



DEFYING GRAVITY



SPECIALTY CONTRACTING FOR TENSILE ARCHITECTURE

EXPECT THE EXTRAORDINARY

Tensile architectural structures delight the eye and capture the imagination. They often cover very long spans, rising and arching without inhibition, appearing to defy gravity.

Only tensile structural engineering, materials and construction methods offer such freedom of form to the architect. With that freedom comes the opportunity to achieve great architecture – sometimes startling, but always intriguing.

Birdair is the world's foremost tensile architecture specialty contractor. More than 1,200 Birdair-built tensile structures can be found in over 30 countries – in every climate – from arctic cold, to arid desert, to steamy tropics.

But the versatility of tensile architecture is best demonstrated through the infinite variety of uses in which it's employed. These extraordinary and often famous structures include stadiums, arenas, convention centers, amphitheatres, airports, shopping malls, entertainment centers, museums, science centers, hospitals, schools, offices and more.

Birdair was founded in 1956 by engineering pioneer Walter Bird. In 1992, the company became part of Japan's Taiyo Kogyo Group.



BIRDAIR IS A PROUD SUPPORTER OF:



CONTENTS

4-5

FABRIC MEMBRANE

6-7

ECONOMICS

8-9

SUSTAINABILITY AND
FUNCTIONALITY

10-11

DESIGN-BUILD
CONTRACTING SERVICES
AND DEPARTMENTS

12-13

DESIGN ASSIST,
FEASIBILITY, ANALYSIS
AND MODELING

14-15

BUDGET DEVELOPMENT,
COST ANALYSIS AND
VALUE ENGINEERING,
FINAL ENGINEERING

16-17

FABRICATION AND
SUPPLY CHAIN
MANAGEMENT

18-21

CONSTRUCTION

22

POST-INSTALLATION
AND SERVICE

23

CLIENTS

MASTERS OF MEMBRANE

Throughout its history, Birdair has continually advanced the art and science of architectural fabric membrane – innovating architectural applications for membrane; devising new, more effective and efficient methods of fabricating, installing, and maintaining membrane; and engineering entirely new membrane systems and materials such as insulated Tensotherm membrane and fully recyclable and remarkably sustainable Kenafine membrane.

Birdair is master of the widest selection of membrane to cover virtually any application, any size project, and any given budget.

Research & Development

ETFE

Lightweight and transparent ETFE, or ethylene tetrafluoroethylene, film allows the creation of cutting-edge large span spatial architecture. ETFE, with appropriate reinforcement, is suitable for both tension and air-supported applications.

ePTFE High Translucency

ePTFE-coated high translucency fabric membrane is a beautifully foldable tensile material unmatched for its aesthetic capability and durability. This woven, non-flammable material can be spot welded or sewn. It uses a 100-percent fluoropolymer coating and can offer up to 40-percent light transmission, eliminating glare to allow broad illumination throughout a given interior space.

Kenafine

Kenafine is a translucent, moisture-resistant, biomass roofing membrane that can be fully recycled into paper products at the end of its life cycle. The fabric is made with fibers of Kenaf, a type of annual hibiscus herb that absorbs more carbon dioxide and grows more rapidly than regular plants and trees.

Silicone-Coated Glass Fiber

Silicone-coated glass fiber fabric is a durable, weather resistant and fire-tested silicone-coated material offering a wide variety of translucency levels and unlimited color selection.

PVC

PVC, or polyvinyl chloride, is a molecule comprised of carbon, hydrogen and chlorine that is available as a woven or non-woven material, providing a cost-effective alternative to conventional roofing systems.

PVC Mesh

PVC-coated (polyvinyl chloride) mesh is an exceptionally durable fabric membrane produced with polyester, fiberglass and other types of reinforcements. PVC-coated mesh is woven during fabrication, increasing tensile strength and design versatility while diminishing concerns about fabric compatibility and size.

PTFE

PTFE, or polytetrafluoroethylene, is a durable, weather- and fire-resistant Teflon®-coated woven fiberglass membrane, with a project life cycle exceeding 30 years.

