

VLA ANTENNA MEMORANDUM NO. 1
March 10, 1967

ENGINEERING ESTIMATE FOR VLA PROTOTYPE UNIT

Lee King

Summary of estimate

Design - - - -	9,100 hrs.
Drafting - - - -	7,300 hrs.
Total - - - -	<u>16,400 hrs.</u>

Scope of estimate

This estimate includes the mechanical and structural design, analysis, and drafting work. The shop detail drawings for trusses, frames, gear-boxes, etc. are not considered, and shall be part of material costs.

The estimate does not include designs of cassegrain reflector and feed cone.

VLA prototype unit

	<u>Hours</u>	
	<u>Design</u>	<u>Drafting</u>
1. Reflector - counterweight assembly	1960	2010
2. Pedestal assembly	2230	1920
3. Tower structures	1470	1070
4. Transport equipments	800	800
5. Foundations & system analyses	800	---
Sub-total	<u>7260</u>	<u>5800</u>

Apply 25% for miscellaneous design and drafting.

Engr. estimate: 9,100 "design" hrs. *
7,300 "drafting" hrs.

* "Design" including work done by design engineers, system analysts, and programmers.

1. Reflector - counterweight assembly

Excluding: 1. Cassegrain reflector
2. Feed horn

Including: 1. Feed support structure
2. Reflector surface panel
3. Reflector backup structure
4. Counterweight support structure
5. Counterweight
6. Elevation bullgear (detail design by gear manufacturer)

The estimate is based on that a structural computer program is available*. An addition subroutine will be programmed for weight, moment, and moment of inertia calculations to help the counterweight design and optimization of structures.

Hours

150	} Interfaces	{ Feed
150		{ Cassegrain reflector
150		{ Elevation cartridges
320	Preliminary design and layout	
960	Optimization	
300	Programming work on weight moment, etc.	
340	Analyzing work + computer input/output	
160	Final panel design	
320	Final structure design	
1120	Detail drafting and checking	

3970 hrs.

including 1960 design hrs.
2010 drafting hrs.

* "Stress" or "Fran" program

2. Pedestal assembly

- Including:
1. Elevation bearings
 2. Elevation cartridges
 3. Elevation gear-boxes
 4. Pedestal housing
 5. Azimuth gear-boxes
 6. Azimuth bearing(s)
 7. Azimuth bullgear

There will be no computer program available for these complicated pedestal structures. An engineering analyst shall be available in helping the design.

Spaces and mountings are designed for gear-boxes, detail designs are carried out in sub-contractor's plants.

Hours

150	Interface - azimuth housing
320	Preliminary layout and design
1280	Optimization
640	+ analysis
480	Final design
1280	Detail

4150 hrs.

including 2230 design hrs.
1920 drafting hrs.

3. Tower structure

- Including:
1. Azimuth housing
 2. Upper frame interface
 3. Main frame
 4. Lower frame interface

The tower structures as the reflector counterweight structures shall use a computer program in helping the design and optimization.

Hours

150	} Interfaces {	Azimuth housing
150		Lower interface
240	Preliminary design and layout	
720	Optimization	
160	Final azimuth housing design	
320	Final structure design	
800	Detail	

2540 hrs.

including 1070 drafting hrs.
1470 design hrs.

4. Transport equipment

Including: 1. Transport vehicles (passenger & freight)
2. Automotive trucks
3. Hydraulic equipments

Estimate: 800 hrs. design
800 hrs. supplemental drafting

1600 hrs. total

5. Foundation + system analyses

Mainly concern for foundation will be cost trade-off study.

Foundation design is considered as a part of system analyst's job.

300 hrs. for math. model preparation & preliminary analyst
400 hrs. optimization
100 hrs. final design analysis

800 hrs. total

The system analyst is assumed to work very closely with all groups in order to obtain data, perform, revise, and achieve the system optimization.

cc: G.W. Swenson
W.C. Tyler
D.S. Heeschen
H. Hvatum ✓

NATIONAL RADIO ASTRONOMY OBSERVATORY

Charlottesville, Virginia

VLA ANTENNA MEMORANDUM NO. 2

March 30, 1967

To : G.W. Swenson, Jr.

From: Lee King

Subj: Engineering Estimate of VLA Antenna Element Design "RCA vs.
VLA Antenna Memo. #1"

Deviations of the estimates

VLA Antenna Memo. #1 covered the engineering estimate for mechanical and structural design, analysis, and drafting work, ref. scope of estimate of the memo., and did not cover the work for servo control, data link and electrical interfaces which were included in RCA estimate.

To justify this, an addition of 2240 hrs. (ref. p. 2 of this report) is added to the estimate of VLA Antenna Memo. #1. The results are summarized as follows:

Estimated	Design Hrs.	Drafting Hrs.
RCA Alt. #1	14,862	9,079
RCA Alt. #2	12,266	7,291
RCA Alt. #3	12,724	7,629
VLA Ant. Memo #1	9,100	7,300
Justified VLA Ant. Memo #1	11,540	7,300

Without having the detail breakdown from RCA it is difficult to analyze their estimate and compare with that of VLA Antenna Memo. #1 but, the results of the two which show a difference of less than 5% give us a realistic guide for the cost of the antenna design.

Scope of Estimates

	RCA	VLA Ant. Memo #1
1. Reflector assembly	yes	yes
2. Pedestal assembly	yes	yes
3. Tower assembly	yes	yes
4. Transport equip.	yes	yes
5. Foundation	yes	yes
6. Servo control	yes	No - see Note 1
7. Data link interface Microwave/electrical group interface	yes	No - see Note 2

Note

1. 1350 hrs. required as per Mr. Kruger of RCA in telephone conversation on 3/30/67.
2. Memo. #1 provided engineering hrs. for rotary joints, cable wraps, limit switches, temperature control of control enclosure, and mountings for electrical motors, tachometers and transducers. The engineering hrs. for interfaces not covered is estimated to be 600 hrs.
3. In order to make the two estimates compatible to each other, engineering hrs. of:

$(1350 + 600) 125\% = 2,240 \text{ hrs.}$

(25% for miscellaneous, ref. Memo. #1)

should be added to the result of VLA Antenna Memo. #1.

cc: Dr. Heeschen
Dr. Hvatum ✓
Dr. Tyler
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