

# **KUTZTOWN UNIVERSITY ARBORETUM PROJECT OR “WHERE ARE THE TREES?”**

**Robert N. Martin**

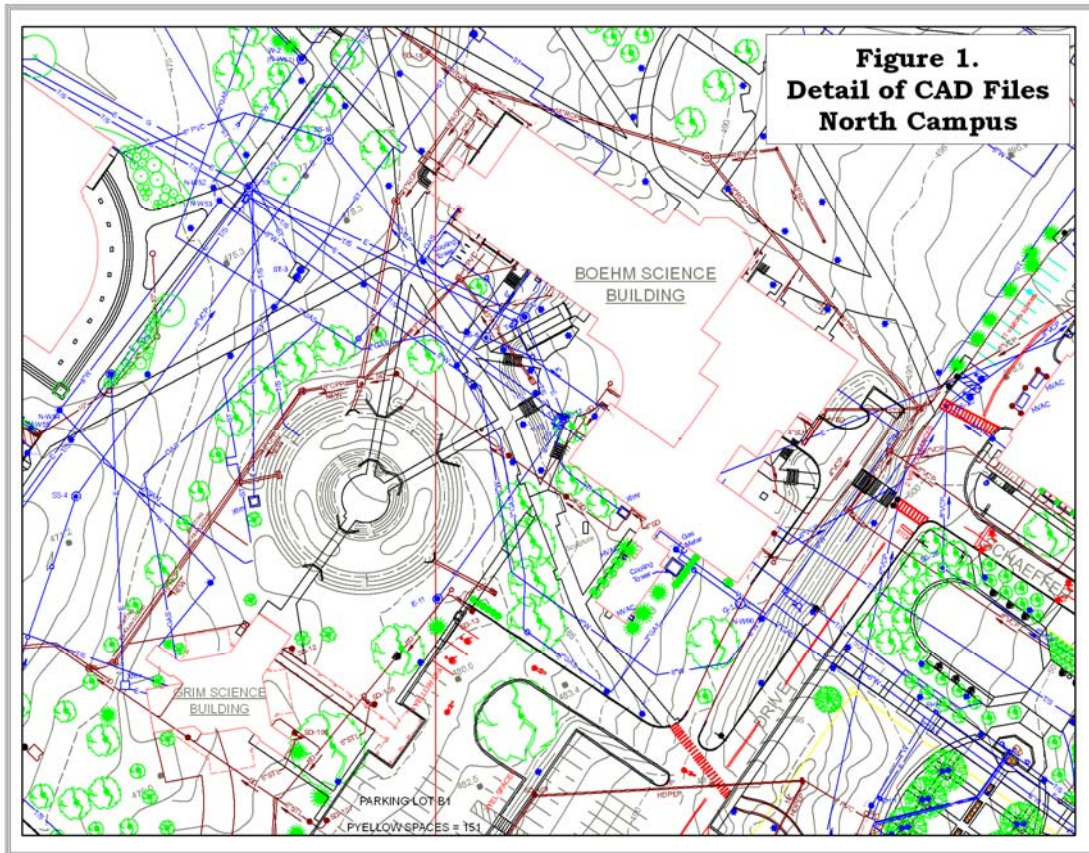
## **ABSTRACT**

The President of Kutztown University has set as a goal for the university the establishment of an arboretum encompassing the campus. The Department of Geography is developing the GIS database using ArcGIS for the arboretum project. The Department of Biology is providing the expertise in species identification for the project. This paper reports on the joint efforts of these two departments to develop the arboretum database. Specifically, this paper discusses the elements of database, the use of CAD-based data files from the campus architect's office, data collection methodologies, and the roles played by students in the fulfillment of the project. The paper concludes with a discussion of the use of the database as a learning tool for students in both departments.

## **BACKGROUND**

In the 1990's the Physical Facilities office of Kutztown University contracted with STV Architects, an engineering firm, to develop a CAD-based campus plan which would be used for renovations and construction on the campus. These renovations would include the Boehm Science building where the Geography Department presently resides. Because I thought that the plan would be a good learning tool for my GIS classes, I was able to obtain a copy of the two AutoCAD files for the campus through the head of the physical facilities. One file contained all the basic facilities and structures on the campus, while the second file contained elevation information for the campus. See Figure 1.

