95 ABW/EM

Environmental Management Directorate

Robert W. Wood
Director

Environmental Management Overview

- EM mission, facts, and figures
- Management Plans, Programmatic Environmental Assessments, and Practices
- Airspace, Directed Energy, and Range programs
- Natural and Cultural Resource Management Programs
- Compliance Program
- Environmental Restoration Program
- Perchlorate Issues and Status
- Other Chemicals of Concern
- Geographic Information System

Environmental Management Supports Military Readiness

- Access to finite set of natural and manmade resources
- Competition for airspace
- Conservation of natural and cultural resources
- Noise level restrictions (AICUZ)
- Caps on air emissions
- Water quality controls
- Endangered and threatened species
- Urban growth

Environmental Management Mission

- Provide Environmental Management for 301,000 acres of Department of Defense (DoD) land
- Jointly manage 20,000 square miles of airspace with China Lake and Fort Irwin
- **Work with all Mojave Desert military installations, the Departments of Interior and Agriculture, and the State of California to jointly manage 35,000 square miles of government-owned land**

Environmental Management Responsibilities

EM has two co-equal responsibilities:

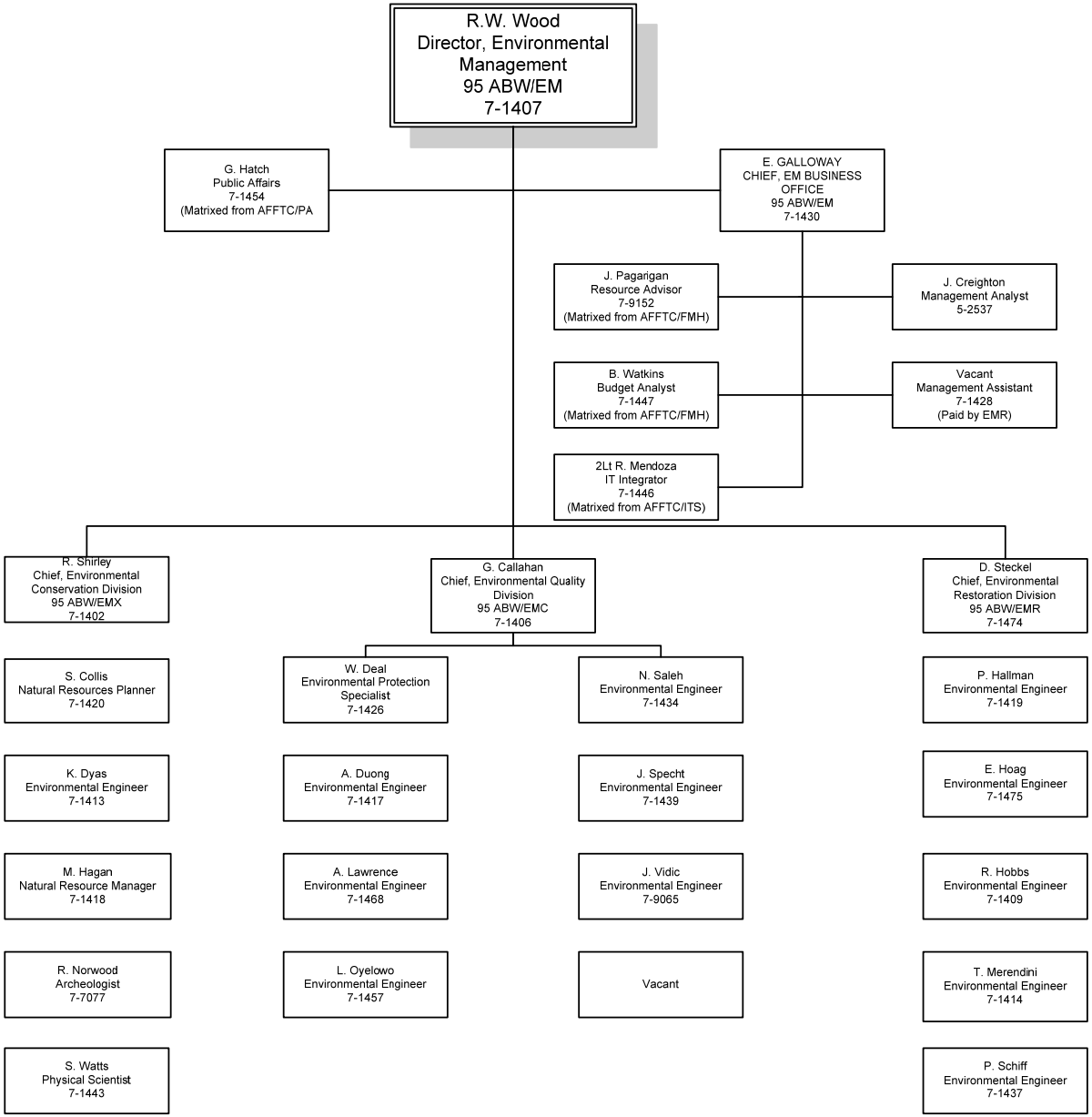
- **To assure that all the activities on Edwards AFB and everywhere an aircraft or weapon system or AFRL activity takes place is in compliance with all the environmental regulations**
- **To manage the natural and cultural resources on all of the lands assigned to Edwards AFB (470 square miles on the base and any off-base sites that are leased or outgranted to the base)**

Environmental Management Philosophy

- Partners (not adversaries) with regulatory agencies and the public
- Maintain and enhance AF credibility in all EM actions and issues
- Prompt notification to all stakeholders on EM issues (when we have data)
- Effective use of programmatic methods to streamline and reduce approval process time
- Assume a proactive position—identify and address environmental issues before they cause a mission impact

7/3/2004

95 ABW/EM
Environmental Management

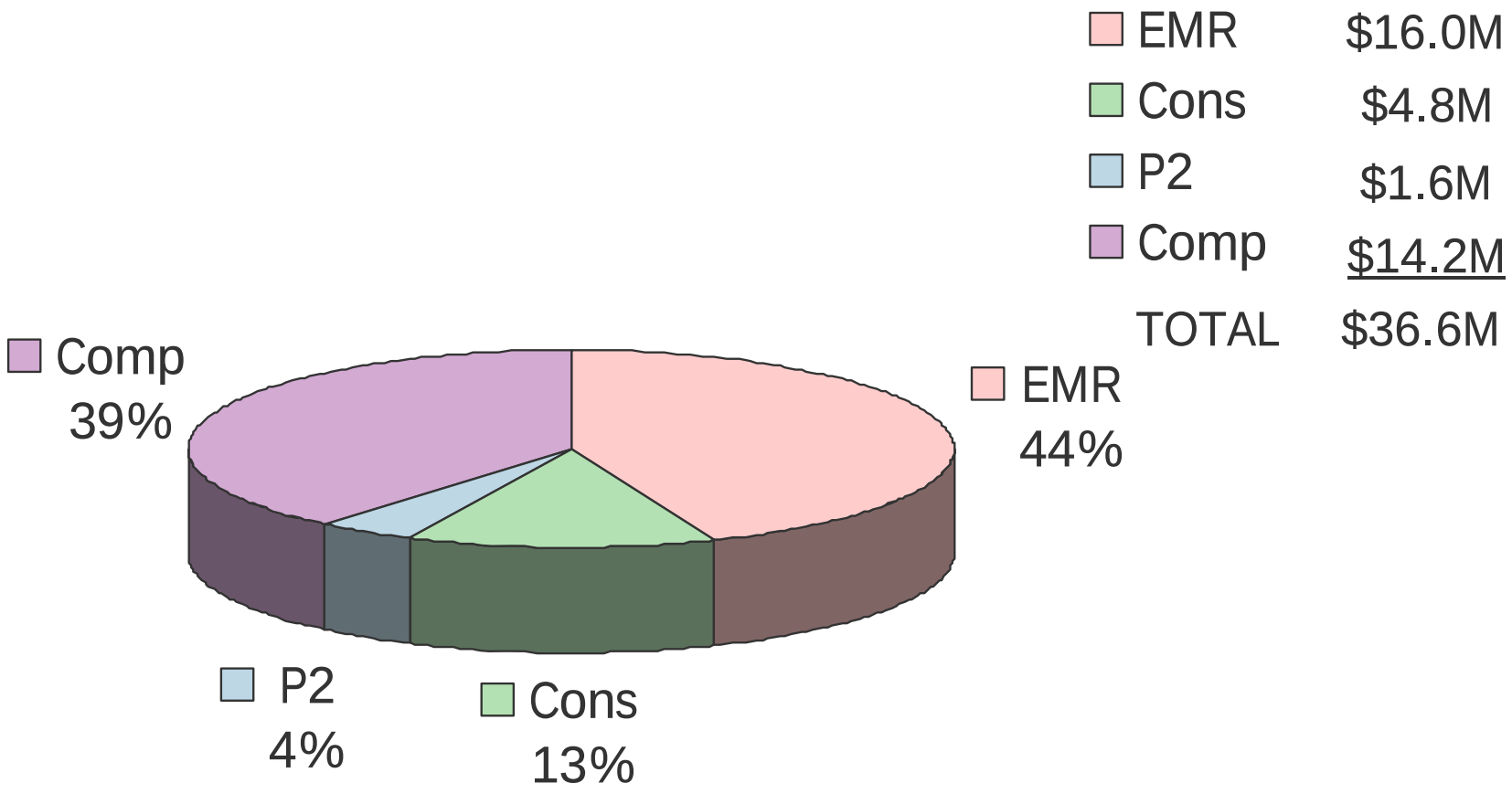


EM Supports Many USAF Communities

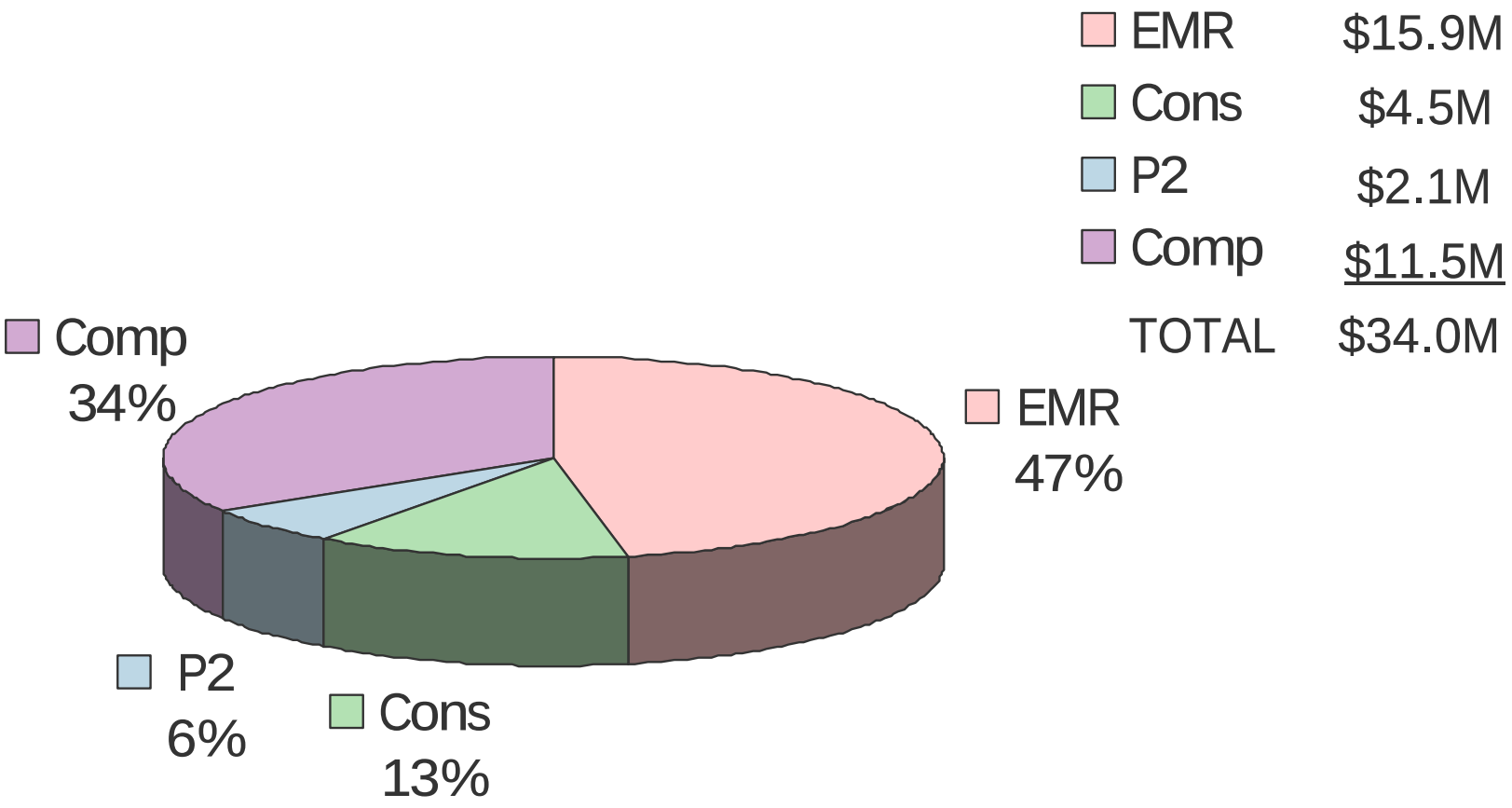
Each Community Speaks a Different Language

- Flight Test Activities
- Rocket fuel and engine research, development and test and evaluation
- Aircraft Maintenance and Support
- Directed Energy
- Access to Space and Hypersonic Aircraft
- Civil Engineering and Mission Support
- Land Management, Natural and Cultural Resource Stewardship
- Environmental Restoration

FY04 Program



FY05 Program



Contractors, National Laboratories, and Academic Partners at Edwards AFB

JT3/CH2MHILL

TYBRIN

Earth Tech Inc.

Tetra Tech Inc.

Jones and Stokes

URS/Radian

FPM Group

Roy F. Weston

Chambers Group

NASA/JPL

Sandia National Laboratory

Oak Ridge National Laboratory

NASA/Dryden FRC

UC Davis

Stanford University

USGS

University of Nevada/DRI

Environmental Management
Some Statistics – FY03

Number of EIAP documents processed: 1,778

Number of current active Air Permits: 215

Inspections by Kern County Regulators: 165 air permits

7 hazardous waste

13 landfill

Pounds of Hazardous Waste: 1, 682, 937

Gallons of Wastewater treated

per month: 37.6 M gal (M Base)

1.8 M gal (AFRL)

Management Plans, Programmatic Assessments, and Practices

Integrated Natural Resources Management Plan

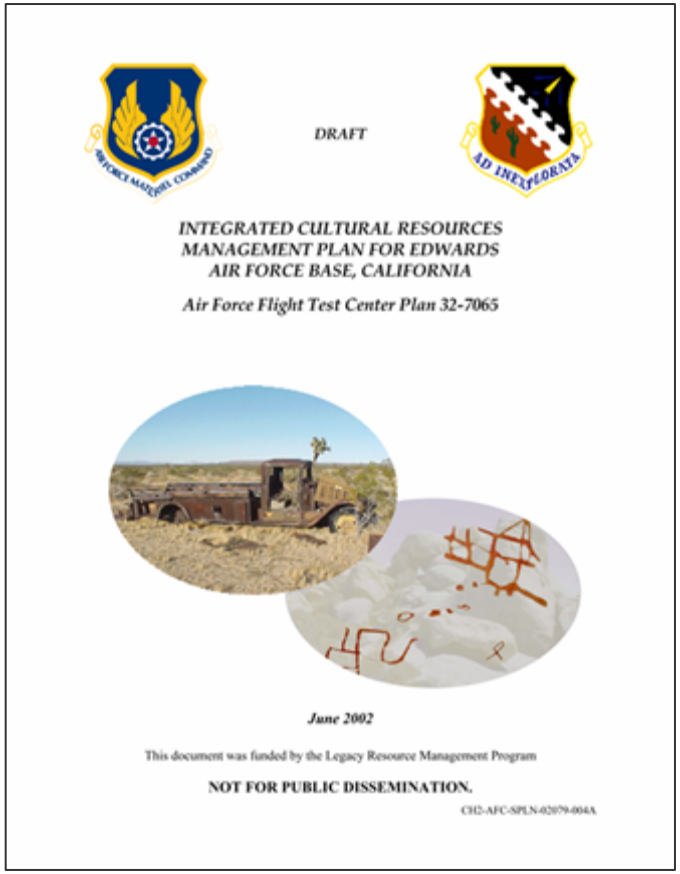
- Ecosystem sustainability
- Supporting the mission
- Management decisions based on scientifically defensible studies
- Approved by California Fish and Game and USF&WS

Biological Opinions

- 49 area-specific biological opinions
- Each biological opinion includes specific measures to protect NRs
- Effort in progress to streamline down to ONE basewide biological opinion

Integrated Cultural Resource Management Plan

- Mission success depends on “integrated” cultural support through management plan and programmatic agreement
- CR issues are resolved and managed by Edwards AFB with yearly review by SHPO
- Enhances CR program and compliance capability
- Institutionalizes CR management
- Reduces CR restraints on mission



DRAFT

INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN FOR EDWARDS AIR FORCE BASE, CALIFORNIA

Air Force Flight Test Center Plan 32-7065

June 2002

This document was funded by the Legacy Resource Management Program

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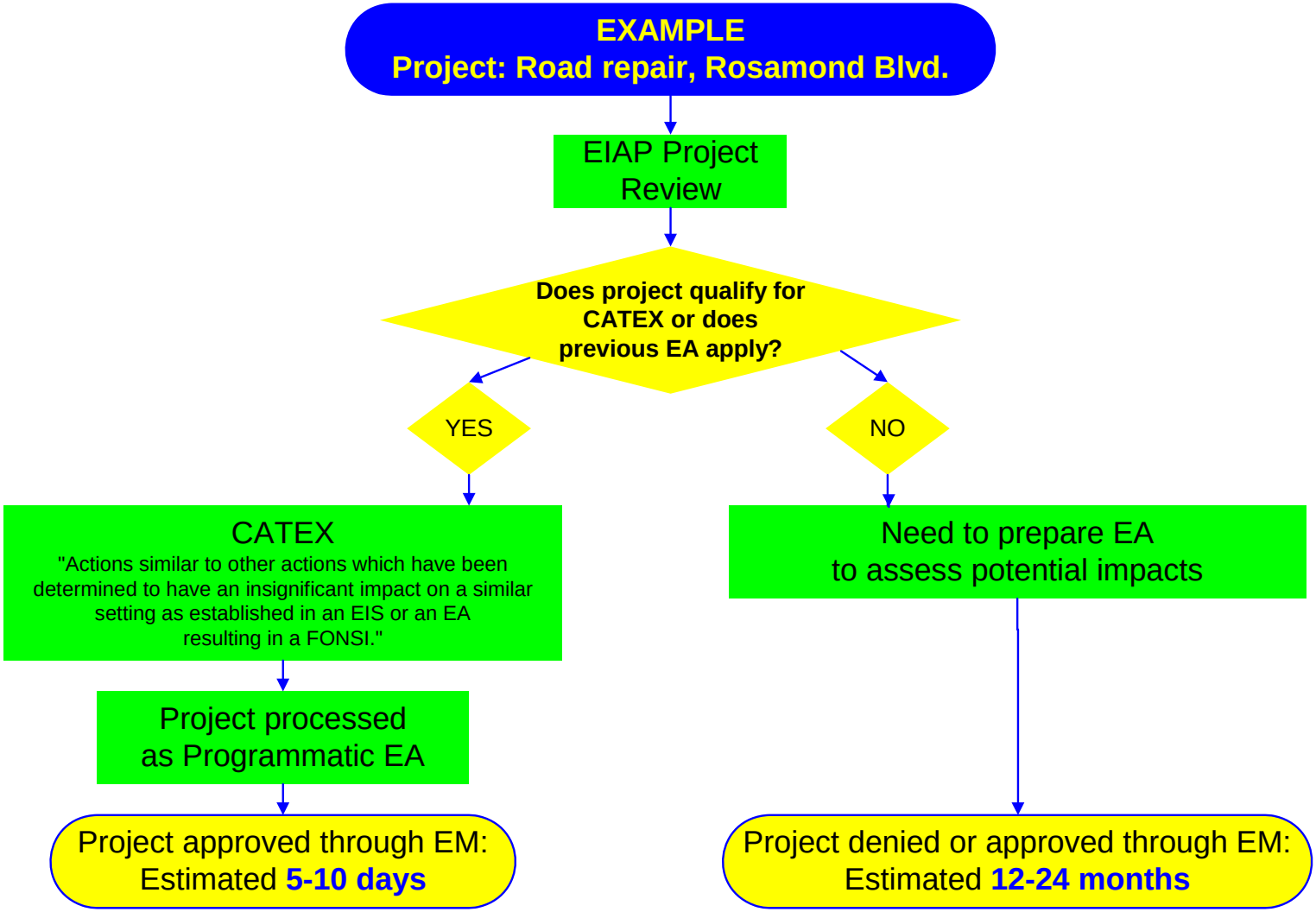
Programmatic Environmental Assessments Applicability



Best Management Practices, Purpose, and Need

- Approximately 1,800 projects are evaluated annually for environmental issues under AFI 32-7061 (32 CFR, Part 989) *The Environmental Impact Analysis Process*
- Many activities are similar or repetitive projects
- Access to best management practices for recurring activities has streamlined and made for more efficient processing of EA documents
- Joint authorship between 95 ABW/EM and proponent allows for proponent understanding of environmental requirements and concerns as related to project activities

