



Femap Case Studies Aerospace and Defense

Femap Case Studies

Aerospace and Defense



	Company	Description	Country
1	ABB Bomem	Satellite equipment	Canada
2	ADS International	Telescope manufacturer	Italy
3	Aquila Engineering	Aerospace services provider	Australia
4	Astroscale	Space research and development	Singapore
5	Columbia Helicopters	Helicopter operations and maintenance	USA
6	Damping Technologies Inc	Aerospace services provider	USA
7	Dynamic Concepts Inc	Aerospace structural engineering	USA
8	EADS Astrium Satellites UK	Satellite manufacturer	UK
9	Evektor-Aerotechnik	Aircraft manufacturer	Czech Republic
10	JAXA	Aerospace research and development	Japan
11	Lockheed Martin	Orion Multi-Purpose Crew Vehicle	USA
12	MT-Propeller	Propeller manufacturer	Germany
13	NASA	GLAS satellite	USA
14	NASA Goddard	James Webb space telescope	USA
15	NASA JPL	Mars rover Curiosity	USA
16	Noesim	Design and engineering services	Italy

Femap Case Studies

Aerospace and Defense

SIEMENS

	Company	Description	Country
17	Pagnotta Engineering	Consultants – space, flight and aircraft hardware	USA
18	Pagnotta Engineering	Consultants – space, flight and aircraft hardware	USA
19	Predictive Engineering	Consultants – aerospace landing gear	USA
20	Quartus	Consultants – SpaceShipOne analysis	USA
21	Quest Aircraft	Aircraft manufacturer	Australia
22	RUAG Aerospace	Satellite launch equipment	Sweden
23	Solar Impulse	Solar Powered Aircraft	Switzerland
24	Space Exploration Technologies	Launch vehicles	USA
25	SpaceWorks	Satellite design and manufacturing	USA

Challenges:

- Design of satellite borne equipment that must withstand the intense vibration of the launch and flight and yet be as light as possible to minimize additional weight and hence reduce cost of the satellite

Keys to success:

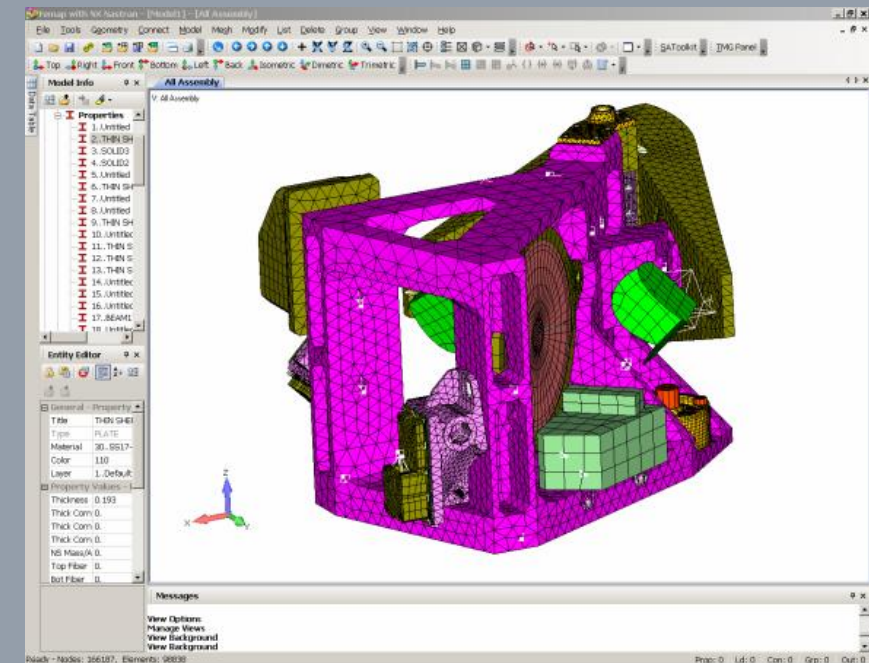
- Femap with NX Nastran and the Structural Analysis Toolkit

Results:

- Unmatched dynamic response capabilities and advanced postprocessing allowed faster turnaround time on analyses that speeded up product development and greater flexibility particularly with subsequent redesign of components

“The Femap with NX Nastran FEA system helps us develop products in the shortest amount of time possible”

*Nicolas Étienne
Mechanical Group Leader*



Challenges:

- Responding to unique demands of each customer in a reasonable time frame

Keys to success:

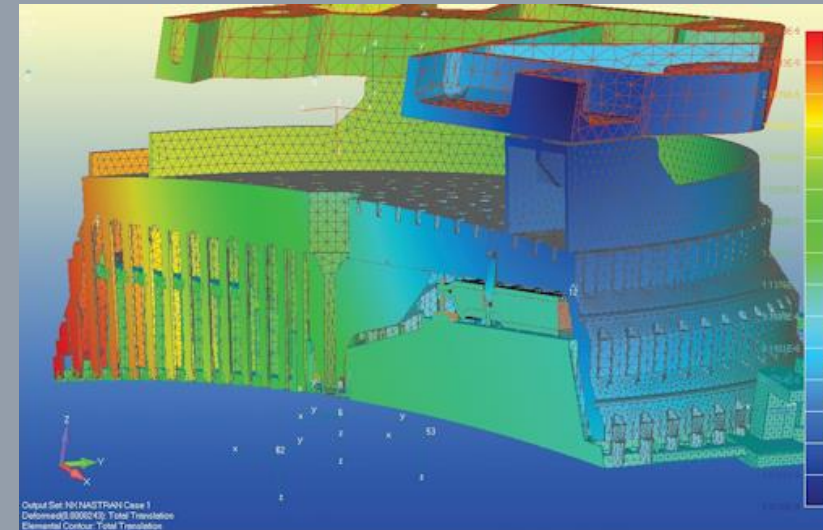
- Fast and robust CAD import
- Take advantage of multi-processor computers

Results:

- Faster analyses – solver cycle time reduced by 30%
- Easier customer interfacing due to universal acceptance of Nastran formats

“From the beginning, Femap showed a profitable cost / benefit ratio. Using Femap, we can import geometry from any 3D format, helping us quickly switch from a virtual prototype to the FE model with a consistently accurate import process.”

