A mammoth Saudi Arabian air terminal's roof, made of aerospace-originated fabric, highlights spinoffs in transportation

# Hostel for the Hajjis

Owens-Corning Fiberglas

*Designed to look like a tent city, Saudi Arabia's Haj Terminal in Jeddah is a rest stop for Mecca-bound pilgrims, or* hajjis. *Made of spinoff material, it is the world's largest fabric structure.*

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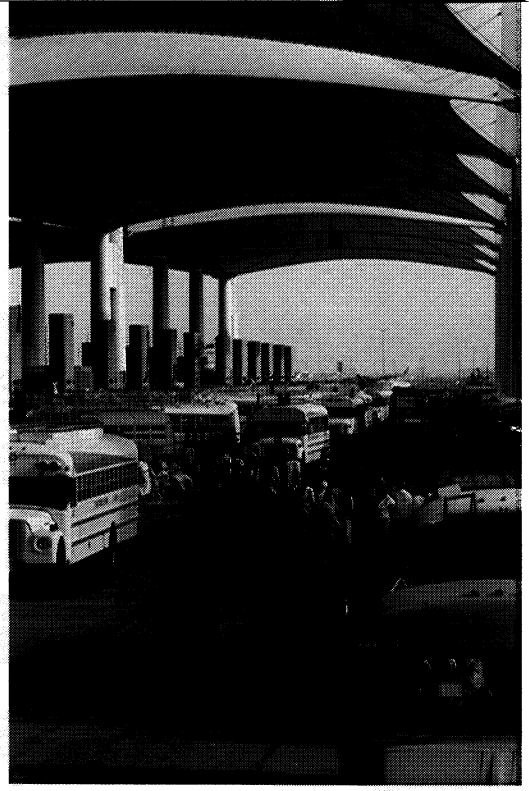
*Although temperatures outside sometimes reach 130 degrees, it is a comfortable 80 under the "big top;" the coated fabric roof reflects 75 percent of the Sun's radiation and a unique open-sided, open-top tent design promotes cooling air circulation.*

In Islamic teaching, the holiest of all places is Mecca, the birthplace of the Prophet Muhammad in Saudi Arabia's Hejaz region bordering the Red Sea. Some 800 million Muslims turn toward Mecca five times daily to pray to Allah. Each of them hopes some day to make the ultimate act of devotion—the *haj,* the pilgrimage to Mecca.

This year, more than a million *hajjis* from all over the world will realize that ambition. Most will make the journey by air, arriving at the new King Abdulaziz International Airport (KAIA) in the gateway city of Jeddah, a Red Sea port 45 miles from Mecca. There they will sojourn briefly at KAIA's Haj Terminal, a colossal facility built by the host nation to ease entry formalities for the massive influx of *hajjis* and to provide them a place of rest before they embark on the final lap of the pilgrimage.

Other air travelers are processed elsewhere at KAIA, but the Haj Terminal is reserved for Muslim pilgrims. A broad expanse of fabric cones, it is designed to suggest the tent cities in which *hajjis* have sheltered themselves during centuries of pilgrimages. The terminal consists of two identical structures separated by a landscaped mall. Each structure has a multi-tented fabric roof spanning more than 50 acres. Together, the structures contain 210 individual tent units and cover an area roughly equivalent to 80 football fields. That makes the Haj Terminal the world's largest fabric structure.

The roof covering is Fiberglas® fabric coated with Teflon® fluorocarbon resin. The fabric is supplied by Owens-Corning Fiberglas Corporation, Toledo, Ohio; Teflon is a product of Du Pont Company, Wilmington, Delaware.



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*After entry formalities and a day's rest, the* hajjis *board buses for the final leg of the journey, to the holy cities of Mecca and Medina.*

The material is an aerospace spinoff whose origin dates to 1967, when NASA was looking for a new fabric for astronaut space suits. Owens-Corning had been experimenting with an ultrafine pure glass fiber yarn called Beta® that seemed to meet all requirements. The yarn was woven into a fabric, coated with Teflon and tailored for astronaut wear. The material thus produced provided the basis for heavier, construction-use adaptations which have found wide acceptance as permanent architectural fabrics for structures all over the world.

Use of the fabric was an answer to a design question pondered by the New York/Chicago firm of Skidmore, Owings & Merrill (SOM), architects and engineers for the Haj Terminal project, and the Saudi Ministry of Defense and Aviation. There was a problem in that the great annual influx of *hajjis* occurs in a short time frame, the 70-day pilgrimage season, thus greatly increasing the daily rate of entries. It was necessary to plan for processing as many as 5,000 persons an hour and for sheltering up to 100,000 at a time—in an area where the temperature may reach 130 degrees Fahrenheit. It would have been next to impossible to build, maintain and air-condition a single conventional, fully-enclosed structure to meet both processing and shelter requirements.

SOM, therefore, decided to provide two kinds of covered space. For customs, immigration, baggage handling and other processing operations, where people would be working 24 hours a day, the firm designed a pair of two-story enclosed air-conditioned buildings. For the shelter area, SOM decided upon the open-sided, tented-roof structure. In lieu of air conditioning, the white Fiberglas fabric, coated with Teflon on both sides, reflects 75 percent of the solar radiation reaching the roof, thus helping to curb under-roof heat. Additionally, the conical tents are open at top and sides, creating a natural venturi effect that promotes a cooling upward flow of air. The fabric's reflectivity, coupled with the air circulation stimulated by the constant desert wind, keeps terminal temperatures in the 80 degree Fahrenheit range even when outside temperatures reach 130.

Each of the 210 tents measures 150 by 150 feet at the bottom and stands 66 feet above the terminal floor. The tents are suspended by steel cables attached to 150-foot steel pylons; the cables support, strengthen and shape the fabric. In addition to its reflectivity, the fabric offers a number of other advantages. It is translucent and permits shadowless natural light to filter to the under-roof area, creating a softly shaded environment that eliminates the need for artificial daytime lighting. It resists the corroding effect of salt air generated by the Red Sea. It also plays a part—along with the conical tent design and the roof height—in diminishing the acoustical problems created by many thousands of pilgrims in the terminal. Very strong and durable, the Teflon-coated Fiberglas fabric gives the roof a life expectancy of more than 30 years.

Fabric structures as temporary shelters date back to 1948, but their use as permanent alternatives to conventional buildings has grown markedly in the past decade, spurred by the availability of advanced materials. Some examples of other structures that incorporate Fiberglas fabric are pictured on the following pages.

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*The many colorful* souks, *selling modern and traditional wares, need no artificial daytime lighting; the translucent fabric admits natural light. In addition to the* souks, *the huge terminal has facilities for processing passengers, many restaurants, lavatories, travel service counters, banks and rest areas.*