Best Management Practices Examples

BMP for routine and recurring lakebed activities

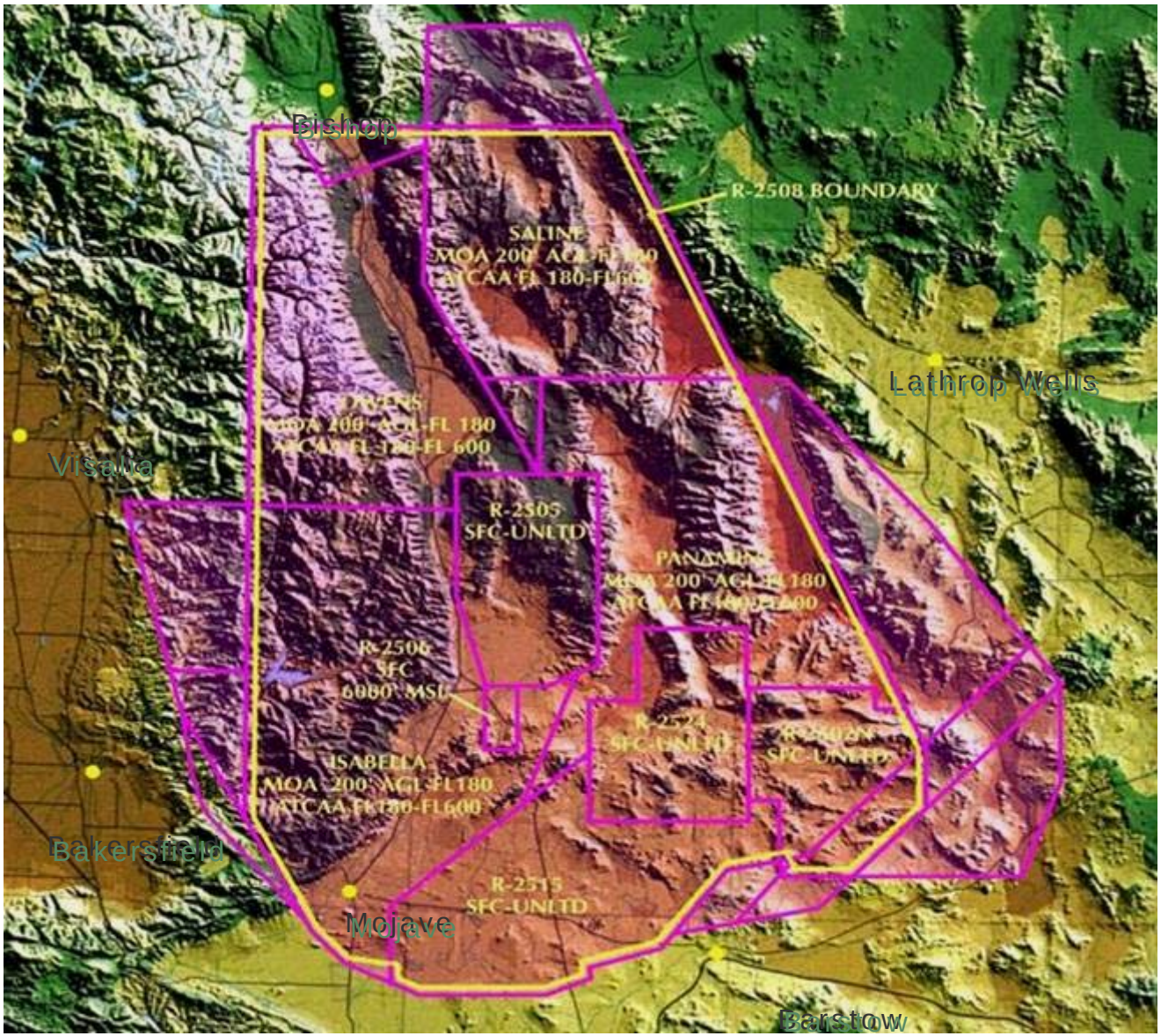
BMP for routine and recurring activities on the Precision Impact Range Area (PIRA)

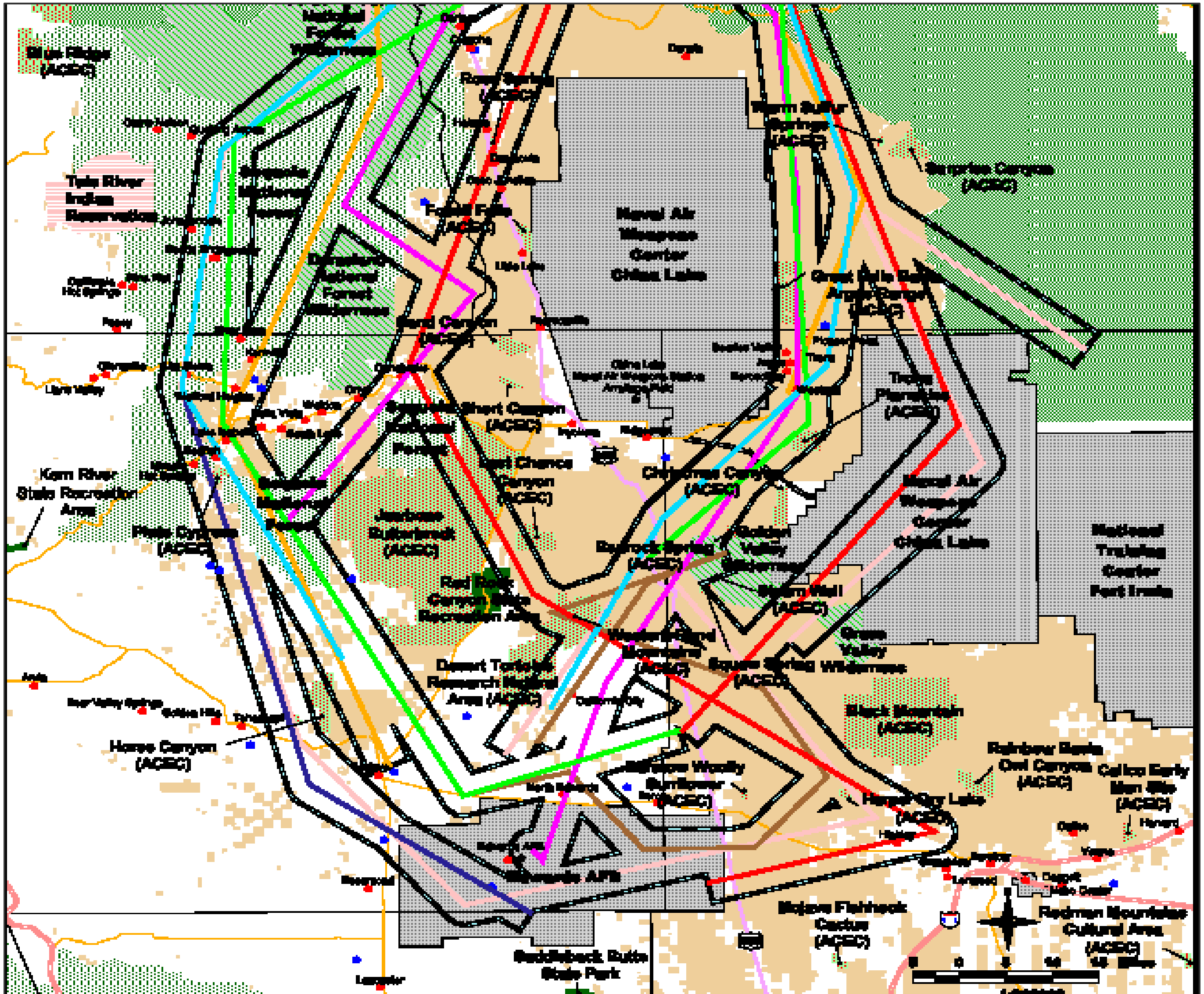
Best Management Practices Examples

Draft BMP for routine and recurring activities at Air Force Research Laboratory (AFRL)

Airspace, Directed Energy, and Range Environmental Assessments

Airspace


Bishop
R-2508 BOUNDARY
SALINE
MOA 200' AGL-FL 180
ATCAA FL 180-FL600
Lathrop Wells
DARENS
MOA 200' AGL-FL 180
ATCAA FL 180-FL 600
Visalia
R-2505
SFC-UNLTD
PANAMINT
MOA 200' AGL-FL 180
R-2508
SFC
6000' MSL
R-2524
SFC-UNLTD
R-2508N
SFC-UNLTD
ISABELLA
MOA 200' AGL-FL180
ATCAA FL180-FL600
Bakersfield
R-2515
SFC-UNLTD
Mojave
Barstow



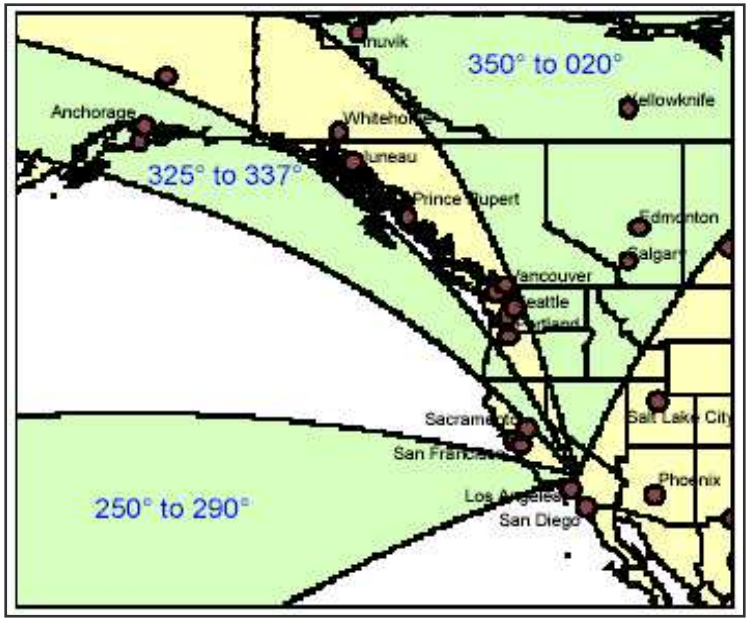
Blue Ridge (ACEC)
Tule River Indian Reservation
Kern River State Recreation Area
Naval Air Weapons Center China Lake
Surprise Canyon (ACEC)
Trona Pinnacles (ACEC)
Last Chance Canyon (ACEC)
Christmas Canyon (ACEC)
Red Rock Canyon State Recreation Area
Desert Tortoise Research Natural Area (ACEC)
Horse Canyon (ACEC)
National Training Center Fort Irwin
Squaw Spring Wilderness
Black Mountain (ACEC)
Rainbow Basin Owl Canyon (ACEC)
Calico Early Man Site (ACEC)
Harper Dry Lake (ACEC)
Edwards AFB
Mojave Fishhook Cactus (ACEC)
Rodman Mountains Cultural Area (ACEC)
Saddleback Butte State Park

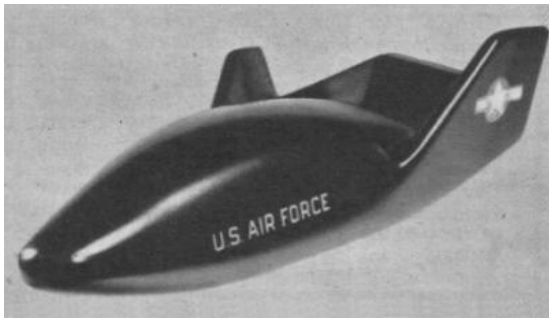
R-2508 Airspace Environmental Baseline Study

- Facilitate new missions within the complex
- Assist complex owners in meeting regulatory responsibilities at federal, state, and local levels
- Identify potential land use/airspace conflicts
- Provide complex owners with a library of information for potential future users of the R-2508 Complex
- Streamline future planning and environmental documentation

Lifting Entry Vehicle Corridor Environmental Assessment

- EA--Finding of No Significant Impact complete
- Unmanned generic vehicle assumed--shortens approval time for future LEVs
- Streamlines environmental review of programs using Edwards AFB for landing
- X-37 Program has made initial selection of Edwards AFB as landing site for orbital reentry flights
- New NASA Orbital Space Plane also a candidate customer





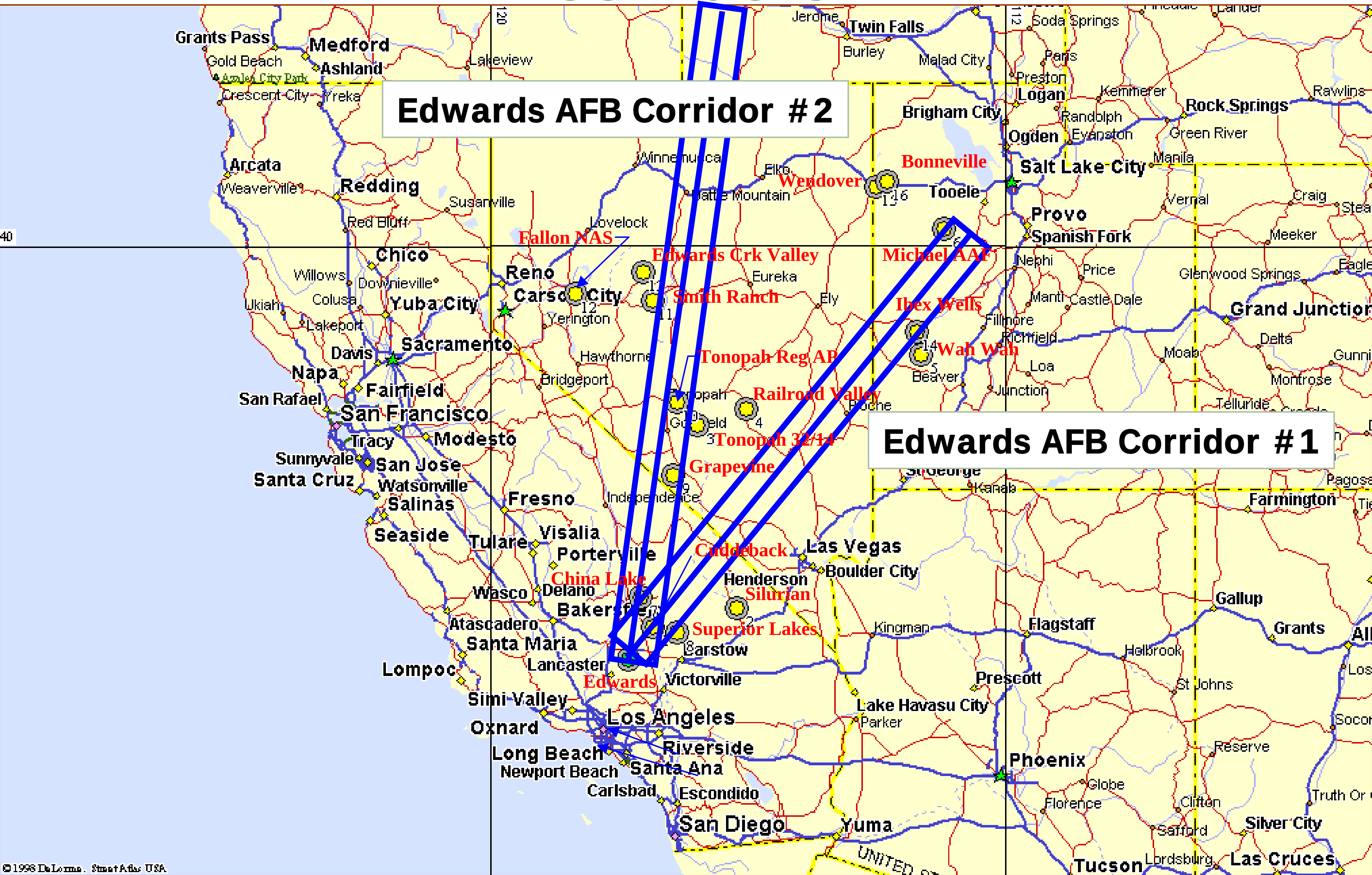
Generic LEV SV-5 Shape

Orbital Reentry Corridor

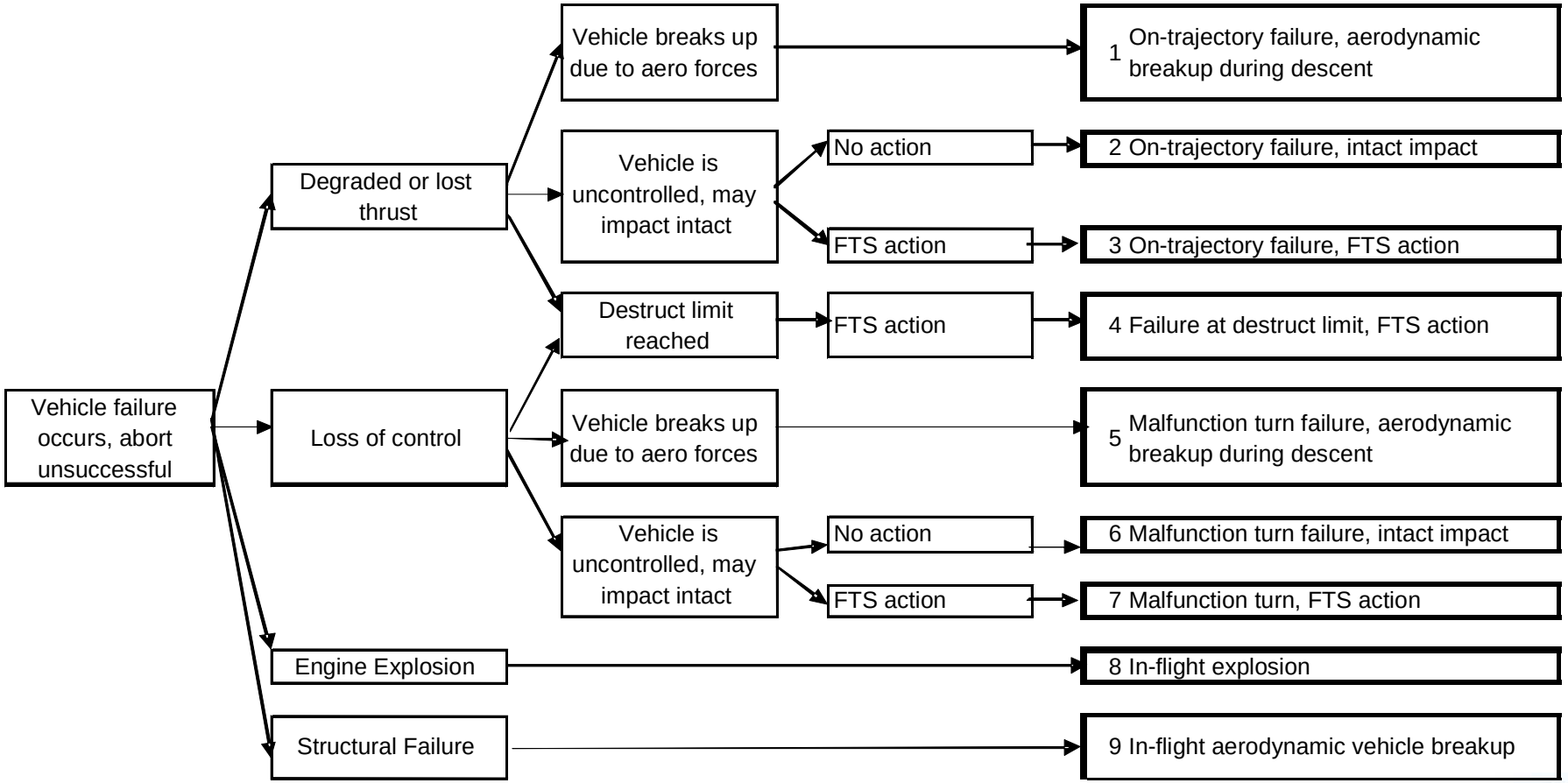
Hypersonic Vehicles Flight Test Corridors Environmental Assessment

- Hypersonic flight test corridors between Nevada/Utah and Edwards AFB
- Testing of X-43B type generic unmanned vehicles
- Rocket Based Combined Cycle (RBCC) air augmented rocket, ramjet, and scramjet
- Trajectories to Mach 7.5
- Streamlines environmental assessment for use of Edwards AFB

