

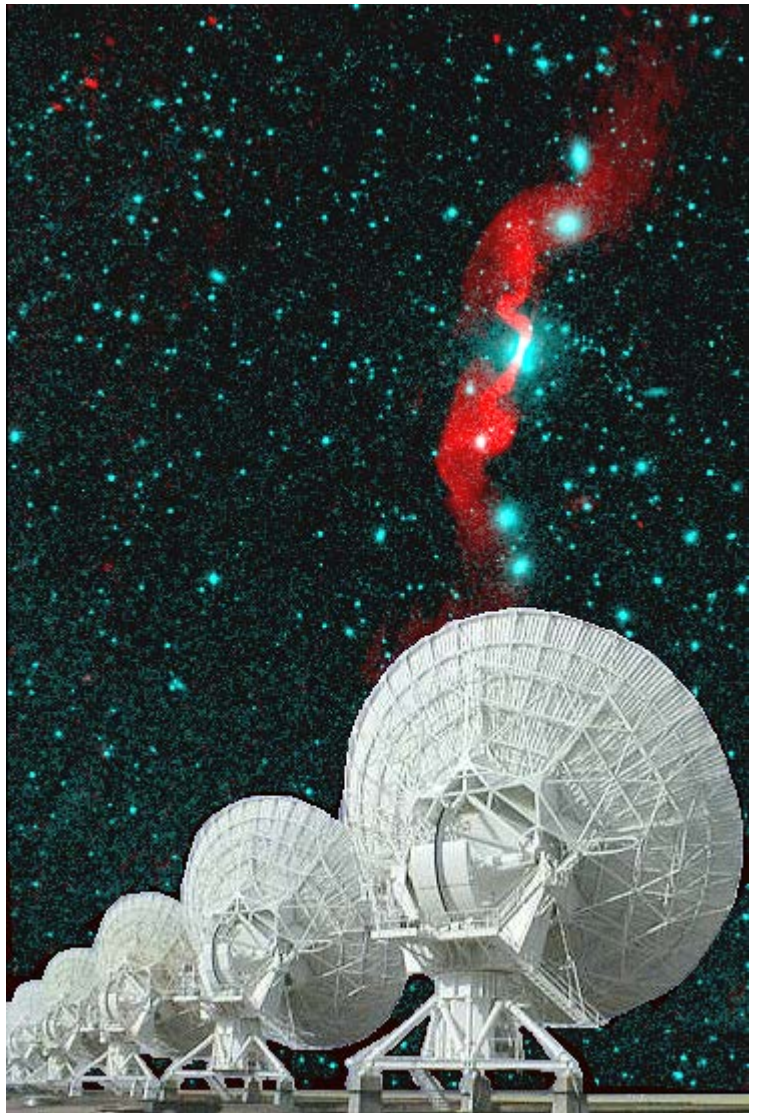
# NRAO

- Designs, builds, operates world-class facilities for astronomical research at radio wavelengths
- Operated by Associated Universities, Inc., a non-profit corporation
- Funded mainly by U.S. National Science Foundation, some NASA
- Our users: world community of radio astronomers (via peer reviewed scientific proposals)

