



ARECIBO OBSERVATORY
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AOSSC REPORT & RECOMMENDATIONS

Arecibo Observatory Survey Salvage Committee
Arecibo, Puerto Rico
March 25 2022



Executive summary

On December 1, 2020, the 57 year old 305-meter Arecibo Telescope structure collapsed after a series of failures of the supporting cables. The suspended platform struck the ground and the side of the natural depression in which it was constructed, with most of the scientific instruments housed beneath the azimuth arm badly damaged. The University of Central Florida (UCF) and the US National Science Foundation (NSF) chartered the Arecibo Observatory Survey Salvage Committee (AOSSC) to work with the Observatory management and the contractor managing the emergency cleanup activities to identify possible items of historic significance that could be found within the wreckage, to suggest which large sections of the structural framework to retain, and to make initial recommendations about conservation, display, and educational outreach aspects of the retrieved material. The AOSSC developed a database of high-priority items for the search, and cataloged the actual pieces collected during the emergency cleanup. The debris removal was documented from site surveys and drone footage to provide a record of the process and where possible, the condition of the wreckage around the recovered artifacts. Final committee recommendations include the need for action to protect the artifacts from further damage or corrosion, distribution of historic and technical information about the instruments and structural elements to museums and universities, and formation of a follow-on group to consider the long-term preservation and educational potential of the recovered material.



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Purpose & Scope

The 305-meter Arecibo telescope was in operation for over five decades prior to its collapse in 2020. Almost all of the observing systems used for the telescope were custom made, often developed in-house, and represent the progression of instrument technology and observing methods across the radio- and radar-astronomy fields. Many of these instruments and the infrastructure of the telescope are historically important and should be considered for preservation for future generations. The AOSSC was formed for the purpose of identifying material from the collapse of the 305-meter Arecibo telescope that has historic importance and/or scientific utility. The Committee focused on particular scientific instruments and representative portions of the suspended structure and reflectors. The Committee also considered the potential for use of these artifacts in public display and educational and outreach programs.

Committee

Members

- Carlos M. Padin, Chair, Arecibo Observatory (AO) Science and Visitor's Center
- Luisa Fernanda Zambrano-Marin, Co-Chair, AO Science Staff
- Olga Figueroa, AO Management
- Luis Quintero, AO Staff, Electronics
- Gabriel Altuz, AO Operations
- Alfredo Santoni, AO Staff, Electronics
- Mike Sulzer, AO Staff, Atmospheric Sciences
- PK Manoharan, AO Staff, Astronomy
- Carmen Pantoja, AO User, University of Puerto Rico
- Chris Salter, AO User, Adjunct Scientist, Green Bank Observatory
- Bruce Campbell, AO User, Smithsonian Institution
- Leo Slater, National Science Foundation (NSF) historian

Observers

- Alison Peck, NSF
- Lori Price, Jacobs



Summary of objectives

- Provide a quick evaluation of material that can be salvaged
- Provide recommendations of potential historic importance of salvaged debris
- Identify materials that have potential scientific utility
- Document recovered items and their historic significance
- Create a report with recommendations on preservation and display of such materials

Procedures and Findings

In the early stages (late December 2020) of the emergency clean-up process, at the direction of the NSF, the Arecibo Electronics and Maintenance departments identified and recovered some material from the collapse area, such as the S-band transmitter klystrons and the ALFA receiver. By the time the committee was established (Feb 05, 2021), the emergency clean-up effort by the contractors had been underway for approximately 5 weeks and most of the electronics components in the Gregorian Dome had been moved to the Staging Area with other debris from the telescope.

The amount of material to assess was quite large, with components of different generations of technology, making it challenging to identify pieces of historic significance. Some pieces were extremely large, awkwardly shaped and heavy, and required significant processing (e.g., metal cutting), by the Thornton Tomasetti & DH Griffin contractors.

Following the establishment of the AOSSC, Committee members at the AO-site performed surveys and visits to areas with potential salvageable debris (Table 1). The Committee held weekly meetings (see: [Meeting Schedule](#)), wrote letters to management and contractors as necessary (for access and retrieval of items), and made initial reports regarding the identification of possible salvageable material. During the process, a “[Guidelines for Survey and Inventory Digital Material](#)” was created to have a procedure to manage an inventory (photographic and tabular) of the recovered items, and track their locations within the initial debris and the staging areas until recovery was completed. To compile all the information, the Committee created an Inventory of Recovered Material document, presented in the [Procedures and Findings](#) section of this report.

The procedures set up for this committee are only to identify items of historic importance or scientific utility. It is recommended that a new committee and separate procedure be established to determine which objects should become a part of museum/Visitor Center displays and educational packages in the future.



