

Card Model Building Instructions for:

Apollo Service Module

Apollo 7 thru ASTP Missions

Carl Hewlett April 20, 2007

Edited by Mike Vink

1st, a look at the Mission History:

The Apollo Service Module, Block II, was the spacecraft developed by NASA in the 1960's as a standard spacecraft for earth and lunar orbit missions. Block II SM's were the only version to fly manned, and they successfully ferried crews to the moon, to the Skylab space station, and to a joint docking with the Russian Soyuz. No production was undertaken after the initial run of 13 Block II SM's - Apollo was abandoned in favor of the Shuttle as the ferry for American manned spaceflight. Forty years later, the Shuttle is about to be retired, and a design similar to the Apollo, the CEV, was conceived as the Shuttle's replacement, (The CEV will have a SM similar to the Apollo SM).

Apollo SM.

Other Designations:	Service Module.	RCS Propellants:	N2O4/UDMH.
Part of:	Apollo CSM.	RCS Isp:	290 sec.
Class:	Manned.	RCS Impulse:	3,517 kgf-sec.
Type:	Spacecraft Module.	Main Engine:	3,000 kg (6 600 lb).
Length:	7.56 m (24.80 ft).	Main Engine Thrust:	97.860 kN (22,000 lbf).
Basic Diameter:	3.90 m (12.70 ft).	Main Engine Propellants:	N2O4/UDMH.
Maximum Diameter:	3.90 m (12.70 ft).	Main Engine Propellants:	18,413 kg (40,593 lb).
Mass:	24,523 kg (54,063 lb).	Main Engine Isp:	314 sec.
Structure Mass:	1,910 kg (4,210 lb).	Spacecraft delta v:	2,804 m/s (9,199 ft/sec).
Electrical Equipment:	1,200 kg (2,600 lb).	Electrical System:	Fuel Cells.
Reaction Control Sys:	Coarse	Electric System:	6.30 average kW.
No of Thrusters:	16 x 440 N.	Electric System:	670.00 kWh.

You will need the following items:

1. PDF reader software
2. Computer Printer, (Color), with 8 ½"x11" media carriage
3. 8 ½"x11" bond copy paper
4. 8 ½"x11" card stock paper
5. Clear drying PVA Glue (Elmers® White Glue or similar)
6. Clear drying Glue Stick
7. Hobby Knife
8. Scissors
9. Straight edge (For cutting guide).

Prep. For build by doing the following steps:

1. Plot/print the Parts PDF file.
2. Plot print with the "fit to page" feature turned off.
3. To make the model 1:96th Scale, plot/print pages with a reduction setting of 33.3% of the original size.
4. Cut parts out on a cutting surface, (i.e. cutting board). This protects the table and prolongs the life of your knife blade.

Steps for Build:

1. Cut out parts 1 thru 6.

If building the Sim Bay option used on Apollo 15 through 17, use parts 1-3 on Page 14. It is recommended to glue part 3 to the blank, reverse side of part 1 before cutting out the area shown for the sim bay, but cut out the area before rolling the skin into a cylinder.

2. Glue part 3 to the reverse, blank side of part 1
3. Glue part 6 to the reverse, blank side of part 4
4. Glue part 3 to the reverse, blank side of part 4, opposite of the end where part 6 is glued, making an exterior skin assembly of parts 1 & 4.
5. Roll the part 1/4 assembly into a tube, gluing the exposed part of 6 to the reverse, blank side of part 1.
6. Glue parts 4 and 5 into the top of cylinder (using the words "United States" for orientation) with the painted side of 4 and 5 facing inward.
7. Laminate parts 7 through 12 and 13 to heavy cardstock. Cut them out after drying and set aside for now.
8. Cut out part 11.
9. Roll part 11 into a tube and glue the white tab to the reverse, blank side of the other end.
10. Glue parts 12 & 13 into the two ends of the part 11 tube, with the gray, painted side facing outward and lining up the markings with the lines on the part 11 tube.
11. Glue parts 9 & 10 to the two ends of part 11 with the painted side facing inward. DO NOT fold the white glue tabs! Instead, glue them to the end caps 12 and 13.
12. Cut out six copies of part 14. Fold them over with painted sides out and glue or laminate them together, making 6 interior wall formers.
13. Glue the six part 14 walls in place between parts 9 and 10, following the markings on parts 9, 10 & 11.
14. If building the "Sim Bay Option", cut out, fold & glue parts 47 thru 49 creating the Sim Bay and set aside. ** Be sure to fold part 49 with the painted side outward. ** Replace 2 part 14's with Parts 50a & b, folded as in step 12.
15. Slide the part 9-14 assembly into the part 1-6 cylinder assembly, aligning with the bottom of part 2 & 5 ring. If building the sim bay version, align the sim bay with the opening on Part 1 before gluing into place.
16. Trim, place and glue part 7 into the top of the part 1-6 cylinder assembly, aligning it with the bottom of the part 2/5 ring.
17. Trim, place and glue part 8 into the bottom of the part 1-6 cylinder, ensuring it is flush with the bottom edge.
18. Laminate part 15 to heavy card stock, score and cut out, removing all white areas. Fold the arms to match the profile provided on page 8.
19. Cut out part 16. Roll and glue into a cone shape and glue to the center of part 15.
20. Glue the part 15/16 assembly onto top of part 7, using the artwork as a guideline.
21. Cut out, fold and glue the two part 17's into exterior scimitar antennas. Glue onto the exterior of the part 1-6 cylinder @ the marked locations (the rectangular markings to the left (below) of the US flag).
22. Cut out, fold and glue part 18 into an exterior EVA light. Glue onto the exterior of the part 1- 6 cylinder @ marked location (It should be placed at the upper right corner of part 4 on Pg 2 with the black circle facing towards the CM).
23. Laminate part 19 to heavy cardstock. When dry, cut out and glue to the marked area on part 8 at the rear of the SM.
24. Cut out, fold and glue four part 20's into four (4) thruster boxes.
25. Cut out, roll and glue sixteen part 21's into sixteen (16) thruster nozzles. The rectangles to the left of the nozzles are the necks of the nozzles. They are formed into small cylinders with the white tab glued to the reverse, blank side at the other end forming a tube. The nozzle cone (part 21) is glued to the neck as shown. If you wish the extra detail and headache, cut out and roll the extra gray arcs next to the original nozzles with the painted side inward

