



*GIS Application in Airport Engineering:
Locations of Air Route Surveillance Radar*

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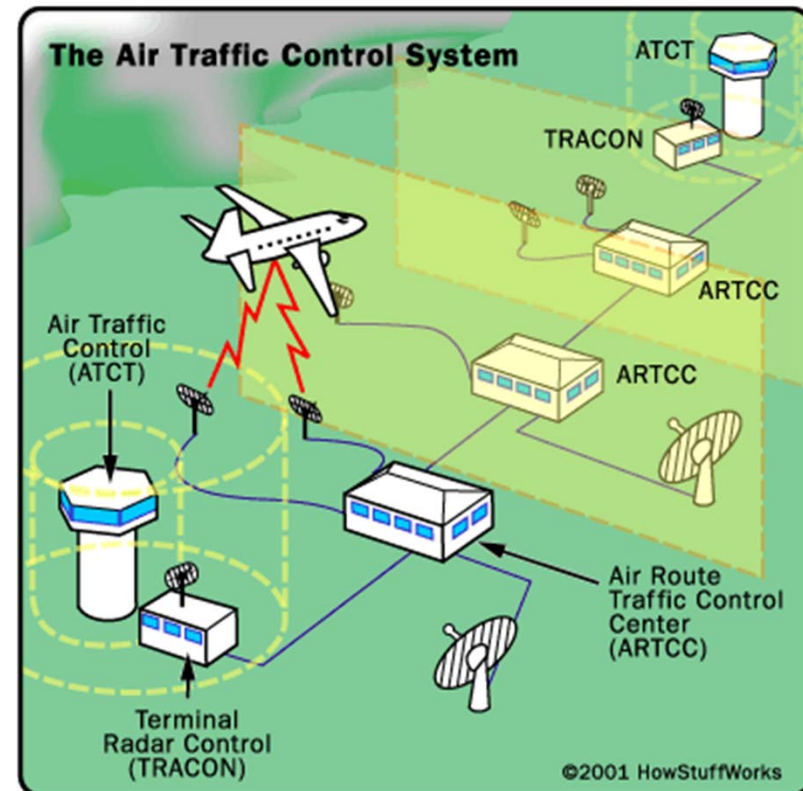
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- **GIS has been used by engineers in design and planning the past few years.**
- **GIS becomes “a decision maker” in engineering.**
- **GIS shortens the time consumed.**
- **This project is to examine the application of GIS in proposing/recommending site locations and settling air route surveillance radar.**

Introduction

- The increasing of population and traveling demand from one place to another place needs more infrastructures to be built such as air traffic system planning in order to accommodate people to travel.
- The air traffic system includes: airport, airways, airlines, air passenger, general aviation, supporting facilities, etc.



- **FAA (Federal Aviation Administration) recognizes two types of radars:**
 - ✓ **Airport Surveillance Radar (ASR)**
 - ✓ **Air Route Surveillance Radar (ARSR)**

- **Airport Surveillance Radar (ARS) established to support aircraft for landing and take off.**
- **ARS reduces conflicts between aircrafts and optimizes the capacity of the airport.**
- **Air Route Surveillance Radar (ARSR) is a system of long-range radar design to provide a display of aircraft operating over a large area, especially en route aircraft flying the airways.**
- **ARSR provides the ground base air traffic controller with information on the azimuth and distance position of each aircraft in the airway.**

- **The radars are installed on a nationwide basis with a range of 200 mile (Ashford, 1992).**
- **ARSR will eventually produce an increase in airways' capacity by permitting a reduction in separations between aircraft flying at the same altitude.**



Problem Description

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- **The government via Department of Transportation is planning to build a surveillance radar system for air traffic.**
- **This project is to provide state of California new air route surveillance system which will be spread out throughout the country.**

- **Engineering Requirements:**
 - ❖ **Installed in 200 mile (322 km) distance between each unit of radars; a standard design from Federal Aviation Administration .**
 - ❖ **3 km distance from river and streams; soil suitability and preventing flood.**
 - ❖ **3 km distance from water bodies; soil suitability and preventing flood.**
 - ❖ **10 km distance from volcanoes; preventing from eruption impact.**
 - ❖ **5 kilometer from busy area/urban; due to magnetic fields and interference.**

- **State governmental requirements:**
 - ❖ **10 km from existing airport.**
 - ❖ **5 km from highway.**
- **Cost:**
 - ❖ **The lower cost of land purchase corresponds with the lower density of people live in.**
 - ❖ **Better to locate on unusable land.**

Study Area

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The study area is entire state of California.