Site Visits and Surveys

In order to identify material to be recovered at the site, members of the Committee performed site visits and surveys. The site visits were scheduled in advance depending on availability of AOSSC members on site, AO staff, and Thornton Tomasetti & DH-Griffin contractors. From these visits, pictures were collected and shared with the entire Committee.

Photo and video surveys were performed by personnel of the Electronics Department and Maintenance on a routine basis and also as requested. The routine surveys were performed mostly with a drone on a weekly/monthly basis, the main purpose being to track changes in the initial recovery and staging areas. Only selected images are made publicly available in this report (Figures 1-4). The digital material is stored in a computer server by date and could be used in the future for reports or public relations. The requested surveys were performed with regular photographic cameras, cell phone cameras or drones. This material was shared with the AOSSC by the AO staff and is housed in a shared repository.

Table 1. List of Field Visits performed from February to August 2021

Date	Participants	Notes
20210202	Electronics Personnel	Staging Area Survey Drone Images
20210205	Committee Members, Platform Personnel, Security and Safety Officers, Electronics Personnel	Staging Area Field Images and Footage
20210224	Committee Members, Platform Personnel, Security and Safety Officers, Electronics Personnel	Dish and Staging Area (VIP parking), Drone Images
20210226	Committee Members, Platform Personnel, Security and Safety Officers, Electronics Personnel	VIP Visitors Parking, Drone and Ground Images
20210302	Electronics Personnel	Primary Reflector Drone Images
20210325	Platform Crew	Various locations



20210407	Committee Members, Platform Personnel, Security and Safety Officers	Various Locations Images and Footage
20210408	Electronics Personnel, Security and Safety Officers	Various Locations, Identified Materials for Recovery, Drone and Ground
202010414	Committee Members, Platform Personnel, Security and Safety Officers	Staging Area Recovered Material and Debris Removal from Staging Area
20210416	SVC Liaison, Committee Members, Platform Personnel	Dish
20210421	Electronics Personnel and Committee Members	Recovered Material -Outside B.1 parking
20210423	Committee Members, Contractors, Safety Director, Platform Personnel, SVC Liaison.	Recovered Material -Staging Area.
20210521	Electronics Personnel	Drone Images of Staging Area Recovered Material

Figure 1. Drone survey picture of the primary reflector. Rectangular markings on the image denote areas with potential material to be recovered. The numbers next to the rectangular areas correspond to more detailed pictures of the area. Image taken 20210224.

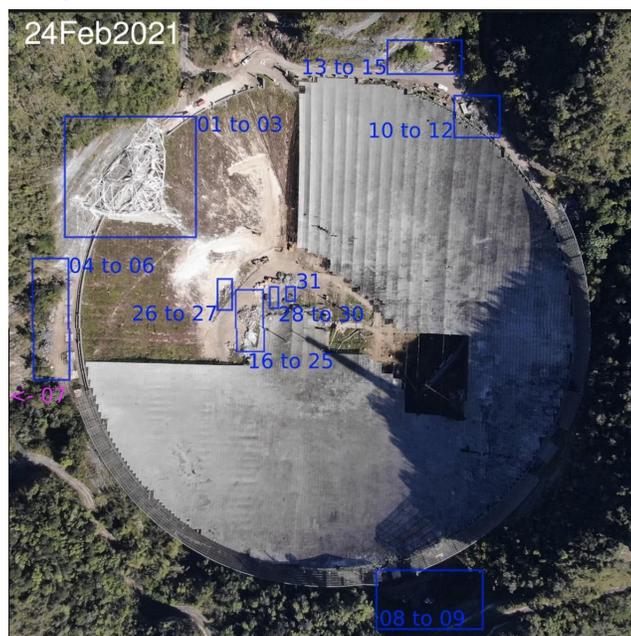


Figure 2. Drone survey picture No. 23 showing Gregorian Dome shell.



Figure 3. Drone survey of the VIP Area. This was historically the “VIP” area at the north-east edge of the primary reflector. This drone survey was performed on 26 Feb, 2021.