and glue these to the inside of the nozzles. The small circles are glued inside the nozzle cone to complete the assembly.

26. Glue the part 21's to the part 20's, 4 per thruster box, to the locations marked with a black circle on part 20.
27. Glue the part 20/21 assemblies to the marked locations on the exterior of part 1-6 cylinder, at the four rectangles on either side of the US flags, at the 4 points of the compass.
28. Cut out parts 23 thru 25. Glue part 24 to the rear, blank side of part 25. Roll/glue part 25 into a cylinder with the printed side inward.
29. Glue part 23 into the bottom of the part 25 cylinder with printed side inward. Glue the white tabs of part 25 to the blank rear side of part 23. Set aside for the moment.
30. Cut out, score and fold part 22. DO NOT cut out the center circle with the number "22" yet.
31. Cut out, score and fold parts 26 thru 28, laminating both part 28's to heavy card stock before cutting them out, then glue these to both part 27's.
32. Form and glue two part 26-28 assemblies to part 22.
33. NOW cut out the center circle of part 22. Glue the part 23-25 assembly to the rear, blank side of the center of part 22, folding the 2nd set of white tabs of part 25 outward when gluing it to the blank, rear side of part 22.
34. Glue the new part 22-28 assembly to the bottom of part 19 at the rear of the SM.
35. Cut out, fold, glue and assemble parts 29 thru 38 into the high-gain antenna assembly. (see attached pictures).
36. Roll parts 30 through 33 into cylinders with printed side outward. Glue the white tabs to the blank rear sides of the parts.
37. Cut out the four part 36's. Do not cut out the center pie slices yet. Fold over and laminate the two halves of each antenna together. When dry, cut out the center pie slices and dress up the edges with a gold gel pen (if desired). Form the four antennas into dish shapes and set aside.
38. Cut out, roll and glue the four part 35's into cones and glue these to the center of the dish antennas. Note: the feedhorns (part 35) should be offset on the dish. Use the circular marking at the center of the dish for placement. Glue the small circle to the front of the feedhorn and then glue the larger circle over the small circle with the painted side forward.
39. Cut out, roll and glue parts 39 and 39a into a cone. Glue part 39a to the reverse, blank side of part 39 with the printed side outward.
40. Do the same with parts 40 through 41a.
41. Assemble part cones 39 thru 41 into engine bell as shown at the upper right on page 12.
42. Laminate part 42 to heavy card stock, cut out and set aside for now.
43. Cut out parts 43 thru 45, rolling these into cones with the printed side inward. Insert and glue these parts into the interior of the engine bell. I would recommend using a glue-stick type of adhesive on the blank, reverse side of parts 43 through 45 and carefully placing them into position. This will allow some movement for positioning and alignment.
44. Glue part 42 into the top of the interior of the engine bell with the painted side inward or down.
45. Glue the engine bell assembly to the bottom of part 23.
46. If you built the Apollo 15-17 version with the sim bay option, you may loosely place part 46 over the sim bay to protect the sim bay pallet from dust or small fingers.
47. If desired, you may attach (glue) the appropriate Command Module to the front of the Service Module, completing your model.

Enjoy your finished model.

Carl

Original release 4/25/07 MHV