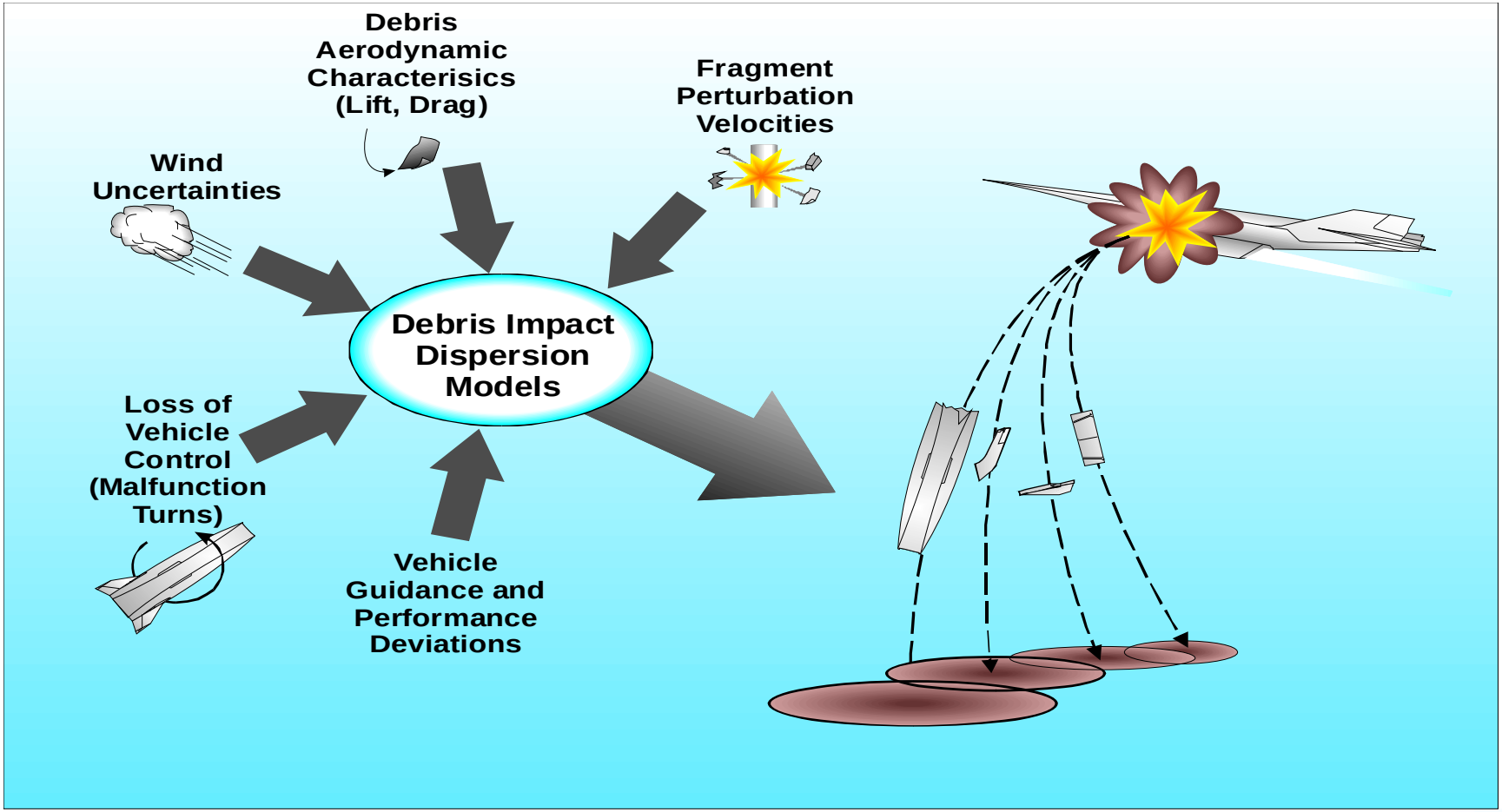
Hypersonic Corridors



Vehicle Failure Modes

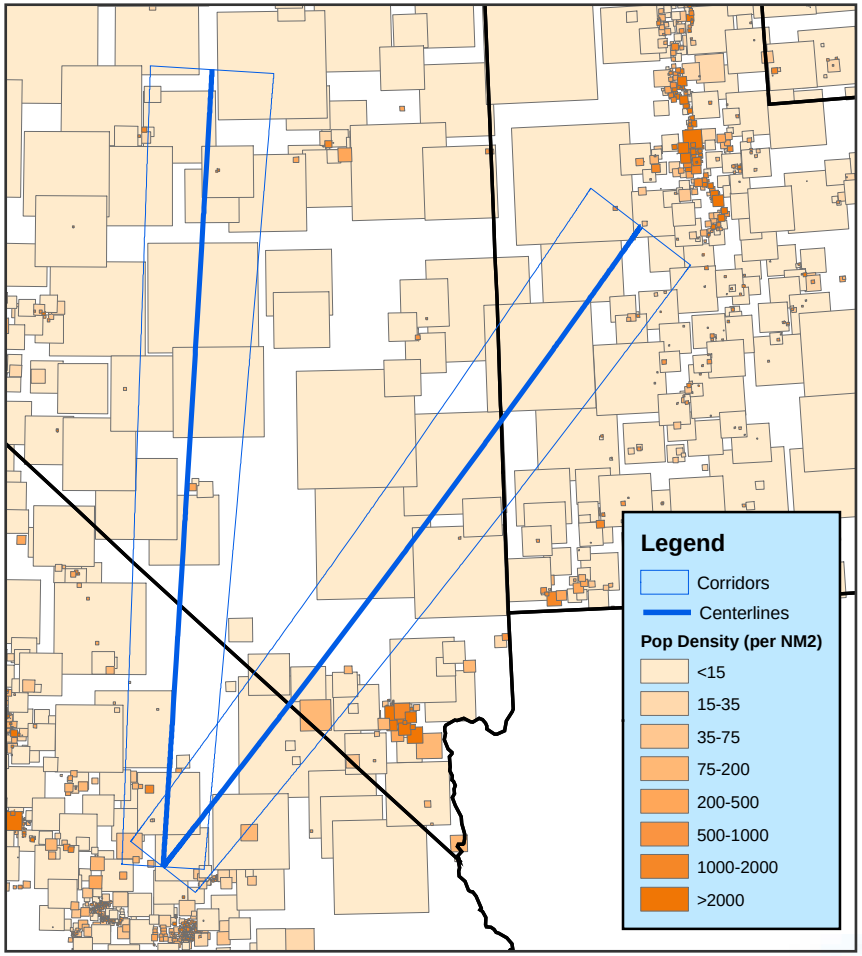


Debris Footprint Modeling



Resulting Population Model

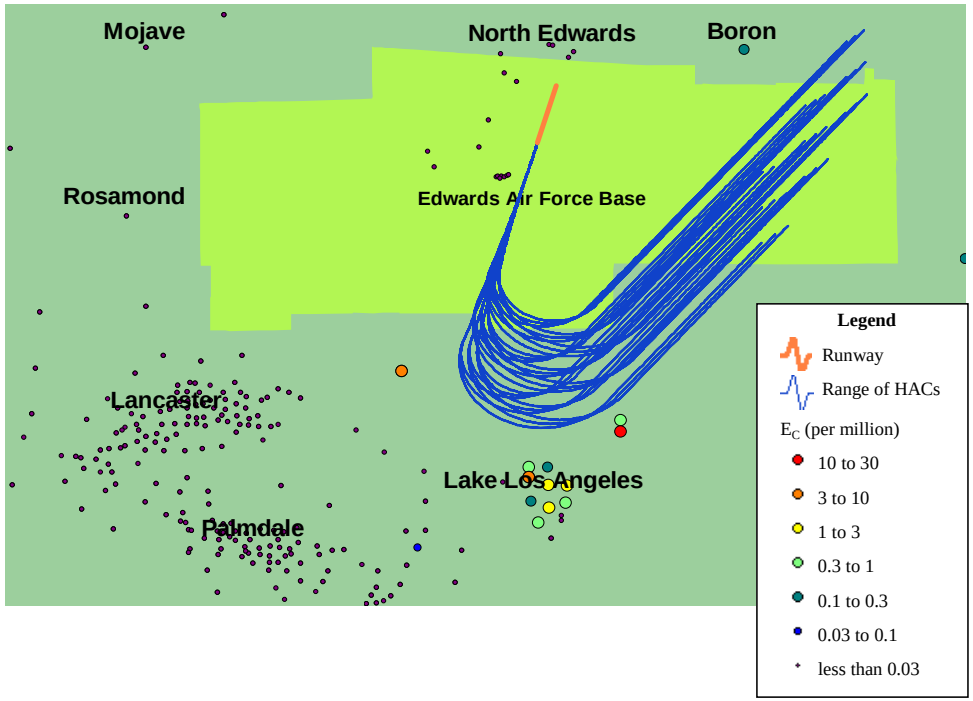
- For each “pop center”
  - ✓ Number of people
  - ✓ Location & area
- Pop centers
  - ✓ Overlap and have gaps
  - ✓ All area and all pop accounted for



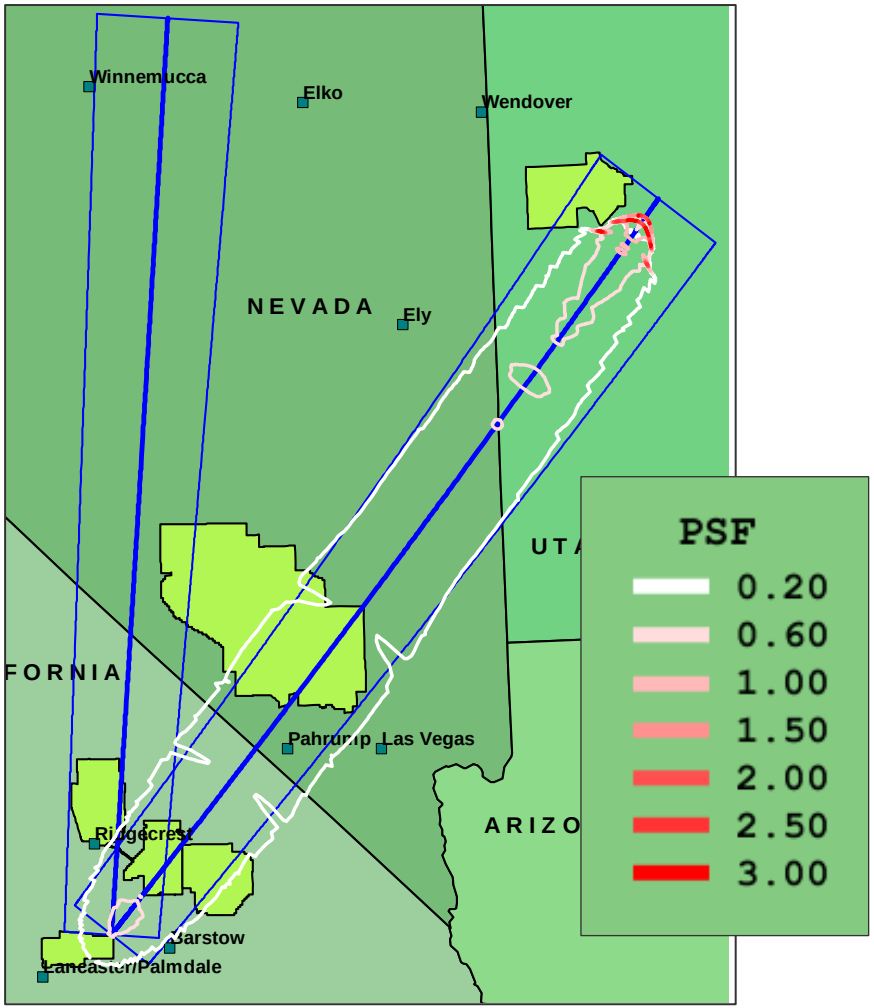
Collective Risks for Planned Final Descent

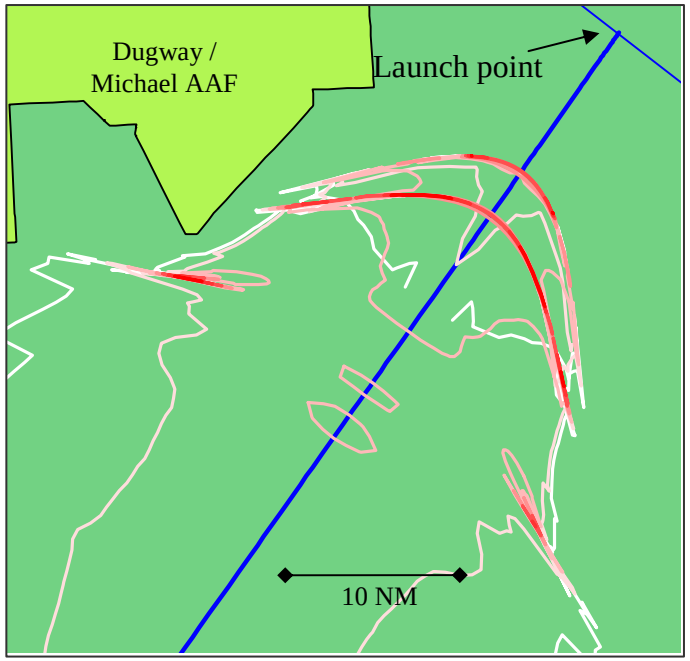
- **Risk is high!**
  - ✓ **With P(f)=10%, Ec=40.5/million**
  - ✓ **Should not contribute to overall risk (i.e., <2/million)**
  - ✓ **Requires >99.5% reliability**
- **Options:**
  - ✓ **Replan to be further from Lake Los Angeles**
  - ✓ **Constrain uncertainties**
  - ✓ **Survey population south of Edwards AFB**

Final descent is the same for all missions



Sonic Boom Baseline Results





- Nearly all below .6 psf
- Focus regions within 30 NM of launch point

Environmental Assessments

- Propulsion Energetics Laboratory EA
  - ✓ FONSI signed on 12 Mar 04
- Runway EA
  - ✓ FONSI signed 17 Sep 04
- Hypersonic Corridor EA
  - ✓ Completed quantative risk assessment
  - ✓ EA will be issued as draft for public review in Oct 04
- Directed Energy EA
  - ✓ High Energy Laser EA in preliminary draft
  - ✓ Microwave EA being scoped with customer
- PIRA Weapons Testing EA
  - ✓ Preparing preliminary draft
- Cooperating Agency with FAA on Mojave Airport Space Port
  - ✓ EA and coordination is complete

Directed Energy (DE) Environmental Assessments

Potential Proponents

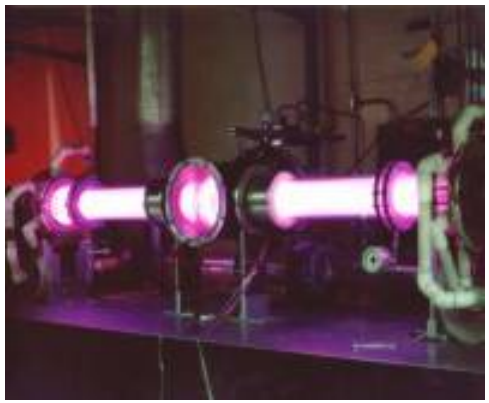
- ABL
- AFRL
- 412 TW
- PIRA
- NASA
- OTHERS

Directed energy includes lasers, high energy microwaves, acoustics, plasma cannons, air cannon

Directed Energy (DE) Environmental Assessments

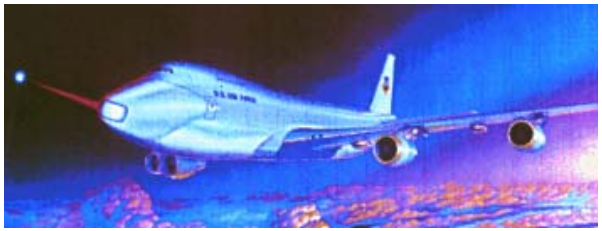
Description and Purpose

- 95 ABW/EM is preparing several programmatic EAs evaluating potential DE technologies
- Analyze the potential environmental consequences of DE activities at Edwards AFB
- Incorporate existing programs and expand operational capabilities
- Allow new DE programs to come to Edwards AFB with minimal environmental delay

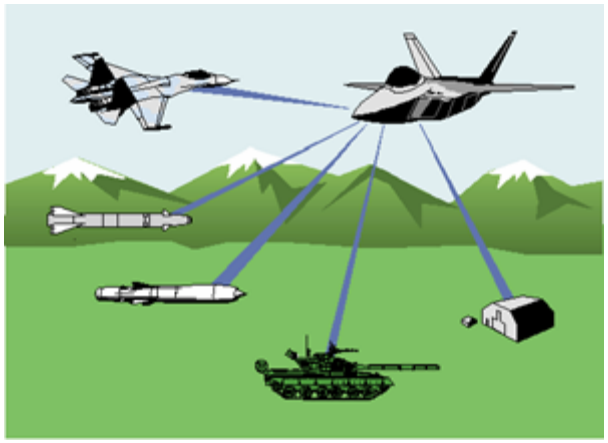


AF Directed Energy Program

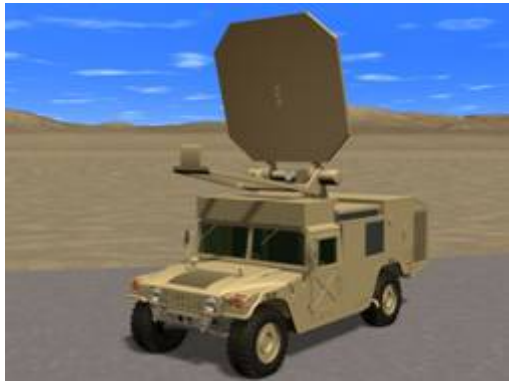
Ground Based Laser Beam Control Technology



Strategic Laser System Technology



Tactical Laser System Technology

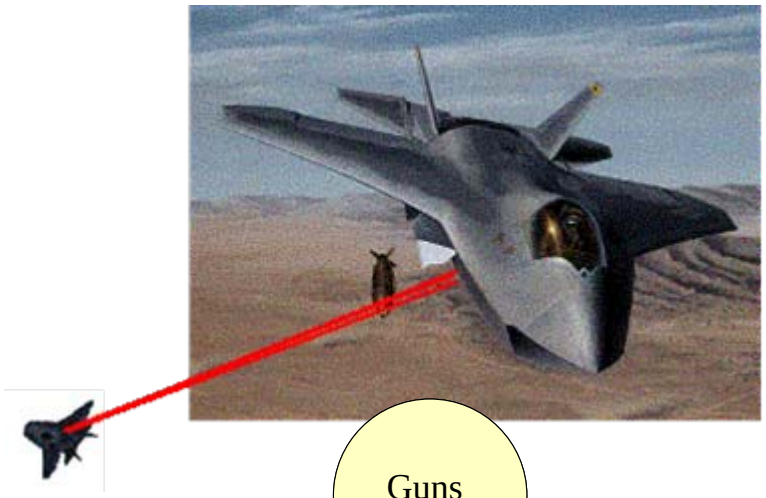


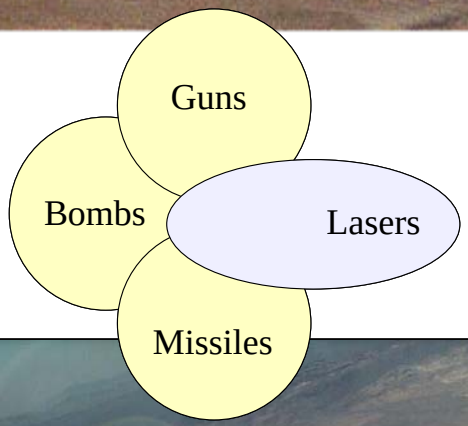
HPM Force Protection Technology

HPM Electronic Attack Technology

Space Situational Awareness Technology

Tactical Laser System Technology





Vision

- Low to moderate-power laser devices will supplement and augment aircraft munitions, enabling greatly enhanced capabilities for protection, strike and awareness.

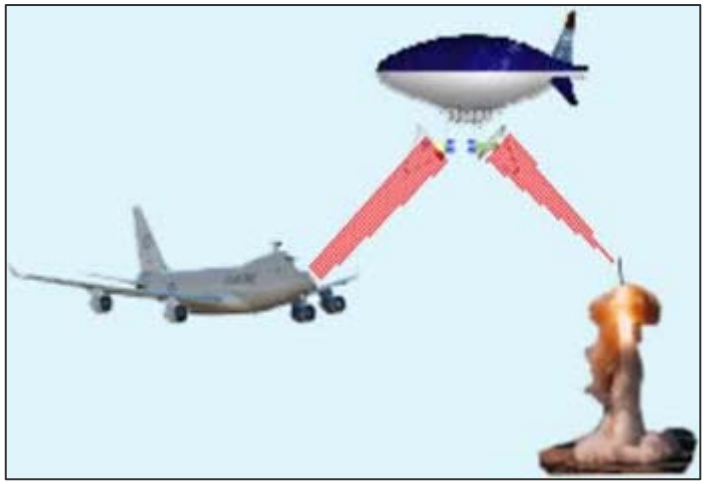
Research Areas

- Solid state lasers
- Beam control dominated by a cluttered environment and platform disturbances
- Propagation dominated by thermal blooming and atmospheric scattering
- Laser target vulnerability assessment

DTOs

- B.46 Adv Tactical Laser ACTD (supporting)
- WE.42 Laser Aircraft Self-Protect Missile CM
- WE.65 High-Eff., Scalable SSL for Military Appl.
- WE.85 Tactical SSL Weapon Technology

Strategic Laser System Technology



Vision

- High power strategic lasers will revolutionize the character of warfare through precision engagement at the speed of light.

Research Areas

- COIL & other high-energy chemical lasers
- Beam control dominated by scintillation and long path lengths
- High altitude airship & space relay mirrors for HEL force multiplication

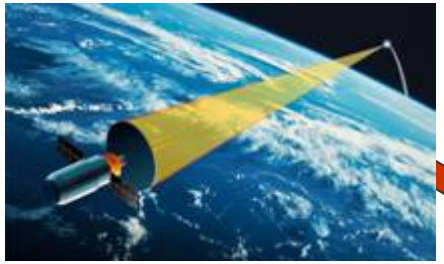
DTOs

- D.10 ABL Technology for TMD

Eagle Concept

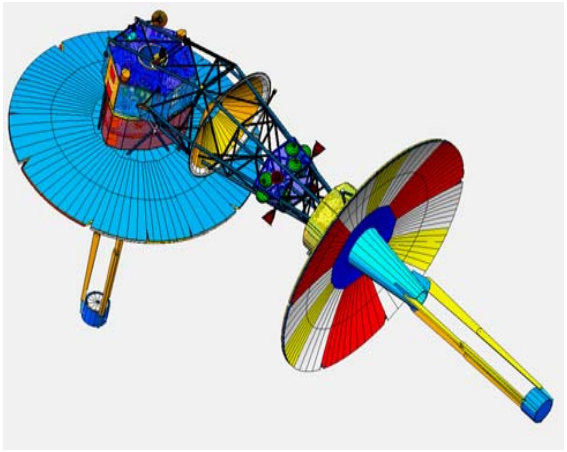
Laser Sources

SBL

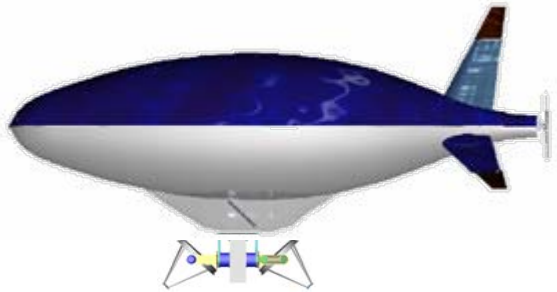


ABL

GBL



Space-Based Relay Mirror



Airborne Relay Mirror

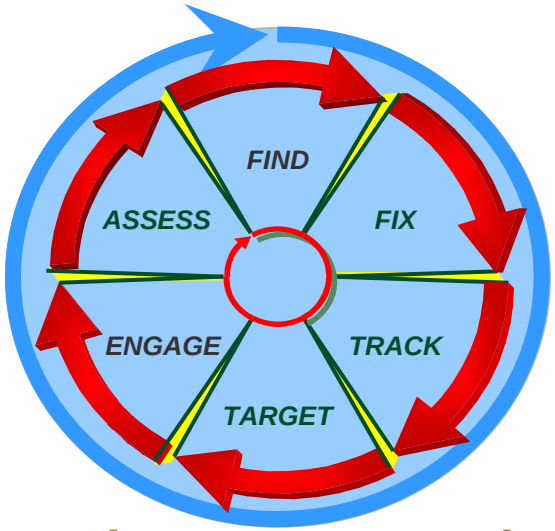
Potential Missions

- Target designation
- Air/ground attack
- Space control
- Asset protection
- Cruise missile defense
- BMD support
- Active tracking
- Surveillance
- Chem/bio detection
- Laser communications

Provides laser capabilities over air/ground/space continuum

Airship Relay Mirror Program

ABL — "uplink link" — Relay Mirror — "target link" — Target



Natural Resources Management

Desert Tortoise

Desert Tortoise *Gopherus agassizii*

Federally- and state-listed as “threatened” and protected by the Endangered Species Act

