



ENGINEERED SOLUTIONS FOR HIGH PERFORMANCE SYSTEMS



TELECOMMUNICATIONS



MEDICAL DEVICE



MEDICAL EQUIPMENT



INDUSTRIAL TECHNOLOGIES

Reliable Custom
Connectivity



nai-group.com

NAI CUSTOM ASSEMBLIES, HARNESSES, PANEL BUILDS AND BOX BUILDS Exclusive Service Benefits for NAI Customers

NAI is an extremely agile designer and manufacturer of custom cable assemblies and harnesses for a diverse group of customers, industries and critical applications. We deliver end-to-end connectivity solutions that inspire confidence among our customers, and among their customers as well. This is the NAI story of our competencies and competitive advantages that will benefit your next project.

1) Custom Engineering & Manufacturing

Many of our customers have experienced significant cost savings by outsourcing to NAI. We add value with design engineering services and by obtaining cost savings through the use of approved equivalent components. We are focused on diligent quality processes throughout manufacturing operations to ensure the reliability of our product performance in a variety of critical applications and technologies.

2) The NAI Centers of Excellence (CoEs)

Many customers outsource the design and development of their fiber optic and copper cable assemblies to NAI. Through expert engineering and specialized testing, our dedicated CoE facilities ensure Design for Manufacturability (DFM), product performance, reliability, on-time delivery and achieve cost savings.

3) Global Sourcing

NAI specializes in obtaining high-value products and components required for the cable assemblies we manufacture. Internal manufacturing capabilities complement our global procurement to provide quality assurance and substantial cost savings. This unique operation, like others at NAI, is flexible and nimble in response to customer needs, allowing NAI to ramp up rapidly for new projects.

4) Critical Applications

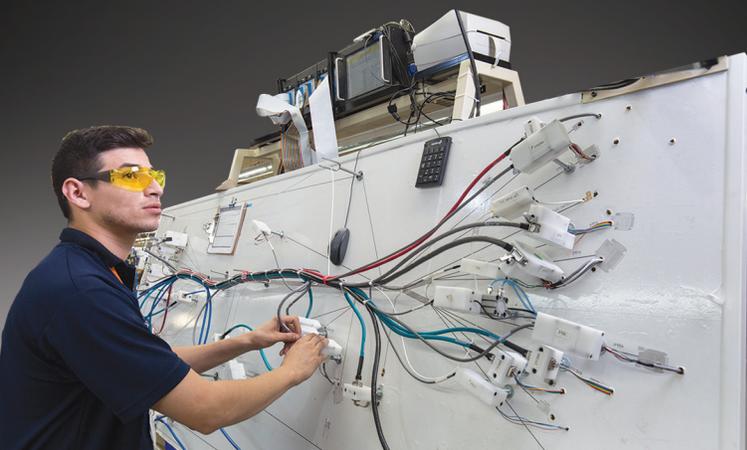
NAI produces assemblies and harnesses used in critical applications for medical, telecommunications, data and industrial technologies.

5) Relentless Quality

NAI employs the principles of Lean Manufacturing in its operations. A dedicated Quality Control staff, use of testing protocols throughout manufacturing and a relentless passion for excellence, all contribute to delivering reliable product performance.

6) Focused Assembly Experts

The people who work at NAI are well trained and committed to producing only the best quality products. Their passion and agility set us apart from others.



Assemblies and harnesses are thoroughly tested on a "working board" for reliable electrical performance, as shown with this harness bundle for the semiconductor industry.

“I found that NAI was able to approve and accommodate the capital investment required to set up operations for our project more quickly than others. Because NAI was so fast and nimble, our project was up and running within weeks!”

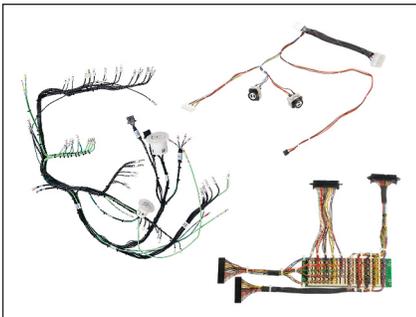
Director of Supply Chain
Leading Telecommunications Company

CUSTOM ENGINEERING & MANUFACTURING

Fast, Agile & Responsive

Cable Assemblies

Fiber optic and copper cable assemblies are the predominant output at NAI. We assemble to specifications and desired ruggedness, using ferrules, strain reliefs, connectors and other components as required.



Preterm

Customers often require pre-terminated fiber optic cable assemblies to make installation easier and quicker, saving valuable time for installers. The pre-terminated ends are protected for shipping and installation.



