Joint Rapid Airfield Construction (JRAC)

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U.S. Army Engineer Research and Development Center

ERDC
Engineer Research and Development Center

JRAC
Joint Rapid Airfield Construction

Program Objective

The Joint Rapid Airfield Construction program will develop materials and techniques for rapidly upgrading existing or constructing new contingency airfields in-theater with a low logistical footprint. From the airfield site assessment, site selection, construction, soil stabilization, and even through the repair and maintenance stages, …

JRAC will transform the U.S. military's approach to rapid contingency airfield engineering.

JRAC Research Pillars

SITE SELECTION

ENHANCED CONSTRUCTION

Joint Rapid Airfield Construction

RAPID STABILIZATION

JRAC Statistics

- *28 work units*
- *Over 30 researchers*
- *$22.5M in Army funds*
- *6 years in 6.2/6.3 phase*

JRAC technologies will dramatically increase contingency airfield upgrade and construction capabilities!

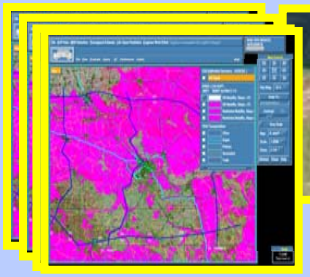
ERDC

Site Selection

OBJECTIVE

Provide decision aids to rank and select sites for contingency airfields based on engineering effort, mission suitability, pavement design and construction requirements, and airfield performance under traffic.

Terrain/Site Data

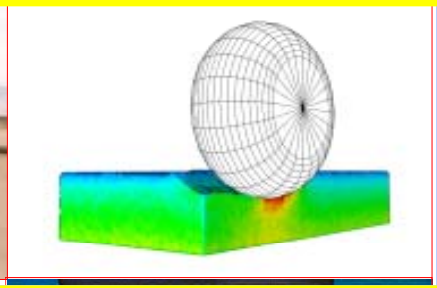


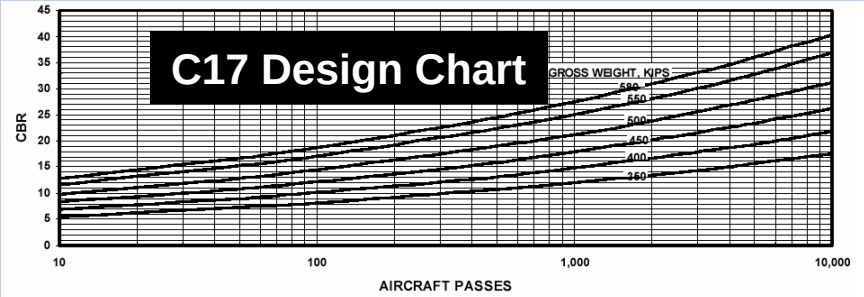
Material Data

Rapid Soil Descriptor Database

USCS Classification		Atterbergs		GSD	Field Properties		
Name	Description	LL (%)	PI (%)	D10 (mm)	w (%)	CBR	γ_d (pcf)
GW	well-graded gravel	8	5	0.4	4	>100	135
SP	poorly-graded sand	8	6	0.25	4	95	105
SM	silty-sand with clay	15	8	0.05	12	85	99
CL	low plasticity grey clay	25	15	0.002	22	89	102
CH	fat black clay	67	42	<0.001	31	78	92

Performance Simulation





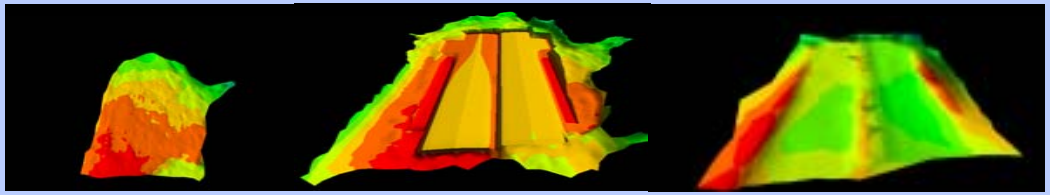
Enhanced Construction Technology

OBJECTIVE

Increase overall design and construction productivity with reduced logistical footprint.

