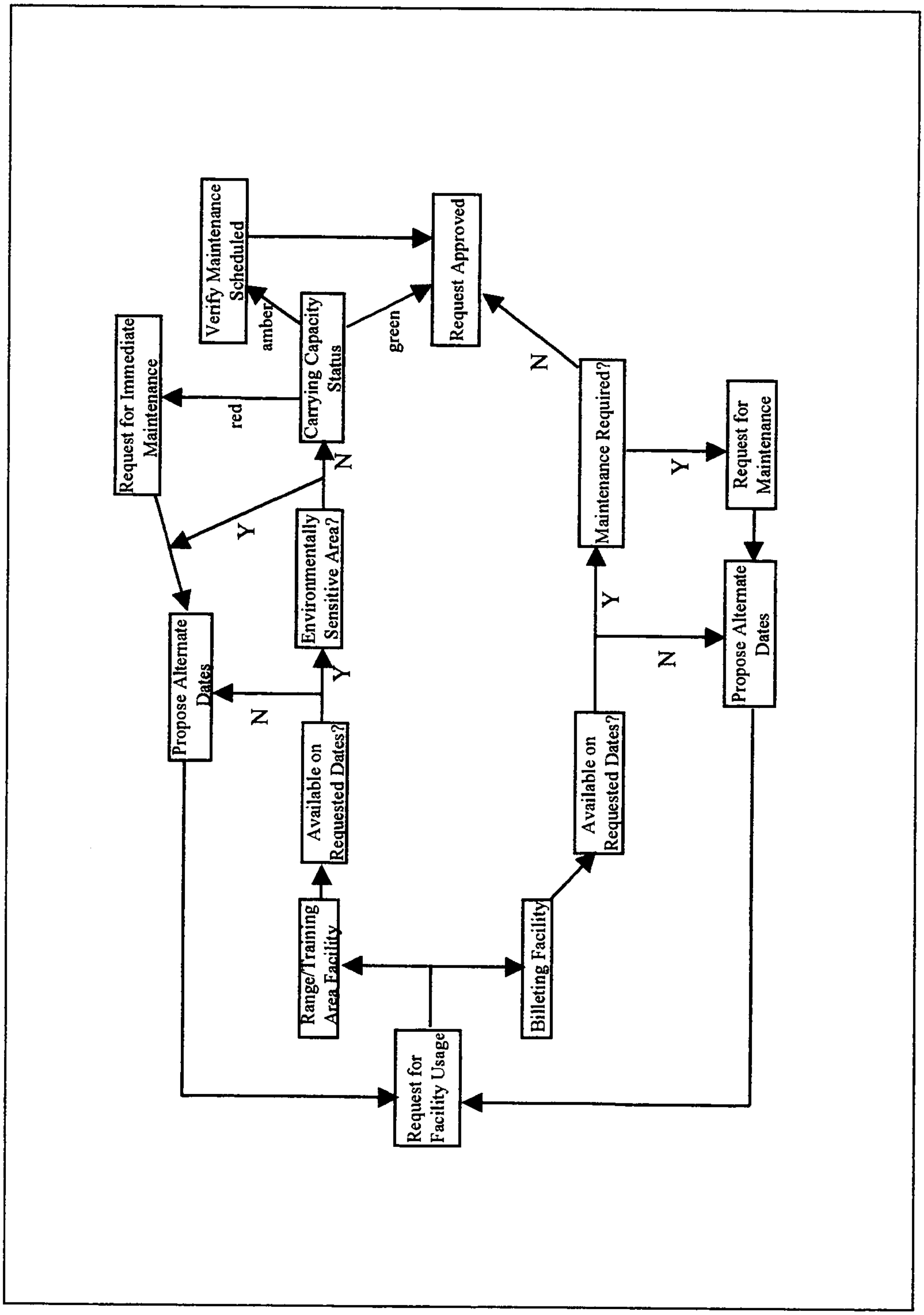


Figure 4. Integrated facility management support system flowchart

The range or training area facility path then passes through another node to determine if the desired facilities are available on the requested dates. This is done by accessing a reservation database, such as RFMSS. If the requested range or training area facilities are available, the logic network flows onward to determine whether the requested facility lies within an environmentally sensitive area. If not available, the integrated facility management support system proposes alternate dates and returns back to the initial request for facility usage node. The system determines if a facility is in an environmentally sensitive area by comparing drawing layers within the portable GIS. It does this by overlaying drawing layers of environmentally sensitive areas against range or training area facility locations. If no environmental conflict exists, the logic network flows to the carrying capacity status node. At this node, a carrying capacity status clock checks each facility and reflects an appropriate status. If more than 90% of a facility's carrying capacity clock time is used up, a red status is shown and an immediate request for facility maintenance is generated. If carrying capacity clock time is between 70% and 90% consumed, an amber status is reflected and the system verifies that maintenance time is scheduled. Finally, if more than 70% of the carrying capacity clock time for a range or training area facility is still available, a green status is shown and the request for facility usage is approved by the integrated facility management support system.

The billeting facility path also initially accesses a reservation database to determine if the requested facility is available on the desired dates. If not available, the system proposes alternate dates and returns to the initial request for facility usage. If the billeting facility is available, the logic network flows onward to determine if maintenance is required on the facility. This maintenance node queries a database and determines if each billeting facility has either scheduled or unscheduled maintenance work pending. If maintenance is pending, the system will generate a request for maintenance, propose alternate dates for usage, and return back to the request for facility usage. If no maintenance is pending, the request for billeting facility usage is then approved by the integrated facility management support system.

Initial GIS Concept

After completing the logic network diagram for the theoretical model, development of an initial concept of how best to use a portable GIS to form an integrated facility management support system is undertaken. A portable GIS was selected for the system because when combined with pen computing, it allows field personnel the flexibility to input data while on-site, yet gives supervisors centralized control over changes. The initial GIS concept developed involved using one parent database input form for the entire system. Relationships between databases can then be established by linking this parent form to one or more child databases in a hierarchical relationship. Figure 5 shows the initial layout design of this single parent database input form concept.