Customer Care at NAI

As a customer, NAI provides one or more manufacturing cells to the assembly of your product. These cells are manned by a dedicated team including engineers and quality control personnel.



Customers at NAI have dedicated manufacturing cells and teams.

Cable Harnesses

NAI rugged harnesses may include any combination of copper, fiber optic and power cables. Effective gauging tools and visual aids are used by operators during the manufacture of the assembly. Each part is thoroughly tested for electrical performance. Automated manufacturing equipment and test fixtures are employed to ensure signal integrity. Other capabilities include braiding, ultrasonic welding of bare copper and inline cable marking.



Electro-Mechanical Assemblies

NAI offers terminal block assemblies, box builds, panel builds and other assemblies. We will design and manufacture just about any electro-mechanical unit you can imagine.





A NEW PARADIGM FOR DESIGN & DEVELOPMENT

NAI's Product Planning Process Supports DFM

Start-up Options Based on the Customer's Need

NAI has created a new paradigm for custom design engineering and product development for fiber optic and copper cable assemblies. For new project start-ups, we employ our **New Product Introduction (NPI)** team, special processes and planning tools to prepare assemblies for production. For customers who need design, prototyping and testing capabilities, NAI offers the unique services of its **Centers of Excellence** or CoEs. All operations provide assurance of Design for Manufacturability (DFM).

NAI's Unique New Product Introduction (NPI) Process

The NPI operation occupies its own special space in the plant and is managed by a dedicated team of specialized engineers and workers who are devoted to the development of new cable assemblies.

This specialized team first prepares a drawing of the assembly design. From that, they create an associated "working board," with a completed assembly fanned out for identification of cables and components. This is used to test the assembly in the manufacturing process. The NPI team also generates a prototype, pre-production sample and Bill of Materials. NAI can provide the First Article in two to four weeks, depending on complexity.

The focused and agile NPI team is also tasked with preparing the visual aids and other tools needed for production. In addition, dedicated Program Managers utilize and oversee the Advanced Product Quality Planning (APQP) process, a tool similar to the one adopted by major auto manufacturers, for proactive quality planning in the design and manufacturing stages.



Detailed drawings of assemblies provide a visual aid to assembly personnel.



Working boards[®] are used to ensure the correct assembly of cables and components, as well as testing their electrical performance.

NAI provides a dedicated NPI team of engineers and quality personnel.



“We required rugged IP67-rated cable assemblies for our equipment, in order to operate in harsh and wet factory environments. We also required complete documentation on all testing conducted throughout manufacturing. NAI met all our technical and commercial needs very well. In addition, they also reduced our costs with alternate processes and approved equivalent components their engineers recommended.”

Commodity Supply Manager
Robotics Equipment Manufacturer

AN EXPERT OUTSOURCING OPTION FOR NAI CUSTOMERS

Dedicated Design, Development, Prototyping & Testing

Full Development at NAI Centers of Excellence

NAI has Centers of Excellence (CoEs) specializing in the design and development of both fiber optic and copper cable assemblies. These twin operations each include a dedicated team of engineers who design, analyze and test assemblies before they go into production.

The CoEs are organized around three main objectives:

- 1) The mission at each CoE is to design and develop fiber optic or copper cable assemblies for customers who require custom connectivity solutions.
- 2) We achieve cost savings for customers by using alternative processes and approved equivalent components to reduce material costs and the costs of manufacturing.
- 3) The CoEs support the NAI manufacturing process by employing Design for Manufacturability (DFM) principles in the design process.

The CoEs utilize CAD equipment and 3D printers to generate the appropriate design solution that will meet a customer's requirements. CAD software platforms include ACAD, SolidWorks and CorelDraw. FormLabs software is utilized for 3D printing to simulate prototype assemblies.

A wall of monitors provides CoE engineers with project dashboards, allowing them to control the design and testing process. Monitors display project data in real time, such as progress to date, important project notes and live test data.

Test operations can include:

- Environmental test
(thermal chamber - for temperature and humidity testing)
- Immersion test according to IP67
- Fiber optic cable cross-section analysis
(connectors, cable assembly and transition areas)
- Pull test based on connector specification or customer requirement
- End face and geometry for fiber optic cable, per standard spec IEC 61300 or customer requirement
- Electrical tests – copper
- Tensile and pressure tests
- Insertion Loss/Return Loss

The CoEs utilize CAD equipment and 3D printers to realize the appropriate design solution.



Once a prototype is made, the assembly is tested. An Environmental Chamber for temperature and humidity, along with tensile and immersion test devices, simulate demanding environmental conditions to ensure the product will perform under these stresses.



