

**PERPENDICULAR PERSPECTIVES:
AN EXPLORATION OF A CITY WITH TWO GRAVITIES**

BY
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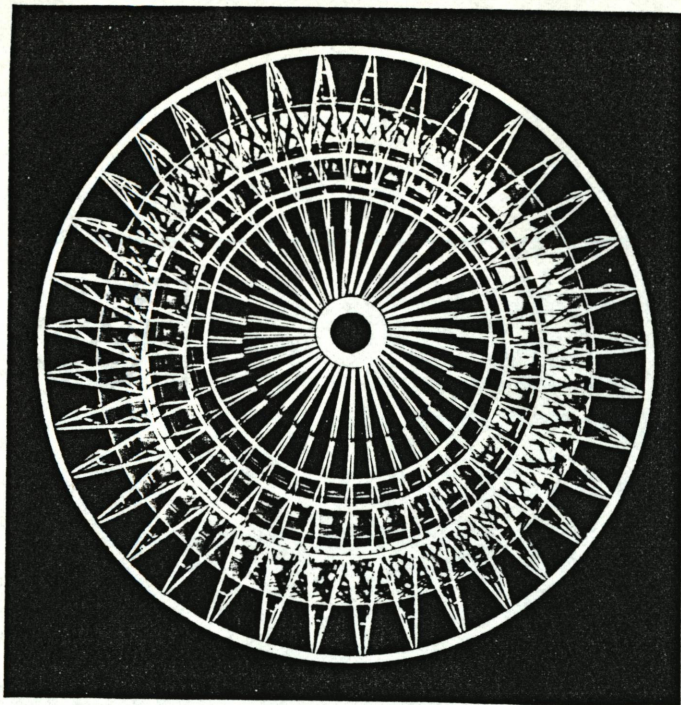
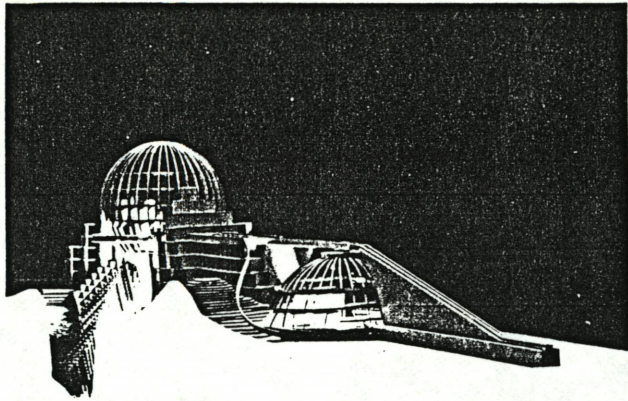


TABLE of CONTENTS

ABSTRACT	PAGE ii
THE ILLUSIONARY PROPERTIES OF PERSPECTIVE AND HOW IT PERTAINS TO MULTIPLE GRAVITIES.	PAGE 1
ON THE PLANET : LIVING WITH THE FIRST AND NATURAL GRAVITY.	PAGE 4
IN SPACE : LIVING WITH THE SECOND GRAVITY; SIMULATED GRAVITY.	PAGE 12
THE REALITIES OF LIVING WITH MULTIPLE GRAVITIES, AND THE USES OF PERPENDICULAR PERSPECTIVES.	PAGE 18
MULTIPLE GRAVITIES AND IT'S EFFECT ON THE FUTURE HOUSE.	PAGE 26
VITA	PAGE 31



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AN EXPLORATION OF A CITY
WITH TWO GRAVITIES

BY
MARK A. SAWYER

COMMITTEE CHAIRMAN:
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ARCHITECTURE AND ENVIRON-
MENTAL DESIGN

(ABSTRACT)

OUR PERCEPTION OF THIS WORLD, ON THE MOST PART, IS ONE DIMENSIONAL. THE LARGE SCALE IS NOT AS EASILY SEEN AS WHAT IS BEFORE OUR EYES AT THE PRESENT. THIS IS TRUE IN THE PHYSICAL REALM AS WELL AS THE SPIRITUAL.

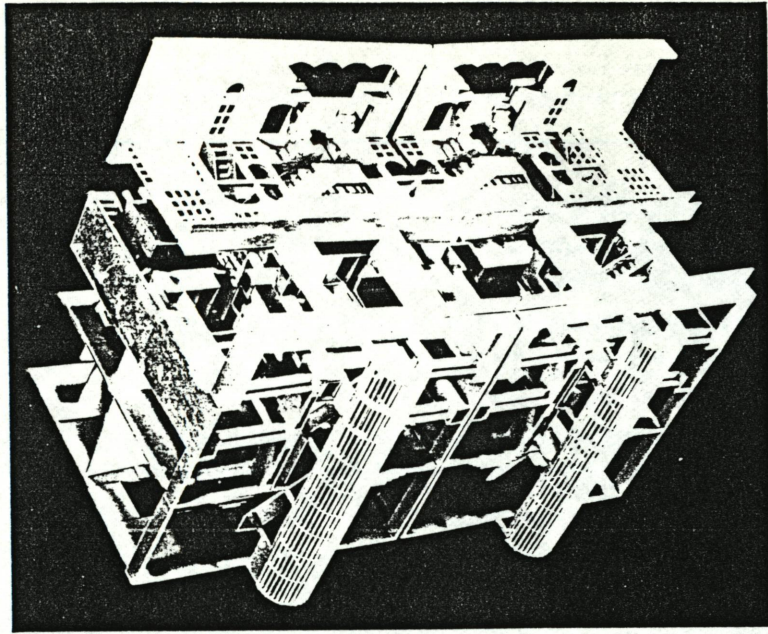
IN BOTH REALMS, WHEN THE LARGE SCALE IS REALIZED WE FIND OUR PLACE IN THIS UNIVERSE IS MORE COMPLEX THAN WHAT IS ON THE SURFACE.

IN THE PHYSICAL REALM, OUR ORIENTATION IS ALL BASED ON REFERENCE POINTS WHICH WE OBSERVE. AS HUMANS WE MUST LIVE WITH THESE IMAGES TO FUNCTION NORMALLY.

THESE IMAGES ARE EITHER SIMULATED, OR NATURALLY PRODUCED. AS ARCHITECTS WE SEEK TO ACCENT THESE NATURAL IMAGES AND TO DESIGN SIMULATED IMAGES WHICH ARE FUNCTIONAL, AND AESTHETICALLY PLEASING.

WITH THE SPACE PROGRAM, ARCHITECTS, WILL OF COURSE, DESIGN THESE SIMULATED REFERENCE POINTS FOR THE INHABITANTS OF THEIR CREATIONS. FOR EXAMPLE, THE ARCHITECT WILL DESIGN WALLS, FLOORS, AND CEILINGS TO DESIGNATE UP, DOWN, RIGHT AND LEFT. WITH TECHNOLOGY IN USE TODAY, AND IN THE FUTURE, THE ARCHITECT WILL DESIGN FOR SIMULATED NATURAL REFERENCE POINTS. THE ARCHITECT IS ABLE TO SIMULATE HIS OWN UP, DOWN, RIGHT AND LEFT.

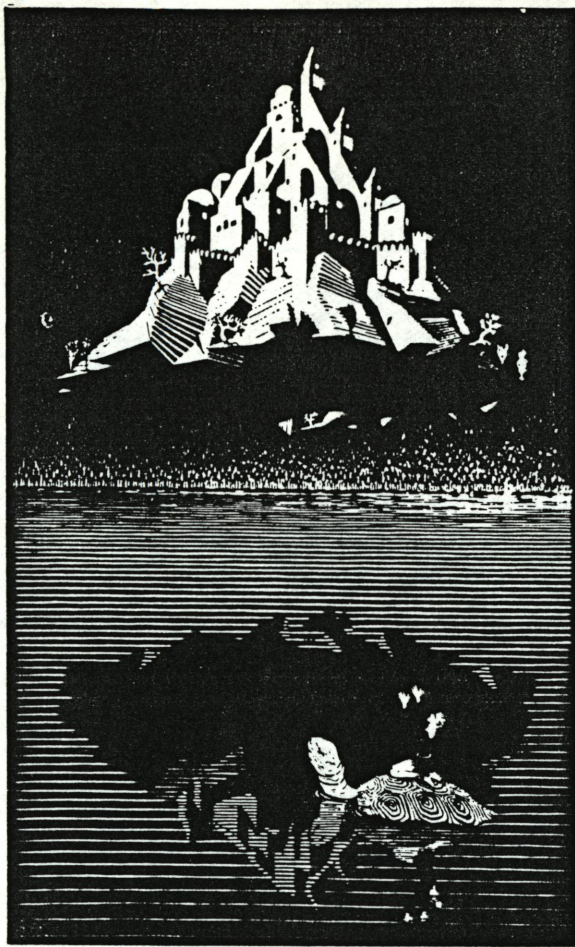
THIS IS A NEW PERSPECTIVE FOR ARCHITECTS. INSTEAD OF ONLY DESIGN-



ING FOR THESE NATURAL
CIRCUMSTANCES, THE
ARCHITECT WILL FIRST
SIMULATE THESE NATURAL
CIRCUMSTANCE, AND
THEN DESIGN SITUATIONS
TO LIVE WITHIN THESE
CIRCUMSTANCES.

FOX RIVER
SECTION

FOX RIVER BOND
SECTION



CITY IN THE SKY
LITHOGRAPH
M.C. ESCHER

ONE OF THE MOST IMPORTANT FACTORS INFLUENCING ARCHITECTURE IS ALMOST ALWAYS TAKEN FOR GRANTED. GRAVITY HAS A DISTINCT INFLUENCE ON THE OUTCOME OF ARCHITECTURE, INCLUDING DESIGN. ALL ARCHITECTURE MUST BE DESIGNED TO WITHSTAND THE FORCES OF GRAVITY. NOT ONLY STRUCTURE IS INFLUENCED BY GRAVITY, BUT OUR ORIENTATION TO ARCHITECTURE AS WELL.

WHAT IS INTERESTING TO NOTE IS THAT OUR ORIENTATION HERE ON EARTH IS EXACTLY THE OPPOSITE DIRECTLY ON THE OTHER SIDE. WHAT IS COMMONLY CONSIDERED AS UP, ON THIS SIDE OF THE EARTH, IS DOWN DIRECTLY ON THE OPPOSITE SIDE, AND VICE VERSA. EAST AND WEST ARE THE SAME ON BOTH SIDES OF THE EARTH. IF WE START AT A POINT ON THE EARTH AND GO DIRECTLY WEST WE WILL RETURN TO OUR POINT OF ORIGIN. IF WE TRAVEL EAST FROM A POINT THE SAME WILL HAPPEN. ALTHOUGH IF WE START FROM A POINT ON THE EARTH, AND TRAVEL DIRECTLY NORTH, WE WILL HAVE TO EVENTUALLY TRAVEL SOUTH AND THEN AGAIN NORTH TO REACH OUR POINT OF ORIGIN. THE SAME WILL HAPPEN AGAIN IF WE START FROM THE SAME POINT AND TRAVEL SOUTH. WE WILL EVENTUALLY TRAVEL NORTH, AND AGAIN SOUTH TO REACH OUR POINT OF ORIGIN. OTHER FACTORS OF LIVING ON A SPHERE ARE INTERESTING. OUR SEASONS, WHICH ARE TAKEN FOR GRANTED IN THE NORTHERN HEMISPHERE, ARE OPPOSITE IN THE SOUTHERN HEMISPHERE. THESE

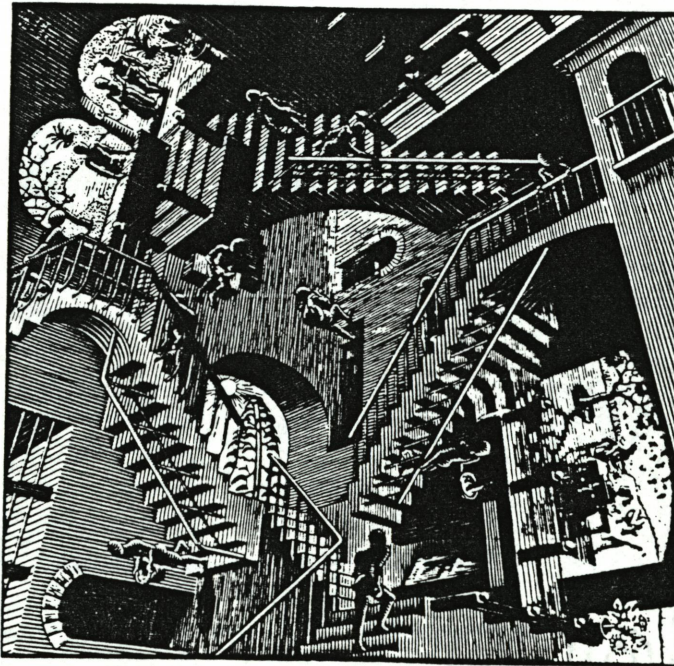


CONCAVE AND CONVEX
LITHOGRAPH 1955
M.C. ESCHER

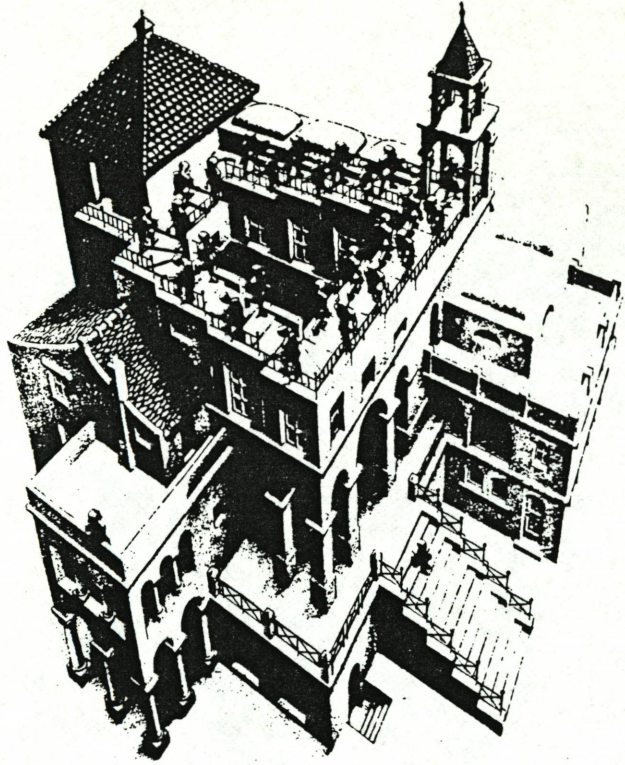
ARE FACTS WHICH WE LIVE WITH ON THIS PLANET, AND ARE NEVER QUESTIONED. OTHER FORMS OF THIS REVERSAL ARE FOUND IN OTHER AREAS.

WHEN DEALING WITH PERSPECTIVE WE FIND THIS CASE AGAIN. OTHER FACTORS ALONG WITH ORIENTATION ARE IMPORTANT. REFERENCE POINTS ALSO AID US IN EVERY DAY LIVING. TWO LINES WHICH CONVERGE TO A POINT WITH LINES THAT CROSS HORIZONTALLY THROUGH THE CONVERGING LINES, COULD BE A SET OF RAILROAD TRACKS FADING INTO THE HORIZON, OR A LADDER GOING TO THE SKY. WITHOUT REFERENCE POINTS EITHER COULD BE POSSIBLE. THIS IS ONE OF THE ILLUSIONARY PROPERTIES OF PERSPECTIVE.

M.C. ESCHER WAS A MASTER AT DEALING WITH ILLUSIONS IN PERSPECTIVE AND AXONOMETRIC. IN HIS DRAWING "OTHER WORLD" ALL FORMS OF PERSPECTIVE CAN BE SEEN. IN HIS DRAWING "RELATIVITY" THESE ILLUSIONS OF PERSPECTIVE BECOME A STAGE FOR MANIPULATING GRAVITY AND THE CUBE. THESE DRAWINGS ARE INTERESTING TO US BECAUSE THE ILLUSION SEEMS CORRECT. IN REALITY THESE SPACES COULD NEVER TAKE PLACE ON THIS PLANET. IN THE FUTURE SPACE ARCHITECTURE WILL BE MORE FLEXIBLE. WITH NEITHER ORIENTATION OR REFERENCE POINTS TO INTERFERE, WE ARE ABLE TO PICK OUR OWN. GRAVITY IS A LARGE DOMINATE FORCE ON US. AS HUMANS OUR OWN BIOLOGICAL FORMS ARE A MAKE-UP RESULTANT OF GRAVITY. OUR BONE STRUCTURE AND CIRCU-

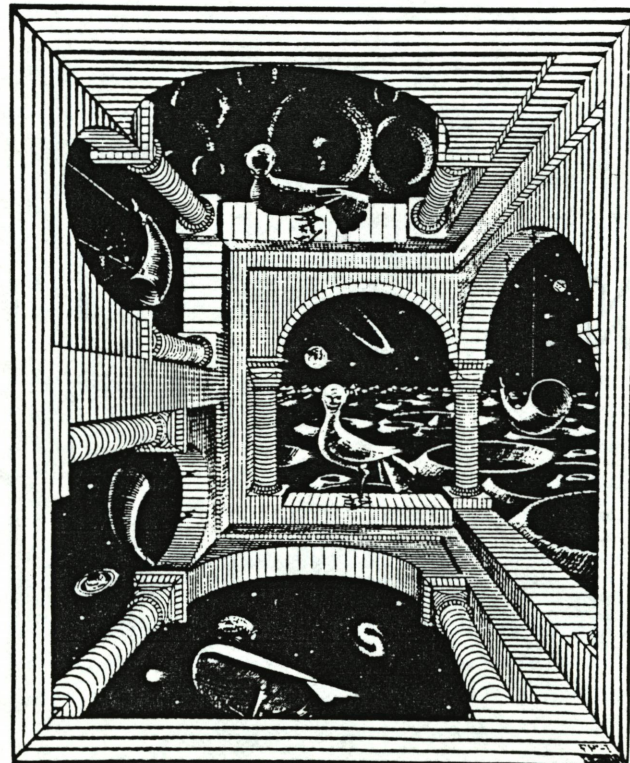


RELATIVITY
LITHOGRAPH 1953
M.C. ESCHER

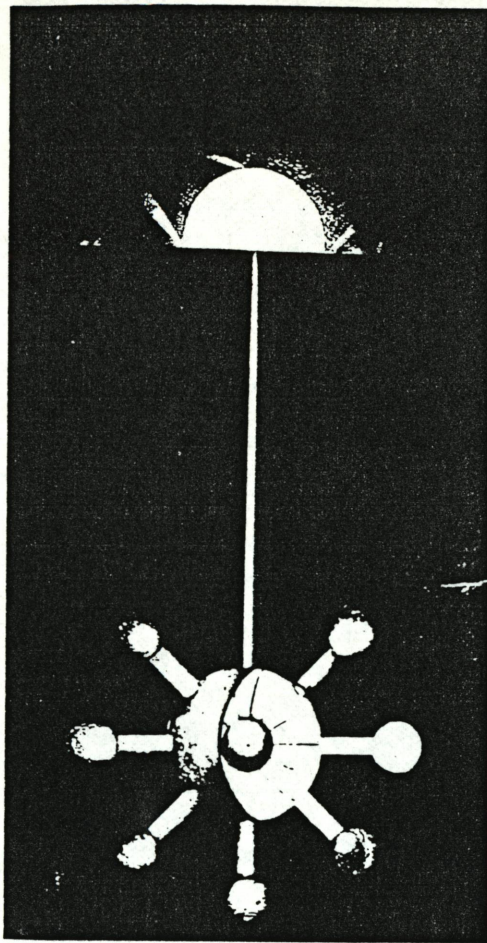


ASCENDING AND DESCENDING
LITHOGRAPH 1960
M.C. ESCHER

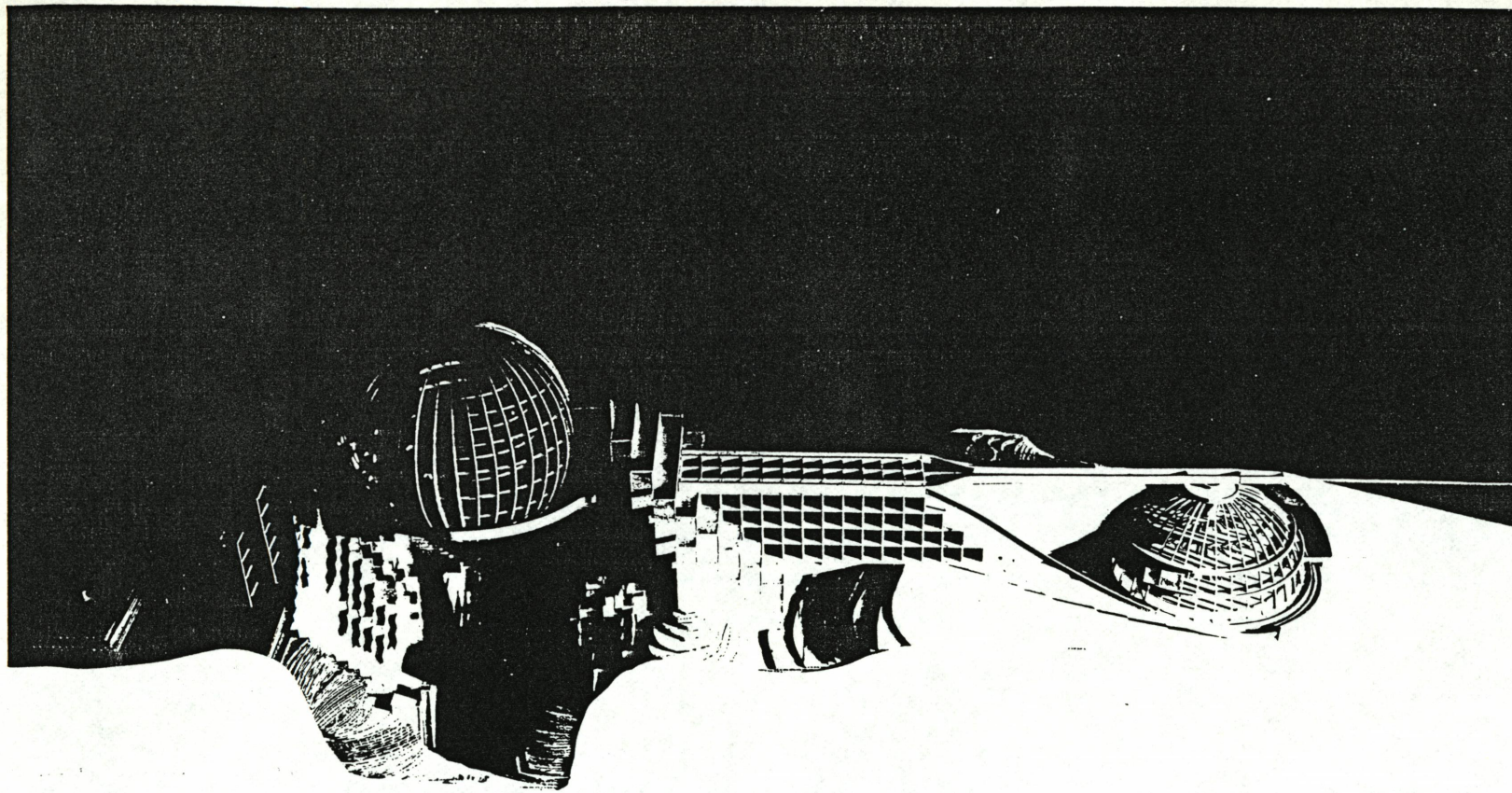
LATORY SYSTEM ALL DEPEND ON GRAVITY TO FUNCTION. WITHOUT GRAVITY THESE SYSTEMS BEGIN TO BREAK DOWN. WE HAVE SEEN THIS IN PAST SPACE MISSIONS. OVER A LONG PERIOD OF TIME ZERO GRAVITY BEGINS TO DETERIORATE OUR BODIES. LOSS OF BONE CALCIUM AND POOLING OF BODY FLUIDS ARE A MAIN PROBLEM. ONLY AN EXCESSIVE AMOUNT OF EXERCISE CAN BE USED TO COUNTER BALANCE THESE EFFECTS, AND THIS IS LIMITED. THE CONCLUSION IS; FOR LONG TERM SPACE FLIGHT SIMULATED GRAVITY MUST BE USED. THIS IS BECAUSE WE ARE INDEED CREATURES OF GRAVITY. THEREFORE WITHOUT GRAVITY OUR SENSE OF ORIENTATION AS WELL AS OUR OWN BODIES CANNOT FUNCTION NORMALLY. SINCE THE NATURAL ATTRACTION OF THE EARTH CONSTITUTES OUR DIRECTION OF DOWN, WITHOUT GRAVITY THERE IS NO DOWN. THEREFORE A SPACE CITY WITHOUT GRAVITY WOULD BE DETRIMENTAL TO HUMANS MENTALLY, EMOTIONALLY, AND PHYSICALLY IN LONG TERM USE. FROM HERE AN EXPLORATION OF ORIENTATION TAKES PLACE.