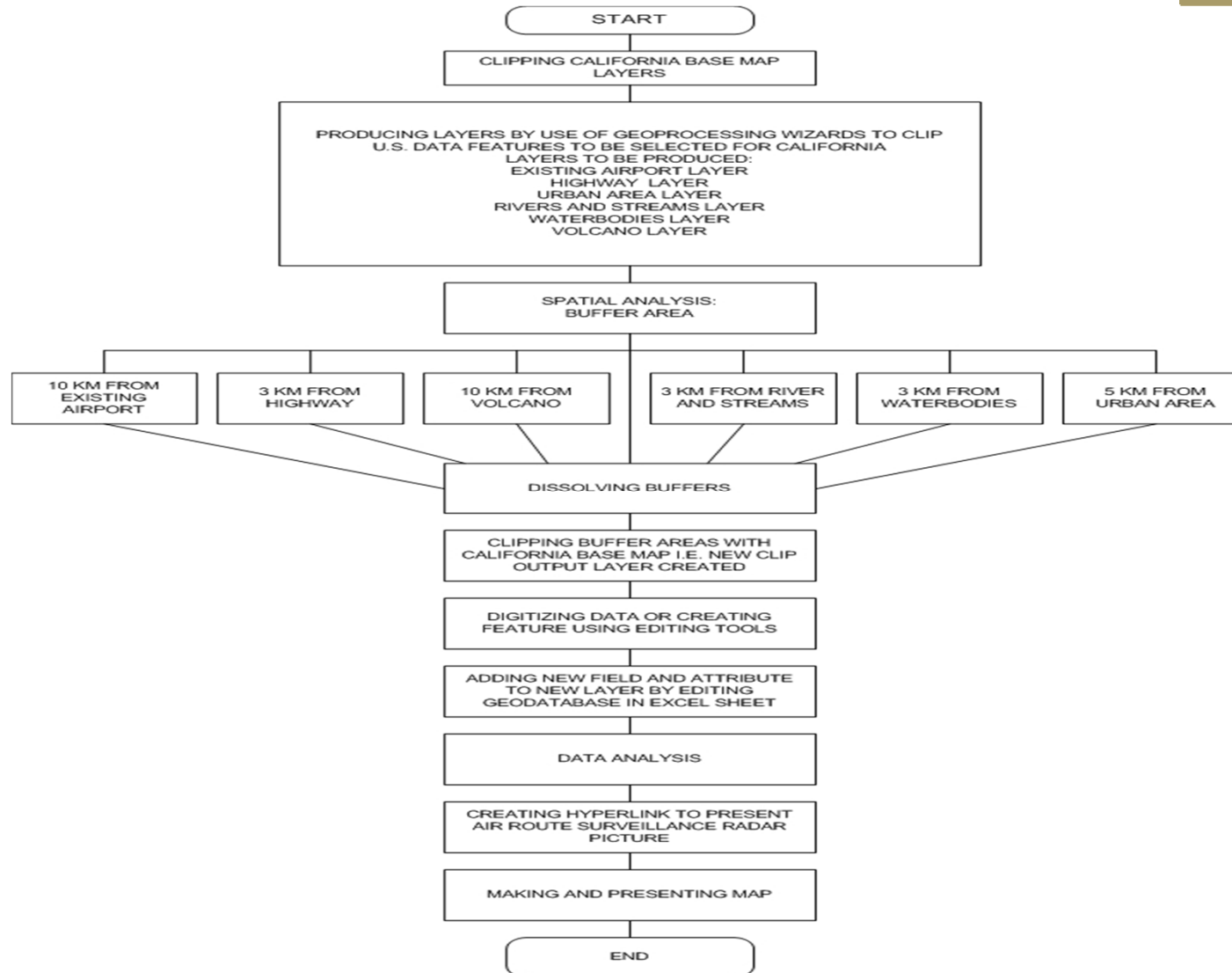
ArcGIS version 8.1 package.

