A history of the NRAO's Edgemont Road Addition Project

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These notes are intended to accompany, and to provide background for, the paper and digital materials pertaining to the Edgemont Road Addition project previously deposited in the NRAO Historical Archives by Bill Porter and by me.

1. June 1998: Motivation for the Addition

In June 1998, the NRAO employed 82 staff in Charlottesville in two locations:

- a 24,423 sq.ft. facility at Stone Hall on Edgemont Road, leased from the University of Virginia (U.Va.); this housed the scientific, administrative and computing functions of the NRAO Headquarters, and
- a 11,522 sq.ft. facility at the Dynamics Building on Ivy Road, leased commercially; this housed the Central Development Laboratory (CDL).

It was clear that the available space in Stone Hall and the Dynamics Building together could not support the scope of work that was anticipated in 1998 for about 105 Charlottesville-based NRAO staff as part of the MMA (later ALMA) and EVLA projects.

In a June 17 1998 memo, CDL Head John Webber stated a need to roughly double the usable square footage available to the CDL for work on these projects. Even if the NRAO could have rented more space in the Dynamics Building, major difficulties would have remained because that space, designed for commercial offices, was basically ill-suited to the CDL's long-term needs. The CDL's work had frequently been constrained by access limitations in its machine shop, by vibration problems in the area used for micro-assembly of mm-wave systems, by logistical and environmental difficulties in expanding its cryogenic compressor shed, and by safety concerns over its use and storage of hazardous materials.

Senior NRAO staff also hoped to consolidate the Headquarters, the CDL, and future MMA/ALMA and EVLA support activities into one building. Consolidation was seen as a way to improve everyday communications between staff involved in these activities and to promote a greater sense of "one observatory, one mission" within the Charlottesville staff. There was also a need for more space in which to host scientific meetings involving the NRAO user community, to support expanded inter-site conferencing and communications, and to house growing library, computing and archiving activities, as well as providing the larger laboratory and machine shop space required by the CDL.

Expansion of the NRAO's footprint at Edgemont Road had been considered twice before:

1. In 1967, the NRAO had considered an addition to Stone Hall of about 26,500 sq.ft. as a three-storey “T” (about 7200 sq.ft. per storey) structure perpendicular to the existing office structure with connections to the Library and Auditorium adding 5000 extra sq.ft. to support their functions. A preliminary architectural design had been drawn up for this project, but it was never taken further.

2. In 1989, the NRAO had briefly considered a two-floor addition of approximately 14,450 sq.ft at the North end of Stone Hall's existing office wing.

Both the 1967 and the 1989 concepts had been shelved due to financial, site (drainage and parking) and other constraints, all of which had to be addressed anew in 1998.

In June 1998, after the U.Va. administration indicated their willingness to re-open the question of enlarging Stone Hall, NRAO Director Paul Vanden Bout asked Associate Director Jim Desmond to organize an effort to explore options and costs.

Jim Desmond formed a Building Addition Committee – Bill Porter (Business Manager, Chair), John Webber and Skip Thacker (CDL), Ellen Bouton (Library), Gene Runion (Computing), Mort Roberts and myself (Scientific Staff) – to work with U.Va. Facilities Management and with architects to initiate a feasibility study, and then to prepare a straw-man design and make a preliminary cost estimate for an addition to meet the combined requirements of the Headquarters and the anticipated CDL functions.

2. Summer 1998: Preliminary Design

U.Va. Project Manager Don Riggin

The U.Va. Facilities Management project group was headed by Senior Project Manager Don Riggin. Consultants were added from Smith Garrett Architects (Charlottesville) headed by Candace Smith, and engineering consultants Lindy Bryant and Malcolm Lyle from Bryant Engineering (Lynchburg, VA)

The main entrance to Stone Hall in 2003, before the Addition construction

Stone Hall (named after Ormond Stone, the first director of the Leander McCormick Observatory) had been built in 1964 to1965 as two separate steel-framed brick faced structures joined by a glassed-in mezzanine. (The original architects were Tippets, Abbett, McCarthy, Stratton, Engineers and Architects and the original construction contractor was R.E.Lee and Son, Inc.) The three-storey “East” building housed offices and computing facilities; its original machine shop and laboratory space had since been converted to other uses. The East building also housed the heating and cooling plant for both structures in a first-floor machine room and in a rooftop penthouse. The two-storey “West” building housed the Auditorium and Library. The second floor of the mezzanine acted both as an extension of the reading room for the Library and as an informal meeting-place for staff. Its first floor acted as an entrance lobby and its basement, accessible only from the outside, served as a communications equipment room. By 1988, all three levels of the mezzanine were considered much too small to support their desired functions.