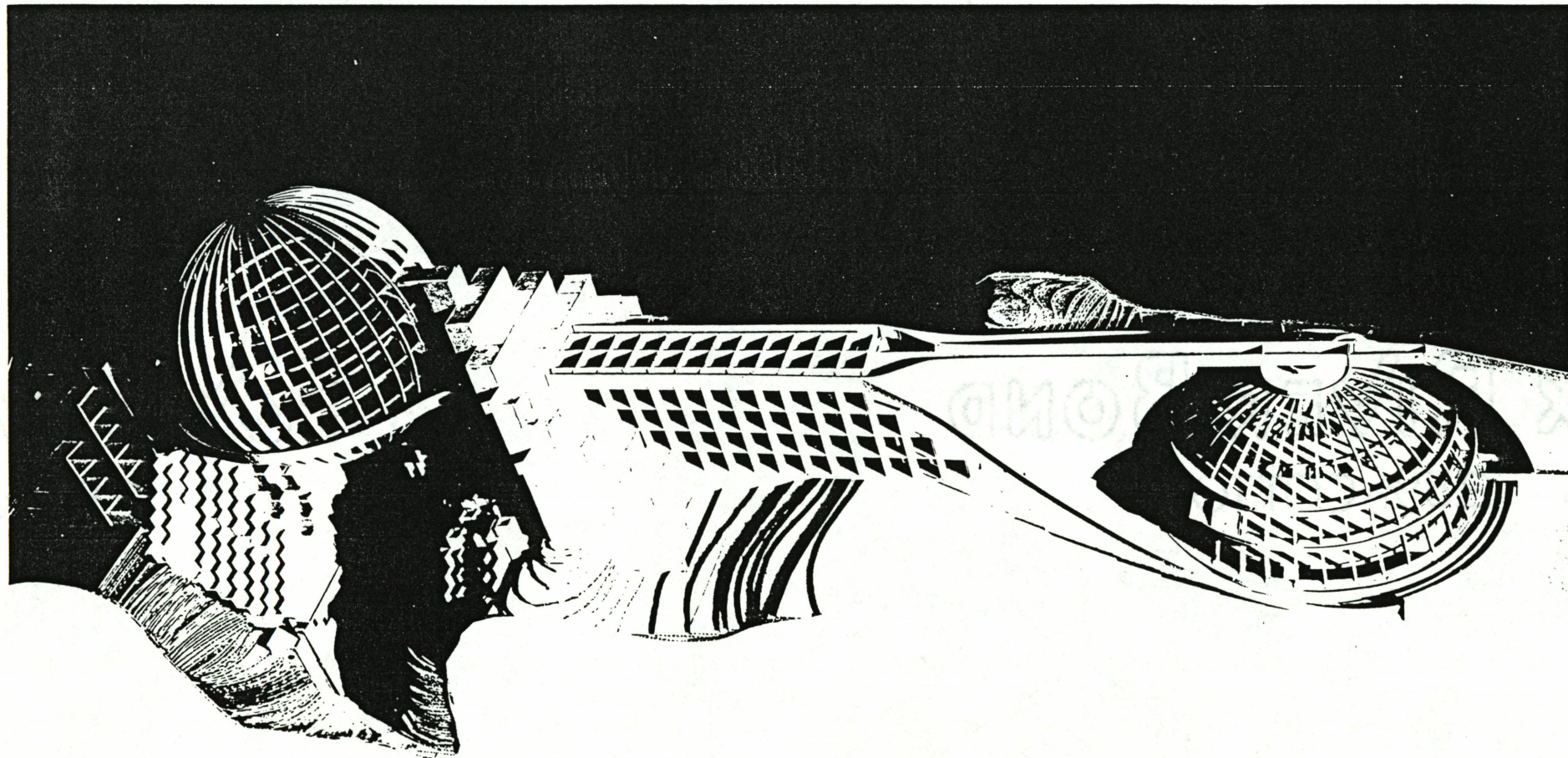
ANOTHER WORLD
WOOD ENGRAVING 1947
M.C. ESCHER

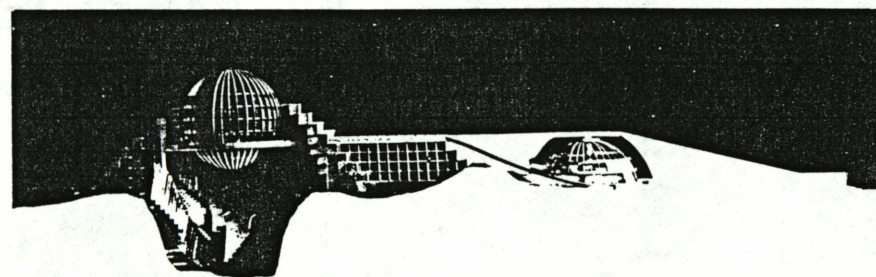
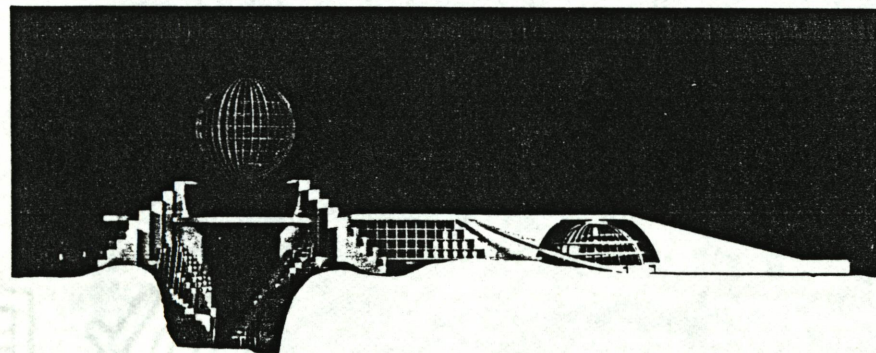
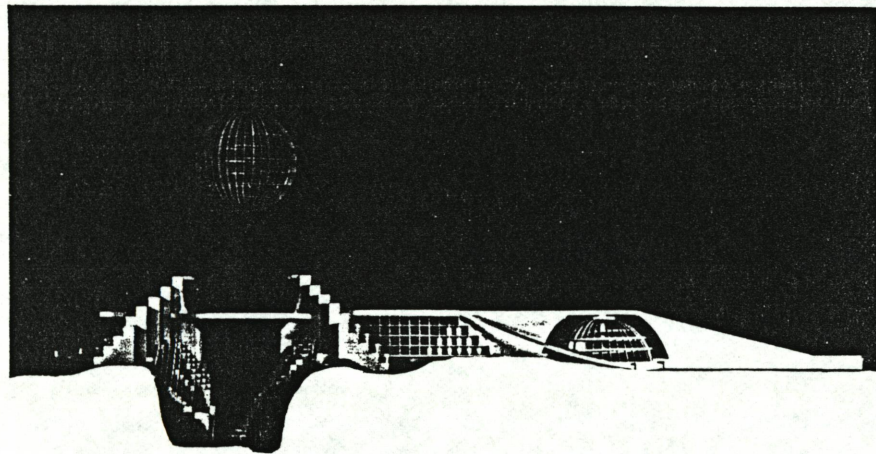
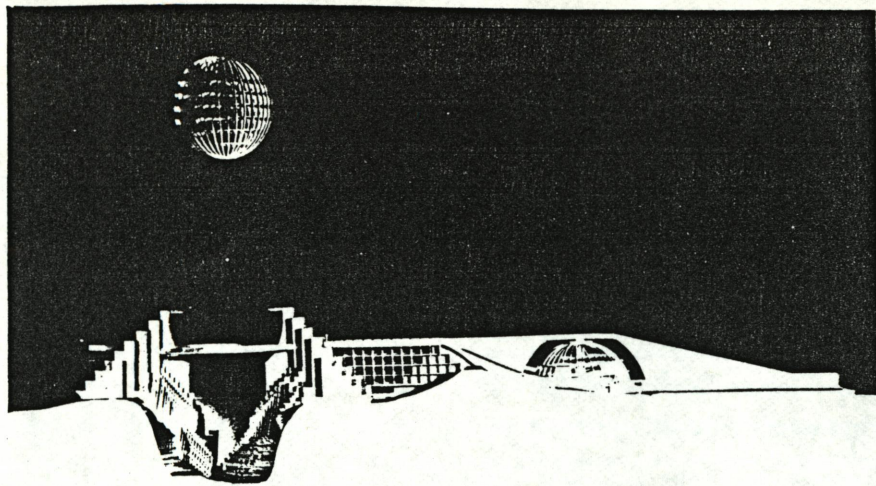


THIS INVESTIGATION BEGAN AS A BASE LOCATED ON THE LUNAR SURFACE. WITH A GROWING NEED FOR A NEW LOCATION OF RESOURCE MATERIAL IN THE FUTURE, THIS SUBJECT IS CLOSER TO A REALITY TODAY THEN IT EVER HAS BEEN BEFORE. THE ORIGINAL BASE BEGAN AS A SPHERE SUBMERGED IN LUNAR MATERIAL. THE SPHERE HAD A DIAMETER OF ONE MILE, AND WOULD ENLIST FROM FIVE THOUSAND TO TEN THOUSAND INHABITANTS. THE SPHERE WAS USED BECAUSE OF ITS UNIQUE PROPERTIES. AS A PRESSURE VESSEL, THE ATMOSPHERE INSIDE THE SPHERE WOULD APPLY PRESSURE EVENLY ALONG THE ENTIRE INSIDE SURFACE. THE SPHERE ALSO MAKES MAXIMUM USE OF ALL SURFACE AREA, AND MATERIALS. THE SPHERE SERVED IT'S INHABITANTS AS A LIVING ENVIRONMENT. AN ENCLOSED ECOLOGICAL SYSTEM WITHOUT WASTE OR GAIN. THIS IS OF COURSE AN IDEAL SITUATION. FROM THE SPHERE SUPPORT SYSTEMS, WHICH MAINTAINED THE SPHERE, RADIATED OUT. THESE FACILITIES RADIATED OUT FROM THE SPHERE IN A LINEAR FASHION. THIS PROVIDED MAXIMUM USE OF TRANSPORTATION SYSTEMS, MECHANICAL LINES, AND FUTURE FACILITIES THAT COULD POSSIBLY RADIATE FROM THE SAME POINT. THIS LINEAR PROGRESSION CONTINUED ON UNTIL IT REACHED A POINT WHERE ANOTHER DOME WOULD BE FOUND. THE FUNCTION OF THIS DOME WAS MORE AS A TECHNICAL SERVICE TO THE SPHERE. HERE MANY OF THE LABORATORIES, MECHANICAL



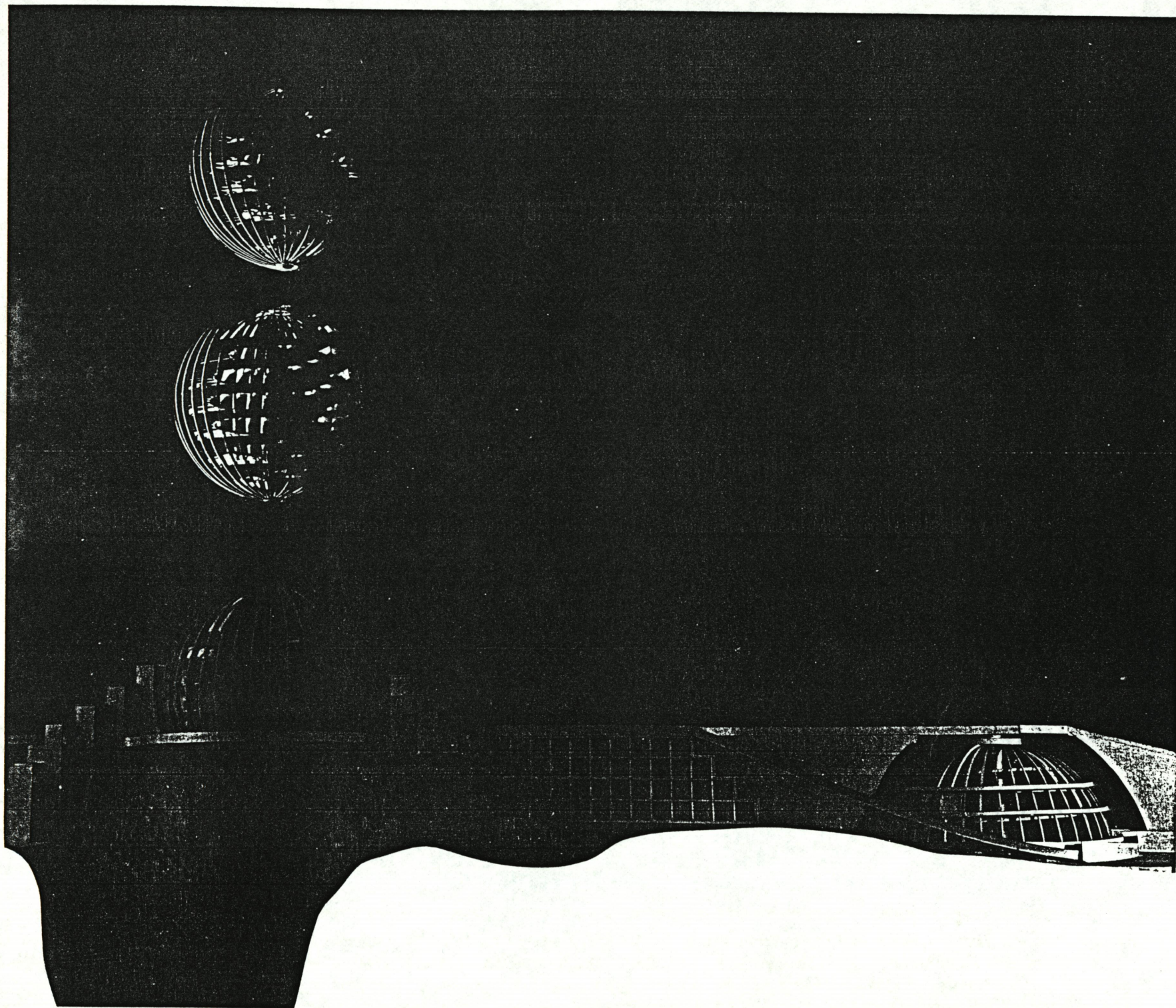
DEVICES, AND EXPERIMENTAL EQUIPMENT WOULD BE LOCATED. AS THE PROJECT PROGRESSED THE DECISION TO ELEVATE THE SPHERE ABOVE THE LUNAR SURFACE BECAME NECESSARY. IT WAS FELT THE DISRUPTION OF THE SPHERE BY THE LUNAR SURFACE WOULD BE IMPRACTICE. PRACTICE USE OF THE SPHERE WOULD BE, TO ALLOW THE SPHERE TO STAND ON IT'S OWN. WHEN THE DECISION WAS MADE TO ALLOW THE WHOLE SPHERE TO BE SEEN, THIS SET THE STAGE FOR NEW CONDITIONS TO OCCUR. AS A LIGHTER THEN AIR BALLOON THE SPHERE ACQUIRED IT'S OWN SEPARATE EXISTENCE. FROM THIS, THE PROJECT BEGAN A NEW DIRECTION.



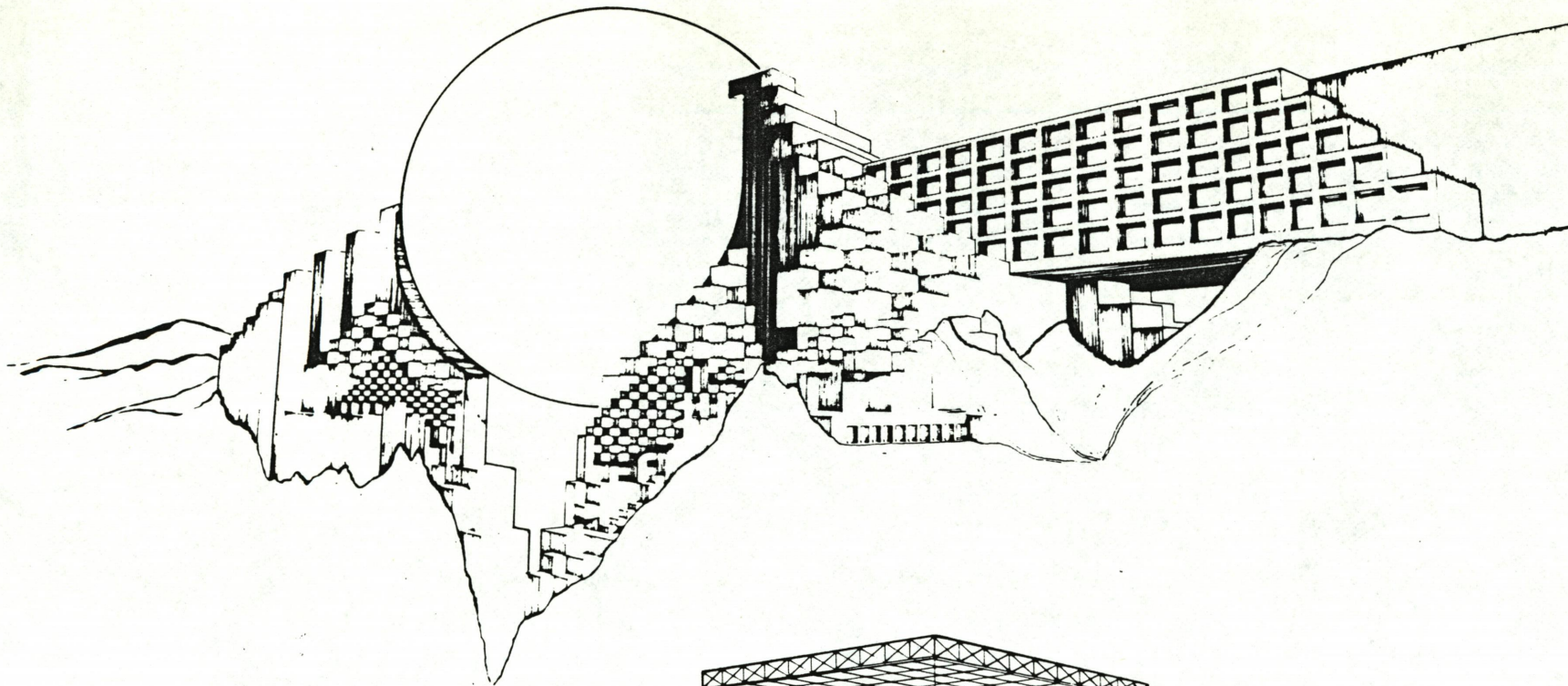


ONE OF THE GREATEST CHALLENGES FACING THE SPACE PROGRAM TODAY IS TO BEGIN DEVELOPEMENT OF AN ORBITING SPACE STATION OR A LUNAR BASED OUTPOST. THERE IS ANOTHER POSSIBILITY. THE CONCEPT OF A LUNAR BASE AND SPACE STATION IN ONE. WITH THIS CONCEPT OF A LUNAR BASE, THE SPHERE WOULD BE ALLOWED TO SEPERATE ITSELF, AT ANY TIME, AWAY FROM IT'S BASE AND THEN RETURN AGAIN AT ANYTIME.

