

# The Navajo County Information System

## A Case Study Review of a GENII Information Enterprise

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**A. Overview** The Navajo County Information System (NCIS) is an excellent example of an enterprise information integration (EII) project. Although the project was began as a replacement for a legacy highway work management system (PECOS), the approach selected by County staff was to use EII software and the PECOS replacement project to seed an enterprise information integration effort. The Genesis Enterprise Information Integrator (GENII) was selected as the EII software and approach.

At the present time, NCIS is integrating 320 applications from a dozen different databases, entailing 307 tables. Over 3.7 million records and 4900 data fields are under read/write/create management. From project month six through eighteen, NCIS facilitated the creation of an average of 20 thousand new records every month. There are approximately 140 NCIS users. General areas of integration include:

Highway Work Management General Ledger Building Permits e911 Addressing  
Traffic Counts Building Inspections Fleet Management Fleet Work Orders Waste  
Water Permits Planning and Zoning Permits Flood Plain Management GIS Spatial  
Data Animal Control Food Permits Zoning Enforcement

Three key points with respect to NCIS should be noted:

- The total system and implementation cost was affordable: \$140 thousand at project completion (12 months and 180 applications), with \$26 thousand for additional data cleaning and incorporation (320 applications at 20 months).
- Application development is extremely fast and can be accomplished by lay personnel.
- Global queries facilitate the asking of single questions to the entire enterprise. Enter a parcel number and all building permits, zoning permits, parcel data, addresses, and other parcel correlated information is pulled all at once. A piece of road may be selected and all signage, work, traffic counts, and associated information are pulled all at once.

**B. Navajo County, Arizona** Navajo County is located in northeastern Arizona, containing some of the most scenic and rugged terrain in the State. The rise of the Colorado plateau creates an eastwest rim, dividing a low desert from a low desert in a feature called the Mogollon Rim. Forested areas spot the mountainous areas on and about the rim. The County contains approximately 10,000 acres with a population of 100 thousand. Prominent incorporated areas include the cities of Show Low, Holbrook, and Winslow.

**C. Project Overview** NCIS began as a request for proposals (RFP) to replace the legacy work management system called Pecos. Pecos was supplied to the County by the Arizona Department of Transportation as a unified means to collect, store, and query the labor materials, and

equipment used to maintain highways. Through time, support for Pecos became unavailable and the product was considered difficult to use in terms of reporting. However, the data design of Pecos was exceptional; the data were clean and relationally stored using information technology best practices. The Pecos replacement RFP was written by the Public Works GIS Director, who also understood the basic concepts of EII. As written, the RFP left room to use the Pecos replacement project as a seed for a County EII initiative. The product of the integration initiative became NCIS, the Navajo County Information System.

Unfortunately, the GIS director with the EII vision left County employment the very day the project started. This left an upper management void in terms of the envisioned EII initiative to be coupled with the simple Pecos replacement. This would lead to several managerial reviews of the project until upper management understood the methodologies of the project. Essential to the project's success were the remaining staff who shared the outgoing GIS Director's EII vision, and helped to push NCIS to its most productive limits.

**D. Project Methodologies** GENII EII software implementation employs methodologies which differ from traditional information technology projects:

- Data are not formatted and loaded into GENII; rather GENII reaches out to existing data wherever they are stored. This means most project time and effort go to County data improvement rather than specialized software procedures or development.
- GENII data applications can be built faster than the time it takes to explain the process. Changes to data, data model, user input, or business process can be accommodated in minutes. This changes the standard of application development from requirements, development, and acceptance; to a quick initial build followed by user-guided evolution. This reflects the writer's adage of, write it and then get it right. As a result, applications can be built at the rate that data can be supplied by management to be incorporated into the EII environment.

The net result was a Blitzkrieg project methodology: any data which was ready for integration was immediately built into NCIS. More difficult items were placed in a queue until a method was found to clean up the data into a form which could be integrated. As illustrated in the table below, this resulted in an initial rapid startup, with a general increase over time in the number of hours required per data/business area conversion.