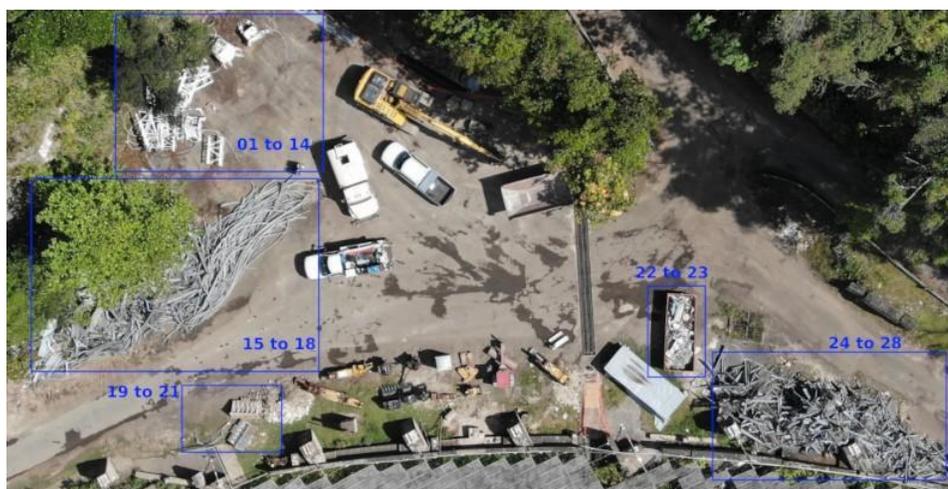


Figure 4. Field visit survey picture No. 20 shows two tower saddles located at the top of the telescope towers. Each saddle supported the cable ends going to the platform on one side and the backstay cables to the anchors.





Communications with Management

The following shows a list of documents created and shared with the Management:

- Proposed procedure and guidelines from AO management to Committee: [AO Salvaging Survey Procedure](#)
- Letter with [initial list](#) of items to recover
- Letter with [items to relocate](#)
- [Document](#) for the International Astronomical Union, History of Astronomy Division Newsletter with summary of workings. Same text was submitted to the Arecibo Observatory Fall 2021 Newsletter.
- [Initial report](#)
- Final report (this Document)



Recommendations

The Committee concluded that most of the items recovered do not have any technical use due to the extensive damage. There are a few exceptions of material that could be reused, like the HF antennas and Distomat lasers, and several hundred panels. The AOSSC's recommendations are summarized as follows:

- Take immediate corrective action so items exposed to weather are protected from corrosion. This is mostly big items like platform pieces where bare metal was exposed by torch cutting. In these cases, it is necessary to prepare the exposed surface and apply a proper primer and paint. Pieces on the ground should be raised to avoid corrosion.
- Ensure that materials not in use (for display or refurbishment) are stored in a climate-controlled facility.
- The AO Management should submit an official request to the NSF for the items to keep, those not part of the collapse, but which may have historical significance, and including the items this committee recommends keeping.
- We recommend that once the items are released from being federal property, the AOSVC should start a procedure to lend the items to other institutions.
- We recommend that AO management requests authorization from NSF to put all these items in a catalogue that would be available for exhibitions at the site and lending institutions.
- Share the list of the items recommended for preservation with universities, museums, and centers of informal education, for possible lending (of small items) and viewing at the (AOSVC).
- NSF should collaborate with the AOSVC for the preservation and maintenance of the items this Committee recommends retaining.
- Because the objects remain NSF property, the AOSVC should develop an impartial system to provide accessibility to exhibits and materials for interested parties. This system could be formed with the Council of Puerto Rican Chancellors and Stakeholders, which includes Chancellors and Presidents from the universities in Puerto Rico, and stakeholders¹ of the Arecibo Observatory.
- AO management should work alongside NSF to form a working group of AO Users, Scientists, Engineers, Educators, and Museum Curators who can create a detailed description of the salvaged items, their historical context, conservation procedures, and maintenance and display needs; this effort should be sponsored by NSF.
- NSF should establish support for and endorse the development of traveling/mobile educational exhibits with some of the items recommended here for preservation.
- Develop a plan to fund the long-term preservation, care, and display of these items. The AOSVC should be a major leader in this effort, but external partners could also be important in providing funds and expertise.
- A follow-up committee should be established to determine costs and facilitate partnerships to conserve and display the various objects. One emphasis should be that materials provided to schools or other institutions must not create unreasonable new costs for those hosts.

¹ https://www.nsf.gov/about/budget/fy2018/pdf/36b_fy2018.pdf

Items to keep

List of Items to be Recovered

The list in Table 2 shows the list of items to be recovered as recommended by the Committee. During the identification process of recovered material, each item was updated with the status: “Identified Not Safe”, “Identified Safe”, “Not Found” and “To Forensic.”

For details of some of the items on Table 2, visit the AO webpage (www.naic.edu) and/or the “[Inventory of Recovered Items](#)” Document.

Locations for storage and display of recovered items

Small pieces are mostly located at the Building 1 Control Room Parking area. Big pieces are mostly at the warehouse, diesel generators, or staging area. These areas are identified in Figure 5. The Building 7 area is halfway between the Visitor Center and the collapse site. The long-term recommendation is to place big pieces, like the 430MHz transmitter rotary joint, there for display.

