

THE LIVEABLE CITY - KING KHALID MILITARY CITY

PROLOGUE - THE GROUND BREAKING CEREMONY

On February 1, 1978, King Khalid formally presided at the ground breaking ceremony for King Khalid Military City at Wadi Al-Batin in the northeast corner of the Kingdom of Saudi Arabia.

The King arrived by C-130 aircraft about 10:30 A.M. Most of the other invited guests had been in position for several hours. The pavilion for the ceremony was most impressive. Built at the future center of the city, named the Centrum, the dedication pavilion had a tent-like appearance. It was, in fact, a wooden structure covered with green and white canvas fringed near the top edge of the open front to enhance the appearance in Bedouin style. Inside were overstuffed chairs for the King and his immediate party, perhaps one hundred dignitaries in total.

Between the tentlike Pavilion and the flagpole was the veiled granite and bronze dedication cube. Beneath its temporary cover, supported on edge, this cube bore three bronze plaques on its upper surfaces: an outline reproduction of King Khalid Military City, a dedication of KKMC, and on the third surface, a Koranic quotation. Marble pavers formed the dais for the cube, and white stone walkways contrasted with the red carpeting.

Having landed, the King proceeded to the dedication site via limousine. The route was lined with royal arches, and five hundred cheering Boy Scouts carrying flags and placards of greeting for the King. They waved and shouted enthusiastically, inspired by the general air of excitement. Finally the King's motorcade arrived at the Pavilion, preceded by impressive security guards with

double bandoleers of ammunition slung across their shoulders and chests. This personal security guard for the King was augmented by additional Army personnel, and jeeps on roving patrol circled the Pavilion in the distance. The immediate Royal party included Crown Prince Fahd and Prince Sultan, Minister of Defense and Aviation, and other distinguished government officials. Official guests were seated outside the Pavilion in rows of folding chairs - military guests to the left of the Pavilion and civilian guests to the right. For several hundred persons, there was standing room only behind these chairs. The people standing were mostly contractor personnel, Boy Scouts, and design personnel. Among the official American personnel were Brigadier General and Mrs. Dick Wells*, Middle East Division Engineer; Colonel and Mrs. Maurice Leiser, Al Batin District Engineer; Dick Huggins, Project Manager; and John Lewis, Chief of Construction for the Corps.

The ceremony itself began after the King and members of his official party were seated. The military band heralded the first speaker, Major Nasser al Faisal, Director of Military Works, MODA, who described in Arabic the genesis and purpose of the city. Next came poets proclaiming the past and future glory of Islam and the Saud family. When these preliminaries ended with readings from the Koran, the King came forward and unveiled the Dedication Monument, revealing the bronze surfaces. Major Faisal then briefed King Khalid on details of the design of the city, using three detailed models erected between the Monument and the flagpole. The day continued bright and fresh because of the sun and breeze, nature perhaps cooperating to enhance the beauty of the occasion.

*Brigadier General Jim Ellis has now succeeded Brigadier General Dick Wells as Division Engineer. Unfortunately, Gordon Dykes, Chief of Engineering for the ME Division was unable to attend, as was Colonel Don Palladino, Deputy Division Engineer.

The King, for his part, seemed quite pleased, and after two hours from the moment of arrival departed for the dedication feast in the contractor's dining room, large enough to accommodate more than a hundred guests at once. Everyone received an invitation to attend the feast which lasted through several sittings. Termed a "goat grab" or "camel roast" in the vernacular, it was in fact an elegant affair with several courses of rare delicacies served graciously. Beautiful shrimp, fish, fowl, game and meat dishes tempted the palate. Fruits and pastries, coffees and teas complemented the lengthy repast.

Finally, the King retired to his specially-built compound and villa for rest. In the midst of the desert, it was a memorable day. Before resting, the King viewed the film of the City, especially produced for the occasion. This film depicted how the city will appear when completed, indeed, one of the most beautiful of all communities in this wonderful land of contrasts - deserts and oases, an ancient culture in a modern and rapidly changing environment.

THE GENESIS OF THE DESIGN TEAM

The genesis of the engineering part of the design team really began in Memphis, Tennessee, in the late sixties. It was then that the Memphis Housing Authority directed the redesign of an apartment project for the elderly to reduce costs. Francis Mah of the architectural firm of Walk Jones + Francis Mah, Inc. turned to structural engineer Bill LeMessurier with a structural scheme that conceivably could accomplish the purpose of HUD. The system that resulted, the Mah-LeMessurier system, has several advantages over conventional high-rise buildings, especially savings in cost and construction time. The advantages of the Mah-LeMessurier precast system were described in an article in a magazine, ARCHITECTURAL RECORD, in April 1971.

The story behind the architectural half of the design team begins in Rome, the home of the American architect, Spero Daltas. Spero Daltas, a disciple of

Eero Saarinen, came to Rome more than two decades ago to receive the Prix de Rome, liked the Eternal City, and opened his office there, forming a partnership with Ben Brown to establish the firm, Brown, Daltas and Associates. From its Rome headquarters, Brown, Daltas performed prestigious work for many Arab clients throughout the Middle East.