- **Data used are from ESRI resources. The layers available are:**
 - ❖ **US Base-map layer**
 - ❖ **US counties layer**
 - ❖ **Airports layer of US**
 - ❖ **Highway layer of US**
 - ❖ **Urban area layer of US**
 - ❖ **River and Streams layer of US**
 - ❖ **Waterbodies layer of US**
 - ❖ **Volcano layers of US**

- **The process starts by selecting the features and creating state of California layers using geoprocessing wizards.**
- **US data are selected for state of California by clipping process.**
- **These processes applies to all layer and feature needed.**
- **The second step is to analyze spatial data by using buffer analysis.**
- **All the area which are avoided or not expected to where the radars will be installed shall be hided.**

- **The last but not least is to create the features i.e. location for radars done through edit session.**
- **The maximum distance between each radars should be 200 mi.**
- **Then the new layer called radar layer is created.**
- **Digitizing data and adding field and attribute is done through editing geodatabase.**
- **File named radar .dbf is opened, edited and saved with Microsoft Excel package and stored in the same file.**

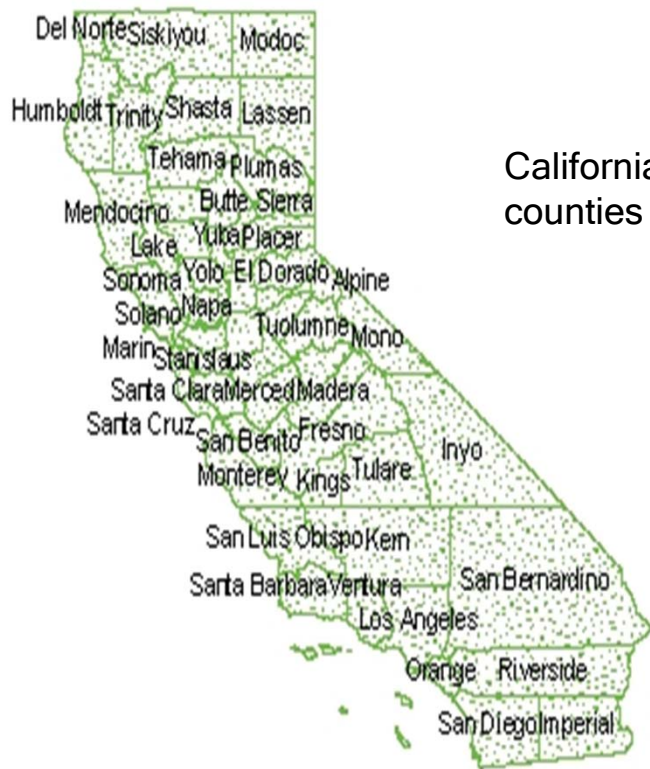
Analysis - cont'd



- **It will be estimated from land purchase cost and accessibility consideration and maintaining cost.**
- **The site location for Air Route Surveillance Radar will be presented in a new shape file to be used in other purpose.**

Map

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California's counties



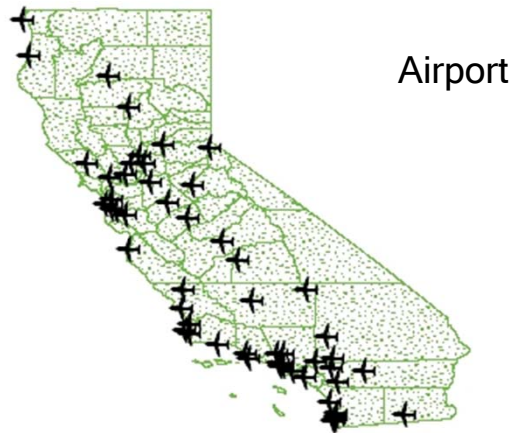
Urban Area



Buffer of Urban Area

Map - cont'd

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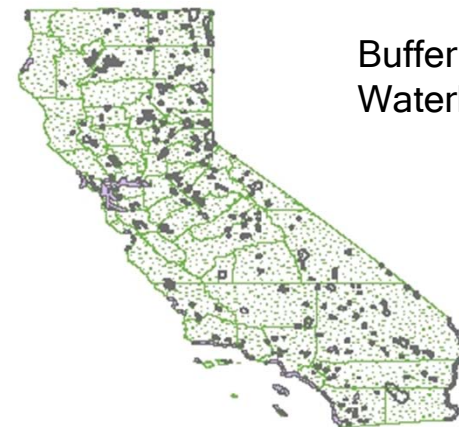
Airport



