how to print a house, and why

new york times photo

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2 Fold marks and instructions can be printed on Kraftboard. Tulane students are making basic fold with paper folding machine (2) for triangles.

3 (3) Stapling fold. Members of Kraftboard triangles are triangular in section, for strength. Finished triangle (6) can hold man's weight.

4 (4) Student staples member of Kraftboard triangle. Diamond cuts permit members, triangular in themselves, to be folded into a triangle.

Each day sees an improvement in the prospects for the two geodesic domes which R. Buckminster Fuller has designed for the Tenth Triennale in Milan next August 25 through November 15. The larger, 72 feet in diameter, is to be placed at the disposal of the Triennale, and the smaller, a 36-footer, will house exhibits from the United States, though both will in themselves actually serve as the most dramatic symbol of America's inventive and industrial genius that this country could place in the Triennale, one of the most important of all international expositions.

The appropriateness of these domes as our prime exhibits is not lessened by the relative indifference—if not hostility—with which U. S. architects look upon them. For one of the basic themes of the Tenth Triennale is industrial design, and it should be understood that geodesic structures do not represent an attempt to supersede architecture, but to supersede our archaic building industries—which have already superseded architecture anyhow, as the tiny percentage of architect-designed houses too grimly proves. But while our building industries have taken shelter away from the architect without offering an economic product (shelter is the only item for which the American citizen has had to pay progressively more per unit of product since World War I), Fuller has been trying to solve the problem with the means that modern technology has placed in industry's hands.

Fuller, eyes riveted on technological facilities and the mathematical facts of structure, does not imply "shelter" to mean what anyone in our society ought to live in but what he can happily live in and is most easily and economically built—and transported—in other words, *basic* shelter. There is a terrible need for such shelter in the world; hence the humanistic implications and good-will value of such an exhibit for the United States.

It is perhaps ironic but by no means illogical that up to now the U. S. Marine Corps is the most important organization to have shown explicit interest in Fuller's experiments. Modern war moves fast and far. Tents are too flimsy and dark for Korea; a squadron may have to make several moves in the time it takes to build quonsets and conventionally built hangars.

But military exigencies do not alter the fact that there are people the world over who cannot afford conventional shelters in the best of times, that even the citizens of the rich United States are becoming mobile, if not nomadic, during increasing periods of their lives, and that to them, also, effective, transportable shelter would be a boon.

There are two phases in Fuller's achievement. The first is an essentially mathematical search into the nature of structures to determine the most efficient geometric over-all form and the most efficient structural module to enclose any given space suitable for human purposes. The second is specific research into industrial materials and methods that would allow low-cost mass reproduction of such shelters, their easy transportation, easy, quick erection by unskilled hands, their easy repair, adaptability, and re-use, either intact or reassembled.

Fuller found the answer to his first question in the geodesic dome. Four basic structural types have been tried in wood, aluminum tubing, other materials. Most important test was the cover over the 93-foot Ford rotunda, whose walls could not hold a conventional, 160-ton steel dome, but easily carry Fuller's 8½-ton aluminum dome.

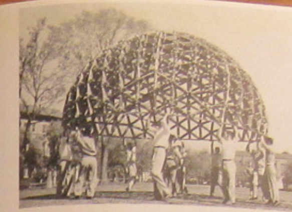
This discussion refers to the material of the dome's *skeletal frame*, not its cover, for which there is a choice of materials including the translucent vinyl to be used over the two domes at the Milan Triennale.

The answer to the question of *mass reproduction* was not found until a recent improvement in paper. In World War II the United States used a Kraft paper of great *wet strength*—meaning it retained *tensile* strength when soaked; cans packed in it were not lost. Kraft paper, incidentally, consists of two straight layers of cardboard glued on either side of a crimped layer. Only recently have we made Kraft paper with wet *compression* strength—by adding a phenolic resin to the "mix" to form a chemical compound whose molecules will not absorb water.