Tensotherm™ with Nanogel®

Tensotherm with Nanogel offers the architectural beauty of PTFE tensile fabric membrane with the added benefit of a feather-light insulation layer known as Nanogel aerogel that traps air to prevent heat loss and solar heat gain.

TiO₂-Coated PTFE

PTFE fiberglass coated with non-toxic and flame-resistant TiO₂ (titanium dioxide) produces a photocatalytic membrane that functions like the leaves of a tree, providing shade while actively neutralizing airborne pollutants.

PTFE Acoustical Liner

Translucent PTFE fiberglass acoustical liner membrane is used in conjunction with the exterior PTFE fiberglass membrane in order to achieve significant sound attenuation and reduce reverberation for a more perfect listening experience.

ATTENTION-GRABBING ECONOMICS

Birdair tensile architectural structures are the most economical way to achieve clearspan roofing enclosures of 150' (45m) or more, eliminating the need of interior columns, support foundations, and providing an overall light weight to support. Most tensile architecture projects are known for their signature rooflines made from millimeters thin membrane material. Flexible and smooth, Birdair membrane roofs are particularly well-suited for economically translating curvilinear designs into reality. Additionally, tensile architecture also offers other advantages:



- Provides the greatest degree of unobstructed interior space
- Optimizes sight lines and maximizes visibility – of utmost importance in stadiums and amphitheatres, for example
- Allows ample daylight to penetrate, reducing the need for artificial lighting and associated energy requirements for the space
- Permits usage in facade applications
- Produces an attractive soft glow through the roof membrane at night with interior lighting

- Membrane roofing system also double as interior ceiling
- Translucent insulated composite systems can provide daylighting while delivering insulation value consistent with built up roofing.
- Membrane can be TiO₂-coated to help maintain a like-new appearance even in dirty or polluted environments, reducing maintenance costs
- Membrane liner and insulated systems can also provide sound-absorbing acoustical benefits
- Birdair offers ENERGY STAR, Cradle to Cradle and Cool Roof certified products





SUSTAINABLE AND FUNCTIONAL BY NATURE AND DESIGN

MATERIAL REDUCTION

Simply put, efficient building is green building. One of the most effective ways for an architect to achieve green design is to use less material. When a structure requires fewer materials, it wastes fewer materials.

The membrane, steel substructure, cables and clamping systems used in tensile architecture amount to a small fraction of the material consumed in creating the structure and building.

LONG LIFE-CYCLE AND RECYCLABILITY

The elements in a Birdair system also contribute to sustainable design by virtue of their reuse and recyclability. Steel, of course, is 100-percent recyclable and the steel used in fabrications produced for Birdair has a high percentage of recycled content. One new membrane material, made entirely of the Kenaf plant, is converted into paper at the end of its useful life as a roof or facade.

Membranes also last longer than conventional roof materials. Many of the oldest Birdair installations, dating back more than three decades, continue to look and perform beautifully today. Many professionals view PTFE fiberglass as the industry's next "forever" material.

Birdair roofs coated in TiO₂ (titanium dioxide) function like leaves on tree, not only providing shade but also actively neutralizing airborne pollutants and odors. Once neutralized, pollutants are washed off the membrane by rainfall, keeping the fabric clean and extending its vibrancy.

ENERGY EFFICIENCY

A membrane roof fabricated to Birdair specifications can save energy two ways. First, through its translucency, the roof allows daylight to flow into the space, reducing the requirement for artificial electrical lighting. Additionally, white membrane reflects heat back into the atmosphere. Birdair offers PTFE composites that can qualify for ENERGY STAR, Cradle to Cradle and Cool Roof Certification.

Birdair has also been instrumental in the innovation of Tensotherm™, a pre-engineered, highly efficient insulated translucent composite roofing system. Insulating Nanogel® aerogel* is the world's lightest solid material and the most efficient insulating material ever created. The result is a thin, translucent composite that delivers impressive insulation values.

* Nanogel® aerogel is a registered trademark of Cabot Corporation. Nanogel® aerogel is Cradle to Cradle certified. Cradle to Cradle (CM) is a certification mark of McDonough Braungart Design Chemistry (MBDC). Some PTFE membranes offered by Birdair have earned ENERGY STAR. Birdair roofs can achieve Cool Roof Rating Council certification.