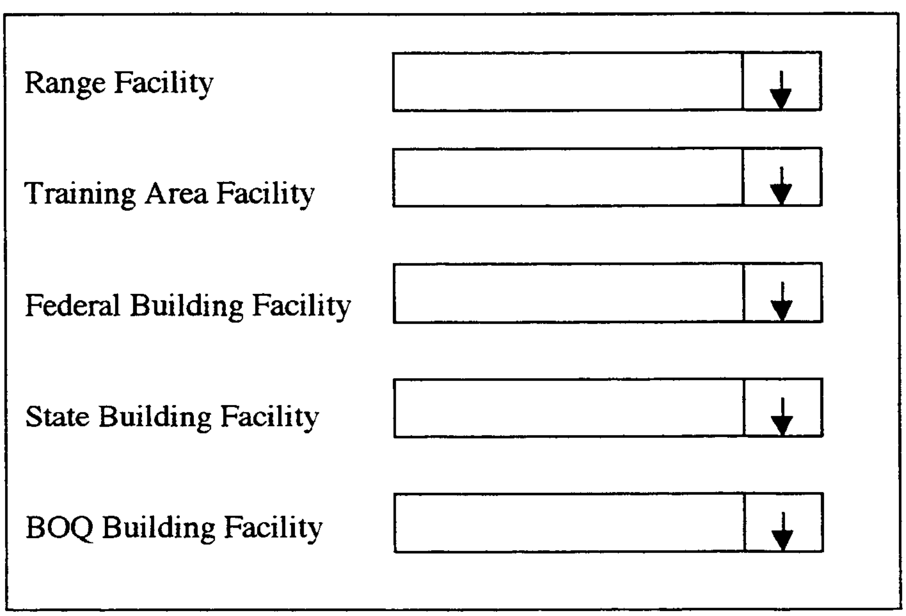


Figure 5. Initial single parent database input form concept

The single parent form concept involves first categorizing the various facility types on the installation. The individual facilities are then embedded into a single form using pull down lists. The 'NAME' field for each facility is subsequently linked to a child database input form, such as the one shown in Figure 6.

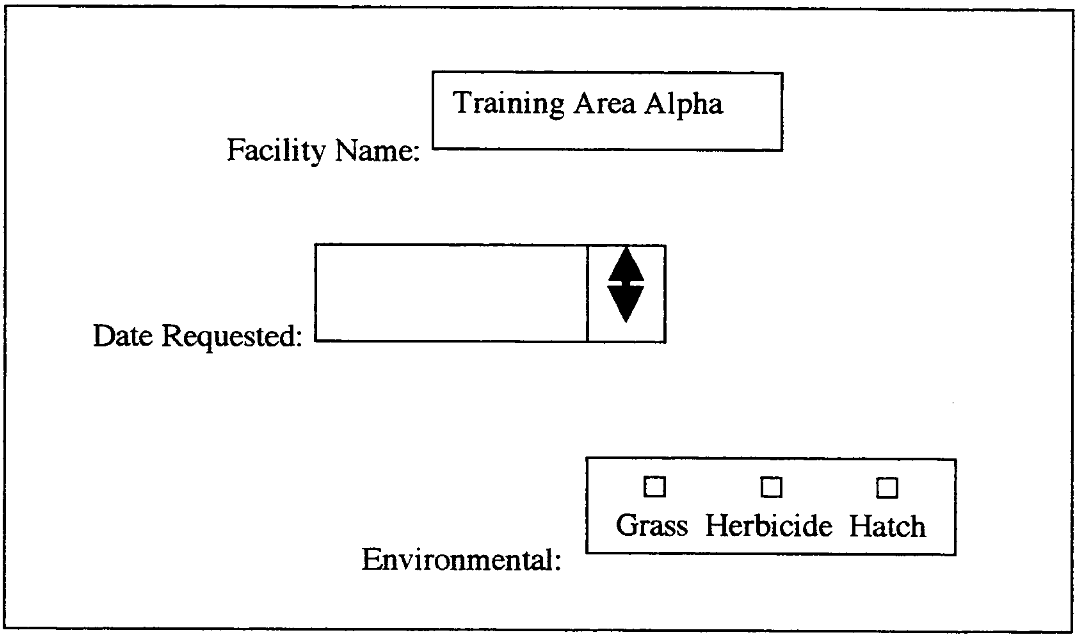


Figure 6. Initial child database input form concept

The user of this training area facility child database input form must first enter the date requested for use. The reservation dates entered into the 'DATE' field form the data for the child database. The 'DATE' field is also linked to the 'ENVIRONMENTAL' field, which contains its own "stepchild" databases. For the training area input form shown in Figure 6, the 'ENVIRONMENTAL' field is linked to three "stepchild" databases: grass.dbf, herbicide.dbf, and hatch.dbf. These "stepchild" databases store dates of potential environmental conflicts to be queried by the child database. Another feature of this initial child database input form concept is using the 'DATE' field to signal the green, amber, or red carrying capacity clock time status. The date requested turns green, amber, or red after the integrated facility management support system checks it's child and "stepchild" databases for potential carrying capacity threshold violations.

FieldNotes Constraints

Once FieldNotes was selected as the portable GIS package for the application model of the research project, this initial GIS concept quickly changed. The fact that FieldNotes can only support one child database per parent database (Washburn, 1997), made the initial single parent database input form concept invalid. Since FieldNotes won't allow child databases to be queried (Penmetrics, 1995), the entire "stepchild" database concept proved unworkable. Finally, since FieldNotes offers no time clock mechanism feature (Washburn, 1997), the carrying capacity clock concept had to be abandoned. Due to these and other constraints provided by FieldNotes, workaround solutions had to be developed in many areas for the application model.

It was decided when selecting a portable GIS package for this research project to use an off the shelf product. The portable GIS package was not to be customized with object oriented programming languages for the application model of this particular research project. This was done in order to focus the research project more on the concepts behind the integrated facility management support system and less on the specifics of the application model. However, it is important to realize the potential improvements some detailed object oriented programming such as Visual Basic, would provide for an integrated facility management support system.

Many of the constraints that FieldNotes provides could be eliminated by using object oriented programming. Some of the technical modifications that would be possible include: querying child databases, linking multiple layers within a single database, allowing for multiple child databases per parent database, and allowing multiple link fields from a parent to a child database (Washburn, 1997). Some of the specific improvements object oriented programming would allow for in an integrated facility management support system include: arranging files chronologically within a child database, using an active carrying capacity time clock mechanism, and avoiding multiple reservation bookings for the same date. Given the constraints that FieldNotes provides as a portable GIS, it still is a powerful program that will serve well as this research project moves from a theoretical to an applied model.

Applied Model

This chapter will outline the technical details behind how FieldNotes may be applied as an integrated facility management support system upon the facilities at Camp Rilea. The chapter begins by describing how the various databases and data input forms used in the project were designed and constructed. Next, the linkages established between databases within FieldNotes to drive the system are explained. Finally, the queries formed to assist the user are briefly described. This chapter presents just one of many possible application models for using a portable GIS as an integrated facility management support system.

Databases

The databases established within the portable GIS will form the heart of the integrated facility management support system, with their data providing the lifeblood. Much thought and care must be shown when designing and setting up these critical databases. Without the proper data structure and retrieval system in place, an integrated facility management support system is not possible.

An initial step when setting up a portable GIS as an integrated facility management support system is deciding whether to use existing databases or create new ones. Although FieldPack has the capability to convert existing databases (such as RFMSS) to a dBase IV file format for use in FieldNotes, new databases were created for this research project. This was done to focus the research on the applicability of an integrated facility management support system and not on database conversion procedures. However, the actual data inputted into these new databases was obtained from the existing databases currently in use at Camp Rilea. The data input into the databases mirror those at Camp Rilea exactly.

