The Arial Home Initiative

Presented by:

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What Problem Are We Trying to Solve with Our FIRST Engineering Skills?

- The human tragedy of inadequate housing
- Employing the talents of FIRST teams worldwide
- Building high quality, high tech homes in one day
- Building homes the way cars are built
  - Mass produced
  - Standardized parts
  - Robotic manufacturing
  - Volume purchasing
Goal of The Arial Home Initiative

Be partially responsible for one million new homes being built for poor families worldwide over the next 10 years.
By Comparison, Habitat for Humanity Has Built Just 200,000 Homes Worldwide in the 30 Years Since It Was Founded.
The U.N. estimates that more than one billion human beings live in houses no better than this one, with no running water or toilet.
With an Arial Home Claudia Will Have These Positive Effects

- A Stable Environment
- More Likely to Attend and Stay in School
- Reduced Incidences of Sickness Due to Dirt Floors and Exposure
- Stabilized Emotional Well-Being
- Strengthened Home Life
- Improved Overall Quality of Life
The Deerfield High School FIRST Team That Built the First Two Arial Homes in Ensenada, Mexico on December 16, 2007
Similarities to FIRST Robotics Challenge

- Team work is essential
- Organizational skills are required
- Tight timeframes - one day per house!
- Variety of team roles
- Must learn to use the right tools
- Continuous improvements to the product and the process can be made
Extensions to the original FIRST Robotics Concept

• Adds a Community Service/Humanitarian aspect component
• Building homes for families has greater appeal to many girls than building robots
• Result of the work effort is long lasting - the homes will be habitable for 50 - 100 years
Decorative shutters will be put around the front window.
The loft floor does not cover the window glass. The diagrams show the entire window panel, including frames and channels, the glass is a smaller area.
The Panels Arrive on Site Via a Flat Bed Trailer
HouseKea....

Simple pictorial instructions so a family and their friends can build an Arial Home.
A Battery Powered Electric Screw Gun is the Only Power Tool Needed
The Floor Channels are Screwed into the Concrete Pad, Through the Vinyl Sheet Flooring
Vinyl flooring is glued to the concrete pad as the first step. Foam tape is put under the J channel as a water barrier. J Channels are screwed down through the linoleum.

Do **NOT** caulk external seams so water will run out.

The J Channel is 2.5” high on the outside and 3” high on the inside to allow water to exit on the outside if the channel is flooded.

Caulk around screws and washers.
The First Wall Panel Goes Up Inside the Floor Channels
The Tongue and Groove Panels Fit Together Like LEGOS
The First Roof Panel is Eased into Position
Advantages of the Arial Home Design

- Will last 50+ years
- Low maintenance, high strength components
- Fireproof, waterproof, termite proof
- Larger homes hold more of the extended family
- Use local labor for manufacturing the components
- No cutting or waste materials due to factory construction to precise dimensions
The Key to Accomplishing the Goal

Build Panel Manufacturing Plants Close to the House Building Sites Around the World.

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We Start With Coils of Pre-Painted Galvanized Steel
The Steel is Unrolled Into Flat Sheets, Bent into the Right Shape, Then Cut To the Right Lengths
Example of a Roll Forming Machine Used to Bend the Sheet Metal Into the Right Shape for the Panels
First Arial Home Self Manufactured Metal Foam Wall Panel
March 23, 2007 at Sealed Air in Chicago
Polyurethane Foam Applicator Nozzle
Nozzle Spraying Liquid Polyurethane into Form
First Panel Undergoing Strength Test on March 26, 2007, Successfully Holding 800+ Pounds
Self Manufactured Metal/Foam Wall Panels

We use 24 gauge sheet, pre-painted galvanized steel. It is originally 48” wide, but the bends reduce the net length to 42”.

The lengths vary between 8’ and 12’6” (for the back wall)

A three inch thick layer of polyurethane foam is poured between the two metal sheets in a form.

2.5” groove, overfilled to make 1.5” until top of foam, .5” vertical bends

1.5” tongue

42” net width

Top and Bottom Pieces are Identical, Metal P1
Illustration of an Arial Home Roof Panel
Arial Home Panel Manufacturing Process

Form being unloaded  Nozzle assembly  Form being filled  Form ready to fill

Roller assembly on floor to slide forms

Approximately 70 feet in total roller length

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Schematic of a Panel Form With a Hinged Wall to Provide Easy Access to the Inside
Robotic System for Moving the Foam Nozzle
Side View of Robotic System for Foam Application
Side View
Schematic of a panel form with a hinged wall to provide easy access to the inside.

Foam Injector Nozzle
Hinge
Roller Table
Schematic of Foam Nozzle Component Array

- Nozzle
- Video Camera
- LED Light
- Distance measuring laser beam controlling nozzle flow trigger

Expanding Foam Level

Panel Form

Liquid Spray

Nozzle Direction

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Solar Powered Shed at Deerfield High School to Test Electrical Systems
Solar Powered Scoreboard at Deerfield High School
Brian and Lawry Mounting PV Panels on the Roof
Batteries (16) and Inverter Inside the Shed
Next Generation of Residential LED Lights
Arial Home Plumbing with Expansion Tank and Pressure Switch

120 volt AC or 12 vdc

Pressure Switch

Backflow check valve, spring loaded

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Fresh Water Tank, 110 Gallons, Filled By Government Water Trucks
Sanitary Waste Tank, 150 Gallons, Emptied By Port-a-Potty Service
An Arial Home Bathroom

A little cramped, but very functional
Arial Home Rain Water Recycling System

Flexible Hose to filter

Six foot length of 2” PVC Pipe to store initial water, With screw on cap at bottom

Changeable Filter

Fresh Water Tank

Roof Dirt Clean Out
A Finished Arial Home - In One Day!
Arial Home Costs

- Basic house materials: panels, windows, door, channels, etc., approximately $7,000
- Cost of fresh water system, sanitary waste system, sink, toilet, shower: $2,500
- Solar power, self contained electrical system with lead acid batteries and LED lights: $1,500
Call to Action for FIRST Teams

- Each FIRST Team raises the funds and builds one Arial Home per year for a poor family somewhere in the world
- This would result in more than 1,000 new homes per year
For Information on Upcoming Arial Home Building Trips

- Visit the Arial Home Initiative web site at: www.arialhome.org

- Send an email to Tom Pirelli, Executive Director of The Arial Foundation at: tom.pirelli@arialhome.org