Integrated Design and Construction Planning

Given Terrain | **Design Overlay** | **Construction Monitoring**



Expedient Construction

Rapid Repairs

GPS Instrumentation

Rapid Quality Control

Soil Strength

Soil Density

Rapid Stabilization

OBJECTIVE

Reduce time and increase strength/durability for airfield stabilization.

Chemical Additives

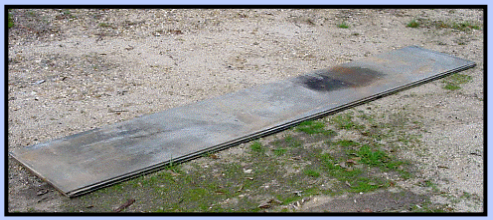
- **Acids**
- **Enzymes**
- **Polymers**
- **Tree Resins**
- **Petroleum Emulsions**
- **Lignosulfonates**

Mechanical Stabilization

Geofibers

Geocells

Mat Systems



AM-2 Aluminum Mat

DURABASE (Heavy)

Fiberglass (Light)

Next-Generation Composite Mats

FY03 Major Activities

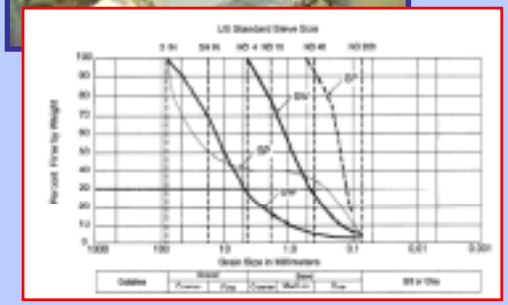
- Stabilized Soil Test Section
- Rapid MOG Enhancement Test Sections
- CRREL Stabilization Test Section
- Enhanced Equipment Evaluations
- Evaluation and Development of QC Tools
- Evaluation of Rapid Assessment Tools
- Select FY04 Demo Site

Test Facility at ERDC Vicksburg

HVS Mark IV in
CRREL Frost Effects Research Facility

Site Selection - Test Section

Material Characterization



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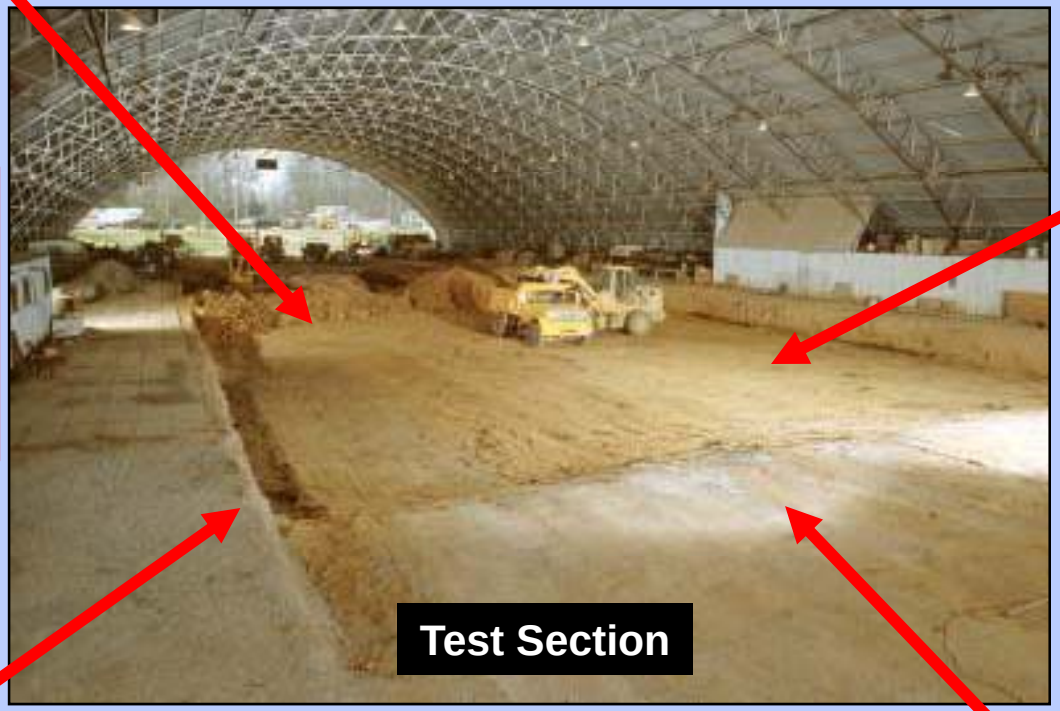
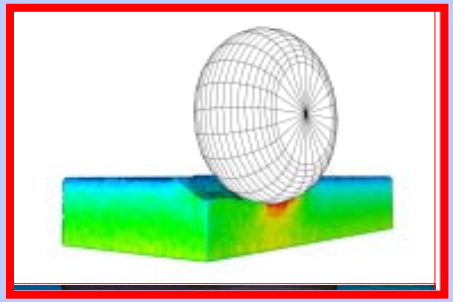
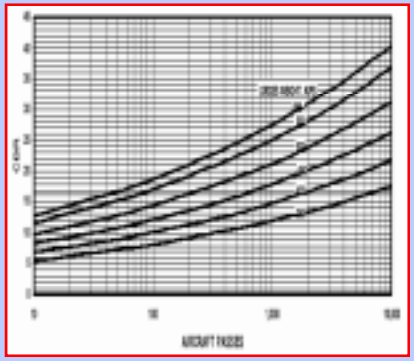