Paolo Lazzarini, System Engineer



Challenges:

- Aircraft modifications that must be cost effective and meet regulatory requirements

Keys to success:

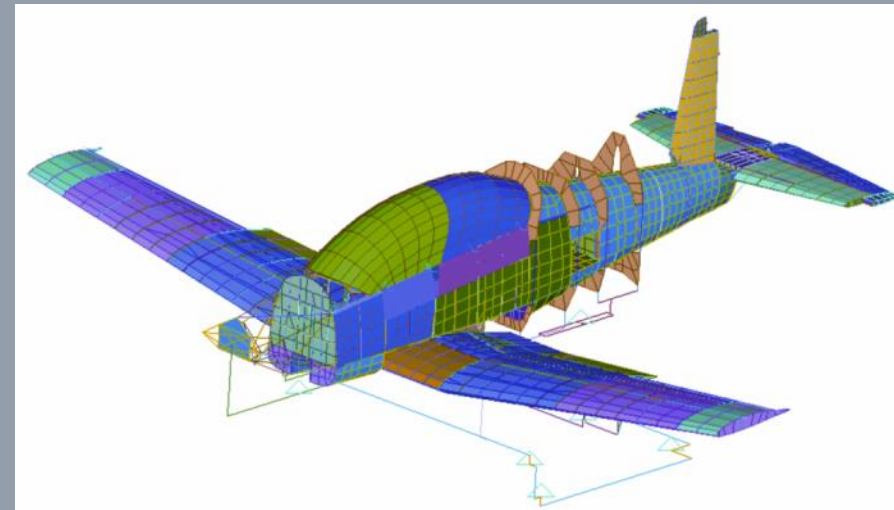
- Adopt usage of an FEA solution (Femap with NX Nastran) that can import NX CAD geometry and is compatible with legacy FEA models

Results:

- Higher engineering productivity bringing about significant cost savings and reduced time required for prototyping and physical testing

“Femap with NX Nastran directly improves the quality of our work, and this is seen in the reduction of prototyping and testing required.”

Ben Terrell, Engineering Manager



Astroscale

Space Research and Development

SIEMENS

Challenges:

- Achieve fail-safe designs with limited resources
- Support faster product development
- Collaborate with multiple companies

Keys to success:

- Implement a cost-effective and easy-to-use CAE solution
- Apply Femap for design verification on an artificial satellite
- Use pre- and postprocessors that support multiple types of CAD data from joint development partners

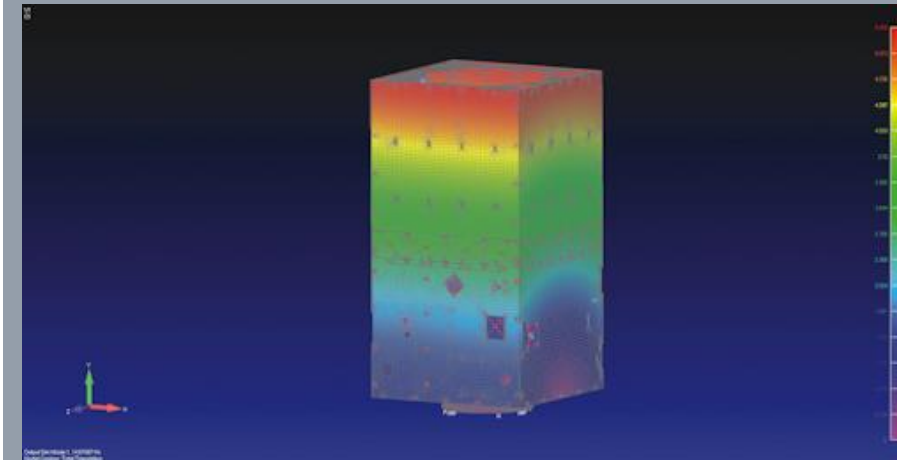
Results:

- Easily created analysis models from 3D CAD models
- Implemented the required analysis with high performance and efficiency
- Achieved high cost-efficiency by using primary 3D CAD data for analysis

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“The mesh creation feature of Femap is easy to use, and its operation is straightforward and intuitive. You can create high-quality meshes with the automatic mesh creation tools and easily adjust them manually.”

Yuta Araki, Engineer



Columbia Helicopters

Helicopter Operations and Maintenance

SIEMENS

Challenges:

- Increase the helicopters lifting capacity and perform repairs as quickly as possible

Keys to success:

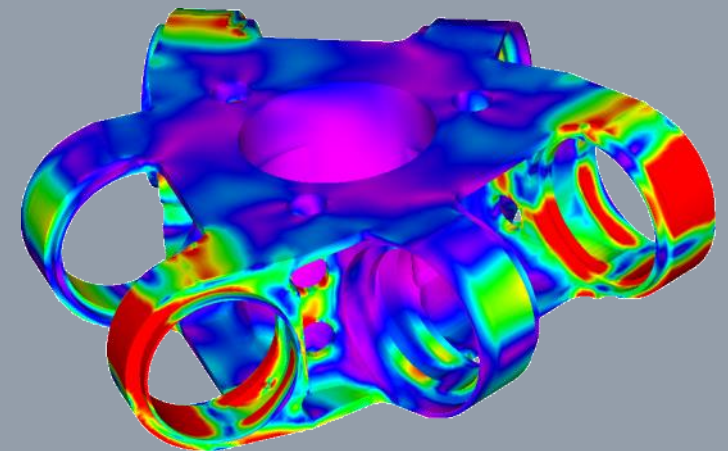
- Use of FEA to optimize structural design, reduce physical testing and speed up FAA approval

Results:

- The use of Femap with NX Nastran provided faster part validation for FAA approval, brought about reduced costs and fewer delays through reduced physical testing, and increased lifting capacity with optimized weight reduction of structural components

“The lighter the helicopter is, the more it can lift, and the more it can carry in one load the more money we make. With FEA, we can validate how much material we can remove from a part and still maintain safe margins, Without FEA you could go too far or not far enough in the weight reduction.”