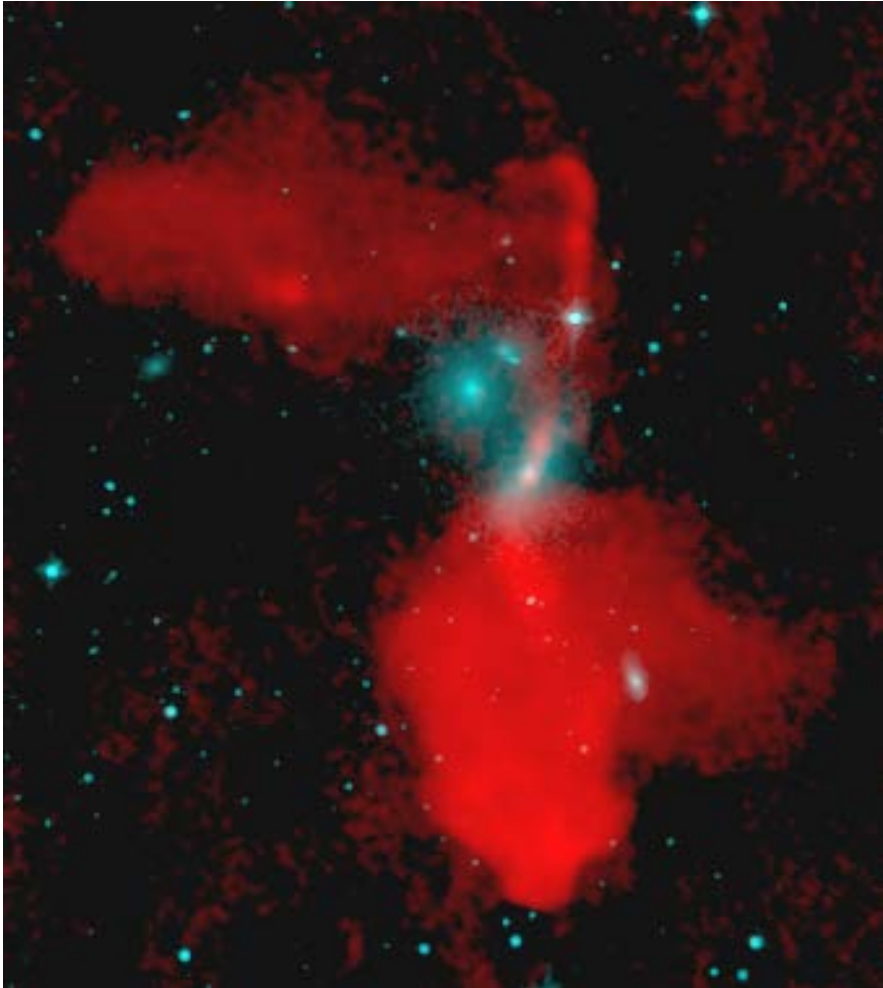


# Radio Astronomy

- Astrophysics research
- High precision antennas
- Low noise electronics
- Digital signal processing
- Advanced imaging algorithms