Performance Prediction



C130 Design Chart

Rapid Airfield Assessment Technologies

Post Test Analysis

Enhanced Construction - Test Section

Compaction

Pulverizer Technology

QC/QA Technologies

Enhanced Construction Systems

Stabilized Soils - Test Section

OBJECTIVE

Provide Rapid Solution for Soil Stabilization in Silty Sand Soil with C-130 Wheel Loads

Site Preparation

Stabilization and Compaction

Application of Traffic

C-130 Tire

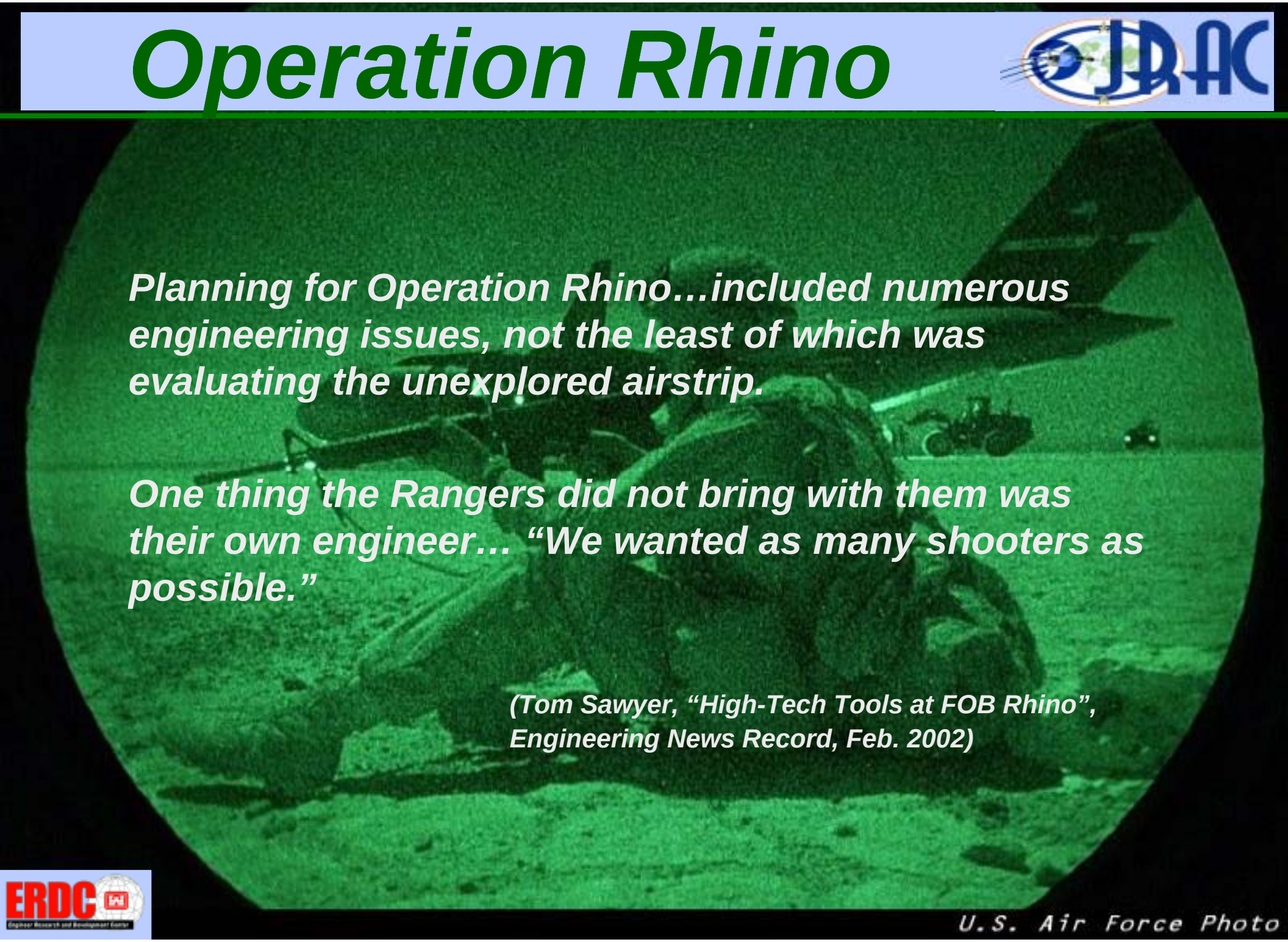
FY04 Demo

Objective – Construct C-130 "contingency" airfield using realistic scenarios and resources with JRAC technologies. The intent is to partnership with a scheduled exercise. Demo will include:

- Site Selection and Assessment Demo
- C-130 Airfield Construction Demo
- Traffic and Performance Evaluation

- Operational Issues – Jeff Edmonds (MANSCEN)
- Technical Issues – Gary Anderton - (ERDC)

Operation Rhino



Planning for Operation Rhino…included numerous engineering issues, not the least of which was evaluating the unexplored airstrip.

One thing the Rangers did not bring with them was their own engineer… "We wanted as many shooters as possible."