The advantages of paper are low cost—2¢ a square foot of enclosing structure against 35¢ for plywood; light weight—half a ton for a 36-foot dome; the speed and accuracy with which cuts, folds, and instructions can be *printed* on it in an operation continuous with the basic Kraft paper manufacture (rolling, crimping, glueing, heat setting).

It is at this point that the problem of mass reproduction is solved. As to on-site erection, the advantage of Fuller's system is that it is not only easy enough for unskilled labor with minimum tools, but is completely *dry*, eliminating the greatest time-consuming factor in all conventional construction.

The system will be demonstrated when Roberto Mango and Zane Yost supervise the building of two domes for the Triennale next August. Its implications are stupendous.—*O.G.*



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6 Triangles (6) at Tulane were taped but wood dowels will assemble future domes. Domes can be disassembled and shipped flat, or lifted intact.

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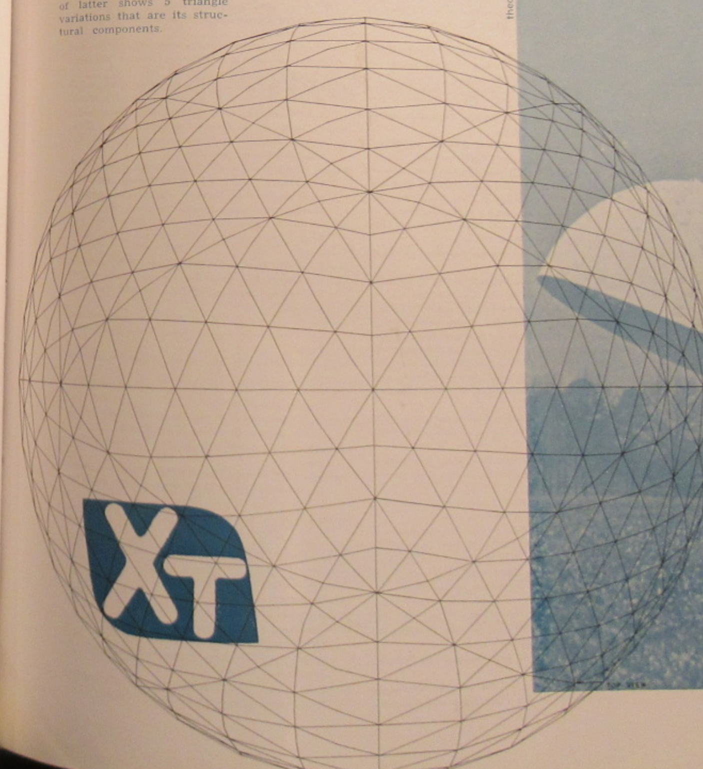

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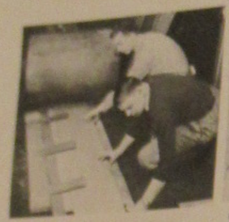
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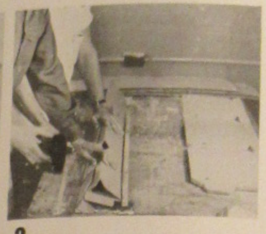
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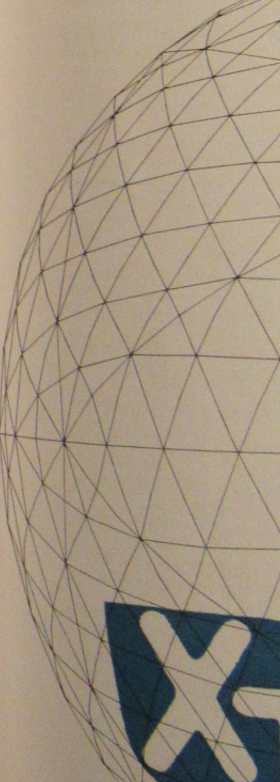

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