In FieldNotes, the database must be a dBase IV file (DBF extension) or converted to a dBase IV file using FieldPack. FieldPack is a database structure and manipulation utility designed to help manage database files in the dBase IV format (Penmetrics, 1995). FieldNotes associates attributes with graphics using three different types of databases: point, object, and block. Point databases are associated with unique X,Y coordinate locations, object databases with layers within drawings, and block databases with layers within a single drawing (Penmetrics, 1995).

A parent-child hierarchical relationship can be established between two databases. A parent database can be a point, object, or block database while a child database may only be a non-spatial database. The parent databases used in this research project are all object databases. This allows layers to be associated with multiple drawings and attribute data to be linked to objects within layers. The parent databases are linked to their non-spatial child database using a link field. The 'NAME' field is the link field used for all the databases in this project.

There are several field types available within FieldNotes including: string, logical, date, time, decimal, and memo (Penmetrics, 1995). When establishing a new object database or modifying an existing one within FieldNotes, a dialog box such as that shown in Figure 7 appears giving various options for database structure. The 'RECCFLAG' and 'RECAFLAG' fields are automatically added when creating an object database. 'RECCFLAG' flags changed records and 'RECAFLAG' tracks new records (Penmetrics, 1995). The results of these fields are visible in Figure 8, a child database used in this research project, in the D, C, and A, columns to the extreme left of the database. The user must determine the number, type, and width of additional fields needed in the database. Of the four fields shown in this child database, three are string field types while the 'DATE' field is a date field type. The 'NAME' field serves as the link field between this child database and its parent database.

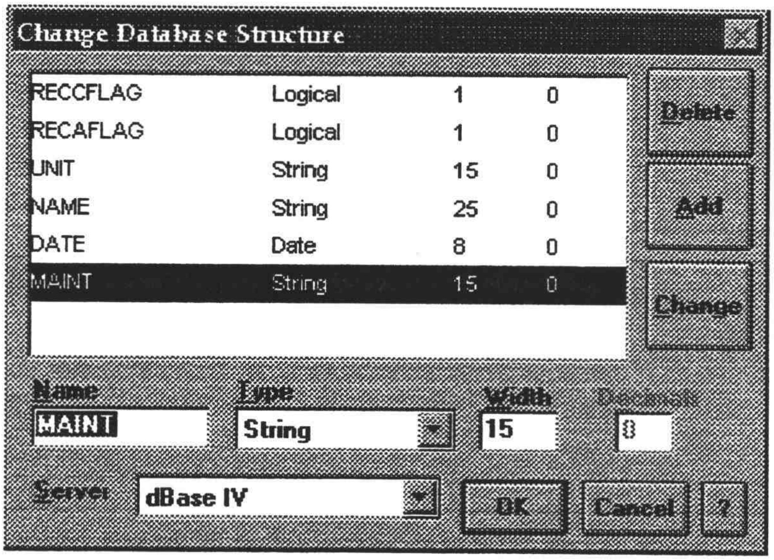
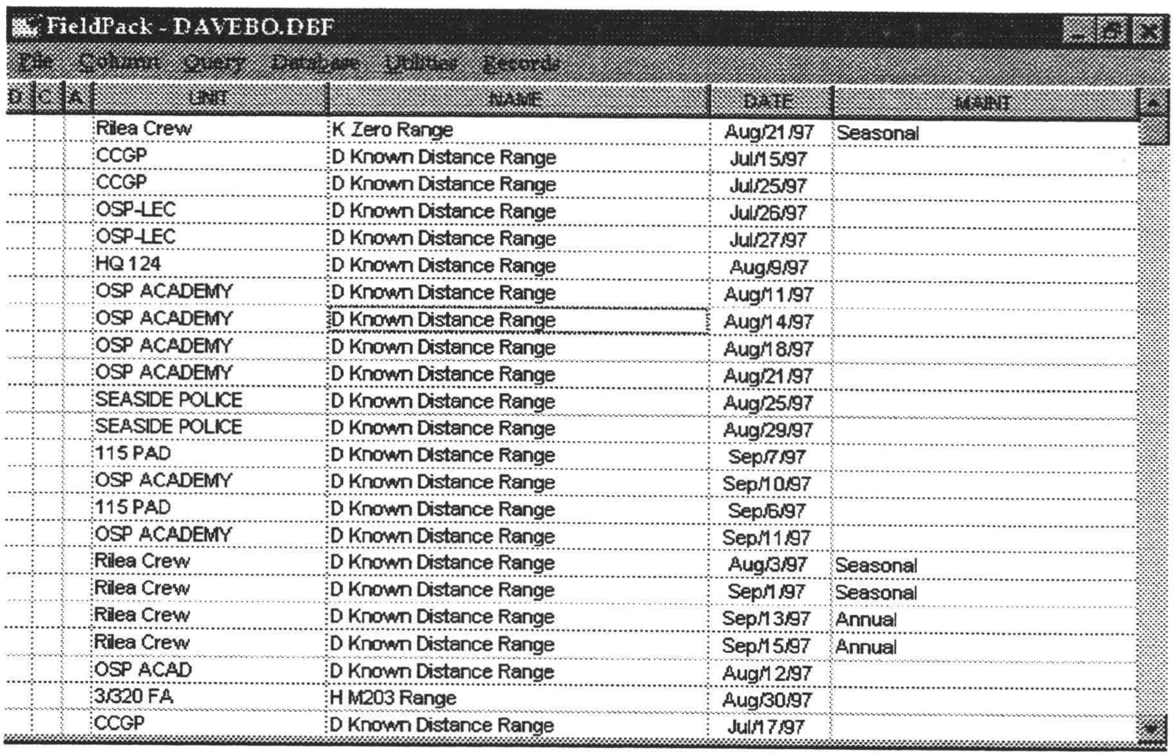


Figure 7. Database structure dialog box



D	C	A	UNIT	NAME	DATE	MAINT
			Rilea Crew	K Zero Range	Aug/21/97	Seasonal
			CCGP	D Known Distance Range	Jul/15/97	
			CCGP	D Known Distance Range	Jul/25/97	
			OSP-LEC	D Known Distance Range	Jul/26/97	
			OSP-LEC	D Known Distance Range	Jul/27/97	
			HQ 124	D Known Distance Range	Aug/9/97	
			OSP ACADEMY	D Known Distance Range	Aug/11/97	
			OSP ACADEMY	D Known Distance Range	Aug/14/97	
			OSP ACADEMY	D Known Distance Range	Aug/18/97	
			OSP ACADEMY	D Known Distance Range	Aug/21/97	
			SEASIDE POLICE	D Known Distance Range	Aug/25/97	
			SEASIDE POLICE	D Known Distance Range	Aug/29/97	
			115 PAD	D Known Distance Range	Sep/7/97	
			OSP ACADEMY	D Known Distance Range	Sep/10/97	
			115 PAD	D Known Distance Range	Sep/6/97	
			OSP ACADEMY	D Known Distance Range	Sep/11/97	
			Rilea Crew	D Known Distance Range	Aug/3/97	Seasonal
			Rilea Crew	D Known Distance Range	Sep/1/97	Seasonal
			Rilea Crew	D Known Distance Range	Sep/13/97	Annual
			Rilea Crew	D Known Distance Range	Sep/15/97	Annual
			OSP ACAD	D Known Distance Range	Aug/12/97	
			3/320 FA	H M203 Range	Aug/30/97	
			CCGP	D Known Distance Range	Jul/17/97	

Figure 8. Child database fields

Form Design

Field Forms is another database utility within FieldNotes. It allows the user to customize a data input form for a particular database without using programming languages. A finished FieldForm appears as a window within FieldNotes. Database input form design is an important aspect of successfully setting up a portable GIS to use as an integrated facility management support system. Forms must be clear, concise, logical, and user friendly. Figure 9 shows the parent database form for the range facility portion of this research project.