COMPREHENSIVE DESIGN-BUILD CONTRACTING SERVICES FROM CONCEPT TO COMPLETION

The complexity of tensile architecture flows from its nature as a precise blend of art, science, engineering, computer modeling and construction know-how. If you're considering tensile architecture, Birdair is the specialty contractor you want on your team from the start.

Birdair's full range of project delivery services – from design assistance to construction – ensures your project will be designed, engineered and built more quickly, more efficiently and more economically.

Most importantly, with Birdair on your design-build team, you have peace of mind. You know you've hired the first name in specialty contracting for custom tensile architecture with the longest history of experience and success in the business.

Experience proves that, when choosing Birdair, you will successfully achieve your next tensile architecture masterpiece.



BIRDAIR IS STRUCTURED BY DEPARTMENT TO PROVIDE OUTSTANDING FULL-SERVICE SPECIALTY CONTRACTING SERVICES

BUSINESS DEVELOPMENT

ENGINEERING

DESIGN & DETAILING

RESEARCH & DEVELOPMENT

ESTIMATING

FINANCE

PURCHASING

CONSTRUCTION

FABRICATION (PLANT)

PROJECT MANAGEMENT

QUALITY ASSURANCE & QUALITY CONTROL



DESIGN ASSIST

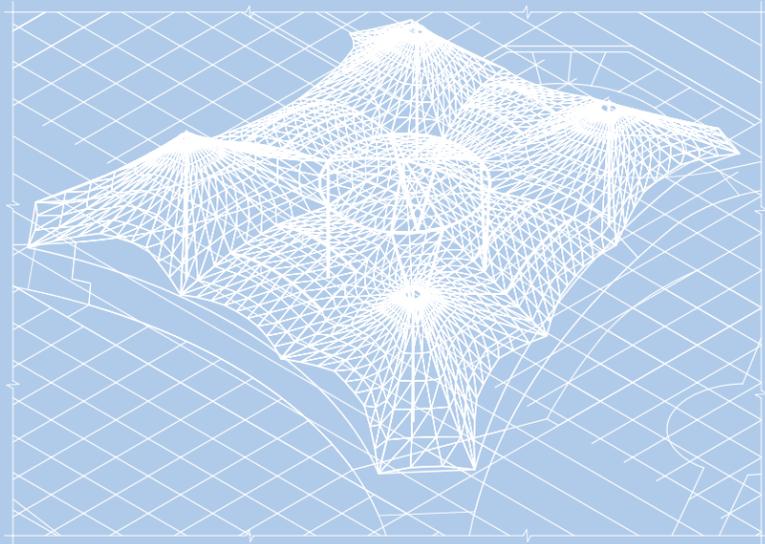
At the schematic design phase, Birdair Design Assist provides your design-build team with guidance and recommendations. Birdair helps you conceptualize form, geometry, scale, materials and structural support systems based on your design intent, budget and timeframe. Because tensile architecture is far more lightweight than traditional roof systems, a project's overall structural requirements are often significantly reduced. With Birdair Design Assist, your design-build team identifies and capitalizes on these reductions from the start.

DELIVERABLES

- Feasibility Study
- Preliminary Analysis
- Pre-construction Budgeting
- Scope Delineation
- Schedule Feasibility

BIRDAIR RESOURCES

- Business Development
- Engineering



FEASIBILITY, ANALYSIS AND MODELING

Through Birdair Feasibility, Analysis and Modeling services, your project's form, geometry and materials begin to crystallize. Now, Birdair can begin to calculate reaction loads, determine methods for construction, perform any required testing and establish a preliminary schedule.