ENGINEERED SOLUTIONS FOR CRITICAL APPLICATIONS

No Project is Too Small or Too Large

Largest Variety for Critical Use

NAI's manufacturing operations are structured to handle an extremely broad variety of cable assemblies, harnesses, box builds, panel builds and terminal block assemblies designed for use in applications critical to life and/or communication. While others may be able to manufacture a portion of what NAI produces, no one matches the breadth and depth of our quality product capabilities and processes. NAI has the capability you need!

NAI has manufactured single assemblies with over 430 terminations. There is no limit to the number of cable assemblies NAI can produce, nor to the number of terminations.

The customer base for NAI is varied. We serve OEMs and contract manufacturers in the cable and connectivity industry. Some of the technologies we support include:

- Cell towers & DAS
- Energy management
- Networking
- Industrial & process control
- Medical devices and equipment
- Power supplies
- Semiconductor
- Telecom CO and OSP equipment



NAI has unique capabilities to manufacture a broad range of assemblies for high performance and mission critical applications.



Industrial Engineered Solutions

NAI has many years of experience in manufacturing ruggedized cable assemblies for the applications listed below. Many NAI assemblies have been engineered and manufactured in response to the growth in the sensor industry for IoT applications. Our capabilities include producing IP67 rated assemblies and products requiring cleanroom facilities.

- Semiconductor equipment
- Energy & power
- Measurement & control devices
- Network test devices
- Oil & gas test equipment
- Testing for pulp & paper manufacturing
- Water treatment test devices



NAI ruggedized cable assemblies are often used in industrial and process control applications.



NAI cable assemblies and harnesses are ruggedized to endure the tough environmental stresses typically encountered in industrial applications.

“The cable assemblies for our medical devices required dedicated clean-room manufacturing to prevent contaminants, which was provided by NAI. Their assembly process, testing and quality systems are second to none. Overall, NAI has delivered great value”

Design Engineer
Medical Device Manufacturer

ASSEMBLIES FOR PRECISION APPLICATIONS Critical to Life & Communications

Medical Devices & Equipment

NAI plants feature the equipment and stringent testing operations needed to produce medical cable assemblies, including cleanroom facilities. These ISO 13485 certified plants have manufactured precision interconnect solutions for medical devices, such as coblation surgical assemblies, SPO2 over-molded sensor assemblies, surgical knife assemblies, ultrasound and laparoscopic surgical assemblies and disposable surgical wand assemblies.

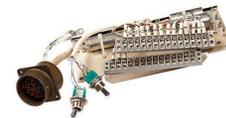
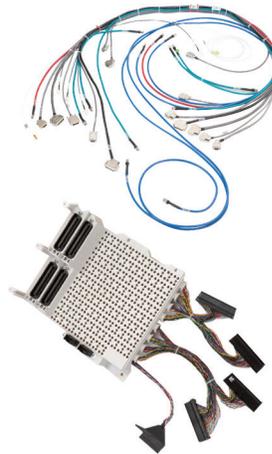
In addition, NAI manufactures assemblies for medical equipment, such as MRI, PET and CAT scan equipment, autoclave sterilization, DNA and chemical analysis hardware, patient handling equipment and other lab and test analysis equipment.



Telecom/Data

NAI outdoor and indoor products include cable assemblies and patch cords for:

- Upgrading cell towers for 4G & 5G LTE
- ADSL/VDSL
- Building Entrance Terminals
- Central Office assemblies
- Data centers and enterprise networks
- Full fiber optic jumper cable
- OSP and Central Office protector blocks and panels





QUALITY MANAGEMENT

QUALITY MANAGEMENT SYSTEMS AT NAI An Exhaustive Process for Precision

Strict Quality Processes

At NAI, we integrate the principles and tools of Lean Manufacturing in our everyday operations. Statistical Process Control methods are employed throughout our planning, sourcing, incoming materials, manufacturing and outgoing processes to reduce variation in our end products. Quality is the focus of relentless pursuit at NAI.

100% of NAI assemblies are inspected.

Fiber Optics: Inline Quality Control

State of the art equipment is employed for polishing, loss tests, laser cleavers, fiber fusion (splicing), cross section, thermo-chamber and immersion testing. All fiber optic cable assemblies are continuously tested throughout manufacturing for:

- Insertion Loss / Return Loss
- Attenuation
- Geometry, including concentricity and light continuity
- End face inspection after polishing

Air cleaning equipment removes contaminants at various stages of manufacturing.

If any part fails testing, the test unit automatically locks up. The operator is then required to have the Quality Dept. release the part from the test unit and fix the problem before continuing with assembly production.