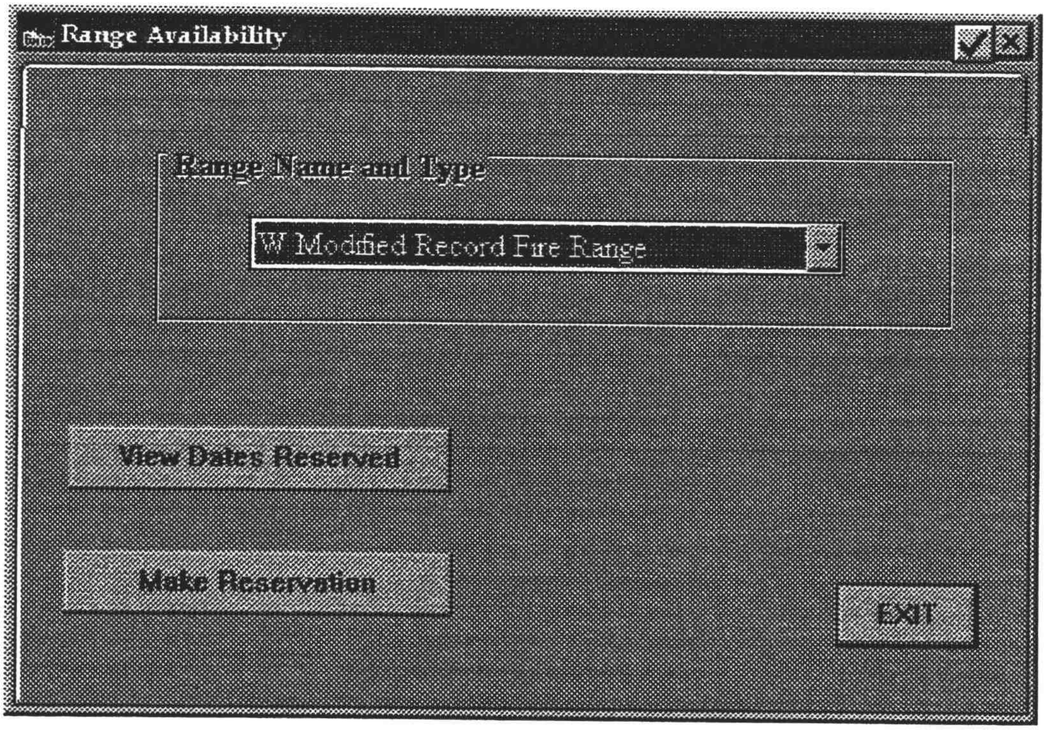


Figure 9. Parent database input form

A pick list is used on the parent form for the 'NAME' field. Pick lists are convenient to use and serve as a predefined control type to avoid the data entry errors which commonly cause frustration for the user. Standardizing the entries into the link field is advisable since each range name from the parent database must be a precise match with its corresponding range name in the child database. Without the precise match within the link field, no linkage will occur between the parent and child databases. Figure 10 shows the child database form for the range facility portion of the integrated facility management support system.

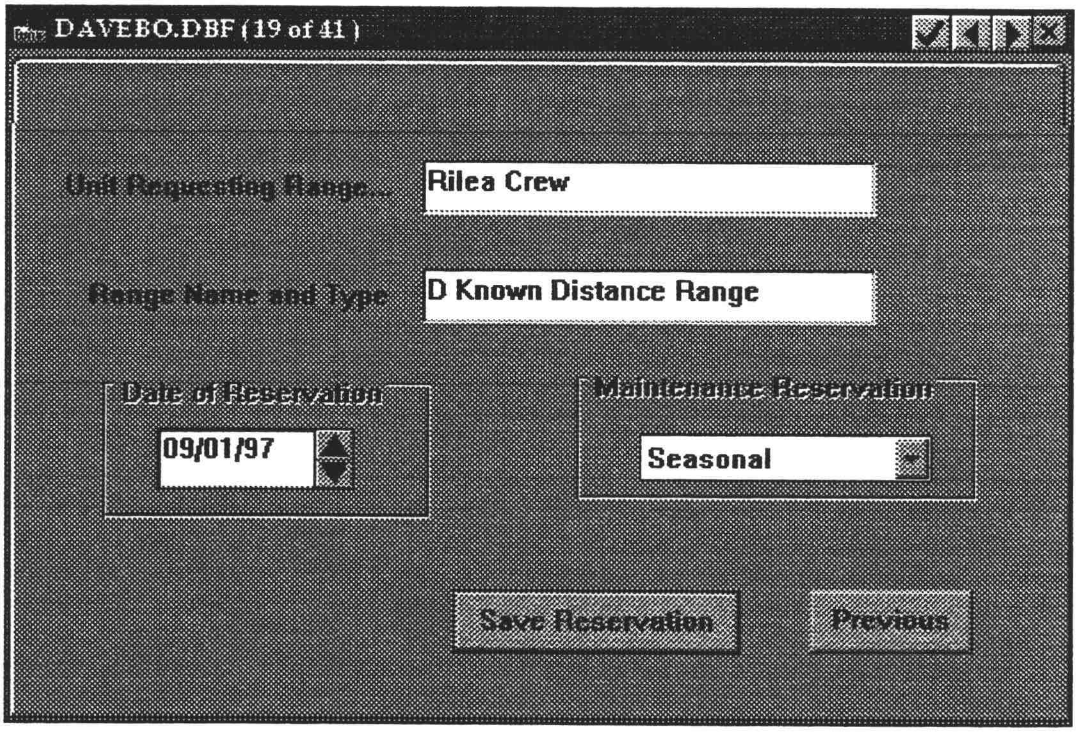


Figure 10. Child database input form

A pick list is not used in the child form for the 'NAME' field. Since this is the link field, the range name and type selected from the pick list is automatically carried over to the child form. This entry is also made "Read Only" to further avoid data input errors by the user. The type of range is also included to further assist the user. The "Drop a Text Frame" option is used on the 'DATE' and 'MAINTENANCE' fields to make the form more visually appealing.