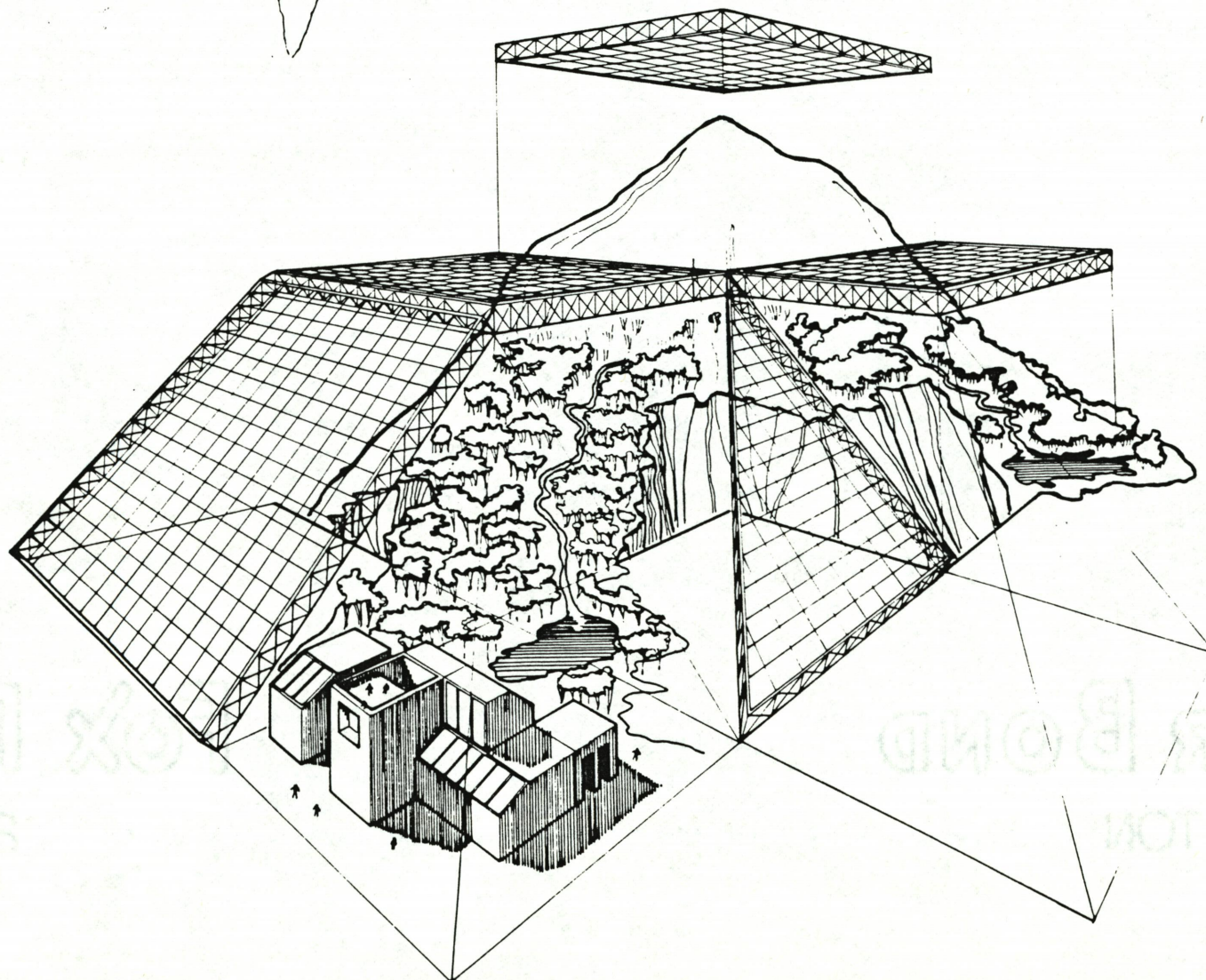
ONE PROBLEM FACING THIS CONCEPT IS THE NECESSARY THRUST NEEDED TO LIFT THE SPHERE FROM IT'S BASE. TWO ADVANTAGES TO THIS PROBLEM IS, GRAVITY BEING ONE-SIXTH THAT OF EARTH, AND ANOTHER, THE FORCES ACTING UPON THE SPHERE. THE FIRST IS AN OBVIOUS ADVANTAGE, LESS WEIGHT LESS THRUST. THE SECOND IS THE STRUCTURE THAT COULD BE USED TO STEADY THE SPHERE. WITHOUT AN ATMOSPHERE ON THE MOON THE ONLY FORCES ARE THE SPHERE'S OWN DEAD WEIGHT, AND THE LIVE LOADS ACTING WITHIN THE SPHERE. WITHOUT WIND LOADS AND SNOW LOADS THE SPHERE'S DIRECTED COURSE WOULD NOT BE ALTERED. THE SPHERE ON THE PLANET SURFACE COULD EASILY BE BALANCED, AND NOT BE UPSET. THIS WOULD CALL FOR UNIFORMITY OF WEIGHT THROUGHOUT THE SPHERE, AND THE UNIFORMITY OF BUILDING MATERIALS USED. THIS WOULD GREATLY INFLUENCE THE DESIGN OF THE INTERIOR OF THE SPHERE. IF THE CENTER OF GRAVITY OF THE SPHERE WERE BELOW THE EQUATOR, THIS



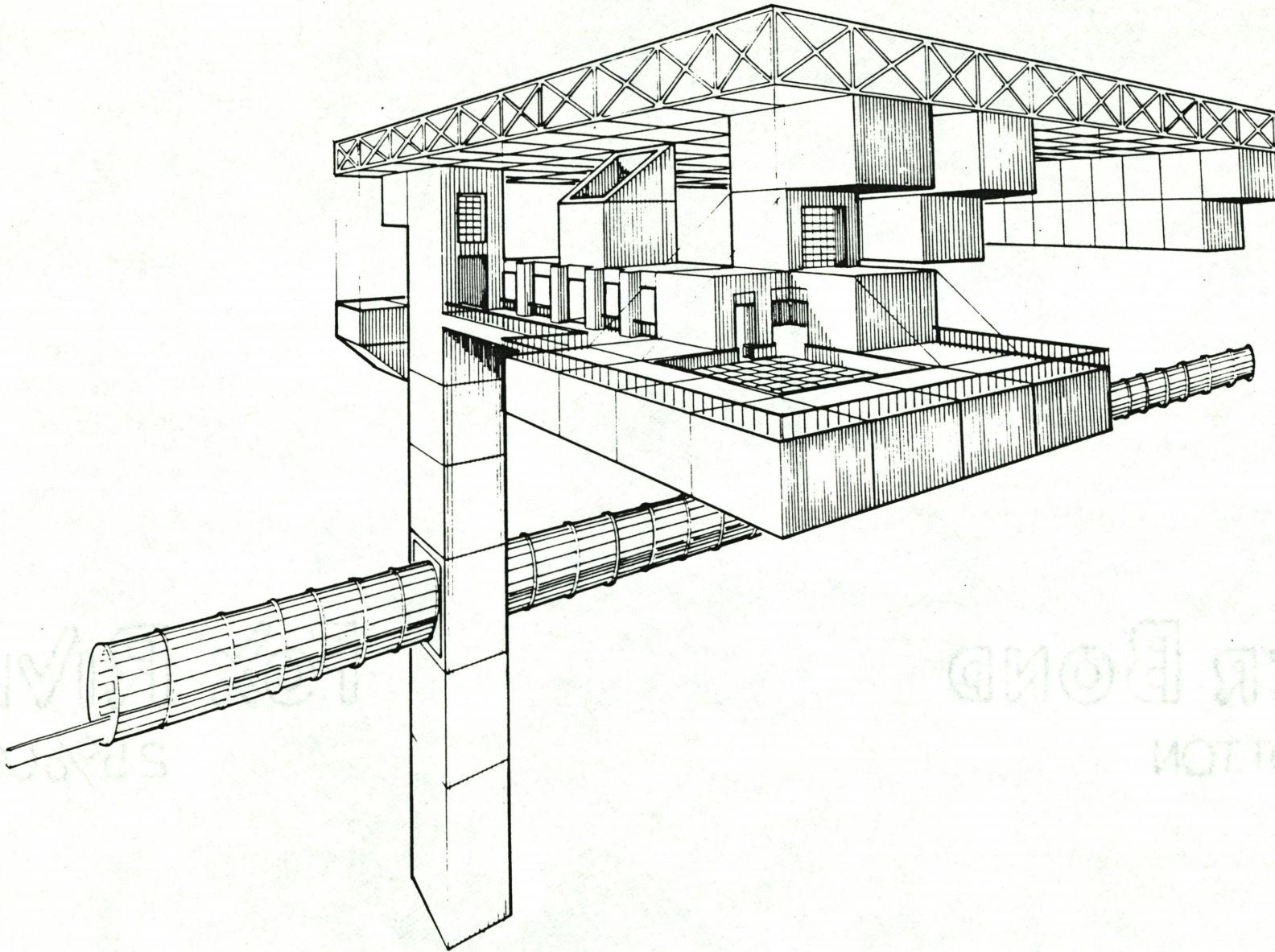
WOULD ALSO HELP BAL-
ANCE THE FLIGHT OF
THE SPHERE. THE RE-
QUIRED THRUST TO LIFT
THE SPHERE WOULD
COME FROM INSIDE THE
SPHERE. MUCH LIKE AN
INTERNAL FUEL TANK.
WHEN AN APERTURE
IS OPENED ALLOWING
THE ATMOSPHERE IN-
SIDE THE SPHERE TO
ESCAPE, THE SPHERE
WILL REACT IN THE
OPPOSITE DIRECTION.
MUCH LIKE A BALLOON,
THE SPHERE WILL
BE PROPELLED
THROUGH SPACE. WITH
THE SPHERE WELL
BALANCED, THE FLIGHT
WILL NOT BE AS
UNPREDICTABLE AS
A BALLOON'S. JETS LO-
CATED ALONG THE EQ-
UATOR CAN MAKE IN-
FLIGHT COURSE CORREC-
TIONS, BY KEEPING THE
EQUATOR PARALLEL
TO THE HORIZON OF
THE MOON. A LATER DE-
TAILED LOOK AT THE
SPHERE WILL TAKE
PLACE LATER IN THE
BOOK. BEFORE LEAVING
THE LUNAR SURFACE
A CLOSER LOOK WILL BE
TAKEN AT LIVING ON THE
LUNAR SURFACE.

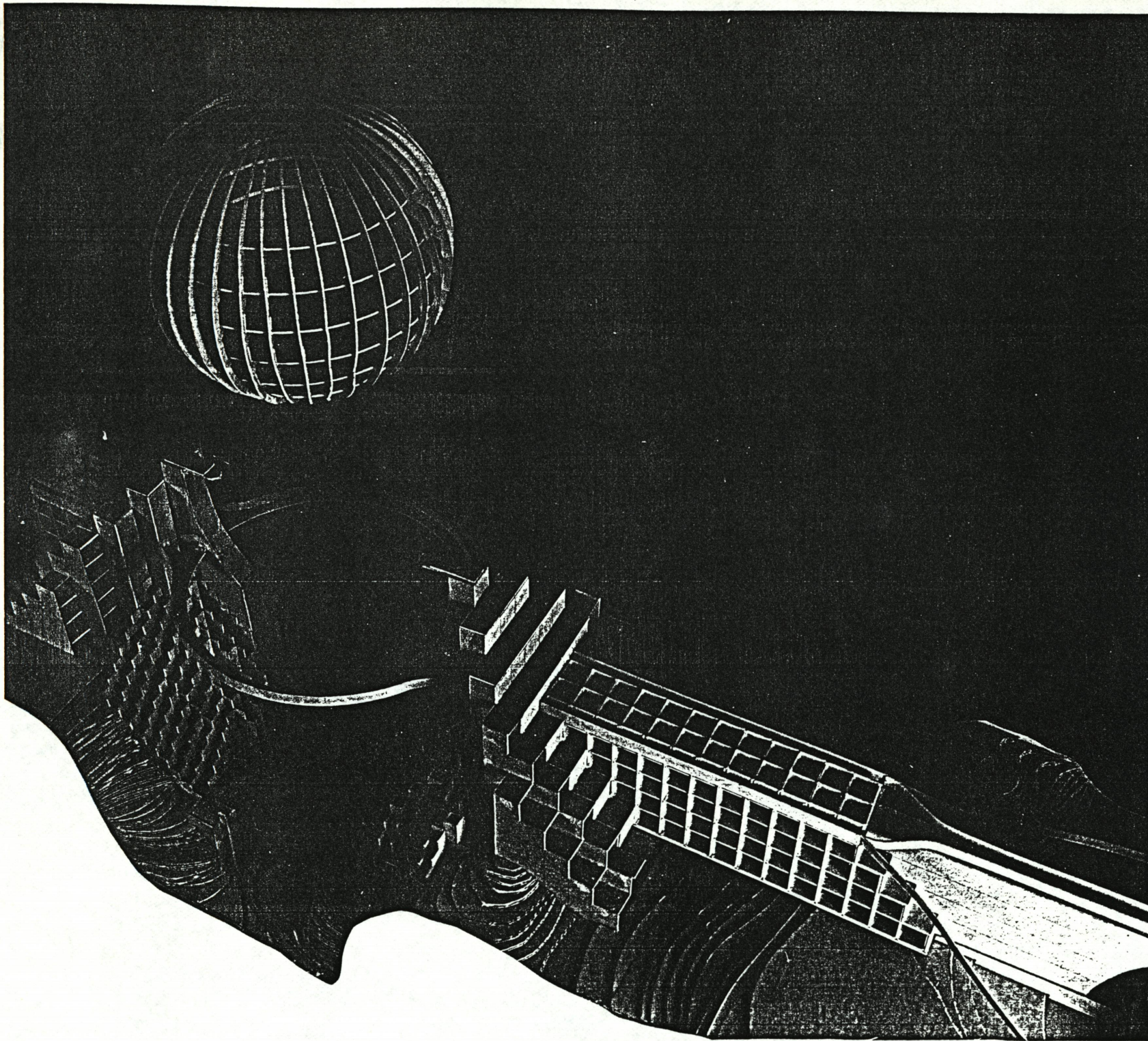


BEFORE GOING MORE INDEPTH INTO LIVING WITHIN THE SPHERE, A CLOSER LOOK WAS MADE INTO THE FUNCTION OF THE LUNAR BASE. DIRECTLY BENEATH THE SPHERE ON THE MOON WILL BE LOCATED MOST OF THE CONVERTED LUNAR SOIL. THE LARGE SHAFTS WHICH SUPPORT THE SPHERE ACT AS BEARING WALLS FOR LUNAR SOIL TO BE PILED AGAINST. LARGE FRAMES BEGIN TO FOLD OVER THE SOIL. THE FRAMES ARE TRANSLUCENT TO ALLOW THE TRANSFER OF SUNLIGHT TO THE SPACES WITHIN. THE FRAMES ARE ALSO AIR TIGHT TO MAINTAIN A SUITABLE ATMOSPHERE FOR SUSTAINING LIFE. THE SOIL IS THEN FERTILIZED AND IRRIGATED. BY A LARGE AQUADUCT. THE AQUADUCT IS THE LARGE TRANSPARENT RECTANGLE THAT APPEARS AS A CAGE. THIS WILL CONTAIN THE ONLY WATER FOUND ON THE LUNAR SURFACE. THIS WILL BE SEEN FROM ALL POINTS OF THE LUNAR BASE. THE COLORS REFLECTED BY THE WATER AND VEGETATION WILL BE A LARGE CONTRAST TO THE LIFELESS SURFACE OF THE MOON.

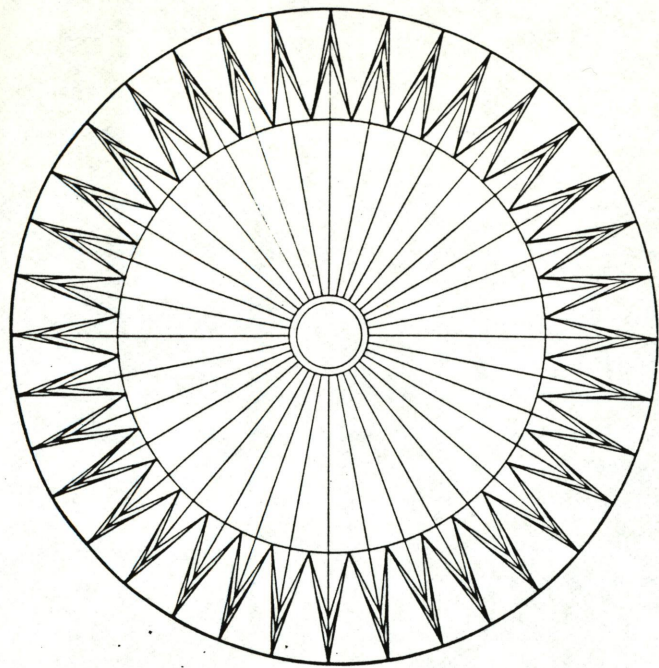


WITHIN THE FRAME USED TO ENCLOSE THE ATMOSPHERE ON THE PLANET SURFACE, CUBES WILL BE CONSTRUCTED TO HOUSE THE INHABITANTS. THE INHABITANTS WILL MAINLY BE THE FARMERS AND MINERS WHO WILL MAINTAIN THE LUNAR BASE. TRANSPORTATION SYSTEMS WILL LINK MANY OF THESE CLUSTERS TOGETHER.

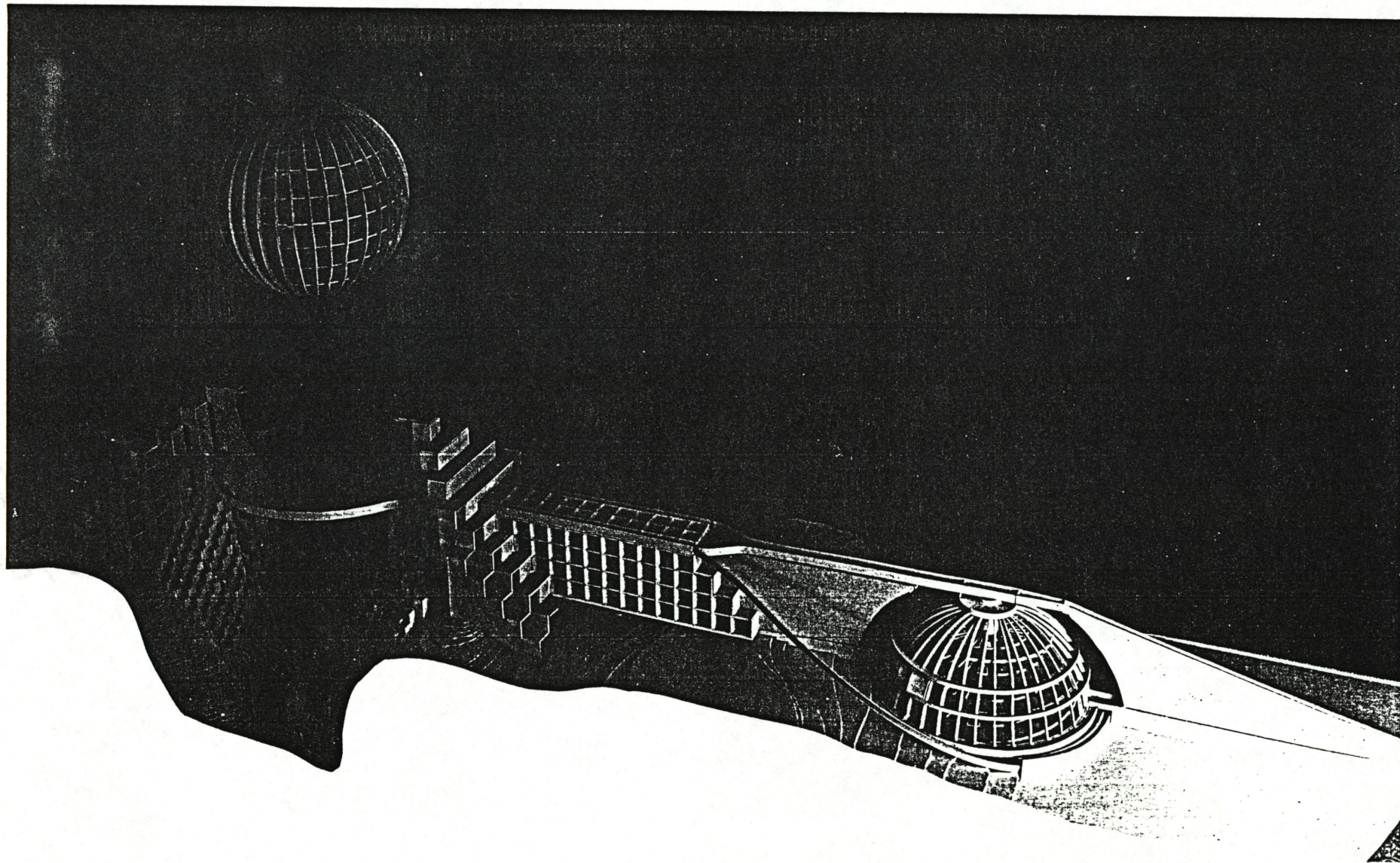


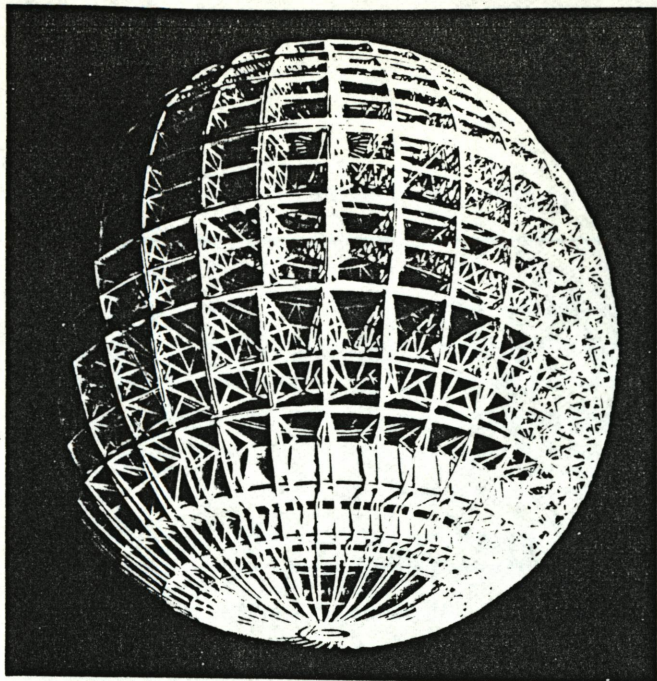


THE HOOP LOCATED BELOW THE SPHERE IS THE TRANSPORTATION SYSTEM THAT CONNECTS THE ENTIRE BASE TOGETHER. THE SYSTEM TRAVELS THROUGH THE BASE AND THEN LOOPS AROUND THE SPHERE GIVING THE BEST VIEWS OF THE SPHERE. ONCE THE SYSTEM LOOPS AROUND THE SPHERE IT TRAVELS IN A STRAIGHT LINE THROUGHOUT THE BASE.