95 ABW Environmental Management Directorate

Maintaining Diversity

Over 25 Documented Species of Mammals

Coyote
Canis latrans

Bobcat
Felis rufus

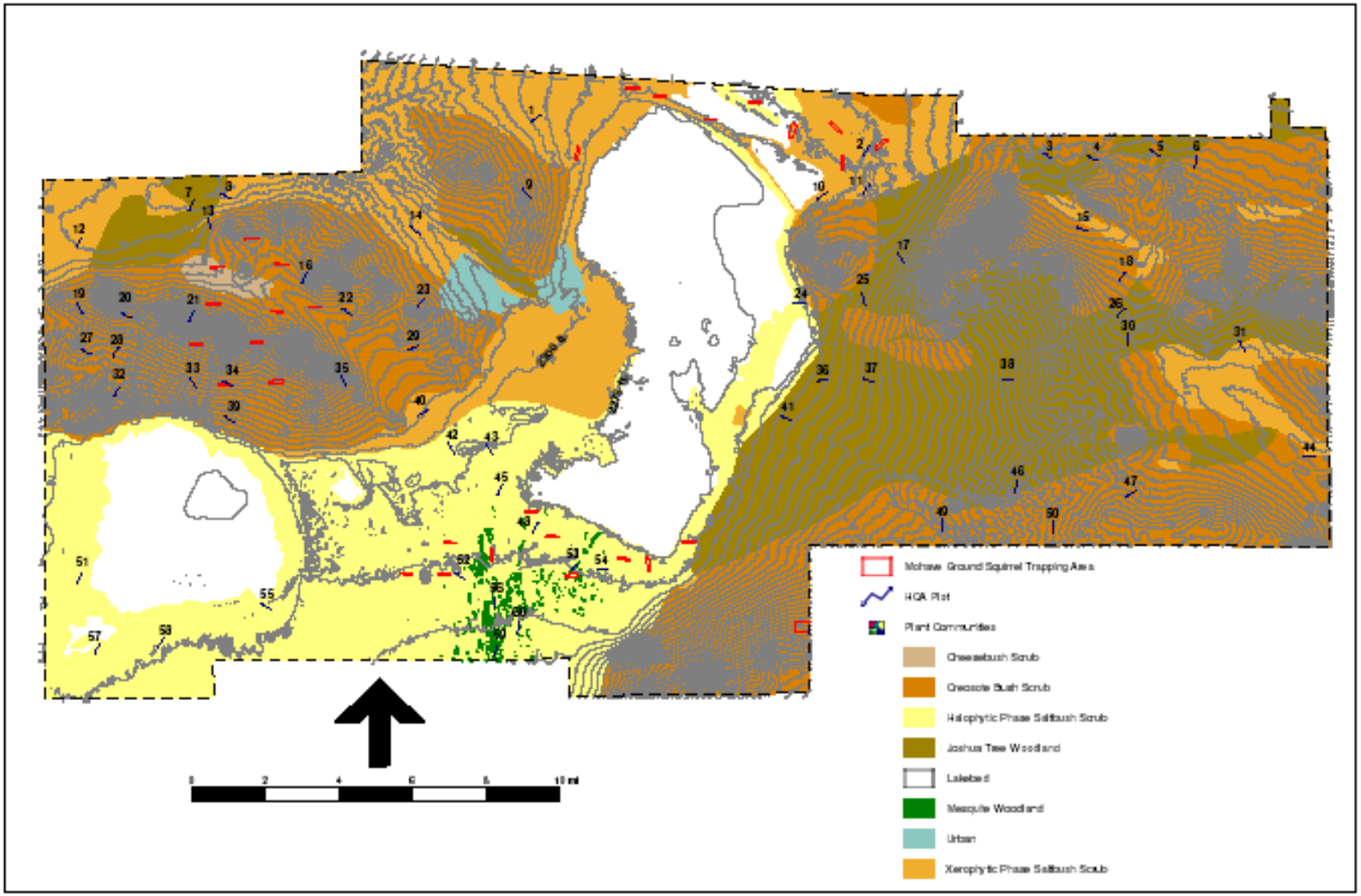
Mohave Ground Squirrel
Spermophilus mohavensis

Mohave Ground Squirrel (Spermophilus mohavense)

Federal Species of Concern and State listed as "Threatened" and protected by the California Endangered Species Act

95 ABW Environmental Management Directorate

Location of Mohave Ground Squirrel Studies



Maintaining Diversity

19 Documented Species of Lizards

Chuckwalla *Sauromalus obesus*

Leopard Lizard *Gambelia silus*

Desert Horned Lizard *Phrynosoma platyrhinos*

Maintaining Diversity

Over 200 Documented Species of Birds

White Pelican
Pelecanus erythrorhynchos

Burrowing Owl
Athene cunicularia

Say's Phoebe *Sazornis sayor*

Raven
Corvus corax

Maintaining Diversity

Over 300 Documented Species of Desert Plant Life

Desert Candle
Caulanthus inflatus

Dune Evening Primrose
Oenothera deltoides

White Tidytips
Lazia glandulosa

Desert Marigold
(Baileza pleniradiata)

Beavertail Cactus *Opuntia basilaris*

Purple Phacelia
Phacelia crenulata

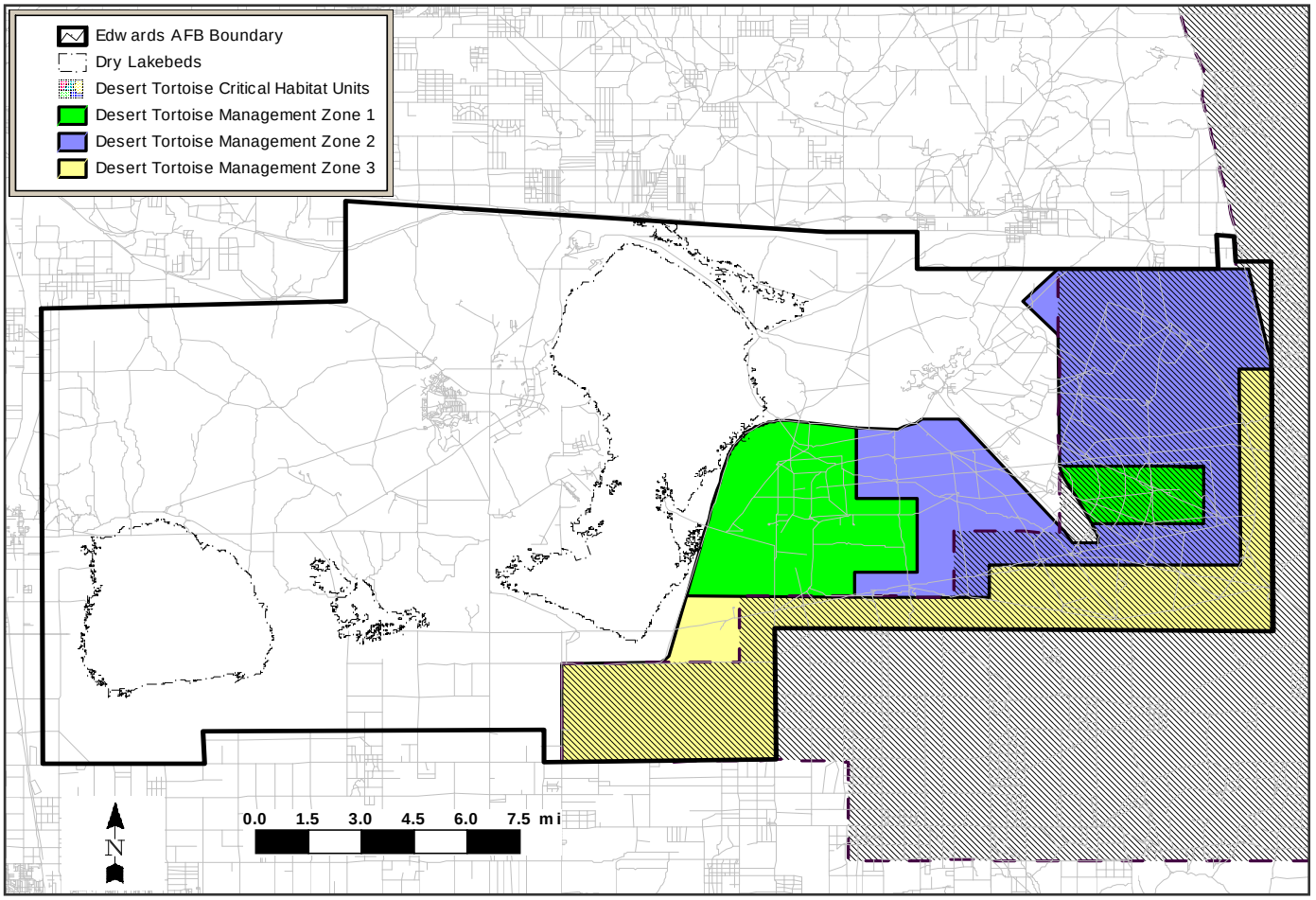
Predictive Habitat Modeling

Desert Cymopterus
Cymopterus deserticola

Alkali Mariposa Lily
Calochortus striatus

Barstow Woolly Sunflower
Eriophyllum mohavense

Managing Critical Habitat



About 60,800 Acres of Critical Habitat at Edwards AFB

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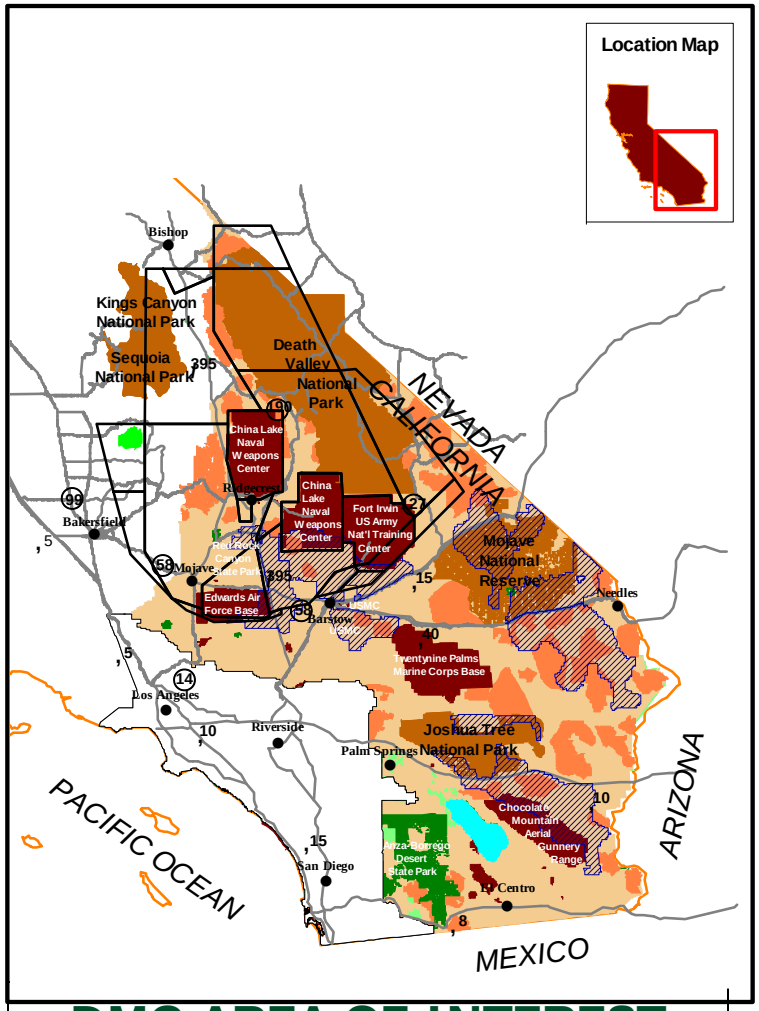
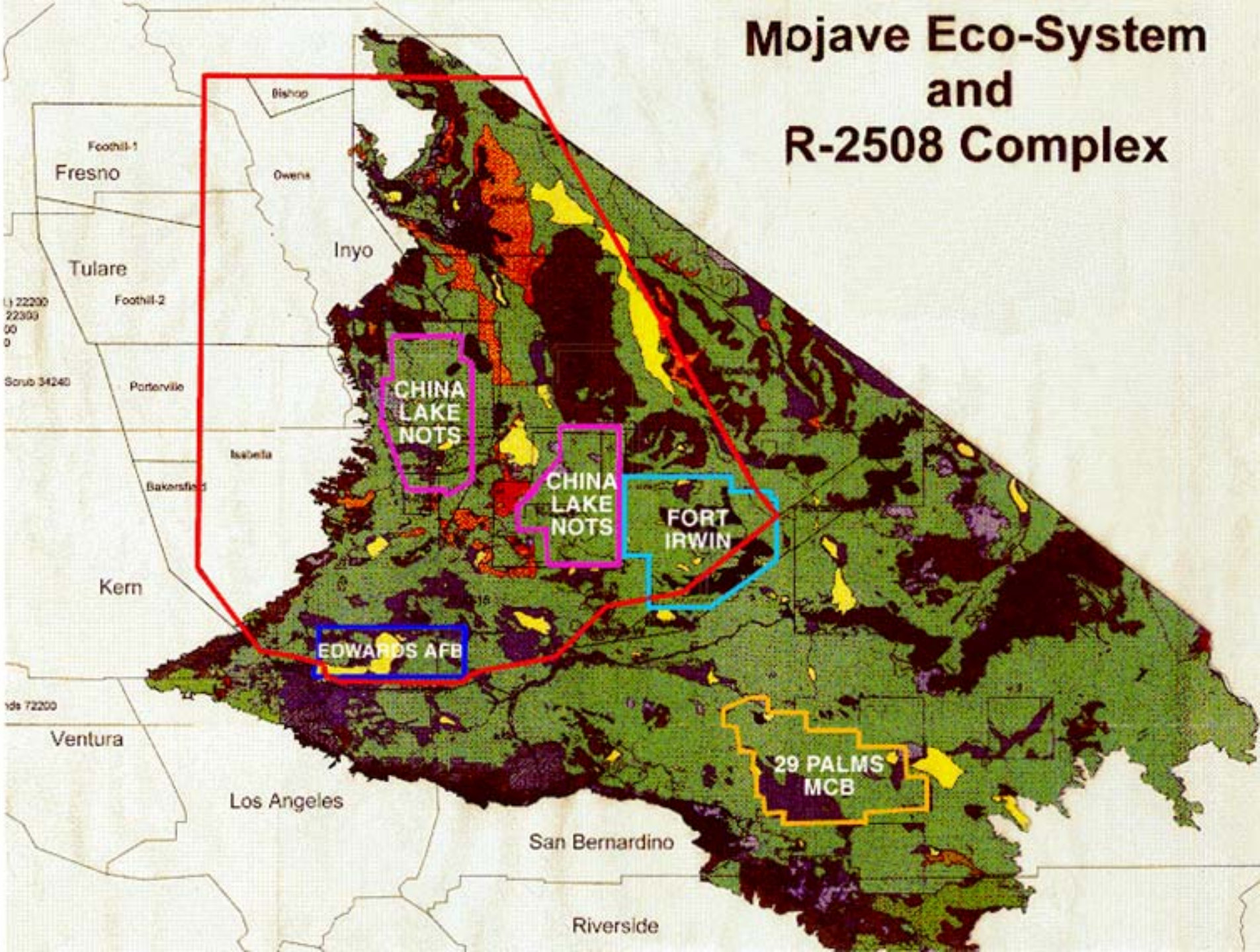
Desert Managers Group



DMG AREA OF INTEREST

MEMBERS

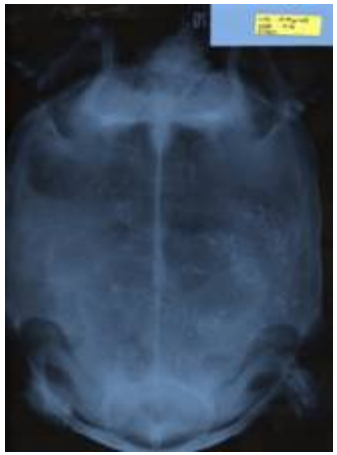
- **DOD**
  - ✓ Naval Air Weapons Station, China Lake
  - ✓ Edwards Air Force Base
  - ✓ National Training Center, Fort Irwin
  - ✓ Marine Corp Logistics Base, Barstow
  - ✓ Marine Corp Air Station, Yuma
- **DOI**
  - ✓ Bureau of Land Management
  - ✓ Fish and Wildlife Service
  - ✓ Nation Park Service
  - ✓ U.S. Geological Survey
- **STATE OF CALIFORNIA**
  - ✓ Dept. of Fish & Game
  - ✓ Dept. of Transportation
  - ✓ State Parks, Colorado Desert Sector
  - ✓ State Parks, Mojave Desert Sector
- **USDA**
  - ✓ U.S. Forest Service


Mojave Eco-System
and
R-2508 Complex
Bishop
Foothill-1
Fresno
Owens
Inyo
Tulare
Foothill-2
Scrub 34240
Porterville
Isabella
Bakersfield
CHINA LAKE NOTS
CHINA LAKE NOTS
FORT IRWIN
Kern
EDWARDS AFB
Ventura
29 PALMS MCB
Los Angeles
San Bernardino
Riverside

Protecting Natural Resources
Desert Tortoise Headstart Program

95 ABW Environmental Management Directorate

Desert Tortoise Reproduction Study



- Female desert tortoises often mate with multiple males within a season
- This study would help determine whether offspring from a given clutch of eggs are from one or multiple males

Information gained from this study would aid in determining the genetic variability in local populations which may provide information leading to the recovery of this species.

Predictive Habitat Modeling

Desert Cymopterus
Cymopterus deserticola

Alkali Mariposa Lily
Calochortus striatus

Barstow Woolly Sunflower
Eriophyllum mohavense

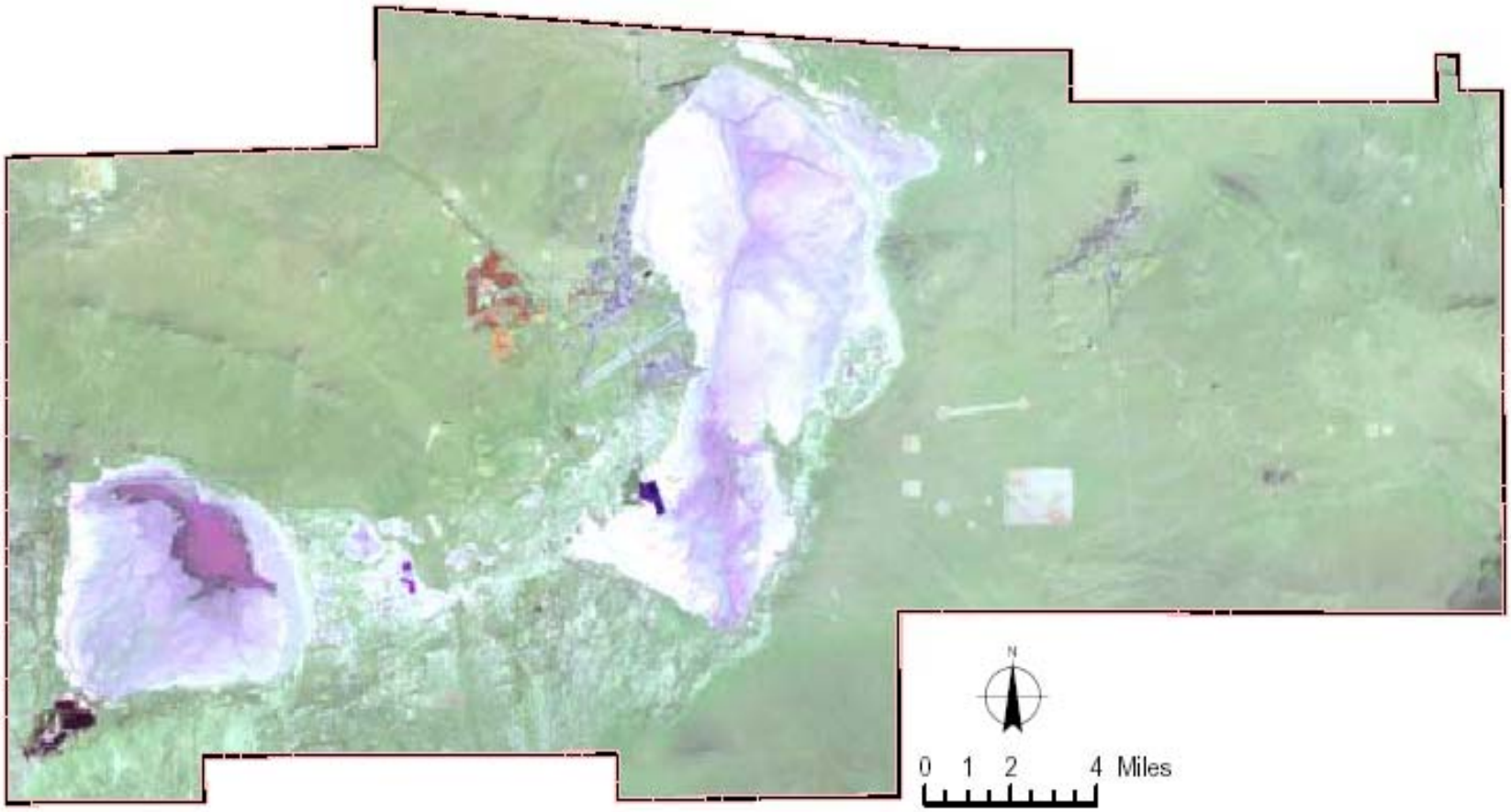
Predictive Habitat Modeling

Decision-Making Tool

- Reduces survey time
- Early project scoping
- Better management through knowledge
- Minimize impacts
- Identify Sensitive Species
  - ✓ Minimize Encroachment
  - ✓ ID Constraints on Base Development
  - ✓ Integration with INRMP Philosophy
  - ✓ Stop Declaration on Base of Critical Habitat