DELIVERABLES

- Formal Analysis
- Model Generation
- Preliminary Reaction Loads
- Construction Feasibility
- Preliminary Construction Method Development
- Materials Recommendations and Applicability Testing
- Preliminary Schedule Development

BIRDAIR RESOURCES

- Business Development
- Engineering
- Research & Development
- Estimating
- Purchasing
- Construction





BUDGET DEVELOPMENT, COST ANALYSIS AND VALUE ENGINEERING

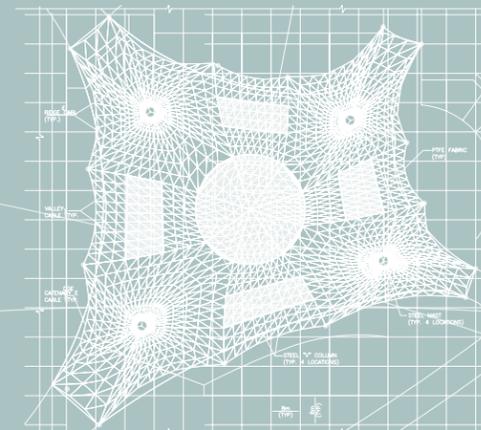
With 50-plus years of proven experience, Birdair is able to offer you Guaranteed Maximum Pricing contracts for complete construction of the largest tensile architectural projects worldwide.

DELIVERABLES

- Proposal Development
- GMP Proposals
- Engineering Take-Off
- Materials Confirmations
- Supply Chain Engagement
- Construction Methodology Confirmed
- Proposal Schedule Confirmed

BIRDAIR RESOURCES

- Pre-construction
- Engineering
- Estimating
- Purchasing
- Fabrication (Plant)
- Project Management
- Research & Development
- Quality Assurance
- Construction



FINAL ENGINEERING

Birdair details each component to be fabricated in-house or by a Birdair supplier. For a given project, these components may include steel support masts or compression rings, as well as an outside element barrier – be it fabric membrane, glass, or metal. Birdair also recommends all manufactured components such as cables, rods, fittings and clampings, and develops detailed methodologies for exactly how and when each component is to be installed on site.

DELIVERABLES

- Formalize Submittal Drawings and Patterning Details
- Develop Final Reactions and Calculations
- Construction Methodology and Engineering Confirmed
- Material Orders Confirmed
- Finalize Fabrication and Associated Scheduling
- Project Schedule Finalized

BIRDAIR RESOURCES

- Engineering
- Design & Detailing
- Construction
- Fabrication (Shop)
- Project Management

FABRICATION AND SUPPLY CHAIN MANAGEMENT

Birdair Fabrication and Supply Chain Management assures that all materials required for your project are fabricated, manufactured, shipped and delivered to your job site according to precise specifications and timetables. Your project's membrane components are fabricated in the controlled environment of a Birdair 9001: 2008 ISO-certified facility. Here, fabric membrane is patterned, cut, welded, packaged, shipped, and many of the structural components, such as steel rods and cable, are pre-assembled. Birdair also maintains excellent relationships with qualified suppliers of tensile architecture building components, including fabric membrane, metal roofing, architectural mesh, and glass curtain wall, as well as structural steel masts and rings, cables, rods, fittings and clamps.

DELIVERABLES

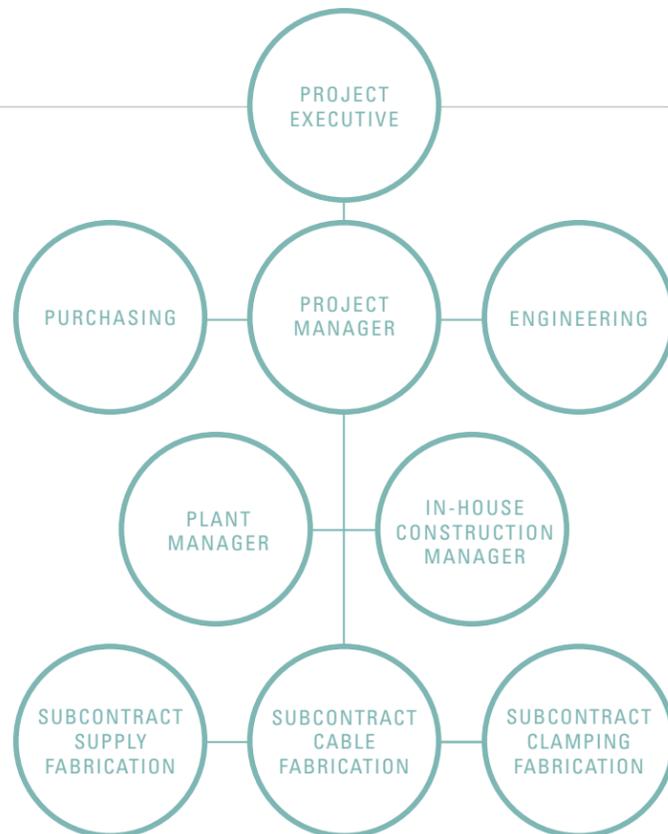
- Supply Chain Established and Coordinated
- Material Schedules Confirmed
- Final Detailing Completed and Released
- Third-party Quality Assurance Testing
- Fabrication Schedules Confirmed
- Delivery Schedule Finalized