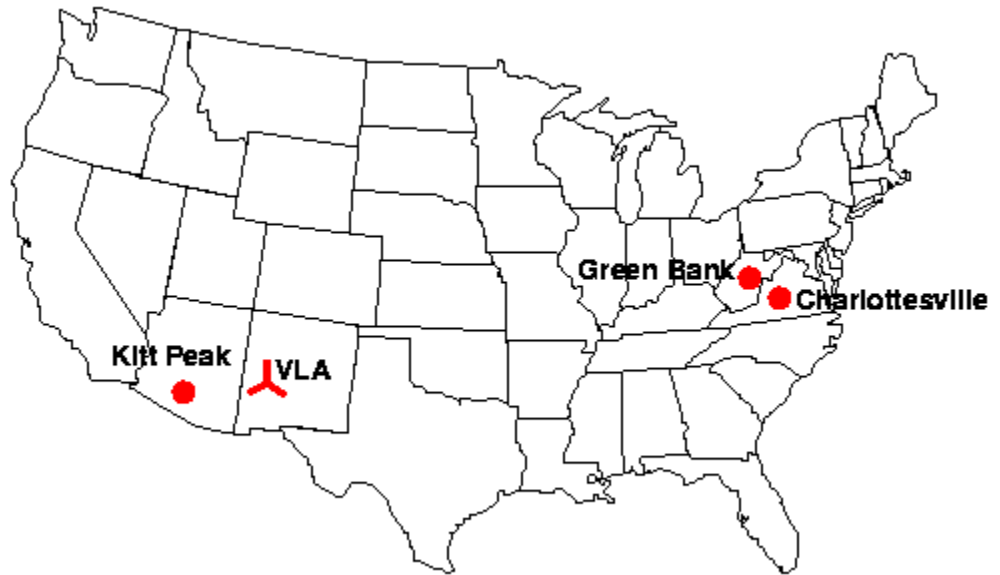


# Imaging the Sky at Radio Wavelengths



- New views of invisible Universe
- New insights in astrophysics

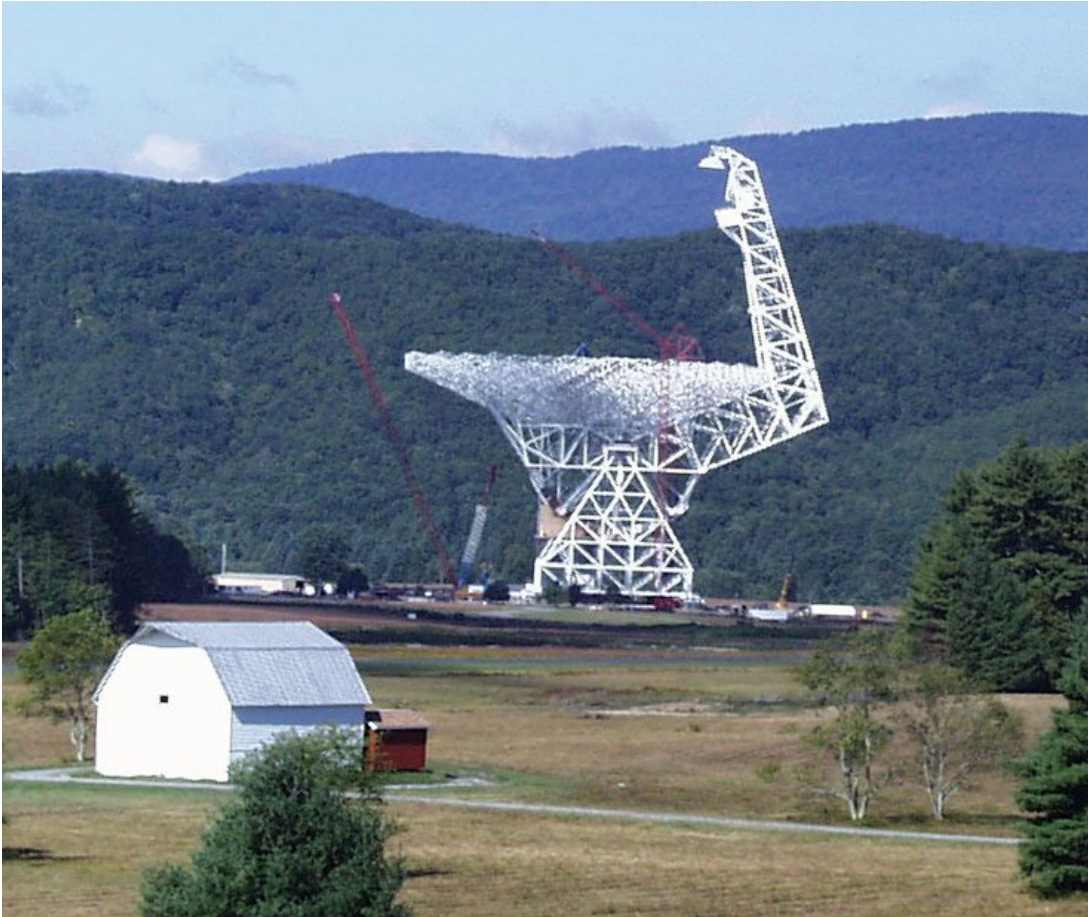
# NRAO Major Sites



- **Charlottesville, Virginia**  
Headquarters  
Central Development Lab
- **Green Bank, West Virginia**  
Large single antenna operations - GBT
- **Socorro, New Mexico**  
Large cm wave array operations - VLA/VLBA
- **Kitt Peak, Arizona (near Tucson)**  
Small mm wave antenna, VLBA antenna
- **Chile (future)**  
Large mm wave array operations - ALMA



# Green Bank Telescope



- Green Bank, West Virginia
- World's largest fully steerable antenna
- Completion Summer 2000

# Very Large Array (VLA)



- 27 antennas, cryogenic systems
- West central New Mexico
- World's most powerful telescope for centimeter wavelengths



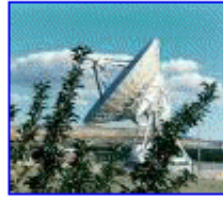
# VLBA (Very Long Baseline Array)