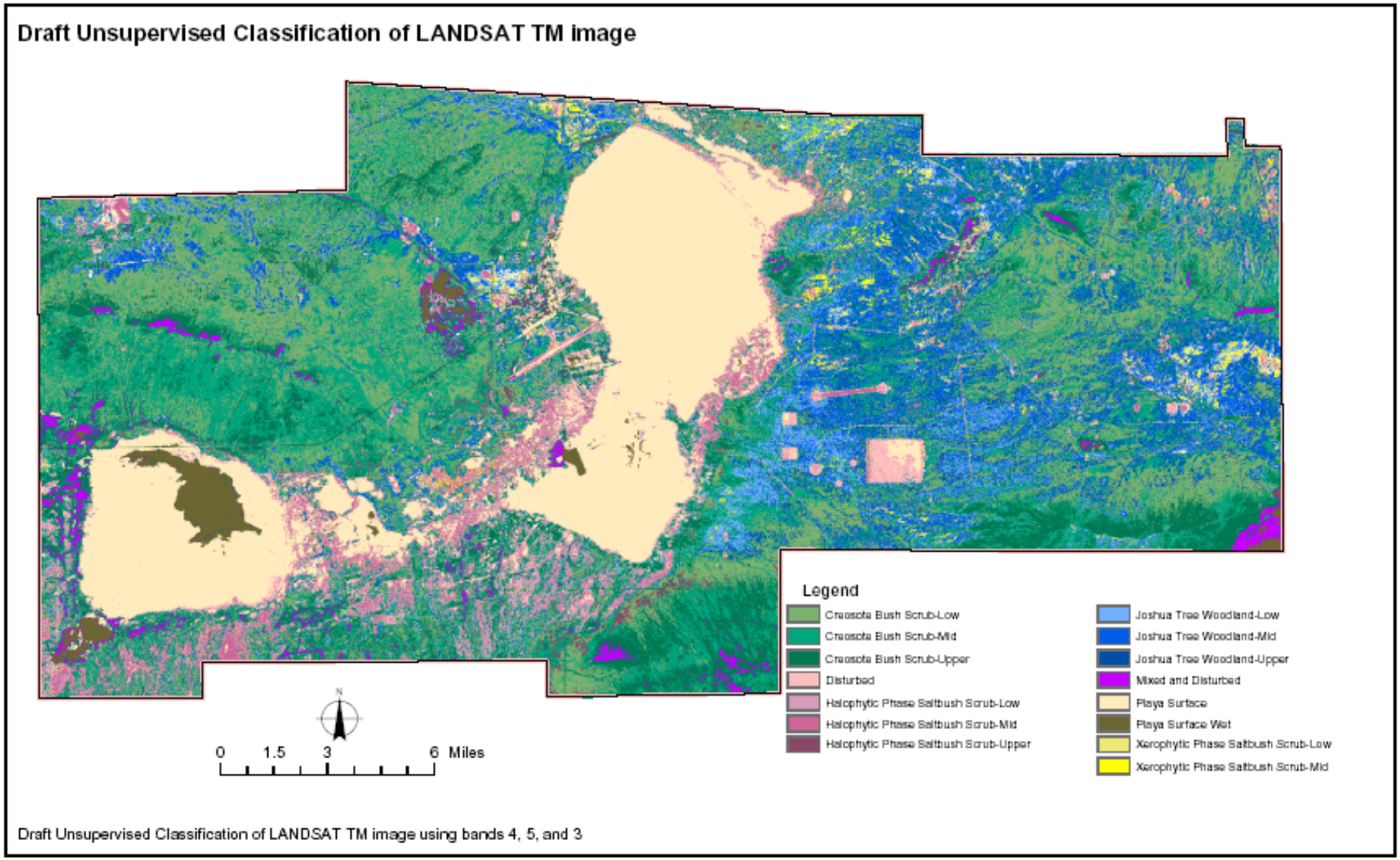
Color Composite of LANDSAT 7 Thematic Mapper Imagery

Landsat TM Image with color composite



On this map, the image is displayed as the color composite with Blue, Green, and Red corresponding to TM Bands 3, 5, and 4

Vegetation Classification Using LANDSAT 7 Thematic Mapper Imagery



Cultural Resources Management

Prehistoric Sites

- Base camps/villages
- Temporary camps
- Lithic deposits
- Paleontology

10,000 Years of Cultural Resources

Early Period
8000 to 5000 B.C.

Middle Period
5000 to 2000 B.C.

Middle – Late Period
2000 B.C. to A.D. 500

Late Period
A.D. 500 to 1200

19th/20th Century Historic Sites

- Homesteading
- Mining
- Ranching
- Railroading
- Moonshining

Military Sites

- Aviation
- Pancho Barnes
- Chuck Yeager
- East Camp

Curation Facility

Curation Facility

2,880-square-foot building with approximately 1,900 square feet of artifact storage – currently houses 393 cubic feet of artifacts and 469 linear feet of records

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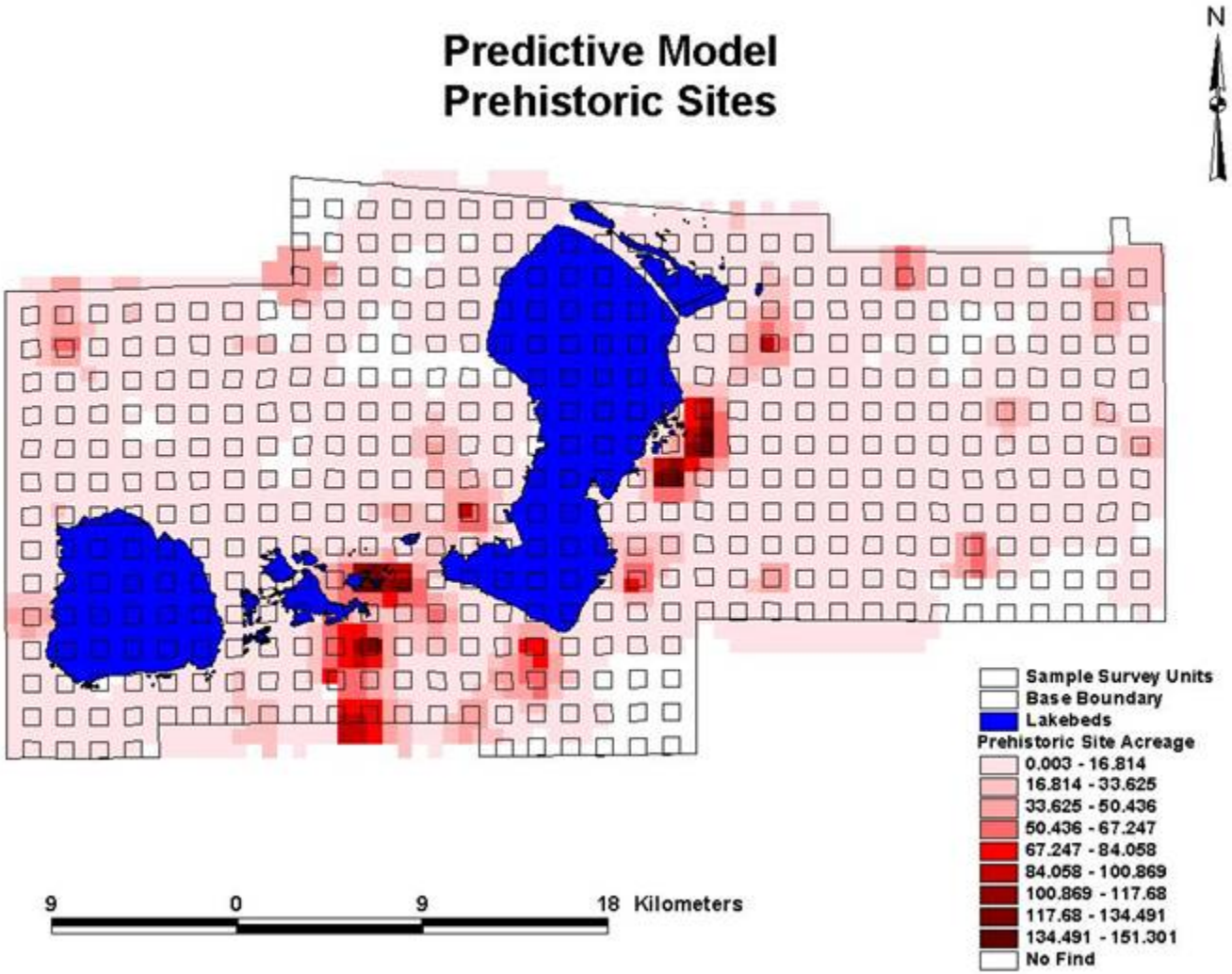
Curation Facility

Cultural Resources Predictive Modeling



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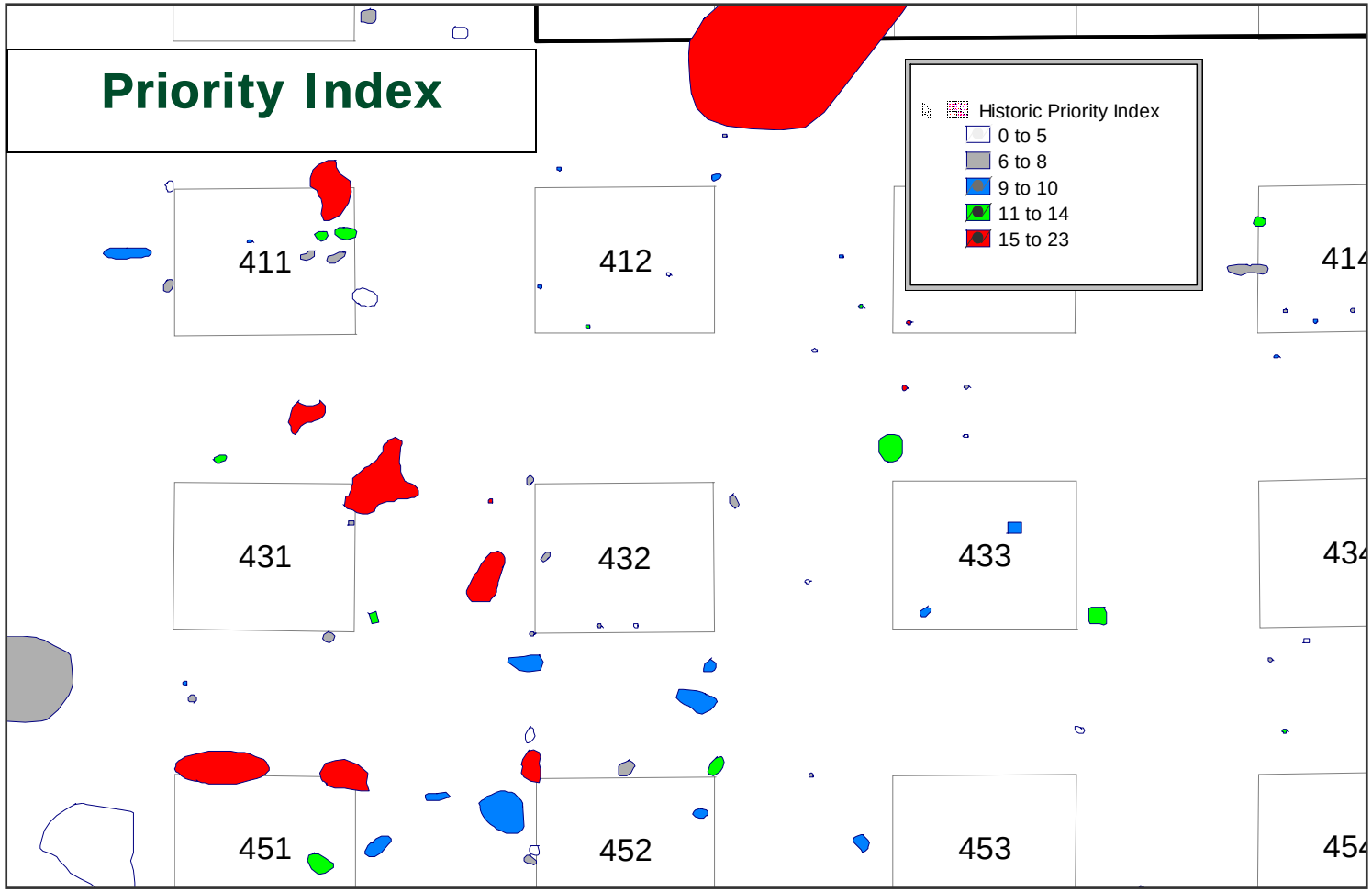
Cultural Resources Predictive Modeling



Cultural Resources Range Rider

In 2003 the Range Rider Program was introduced to monitor and protect key archaeological resources.

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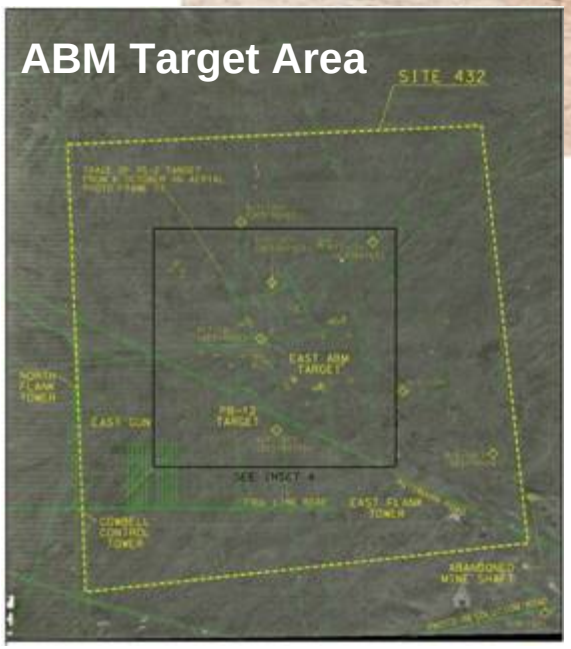
Cultural Resources Range Rider

- Reports fence/gate damage to BHPO
- Visits sites and documents new damage
- Reports observed violations to SFS

Range Management

Past Ordnance and Explosives (OE) Use

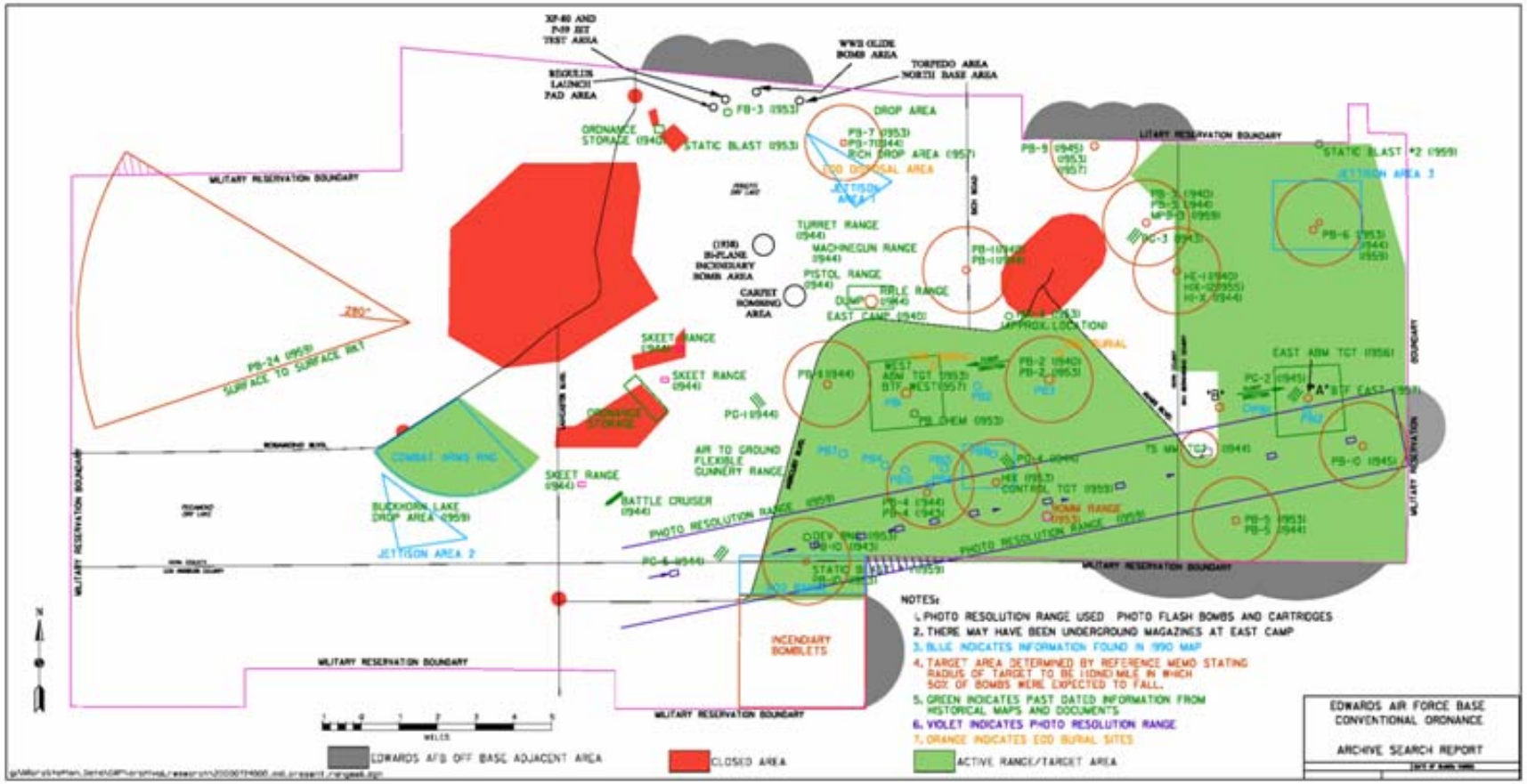
- General Categories
  - ✓ Bomber Crew Training
  - ✓ Individual Training
  - ✓ Aberdeen Bombing Mission (ABM)
  - ✓ Precision Impact Range (PIRA)
  - ✓ Ammo Storage
  - ✓ Miscellaneous



Use Not Limited to Current PIRA

- Targets outside PIRA
- Targets on/near/outside base boundary
- Two static blast sites on/near base boundary
- Approach runs to/from offbase – under/over shoot
- Jettison areas

Range Designations



UXO

- Surface-only clearances performed
- 20-30 ft deep impact potential
- Potential for UXO on “virtually all parts of Edwards” and off-base near boundary due to high release, pilot or drop equipment error, intense long-term OE use, and shifting base boundary

AFFTC Responsibilities

- Projection of future range requirements
  - ✓ ABL, UAV, Directed Energy, Microwave, Air Print…..Next step?
- Intelligent future range planning allows efficient AFFTC resource allocation now

Compliance Site Management

Compliance Site Inventory

Underground Storage Tanks	16
Above Ground Storage Tanks	76
RCRA Cleanup Sites	12
Drinking Water	69
Storm Water	79
EPCRA	205
Air Sources	2,108
Hazardous Waste Storage Sites	78
OB/OD Facilities	4
Solid Waste Landfills	1
Total	2,648

Solid Waste Landfill

- Municipal SW only
- Design capacity = 2.25 million cubic yards
- SW compacted into bales
- Regulated by
  - ✓ Kern County Environmental Health Services Dept
  - ✓ Kern County Air Pollution Control District
  - ✓ Kern County Waste Management Board
  - ✓ CA Board of Equalization, Excises Taxes Division
  - ✓ CA Regional Water Quality Control Board, Lahontan Region
  - ✓ CA Integrated Waste Management Board

Recycling Center

- Accommodates all base recyclables
- Base residents receive $ for turn-in of recyclables
- Curbside pick-up pays for itself
- Center sorts all recyclables
- Only SW goes to landfill
- Certified CA Recycling Center
- Regulated By Department Of Conservation - Division of Recycling

Hazardous Waste Storage Facility

- RCRA large HW generator
- RCRA permitted HW storage facility -- can store for up to 1 year
- Regulated By CA DTSC
  - ✓ RCRA enforcement authority
- Includes CA non-RCRA HW
- Central Main Base location serves all APs
- Stores, manifests and containerizes all HW prior to off-site disposal

Hazardous Waste Accumulation Points

- 70 ACCS (90-day) & IAP (270-day) sites through out the base
- Allows cumulative collection of like HWs
- POL accumulation as used oil reduces cost of disposal via recycling
- Regulated By Kern County Environmental Health Services Department

Corrosion Control Facility

- Large VOC and PM controlled paint booth accommodates up to a B1
- Permits high performance (RAM) coatings application
- Regulated by Kern County Air Pollution Control District
- Compliance with 154 primary conditions – including specific emission limits
- Compliance with and certification for Aerospace NESHAP

Air Monitoring Station

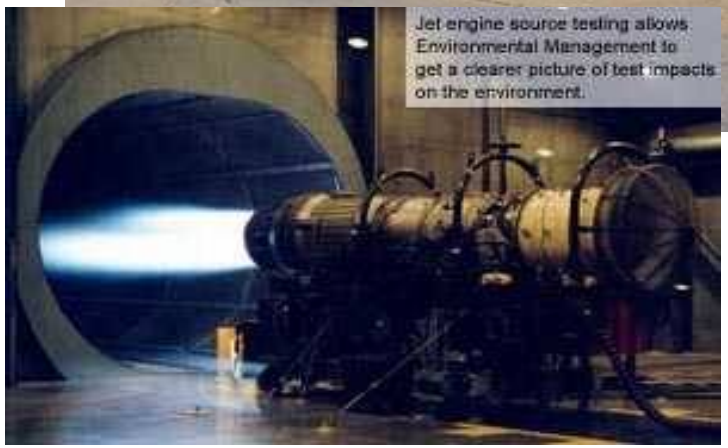
- Characterize ozone from up-wind transport
- Zero 1-hr ozone exceedances in CY99-CY01
- Data used by Kern County Air Pollution Control District
  - ✓ Breakout of East Kern County from San Joaquin Valley ozone planning area
  - ✓ Ozone Attainment Demonstration Plan & Re-designation Request

Air Pollution Monitoring

- Eastern Kern County is non-attainment for 1-hr ozone NAAQS
- Monitoring station installed in 1996 to measure ambient ozone, nitrogen oxides and PM_{10}
- Data used to affect Clean Air Act implementation changes in 1999 and 2000
- Eliminated potential mission restrictions due to Federal Conformity

Jet Engine Test Facility

- Contains four jet engine test cells
- Regulated by Kern County Air Pollution Control District and Kern County Environmental Health Services Department
- As an alternate to UST secondary containment testing, Kern County provided approval to perform an enhanced leak detection test