Smith Garrett Architects considered and rough-costed two options in the summer of 1998, one of which was similar to the NRAO’s own 1967 plan. As well as providing facilities for the CDL and additional office space in an Addition that was (mainly) to the North of the existing buildings, this option expanded the Library and Lobby areas by removing the North wall of the mezzanine to create two large central spaces in the combined building. One version of this design added 30,095 gross sq.ft. at a construction cost estimated at $4.6 million by chartered quantity surveyor Martin P.

O'Connell (in a report to Smith Garrett dated August 28, 1998). This option was adopted as the basis for further design.
On September 18, 1998, a memorandum from the NRAO Building Addition Committee to Paul Vanden Bout, Bob Brown and Jim Desmond formally recommended that the NRAO should seek AUI and NSF approval for the Edgemont Road Addition while continuing to work with U.Va. to refine the cost estimate and building plan based on the committee's preferred design.

At that time, the target date for NRAO occupancy of the Addition was late 2002. The NRAO committee's memorandum noted that "time is of the essence" if the facility was to be ready for the proposed millimeter-wavelength project work.

On November 8, 1998, U.Va. Facilities Management advertised in *Virginia Business Opportunities*, the *Daily Progress* and the *Richmond Times Dispatch* for letters of interest from firms wishing to provide "full architectural/engineering consulting services … as required for planning, design and construction phases for new construction of an approximately 30,000 gross sq.ft. addition to existing Stone Hall".

On December 17, 1998 a Screening Committee of Kenneth G. Smith P.E. (Chair), Louis G. Martsolf A.I.A., Mary Hughes (U.Va.) and Gene Runion (NRAO) named five of the fourteen firms who had sent letters of interest as being the best qualified for further consideration to provide the required design services.

On March 27, 1999 the U.Va. Board of Visitors gave permission to proceed with the detailed design. A Request for Proposals from the five pre-qualified design firms was issued on March 30, 1999 with a due date of April 20,1999.

Proposals were duly received from RTKL Associates (Baltimore, MD), The Greenwood Partnership (Williamsburg and Lynchburg, VA), Shriver and Holland Associates (Norfolk, VA), VMDO (Charlottesville) and Smith Garrett (Charlottesville).

The proposers presented their proposals on May 3, 1999 to a U.Va.-appointed Interview Committee of Samuel A. Anderson III A.I.A., Robert P. Dillman and Donald C. Riggin (U.Va.), and Alan Bridle (NRAO). This committee recommended that the Greenwood Partnership be awarded the contract for the detailed architectural/engineering design and construction supervision.

Following this recommendation, U.Va. awarded the design contract to the Greenwood Partnership (which later became Versar, Inc.) on May 24, 1999. At this time, the "design-to" cost was estimated at $4.78 million.

Don Riggin continued as the University's Project Manager, while Randy Vaughn headed the design effort at the Greenwood Partnership.

The NRAO team for the ongoing project was headed by Bill Porter, with John Webber, Skip Thacker, Gene Runion, Ellen Bouton and Alan Bridle as its members.

3. 1999: Detailed Design

Model of the Addition and site as approved by U.Va. In November 1999

On September 10, 1999, U.Va.'s Art and Architecture Review Board approved a schematic design for the building that had been produced by the Greenwood Partnership in consultation with U.Va. and the NRAO. This design defined the footprint of the expanded building as a T-shaped addition to the North, extending Westward up Observatory Hill by a different amount on each floor (to minimize excavation costs). The filled-in center would house expanded Library, Lobby, conferencing and central utilities, and the parking space would be significantly expanded. A ground rule for the design at this stage was to minimize the renovation of the existing building, except where required by code and to connect it to the Addition.