*Ron Heberlein,
Senior Mechanical Engineer*



Challenges:

- Accelerate the pace of R&D and be able to quickly design application specific damping solutions

Keys to success:

- Upgraded to the faster NX Nastran and Femap solution

Results:

- Faster analysis throughput and a 75% reduction in run times for complex dynamic analyses, with new knowledge leading to damping innovations

"I was used to ANSYS, but as I worked through the Femap tutorials, I found that it was intuitive and that I could get up and running with it quickly. It's flexible and intuitive."

Kristopher Notestine, Manager R&D



Challenges:

- Assist customers with solutions to complex problems supporting innovation in space exploration

Keys to success:

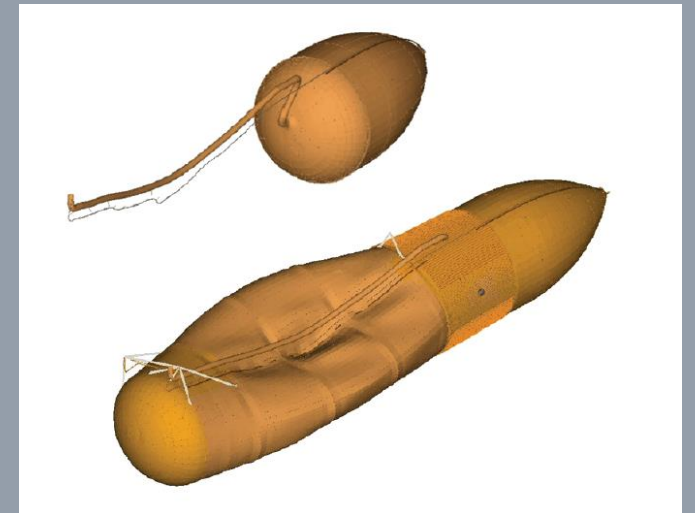
- Use of Femap with NX Nastran to provide fast accurate analysis and simulation

Results:

- Faster more accurate analysis was achieved with more in-depth insight into behavior of complex structures – support of advanced studies was enhanced with improved FE models and documentation

“With Femap we can quickly produce animations of the analysis results using the entire model, from inside or outside the structure and from any angle, depending on the interest. Femap takes all that engineering data and communicates it in a clear and intuitive way”

Anthony Williams, Senior Engineer



Challenges:

- Reduce satellite development time

Keys to success:

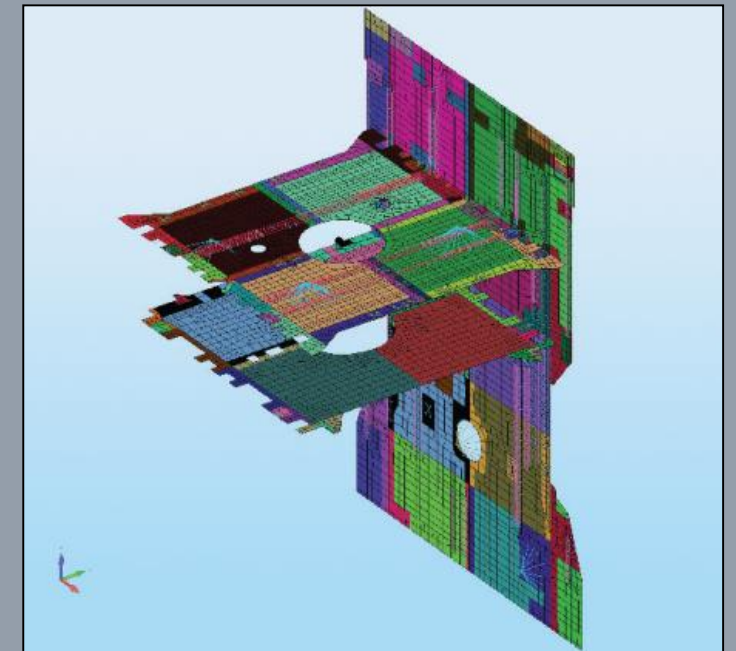
- Use of FEA to increase understanding of complex designs

Results:

- Quick model generation, easy handling of multiple modeling scenarios and the ability to automate certain processes allowed fast design validation

“Everything we do is about trying to get it right the first time. Our success depends on how thoroughly we conduct the simulation and how quickly we get the results out.”

Glenn Harris, Structural Engineer



Challenges:

- To remove weight from aircraft designs while ensuring highest safety and quality

Keys to success:

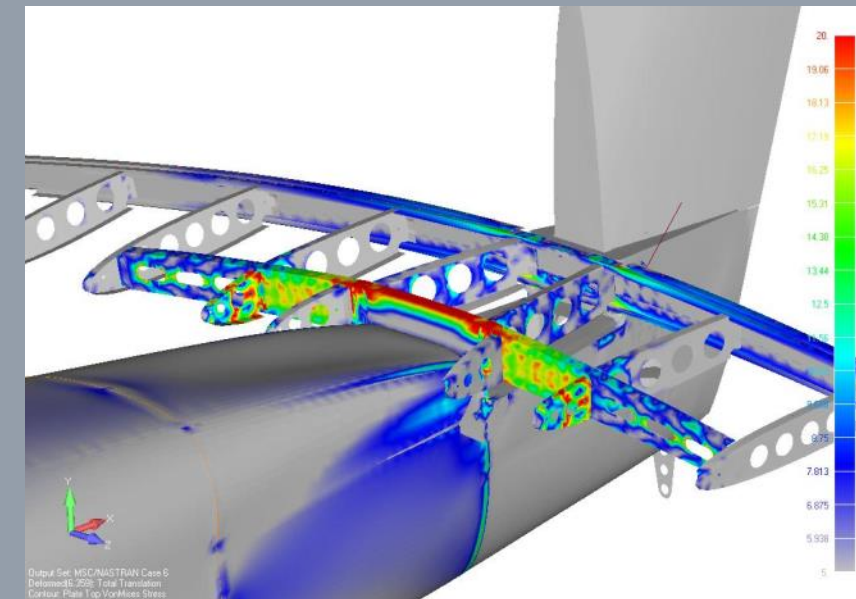
- Customization through the API and Femap's flexible postprocessing control helped expedite the simulation process

Results:

- Awarded FAA special airworthiness certificate and created new aircraft models that impress the industry

“Femap’s value cannot be beaten by more expensive pre- and postprocessors, Femap really has no competition, and we are completely satisfied with the product’s functionality.”