These CAD files have been used in several exercises in the GIS classes I teach. The initial use of the files was to show the students how to geo-reference the CAD files by using a Trimble ProXRS global position system and ArcView software. Basically the students had to identify a series of points within the CAD file that were spread across the campus and were easy to identify when in the field on campus. Then using the GPS systems the students collected the coordinate values of these points, transferred the coordinate information to their computers and performed the geo-referencing of the CAD files. Another example was to use the geo-referenced elevation CAD data to develop surface run-off models to determine if the storm drains were in the correct locations. These files were also the basis of the student exercise on handicapped routing on campus that I presented at the 2007 ESRI Education User Conference.



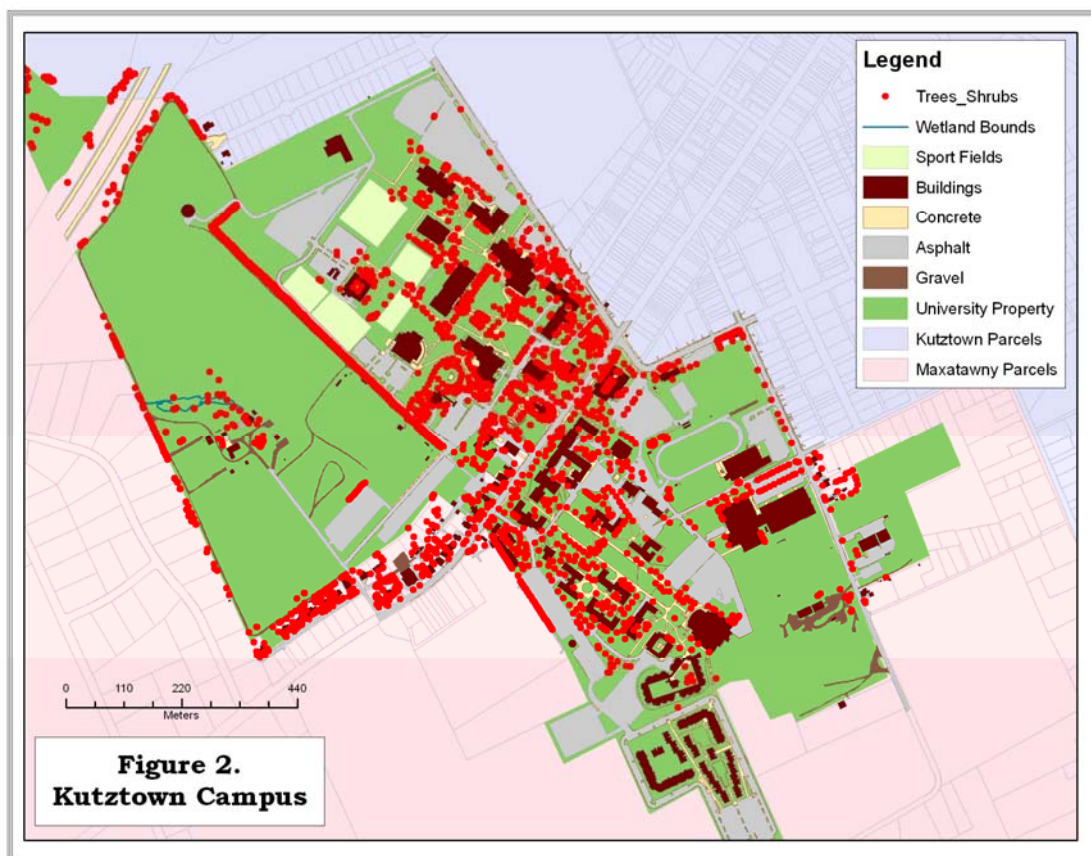
### **THE ARBORETUM DATABASE**

An element of the CAD files which directly relates to topic of this paper is the inclusion by STV Architects of over 3,500 trees and shrubs on the campus as features. Once the campus CAD files were geo-referenced, a database could be created that would become the arboretum database. The reason for incorporating this project into the GIS class is the fact that much of the data that the students use in my GIS classes had already been attributed or contained spatial objects that could be joined with attribute files. Using the campus trees as spatially referenced objects would allow the students to experience first-hand field data collection. Therefore in the summer of 2000 I asked Dr. Chris Sacchi from the Biological Sciences Department if he would be willing to provide some basic guidance for my GIS students to develop an arboretum database. I knew Dr. Sacchi had work at two arboretums before coming the Kutztown and that he was interested in establishing one on our campus.