Push buttons are used on the parent form to connect to the child form. The 'View Dates Reserved' push button allows the user to browse through the range records within the child database. If after browsing the user decides to make a range reservation, he pushes the 'Make Reservation' button and fills in the range child data input form. After the user has completed filling out the range child database input form to his satisfaction, he then pushes the 'Save Reservation' button.

When filling out the range child data input form, the user begins by filling in the 'Unit Requesting the Range' block. If the range is being reserved for maintenance purposes, the user selects the type of maintenance being performed from the pick list. A spin dial is used on the child form for the 'DATE' field (Figure 10). The "Value Required" option is used in this field to ensure the user does not forget to enter a date. The spin dial is another convenience feature for the user. It can be used in the standard way by using a mouse to toggle the up and down arrows to rotate the dial. The date box can also be double clicked with the mouse to pull up a monthly calendar, from which the desired date may be selected.

The database input forms designed for this integrated facility management support system are not without flaws. One problem area with these forms is that as the user browses through records after using the 'View Dates Reserved' push button, he can modify existing records. Since FieldNotes can only link one child database per parent database, the existing records can not be made "Read Only". This is necessary in order to allow additional data input when using the 'Make Reservation' push button. Also, each database entry forms a separate page in the child database. Since FieldNotes can not query child databases, the user must scroll through each page individually to view the existing records within the child database. As discussed earlier, most of these constraints could be eliminated by using object oriented programming to customize a particular system. Despite these flaws, the database input forms designed for this integrated facility management support system were shown to be effective when used during testing.

Database Linkages

The linkages between the parent and child databases are critical when setting up a portable GIS to use as a facility management support system. In order to create the parent-child relationship within FieldNotes, a link must be set up between the parent and child databases, and a push button made to access the link. The initial process in establishing this relationship between databases is to set up the push button which will access the link. Figure 11 shows the dialog box used to establish a push button to link between parent and child databases.

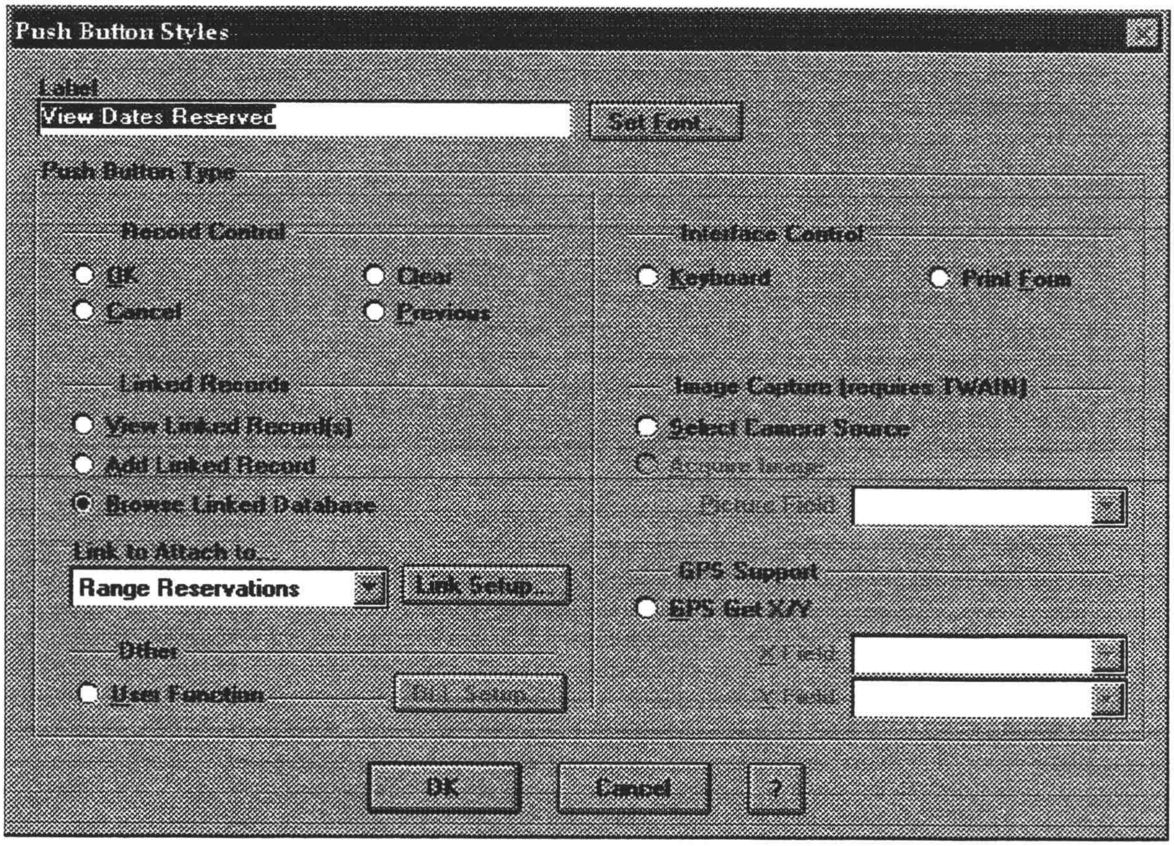


Figure 11. Parent/child database push button linkage dialog box

In order to set up a push button, the user first selects a label to appear on the push button. Next, the type of linkage must be selected. FieldNotes offers three different ways to link records: adding, browsing, and viewing. "Add Linked Record" adds a record to the child database using a link field to link the record to the parent database record. The 'Make Reservation' push button seen in Figure 9 uses this type of linkage with the 'NAME' field being the link field. "Browse Linked Database" allows the user to see the entire child database. The 'View Dates Reserved' push button in Figure 9 uses the browse linkage feature. Finally, "View Linked Record(s)" opens the child database and views the records linked to the parent database record (Penmetrics, 1995). There are no parent-child database linkages in this integrated management support system project that use this type of linkage. The final step in establishing the linkage between a parent and child database is to set the link field. Figure 12 shows the dialog box used to set up this critical relationship.