Milan Bureš, Structural Engineer



Challenges:

- Use CAE modeling tool of choice
- Reduce training workload
- Create environment for efficient analysis

Keys to success:

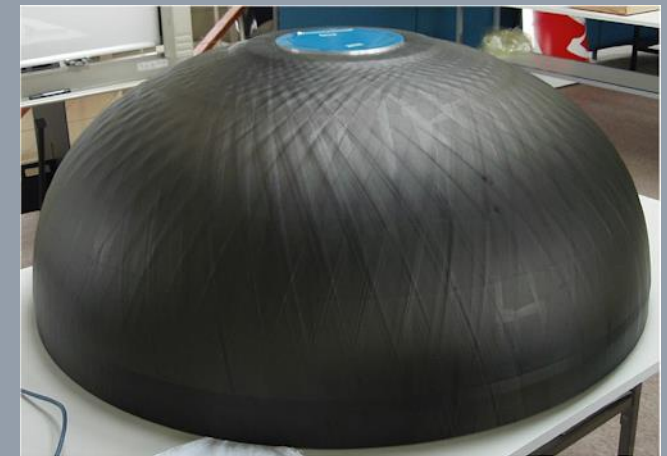
- Use of a pre- and postprocessor that works with various CAE solvers
- Employ intuitive user interface
- Generate and directly edit meshes

Results:

- One pre- and postprocessing tool for all CAE projects
- Significantly reduced training costs
- Substantially more time for R&D
- Quick editing
- Easily generated custom analysis models

“There are two types of preprocessors: those that are good at generating a mesh top down from CAD geometry or those that are good at generating a mesh from the bottom up. Having both capabilities in one package – as Femap does – is pretty rare. We actually need both, so Femap works very well for us.”

*Dr. Akinori Yoshimura,
Innovative Materials Section Researcher*



Lockheed Martin Space Systems

NASA Orion Multi-Purpose Crew Vehicle

SIEMENS

Challenges:

- More than 900 load cases associated with launch and abort
- FE models with up to one million elements
- High volume of results data to sort through to determine critical load cases

Keys to success:

- Integrated solver and pre- and postprocessor
- Easy-to-use pre- and postprocessing (utilizing Windows) with powerful visualization
- Ability to import Pro/ENGINEER CAD geometry
- Creation of custom functions using the API

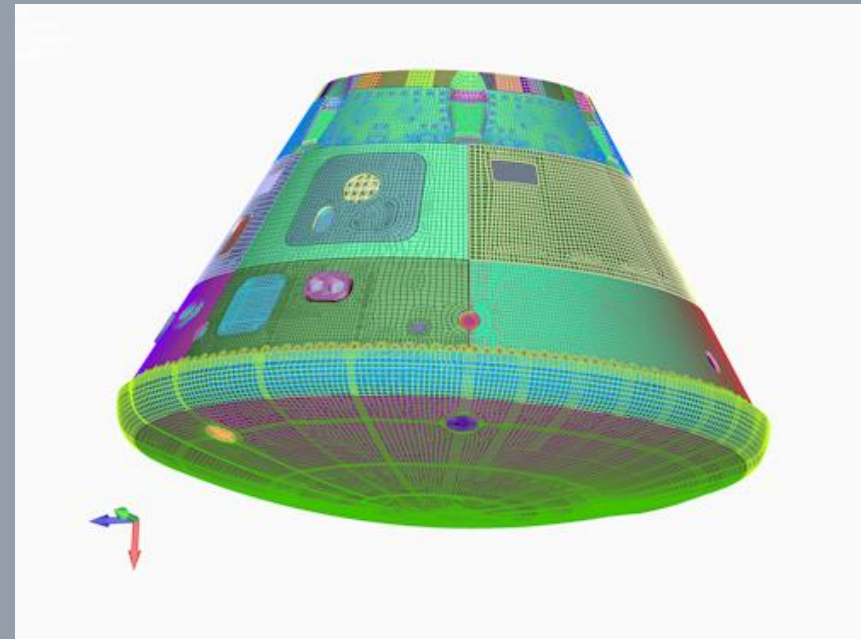
Results:

- Complicated trade studies completed in two weeks
- Improved accuracy through visualization and geometry manipulation tools that help confirm the FE model was properly created
- Ability to sort through hundreds of load cases quickly using data ranking and free body functions
- Automation of routine tasks via scripts saves time and increases accuracy

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“We like the free body tool because we can do section cuts through the vehicle at different stations and figure out the load paths to see what types of loads are in the different areas very quickly.”