During the fall term of 2000, Dr. Sacchi provided the GIS students with information on the attributes in a typical arboretum database as well as showing them examples from other arboretums. Attributes were established in the tree shapefile of the campus database. Using the *Tree Identification Keys to Common Trees* guide developed and used by the Biology Department, the students were assigned a small portion of campus

within which they had to collect information on the trees. The information collected included common name, diameter at breast height, and the status of the tree (viable, removed, or new). Since the students had a map of that portion of campus with each tree having an ID code, data collect was simple once they got the hang of how to use the *Tree Identification Keys*. Back in the GIS lab the students then added the attributes to the shapefile for trees and produced a map of their study area.

Because of construction, the arboretum project was placed on hold until the new science building was completed. Unfortunately in the move from the old science building to the new, the students' trees files were lost. However, the project was revived in the spring of 2006 when I had members of the Advanced GIS class build a geodatabase for the campus with ArcGIS from revised AutoCAD files for the campus, see Figure 2.

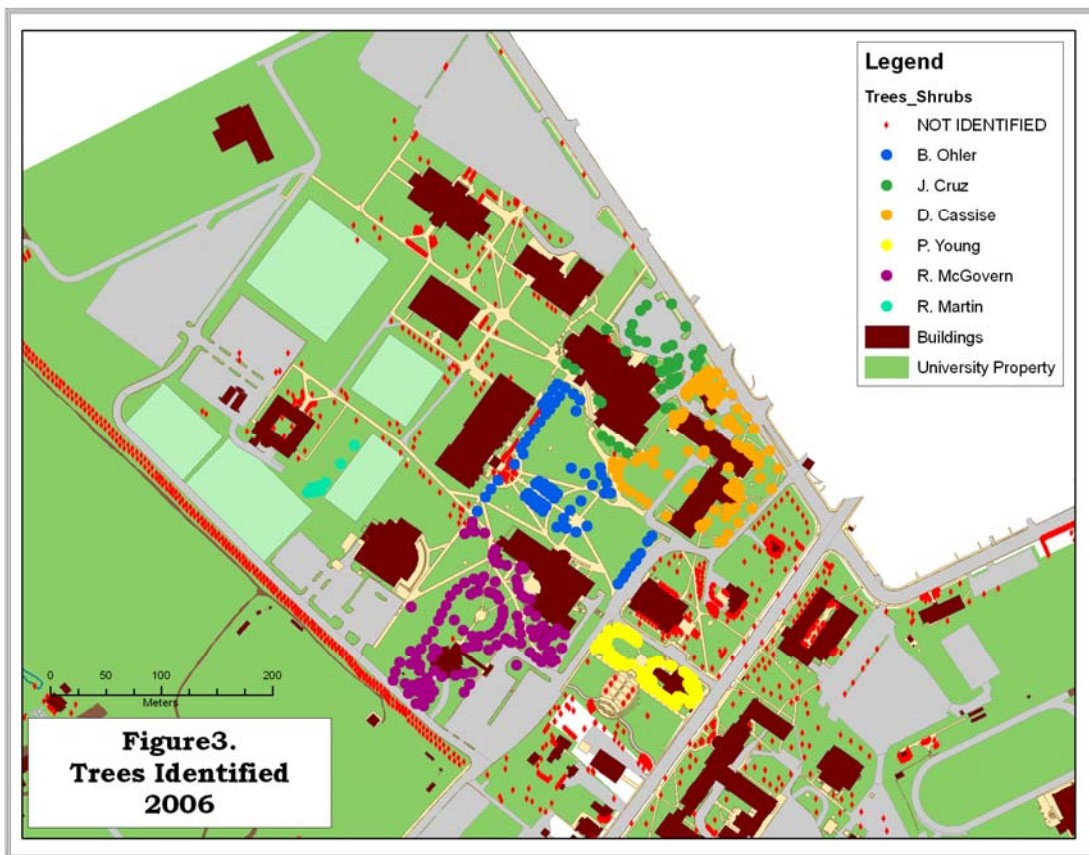


Again Dr. Sacchi assisted by helping the students identify the basic attribute elements needed in the arboretum database, see Table 1.