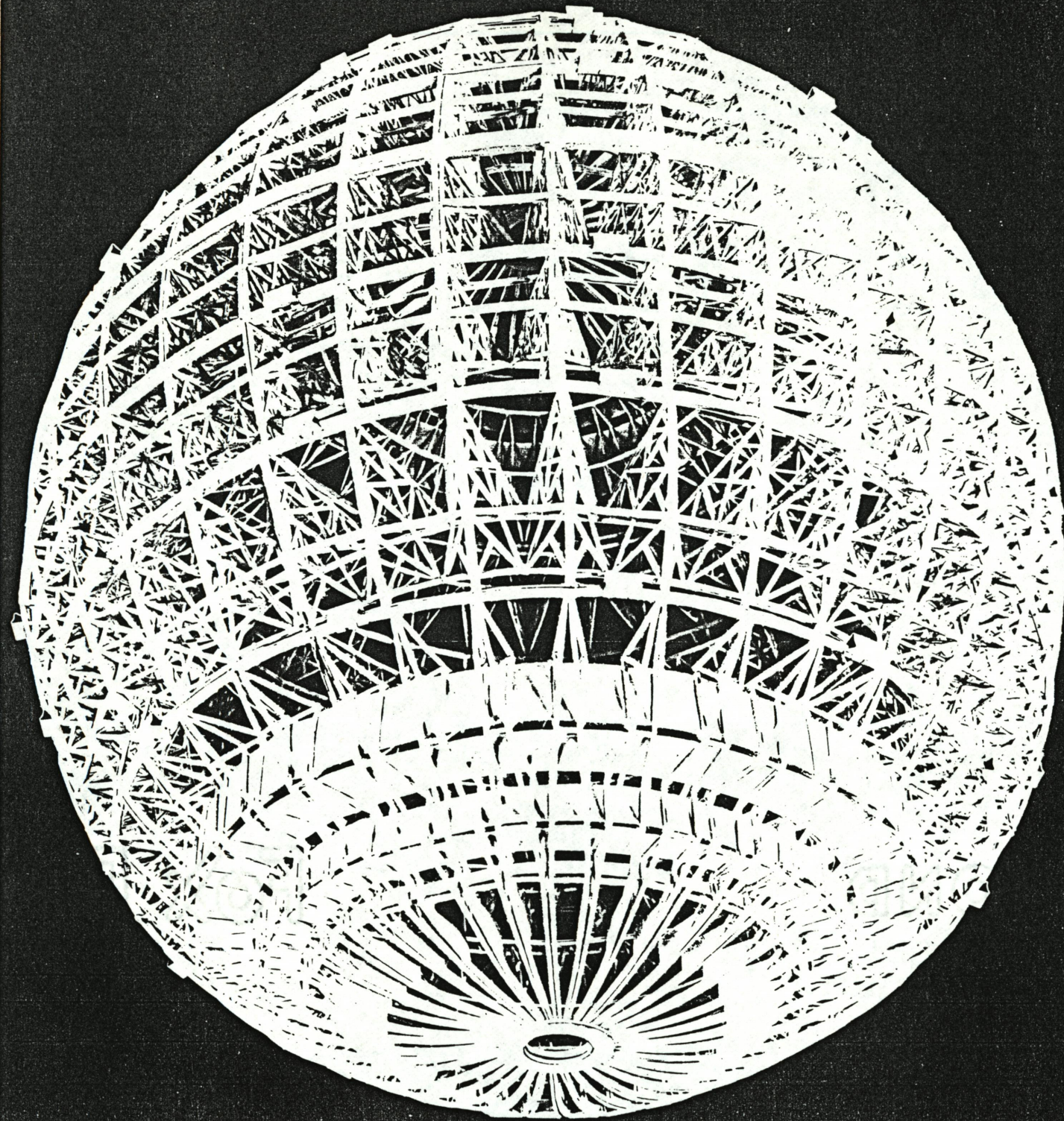


FROM HERE BEGINS
A CLOSER LOOK AT THE
SPHERE ALONE. THIS IS
THE BEGINNING OF THE
MULTIPLE USES THE
SPHERE HAS TO OFFER.
FROM ONE GRAVITY,
THAT IS THE NATURAL
ATTRACTION OF THE MOON,
TO ARTIFICIAL GRAVITY,
THAT IS PRODUCED FROM
CENTRIFUGAL FORCE. THE
DIAGRAM OF THE SPHERE
IN PLAN SHOWS THE
BASIC STRUCTURAL
DETAIL THAT BEGINS THE
CONSTRUCTION OF THE
SPHERE. MANY OTHER
ATTRIBUTES OF THE
SPHERE BECOME MORE
OBYIOUS AS THE CORRECT
FORM TO USE FOR
THESE SPECIAL CIRCUM-
STANCES.

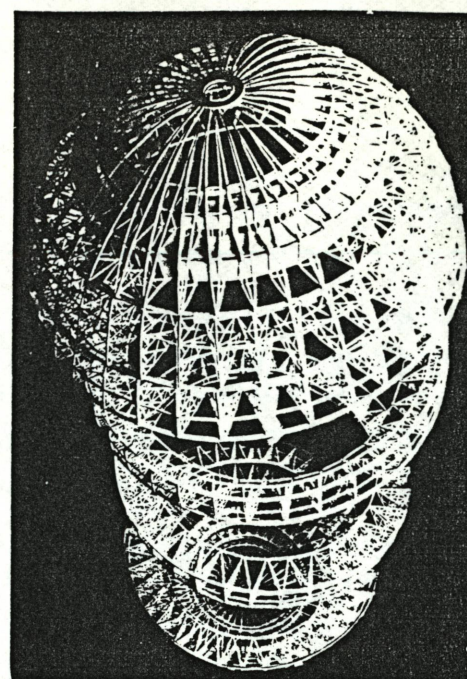
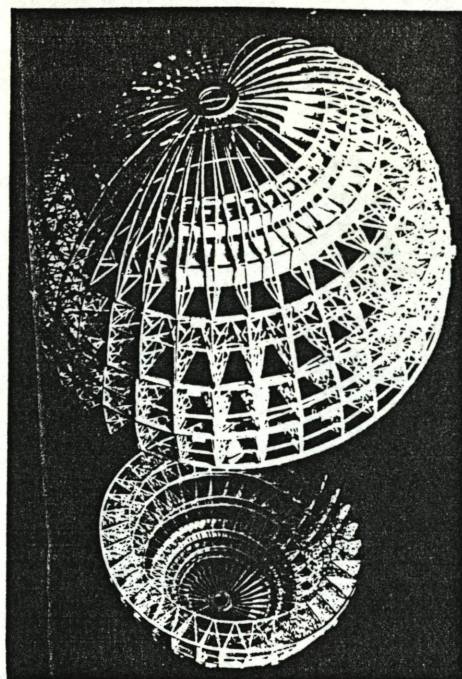
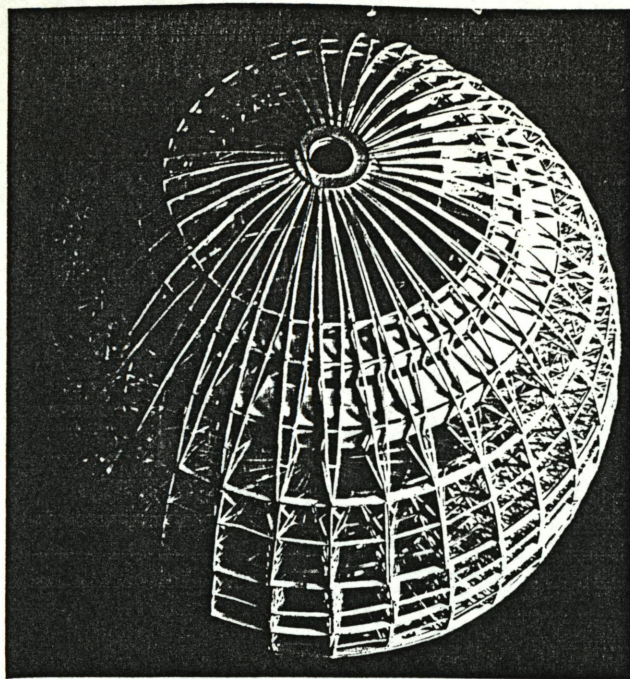




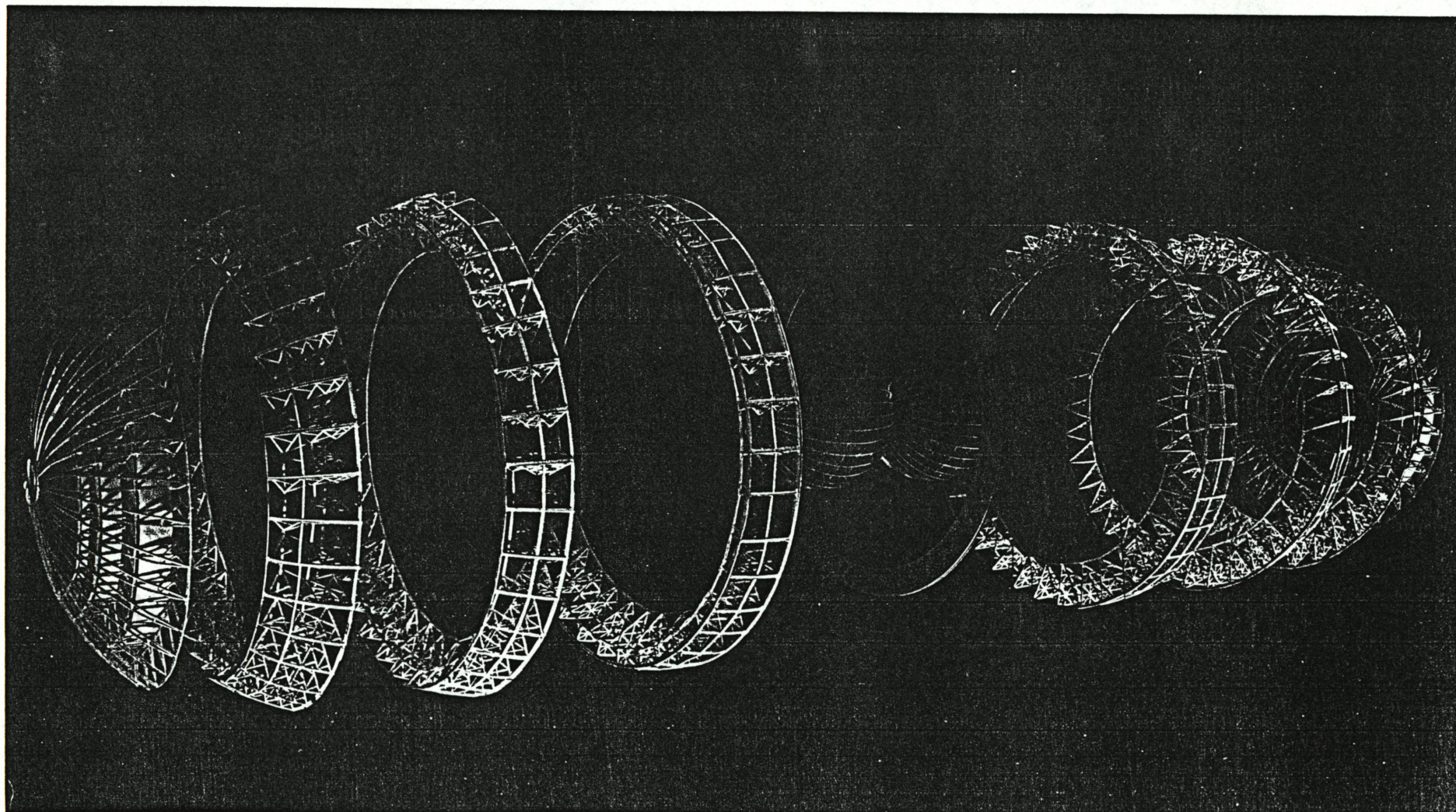
HERE BEGINS THE REMARKABLE TRANSFORMATION WHICH BRING M.C. ESCHER'S DRAWINGS TO LIFE. AS THE SPHERE GAINS A GREATER DISTANCE FROM THE PULL OF THE MOON'S GRAVITY, JETS ARE FIRED PUTTING THE SPHERE IN ROTATION ABOUT A SET AXIS. THE UNIQUE PROPERTIES OF THE SPHERE BECOME MORE APPARENT AS A SUITABLE CHOICE FOR AN ORBITING SPACE STATION. THE SPHERE'S ROTATION IS MUCH LIKE THE EARTH'S ROTATION. UNLIKE THE EARTH, GRAVITY INSIDE THE SPHERE IS QUITE DIFFERENT. SINCE CENTRIFUGAL FORCE IS USED TO SIMULATE GRAVITY, THE SPHERE BECOMES A VESSEL THAT CONTAINS MULTIPLE GRAVITIES. THE EARTH'S GRAVITY IS PRODUCED BY A NATURAL ATTRACTION THAT BODIES IMPART TO ONE ANOTHER. THIS ATTRACTION IS DIRECTLY PROPORTIONAL TO THE DENSITY OF MASS THAT THE BODY CONTAINS. THAT IS WHY PLANETS VARY GREATLY IN THE FORCE OF GRAVITY EACH MAY HAVE. SIMULATED GRAVITY IS PRODUCED BY THE AMOUNT OF SPEED AND DISTANCE ABOUT A FIXED POINT. THIS IS WHAT PRODUCES MULTIPLE GRAVITIES WITHIN A SPHERE. THE EQUATOR OF THE SPHERE WILL PRODUCE THE GREATEST AMOUNT OF GRAVITY. TRAVELING TO THE POLES IN EITHER DIRECTION WILL RESULT IN LESS AND LESS GRAVITY. WHEN EITHER POLE IS REACHED THE RESULT WILL BE WEIGHTLESSNESS. THIS WILL BE THE AXIS OF WEIGHTLESSNESS THAT TRAVELS THE DIAMETER OF THE SPHERE. THIS IS ALSO THE AXIS THE SPHERE WILL ROTATE ABOUT. UNLIKE THE RING PROPOSED IN FUTURE SPACE

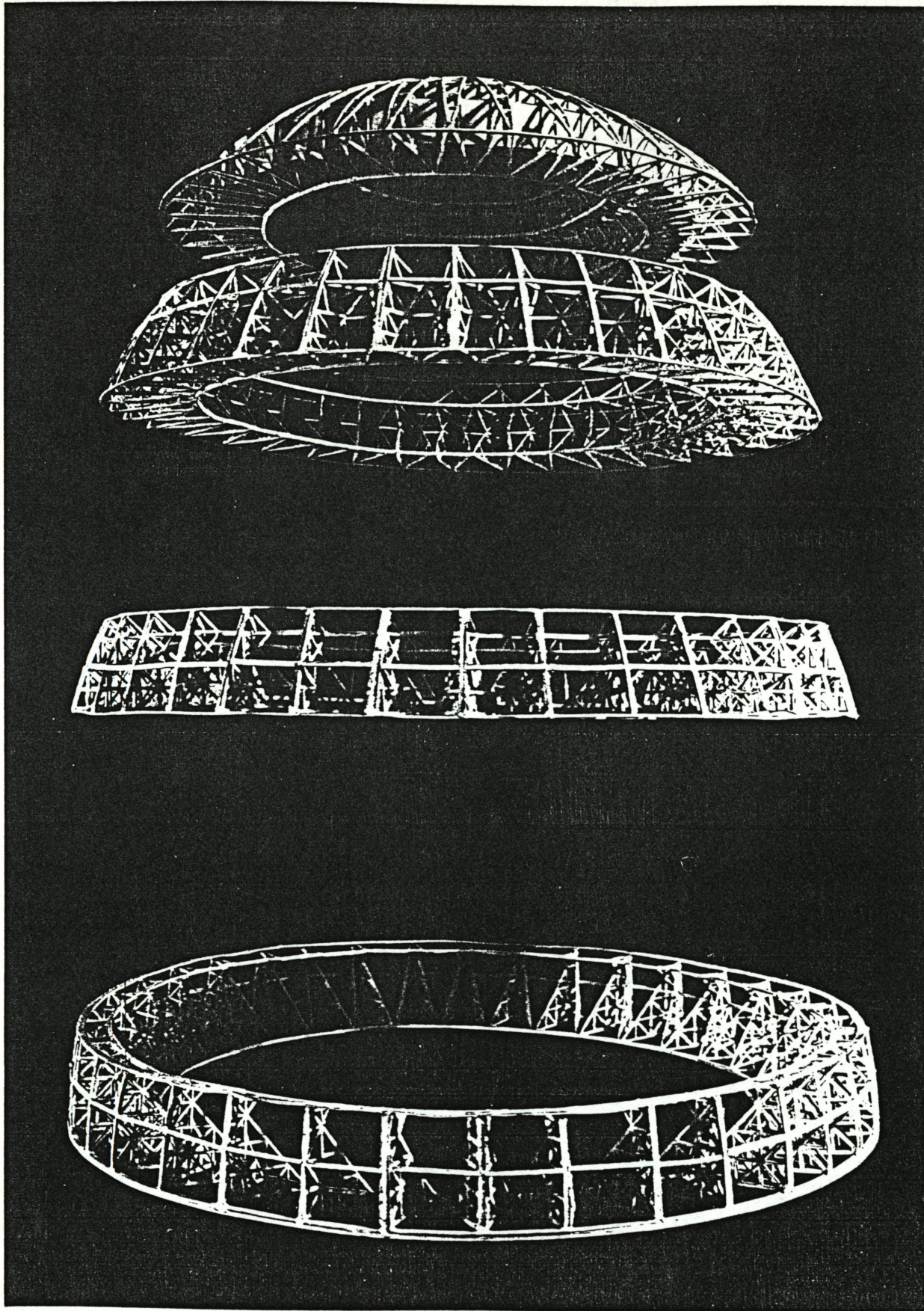


STATIONS THE SPHERE IS MUCH MORE VERSITILE. THE RING, WHICH PRODUCES SIMULATED GRAVITY ABOUT A POINT (A HUB) ONLY PRODUCES ONE FORM OF GRAVITY UNTIL THE HUB IS REACHED. THE HUB IS ONLY A POINT OF WEIGHTLESSNESS WHEREAS THE SPHERE HAS AN AXIS OF WEIGHTLESSNESS. THE SPHERE ALSO ENCLOSES THE AXIS OF WEIGHTLESSNESS. THIS ENCLOSURE IS A HUGE SPACE THAT IS PRESSURIZED WITH A BREATHABLE ATMOSPHERE. THIS ALLOWS A SPACE WHERE THE INHABITANTS MAY UNDERTAKE HUGE PROJECTS THESE PROJECTS CAN BE UNDERTAKEN WITHOUT THE CONFINES OF SPACE SUITS. THE AXIS OF WEIGHTLESSNESS ALLOWS THE SPACE INHABITANTS TO WORK ON PROJECTS WITH NO RESTRICTIONS ON WEIGHT. OBJECTS THAT MAY REQUIRE HUGE MACHINES TO MOVE ON EARTH CAN BE EASILY MOVED BY ONE MAN IN THE SPHERE. AT THE EQUATOR OF THE SPHERE WHERE THE GRAVITY IS THE GREATEST ALL THE RESIDENTS WILL LIVE IN COMFORT. THE GRAVITY WILL BE MUCH LIKE EARTH'S. THE INHABITANTS OF THE SPHERE MAY LIVE WITHOUT THE WORRIES OF THE EFFECTS OF ZERO GRAVITY. ANY EXPERIMENTS THAT REQUIRE ZERO GRAVITY TO FUNCTION CORRECTLY MAY ALSO BE CONDUCTED AT THE POLES OF THE SPHERE. EXPERIMENTS WHICH REQUIRE A VACUUM CAN OBVIOUSLY USE THE VAST VACUUM OF SPACE WHICH COSTS NOTHING. FOR THE PROJECTS THAT BECOME TOO LARGE TO PASS THROUGH THE TWO APERTURES AT THE POLES OF THE SPHERE, A SPECIAL CIR-