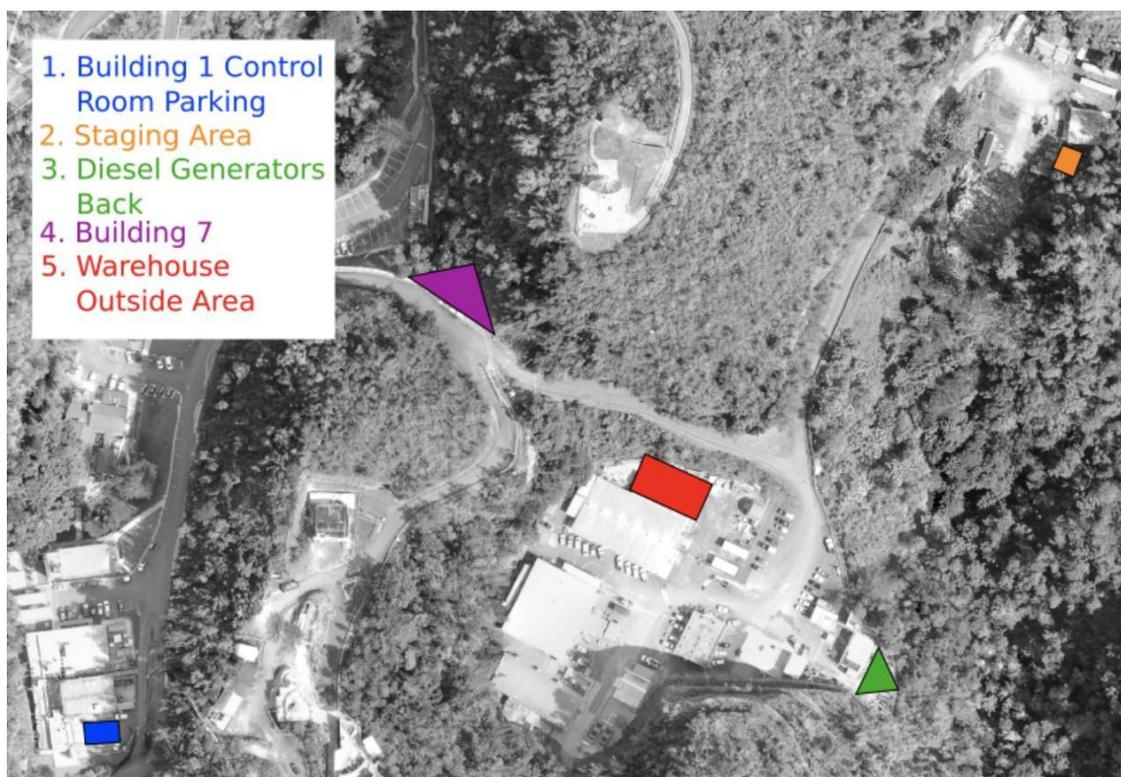


Figure 5. Arecibo Observatory site layout with demarcated interest areas.



Inventory of Recovered Material

The inventory of recovered material is at the Google Sheets document “Inventory_of_Recovered_Material” under the “recovered” spreadsheet; a few details of the inventory are listed in the Appendix, [Table 2](#). Each item has a unique ID number (4 characters) and the list is in no particular order. The “ID Label” column shows if AOSSC placed a sticker with the ID number on the item or not, and has been logged. The second column lists the item's brief description and the third column lists if the item has any potential technical or scientific use.

The document can be found here:

https://docs.google.com/spreadsheets/d/1bbCTqhuqrN-R2t-GT3aNj_atcID1rwLs9LdzDgQ6d9c/edit?usp=sharing