**Table 1. Arboretum Attributes**

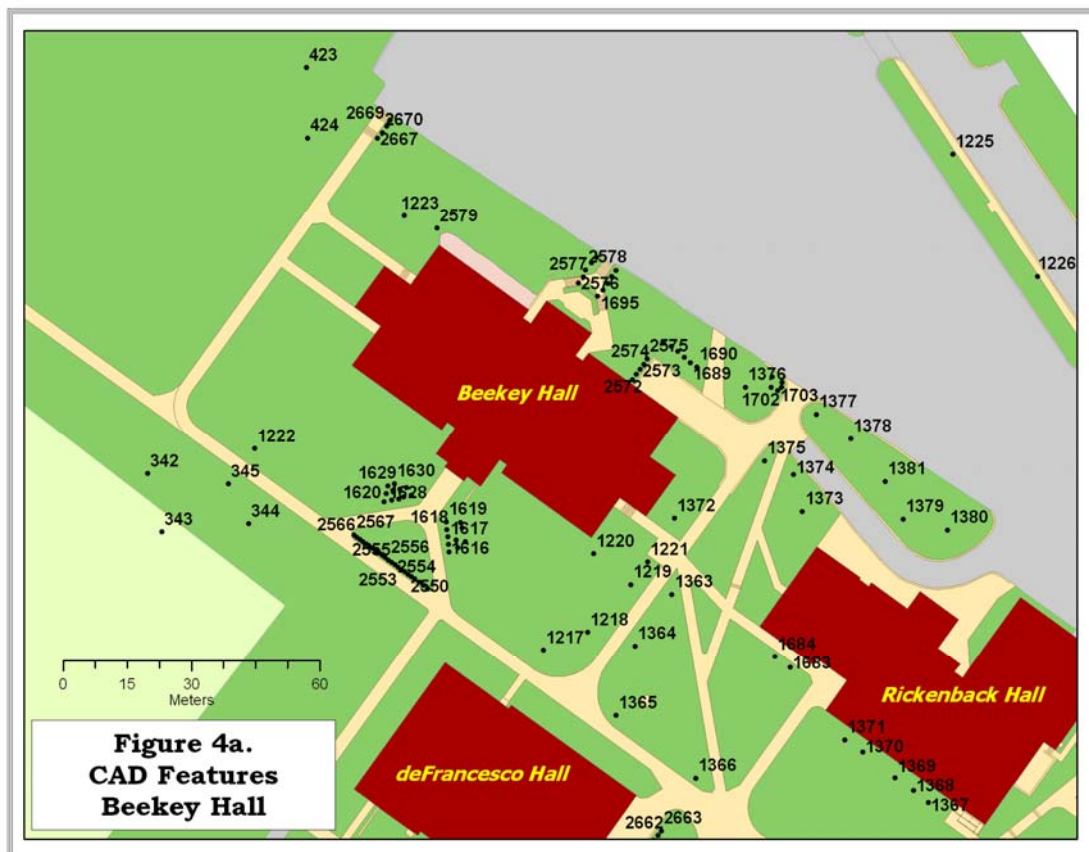
Common Name	Accession
Diameter Breast Height	Source
Multi-Trunk	Origin
Reproductive	Status
Family	Date Removed
Genus	Reason Removed
Species	Person Updating
Variety	Labeled
Cultivar	Date Planted