Eric Lewis, Senior Staff Engineer



MT-Propeller

Propeller Manufacturer

SIEMENS

Challenges:

- Retain edge in product development and increase production efficiency
- Reduce physical testing and the number of prototypes
- Secure the a competitive advantage

Keys to success:

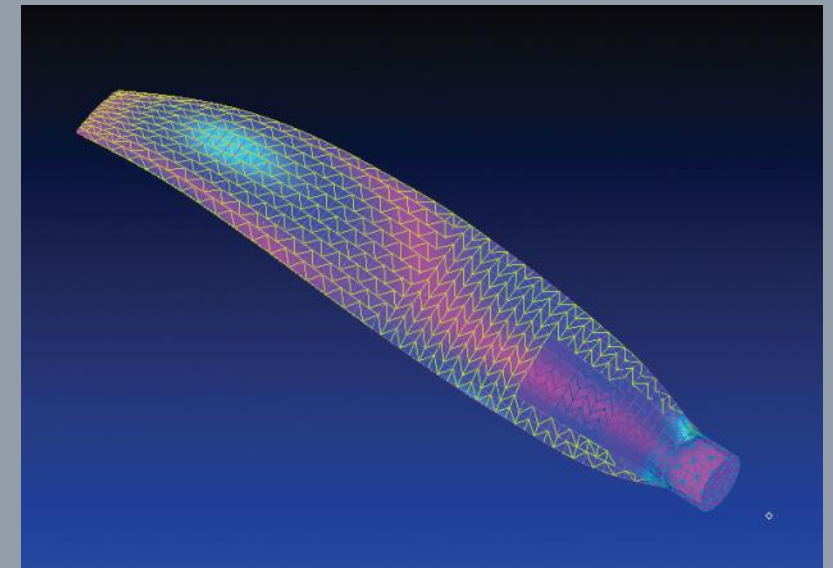
- Introduce new product developments and enhancements
- Leverage FEA for materials testing

Results:

- Reduced number of tests and prototypes and compressed production times
- Pushed back material boundaries and improved manufacturability
- Increased sales and growth

Femap and NX Nastran have played a major part in the company's growth. With these tools, we are able to push material boundaries even further and what we build is thus much lighter, but just as safe."

Martin Albrecht, CEO



Challenges:

- The satellite's laser transmits light through several instruments within the system
- Positional error between the various components must be extremely low

Keys to success:

- To meet these requirements, physical testing and computer simulation using Femap are used to predict the response of the satellite to the stresses of space flight

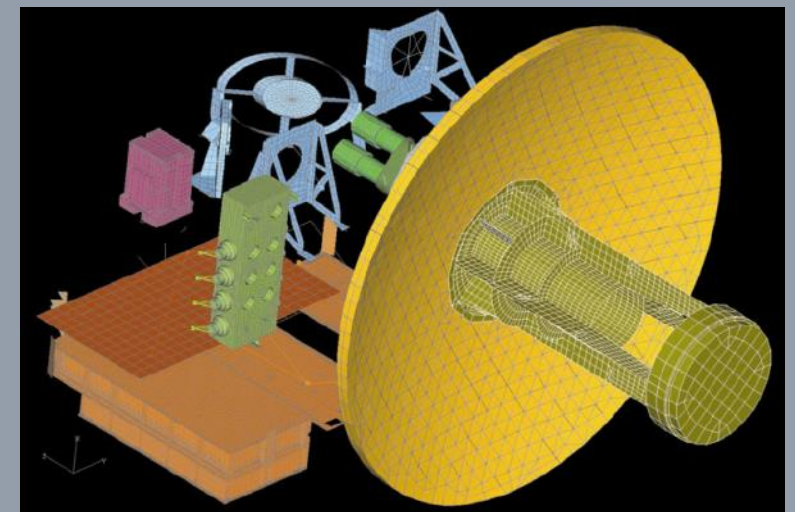
Results:

- The use of analysis has made it possible to eliminate physical testing for some individual components

“The ease of creating the analysis model, combined with powerful post-processing tools, has reduced turnaround time for many analyses. In addition to overall ease-of-use, many features within Femap are helpful to our work”

Ryan Simmons

Lead Mechanical Analyst for GLAS



Challenges:

- Multiple CAE solvers used for modal, thermal, thermal distortion and structural analysis

Keys to success:

- Using a single pre- and postprocessor for multiple analysis applications
- Assembly of very large FE models
- Clear visualization of structural models

Results:

- Standardizing on Femap shortens learning curve
- Clear understanding of analysis results
- Finding and fixing potential problems long before the telescope is launched

“Femap is a very usable tool that is at once very affordable and also provides high value. It enables us to carry out our mission of analyzing the structural and thermal performance of parts and systems. Femap is easy to learn and use, and works well with any solver.”

Mark McGinnis, Project Lead



NASA Jet Propulsion Laboratory

Mars Rover “Curiosity”

SIEMENS

Challenges:

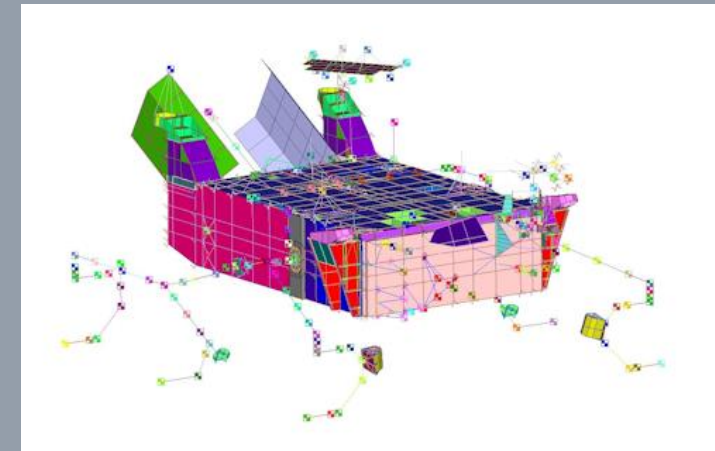
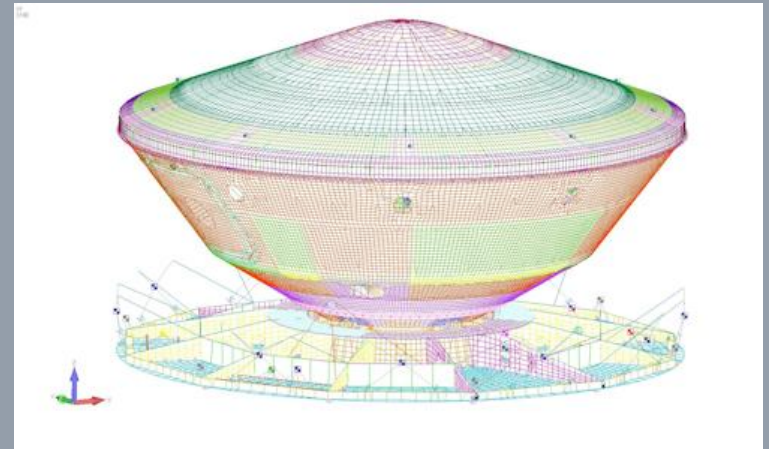
- Designing and building a new roving Mars Science Laboratory
- Developing and implementing a totally new landing procedure for “the hardest mission ever...”
- Missing the launch window deadline would mean more than two years of delay