Mauna Kea  
Hawaii



Owens Valley  
California



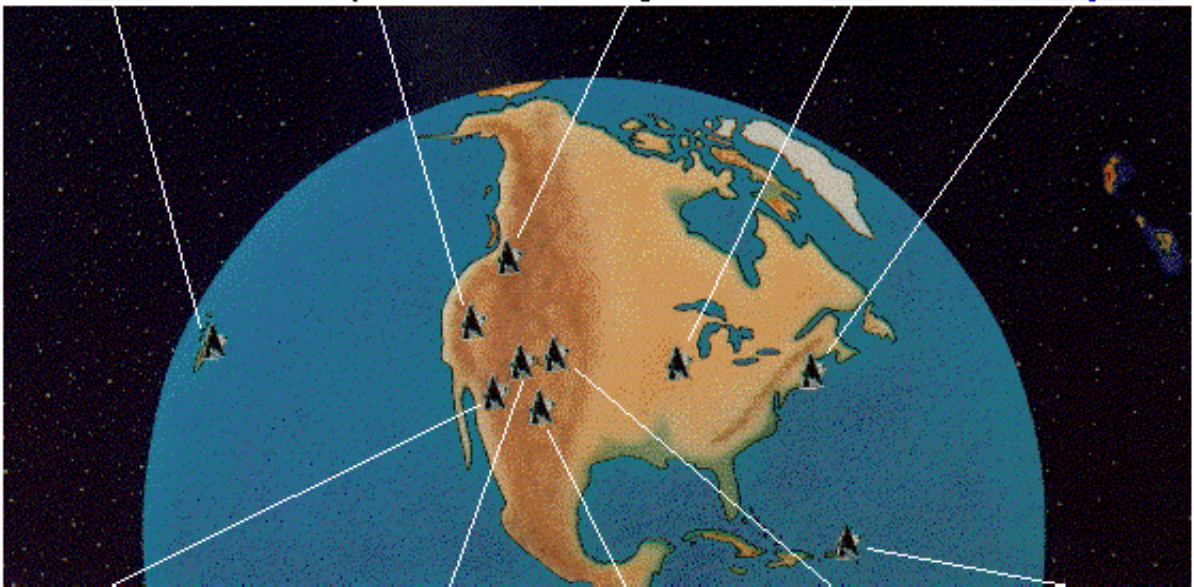
Brewster  
Washington



North Liberty  
Iowa



Hancock  
New Hampshire



Kitt Peak  
Arizona



Pie Town  
New Mexico



Fort Davis  
Texas



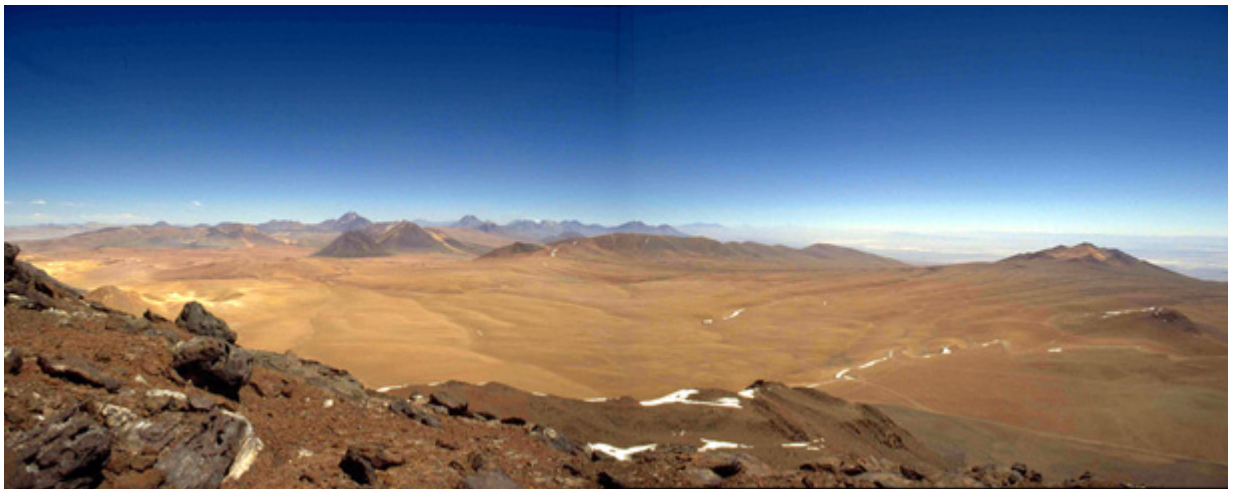
Los Alamos  
New Mexico



St. Croix  
Virgin Islands

- 10 station data combined to emulate Earth-sized antenna

# ALMA (Atacama Large Millimeter Array)



- 64 high precision mm-wave antennas
- many custom microelectronic systems
- Llano de Chajnantor, Chile
- Design 1999-2001
- US, Europe, Japan cooperation



# NRAO in Charlottesville

- Headquarters, Edgemont Road

Scientific and Computing Staff,  
Administrative Offices,  
Library, Auditorium

- Central Development Lab, Ivy Road

Electronic, Electromagnetic and  
Digital Engineering



# Primary NRAO Goals for Edgemont Road Addition

- Provide Central Development Lab with increased space meeting its special physical requirements
- Consolidate all NRAO activity in Charlottesville in one building
- Promote new interactions between astronomers, engineers, computing staff
- Improve meeting/conferencing facilities
- Allow future flexibility as NRAO programs change
- Cost effectiveness



# Central Development Lab

- Advanced projects, unique technology
- Design, assembly, test systems not available commercially
- Cryogenic amplifiers, mixers, frequency multipliers
- Electromagnetic components
- Digital spectrometers, correlators
- Supports projects at NRAO, other observatories, universities, some NASA missions
- 50% growth required for ALMA



# Central Development Lab

- Labs for assembly, test of millimeter-wave devices
- Digital Lab
- Chemistry Lab
- Clean Room
- Cryogenics
- Machine Shop
- Graphics
- Engineer offices
- Administrative offices
- Library, conference rooms



# Central Development Lab Physical Requirements

- Detailed presentation  
by Skip Thacker



# Central Development Lab Physical Requirements

- Temperature & mist control in machine shop
- Humidity & dust control, good electrical grounding in labs
- High ambient light levels & low vibration in assembly area