Rocket Test Facilities

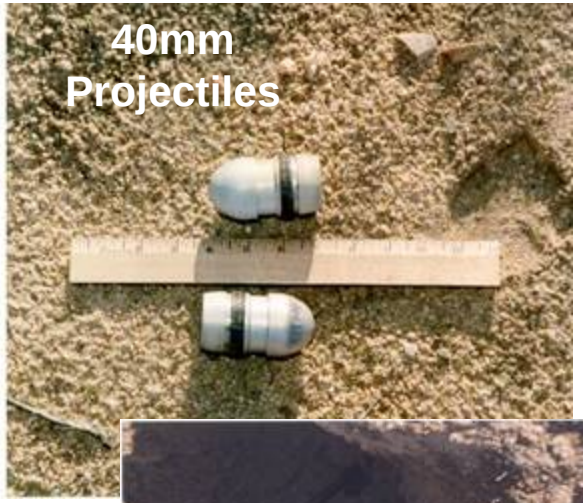
- AFRL - tenant organization
- Execute USAF research and exploratory advanced development programs
  - ✓ Space operations
  - ✓ Propulsion technology
  - ✓ Interdisciplinary space technology
- Regulated by Kern County Air Pollution Control District and Kern County Environmental Health Services District
- WW discharge requirements

Waste Water Treatment Facility

- Reclamation plant – tertiary quality effluent used for landscaping
- Design flow = 2.5 MGD
- Process by biological aeration, clarification, flocculation, dual-media filtration and disinfection
- Regulated by Kern County Air Pollution Control District and Kern County Environmental Health Services Department
- WW discharge requirements
- Separate WW treatment plant at AFRL

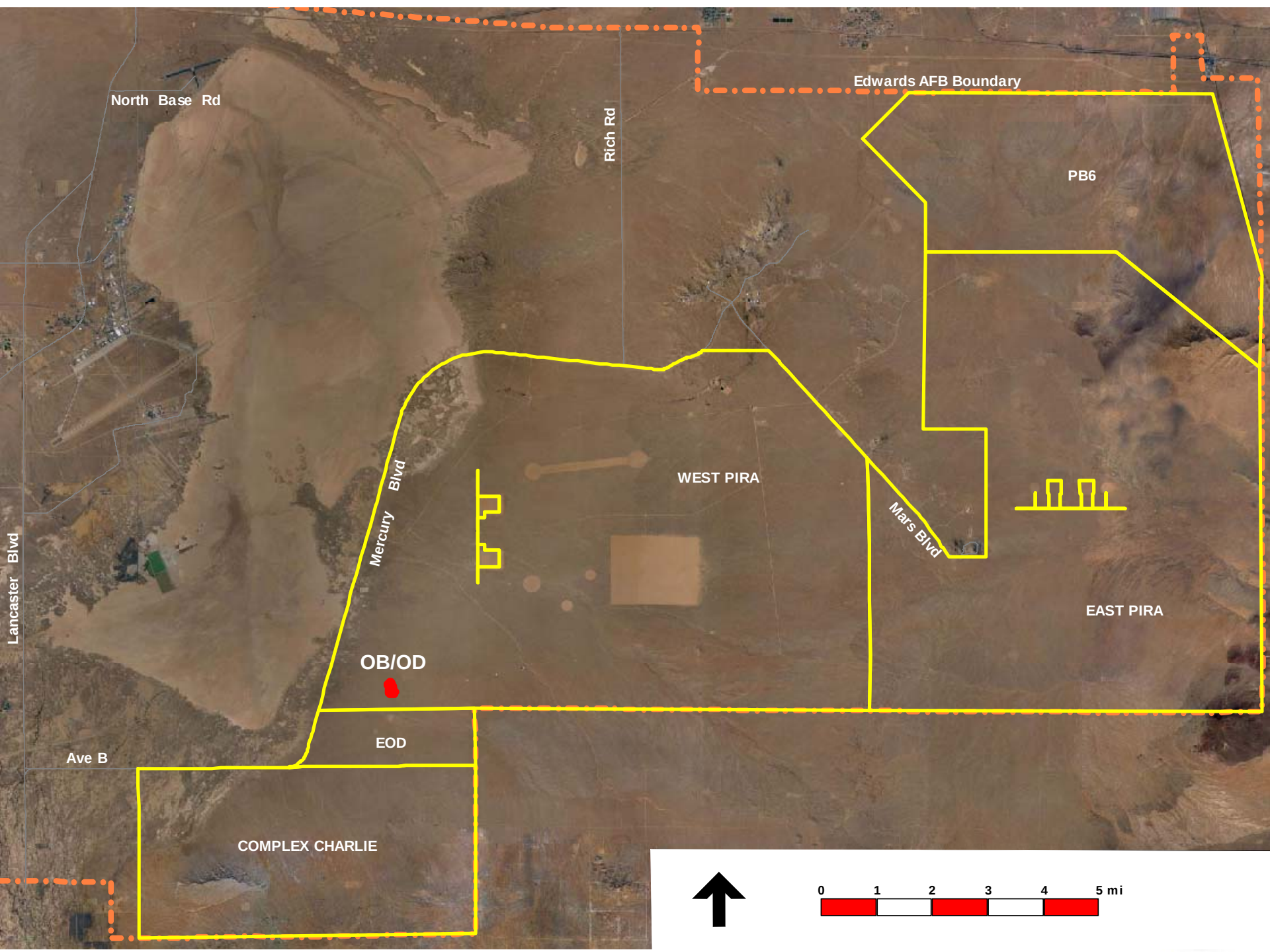
Open Burn/Open Detonation (OB/OD)

- Pending RCRA permit mod for waste propellant/ordnance treatment
  - ✓ Current interim status agreement
  - ✓ Over $2 million spent and on contract
  - ✓ Effort ongoing since 1990
- Safest way of disposal for waste propellant/ordnance
- Regulated by Kern County Air Pollution Control District and CA Department Of Toxic Substances Control
- Multiple agencies with overlapping requirements
- Complex multimedia permit process and requirements



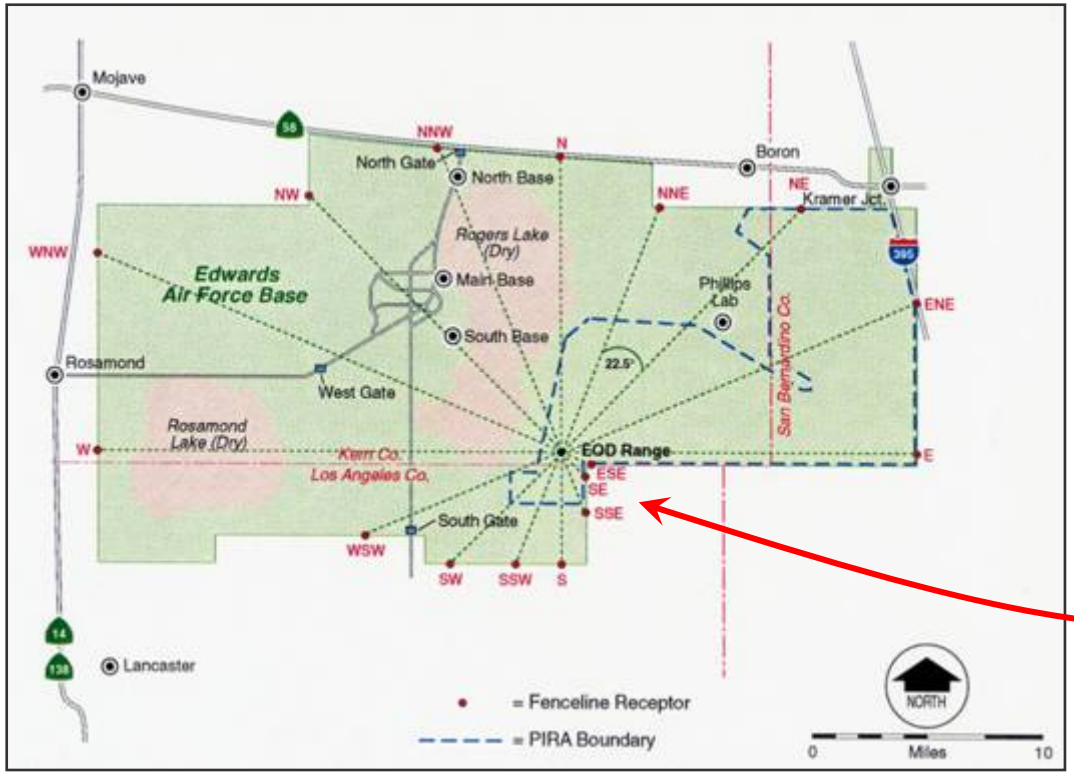
Open Burn/Open Detonation (OB/OD) Permit

- Edwards AFB is working towards full RCRA permit status for the PIRA OBOD Unit
- Most regulated and controversial HW disposal activity within California
- Complex multi-media permit process – addresses impacts to human health and ecological resources


North Base Rd
Rich Rd
Edwards AFB Boundary
PB6
WEST PIRA
Mercury Blvd
Mars Blvd
EAST PIRA
Lancaster Blvd
OB/OD
EOD
Ave B
COMPLEX CHARLIE
0
1
2
3
4
5 mi

Open Burn/Open Detonation (OB/OD) Permit

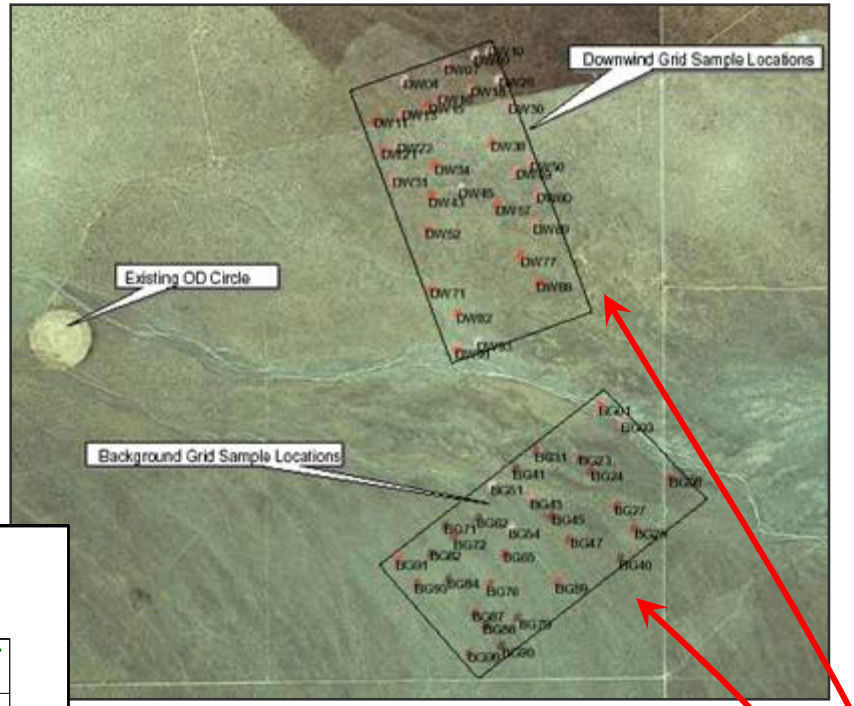
- Risk assessments for human health use air dispersion models and chemical toxicity data to calculate effects of human exposure to OBOD chemical emissions.

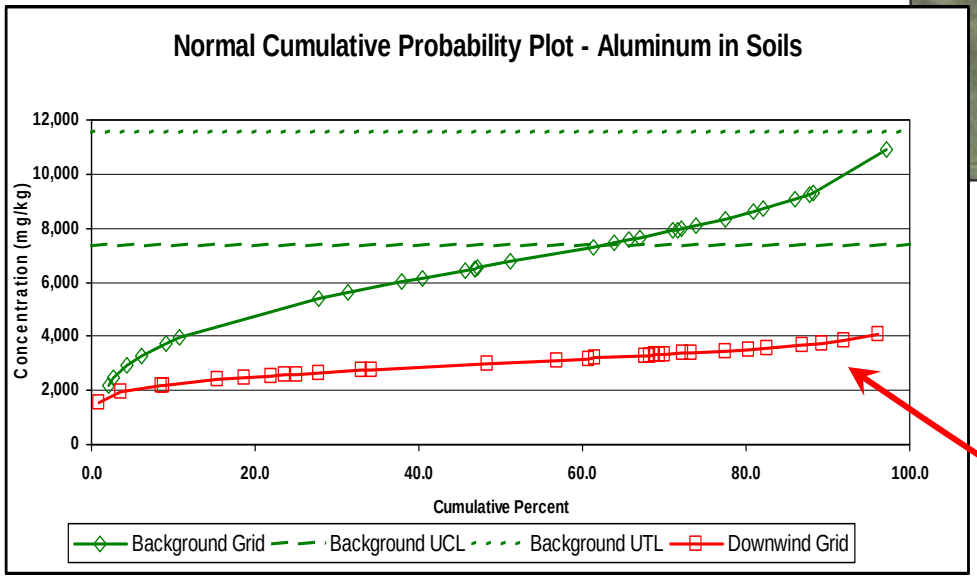


- Each fenceline receptor point is modeled for exposure to OBOD chemical emissions
- Lifetime cancer risk must be less than one-in-a-million to get a permit

Open Burn/Open Detonation (OB/OD) Permit

- Ecological impacts are assessed based on sampling soils and plants exposed to past activities and statistical analysis

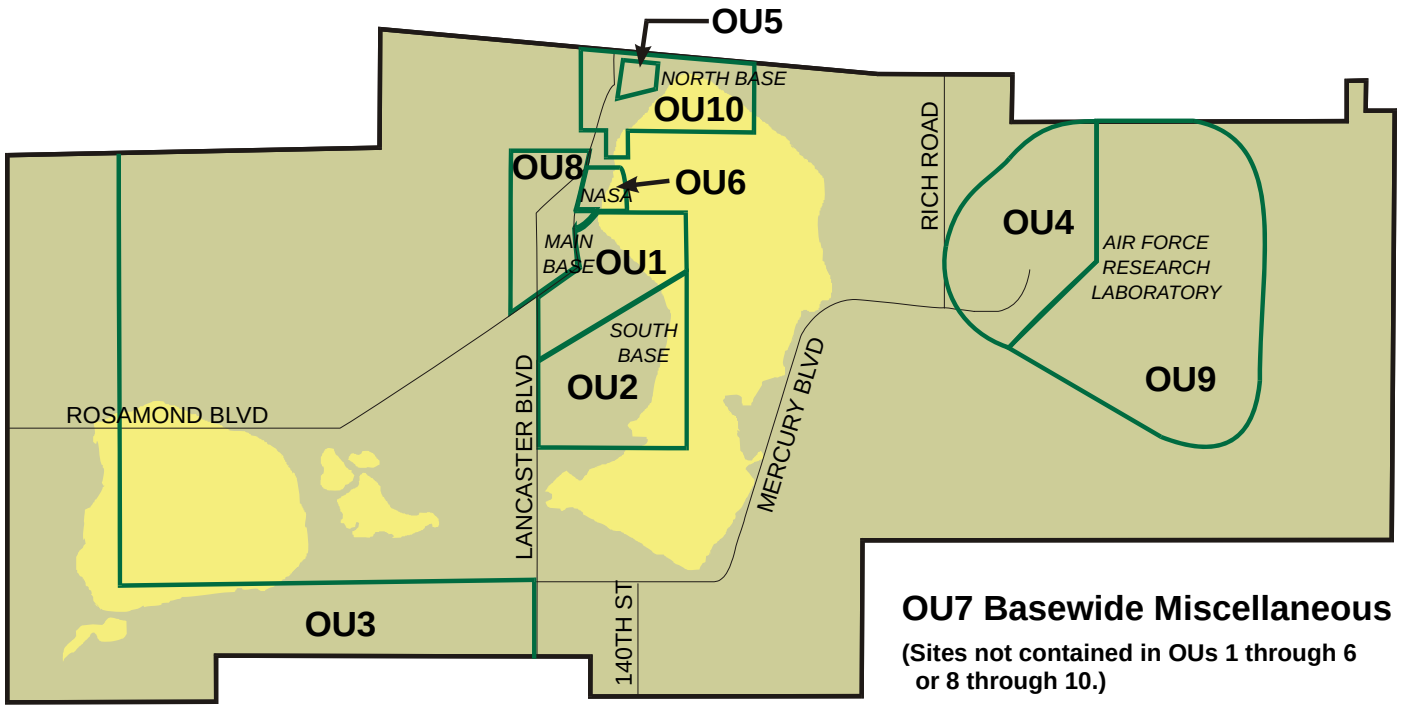




Samples from downwind and background grids are statistically compared

Environmental Restoration Management

Operable Unit (OU)



Operable Units (OUs)

1 - Main Base Flightline
2 - South Base
3 - Basewide Water Wells
4 - Air Force Research Laboratory
5 - Jet Propulsion Laboratory
6 - NASA
7 - Basewide Miscellaneous
8 - Northwest Main Base
9 - Air Force Research Laboratory - East
10 - North Base

471 ERP Sites, 10 Operable Units at Edwards AFB

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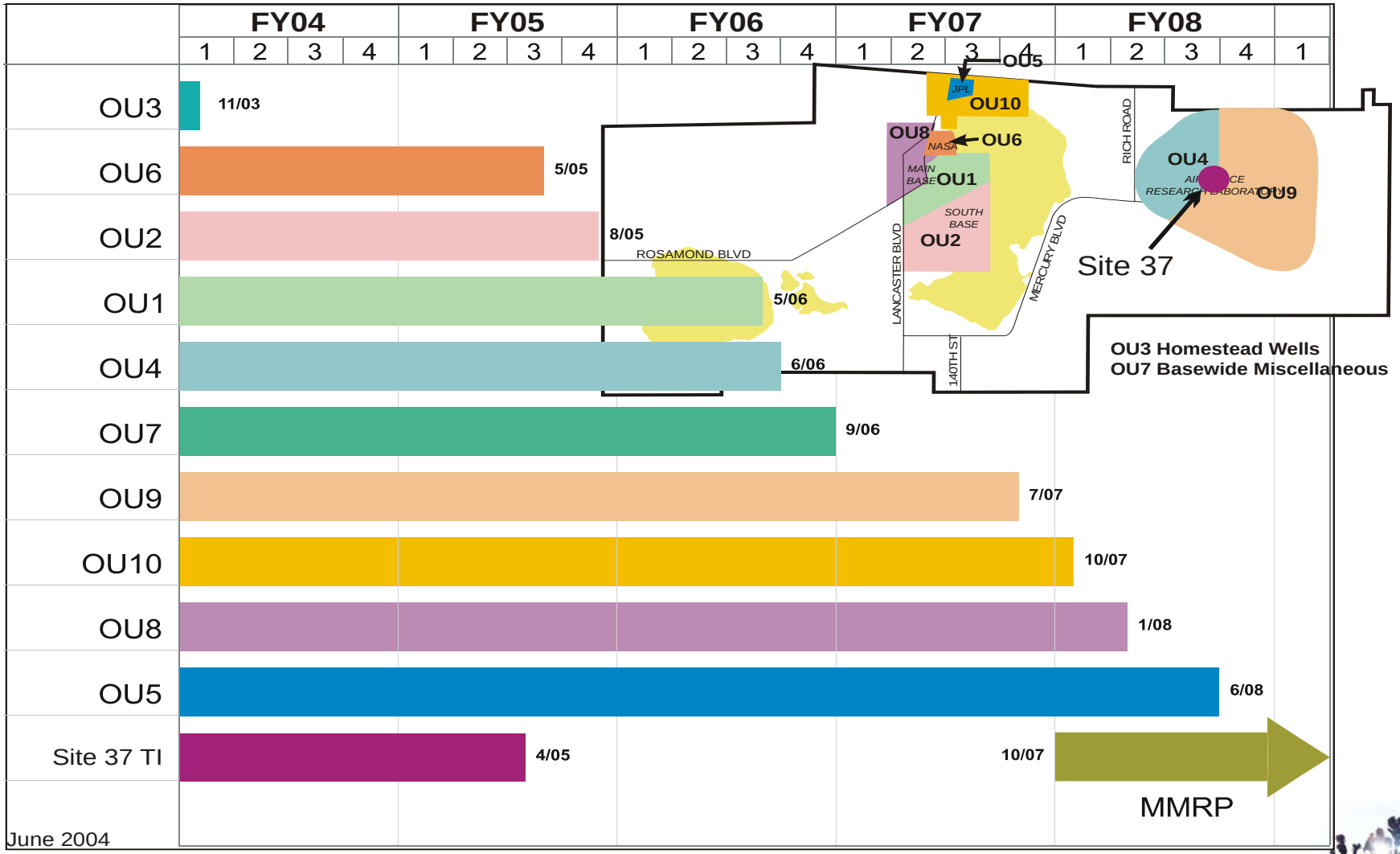
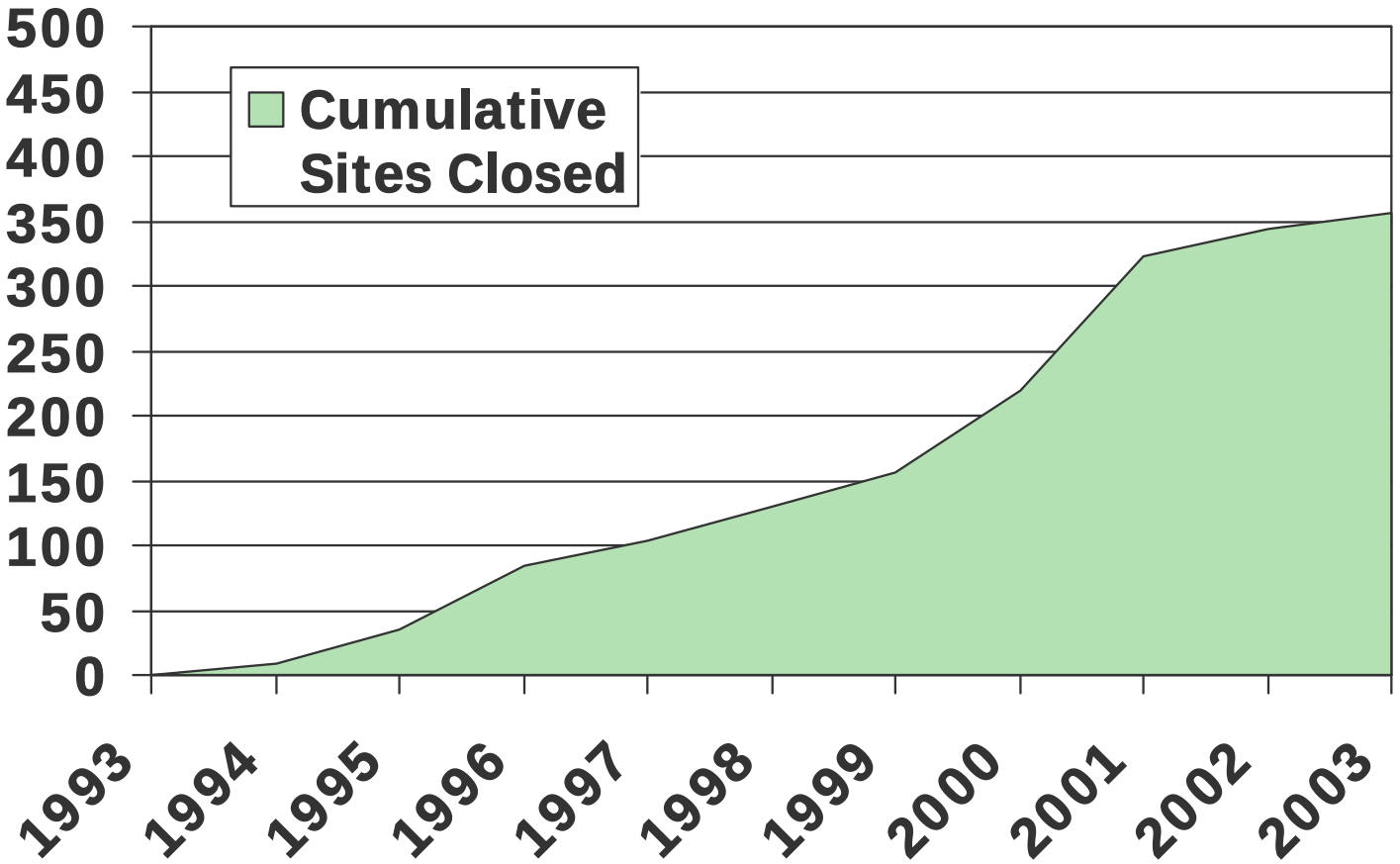
Record of Decision Schedule