Keys to success:

- Innovative, one-of-a-kind product development
- Thorough project planning and execution
- Precision engineering and fabrication

Results:

- A soft landing with no damage to components
- Continuing a new era in Mars exploration
- Determining whether Mars could ever have supported life



Challenges:

- Implement CAE software that can interface across CAD packages
- Acquire multi-disciplinary analysis tools to fully utilize in-house expertise

Keys to success:

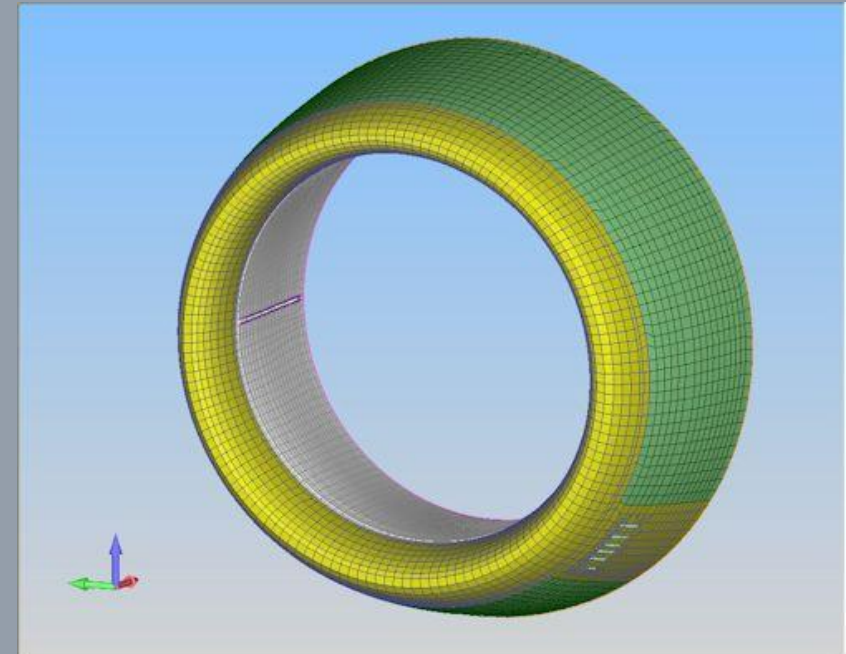
- Use of the de facto standard solver for the aerospace industry working with Windows-native software

Results:

- Automated the CAE process from simulation model generation to analysis and final reporting
- Reduced finite element modeling time ensuring early design validation
- Reduced prototyping costs for customers

“Femap can be customized and enriched with tools to automate the entire process of model generation, analysis, calculation and data management.”

Franco Belloni, Co-founder



Pagnotta Engineering

Consultants – Space, Flight and Aircraft Hardware

SIEMENS

Challenges:

- Expectation of fast turn around of analysis results from Pagnotta's customers

Keys to success:

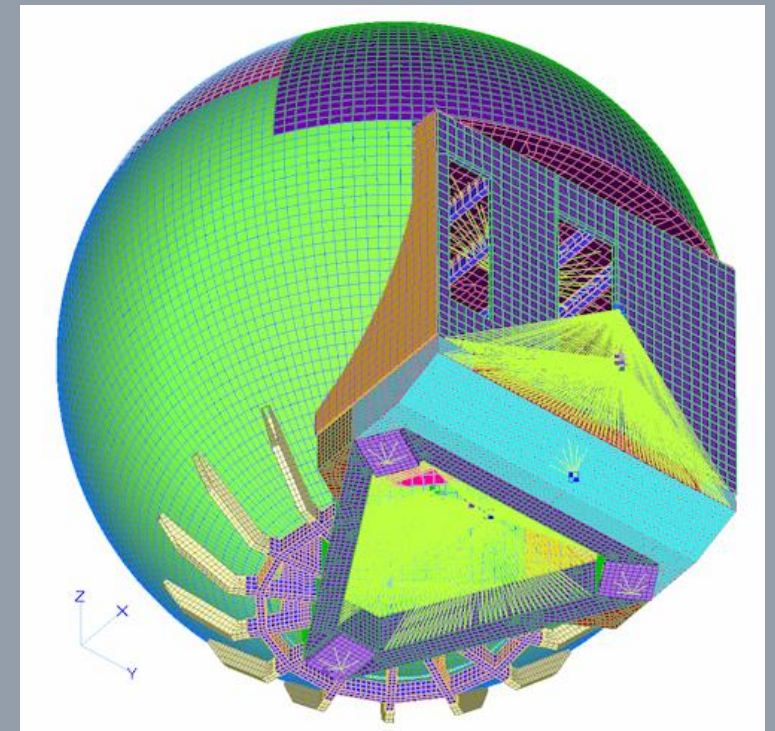
- Use of Femap with NX Nastran, well-known and well-respected solutions, gave Pagnotta's clients confidence in the analysis results

Results:

- Fast and easy-to-use modeling tools reduced modeling and analysis time and allowed Pagnotta to deliver "responsive quality engineering" to their customers

"The new interface of Femap has increased our efficiency for both model generation and analysis of results"