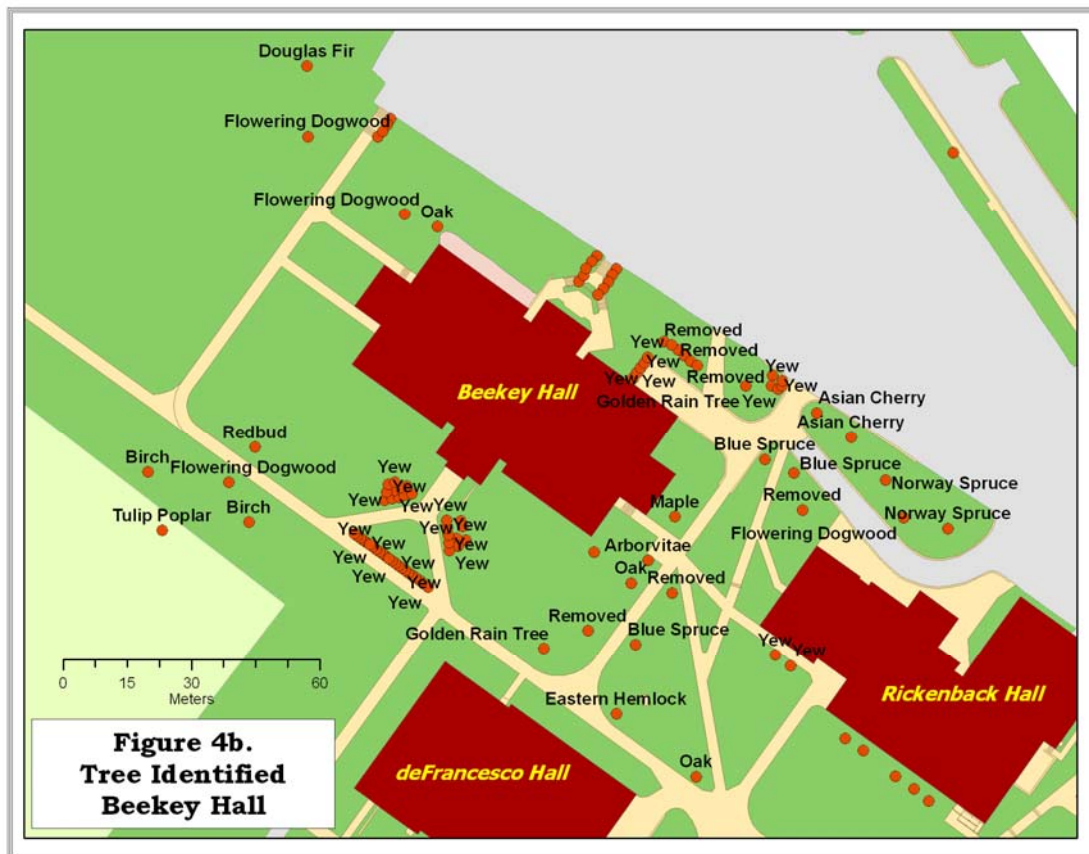
While the database design was a class group project, each student was responsible for identifying the trees in a particular area of North Campus. The major problem that the students experienced was the late arrival of spring. With only two weeks left in the semester, the trees finally began to leaf out. The students were able to collect their data and attribute the database. See Figure 3. The lesson I learned from this experience was do not have students work on the arboretum project in the spring term.



No further work was done on the project until the fall term of 2007. During the President's State of the University speech at the opening breakfast in late August, Dr. Cavallas announced that the Kutztown University would develop a campus arboretum based on Dr. Sacchi's efforts. To help develop the database two geography classes, Introduction to GIS and Field Methods in Geography, became involved in data collection for the arboretum database during the fall term.