Month	Hours into project	Key Datasets Integrated	Number of NCIS Applications
1	120	General Ledger Deposit Receipts Roadway Abandonment Flood Requests Flood Parcels	40
3	421	Building General Ledger Floodplain Use Permits Resolution Logs Temporary RV Permits Subdivision Master E911 Addressing Zoning Enforcement Building Permits	108
		Building Deposit Receipts GIS Support Data	

5 545 Signs

131 7 750 Work Management

150 9 1000 Fleet Management

180

For example, although Pecos was a very complicated application, its data were well structured and clean. Very few hours were required to incorporate it into NCIS. To the contrary, fleet management data were stored within an unstructured flat file, and the meticulous hand cleaning of individual fields within individual records was required.

**E. Domains Provide Common Search Keys** A domain is the set of valid values for each piece of information. Domains help ensure data integrity and also facilitate extremely useful Global Queries. For example: signs, e911 addresses, roads, work management, and permits should all use the same set of valid road names. Likewise: permits, subdivisions, e911 addresses, and work activities should use the same set of valid values.

The key initiative of NCIS was to flush through all County data the same set of parcels, road names, and subdivision names. In the case of road names, separate lists were maintained by e911, highway maintenance, signs, and subdivisions. The same situation existed for subdivisions and parcels (many workers had their own set to parcels and subdivisions).

If one were to ask what was the most powerful tool offered by NCIS, it would be the Global Queries. These are made possible from the use of the common domains. At the twenty month points, NCIS contained the following number of common domains:

Domain Type	Number of Domains
Integer Domain	121
String Domain	108
Range Domain	6
Foreign Domain	85

**F. Technical Brief** GENII functions as a hub which can connect to any number of tables, within any number of databases, mounted on any number of different database platforms. It can interpret structured data, unstructured data, spatial data, and time-dependent temporal data. Table relationships are maintained as metadata such that an IT DBA is not required to watch over application development. NCIS contains three hundred tables and 200 relationships. Through these relationships it is possible for a user to select a section of road from a map, determine what work was done on the road, link to what equipment was used, find the mileage of that equipment, determine when the equipment went in for its last oil change, and then link to the number of quarts of oil used and how much they cost.

GENII software is mounted alone on a dual core .NET web server with 9GB RAM. It addresses data located on a dozen other database servers. Users can authenticate to the system using Windows Active Directory, and the GENII security system functions well through the County VPN concentrator.

**G. Project Outcome** NCIS has provided a focal point for both data standardization and emphasis on data which are valuable to the organization. Specifically:

- NCIS displays its 320 integrated applications in a single view. What data are available—and not available—are evident to all users.
- Data which are in poor condition, or cannot be transformed into information easily, are readily visible to managers. Because the job of NCIS is to get the information out, bad data are easily spotted. Likewise, NCIS provides a framework to clean and evolve data into more useful forms.
- NCIS facilitates easy data entry: within the first month of operation of the Pecos-replacement applications, two employees were able to create 10,000 new records.
- NCIS reports to managers the number of applications, tables, fields, and records managed by the system. Likewise it summarizes the number of new records created by each application within it each month.

H. Costs and Benefits Total project costs through the twentieth month are listed below:

Cost	Date	Task or Item	Cost	Date	Task or Item	Cost
	15 Sep 2006	Project initiation	\$65,000	01 Apr 2007	Software acceptance and purchase	\$74,800
				01 Aug 2007	County data value adding and training	\$10,355
	15 Sep 2007	Annual software maintenance for second year				
				28 Jan 2008	Fleet and other data cleaning	\$7050
				25 Jan 2008	County data valueadding	\$2100
					County data valueadding, including the creation of 4100 P&Z records by hand from paper files.	\$175,955
\$16,650	01 Apr 2008	Total system and data cost				

NCIS has eliminated the following software from the Navajo County inventory, and the maintenance costs associated with them:

- Cartography (signs and assets).
- RTA (fleet management).
- Pecos (work management).
- Paradox (building permits).
- ArcIMS (internet mapping).
- Numerous replacements of unstructured data: Access, Word, and Excel.

The following has been cited as principle NCIS benefits:

- Brought many departments together by eliminating information silos.
- Data development efforts have ensured open access to all data with data formats stressing best practice.
- NCIS emphasizes that EII is about data format, content, and interoperability, and not the software used to access it.
- The distribution of GIS spatial capability without a large capital outlay.
- Applications can be developed rapidly and can be built by competent lay users.
- NCIS promotes and nurtures enterprise growth. New applications are routinely added.
- Both NCIS use and administration are web distributed, making the distribution of information and application development a simple process.

NCIS continues to grow and promote better customer service at lower operating costs.