The overall site plan was separately approved by the U.Va. Arboretum and Landscape Committee on September 24, 1999. This committee also strongly endorsed my request that as many large trees as possible from the old University Arboretum plantation be preserved, and that new dogwoods and redbuds be added around the building wherever possible. (These became explicit components of the final construction plan)

Additional architectural enhancements required by the U.Va. Board of Visitors, including roof entablature and the replacement of all existing windows with double-hung windows to match those specified for the Addition, were communicated to the NRAO on

November 15, 1999. These features were added to the working design as potential "additive bid items", to allow for deleting them if construction bids for the base design came in too high.

On December 16 1999 a preliminary construction cost estimate for the project by the Greenwood Partnership came in at $5.9 million, i.e., about $1 million over the "design-to" cost. In January 2000 U.Va. obtained an independent construction cost estimate from contractor Martin/Horn Inc. of Charlottesville, who estimated their cost to build the Greenwood design as $5.1 million.

4. 2000: Value Engineering Review

Although Martin/Horn's independent cost estimate was closer to the design-to cost than the Greenwood Partnership's estimate, further study was mandated because all projects with estimated construction costs over $5 million financed by the state of Virginia were required to undergo a "Value Engineering" (cost-effectiveness) review. This review was held during the week of February 7-11, 2000 at the Courtyard Marriott Hotel.

The review group, appointed by U.Va. and led by Dale E. Daucher P.E. (Pacific Environmental Services, Herndon, VA) with members Chuck Callaghan (Senior Review Architect), Adrienne Hendrickson (Senior Electrical Engineer), Ron Herfurth (Senior Mechanical Engineer), Shashi Kavde (Senior Structural/Civil Engineer), Sandy Lambert (Senior Architect) and J.E. Rich (Construction Cost Estimator, through Pacific Environmental Services) suggested modifications and potential savings with a net cost reduction of just under $0.5 million. Design then went ahead with most of these measures incorporated. A major modification introduced by the Value Engineering Review was to revise the overall concept from two almost-independent structures separated by a firewall to become a single fully-sprinklered building with integrated (and new) heating/cooling plant and electrical services. There was also some down-sizing of the central area relative to the December 1999 plans. This building integration complicated the construction scheduling and required a more invasive approach to the existing building (which was to remain occupied by some NRAO staff throughout the project) but it resulted in a safer and more efficient physical plant. It also provided enough (net) saving in construction costs to bring the project back on-budget.

At about the same time, the NRAO administration separately costed an alternative option to relocate the entire Charlottesville operation into new construction at one of the U.Va. Real Estate Foundation's off-grounds research parks. On March 10, 2000, at Paul Vanden Bout's request, Alan Bridle and John Webber wrote a needs statement for a single 60,000 gross sq.ft. building with 39,670 *net assignable* sq.ft. of which 14,750 sq.ft. would be specialized lab space similar to that planned for the enlarged Stone Hall. The U.Va. Real Estate Foundation's estimate of long-term rental costs for this building was determined by Paul Vanden Bout to exceed those of renting an enlarged Stone Hall (as amended after the Value Engineering Review) directly from U.Va. This comparison satisfied the NRAO administration that the Edgemont Road Addition was the least expensive way to provide the additional space needed to support ALMA construction.

This choice was reinforced by the wish of many NRAO astronomers to remain in close proximity to the U.Va. Astronomy Department. These considerations solidified the decision to proceed with the Addition as an integrated extension to Stone Hall with new boilers, chillers, sprinklering and electrical service, and a construction cost (as re-estimated in May 2000) of $5.28 million.

5. 2001: Delay from D.C.

By December 2000, all necessary U.Va. and state approvals, and a building permit, had been obtained. The Greenwood Partnership were about to prepare final drawings and specifications for U.Va. to go out for construction bids in February 2001.

The National Science Foundation then stipulated that it could not approve the project until ALMA construction (on which the need for the building expansion was predicated) was funded in the first budget of the incoming (G.W.Bush) administration. The 2001 Presidential budget instead froze all new construction. The Addition project was formally put on hold and production of the final bidding documents and drawings was halted.

The project was reactivated on 25 July 2002 when the NSF gave the NRAO its approval to move forward. At this point the building expansion was expected to provide 38,360 sq.ft. of new office and laboratory space to house all NRAO employees who were then working at Edgemont Road and in the Dynamics Building, and to support the whole Charlottesville staff's defined roles in ALMA and in the EVLA. The combined building would be 62,783 gross sq.ft. (of which 20,800 sq.ft. were required to support ALMA construction). The completion target was to be the end of 2004, predicated on U.Va. going out for construction bids by December 2002.