BIRDAIR RESOURCES

- Engineering
- Design & Detailing
- Project Management
- Purchasing
- Fabrication (Shop)
- Quality Assurance
- Transportation & Logistics Coordination



SUPPLY CHAIN MANAGEMENT





CONSTRUCTION

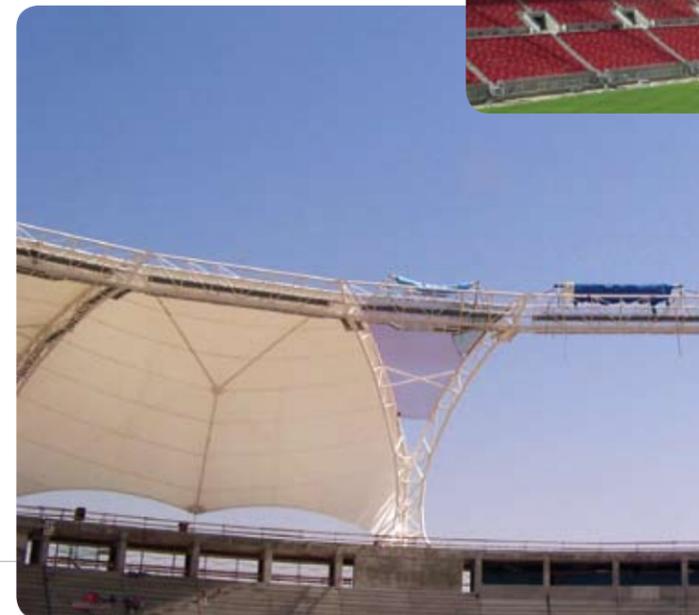
ESTABLISHED EXPERIENCE

Birdair – the original mega tension design-builders – founded many of the tensioning techniques used in modern tensile construction. For more than 50 years, Birdair has developed the art of tensile architecture, including hydraulics and tensioning equipment as well as specialty rigging.

More than 1,200 projects worldwide exemplify Birdair's custom engineering, craftsmanship and quality of work.

DELIVERABLES

- Mobilization of Manpower and Equipment
- Site Offices Established
- Erection and Site Coordination Begins



CONSTRUCTION

INNOVATIVE EXPERTISE

From the initial concept to project completion, Birdair is fluent in the science of construction. This versatility transcends blueprints, allowing execution of creative design using methods unique to each application. Birdair's scalable services can accommodate any project demands, no matter what size or scale.

BIRDAIR RESOURCES

- Project Management
- Construction
- Engineering



POST-INSTALLATION AND SERVICE

Birdair boasts of an impressive roster of satisfied architects and owners who have achieved results surpassing the ordinary, both aesthetically and functionally. To keep their investments looking beautiful and functioning perfectly, Birdair offers service contracts for routine inspection, cleaning, and service if required.

“We wanted a material that would require simple periodic maintenance without time-intensive cleaning or repair. Birdair provided us with a structural fabric that meets those goals.”

- John Drum, vice president of stadium operations for the Arizona Cardinals



“Our current Birdair roof has performed well beyond its expectations and has exceeded its lifespan. We made the decision to go with Birdair again a couple years ago when we foresaw that the roof would need to be replaced soon.”

- Roy Saville, Radford University's director of facilities planning and construction

“I've been told by people that I broke the mold in U.S. sports architectural design. Working with Birdair's technical staff of design engineers helped me accomplish that.”