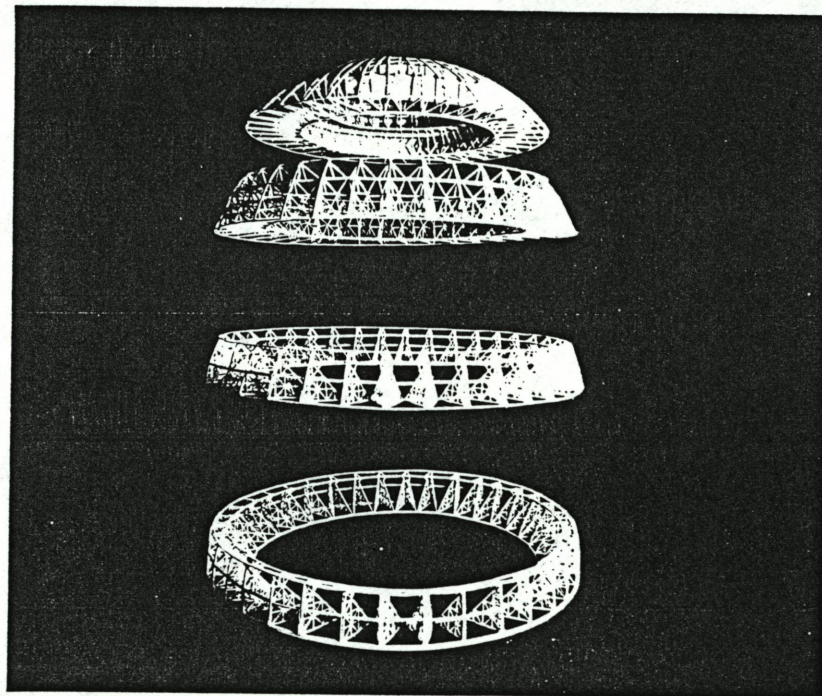
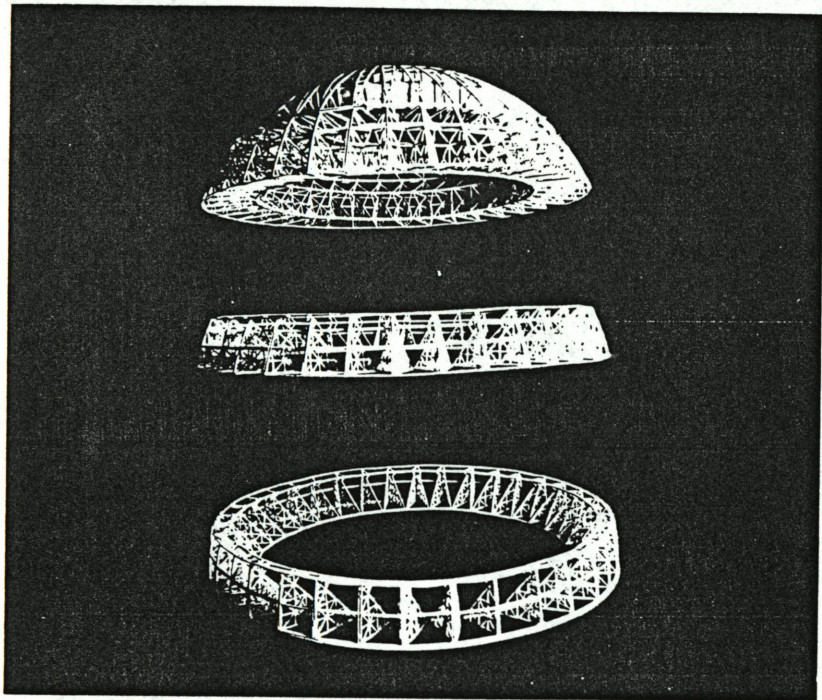
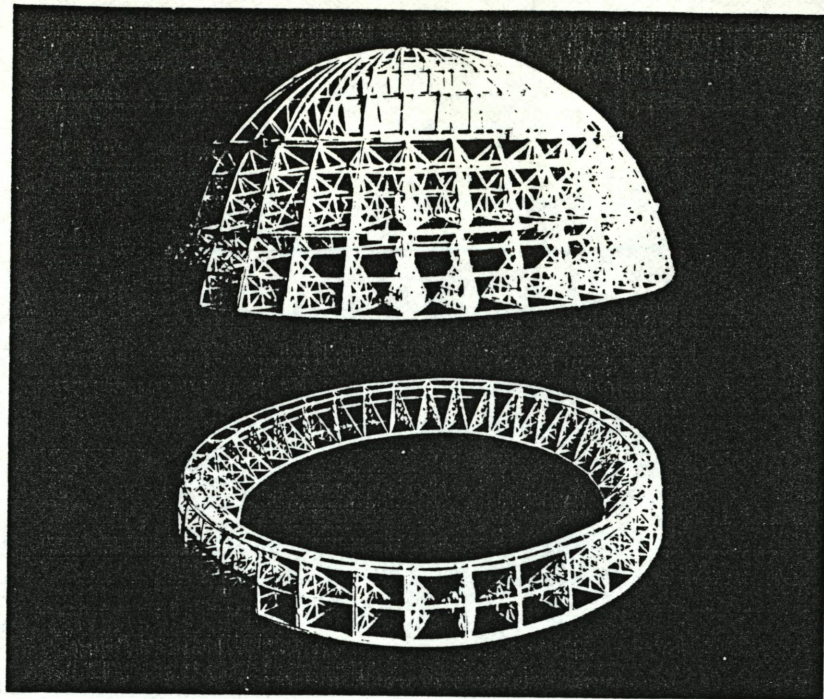
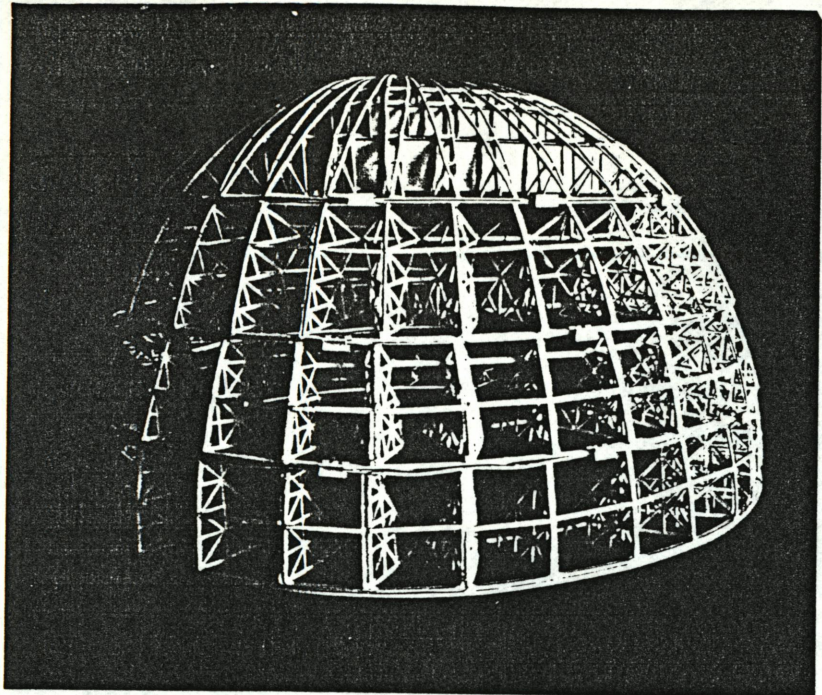


CUMSTANCE TAKES PLACE TO SOLVE THIS PROBLEM. THE SPHERE IS A MAKEUP OF INDIVIDUAL RINGS WHICH CONNECT TOGETHER. EACH RING HAS A CURVED OUTSIDE SURFACE WHICH IS CONNECTED TOGETHER WITH AN INTRICATE NETWORK OF TRUSSES. THESE TRUSSES ARE FOLDED INTO PLACE MUCH LIKE AN ACCORDIAN. THE TRUSSES ARE THEN STIFFENED WITH MEMBERS IN BETWEEN. THIS MAKES EACH RING A MORE RIGID STRUCTURE. THE DIAMETER OF EACH RING ALSO VARIES. THE RING AT THE EQUATOR HAS THE GREATEST DIAMETER. EACH RING THEN GROWS SMALLER IN DIAMETER. THE POLES ARE THEN CAPPED WITH DOMES.



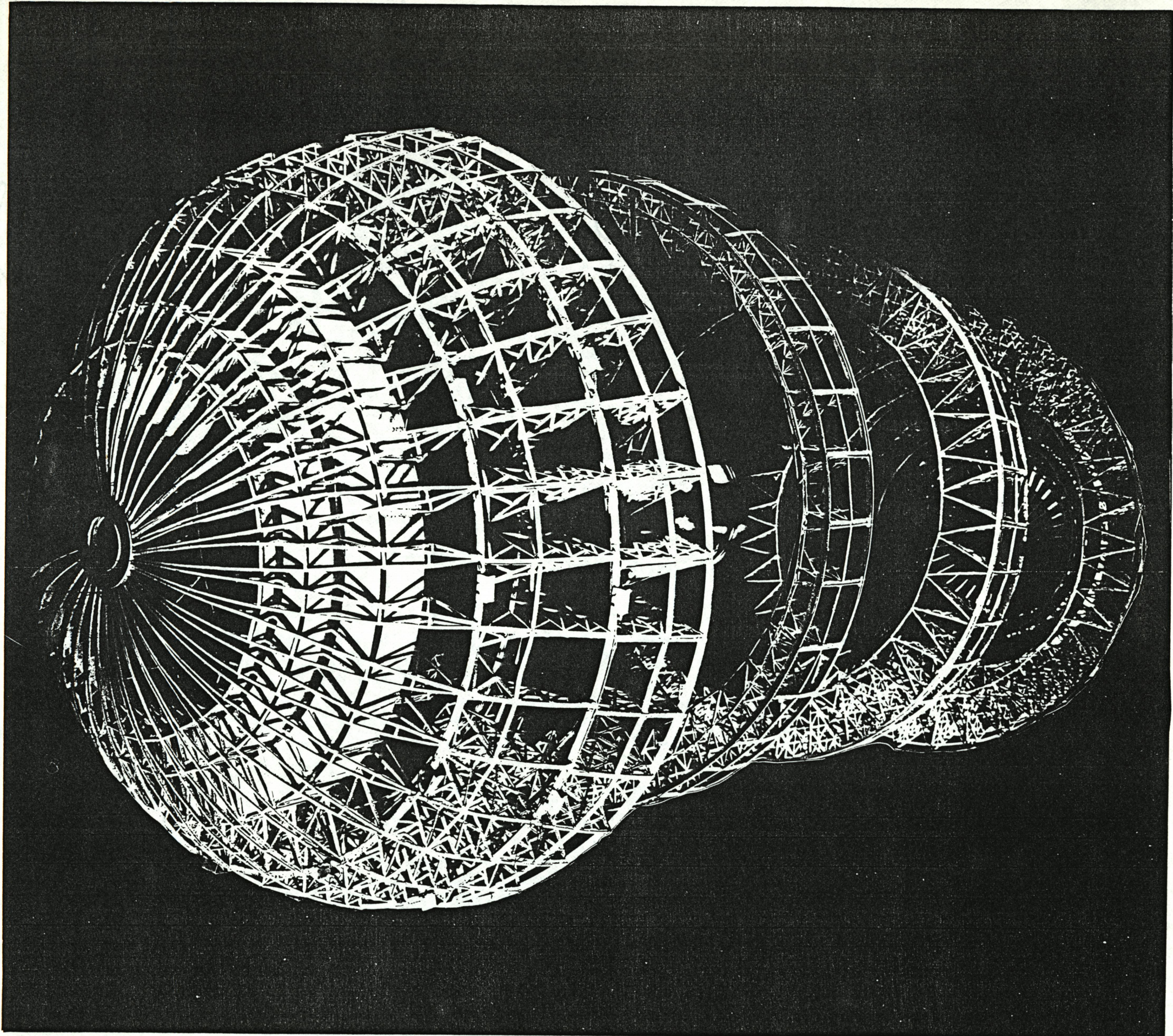


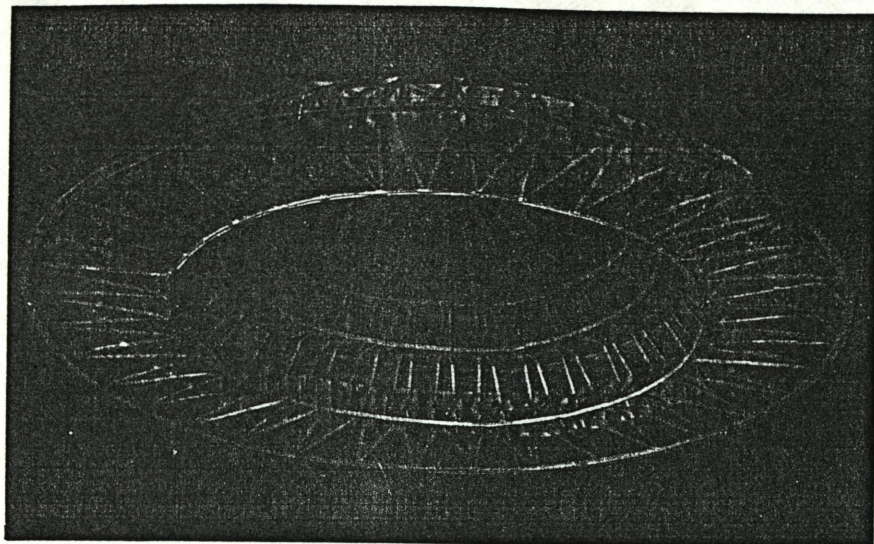
THE SEPERATIONS OF THE SPHERE ARE SHOWN IN THIS PHOTOGRAPH. EACH RING CAN FUNCTION ON IT'S OWN. THIS IS POSSIBLE DUE TO THE CONSTRUCTION OF EACH RING. EACH RING IS CONSTRUCTED MUCH LIKE A SHIP AT SEA. EACH RING IN COMPARTMENTALIZED INTO AIR TIGHT CHAMBERS. THIS ALSO ADDS TO THE SAFTY OF THE OVERALL SPHERE. IF THE MEMBRANE OF THE SPHERE IS PUNCTURED BY ANY SPACE DEBRIS THE DAMAGED AREA CAN BE SECURED AND REPAIRED WITHOUT THREATING THE REMAINING SECTIONS OF THE SPHERE. THE SPHERE CAN ALSO BE BROKEN INTO A VARIETY OF COMBINATIONS TO SUIT THE NEEDS OF THE INHABITANTS. THE FOLLOWING TWO PAGES SHOW THESE COMBINATIONS. THE DESIGN OF THE INTERIOR OF THE SPHERE DEMAND EXPLORATION, AND SHOW HOW THE INHABITANTS WILL ACTUALLY LIVE.



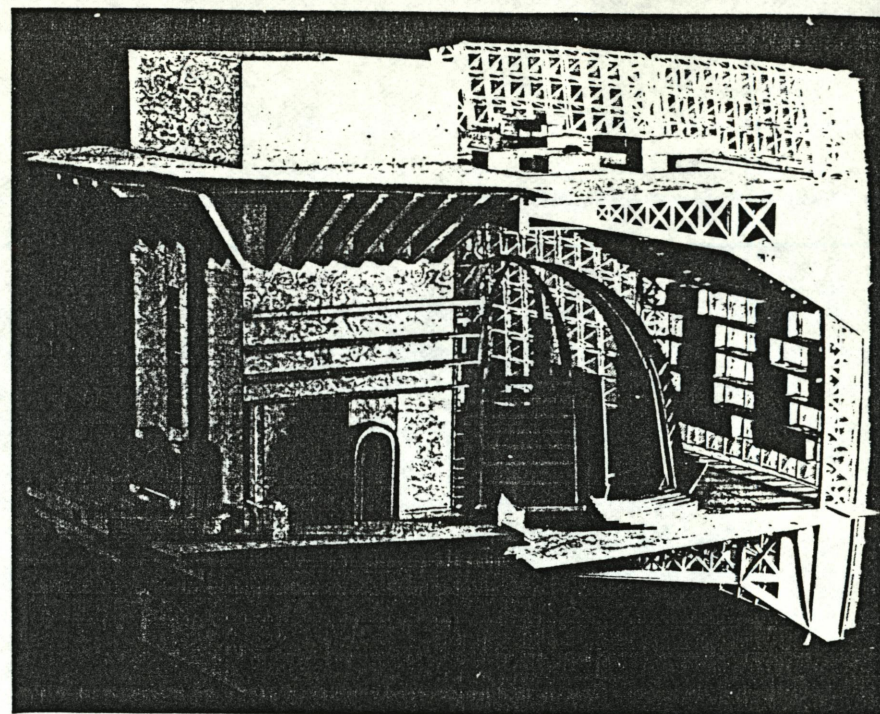
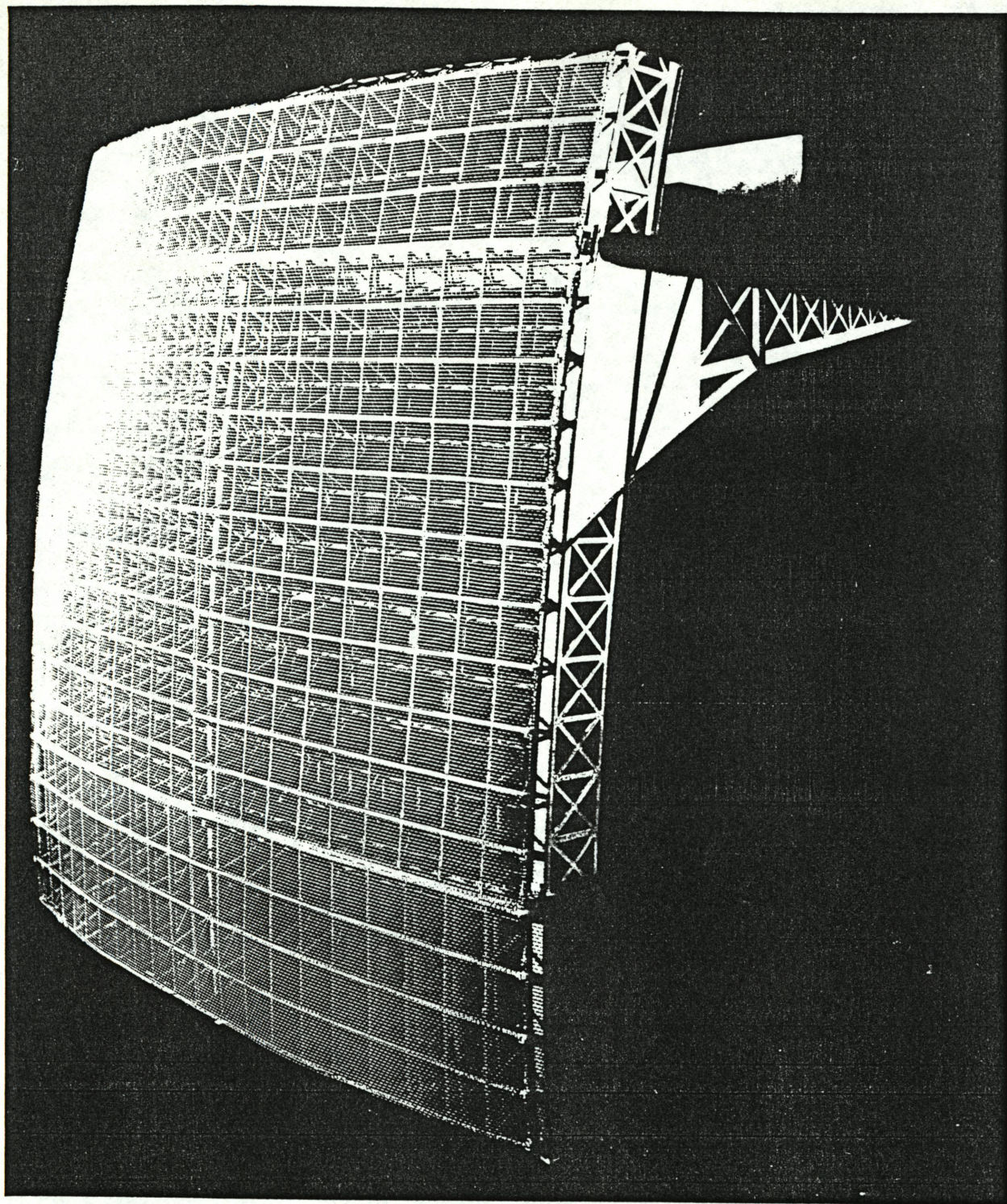
FOX RIVER
SPACOTON