(Tom Sawyer, "High-Tech Tools at FOB Rhino", Engineering News Record, Feb. 2002)

U.S. Air Force Photo

What if Operation Rhino had JRAC?

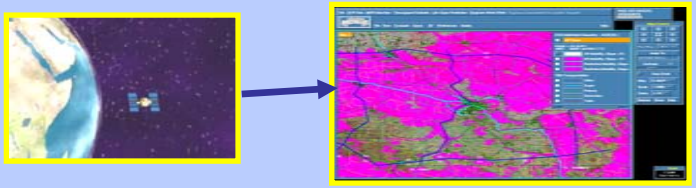
Rhino Problems

"The most important intelligence we brought back was really the condition of the runway…That was something we could not tell until we were actually on the ground and sampled it."

"By the time we left, we were absolutely certain it would support C-130s and cautiously optimistic that it would support C-17s."

Maj. Robert Whalen
U.S. Army
3rd Ranger Battalion
75th Ranger Regiment
(ENR, 2002)

JRAC *Site Selection* Solutions



Satellite imagery and geospatial data used for site selection and assessment

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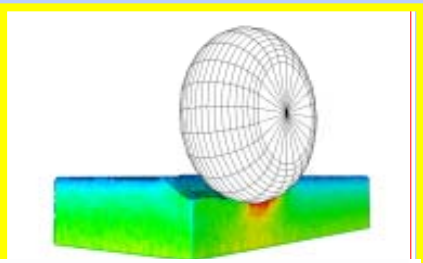
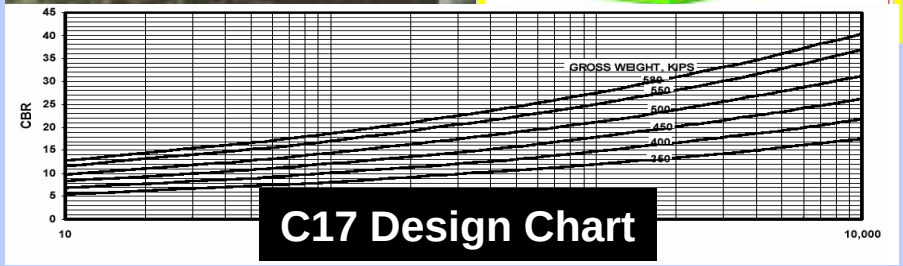
Worldwide Materials Database used to assess potential sites and to project construction/stabilization requirements





Site selection decision-aid which incorporates site conditions with known traffic implications to reliably predict airfield performance

What if Operation Rhino had JRAC?