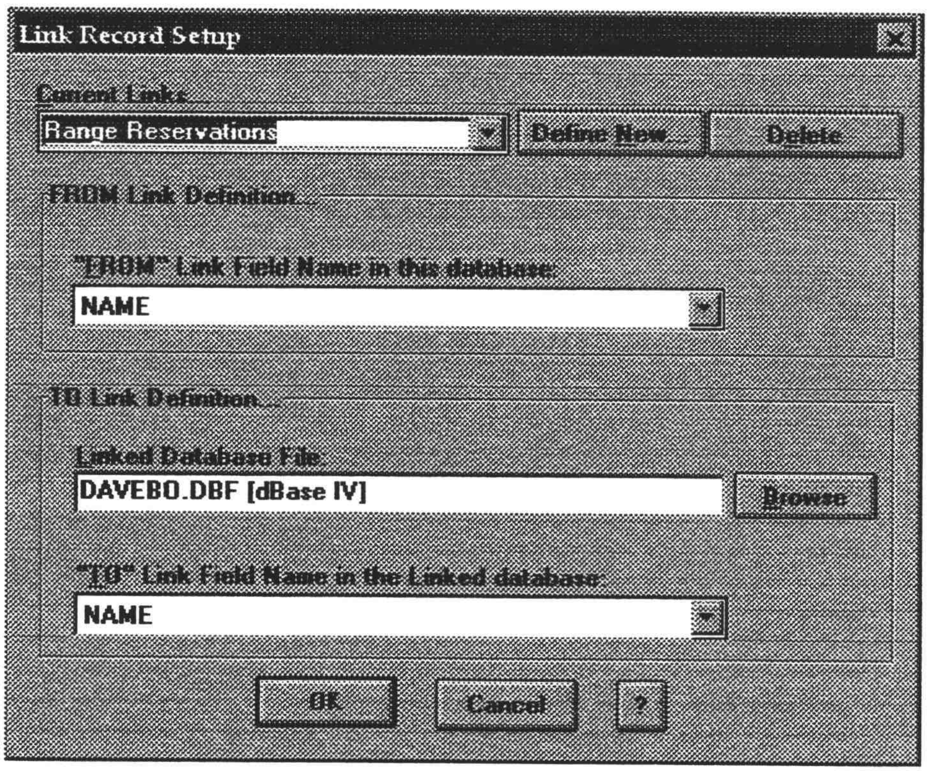


Figure 12. Parent/child database linkage field dialog box

The linkage is first given a name by the user. The desired link field name from the parent database is then entered into the dialog box. Lastly, the child database name and link field are entered to complete the linkage process between the parent and child databases.

Queries

Two query features are available within FieldNotes, "Query by Example" and "Query by Equation". Both query features perform important functions within the integrated facility management support system. However, their usefulness is limited for this project since both query features can only query parent databases and not child databases. "Query by Example" is a textual query feature that can be used to search for specific information about textual data in any database. This query feature is used in the integrated facility management support system project to identify conflicts between environmentally sensitive areas and training area facilities. The "Query by Equation" feature can manipulate database files by using equations to solve queries involving several database fields (Penmetrics, 1995). The "Query by Equation" feature is used in this project to identify when carrying capacity thresholds have been exceeded.

Identifying environmentally sensitive areas within the portable GIS is an important feature of an integrated facility management support system. As was discussed earlier, Camp Rilea has several rare and endangered plant and butterfly species. These species are located within training area facilities on Camp Rilea. The query by example function enables the GIS to remind the user about potential environmental conflicts on the training area data input form. When the user selects a training area data input form that has a potential environmental conflict, a block is checked on the form alerting the user to the potential environmental conflict. FieldNotes can access a parent database through individual facility icons. Double clicking on an enclosed facility polygon icon accesses the parent database. By using the "search within enclosed area" feature within the query by example preferences list, the integrated facility management support system can identify environmental conflict areas (Washburn, 1997). Additionally, the "view/color" function can be turned on within the database "display fields" to highlight in color the training area facility icon that is within an environmentally sensitive area.

The "query by equation" feature may be used to identify a carrying capacity threshold violation of a range or training area facility. Two additional fields must be established within a parent database to use this feature. The 'CAPACITY' field is a numeric field that lists the predetermined carrying capacity threshold in days for an individual facility. The 'DATE' field is a date field that lists the most recent date maintenance was performed on an individual facility. An equation is then used to query the parent database and determine if a facility has violated the carrying capacity threshold. A typical query statement for the integrated facility management support system might be: "Where are all the training area facilities with carrying capacity thresholds more than 70% exceeded?". To solve this query, the training area facility parent database would be queried with the equation [GTYPE((TODAY()-DATE)/CAPACITY≤.7)]. The GTYPE command in this query equation is a drawing query that obtains the type of training area facility polygon icons requested by the equation. The TODAY command is simply the current date within the computer's internal clock.

The "color by value" feature may also be used to highlight in color the individual facility polygon icons where the violations have occurred. The green, amber, or red status symbols may be used as described in the theoretical model. However, with no alarm clock type function available within FieldNotes (Washburn, 1997), this feature is limited by the constant manual updating required in the 'DATE' field. Despite some limitations, both the "Query by Example" and the "Query by Equation" features of

FieldNotes, can perform important functions within an integrated facility management support system.

The application model detailed in this chapter is just one of many possible models for using a portable GIS to develop an integrated facility management support system. However, this application model has accomplished the primary goal of this research project by successfully linking existing facility, environmental, and operational data within a portable GIS.

Testing

This chapter outlines the procedures, conduct, and results of the testing performed on the integrated facility management support system developed for this research project. Testing was performed in order to determine the functionality of the system and to learn ideas for improvement from the Camp Rilea personnel who operate the existing facility management systems. The chapter begins by describing the general procedures followed during the testing. The details of how the testing was designed and conducted is then discussed. The chapter concludes by reviewing the lessons learned from the testing and outlining the ideas for process improvements raised by the Camp Rilea personnel. This chapter confirms the viability of the theoretical concept behind using a portable GIS to develop an integrated facility management support system and demonstrates this through the testing of the Camp Rilea application model.

Procedures

Testing of the integrated facility management support system was conducted on-site at Camp Rilea on 18-20 August 1997. The three phases of testing involved the testing of building, range, and training area facility types. Actual reservation, maintenance, and environmental data from Camp Rilea databases were used in the FieldPack child databases during testing. The Camp Rilea personnel who physically use the existing systems on a daily basis were used to conduct the testing. This was done in an attempt to stabilize as many constants as possible in order to isolate the integrated facility management support system variable during testing. As many situations and scenarios as possible were incorporated into the testing.

Conduct

Testing of the integrated facility management support system was accomplished using the crawl, walk, run methodology. Since the users had no experience with FieldNotes or any other portable GIS package, testing began with an overview of the system. The crawl phase consisted of a talk through hands-on demonstration to show the users how the integrated facility management support system worked. The walk phase involved Camp Rilea personnel physically performing the requiring tasks while being verbally coached by the tester. Finally during the run phase, Camp Rilea personnel performed all tasks independently of the tester, receiving only task commands.

Phase one of the testing involved the building facility test (Appendix B) and included integration of both scheduled and emergency maintenance. Child database sizes for the building facilities used varied from no entries up to 29 entries. Again, all entries were actual Camp Rilea data. All three funding source codes for Camp Rilea (federal, state, and BOQ) building facilities were also incorporated into the testing. Various facility types were used in the testing for all three phases. Phase two of the testing involved the range facility test (Appendix C) and included both seasonal and annual type maintenance. Phase three, the final phase of testing, included the training area facility test (Appendix D) and involved scheduling environmental maintenance for environmentally sensitive butterfly habitat areas. Conflicts were embedded into the test between units requesting to use environmentally sensitive areas versus the environmental maintenance necessary to avoid carrying capacity threshold violations. The final run phase command during the training area facility test required the Camp Rilea personnel to transition between multiple parent databases to accomplish the assigned tasks.