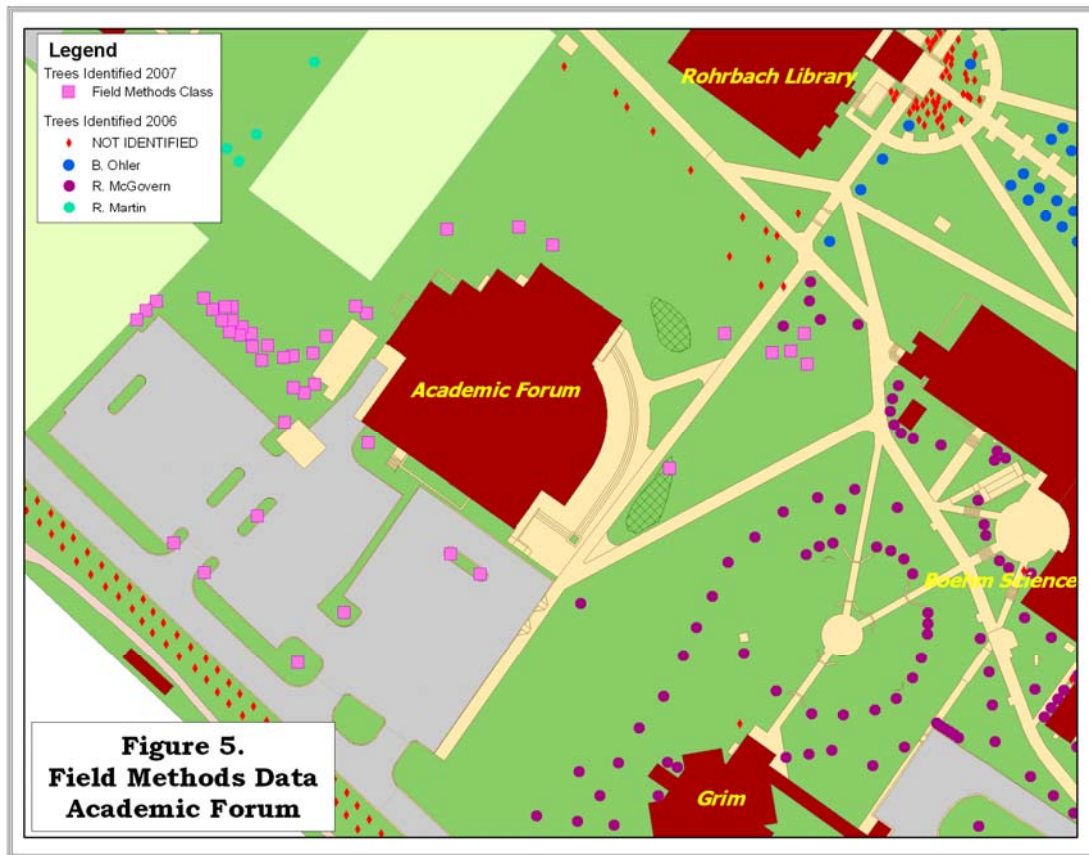
Members of the Introduction to GIS class term were assigned areas around Beekey Hall which houses the College of Education, see Figure 4. Since this was a large class with over thirty students, the study area was split into four sub-areas for which a student group was responsible. An approximately equal number of students were assigned to each of the four groups. At least one biology/environmental science major who was familiar with the *Tree Identification Keys to Common Trees* guide was a member of each group. To simplify the process the Beekey tree data had been extracted from the campus file. A base field map was printed for each sub-area with each vegetation feature indicated by their Feature ID. Corresponding tables were also generated. The Feature ID's were recorded within the table as well as the principle attribute fields that would be collected using the database design established by the spring 2006 class. Based on their field work the groups attributed their spatial objects, exchanged data sets, and created a single merged dataset that was then rejoined with the campus arboretum dataset.





Dr. Lindsay Spigel, a temporary geography faculty member, taught our Field Methods in Geography class during the fall 2007 term. She had her students collecting information on a variety of features on campus using traditional methods and global positioning systems. The field method students determined locational information and attributes of the trees and other vegetation around the Academic Forum since this information was not part of the original CAD files. This data was then incorporated into the arboretum database, see Figure 5.

Development of the arboretum database has been a worthy project for the students at Kutztown University. Students in the GIS classes have learned how to use CAD files as a source for building a geodatabase. They have learned how to georeference data recorded in page coordinates to the face of the earth. And they have learned how to attribute spatial objects from the world in which they live. The database will continue to be used in the GIS classes. With the fall term Biological Science department plans to have a group of students attributing and updating the arboretum database on a regular basis.



## RECENT AND FUTURE DEVELOPMENTS

Recently the University hired a horticulturist as a member of the physical facilities staff who is responsible for maintaining and improving the vegetation on campus. Using Kutztown University's site license for ArcGIS the arboretum geodatabase will be used by the physical facilities staff, the Biological Science Department and the Geography Department to complete and maintain the database. As I write these lines in late May campus improvements and renovations have already required changes to the made in the arboretum database. There are two planned improvements with the database. First an image file of the objects within the arboretum database will developed. Second, we are looking a developing an internet map application for individuals to access the data. With less than 20% of the trees and shrubs on campus identified, the arboretum project will keep the students and interested faculty busy for many years.

## REFERENCES

Robert N. Martin, "Finding a Way: Student Exercises with Network Analysis,"  
*Proceedings of the 7<sup>th</sup> Annual ESRI Education Users Conference*, Redland,  
 CA: ESRI, 2007.

## **ACKNOWLEDGEMENTS**

I would like to thank the following individuals who made this project a success:

Dr. Christopher Sacchi, Biological Sciences Department

Dr. Lindsay Spigel, Department of Geography

Advanced GIS Students, Spring 2006

Dominick Cassie, Jonathan Cruz, Ryan McGovern, Barry Ohler, Peter Young

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