Buffer of
Airport



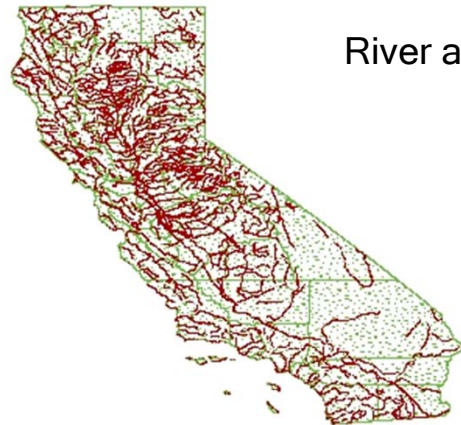
Waterbodies



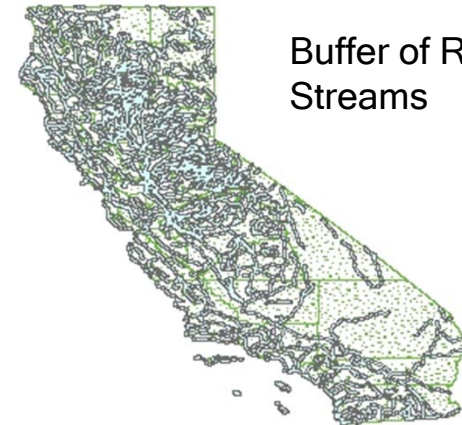
Buffer of
Waterbodies

Map - cont'd

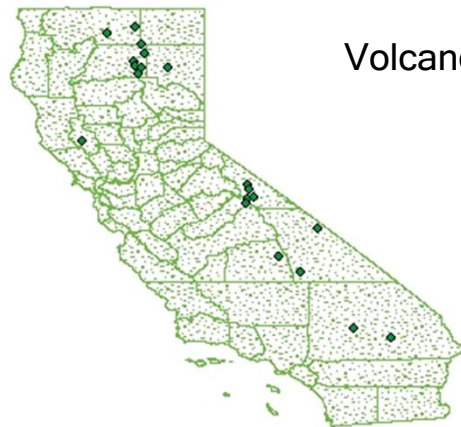
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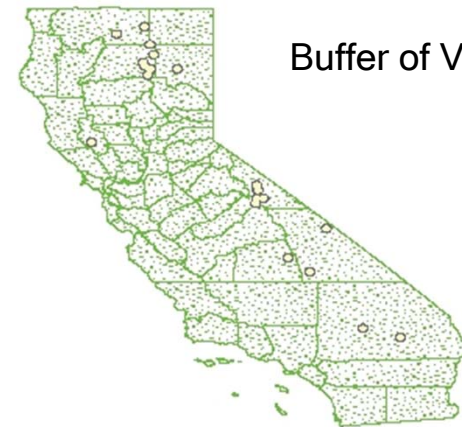
River and Streams



Buffer of River and Streams



Volcanoes



Buffer of Volcanoes

Map - cont'd

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Highway

Total Buffer



Buffer of Highway





Radar Locations

Map - cont'd

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Attribute of radar layer

ID	IN_COUNTY	Area	Land Purchase (\$)	Pop. 2000	Pop 2001
Radar 1	San Bernardino	20106.0267	4.0000	1709434.0000	1752242.0000
Radar 2	San Luis Obispo	3319.4682	4.0000	246681.0000	251601.0000
Radar 3	Inyo	10227.1659	0.0000	17945.0000	17907.0000
Radar 4	Imperial	4481.7564	2.0000	142361.0000	143728.0000
Radar 5	Sacramento	995.2794	61.0000	1223499.0000	1249624.0000
Radar 6	Modoc	4203.3544	0.0000	9449.0000	9326.0000
Radar 7	Humboldt	3586.4616	2.0000	126518.0000	126226.0000

- **GIS-resources in ArcGIS version 8.1 package**
- **ESRI Website**
- **FAA (Federal Aviation Administration) and Advisory Circular.**
- **Ashford, Norman. Airport Engineering, John Willey & Sons, 1992.**
- **US Transportation Bureau**
- **www.howstuffworks.com**
- **etc.**

End

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Thank You