FOX RIVER BOND
SPACOTON

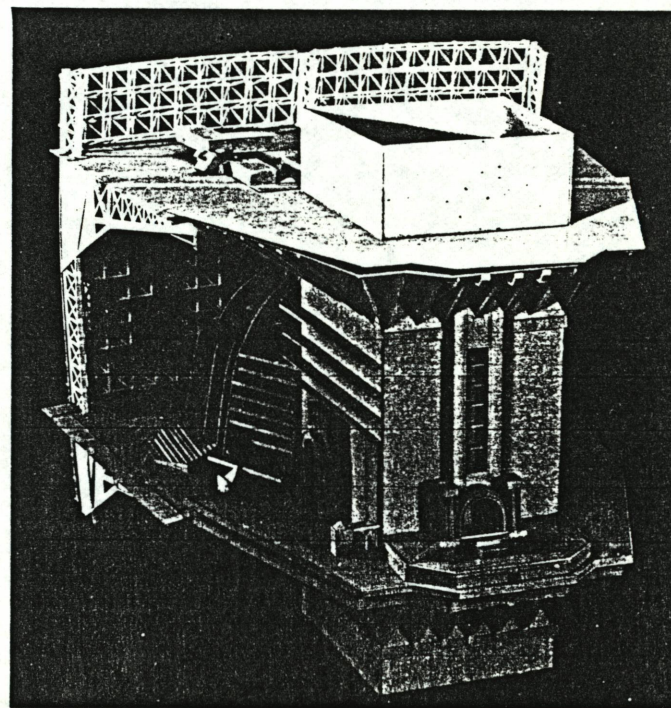


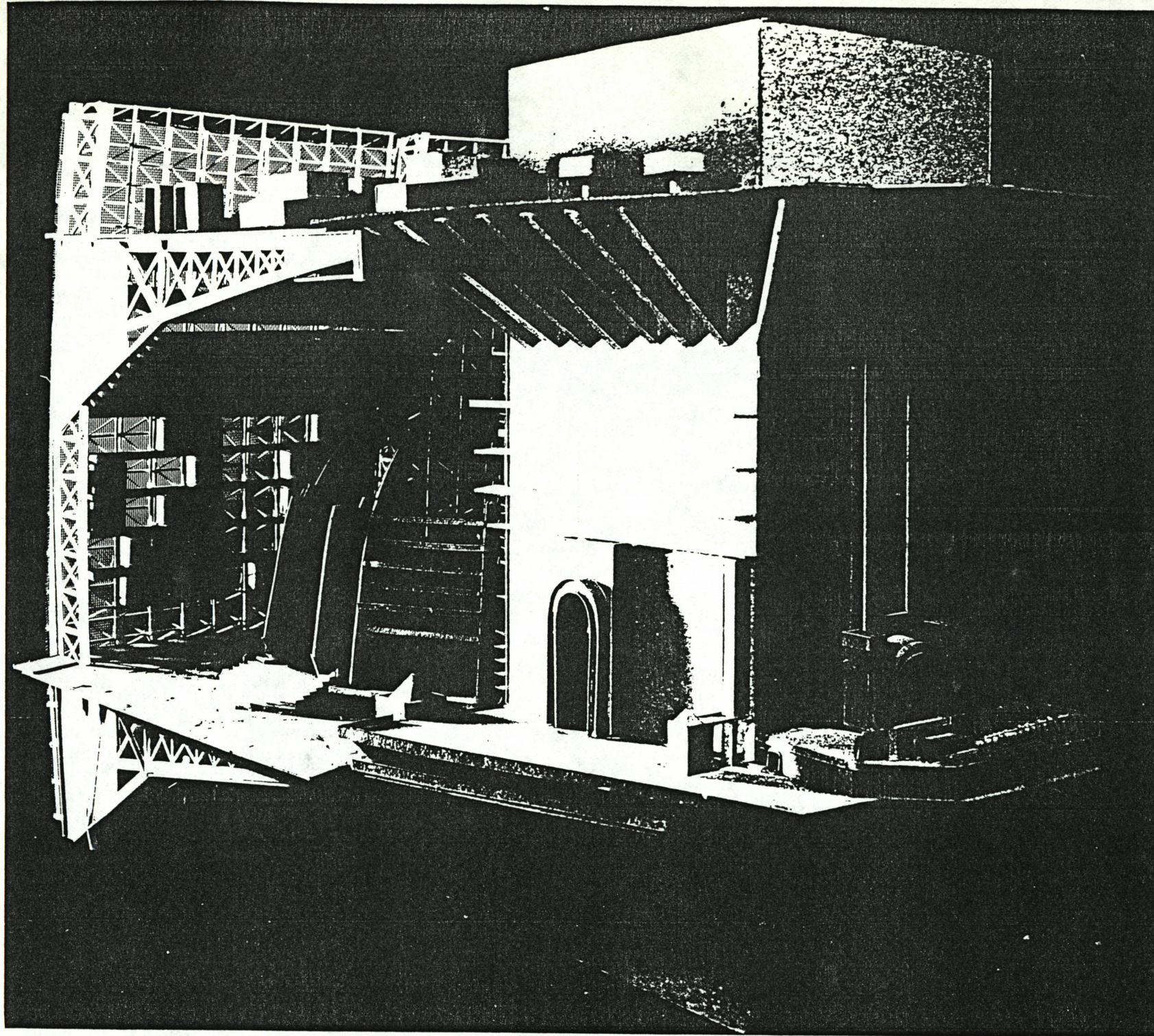


THE INTERIOR OF THE SPHERE IS A MAZE OF PLANES AND PLATFORMS PERPENDICULAR TO ONE ANOTHER. THE PLATFORMS AID IN THE RIGID CONNECTIONS OF THE TRUSS WORK. THE LARGE TRUSSES ARE BROKEN DOWN INTO A NETWORK OF SMALLER TRUSSES. ALL CIRCULATION THROUGHOUT THE SPHERE TAKES PLACE WITHIN THIS SYSTEM. FOR EXAMPLE THE LONGITUDINAL MEMBERS OF THE SPHERE CONTAINS A TRANSPORTATION SYSTEM WHICH CAN CARRY PASSENGERS FROM ONE POLE OF THE SPHERE TO THE OTHER. THE TRUSS WORK THAT RUNS LATERALLY AROUND THE SPHERE FUNCTIONS THE SAME WAY. ON THE NEXT TWO PAGES THE PHOTOGRAPHS OF THE MODELS REPRESENT AN EARLIER DESIGN. THE MODEL ALSO REPRESENTS A SECTION OF THE SPHERE MUCH LIKE A WEDGE OF AN ORANGE. THE VERTICAL SHAFT IS NO LONGER PRESENT. THE PLATFORM THAT IS SHOWN IN THE SPHERE REMAINS, BUT ANOTHER PLATFORM PERPENDICULAR TO THE EXISTING PLATFORM WAS ADDED. THIS PLATFORM WILL BE USED FOR THE INHABITANTS DURING SIMULATED GRAVITY. THE PLATFORM SHOWN IN THE MODEL IS USED WHILE THE SPHERE IS USED ON THE LUNAR SURFACE. THE MODEL MAINLY REPRESENTS THE MATERIAL THAT IS USED FOR THE SKIN OF THE SPHERE. A LARGE CURVED SPACE FRAME IS CONNECTED TO THE TRUSSWORK OF THE SPHERE. SEVERAL LAYERS OF A MATERIAL SIMILAR TO MYLAR, REINFORCED WITH A SCREEN, IS ATTACHED TO THE SPACE FRAME. THE LAYERS ARE THEN SIZED TOGETHER TO FORM AN AIR TIGHT BOND. CUBES USED FOR STORAGE ARE



ALSO PLUGGED INTO THE SPACE FRAME. MOVEABLE LOUVERS ARE ALSO USED TO CONTROL THE AMOUNT OF SUNLIGHT INTO THE SPHERE. THE MYLAR MAY ALSO BE TINTED TO FILTER HARMFUL RAYS FROM THE SUN.



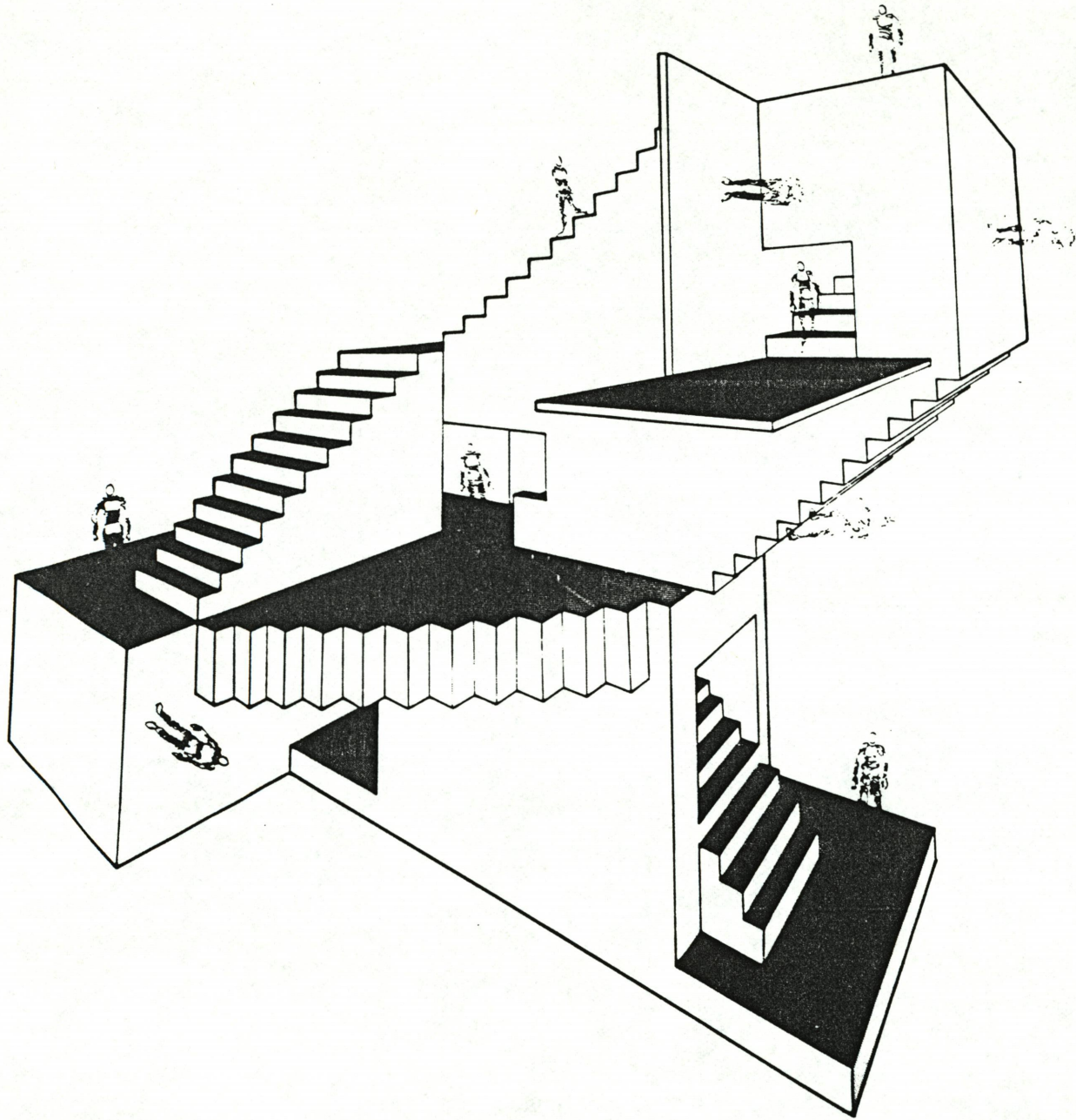


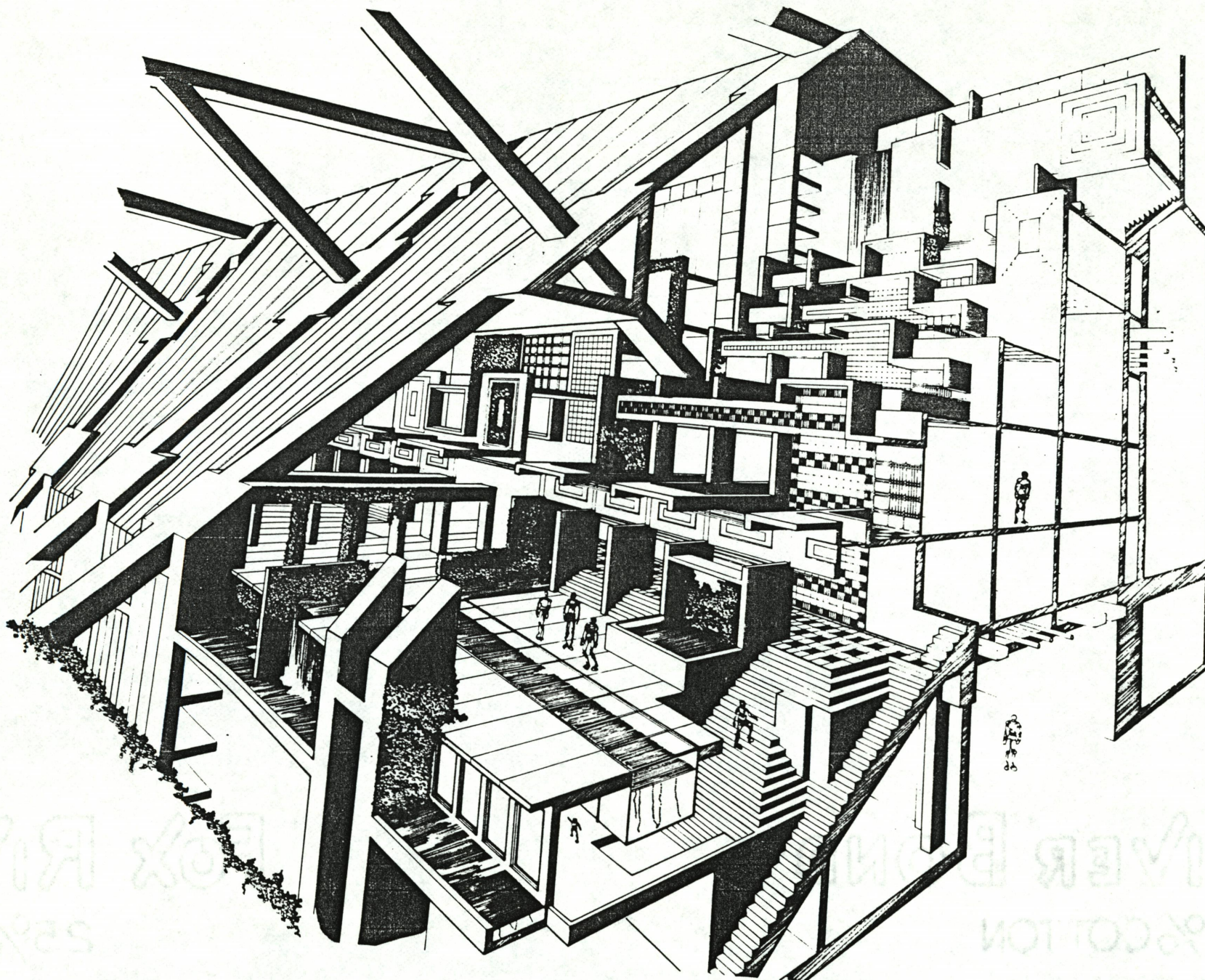
THIS MODEL IS AN EARLIER DESIGN OF THE SPHERE. THE SPHERE AT THAT TIME WAS ATTACHED TO THE LUNAR SURFACE. AS THE CONCEPT OF THE LUNAR BASE DEVELOPED FURTHER, SO DID THE DESIGN OF THE SPHERE. THE MODEL WAS NOT REJECTED SINCE MUCH OF THE CONSTRUCTION SHOWN IN THE MODEL IS HELPFUL IN UNDERSTANDING THE FINAL DESIGN. THE FINAL DESIGN OF THE SPHERE IS SHOWN ON THE NEXT FEW PAGES. THE DRAWINGS AND DIAGRAMS ON THE NEXT FEW PAGES SHOW THE COMMUNITY ASPECT OF THE INHABITANTS OF THE SPHERE.

FOX RIVER
SAPCOITON

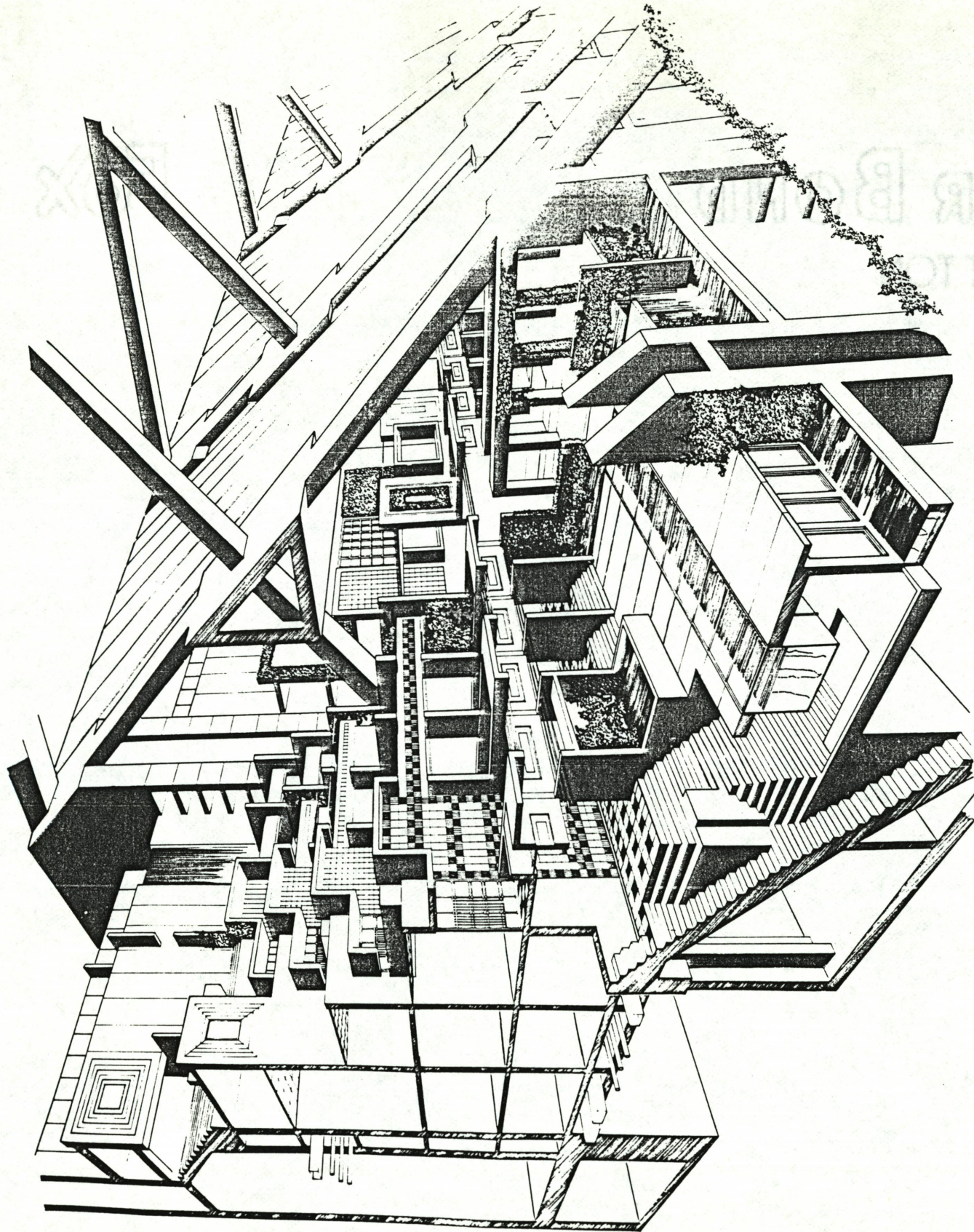
FOX RIVER BOND
SAPCOITON

THIS DIAGRAM REPRESENTS THE TWO GRAVITIES THAT WILL OCCUR ON THE INTERIOR OF THE SPHERE. AS PREVIOUSLY STATED, THE TWO GRAVITIES ARE PRODUCED BY THE NATURAL ATTRACTION OF THE MOON, AND SIMULATED GRAVITY CAUSED BY CENTRIFUGAL FORCE. THE TWO GRAVITIES ARE SHOWN OCCURRING AT THE SAME TIME IN THIS DIAGRAM. THIS DOES NOT OCCUR. ONLY ONE GRAVITY MAY OCCUR AT ONE TIME. THE FOLLOWING DRAWINGS WILL SHOW HOW THE DESIGN OF THE SPHERE WILL ACCOMMODATE BOTH GRAVITIES. THIS IS MUCH LIKE HAVING A FLOOR PLAN ON TWO PLANES. ACCESS MUST BE MADE FOR BOTH.