Inventory of Material to be recovered		Slides of recovered material					
AO Salvage Survey Committee, Arecibo Observatory Created: 04Mar2021		https://docs.google.com/presentation/d/1NUi0VGy0CsMxCieNdQM6T4CHz49YJCFAd6F2aX45jo/edit					
Moved to Recovered List	Item Name/Current state pic (log number)	Status	Description (Link to image of what it looked like)	Current State	Telescope Location	Recovered From	Current Location/ last
Yes	S-band transmitter portions: combiner, dummy loads, transitions, rotary joint	Identified Safe			Gregorian Dome	?	?
Yes	Tertiary Reflector Part, Tertiary reflector portion, (the central reflector pan)	Identified Safe	pictures, web pic		Inside Gregorian Dome	not found yet	unknown
Yes	HF antenna dipoles tower (ALL) (006-8)	Identified Safe		https://drive.google.com/drive/folders/430CH	main reflector bowl	Main reflector	Behind Generators
Yes	430-MHz Carriage House line-feed portions and Rx/Tx remains (022)	Identified Safe			Between Platform and dish	Crash site?	Back and sides for rubble
Yes	430-MHz Rotary Joint (044)	Identified Safe	https://drive.google.com/drive/folders/430CH	https://drive.google.com/drive/folders/430CH	Center of the Platform Triangle	not recovered yet	Rim Road, To be moved
Yes	430MHz line feed by learning center (0077)	Identified Safe		https://drive.google.com/drive/folders/430CH	Learning Center		staging area, not on platform
Yes	A corner of the platform (0015-17)	Identified Safe	https://drive.google.com/drive/folders/430CH	https://drive.google.com/drive/folders/430CH	Platform	Crash site	Behind Diesel Generator
Yes	Any "long" section of the Azimuthal arm (0054-55)	Identified Safe			Platform	not recovered yet	staging area
Yes	Assorted electronics cables (0057)	Identified Safe			Platform, catwalk	staging area	staging area
Yes	Azimuth angle track portion	Identified Safe		https://drive.google.com/drive/folders/430CH	Platform	crash site	last seen on VIP parking lot https://drive.google.com/drive/folders/430CH
Yes	Cable car (0074)	Identified Safe			Platform landing	Cable car "house" / ground landing	Warehouse
Yes	Catwalk floor, sides and roof (0066)	Identified Safe		https://drive.google.com/drive/folders/430CH	Bridge from Learning Center hill to	various	Staging Area pile
Yes	Distomat Lasers (005)	Identified Safe		https://drive.google.com/drive/folders/430CH	Sides of Dish	Crash sites	B1 Parking (LQ)
Yes	Dome azimuth transmission. (platform motor transmission 0060-62)	Identified Safe		?	?	?	Staging Area Safe Zone
Yes	Dome Track Gear (Rotary Floor track 0014)	Identified Safe			Dome	side of road	Staging Area
Yes	Gregorian Dome Outside/Shell (0050)	Identified Safe	https://drive.google.com/drive/folders/430CH	https://drive.google.com/drive/folders/430CH	Platform Azimuth Arm	Crash site	Staging Area Safe
Yes	IF/L0 rack cabinet (0031-32)	Identified Safe	https://drive.google.com/drive/folders/430CH	https://drive.google.com/drive/folders/430CH	Gerogian rotary Floor	located at the middle of the	Back of staging area pile
Yes	Landings of the rotary joint (Platform Step / Landing, Catwalk, 0059)	Identified Safe		?	Platform center	crash site	Within rotary Joint

Figure 6. Example of inventory management of material to be recovered based on feedback from AOSSC members. One item in this could be represented by one or more items in the recovered material list.

Inventory of Recovered Material		Color Key							
AO Salvage Survey Committee, Arecibo Observatory Created: 11Feb2021		FOR REPORT	Tagged	To be tagged	Duplicate				
REPOF REPORT	REPORT	REPORT	REPORT	REPORT	REPORT	REPORT	REPORT	REPORT	REPORT
ID	Item Name	Description	Estimated Size (in)	Estimated Weight (lbs)	Telescope Location	Recovered From	Current Location	Technical or Scientific Use	Historic Use
0005	Distomats - Laser Ranging	Used to measure Platform height. Six enclosed. Recovered on 9Feb2021. D2, D3, D4. Partially recovered; D5, Missing; D1, D6, D6 can't be saved, it's under the platform triangle now. Uses Leica Distomat DI 1001 or DI 1600	8 x 8 x 16	4 canisters 12 lb each	Around the Primary Reflector	Around the Primary Reflector	Electronics Department, technicians work benches	Could be used for future projects. The lasers have been in service for 25+ years.	For display
0006	HF Tower 1.5MHz	Dipoles support structure with a portion of the towers	150x150x72	>1000	Primary reflector, HF antenna towers	Collapse Area, Primary Reflector	Next to Diesel Generators Control Building 35 and Fuel Tanks	Parts can be re-used to rebuild other three HF towers.	None
0007	HF Tower 3.5MHz	Dipoles support structure with a portion of the towers	150x150x72	>1000	Primary reflector, HF antenna towers	Collapse Area, Primary Reflector	Next to Diesel Generators Control Building 35 and Fuel Tanks	Parts can be re-used to rebuild other three HF towers.	None
0008	HF Tower 6.8MHz	Dipoles support structure with a portion of the towers	150x150x72	>1000	Primary reflector, HF antenna towers	Collapse Area, Primary Reflector	Next to Diesel Generators Control Building 35 and Fuel Tanks	Parts can be re-used to rebuild other three HF towers.	None
0009	430MHz Receiver Pol A Dewar	Polarization A dewar for astronomy receiver, cryo-cooled LNA	12 x 12 x 14	44	Gregorian Dome, Rotary Floor	Collapse Area, Primary Reflector	Building 1 Exterior, Next to the 430Tx Rolling Door	None, won't hold vacuum in the current condition.	For display
0010	430MHz Receiver Mini-Dewar	Mini-dewar for astronomy receiver, peltier cooler for LNA	7 x 7 x 18	17	Gregorian Dome, Rotary Floor	Collapse Area, Primary Reflector	Building 1 Exterior, Next to the 430Tx Rolling Door	None	For display
0011	327MHz Receiver Dewar	Cryo-cooled dewar for LNAs, cold head attached	12 x 12 x 24	80	Gregorian Dome, Rotary Floor	Collapse Area, Primary Reflector	Building 1 Exterior, Next to the 430Tx Rolling Door	None, won't hold vacuum in the current condition.	For display