6. 2002: Restarting the Project

Re-starting the project was not instantaneous, however, as the original chief architect for the Addition, Randy Vaughn, had left the Greenwood Partnership, which was also in the process of becoming Versar, Inc.

Arthur Wilson took over as Versar's head architect, with Scott Burger as their chief liaison with the NRAO, and the process of preparing bidding documents and drawings began as rapidly as possible.

The outstanding design and cost issues in July 2002 were the scope and specification of RFI mitigation for the labs, and on-site storm water runoff management.

The final design and code review meeting by the Assistant State Building Officials took place on January 29, 2003 in the Edgemont Road Auditorium and the request for bids was published on February 9, 2003.

A pre-bid conference with potential contractors was held in February 19, 2003 and the bids were opened on March 12, 2003. The low bidder (just below $6 million including the additive bid items) was Martin/Horn Construction of Charlottesville, who were formally awarded the construction contract on March 19, 2003.

On April 16, 2003 a ground-breaking ceremony was held on what had previously been the Stone Hall volleyball court. New NRAO Director K.Y. “Fred” Lo and AUI President Riccardo Giacconi officiated.

Martin/Horn were given notice to proceed with actual construction on April 18, 2003. On that date, the NRAO and U.Va. had a full set of design and construction drawings, an agreed cost, and a contractor ready to start work immediately. What followed was not straight-forward, however, because the new NRAO administration significantly changed its plans for supporting ALMA construction.

7. April 2003: “Change Order #1”

On April 22, 2003 at the request of Director K.Y.Lo, NRAO staff met with U.Va., Versar and Martin/Horn staff to discuss the re-scoping of the project that was required by a newly made decision to relocate to Charlottesville all of the ALMA activity that the NRAO had previously planned to occur in Tucson.

This relocation required further engineering space to be provided in Charlottesville that was not in the Addition design. It also introduced new physical requirements, such as a ceiling clearance sufficient to maneuver large ALMA cryogenic receiver assemblies, which could not be met with the 1960's-era floor separations that existed in Stone Hall (and thus had to be matched in the building's Addition).

The Addition Project Group’s primary goal became that of keeping the actual Addition construction on schedule and on budget through a massive change order to the “as-bid” design, while responding to the NRAO’s modified specification of the Addition’s purpose. The NRAO's project group was also tasked with planning for major ALMA construction activities to be done at a new site that was still to be identified.

On May 13, 2003 a pre-construction meeting was held at which the NRAO team, U.Va., Martin/Horn and Versar staff reviewed the main issues of the project as-bid. They also discussed options for modifying the Addition's interior plan to support the required change in scope while preserving the U.Va.- approved exterior appearance and footprint.

Tim Patronik was named as Martin/Horn’s construction supervisor and Bill Vickers as Versar’s supervising architect for the construction. Steve Ratliff was named as U.Va.’s construction supervisor/site inspector.

Intensive discussions took place throughout May 2003 to finalize aspects of the redesign that affected immediate site and foundation preparation work, and Martin/Horn's pre-ordering of construction materials.

Martin/Horn's first construction trailer arrived on the site on May 27, 2003.

8. 2003: Construction and Simultaneous Re-design

Bill Porter and Alan Bridle (NRAO), Tim Patronik (Martin/Horn) and Steve Ratliff (U.Va.) on site in June 2003

Martin/Horn presented a detailed construction schedule on June 10, 2003 and the actual site preparation work (tree removal, excavation and regrading) began on June 12, 2003.

A detailed review of the modified design, eliminating the RFI-protected electronics labs, chemistry labs, and machine shops, took place on June 30, 2003.

To the extent possible within structural constraints, the original Third Floor plan was replicated onto the Addition's Second Floor, adjusting the central area of that floor to account for removal of the labs.

The Second Floor area formerly assigned to on-grade (vibration-free) lab and assembly space was reassigned to Business and HR offices and Business Archives. The communications, conference room and storage areas on the Second Floor were also reconfigured and enlarged and the previously planned lab and machine shop spaces on

the First Floor East were reassigned to the NRAO Historical Archives and to an expanded area for Shipping and Receiving.