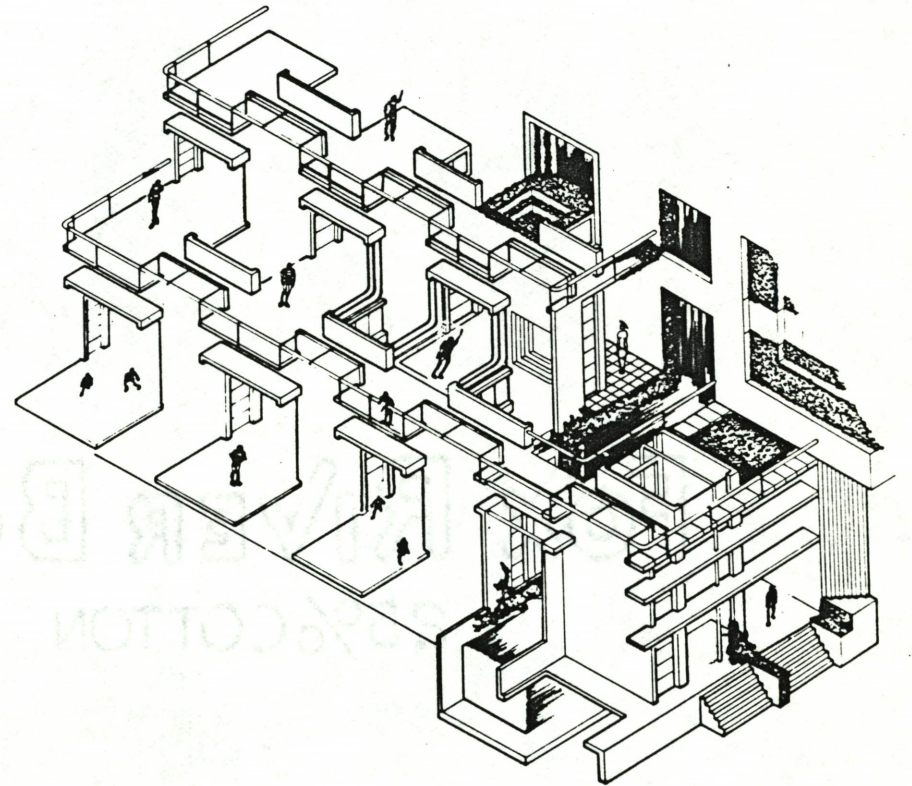
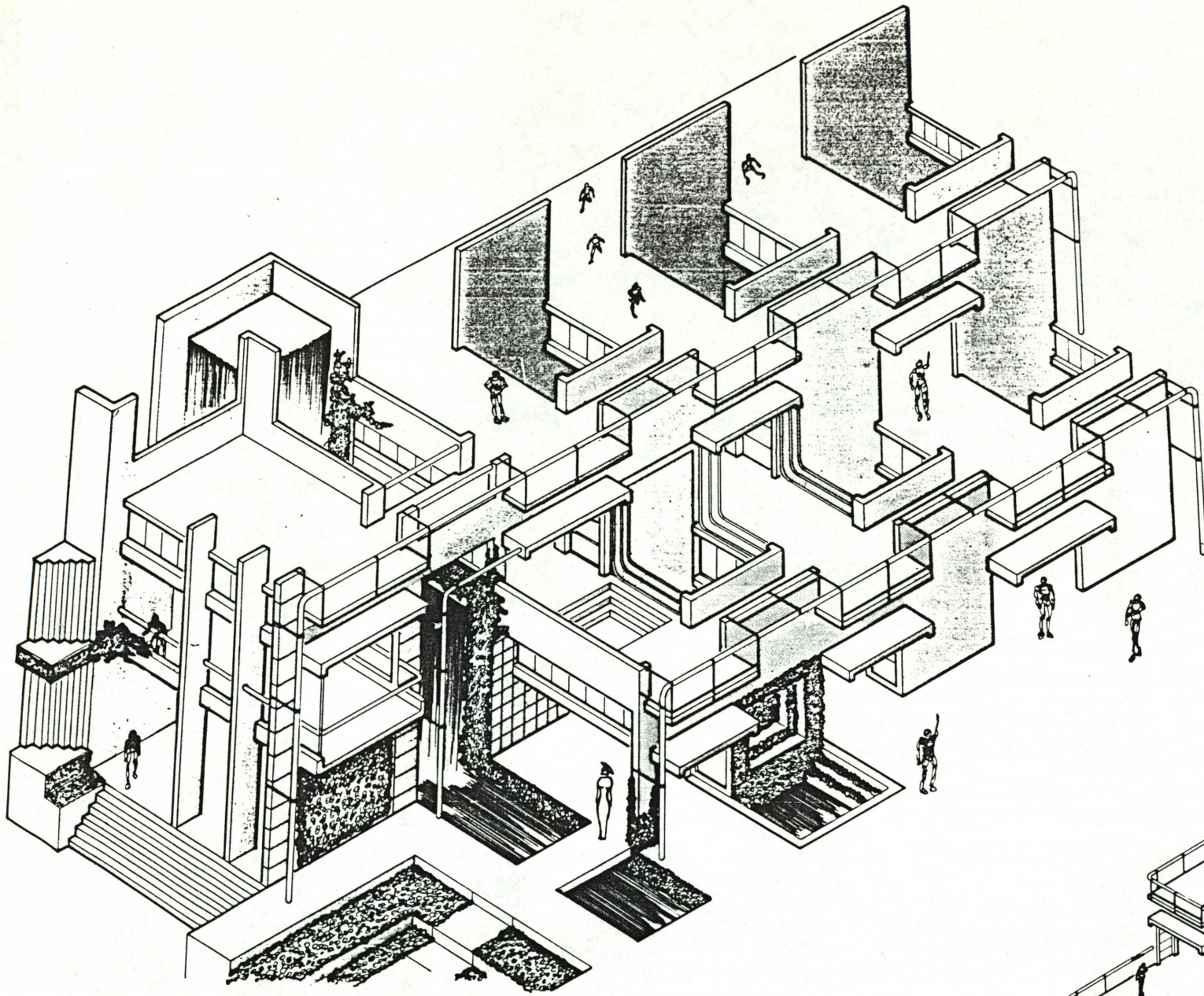


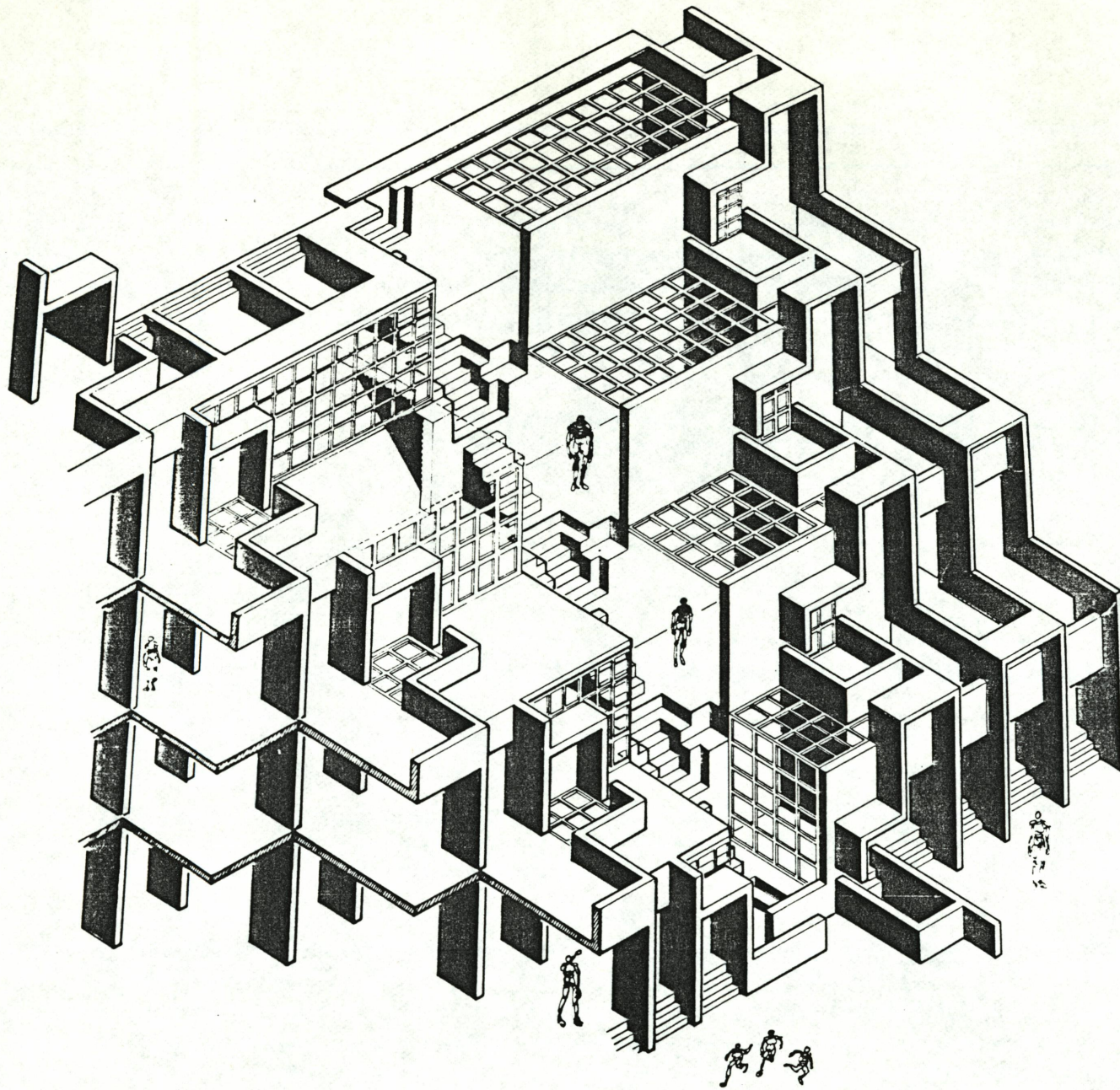
THIS PERSPECTIVE SHOWS THE INTERIOR OF THE SPHERE. THE PANELS WHICH ENCLOSE THE AIR TIGHT COMPARTMENTS OF THE SPHERE ARE ALSO SHOWN. BOTH AREAS ARE PRESSURIZED WITH A BREATHABLE ATMOSPHERE. THE BOTTOM OF THE PAGE IS TAKEN TO BE THE DIRECTION OF THE PULL OF GRAVITY. THIS MUST BE KEPT IN MIND WHEN VIEWING THE REMAINING DRAWINGS. ANOTHER THING TO KEEP IN MIND WHILE VIEWING THESE DRAWINGS IS THAT THE STRUCTURES WITHIN THE SPHERE ARE STATIONARY. THE STRUCTURE REMAINS IN PLACE WHILE IT IS THE GRAVITY THAT IS CHANGED. IT IS EASIER FOR US TO COMPREHEND THAT DOWN IS AT THE BOTTOM, SO THE DRAWINGS HAVE BEEN REPRESENTED IN THIS MANNER. IN THIS DRAWING THE GRAVITY REPRESENTED IS AS IT WOULD OCCUR ON THE PLANETS SURFACE. DOWN IN THIS CASE WOULD SHOW THE DIRECTION OF THE MOON. TAKE NOTICE OF THE WALLS AND WINDOWS. THE DIRECTION OF THE FLOW OF WATER IS ALSO IMPORTANT. IVY WAS CHOSEN AS THE PRINCIPAL FOLIAGE USED INSIDE THE SPHERE. MANY TREES AND SHRUBS GROW UPWARDS, AWAY FROM THE PULL OF GRAVITY. IVY IS MORE SPARATIC. IVY WILL GROW HORIZONTALLY AS WELL AS VERTKALLY.



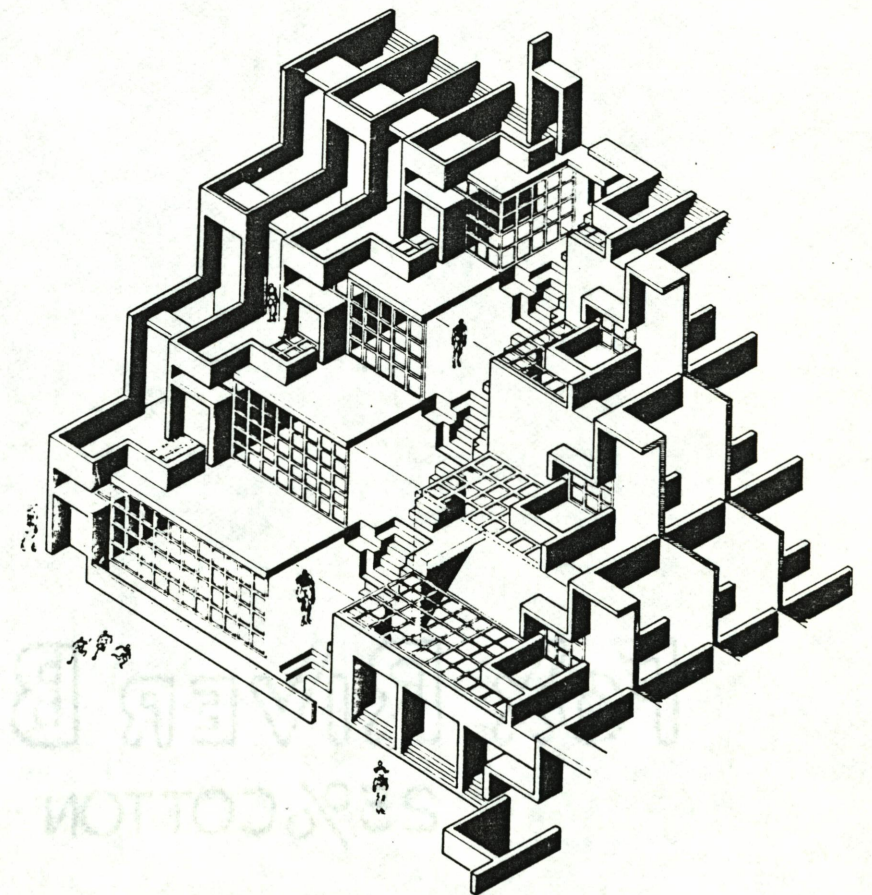
AS THE GRAVITY IS TRANSFORMED, MANY CHANGES TAKE PLACE. WITH THE AID OF M. C. ESCHER'S ILLUSIONARY PERSPECTIVE, A NEW VIEW IS DERIVED FROM THE SAME DRAWING. IN THIS CIRCUMSTANCE THE GRAVITY IS NOW SIMULATED. DOWN IS NOW OUTER SPACE. THERE IS REALLY NO DOWN, BUT GRAVITY SUGGESTS THERE IS ONE. AFTER THE TRANSFORMATION TAKES PLACE WHAT WAS ONCE A WALL HAS BECOME A FLOOR. WHAT WAS ONCE A WINDOW IS NOW A SKYLIGHT. WATER IS ALSO FLOWING IN A NEW DIRECTION.

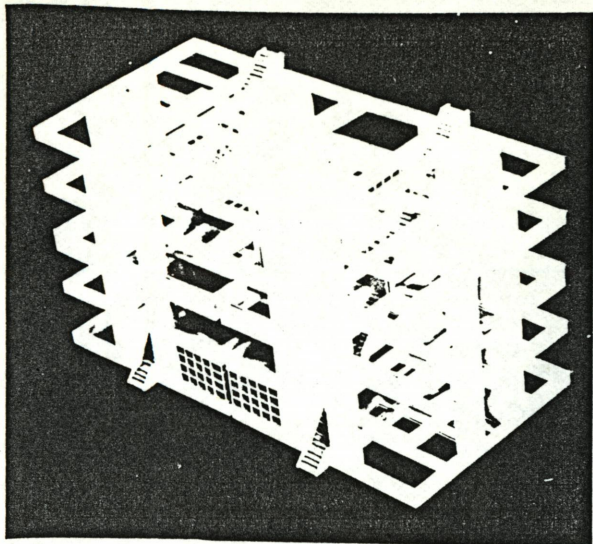
TO DESIGN THE COMMUNITIES FOR THIS FUTURE SPACE STATION BOTH GRAVITIES MUST BE COMPREHENDED AT THE SAME TIME. BY USE OF THE AXONOMETRIC THIS MAY BE ACCOMPLISHED. IN THESE TWO DRAWINGS BOTH GRAVITIES ARE SHOWN. THE AXONOMETRIC IS ABLE TO SHOW TRUE MEASURED DISTANCES AS WELL AS SPACE. THIS DRAWING SHOWS PLANES PASSING THROUGH ONE ANOTHER. WHAT IS ONCE A WALL BECOMES A BALCONY. THESE PANELS ARE CONNECTED BY A WALKWAY. WHAT WAS INTERESTING TO SEE WAS THE HANDRAIL THAT WOULD SERVE THE WALKWAY NO MATTER WHICH GRAVITY WAS IN USE. MORE ATTEMPTS AT THIS VERSITILE USE WERE EXPLORED.



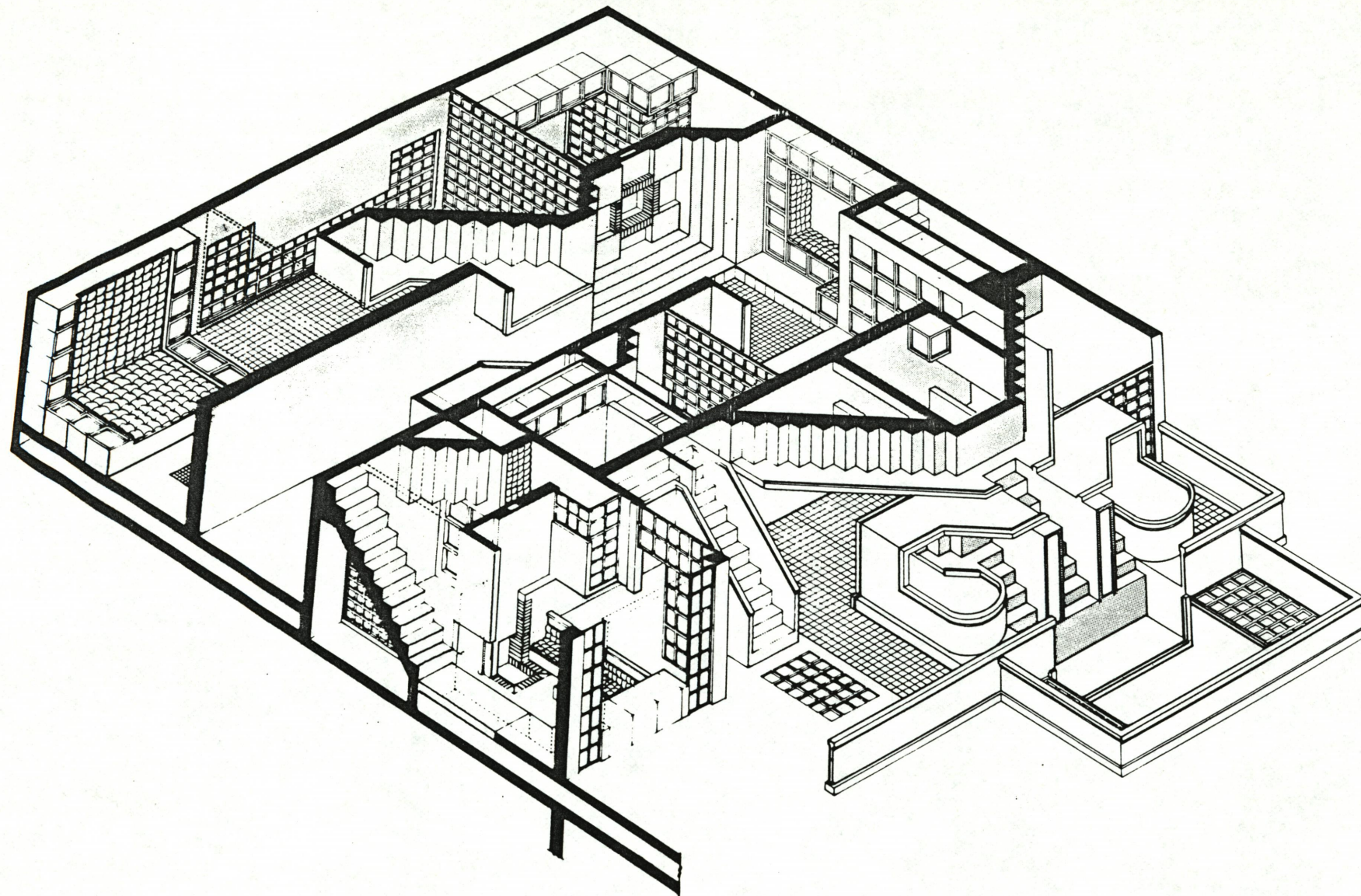


IN THESE TWO DRAWINGS THE VERSITILE USE OF MANY ARCHITECTURAL FORMS BECOME APPARENT. THE STAIRS WHICH BISECT THE TWO STRUCTURES CAN BE USED IN EITHER DIRECTION. THE STRUCTURE WHICH IS SHOWN ON ONE SIDE OF THE STAIRS IS MIRRORED ON THE OPPOSITE SIDE OF THE STAIRS. EACH STRUCTURE RESPONES TO THE DIRECTION OF GRAVITY. ALL WINDOWS, BALCONIES AND PLANES ON ONE SIDE OF THE STAIRS ARE FLIPPED ON THE OPPOSITE SIDE. THIS TYPE OF ARCHITECTURE WILL REDUCE THE AMOUNT OF DISORIENTATION WHEN THE TRANSFORMATION OF GRAVITY TAKES PLACE.