Copper: Inline Quality Control

NAI produces copper cable assemblies and harnesses using leading edge test procedures and equipment to ensure optimal performance. Electrical tests include continuity, high voltage (HiPot) and capacitance. Some of the tests we perform include:

- Sub-assembly
- QA inspection
- Connector terminal height
- Tensile and pressure tests
- Interface resistance / voltage drop

NAI Certifications

NAI maintains the following certifications:

- ISO 9001:2015 – for overall QC
- ISO 13485:2016 – for medical product QC
- TL 9000 – H R6.0/5.0 or 5.5 – for telecom product QC
- AS 9100D – for aerospace cable QC
- 2011 C-TPAT
- UL and C(UL) certifications

In addition, we have also been certified for many other specific quality or product protocols as required by certain industries and customers, such as UL, Intertek and Nadcap. Let us know your project requirements, and we will obtain the necessary certifications.



Automated electrical testing
ensures product performance.



“Our customers’ product applications are critical to supporting industrial control systems for manufacturing, thereby preventing costly downtime. NAI provides reliable products that give us the confidence in the performance of our products. Their quality systems are exemplary.”

Quality Engineering Manager
Manufacturer of Industrial Control Systems

RELENTLESS QUALITY Means Reliable Performance

NAI Quality is All-Encompassing

There are many procedures and processes NAI uses as part of its Quality Management System. Here are just a few examples:

- An Out of Box Audit (OBA) is conducted by a Supplier Quality Engineer on all incoming material to test for any defects and determine if any CTQ tests (discussed below) are needed. In working with our supply chain, we have achieved a very high level of acceptability, well beyond the 99 percentile.
- NAI utilizes the Advanced Product Quality Planning (APQP) process and tools, similar to those used by major auto manufacturers, for the design and manufacturing of new products.
- Each product has its own Product Quality Planning Project Status Report that is updated continuously throughout manufacturing. Project tracking tools are used to monitor progress.
- All assemblies produced at NAI are traceable back to the station and worker, in the event of a defect.
- Every completed harness is fitted to the working board for final testing.
- NAI also uses a Critical to Quality (CTQ) process, which adds another layer of testing to the routine testing done on the production line. The CTQ defines additional parameters, typically identified by customers, which need to be tested to ensure the final product meets their specifications.

- Quality Management System engineers at NAI will service our rare customer complaints and utilize 8D problem-solving disciplines for resolution.
- Calibration technicians continuously monitor and maintain NAI’s measurement equipment. A preventative maintenance team monitors the life of tools and equipment and makes changes as needed.
- Kaizen events occur regularly at NAI, as the production teams strive to eliminate waste and improve processes.
- As a customer of NAI, you have access to all our extensive QC data associated with your project.

The Ultimate Packaging Protection

NAI will utilize both standard and custom packaging materials to ensure our customers’ products are shipped safely and securely. A few examples include:

- Tubing used to protect terminations.
- Styrofoam packing designs.
- Custom reels

*Custom reels,
when needed,
protect your
assemblies
at NAI.*



NAI utilizes innovative protection and custom packaging during manufacturing, as well as for shipping.





PARTS & MATERIALS

Global Procurement Expertise and Agility

Worldwide Sourcing

The global sourcing strategy at NAI is proactive and key to our ability to continue to serve our growing customer base. NAI utilizes an experienced Global Supply Chain Management Team to oversee the planning and implementation of this strategy. A Global Distribution Center in Nogales, AZ, incorporates Kanban and vendor managed inventory services.

At NAI, there is a major focus on reducing cycle time and integrated material component planning.

NAI Materials & Components

NAI utilizes a large variety of cables and connectors, along with other products and components. Our global sourcing operations often procure approved equivalent components that meet project specs and achieve overall cost savings. Here are just some of the components and materials used in typical assembly work:

Copper Cable	Fiber Optic Cable	Connectivity	Other Components
Hook-up Wire	Ribbon	Connectors	Ferrules
Cat. 3 – UTP, STP	Single Mode	Covers	Strain Reliefs
Cat. 5 – UTP, STP	Multimode	Housings	Shrink Tubing
Coaxial	Hybrid	Pins	Terminal Blocks
Multi-conductor	Simplex	Terminals	Potting Material and Epoxies
Power	Duplex	Contacts	Enclosures
			Boots, Bushings and More



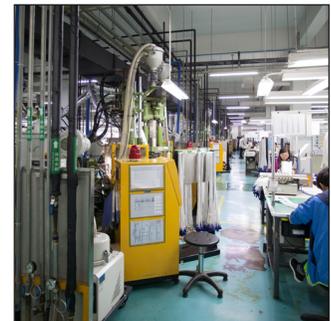
Sampling of NAI molded connectors.