Early in 1973, Spero Daltas, reading in his atelier at Via Gregoriana 12, came upon the ARCHITECTURAL RECORD article describing the work of Bill LeMessurier on the Luther Towers project in Memphis and asked his partner, Ben Brown, to check to see if Bill LeMessurier would be interested in designing precast systems in the Middle East. By chance, Ben Brown had been the Georgia Tech roommate of Francis Mah, so he went to Francis Mah for information about Bill LeMessurier. The recommendation he received was a very enthusiastic one, because after collaborating on several projects in Memphis - including a Hyatt Regency Hotel - Francis Mah and Bill LeMessurier had also done the Massachusetts Eye and Ear Infirmary in Boston. Francis Mah's enthusiasm led Brown's office to contact LeMessurier in Cambridge, Massachusetts, and from this contact in early 1973 was born the Brown, Daltas and Associates/Sippican Consultants International Joint Venture, headed by Joint Venture Manager John Brennan.

Sippican Consultants International, for which Bill LeMessurier serves as Chairman and Chief Executive Officer, is a multidisciplinary engineering design firm working almost exclusively for architects. It was precisely the sort of broadly-based engineering firm that Brown, Daltas needed to help with the studies of Khamis Mushayt and Tabuk. These studies were conducted with a view toward the conception of a new city, a third military city, that would in some way be less cantonment-like and more urban in its nature. The studies accepted by the Saudi Arabian government and the contract manager, the U.S. Army Corps of Engineers, led to master planning.

The master planning effort was accomplished primarily in Rome and Saudi Arabia, with Spero Daltas personally playing a key role in the location of the city, in the northeast corner of Saudi Arabia, on the edge of Wadi Al-Batin. The city was originally named Al-Batin Military City, and sometimes referred to as Qaisumah, a town of about 3,000 population, some 42 miles to the northeast. Actually, King Khalid Military City is about 220 miles north of Riyadh, 120 miles south of the country's border with Iraq, and about 180 miles west of the Gulf of Arabia, where a special port, called Ras al Mish'ab has been built to service the city.

The original master plan went quickly from a small cantonment with a population of approximately 15,000 to the so-called "two-brigade scheme" for a population of about 35,000. This master plan literally filled twenty-three volumes and thousands of pages of documentation.

During the master plan phase of the program, Cambridge-based SCI opened an office in Rome, and Rome-based BDA opened an office in Cambridge. The BDA/SCI Rome offices facilitated coordination with the U.S. Army Corps of Engineers office in Livorno-Turenia, and there were frequent trips by designer and Corps personnel to Saudi Arabia to insure the completeness and acceptability of the plan.

The master plan was really the key to the effective design of the city because it established the agreed parameters among the owner, the designers, and the contract manager, the Corps of Engineers, about how the city should look and how it should function. Rarely in the history of the world have designers been faced with a more challenging task - to design a city in the middle of an uninhabited area. However, this task was undertaken with considerable enthusiasm by BDA/SCI personnel, largely because of its uniquely challenging nature. At the conclusion of the two-brigade master plan, the scope of the project was significantly increased by enlarging the city to accommodate three brigades, and

essentially a fourth "support brigade," raising the population of the city from about 35,000 to 66,000 plus a workers' community outside the walls of about 22,000 personnel. This change presented an unusual problem to the master planners. The basic concept of the city was a pedestrian city with walkways that would not overlap with roadways. Also, the city was to be fairly concentrated in area in order to shield it from the severe environmental effects of sun and wind. Originally a rectangle, the corners of the rectangle - as the area increased with the new population - were cut off, forming an octagonal shape, the shape which now distinguishes King Khalid Military City.

The master planning phase of the city exercised all the capabilities and disciplines of the combined BDA/SCI A-E teams and reflected the goal of the teams, to make of the city a place where soldiers could learn and train and serve their country, and families could live in a pleasant, useful and productive environment. It was important to blend modern building methods for reasons of economy and speed of construction with traditional Islamic tastes and social preferences. Countless studies were executed to make certain that the city would meet the requirements of its inhabitants for a liveable city. These studies ranged from the cultural to the technical, and included such areas as use of solar energy, energy conservation, water conservation, water reclamation, horticulture, religious life and social customs, to mention only a few.

Because of the remote location of the site, even defining the ambient weather condition was somewhat of a problem, due to the lack of previous records. The search for weather data of a virtually uninhabited area over 200 miles from the nearest large city was a challenge solved by combining references to geological investigation reports, ARAMCO reports of weather from stations on ARAMCO's oil pipe line passing to the north of the site, and research and correlation of the meteorological department of the Saudi Arabian Department of Defense. Summer and winter design temperature frequency curves, daily temperature profiles and

wet bulb temperature frequencies were established and used as a basis of design. The new master plan, the so-called "three-brigade scheme," was obviously required before detailed design could commence. The BDA/SCI team, assembled for the master planning task, again demonstrated its capabilities by producing the new master plan just nine months after the decision to change from a two-brigade to a three-brigade city had been made. The submittal in May 1976 culminated three years of program development and documentation, and began an additional three years of intensive design effort for the BDA/SCI Joint Venture.