Figure 7. Example of [list of recovered items](#).



(a)



(b)

Figure 8. (a) Shows an example of the AOSSC ID tag. These are self-adhesive laminated stickers that are water and UV-resistant; (b) Small items pallet at Building 1 Control Room parking.



Figure 9. Current location of Rotary Joint, item No. 0044, proposed location for permanent display.



Accessibility of materials to public

Exhibits and displays

The inventory of recovered material shows the location of the piece as well as the approximate dimensions and weight at the time of this report completion. That information will help in the exhibit design process. The creation of exhibits using these pieces is outside the scope of this committee.



Appendices

Meeting Schedule

List of dates with hyperlink to meeting notes:

1. [Feb 05 2021](#) (#1)
2. [Feb 11 2021](#) (#2)
3. [Feb 18 2021](#) (#3)
4. [Feb 25 2021](#) (#4)
5. [Mar 04 2021](#) (#5- no minutes)
6. [Mar 11 20201](#) (#6)
7. [Mar 18 2021](#) (#7)
8. [Mar 25 2021](#) (#8)
9. [Apr 08 2021](#) (#9)
10. [Apr 15 2021](#) (#10)
11. [Apr 22 2021](#) (#11)
12. [Apr 29 2021](#) (#12)
13. [May 06 2021](#) (#12)
14. [May 13 2021](#) (#14)
15. [May 20 2021](#) (#15)
16. [May 27 2021](#) (#16)
17. [June 10 2021](#) (#17)
18. [June 24 2021](#) (#18)
19. [July 01 2021](#) (#19)

Photo Folders

[Web directories](#) with photos of items recommended for preservation.

Communications to management

[Web directory](#) with letters and communications created by this committee.



Items to Keep

For the current version of this table and more details on the items and location, usage and historical relevance see the [“Inventory of Recovered Items”](#) web document. Skipped sequence means an item was identified twice or has more than one item.

<p><i>Table 2. Items Recommended for Preservation due to their Historic Significance to Astronomy, Earth and Atmospheric Sciences as well as Planetary Radar.</i></p> <p><i>*Note: skipped number sequence for duplicate items.</i></p>			
ID	Item Name	Description	Possible Technical or Scientific Use
0001	ALFA Receiver - Arecibo L-Band Feed Array	Seven beam L-band receiver (1.225-1.525GHz)	Not as a whole unit. Probably some internal components (LNA).
0002	S-band Transmitter Klystron	CPI VKS-8270A S/N 2xx	None, completely destroyed.
0003	S-band Transmitter Klystron	CPI VKS-8270A S/N 2xx	None, completely destroyed.
0004	S-band Transmitter Control System Rack	Installed by Continental Electronics during the Gregorian Dome upgrade, 1995	None
0005	Distomats - Laser Ranging	Used to measure Platform height. Six enclosed. Recovered on 8Feb2021: D2, D3, D4. Partially recovered: D5. Missing: D1, D6. D6 can't be saved, it's under the platform triangle now. Uses Leica Distomat DI 1001 or DI 1600	Could be used for future projects. The lasers have been in service for 25+ years.
0006	HF Tower 1 5MHz	Dipoles support structure with a portion of the towers	Parts could be re-used to rebuild the other three HF towers.
0007	HF Tower 3 5MHz	Dipoles support structure with a portion of the towers	Parts can be re-used to rebuild the other three HF towers.
0008	HF Tower 6 8MHz	Dipoles support structure with a portion of the towers	Parts could be re-used to rebuild the other three HF towers.
0009	430MHz Receiver Pol A Dewar	Polarization A dewar for astronomy receiver, cryo-cooled LNA	None, won't hold vacuum in the current condition.
0010	430MHz Receiver Mini-Dewar	Mini-dewar for astronomy receiver, peltier cooler for LNA	None