Sampling of NAI molded components.

Molding Capabilities

NAI provides its own internal molding capabilities, when needed, to produce specific custom components, ferrules, boots and more. We use 3D printers and have substantial automated molding equipment, which can produce components in a variety of shapes and sizes in Silicone, ABS, PC, PVC, POM, PP, TPU, PA, PMMA and more. Our silicone molding equipment produces prototypes which can often be turned around in 3 to 7 days.



NAI makes the capital investments needed for customer projects, such as for this line of 16 state-of-the-art over-molding machines



TOP LEFT: Injection molding equipment provides capabilities to mold a broad variety of components.

LEFT: Over-mold equipment provides molding of strain reliefs, boots, etc.

“We visited one of the NAI plants, and we found the labor force to be well trained and committed to their work. NAI’s training program is outstanding, and, along with their capital strength, they were able to ramp up quickly for our project.”

Business Unit Manager
Telecommunications Company

THE PEOPLE AT NAI

Well Trained, Committed and Essential

The Passion Component

As a custom contract manufacturer with high labor content, the work force at NAI is critical to our success. Therefore, over the years, we have established unique systems to grow the expertise and professionalism of our personnel. As a result, we achieve levels of learning, commitment and teamwork that inspire passion and motivation.

An Organization Focused on Learning

To maintain a capable labor force in an ever-changing manufacturing environment, NAI has an entire team of expert trainers to work with new hires and establish specific training programs for each of them. Once the trainees move into production, the trainers continue to work with them, and efficiency and quality levels are tracked.

Responsive, Fast & Competitive

NAI aspires to continuously improve and reduce its overall cycle and response times. Whether for quoting, which is already considered to be fast by our customers, or for manufacturing and delivery, NAI will continue to strive for improvement.

Leadership “U”

NAI operates the “NAI University,” a formalized educational system within the company, for two purposes:

- 1) To promote leadership among the labor force.
- 2) To create more motivated and professional leaders at NAI.

NAI promotes a list of 21 qualities to become a leader. The NAI “U” defines a model for leadership and provides the training and tools for the development of leadership skills.



A member of NAI's Training Team teaches new hires by using established training programs specific to the project.

Community Outreach

Local community engagement is a company-wide value, featured on NAI's Strategic Architecture model, which drives company initiatives. NAI volunteer employees launch special programs on an ongoing basis to help support their local communities, and to make NAI a more socially responsible organization.



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PORTRAIT OF NAI A Manufacturing Success Story

Since Production Began in 1993, NAI Has Had an Explosive History.

NAI operates seven plants worldwide with nearly 600,000 sq. ft. of production capacity. Our current production levels are above 2.5 million assemblies, with over 25 million terminations per month...and growing. We employ over 3,200 personnel. Hiring and training are ongoing at NAI.

NAI is fast, nimble and flexible in accommodating any order, whether it's High Mix / Low Volume or High Volume / Low Mix. Our ability to meet varying needs, along with our delivery performance, is second to none.

One of the main advantages of working with NAI is our agility to ramp up quickly for any increase in demand.



Dedicated manufacturing cells and teams are assigned to customer projects.

NAI GLOBAL OPERATIONS Regionalized for Value & Proximity

Hermosillo, Mexico

NAI began with one plant in Hermosillo, Mexico in 1993. Today, there are four plants in Hermosillo, with over 400,000 square feet of manufacturing space.



Suzhou, China

Started in 2006, our Suzhou plant in China occupies nearly 130,000 square feet. Suzhou also features an adjacent plant which transacts in RMB currency for local customers in China.



Gaylord, Michigan, USA

One of NAI's newest plants is located in Gaylord, Michigan, USA. The 25,000 square foot plant includes injection molding, sterilization and the assembly of finished goods.



NAI Solutions Center, USA

700 Tower Drive,
Suite 125
Troy, MI 48098

Ph: 248-817-4106

NAI Administration Center, USA

7975 N. Hayden Road,
Suite D-105
Scottsdale, AZ 85258

Ph: 480-556-6066

Hermosillo, Mexico Plants 1-4

Ph: 52-662-250-9882
(From U.S., dial 011 prefix)

Suzhou, China Plants 1-2

Ph: 86-512-88169622
(From U.S., dial 011 prefix)

Gaylord, Michigan, USA Plant 1

Ph: 248-817-4106

NAI Distribution Center, USA

Nogales, Arizona
Ph: 520-281-0679

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