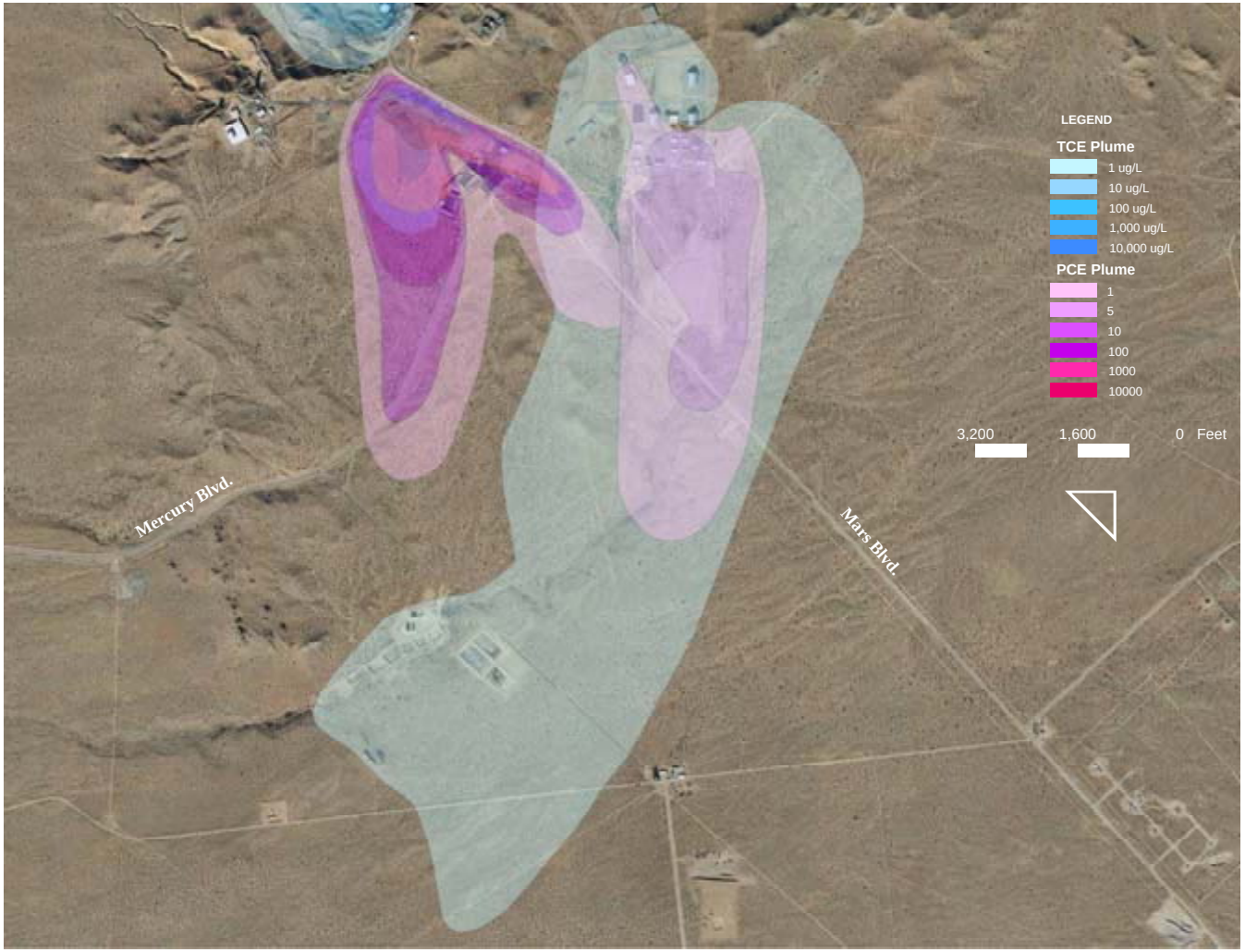
ERP and Range Sites

- ERP Sites
  - ✓ Total Quantity: 471
  - ✓ Closed: 356
  - ✓ Active: 115
- Range Sites
  - ✓ Total Quantity: 6
  - ✓ Closed: 0
  - ✓ Active: 6

ERP Sites Closed To Date

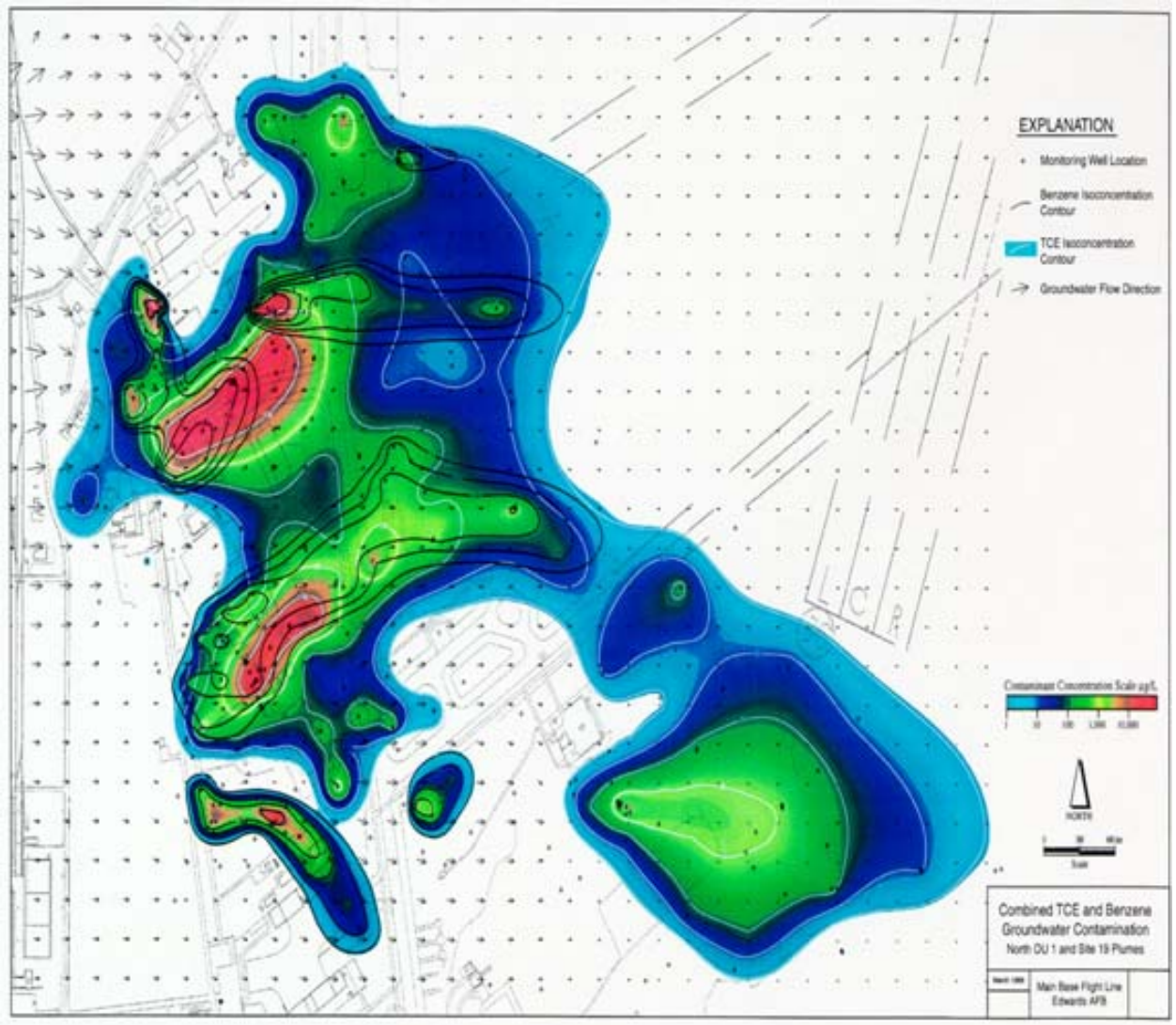


AFRL Groundwater (GW) Plumes



File Path: G:\GIS_Workorders\ERP\rab_meetings\rab0303\afrl.MXD, Date: March 4, 2003,

North OU1
GW Plumes



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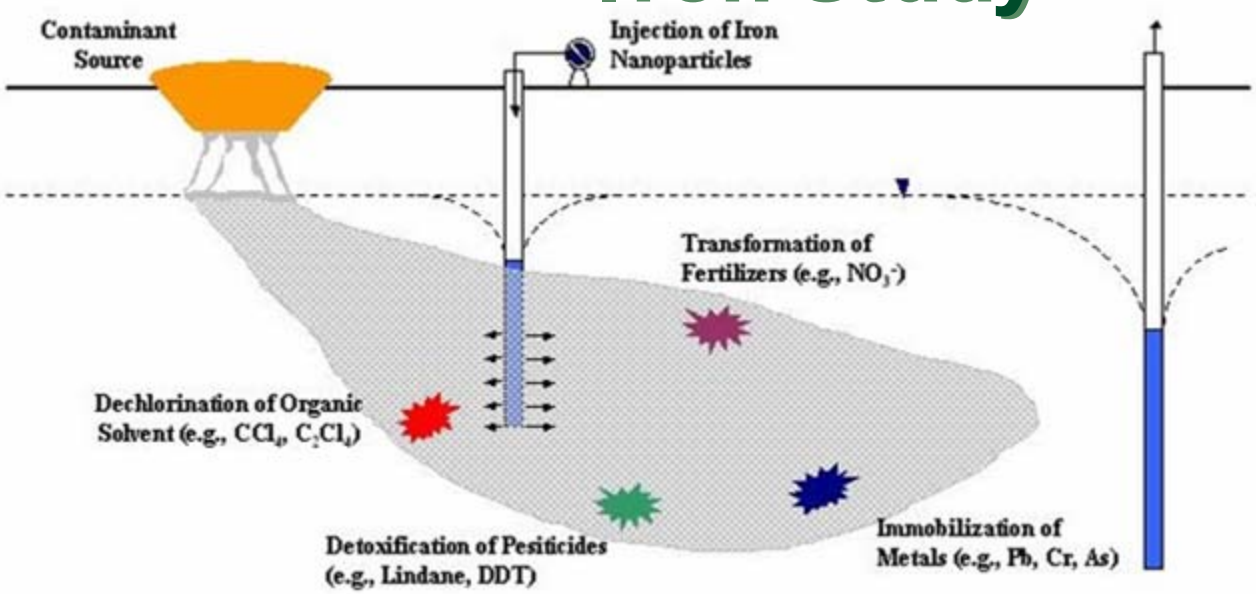
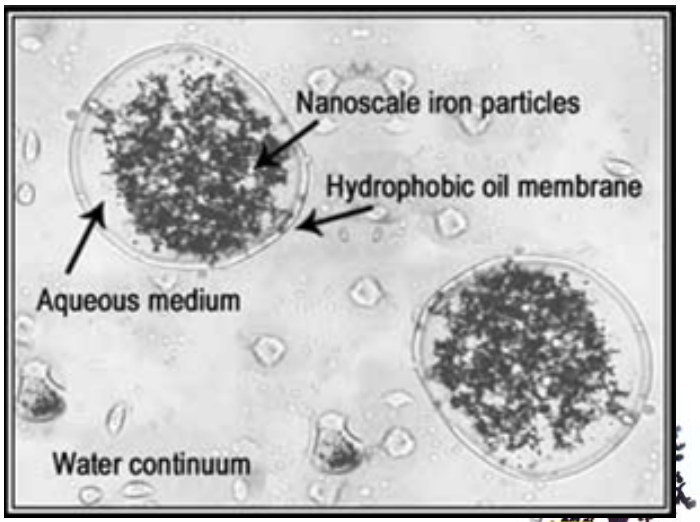
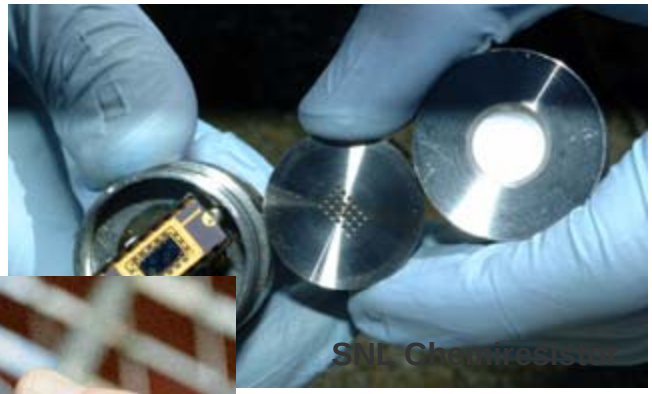
Nanoscale Zero-valent Iron Study

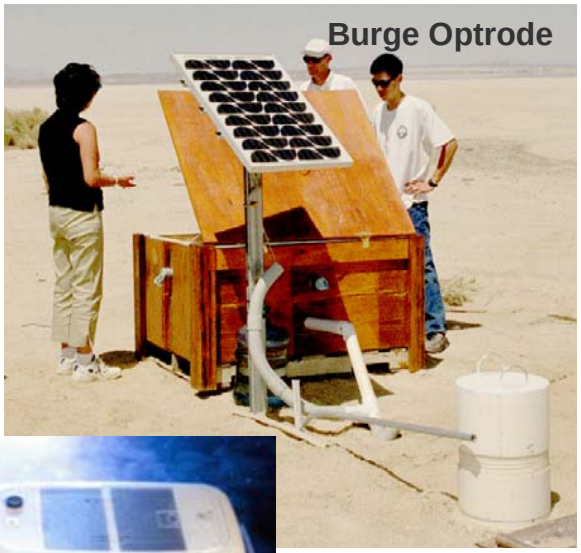


- Nanoscale iron particles suspended in an emulsion are injected into a contaminated aquifer in order to destroy contaminants through reductive dehalogenation
- The technology will be tested at sites contaminated with perchlorate, TCE, and carbon tetrachloride to evaluate its effectiveness in treating chlorinated solvent plumes at Edwards AFB



In Situ Chemical Sensor Field Test Program





- Edwards AFB is partnering with several national laboratories to conduct field tests of recently developed in-well chemical sensors for unattended monitoring
- The tests will evaluate the feasibility and effectiveness of various in situ sensor technologies for detecting contaminant concentrations in groundwater

In Situ Catalytic Groundwater Treatment

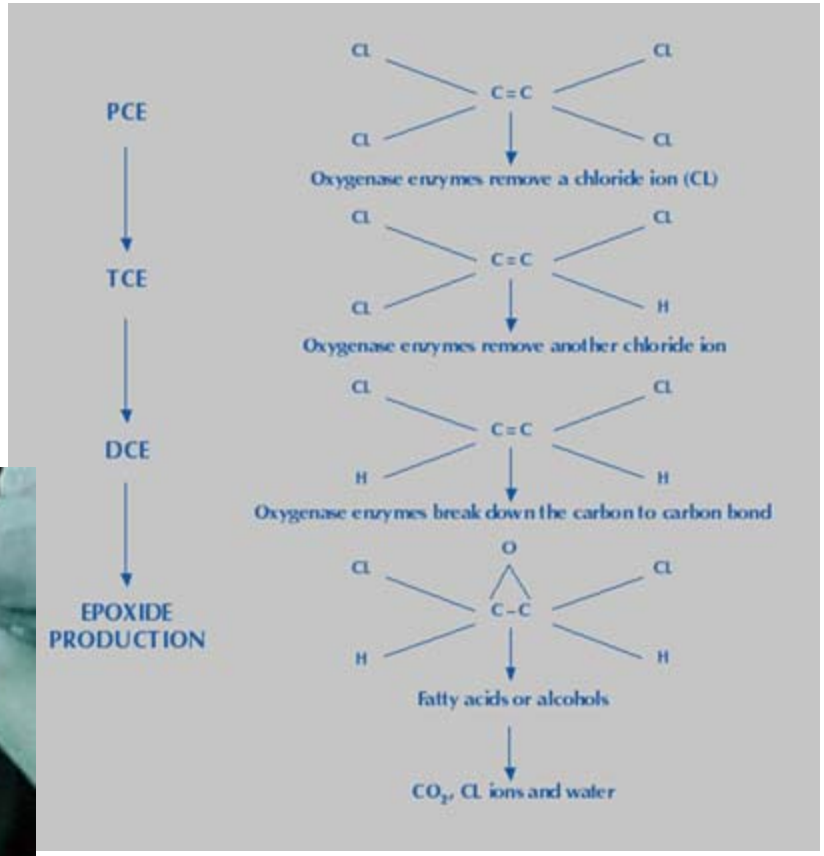
- *In Situ* Catalytic Groundwater Treatment using Palladium Catalyst and Horizontal Flow Treatment Wells is being tested at ERP Site 19
- A multiyear demonstration project is being performed by Stanford University to evaluate this cutting-edge technology for remediating TCE-contaminated groundwater

Steam Injection with High Vacuum Extraction

- The injection of steam into subsurface material, combined with liquid and vapor extraction for recovery
- This study, performed at ERP Site 61, was the first to demonstrate successful removal of chlorinated solvents from fractured bedrock

In Situ Bioaugmentation

- Bioremediation allows natural processes to clean up subsurface contaminants
- Microbes consume certain contaminants, such as those found in gasoline, oil, and solvents, changing them into water and harmless gases, such as carbon dioxide
- Bioaugmentation (injecting microbial solutions into the subsurface) increases the population of these microbes, thereby speeding up this process.



Soybean Oil Injection

- A process for distributing an organic food source into a contaminated aquifer to stimulate *in situ* biodegradation of chlorinated solvents by indigenous microbes
- Emulsified soybean oil was introduced at ERP Site 5/15 to create a permeable reactive barrier to enhance biodegradation of TCE in groundwater.