0011	327MHz Receiver Dewar	Cryo-cooled dewar for LNAs, cold head attached	None, won't hold vacuum in the current condition.
0012	SBH Receiver Feedhorn	Feed-horn ring only	None
0013	S-band Transmitter Combiner	Waveguide WR430 compatible, combined output power of two klystrons CPI VKS-8270A	None, deformed, not in good condition for direct use.
0014	Rotary Floor Track	Portion of the track gear of the rotary floor	None
0015	Platform Piece	Bottom cord of the triangle structure. Corner #8	None
0016	Platform Piece	Top cord of the triangle structure. Corner #8	None
0017	Platform Piece	Bottom cord of the triangle structure. Corner #4	None
0018	S-band transmitter high voltage cable splice tank	Splice of the high voltage cable that carried the 65kV DC from the power supply next to the catwalk entrance to the Gregorian Dome	None
0019	Receiver LBW Orthomode transducer (OMT)	Part of the single beam L-band wide receiver, 1.15 - 1.73 GHz.	None
0020	Receiver LBW Feed Horn	Part of the single beam L-band wide receiver, 1.15 - 1.73 GHz.	None
0021	X-Band Dewar	Part of the single beam X-band wide receiver, 7.8 - 10.2 GHz.	None
0022	Receiver 430MHz Carriage House Dewar	Dewar for astronomy receiver, cryo-cooled LNA	None, won't hold vacuum in the current condition.
0023	Turnstile (Receive/Transmit) 430MHz Carriage House	Center piece of the turnstile.	Could be used to confirm dimensions in case of rebuilding a turnstile.
0024	S-band Transmitter Directional Coupler and Dummy Load	Placed before the transmit feedhorn.	None
0025	S-band Transmitter Control Cabinet Status LEDs	Part of the upstairs control system, inside the blue cabinet next to the klystrons.	None
0026	S-band Transmitter Control Cabinet Meters	Part of the upstairs control system, inside the blue cabinet next to the klystrons.	None



0027	S-band Transmitter Control Cabinet Exciter	Part of the upstairs control system, inside the blue cabinet next to the klystrons.	None
0028	Platform Cable Damper	Vibration damper for the platform cables.	None
0029	Carriage House Track Gear	Tenth gear part of the carriage house transmission	None
0030	Tertiary Reflector Support Joins	Support structure of tertiary reflector	None
0031	IF/LO Chassis	RF filters and switches, part of the upstairs IF/LO	None
0032	IF/LO Chassis / Filter Bank	Just switches, no filters	None
0033	Receiver S-band Narrow / SBN shutter cover	For SBN radar protection	None
0034	S-band transmitter turnstile	Converts from linear to circular polarization before the transmitter feedhorn	None
0035	Receiver S-band Low / Wide - SBL/SBW Feedhorn	Part of the single beam S-band receiver, 1.8 - 3.1 GHz.	None
0036	Receiver X-band / XB feedhorn	Part of the single beam X-band wide receiver, 7.8 - 10.2 GHz.	None
0037	Receiver C-band Wide / CBW Orthomode transducer (OMT)	Part of the single beam C-band wide receiver, ~4-8 GHz.	None
0038	Receiver 430MHz Gregorian Jennings Switch	Part of the Incoherent Scatter Radar, 430MHz transmitter/receiver	None
0039	Rotary floor encoder and rack gear	Rotary encoder and housing for the rotary floor	None
0040	S-band Trasmmitter WR430 Waveguide to Coax Transitions	Used for testing	None
0041	S-band Trasmmitter WR430 Waveguide to Coax Transitions	Used for testing	None
0042	Tertiary Reflector Support Joins	Support structure of tertiary reflector	None



0043	S-band Transmitter Pre-Amplifier Chasis	Pre-amplifiers with power supply, part of the transmitter exciter	None
0044	430MHz Rotary Join	WR2100 waveguide rotary coupling, part of the Incoherent Scatter Radar	None
0045	S-band Transmitter Socket Tank	Socket for the klystron CPI VKS-8270A	None
0046	S-band Transmitter Socket Tank	Socket for the klystron CPI VKS-8270A	None
0047	S-band Transmitter Socket Base	Socket base for the klystron CPI VKS-8270A	None
0048	Platform Piece	Catwalk and Cable car hanger Platform Piece	None
0049	Platform Piece	Tie down boom - corner 4 Platform Piece	None
0050	Gregorian Dome Shell	Dome protection shell and beams	None
0051	Rotary Floor Piece	Portion of the track gear of the rotary floor, also part of the floor itself with a receiver hole	None
0052	S-band Transmitter Heat Exchanger Coil	Part of the cooling of the klystrons CPI VKS-8270A	None
0053	430MHz WR2100 Full Height Waveguide	Part of the Incoherent Scatter Radar / Transmitter	None
0054	Azimuth Track Piece	Part of the ring that supports the azimuth arm	None
0055	Azimuth Track Piece	Part of the ring that supports the azimuth arm	None
0056	Platform Piece	Auxiliary socket cable at platform side	None
0057	Platform Cable Assembly	cable with socket and tension rods	None
0058	Cable Wrap at Transmitter Room in Gregorian Dome	Cable wrap for power, fiber and helium lines	None
0059	Platform Step / Landing, Catwalk	First step at the platform triangle from the catwalk	None
0060	Platform Motor Transmission	Gregorian Dome transmission	None
0061	Platform Motor Transmission with Motor	Gregorian Dome transmission with Kollmorgen motor	None
0062	Platform Motor Transmission	Gregorian Dome transmission	None