DESIGN

At the peak of design, BDA/SCI has had over 400 personnel working to produce more than 14,000 drawings, hundreds of books and thousands of pages of specifications and related documents required to support the basis of design, design analysis, computations and, ultimately, the bidding documents for this project.

The power and chilled water plants for the city evolved into two separate programs; a small support facility plant with a 4,000 ton refrigeration capacity and a six megawatt power supply was designed as a first-phase plant to support a community of 3,000. Revisions in the timing of construction and occupancy scheduling have resulted in the assimilation of the functions and capabilities of the initial plant into the second-phase, main city, central plant. This plant, a 250 megawatt, diesel-powered turbine generator yard and a 52,000 ton refrigeration plant, constitute the main source of power and chilled water for the city. Planning and design includes maintenance facilities, the supply and storage and distribution of fuel, and the computerized central monitoring and control system for power and the chilled water plant and their distribution.

All of the facilities for the city are buried in tunnels for easy access of maintenance. The basic structural system for the city is precast concrete,

using sandwich panels to increase insulation against the harsh environment. There are hundreds of thousands of these precast elements, and the precast plant to be erected by the initial contractor on the site is reputedly one of the largest - if not the largest - in the world. In charge of this erection is MKSAC, Morrison-Knudson Saudi Arabian Consortium, a combine of Morrison-Knudson of Saudi Arabia, Inc., Boise, Idaho; Fishback & Moore Corporation, Dallas, Texas; and a concrete consultant, Interbeton Construction, N.V., Curaçao. In addition to providing the precast plant and operating it, MKSAC will build support facilities and provide the basic services and life support for the contractors that will build the city. Most of the industrial buildings are of light steel framing construction.

Another unique feature in the design of the city involves the waste treatment of the sewage. Sewage is pumped to a treatment plant north of the city, and after thorough treatment is cycled back down to the city for underground irrigation of vegetation. The plantings within the city are the result of an extensive horticultural study and the years of experience of BDA working in Saudi Arabia on landscaping problems.

The drainage system of the city took advantage of the location of the city on the highest ground in the area and the light slope into Wadi Al-Batin. Under-drainage was provided for the plants to prevent the collection of salts in the soils that would be deleterious to plant growth. Plantings themselves were selected with great care to provide maximum shade and beauty for the benefit of the inhabitants of the city, with a minimum amount of irrigation.

Even in its final, three-brigade version, the city retained its unblocked pedestrian ways to the Centrum, so that the central character of the city, the ease of communication, has been preserved even in the final design. The walkways leading to the Centrum do not cross the roadways, which are primarily to parking areas within the housing clusters, leading from the perimeter road which, in

turn, permits traffic onto the main east-west road dividing the city in half, with family housing to the north and troops and related facilities to the south of the road.

Any system of construction, while economical in terms of overall cost, time and ease of construction, has the disadvantage of being somewhat monotonous. The designers of King Khalid Military City have attempted to counter this monotony with careful selection of colors and varying finishes, primarily based on natural aggregates available in Saudi Arabia. The colored pavers and varying colors and textures of finishes are again a reflection of the brilliance of Spero Daltas, the city's Chief Design Architect.

DESIGN STATISTICS

The statistics for the city are rather mind-boggling, with 121 miles of piping systems, 370 miles of electrical conduits, an overall area within the city octagon itself of 2.5 square miles, and a building area of 23,000,000 square feet.

Housing includes 6,350 family houses and 1,000 apartments. In addition, the Centrum will provide housing for another 4500 persons, including officers. The Centrum is, in fact, the heart of the city with a downtown shopping area, a VIP hotel, restaurants, theatre, the main 99-foot high Friday mosque, military clubs, military command headquarters and vocational training schools.

In addition to the main mosque, the Friday mosque, there are an additional fourteen mosques in the city, distinguished by concrete hemispherical domes.

With an estimated cost of construction of \$7 billion, KKMC is one of the largest construction projects in the world. It involves more than 40 "construction packages."

POST SCRIPT

As the sun set on February 1, 1978, the day of the ground breaking ceremony, one could hardly imagine the activity that was just beginning at Wadi Al-Batin: the thousands of construction workers that would arrive, the activity that would take place in the months ahead, beginning from that moment forward. Each person in the advance party of the contractor would be multiplied a hundred-fold to one of the largest projects ever undertaken in the history of the world.

The Saudi Arabian sun became obscured before reaching the horizon by the dusty haze that gives it a particularly delightful red color. One could imagine the Friday mosque outlined against this background with its beautiful golden domes, the city gleaming in the fading light, its colored panels and textures gradually changing in the lengthening shadows. The call to evening worship fills the air in a thrilling way as people interrupt their conversations and social gatherings in the inner courtyards to proceed to the nearest mosque. The vision and imaginary sound fade with the dimming light, but someday - on this site - at Wadi Al-Batin, miles from any other center of population, will rise one of the most beautiful cities of the world, designed and constructed with care by the combination of man's imagination, vision and skill.