In Situ Chemical Oxidation

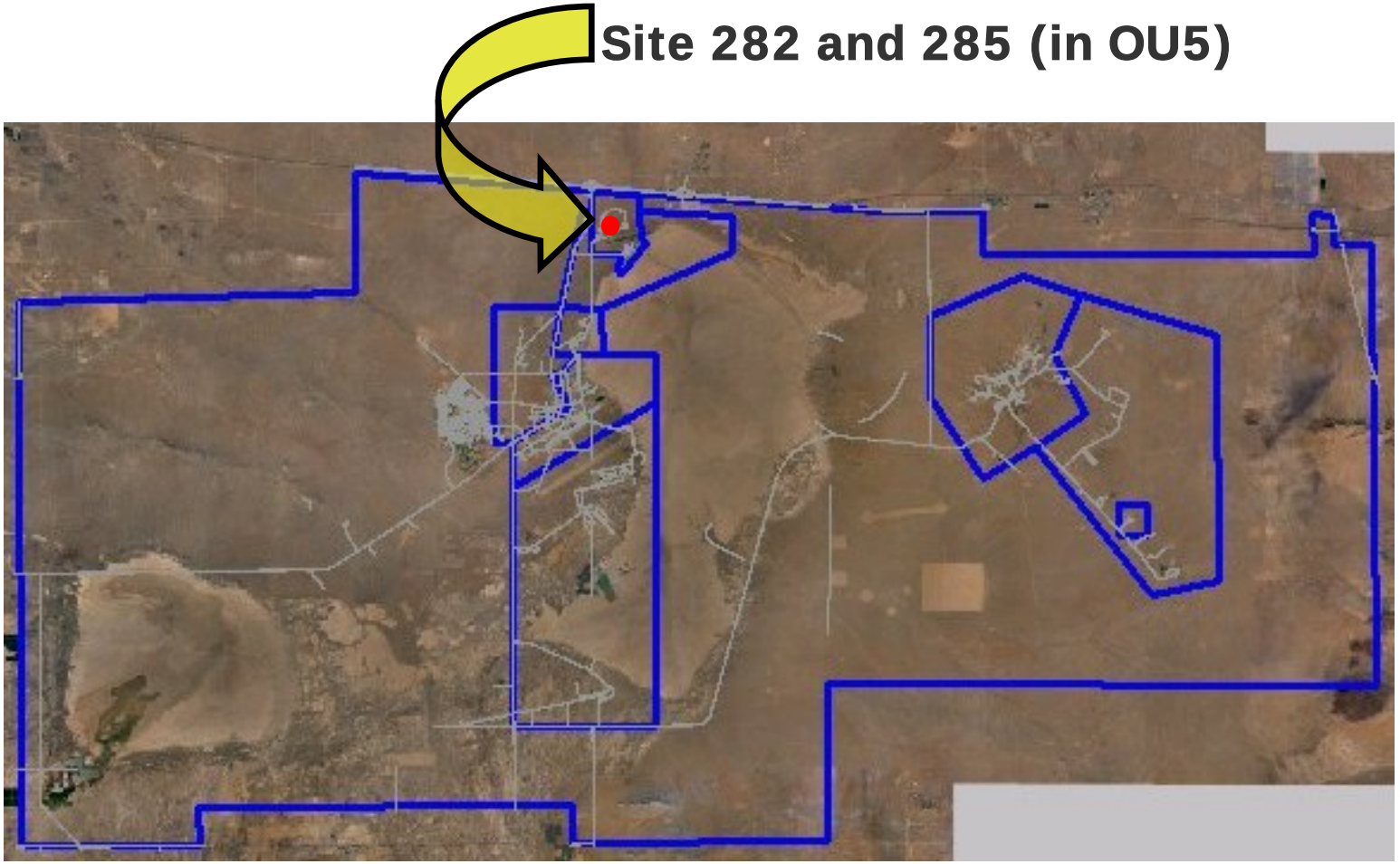
Using Fenton's Reagent or Potassium Permanganate Injection

- Chelated iron catalysts and stabilized hydrogen peroxide (modified Fenton's Reagent), or potassium permanganate, are injected into the subsurface to produce oxidizing and reducing free radicals that attack and destroy contaminants
- Reaction byproducts are innocuous
- Successful pilot tests have been performed at Sites 207 and 211

Perchlorate Management

Site 285 Opening

Site 282 and 285 Location



Perchlorate Management
Site 282 and 285 Plumes

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Perchlorate Management
Site 285 System

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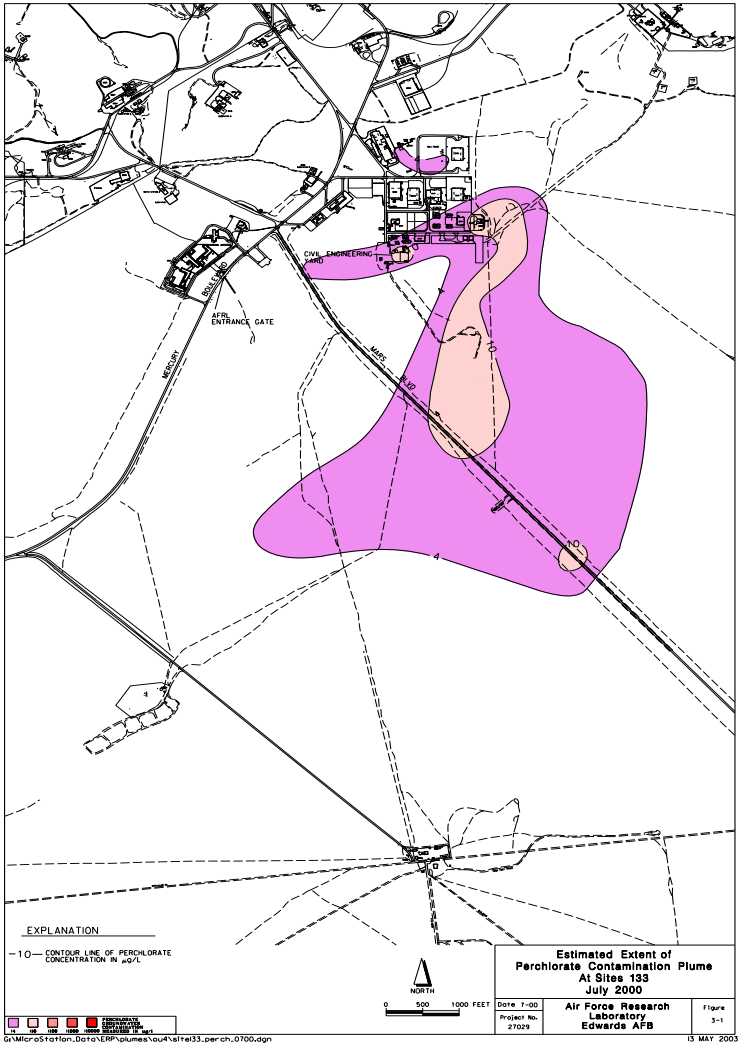
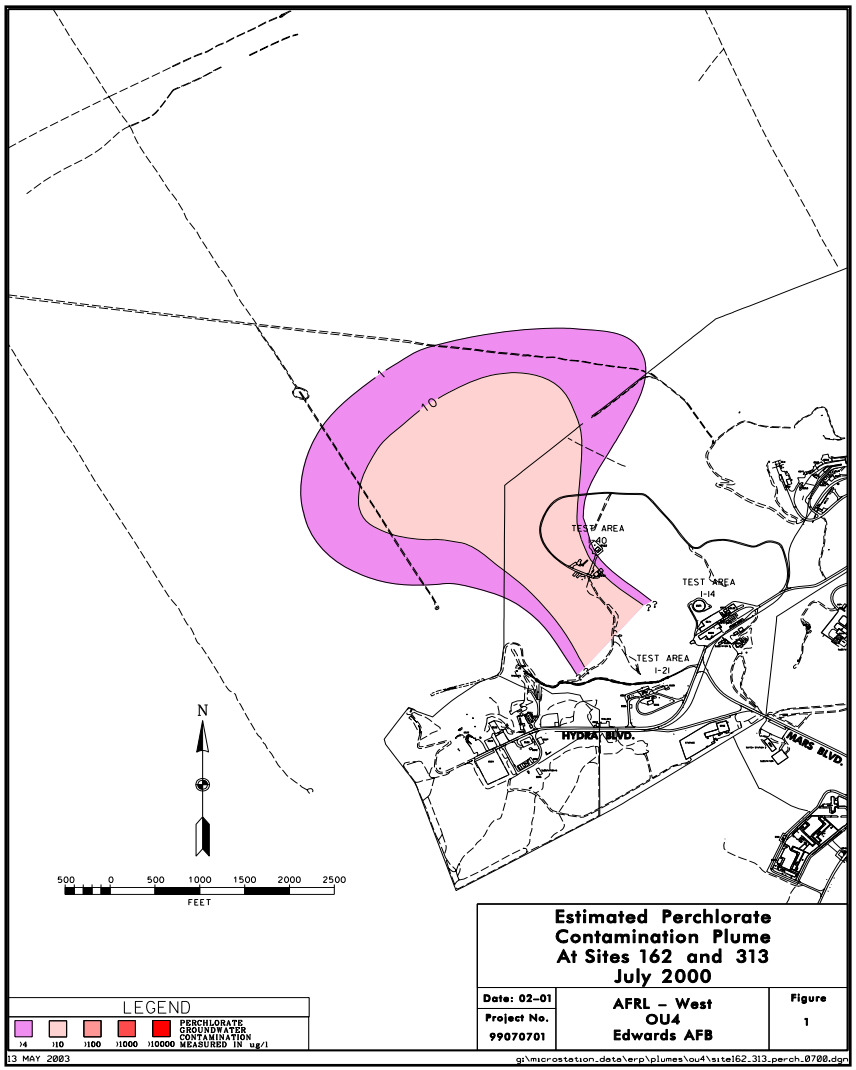
AFRL
Plume Contours



Site 133

AFRL
Plume Contours



Site 162/313

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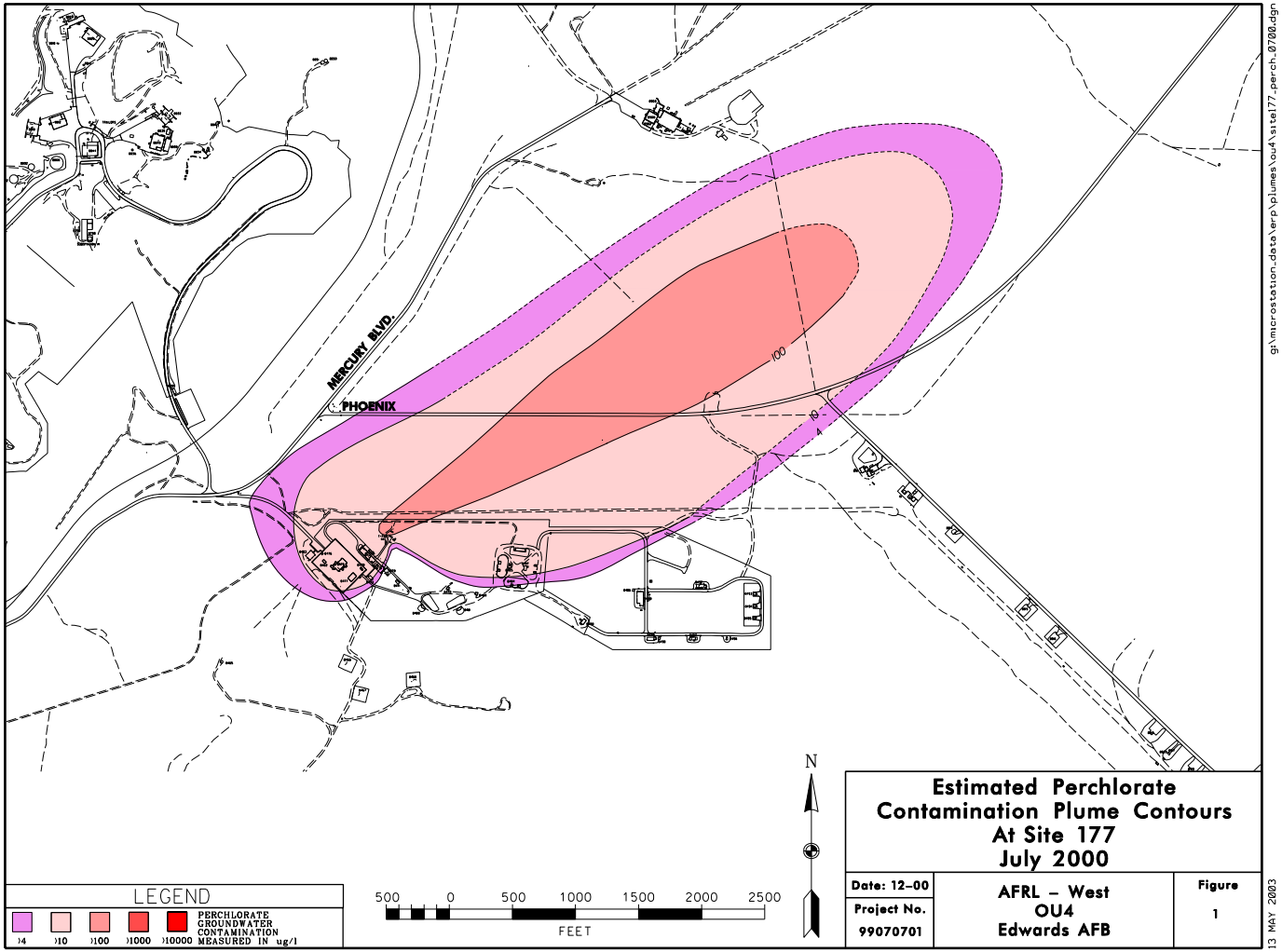
AFRL
Plume Contours



Site 177

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Emergent Chemicals

Emergent Chemical	Health Risk	Action Level
Perchlorate*	EPA concern: Inhibits uptake of iodide in thyroid gland	4.0 µg/L
N-Nitrosodimethylamine (NDMA)*	Probable carcinogen	0.010 µg/L
1,4-Dioxane*	Probable carcinogen	3.0 µg/L
1,2,3-Trichloropropane*	Probable carcinogen	0.005 µg/L
Hexavalent Chromium*	Probable carcinogen	None (50 µg/L total Cr)
Polybrominated Diphenyl Ether**	Thyroid and liver effects, little data available	None

* Known to be present at Edwards ** Related chemicals detected at Edwards

House Energy and Commerce Committee

- White phosphorus
- HMX
- PETN
- Tetryl
- Picric acid
- Explosive D
- Tetrazene
- DEGDN
- Nitrocellulose
- Dinitrotoluene
- Perchlorates
- Ammonium Nitrate
- Nitroglycerine
- Lead azide
- TNT*
- Lead styphnate
- Mercury fulminate
- Hydrazine
- Nitroguanidine
- Diphenylamine
- Phthalates
- RDX

*Degradants

Underscore indicates the presence of HEC Chemicals of Concern at Edwards

Base Environmental and Analytical Laboratory (BEAL)

- State of the art instrumentation
  - ✓ 1 Inductively Coupled Mass Spectrometer
  - ✓ 7 gas chromatographs
  - ✓ 2 gas chromatographs with mass spectrometer detectors
  - ✓ Stereo and polarized light microscopes
  - ✓ Analytical Balances
  - ✓ Physical testing equipment (pH, FP, % H_2O)

Base Environmental and Analytical Laboratory (BEAL)

- Quick turnaround
- Classified samples
- Professional experienced staff
- Special method development
- Data interpretation
- Sampling capabilities

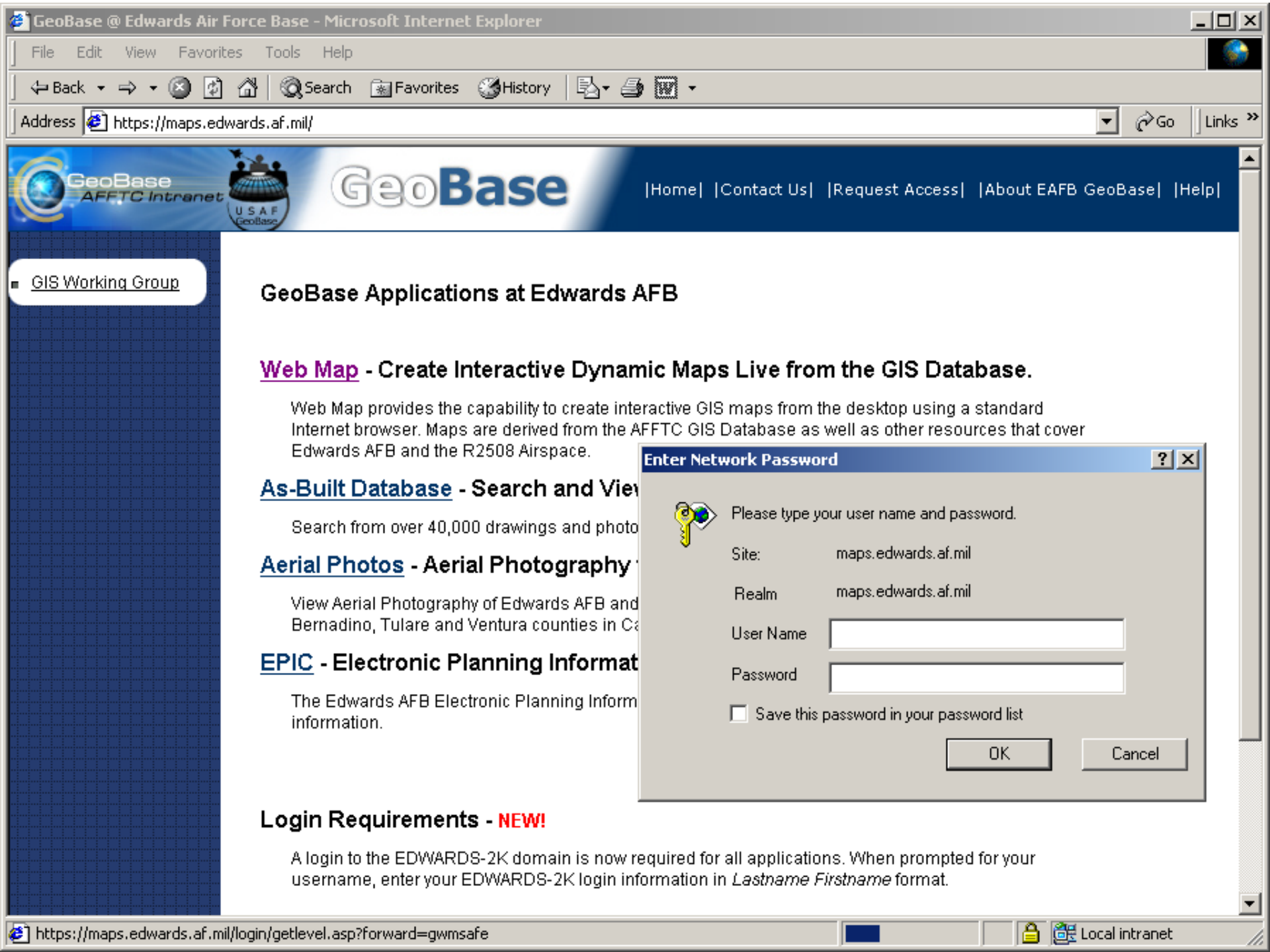
Geographic Information System (GIS)

Edwards AFB
GIS Architecture

- Hardware & Operating System
  - ✓ Windows Servers & Workstations
- GIS Software
  - ✓ Commercial Off-The-Shelf (COTS)
  - ✓ ESRI, Intergraph, ERDAS
- Database
  - ✓ Oracle Spatial
- Personnel
  - ✓ JT3 (CH2M HILL)

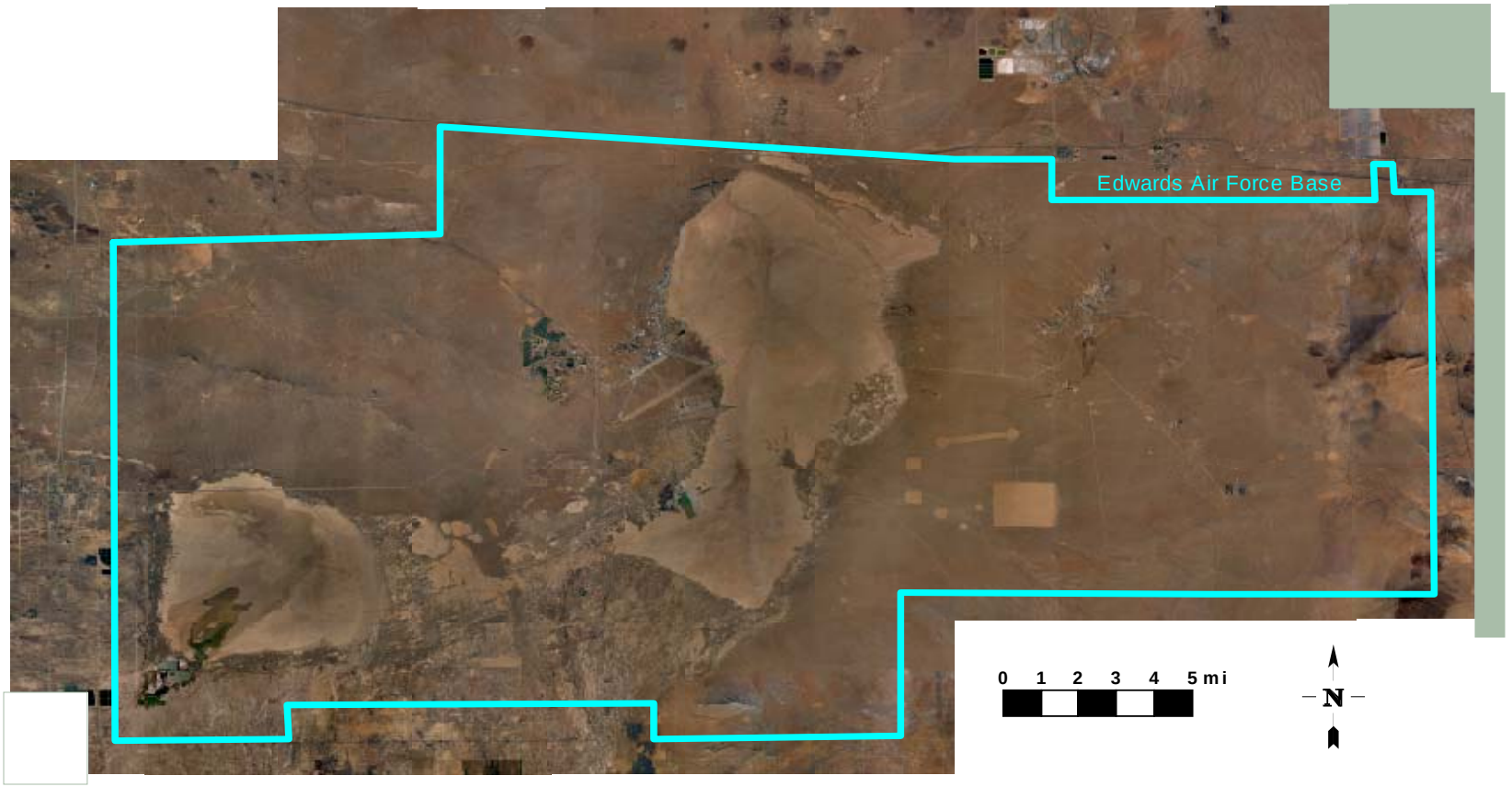
WebMap

- Designed for End Users
  - ✓ Easy to use
  - ✓ Does not require GIS expertise
- Map Creation
  - ✓ Creates maps containing commonly-requested items
- Queries
  - ✓ Allows users to conduct standard spatial queries


GeoBase @ Edwards Air Force Base - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address https://maps.edwards.af.mil/
Go Links
GeoBase AFFTC Intranet
USAF GeoBase
GeoBase
|Home| |Contact Us| |Request Access| |About EAFB GeoBase| |Help|
GIS Working Group
GeoBase Applications at Edwards AFB
Web Map - Create Interactive Dynamic Maps Live from the GIS Database.
Web Map provides the capability to create interactive GIS maps from the desktop using a standard Internet browser. Maps are derived from the AFFTC GIS Database as well as other resources that cover Edwards AFB and the R2508 Airspace.
As-Built Database - Search and Vie
Search from over 40,000 drawings and photo
Aerial Photos - Aerial Photography
View Aerial Photography of Edwards AFB and
Bernadino, Tulare and Ventura counties in C
EPIC - Electronic Planning Informat
The Edwards AFB Electronic Planning Inform
information.
Enter Network Password
Please type your user name and password.
Site: maps.edwards.af.mil
Realm maps.edwards.af.mil
User Name
Password
Save this password in your password list
OK
Cancel
Login Requirements - NEW!
A login to the EDWARDS-2K domain is now required for all applications. When prompted for your username, enter your EDWARDS-2K login information in Lastname Firstname format.
https://maps.edwards.af.mil/login/getlevel.asp?forward=gwmsafe
Local intranet

Aerial Photography

Aerial Photography



For More Information Contact

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Environmental Management

robert.wood@edwards.af.mil

(661) 277-1407