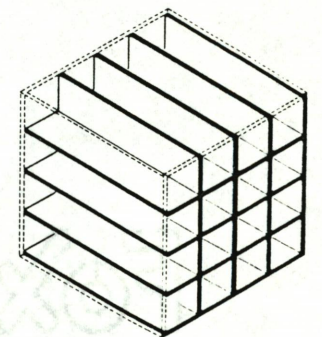


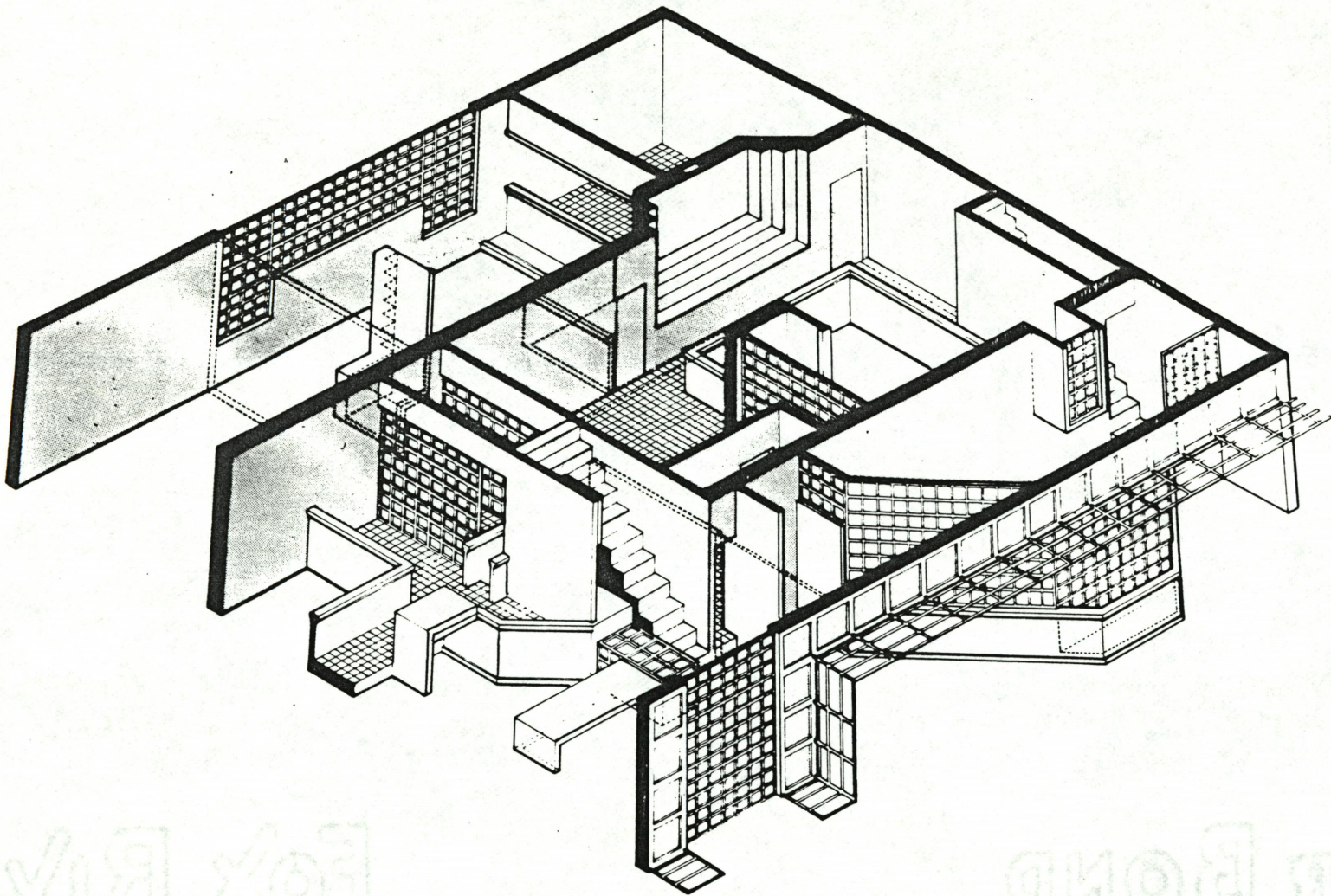


AFTER INVESTIGATING THE COLLECTIVE ASPECTS OF THE SPHERE, AN EXPLORATION OF THE INDIVIDUAL SPACES OF THE INHABITANTS IS MADE. THE AESTHETICS OF THE SPACE STATION HOME MAY BE AS VERSITILE AS THE STYLES OF ARCHITECTURE FOUND ON EARTH TODAY. ALTHOUGH THE STYLE OF ARCHITECTURE MAY VARY, THE FUNCTION OF THE ARCHITECTURE MUST REMAIN COMMONLY FIXED CONCERNING ONE POINT. THE ARCHITECTURE OF THE SPHERE MUST ACCOMMODATE BOTH GRAVITIES WHICH WILL EXIST. TO DESIGN A SPACE TO FUNCTION IN THIS MANNER BOTH GRAVITIES MUST BE COMPREHENDED AT THE SAME TIME. WHEN DESIGNING THE FLOOR PLAN AN INTERESTING EVENT TAKES PLACE. SINCE THE GRAVITY OCCURS ON PERPENDICULAR PLANES WHAT IS SEEN IN FLOOR PLAN FOR ONE GRAVITY ALSO IS SEEN IN SECTION FOR THE OTHER GRAVITY. THIS MAY BECOME COMPLICATED. THEREFORE THE AXONOMETRIC BECOMES A USEFUL TOOL FOR THE DESIGN OF THIS UNIQUE OCCURANCE. THE FOLLOWING PAGE WILL EXPLAIN HOW THIS OCCURS. AGAIN, TO HELP ORIENT OURSELVES TO THE DRAWINGS DOWN WILL BE THE BOTTOM OF THE PAGE. ALSO REMEMBER THE ARCHITECTURE OF THE SPHERE DOES NOT FLIP AS THE DRAWINGS INDICATE. IT IS ACTUALLY THE GRAVITY WHICH TRANSFORMS ITSELF. FLIPPING THE DRAWINGS MERELY HELP ORIENT US TO THE DIRECTION OF DOWN. YOU MAY NOTICE THE PREVIOUS DRAWINGS HAVE BEEN MORE REFINED CONCERNING THE USE OF STAIRS AND WIN-

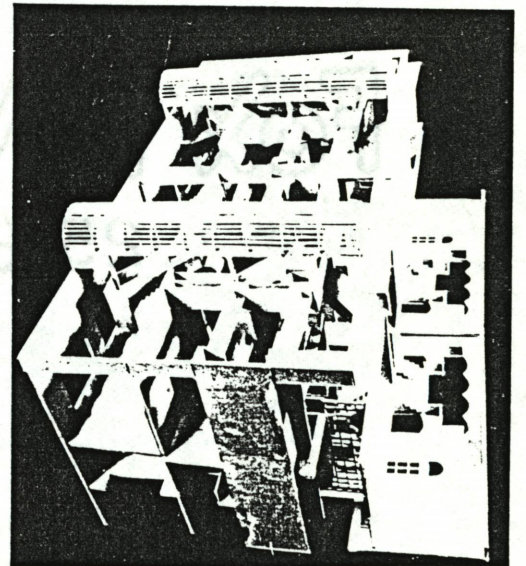


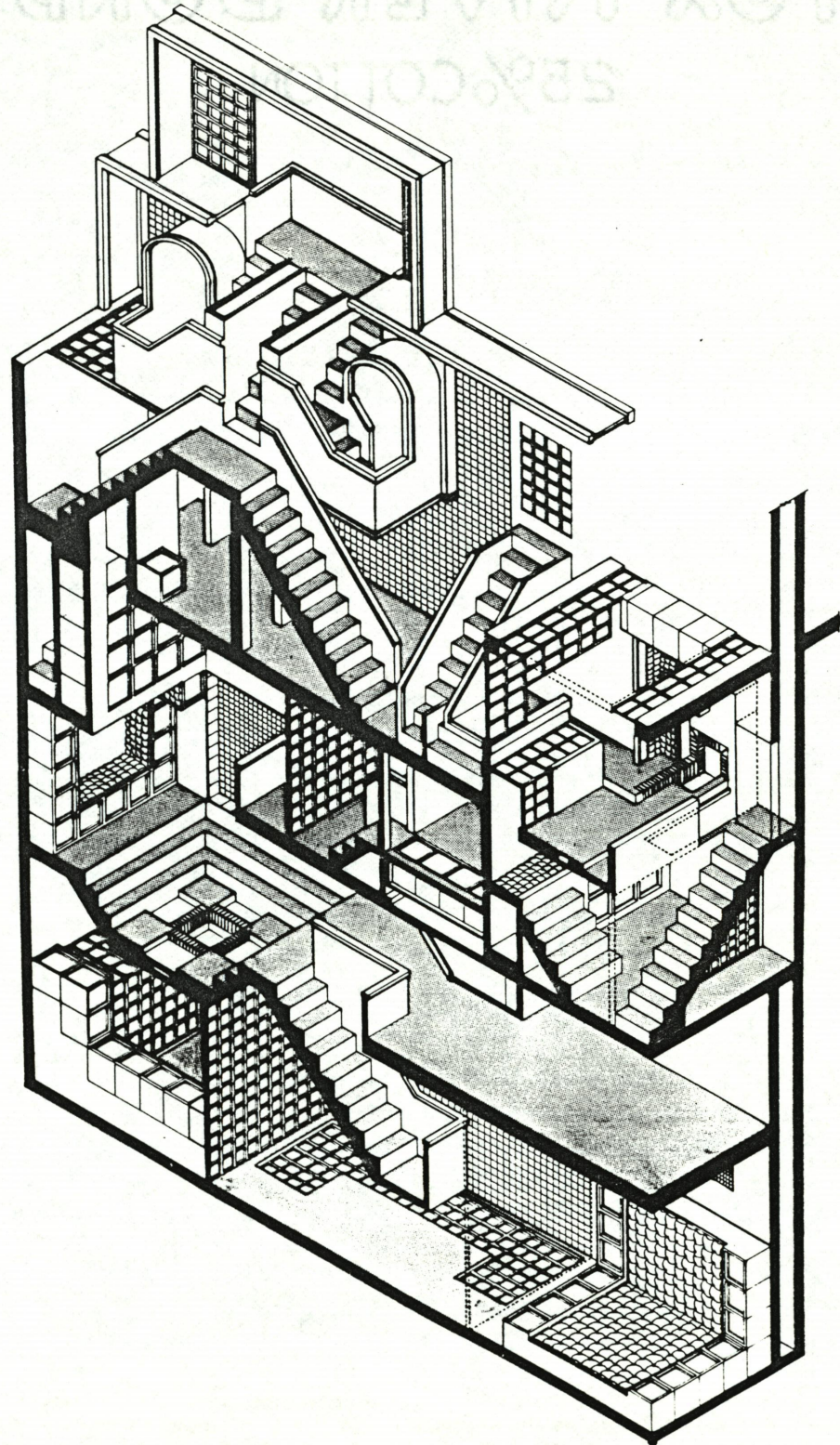
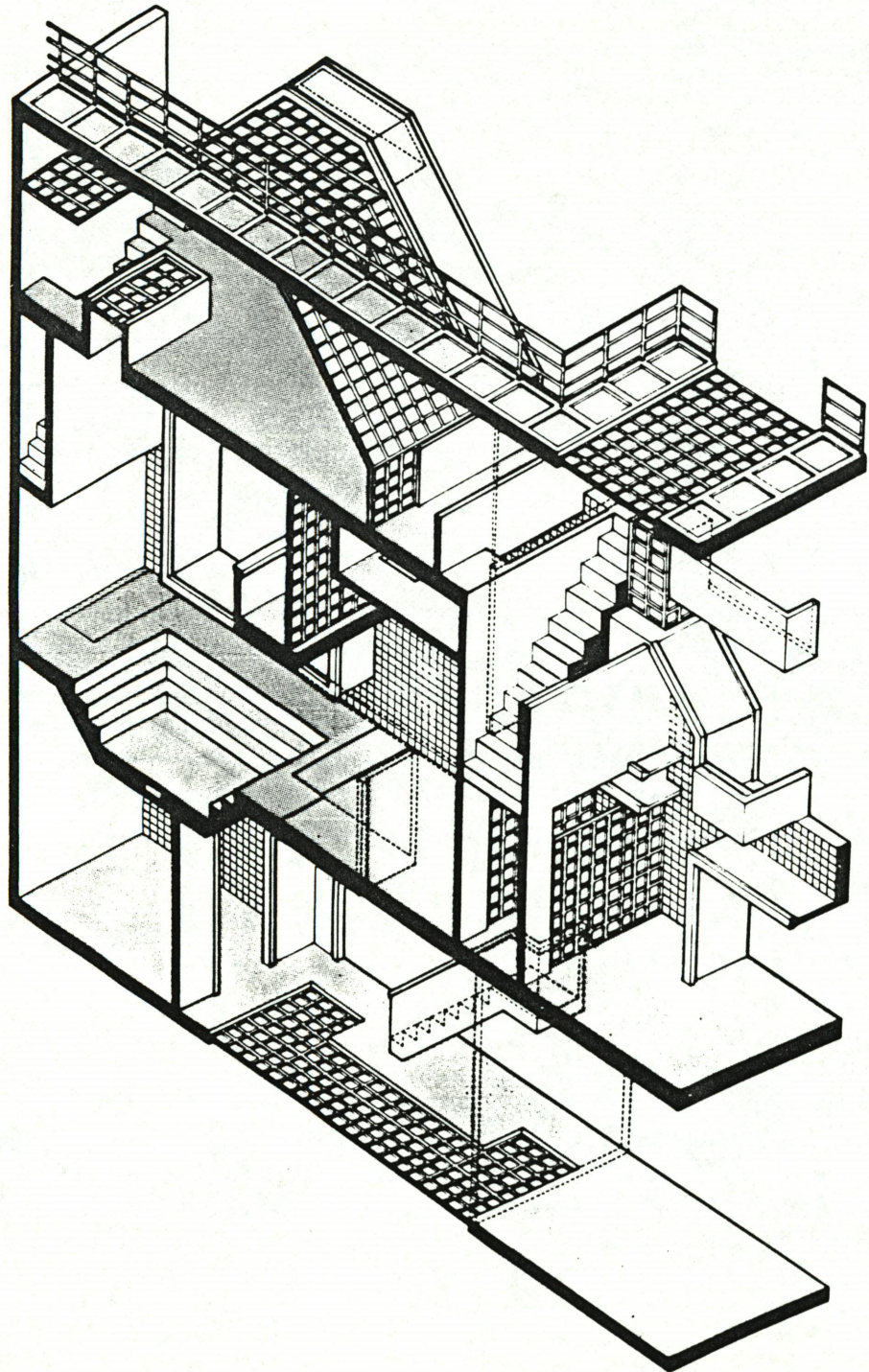
DOWNS IN THE SPHERE. THESE DRAWINGS WERE ALSO AN EARLIER DESIGN. THE DRAWINGS WERE NOT REJECTED COMPLETELY BECAUSE THEY ALSO HELP EXPLAIN THE FUNCTION OF THE HOUSE IN SPACE ARCHITECTURE. THE SMALL AXONOMETRIC NEAR THE BOTTOM SHOW THE SUBDIVISION OF THE CUBE INTO PERPENDICULAR PLANES. THESE PLANES ARE USED BY THE INHABITANTS OF THE SPACE STATION. IN THE LARGE AXONOMETRIC THE UPPER FLOORS HAVE BEEN REMOVED. WHAT IS INTERESTING TO NOTE IN THIS DRAWING IS THE RECESSED FIREPLACE. WHILE GRAVITY OCCURS IN THIS DIRECTION, THE FIRE PLACE IS USE AS AN ORNAMENT TO BE VIEWED. MUCH LIKE A PICTURE ON A WALL THE FIREPLACE CAN ONLY BE VIEWED. WHEN THE GRAVITY IS TRANSFERED TO THE PERPENDICULAR PLANE, THE LOCATION OF THE FIRE BECOMES A PIT. HERE THE USE OF THE FIRE HAS TAKEN ON A WHOLE NEW MEANING. IT BECOMES MORE A COMMUNAL STATEMENT. IT IS USED MUCH LIKE IT WAS USED BY THE INDIAN. THIS IS QUITE DIF-

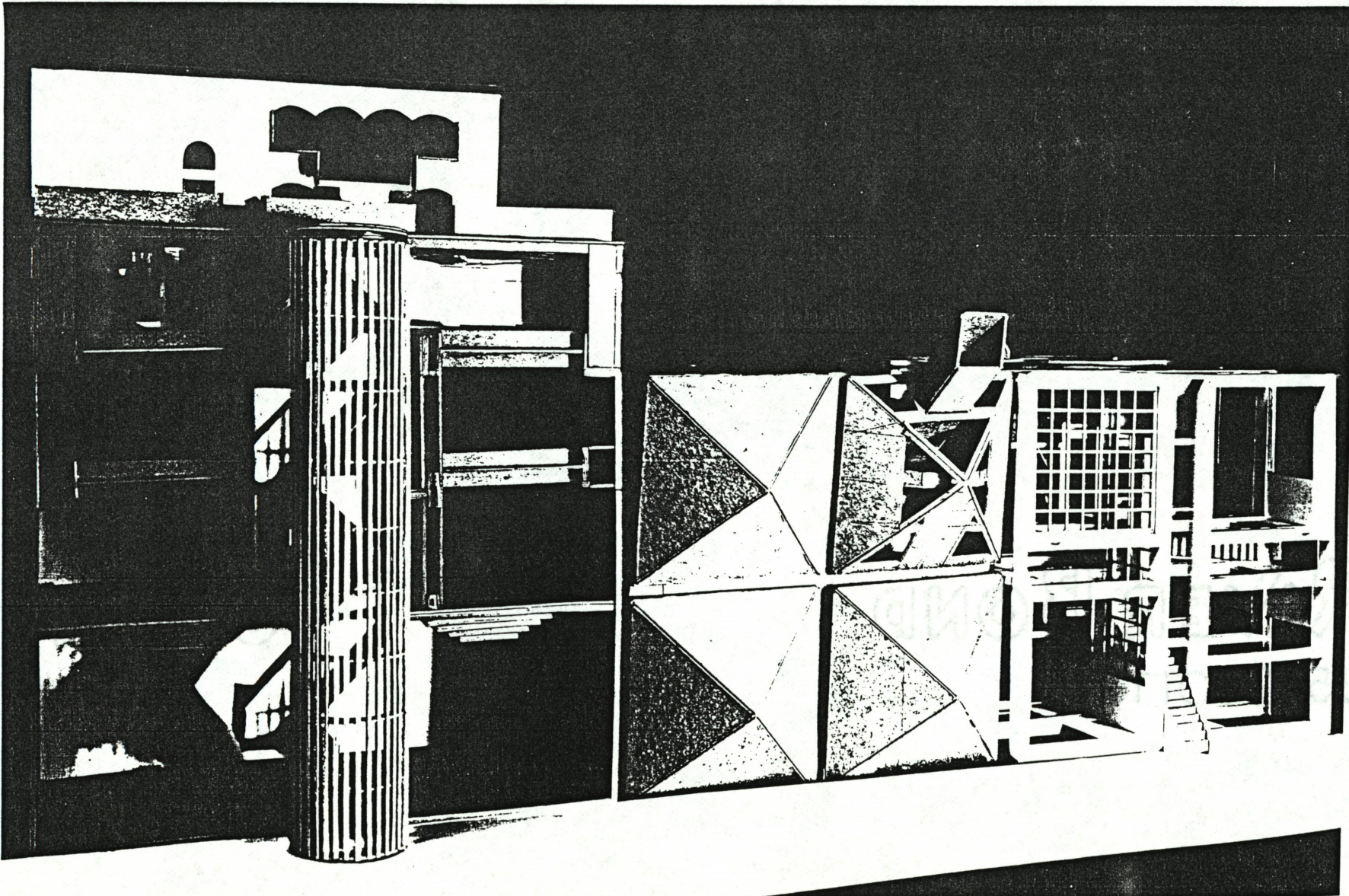
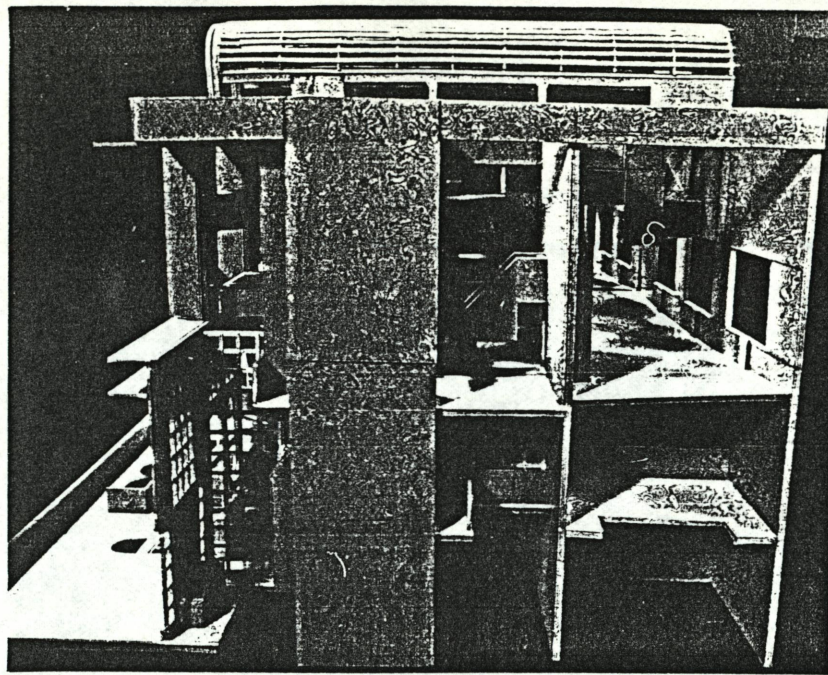
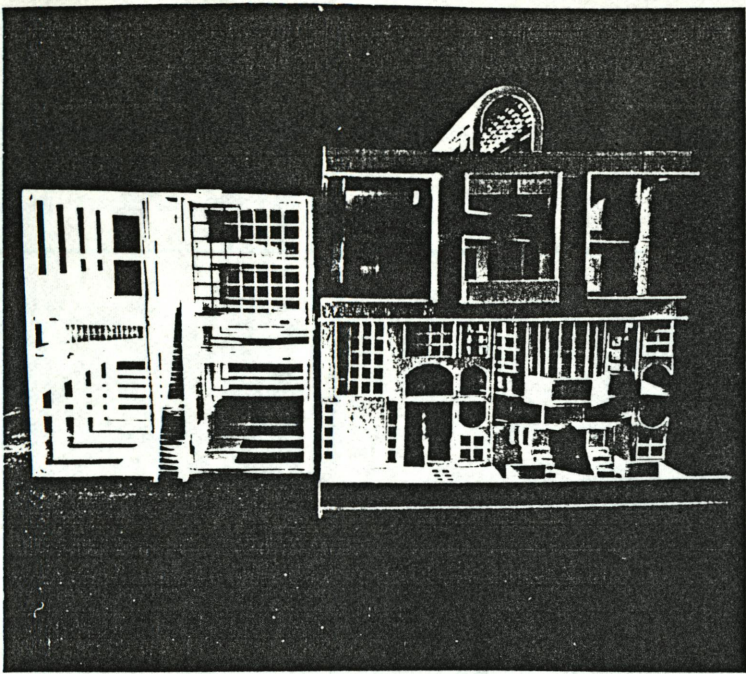




FERENT FROM THE PRESENT USE OF THE FIRE PLACE. THE SLEEPING AREAS ALSO FUNCTION SIMILARLY TO THIS. THE MATERIAL USED FOR CUSHIONS CAN BEGIN TO BE MULTICOLORED AND USED AS WALL PATTERNS OR MURALS, WHEN NOT ACTUALLY BEING USED FOR SLEEP. THE USE OF THE WINDOWS AND STAIRS ARE ALSO TRANSFORMED WITH THE CHANGING GRAVITY. THE USE OF THE STAIRS IN THESE DRAWINGS STARTED THE EXPLORATION FOR A STAIR THAT WOULD BE MORE VERSITILE AND LESS COMPLICATED. THIS RESULTED IN A MODIFIED LANDING WHICH COULD BE USED FOR EITHER GRAVITY. THE EARLIER DRAWINGS ALSO HELPED IN REDUCING THE AMOUNT OF DISORIENTATION WITH THE CHANGING OF GRAVITY. THE FOLLOWING PAGE SHOWS THE TRANSFORMATION OF GRAVITY. THE AXON-METRIC NOW APPEARS AS A SECTION THROUGH THE STRUCTURE RATHER THEN A FLOOR PLAN.







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