Rhino Problems

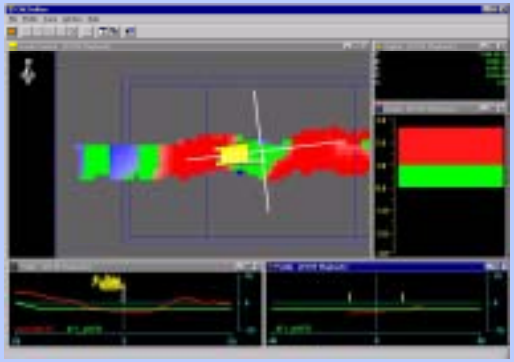
If…runway maintenance fell behind, it could have interrupted the airlift and compromised the mission.

The machines worked the runway from sunup to sundown and between landings at night.

With more than 6000 ft. of runway, the Seabees were not exactly gaining.

(ENR, 2002)

JRAC *Expedient Construction* Solutions



Integrated digital terrain data connects remote design and rapid construction

GPS and laser controls increase earthmoving efficiency and allow for night operations

Methodologies for lasting repairs of contingency airfield surfaces

What if Operation Rhino had JRAC?

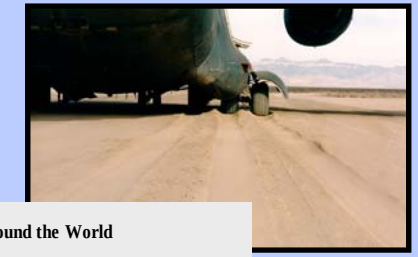
Rhino Problems

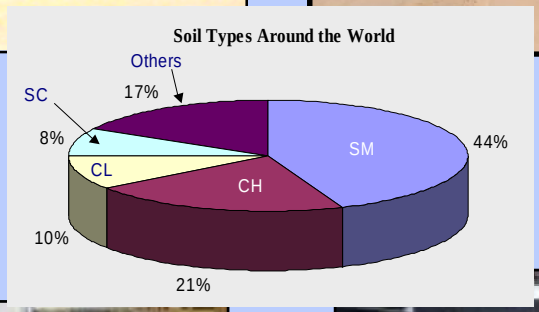
During the month the base was in use, heavy transport aircraft, including the C-17s, arrived nightly. Their landing gear gouged huge gashes into the unpaved surface.

Helicopter pilots throughout the theater of operations are plagued by blinding brown-outs as they return, resulting in hard landings and broken gear. Some crashes resulted in injuries and fatalities.

(ENR, 2002)

JRAC *Soil Stabilization* Solutions





Through laboratory analyses, test sections, and field trials, JRAC will match the right stabilizer with the right soil to increase airfield life

JRAC researchers helped address the helipad dust problem through participation in Operation Brown-Out Exercise at Ft. Campbell, KY

Technology Gaps

- **JRAC Potential Work Units (Currently Unfunded):**
  - **Rapid PCC Slab Replacement**
  - **Contingency Airfield Dust and Foreign Object Damage Abatement**
  - **Design and Construction of Super-Smooth Runways for Unmanned Aerial Vehicles**
  - **Soil Stabilization of Cohesive Soils**
  - **Soil Stabilization of Granular Soils**
  - **Hydrology and Drainage of Contingency Airfields**

Joint Rapid Airfield Construction

- **JRAC Website**
  - **https://jrac.erdc.usace.army.mil**
  - **Accessible by all .mil domains**
  - **Latest Information on Testing, Equipment, Construction Procedures**
  - **JRAC Information on Meetings, Progress, etc…**
  - **Current JRAC issues addressed through Tele-Engineering Operations Center (TEOC) – (601)634-2735 (Comm) or 446-2735 (DSN) unsecured**
    NIPR: TEOC@usace.army.mil
    SIPR: TEOC@TeleEngineering.army.smil.mil

Joint Rapid Airfield Construction

Supports Contingency Airfield Needs. . .

. ..Today

. . . Tomorrow

… and Beyond