Martin/Horn's reduced cost of construction and materials was applied to the costs of the redesign and redrawing of the plans and to an increase in scope of the roofing renovation (see segment #11 below).

9. Relocating the CDL

On June 26, 2003, in response to further concern from the NSF about the scale of the new Charlottesville facilities plan, NRAO Deputy Director Dave Hogg tasked Bill Porter, Rich Bradley, Alan Bridle and Dale Webb with reviewing options for using the expanded Edgemont Road facility for as much as possible of ALMA construction while retaining other CDL activities in rented space at a site to be determined.

This review committee reported on July 10, 2003, in a memo to Dave Hogg and Ted Miller, that:

1. The Dynamics Building was structurally unsuitable for any further use by the CDL and should be vacated as soon as possible,

2. Only the ALMA correlator lab could be housed at Edgemont Road. (While unstated in the memo, this option was also compatible with the re-scoping of the Addition design that was about to be completed by Versar),

3. The balance of an "NRAO Technology Center" should be housed at 2551 Ivy Road (the former Institute of Textile Technology --- ITT --- later known as the Boxwood Estate) by the end of 2003.

A new Facilities Plan based on these recommendations was accepted by the NSF.

Arrangements were then made to terminate the lease of the Dynamics Building by December 31, 2003, to renovate existing laboratory and classroom space at the ITT to the CDL's specifications, and to move all NRAO engineering activity in Charlottesville into that renovated space as soon as possible.

The CDL moved into the Boxwood Estate on schedule by the end of 2003.

Proximity to the other ALMA engineering effort was the deciding factor in locating the correlator lab in the former ITT classrooms at Boxwood estate rather than on the First Floor of the Stone Hall addition. In the final Plan, the only ALMA activities to be located at the Edgemont Road site were the scientific user support group (the North American ALMA Science Center) and the ALMA business and administrative offices.

First concrete was poured for footings of the Addition on July 15, 2003

Excavation for the First-Floor footprint at Edgemont Road was largely completed by July 11, 2003 and the first concrete was poured for footings on July 15, 2003. Steel erection for the frame of the Addition began on September 10, 2003.

10. Storm Water

From the start of the project, both U.Va. and NRAO had been concerned about storm water management. Stone Hall is on a steep hillside slope and both the visitor parking lot and the First Floor were prone to flooding after heavy rains due to inadequate capacity (hence backup) of the building's original storm drains. A larger-capacity drainage system was specified but U.Va. initially wanted the project to provide on-site storm water runoff detention and conditioning (sand traps) which would increase construction costs and require long term maintenance. After some negotiations, U.Va. agreed to include the regraded site's runoff in a larger-area storm water detention project - provided the runoff would initially be slowed by emptying it into a new rip-rock channel at the east edge of the lot. This channel had to extend into the neighboring Midmont Lane property, which was jointly owned by the U.Va. Real Estate Foundation and a private individual. Negotiations with that individual to extend the rip-rock channel onto their property delayed full installation of the new storm drains throughout what turned out to be one of the wettest summers on record, increasing the mud and other adverse conditions for the building's occupants and for the construction work until the channel was finally completed in April 2004.

The “Summer of Mud”: construction around the elevator jack in August 2003

On the night of September 18, 2003 Hurricane Isabel passed between Charlottesville and Richmond with sustained winds just below Category One force. This storm caused significant damage both in the city and in the surrounding counties. Power was lost and construction stopped at Edgemont Road but preparation by both the Martin/Horn and the NRAO staff minimized damage and down time from the unusually severe storm, and the Addition construction work resumed on Monday, September 22, 2003.

11. Re-roofing

The original flat roof on the old office “East” building had deteriorated. It was known from the start of the project that the roof surface was in poor condition, but the lightweight concrete insulation under the surface was found to be cracked, and that this cracking was contributing to leaks in the Third Floor ceilings over the NRAO offices and the main conference room. (A long-known leak over the NRAO Director's Office had been mitigated by using it to water a potted plant during the tenure of Director Vanden Bout).

Demolition of the old roof on the East building in May 2004 … as NRAO staff continued to work below.

It was therefore decided to strip the old roof all the way down to its hard concrete slab and then to refinish it with an EPDM membrane identical to that specified for the new flat roof over the Library. This refinishing task was plagued by more excessively wet weather throughout the spring; the resulting leaks into the Third Floor spaces eventually forced more extensive renovations on that floor than were originally planned.