0063	Platform Piece	Bottom part of the boom - Tiedown cable Platform Piece, exact location TBD	None
0064	Platform Fence	Platform Piece	None
0065	Secondary/Tertiary Panel Pieces	Part of the reflectors	None
0066	Catwalk Floor Pieces	Metallic floor grating	None
0067	Cable Car Landing	with push buttons	None
0068	S-band Transmitter Water Pump	Part of the cooling of the klystrons CPI VKS-8270A	None
0069	Gregorian Dome Join	Beams join for Gregorian Dome Shell	None
0070	Gregorian Dome Join	Beams join for Gregorian Dome Shell	None
0071	Gregorian Dome Join	Beams join for Gregorian Dome Shell	None
0072	Zenith Hydraulic Brakes	Pipe of hydraulic brake system	None
0073	S-band Transmitter Deionizer Filters	Part of the cooling of the klystrons CPI VKS-8270A	None
0074	Cable Car	Transportation to the platform, four people capacity	None
0075	Mini Gregorian Reflector Small	Was part of the Gregorian Dome prototype	None
0076	Mini Gregorian Reflector Big	Was part of the Gregorian Dome prototype	None
0077	430MHz linefeed at the Learning Center	Was an exterior exhibit next to the Learning Center. Crashed by Tower 12 cables during the telescope collapse.	None
0078	Cryo Cooler / Coldhead	Part of a receiver at the Gregorian Dome	None
0079	Cryo Cooler / Coldhead	Part of a receiver at the Gregorian Dome	None
0080	Cryo Cooler / Coldhead	Part of a receiver at the Gregorian Dome	None
0081	Waveguide from top of the Rotary Joint	Part of the WR2100 waveguide rotary coupling, part of the Incoherent Scatter Radar	None
0082	Cable Spider	Used for platform and telescope cables maintenance	None
0084	Antenna Mount Plate	N/A	None
0085	Platform Landing Stair	One of the first steps arriving to the platform	None
0086	Platform Beam	Structural beam of the platform	None



0087	Platform Cable Support	Part of the support cables of the platform	None
0088	Fiber Optic Cable Wrap Section	Located at the rotary floor to provide tension to the fiber optic	None
0089	Main cable screw back-end	N/A	None
0091	Tertiary Reflector Support Joins	Support structure of tertiary reflector	None
0093	430MHz Cavity Filter	Part of the Incoherent Scatter Radar	None
0094	Rotary joint part - waveguide	Located at the center of the 430MHz rotary join	None
0097	327 receiver filter	Passband filter used in the 327 receiver system in the Gregorian Dome	None
0098	X-band transmission dual connector	Transition connecting feedhorn and dewar of XB receiver	None
0099	Distomat	One of six ranging systems used to determine the platform height	None
0100	S Band narrow top plate	Used for receiver hoisting	None
0101	Neumatic actuator 1	Part of the ALFA automatic shutter system	None
0102	Neumatic actuator 2	Part of the ALFA automatic shutter system	None
0103	Alpha Focal plate	Plate surrounding ALFA's feed array	None
0104	Tower 8 - Auxiliary end cable	Platform end of auxiliary cable system added during the 90's upgrade	None
0106	Mini gregorian frame	Was part of the Gregorian Dome prototype	None
0107	Tie down assembly bottom end	Platform's tiedown jack system. This was located under the main dish	None
0108	Metal "snow" shoe	Used to walk on top of the 305m primary reflector	None
0109	L band wide bottom plate	Part of the L band wide system.	None
0110	Wind Vail	Part of the wind monitor at the platform	None
0111	Bolts and Screws (Loose) Misc sources.	Miscellaneous screws and bolts	None
0112	Platform Cable Socket Screws	Part of the support cables of the platform	None
0113	Metal "snow" shoe	Used to walk on top of the 305m primary reflector	None
0114	Towers structure rods	Internal components of the tower structure	None