- Helium, dry nitrogen, compressed air lines
- Noise abatement, ventilation for cryogenic compressor farm
- Access for large racks
- Large machine access for shop
- Chem Lab fume extraction



# Library

- Central information resource for all NRAO professional staff
- Books, periodicals, preprints, astro plate archives, microfilm, microfiche, videos, CDs
- National facility: reference source for radio astronomers, other libraries worldwide
  
- Double shelf space
- Increase Reading Room area
- Informal interactions



# Large Meetings

- Multi-national project reviews
- AUI/NRAO oversight groups
- Technical workshops with ALMA partners, NRAO users
- Scientific Symposia
  
- Expand entrance lobby to serve as discussion, display, reception area for Auditorium
- Large Conference Room near Auditorium
- Small canteen near Auditorium
- Outdoor reception, BBQ area





# Small Conferences

- NRAO inter-site conferencing (telephone and video)
- Multi-observatory project management meetings
- Seminars and lunch talks (internal and with U.Va. faculty)
- Smaller conference room(s)
- Windowless rooms o.k. for small meetings



# Other NRAO Goals for Edgemont Road Addition

- Relocate Communications Room
- Mail/FAX/Printer Room on Library level
- Shipping/receiving, loading dock
- Freight-capable elevator
- Parking for 105 vehicles
  
- Future Flexibility: mix of NRAO C'ville activities will change



# Integrating Diversity

- Professional/admin. Offices
- Meetings/conferences
- Manufacturing facilities
- Large machines, tiny devices
- Research Library

must also balance:

- Wish to promote interactions among professional staff
- Need isolation for some areas from odors, noise, vibration, etc. intrinsic to work in others



# Synergy

- ❑ Library Reading Room is important interaction center for professional staff
- ❑ Common-use area near Reading Room with good visibility into it
- ❑ Concentrate professional offices on same level as Library
  
- ❑ Expanded lobby can display NRAO-wide activities, increase awareness of CDL for visitors
  
- ❑ NRAO likes TGP concept!