- World-renowned architect Peter Eisenman regarding the University of Phoenix Stadium



BIRDAIR CLIENTS INCLUDE

Altoon + Porter Architects
 Anschutz Entertainment Group
 Arizona Sports & Tourism Authority
 Arquitectonica
 Arthur Erickson
 Arup
 Balfour Beatty Construction
 Banca Mifel
 Barton Malow Co.
 Bay Area Rapid Transit District (BART)
 BDP International
 Bermello Ajamil & Partners
 Bliss & Nyitray, Inc.
 Bovis Lend Lease
 Brasfield & Gorrie LLC
 Buro Happold
 Cambridge Seven Associates, Inc.
 Cannon Design
 Carter & Burgess, Inc.
 City and County of Denver (CO)
 City of Calgary (AB)
 City of Palm Springs (CA)
 Dar Al-Handasah
 Del Castillo Márquez y Asociados
 Dewhurst Macfarlane and Partners Inc.
 E. Verner Johnson and Associates, Inc.
 Eisenman Architects
 Ellerbe Becket
 EllisDon Corp.
 Fentress Architects
 Foster & Partners
 FTL Design Engineering Studio
 Geiger Engineers, P.C.
 General Growth Properties, Inc.
 Gensler
 Georgia World Congress Center Authority
 Gerkan, Marg and Partner
 Gilbane Building Co.
 Greater Orlando Aviation Authority
 Grupo Arquitech
 Grupo Aryba

Grupo Franco
 Grupo GP
 H-E-B
 HDR, Inc.
 Heery International
 Hensel Phelps Construction Co.
 Hillier
 HKS, Inc.
 HNTB Corp.
 Hochtief AG
 HOK
 HOK Sport
 Hornberger + Worstell, Inc.
 Horst Berger
 Hunt Construction Group
 Interdiseños
 Jacksonville Port Authority
 Jerde Partnership International, Inc.
 Kajima International
 KMD Architects
 KPFF Consulting Engineers
 Liverpool
 LMN Architects
 Magnusson Klemencic Associates
 Manhattan Construction Company
 Martin & Martin
 Metropolitan Transit Authority (Houston)
 Metrorrey
 Miami-Dade Aviation Department
 Michael Hopkins + Partners
 Murphy/Jahn Inc.
 National Football League
 National Park Service
 NBBJ
 New Jersey Sports & Exposition Authority
 Nuevo Malecon Cancun
 Palace Resorts
 Palacio De Hierro
 PCL Construction
 Pei Cobb Freed & Partners Architects
 Perini Corp.

Pittsburgh Sports & Exhibition Authority
 Port Authority of New York & New Jersey
 Radford University
 Rafael Vinoly Architects PC
 Raices En Promocion Sa De Cv
 Raleigh-Durham Airport Authority
 Richard Rogers Partnership
 Rosser International, Inc.
 Rossetti Associates
 Rowan Williams Davies & Irwin
 Royal Caribbean International
 RTKL Associates, Inc.
 San Diego Unified Port District
 Schlaich Bergermann and Partner
 Severud Associates
 Simon Property Group
 Skanska USA Building
 Skidmore, Owings, & Merrill
 SmithGroup, Inc.
 Swinerton, Inc.
 Syracuse University
 The Clark Construction Group, Inc.
 The Cordish Company
 The Irvine Company
 The Pyramid Companies
 The Whiting - Turner Contracting Co.
 Thompson, Ventulett, Stainback and Associates
 Thornton Tomasetti
 Tishman Speyer Properties
 Turner Construction Company
 U.S. Department of Defense
 U.S. General Services Administration
 Uni-Systems, LLC
 VOA Associates Inc.
 Walker Parking Consultants
 Walt Disney Imagineering
 Walter P. Moore and Associates, Inc.
 Weidlinger Associates, Inc.
 Werner Sobek
 Zeidler Architects
 Zimmer Gunsul Frasca Partnership

BIRDAIR LOOKS FORWARD TO WORKING WITH YOU.



SPECIALTY CONTRACTING FOR TENSILE ARCHITECTURE

65 Lawrence Bell Drive
Suite 100
Amherst, NY 14221 USA
Phone: 001.716.633.9500
Toll-Free: 1.800.622.2246
birdair.com

© 2009 Birdair, Inc. A Taiyo Kogyo Company. All Rights Reserved.