Mike Pagnotta, President



Pagnotta Engineering

Consultants – Space, Flight and Aircraft Hardware

SIEMENS

Challenges:

- Quickly design a support structure for a 555 lb IMAX camera within a Unrestricted amount of space in the shuttle Atlantis

Keys to success:

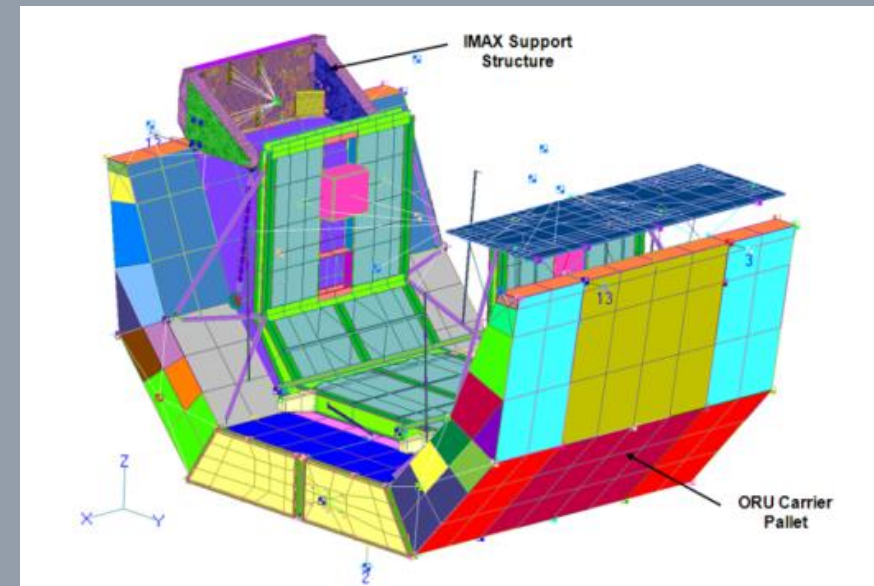
- Ability to quickly perform trade-off studies through the use of Femap with NX Nastran

Results:

- Complex design task completed in five months and a satisfied customer

“Femap is used by everyone at NASA. Everyone is comfortable with it and knows how powerful it is.”

Mike Pagnotta, President



Predictive Engineering

Consultants – Aerospace Landing Gear

SIEMENS

Challenges:

- Proposal stage structural analyses of the landing gear of the Boeing 787 aircraft

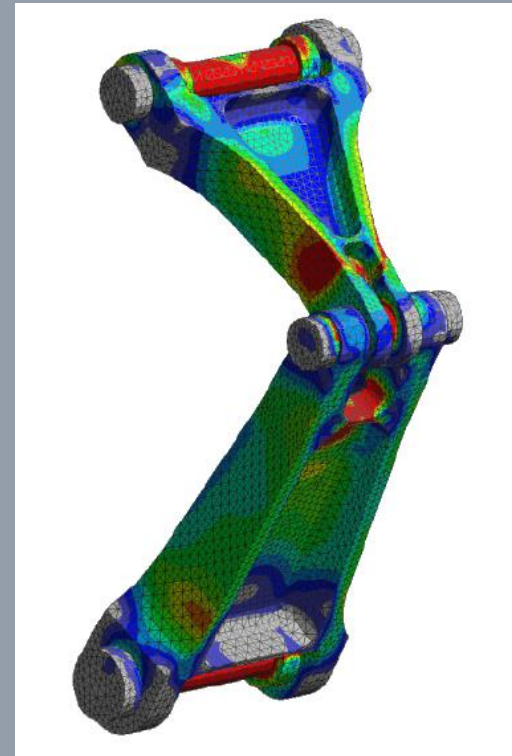
Keys to success:

- Use of Femap's strong solid modeling functionality with direct Catia import capabilities

Results:

- Efficient creation of FEA models based on preliminary designs exported from Catia V4 and V5 which helped Messier-Dowty win the 787 landing gear contract

“Femap was an invaluable tool with direct Catia import capabilities and its own strong solid modeling capabilities”
George Laird, President



Challenges:

- To complete two successful manned flights and claim the Ansari X-Prize

Keys to success:

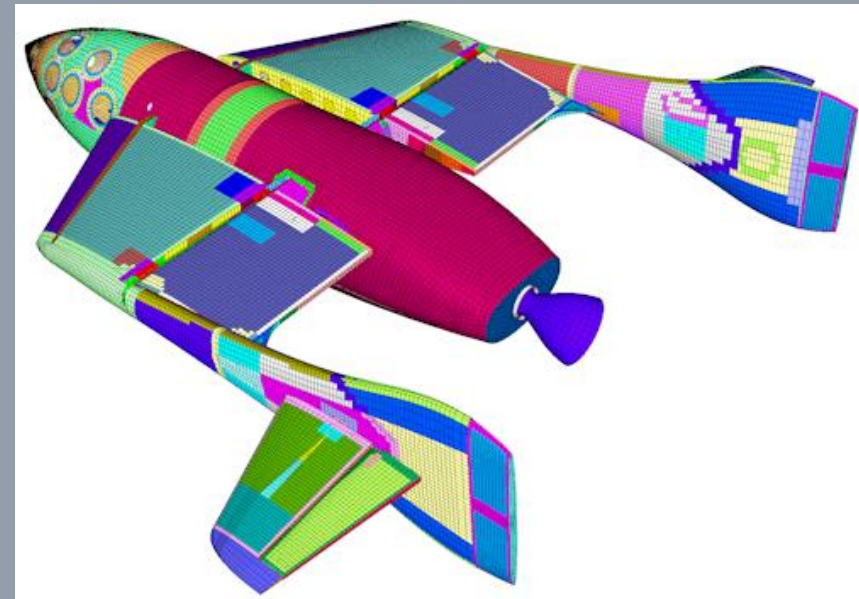
- Use of Femap with NX Nastran to design SpaceShipOne

Results:

- Beat all competitors into space and met all mission requirements
- The vehicle experienced no aeroelastic flutter issues during two suborbital flights and subsequent atmospheric re-entry and landings

“In our work with SpaceShipOne, we selected Femap as the central processor before going to Nastran. In our opinion, it’s one of the best solutions on the market, and it’s very easy to use”

*Chris Flannigan, Quartus Co-founder
and Vice President of Engineering*



Quest Aircraft

Aircraft Manufacturer

SIEMENS

Challenges:

- Design and certification of a new design of aircraft

Keys to success:

- Use of Femap with NX Nastran – easy to learn FE software with full functionality

Results:

- Reduced physical testing and development costs
- Time for part validation reduced by a factor of 4
- Achieved FAA certification within seven months

“I think the best feature of Femap with NX Nastran is that it was really easy to get started. Using Femap we were able to obtain information that would have taken four times as long to get from physical testing”

Brenton Ellis, Design Engineer



Challenges:

- Shortened project durations
- Requirement for fast and accurate model validation
- Overall goal to reduce overhead costs

Keys to success:

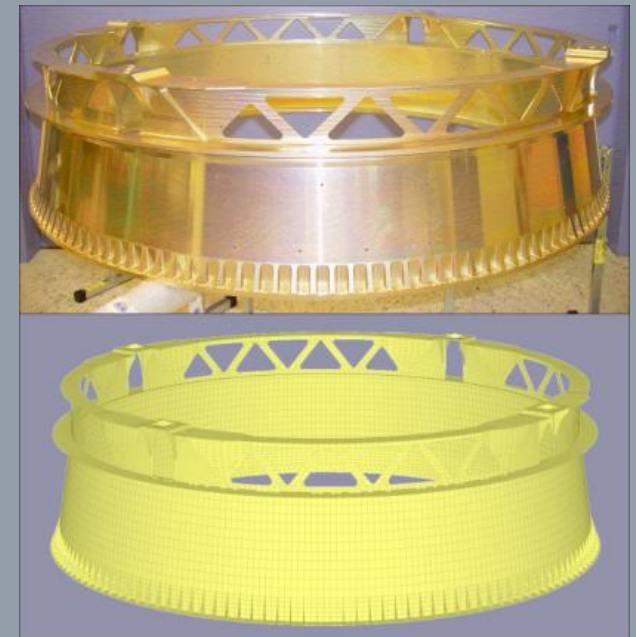
- Use of Femap allowed easy access to CAD geometry and easy definition and evaluation of laminate structures

Results:

- Significant reduction in modeling time through the use of automated meshing functionality
- Faster analysis turn-around time for more detailed and more accurate models

"Femap's ability to import geometry enhances the quality of the analysis, and this feature of Femap lets us add more detail to the models so we get more accurate results."

Jan-Erik Larsson, Head of Engineering



Solar Impulse

Solar Powered Aircraft

SIEMENS

Challenges:

- Optimize the design of the plane's metal components, composite and sandwich structures of the Kevlar paper honeycomb core to minimize weight

Keys to success:

- Integrated FEA solver, pre and postprocessor that supports a wide range of analysis types
- Ability to import geometry created using CATIA
- Custom functions created using the Femap API
- Fast interpretation of results using data table; ability to combine output sets
- Collaboration with Siemens partner AeroFEM

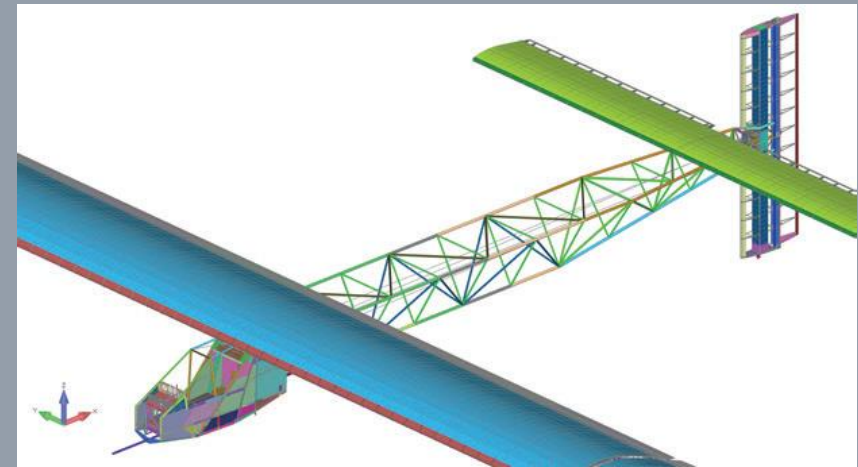
Results:

- Cockpit size increased by a factor of 3 with less than a 2X increase in weight
- Ability to optimize carbon fiber ply thickness and number of plies helped hold down weight of wing structure

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“Using Femap, it was really fast to see what we had to work on and where we could optimize.”

Geri Piller, Head of Structural Analysis



Space Exploration Technologies

Launch Vehicles

SIEMENS

Challenges:

- Develop rockets that reduce the cost of space access by a factor of 10

Keys to success:

- Create virtual mockups of entire rockets using Femap and NX software

Results:

- More effective collaboration between design groups
- 50% productivity improvement
- Successfully launched two Falcon 1 rockets

"On the analysis front Femap and NX Nastran were the clear winners, not only due to wide industry acceptance but also from an ease of use and support standpoint."

Chris Thompson, Vice President of Development Operations



SpaceWorks

Satellite Design and Manufacturing

SIEMENS

Challenges:

- Create off-the-shelf structural models for fast satellite assembly, test and launch

Keys to success:

- Used Femap's versatile modeling functionality with the advanced analysis capabilities of NX Nastran to gain insight into structural performance

Results:

- Completed virtual testing to the required accuracy fast enough to allow the satellite designs to be verified in days rather than months

“Creating advanced models that are both accurate and fast definitely gives us a competitive edge and has become a critically important contribution on these fast-paced, technically challenging spacecraft projects.”

Jeff Preble ,President