11. Multiple Moves

The decision to combine the mechanical and electrical systems of the Addition and the original building implied that the original building had to be fully sprinklered. This forced a complete renovation of the corridor ceilings and many office ceilings in the old office wing to accommodate the new sprinkler system, as well as extensive modifications to the existing Library and Auditorium. Raised floors installed for computer and lab space in the original building were removed. Adhesives used in these floors, and some floor tiles and insulation in the mechanical systems, were found to contain asbestos, requiring specialized removal methods. The logistics of performing all of these modifications while continuing to use as much of the existing building as possible for routine NRAO business were complex, and required much day-to-day co-ordination between Martin/Horn's supervisors (Tim Patronik and Mark Snodgrass) and the NRAO liaison staff on-site (Alan Bridle and Gene Runion).

Construction scheduling was tight, owing to the need to demolish and replace the old oil-fired boilers during the cooling season and the old chillers during the heating season, and to replace the existing roof, while also attempting to maintain a usable environment for NRAO staff throughout.

The original building had used a two-line system to distribute hot and cold water from the boilers and chillers to fan-coil heat exchange units in all of the rooms, but it had no shutoff valves so the entire system had to be shut down in order to perform maintenance on any room unit. During the Addition construction, work was needed on many different parts of the building throughout the heating and cooling season, so we had planned to install shutoff valves to allow parts of this HVAC system to be isolated while others were operated.

Unfortunately, it soon became apparent that the existing water lines were heavily corroded from 40 years of being used to carry both hot and cold water. Versar's estimate of the cost of replacing the corroded lines was too large to be absorbed into the Addition project's contingency. Versar were therefore asked to specify a refitting for the old heating/cooling lines as a separate renovation project. This project was eventually separately funded and completed only in 2006.

The original office and Library/Auditorium buildings were independent free standing structures joined by a glassed-in mezzanine. In the new design they were to be joined by extensive concrete floors to create large assembly spaces in the Second Floor Lobby and Third Floor Reading Room. The floor levels of the Library and the old Third Floor offices were mismatched by up to several inches in places (the old Library stack floor was also not level), so ingenuity was required of Martin/Horn to distribute the mismatch over a wide area.

12. Fire Hazards

On the afternoon of Thanksgiving Day, November 25 2004 wind gusts toppled a temporary parking lot light onto the renovated roof of the old office building, eventually starting a fire in the newly-installed EPDM roof covering. Fortunately, a U.Va. employee in the Facilities Management yard saw smoke coming from the roof of Stone Hall and sounded the alarm. Several fire departments responded and the fire itself was quickly extinguished, but significant smoke and water damage was done to the Third Floor and to a section of roof and parapet covering. Repairs to the roof and parapet were complete by early February, 2005 and did not significantly delay the overall completion of construction. (The cost of repairs was covered by Martin/Horn's construction project insurance.)

The state Fire Marshal and Bureau of Capital Outlay Management staff inspected the building on 26 January, 2005 and identified a list of minor corrections to be made before the Certificate of Occupancy could be issued. One of the more unexpected corrections

stemmed from an arcane code requirement that internal hose fittings on the sprinkler riser piping in the Stone Hall stairwells had to be of a type compatible with C&O steam locomotives. Although Martin/Horn had been fully aware of this requirement, the fittings that had been installed by the sprinklering contractor were not of the correct type and they had to scramble to locate and reinstall the correct hardware from a supplier in Atlanta before the building could be certified for occupancy.

13. 2005: Occupancy

A temporary Certificate of Occupancy was issued on 17 March, 2005. This allowed the NRAO staff to begin using the new Addition areas as work space. Office moves by NRAO staff began on 1 April, 2005 and were completed by the end of that month.

Claire Chandler gave the first Colloquium in the reopened Auditorium on March 24, 2005 and the first major all-day meeting to be held in the new facilities was the Jansky Fellows' Symposium, on April 18-19, 2005.

A "Thank Goodness It's Over" (TGIO) celebration was held in the new Auditorium and Lobby on the afternoon of May 25, 2005.

"TGIO" Celebration in the new Lobby on May 22, 2005

Main entrance to renovated Stone Hall, November 2005