Results

At the conclusion of each phase of testing an after action review (AAR) was performed involving all participants. Camp Rilea personnel were asked their thoughts about the integrated facility management support system and how they compare it to the existing Camp Rilea systems. They were also asked any ways the integrated facility management support system might be improved, how easy the system was to use, and whether having billeting, operations, and maintenance linked into one integrated system was helpful.

The building facility test was conducted with an official representative of Camp Rilea billeting, on 18 August 1997. The billeting representative had no experience working with GIS and immediately found the visual map effect of the various layers very helpful. Several specific FieldNotes applications were mentioned including the pop up calendar display and the "Named Zoom" feature which allows a 'hot list' of frequently used facilities to be formed and quickly accessed. When asked to compare the integrated facility management support system to the existing Camp Rilea billeting system, the billeting representative stated that currently they have to toggle between federal, state, and BOQ building facility types rather than having them all integrated as they are in the integrated facility management support system. The current billeting system has prices for building facilities listed and many building facilities can be seen on a single screen. The integrated facility management support system does not currently list prices and each child database reservation must be accessed separately. The billeting representative mentioned several possible integrated facility management support system improvements: listing unit point of contact and phone numbers on child database input forms, retaining the manual deletion of reservations as a check-in/check-out system check, incorporating a flashing conflict sign to avoid late check-out/new- arrival problems, locking out double bookings for the same date, and making the date field chronological to ease the task of scrolling through each child database separately.

The range and training area facility tests were conducted with an official representative of Camp Rilea operations, on 19 August 1997. As with the billeting representative, the operations representative did not have any previous experience working with GIS. The operations representative also found the map effect produced by the various GIS layers easier to use visually than the RFMSS environment he normally works with. He felt the benefits of this visual map effect increase in correlation to the users familiarity with the geographic layout of the installation. The operations representative especially liked the "Named Zoom" shortcut feature within FieldNotes. When asked to compare this system to his current RFMSS 3.1 system, the operations representative mentioned the calendar format in RFMSS being simpler to use for reservations than the integrated facility management support system scroll buttons. The operations representative mentioned several ideas for possible process improvements to the integrated facility management support system including: listing the activity occurring within the range or training area facility on the child database input form; establishing pick lists for the units using facilities rather than manual entry; and labeling facilities within map layers (although FieldNotes won't allow this, a separate text layer may be established). The operations representative was very encouraged by the prospect of connecting the portable GIS package to the existing RFMSS databases.

Overall, the Camp Rilea personnel felt that the integrated facility management support system was very easy to use and would improve communications and interoperability between the billeting, operations, and maintenance systems at Camp Rilea. By testing the integrated facility management support system at Camp Rilea on several different facility types, the secondary goal of this research project has been accomplished. These tests have confirmed that improvements in the efficiency of facility management operations are possible by using a portable GIS to develop an integrated facility management support system. The testing also demonstrated that an integrated facility management support system can assist in the prevention of carrying capacity threshold violations.

Conclusions

The primary goal of this research project, to link existing facility, environmental, and operational data within a portable GIS to produce an integrated facility management support system, has been accomplished. While accomplishing this primary goal, this research project also met its primary objective of validating the theoretical concept of the system to allow for possible future implementation at Camp Rilea and other U.S. Army installations in the State of Oregon, and the U.S. Army at large. The secondary goal of testing the integrated facility management support system on several different facility types at Camp Rilea was also accomplished. The testing conducted on the system demonstrated its potential for providing improvements in the efficiency of facility management operations, and in the assistance of preventing carrying capacity threshold violations.

Recommendations for Future Research

The next research step beyond this project, which presented a theoretical model and validated an application model for an integrated facility management support system, is to install and monitor an integrated facility management support system. In order to conduct this future research most effectively, several considerations should be examined. The Army National Guard's implementation guidance for the ITAM program states that they will only provide funding for the purchase of the ARCVIEW 2.1 GIS package (Army National Guard Bureau, 1997). Therefore, if the research were conducted at an Army National Guard installation, it may be prudent to design the system to use the ARCVIEW 2.1 GIS package. However, due to the loss of portability when using the ARCVIEW 2.1 GIS package, especially for maintenance field workers, an exception to policy to use FieldNotes or another portable GIS package may be appropriate.

The installation selected for conducting the research implementation of an integrated facility management support system needs to be fully hardwired with a local area network (LAN). A functional LAN is critical to allowing all key components of the facility management process to be fully integrated into the system. The installation's erosion status should also be determined using LCTA assistance prior to conducting the research. The research implementation needs to be tied in fully with the existing RFMSS databases to leverage the capabilities of that powerful system. Finally, the research implementation of an integrated facility management support system should use Visual Basic or another higher level programming language to customize the system to the military installation chosen for implementation.

Summary

With the large number of military installations being shut down in recent years and the downward spiral of military budgets, efficient management of our available resources has become essential. The failure to leverage existing technologies to improve facility management operations and the budgetary costs born on military installations from exceeding carrying capacity thresholds due to poor management can no longer be tolerated. This GIS based integrated facility management support system can be an effective tool for the leadership at Camp Rilea, Oregon, to assist them in accomplishing that task. Hopefully, the lessons learned from this research project can also be applied to benefit other military installations in the State of Oregon, and the entire Army at large.

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APPENDICES

CAMP RILEA SUPPORT REQUEST		
TO: OPERATIONS OFFICER CAMP RILEA ROUTE 2, BOX 497-E WARRENTON, OREGON 97146-9711	THRU: OREGON MILITARY DEPARTMENT STATE OF OREGON ATTN: AROPT-T P.O. BOX 14350 SALEM, OREGON 97309-5047	THRU:
FROM:	ADDRESS:	DATE PREPARED: POINT OF CONTACT/TELE:

TYPE OF REQUEST:	TRAINING STATUS:
[ ] INITIAL REQUEST [ ] CANCELLATION [ ] CHANGE	[ ] INACTIVE DUTY TRAINING [ ] ANNUAL TRAINING [ ] ACTIVE MILITARY USE [ ] CIVILIAN REQUEST

INCLUSIVE DATES: FROM: (DATE)________ TO: (DATE)________

ADVANCE PARTY ARRIVES (DATE)________ (TIME)____ (NO. PERS)____

MALE: (OFF)________ (SR NCO)____ (ENL)____

FEMALE: (OFF)________ (SR NCO)____ (ENL)____

MAIN BODY ARRIVES (DATE)________ (TIME)____ (NO. PERS)____

MALE: (OFF)________ (SR NCO)____ (ENL)____

FEMALE: (OFF)________ (SR NCO)____ (ENL)____

TOTAL NUMBER OF PERSONNEL EXPECTED MALE: FEMALE:

FACILITIES AND EQUIPMENT	YES	NO	REMARKS
BILLETS REQUIRED			
DINING FACILITY REQUIRED	___	___	___
COOKING UTENSILS REQUIRED	___	___	___
RATIONS "A" REQUIRED	___	___	___
RATIONS "MRE" REQUIRED	___	___	___
DA FORM 2970 SUBMITTED	___	___	___
HQ/ORDERLY ROOM REQUIRED	___	___	___
TROOP MEDICAL BUILDING 7315	___	___	___
SUPPLY ROOM REQUIRED	___	___	___
CLASS "A"/AUTOVON SERVICE REQUIRED	___	___	___
AMMO SUPPLY POINT (ASP) REQUIRED	___	___	___

POL/PLL REQUIRED
MOGAS GAL_____ DATE/TIME________
DIESEL GAL_____ DATE/TIME________

CHEMICAL LATRINES REQUIRED [ ] YES [ ] NO LOCATION________

MILITARY DEPARTMENT/CAMP RILEA OPERATIONS OFFICER USE ONLY			
DATE RECEIVED	DATE APPROVED	DATE RETURNED TO UNIT	APPROVED BY:

AGO FORM 207, 1 JUL 94. Previous editions of this form are obsolete and will be destroyed. For use of this form see ORNG PAM 350-5

Appendix A1. AGO Form 207 (front)

RANGES AND TRAINING AREAS			
ESTABLISHED RANGES		ESTABLISHED TRAINING FACILITIES	
NAME	DATE REQUIRED	NAME	DATE REQUIRED
ZERO		MOUT SITE	
KNOWN DISTANCE (KD)		NBC CHAMBER	
MODIFIED RECORD FIRE		OBSTACLE COURSE	
NIGHT FIRE (MRF)		WEAPONEER	
SQUAD LIVE FIRE		LAND NAVIGATION (EIB)	
PISTOL		RAPPEL TOWER	
M203-TP/50 CAL		MILES ASSAULT	
LAW SUBCAL/AT4 SUBCAL		FORCED MARCH 6K	
DEMOLITIONS		FORCED MARCH 12K	
CLAYMORE		TWO MILE RUN	
81MM SABOT		ORIENTEERING	
HAND GRENADE		BRIDGE TRAINING SITE	

ON POST TRAINING AREAS	DATES REQUIRED	OFF POST TRAINING AREAS	DATES REQUIRED
1		CLATSOP RIDGE	
2		TWILIGHT	
3		ROCK CREEK	
4		FISHHAWK/HUMBUG	
5		300 LINE	
6		TIDEWATER/ELK MOUNTAIN	
7		FORT STEVENS STATE PARK	
8		SADDLE MTN STATE PARK	
9			
10			
11			
12			
13			

NIGHT TIME OPERATIONS:	DATE:	TIME:

SPECIAL PURPOSE BUILDING REQUESTS			
BUILDING	DATE REQUIRED	BUILDING	DATE REQUIRED
7001 ARMORY DRILL FLOOR		7230 HALL OF HONOR	
7001 ARMORY CLASSROOM		7228 LAUNDROMAT	
7001 ARMORY KITCHEN		7226 CLASSROOM	
7015 GYMNASIUM		7302 OFFICER'S CLUB	

1. Units other than the Oregon Army National Guard must make funding arrangements through the USPFO for Oregon (telephone: COMM 503-945-3946; AUTOVON 355-3946) prior to arrival at Camp Rilea.
2. Oregon Army/Air National Guard units requiring equipment from Camp Rilea must use AG Form 740. All other non-Guard units will attach a letter of requirement to this form.
3. DA Form 1687 (Notice of Delegation of Authority-reciept for Supplies) must be completed and signed by the Property Book Officer indicating authorized representative, and be on file at Post Supply (Bldg 7401), TISA, and UTES prior to obtaining any supplies, equipment, ranges, or training areas.

Appendix A2. AGO Form 207 (back)

Building Test Commands

Crawl Phase Commands:	**Result:**
1) Reserve BOQ 101 for tester from 20-22 Aug	(No-Emergency Maint Scheduled)
2) Reserve BOQ 100 for tester from 20-22 Aug	(OK)

Walk Phase Commands:	**Result:**
1) Reserve Bldg 7251 for BG Rosenfeld 27-29 Aug	(No-Gov Kitzhaber reserved)
2) Reserve Bldg 7251 for BG Rosenfeld 2-4 Sep	(No-Maint on 2 Sep)
3) Reserve Bldg 7251 for BG Rosenfeld 3-4 Sep	(OK)

Run Phase Commands:	**Result:**
1) Reserve Bldg 7023 for C/326 En Bn on 14 Sep	(No-Maint Scheduled)
2) Reserve Bldg 7023 for C/326 En Bn on 12 Sep	(No-Reserved 7/101 AV)
3) Reserve Bldg 7023 for C/326 En Bn on 15 Sep	(OK)
4) Schedule Bldg 7026 for Emergency Maint 3-5 Sep	(OK)

Appendix B. Building Facility Test Commands

Range Test Commands

Crawl Phase Commands:	**Result:**
1) Reserve Zero Range for OSP Academy 20 Aug	(No-Seasonal Maint Scheduled)
2) Reserve Modified Record Fire Range for OSP Academy 20 Aug	(OK)

Walk Phase Commands:	**Result:**
1) Reserve M203 Range for C/326 En Bn 30-31 Aug	(No-3/320 FA using)
2) Reserve M203 Range for C/326 En Bn 6-7 Sep	(Seasonal Maint on 6 Sep)
3) Reserve M203 Range for C/326 En Bn 7-8 Sep	(OK)

Run Phase Commands:	**Result:**
1) Reserve KD Range for C/326 En Bn on 2-3 Sep	(No - Seasonal Maint Scheduled)
2) Reserve KD Range for C/326 En Bn on 6-7 Sep	(No - Reserved 115 PAD)
3) Reserve KD Range for C/326 En Bn on 4-5 Sep	(OK)
4) Schedule Pistol Range for Annual Maint 11-12 Oct	(OK)

Appendix C. Range Facility Test Commands

Training Area Test Commands

Crawl Phase Commands:	**Results:**
1) Reserve TA 3 for OSP SWAT 20 Aug	(No-1/187 IN Scheduled)
2) Reserve TA 4 for OSP SWAT 20 Aug	(OK)

Walk Phase Commands:	**Results:**
1) Reserve TA 10 for 2-187 IN on 6-8 Sep	(No-Enviro Maint Scheduled)
2) Reserve TA 10 for 2-187 IN on 9-11 Sep	(No-3/327 IN Scheduled))
3) Reserve TA 10 for 2-187 IN on 3-5 Sep	(OK)

Run Phase Commands:	**Results:**
1) Reserve TA 1 for C/326 En Bn on 9-10 Sep	(No-Enviro Maint Scheduled)
2) Reserve TA 1 for C/326 En Bn on 6-7 Sep	(No-Reserved 115 PAD)
3) Reserve TA 1 for C/326 En Bn on 11-12 Sep	(OK)
4) Reserve TA 10 for environmental maintenance for Oregon Fish & Wildlife on 15-16 Sep 97 and also Schedule BOQ 102 for them.	(OK)

Appendix D. Training Area Test Commands