

## Cindy L. Klahn

### Summary of Qualifications

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| <ul style="list-style-type: none"> <li>▪ Aircraft Structural Integrity – Failure Analysis</li> <li>▪ Composite Structural Analysis/Design</li> <li>▪ Design and Analysis of Aircraft Structures</li> <li>▪ Finite Element Analysis – FEMAP, Patran, NASTRAN, Marc</li> <li>▪ Design and Analysis of Aircraft Structures</li> </ul> | <ul style="list-style-type: none"> <li>▪ Fatigue Damage Tolerance - AFGROW</li> <li>▪ Static, Strength and Fatigue Testing and Analysis</li> <li>▪ Education, Training and Mentorship</li> <li>▪ Engineering Program Management</li> </ul> |
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### Experience

Sep 2014 to Present	SAFE Inc.	Monument, CO
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#### Senior Engineer

- Led team of 5 engineers analyzing critical teardown findings for KC-135 teardown program
  - Combination of classical stress analysis and finite element calculations to determine loads
  - Performed fatigue damage tolerance analysis including crack growth and residual strength evaluations for each detail (AFGROW)
  - Reviewed existing inspections and recommended changes based on analysis
  - Currently leading follow-on program using detailed FEA to refine loads for FDT and correlation of models to teardown findings – FEMAP/NASTRAN
- Lead engineer for material testing program for supersonic particle deposition (SPD) materials
  - Responsible for test matrix, test plans, results, and preparing documentation for approval by FAA for SPD materials
  - Coordinated all phases of the program from specimen design, manufacturing, quality control and testing
- FAR Part 25 stress and fatigue damage tolerance (FDT) engineering services
  - Structural substantiation for Boeing 757 and 767, IAI KFIR C2 parts identified for proposed repair with SPD
  - Classical stress analysis and fatigue damage tolerance – FEMAP/NASTRAN, AFGROW
- Engineering analysis reviewer for substantiation reports for replacements parts for Lockheed L-1649A restoration

Jun 2008 to Sep 2014	CLyK Engineering Inc., US Air Force Academy	Colorado Springs, CO
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#### Senior Research Engineer/Program Manager (Center for Aircraft Structural Life Extension)

- Lead – B-1B teardown planning team and the C-130 empennage teardown program
- Conducted failure analysis evaluations for KC-135 destructive teardown program determining root cause of failure
- Finite element analysis – developed and analyzed models ranging from test coupons to complex stiffened structural panels
- Developed and documented robust processes for all aspects of teardown program ensuring all pertinent data was captured and available for fleet decision makers

Apr 2005 to Jun 2008	NexAer Inc. & Enfusion Technologies Inc.	Colorado Springs, CO
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#### Co-founder and Lead Engineer

- Used problem solving skills to develop solutions for all aspects of the businesses: co-authored business plans, wrote proposals, researched business opportunities, presented plans and strategies to prospective investors, customers, and economic development entities, performed structural design work, and testing
- Designed composite landing gear using finite element analysis for Nexaer LS-1 aircraft saving 40% on weight, completed design and fabrication in 2 weeks (vs. 8 weeks for aluminum gear), and saved 50% of the cost compared to aluminum landing gear alternative
- Led engineering team to design, build and fly all-composite, general aviation aircraft from napkin drawing to first flight in less than two years
- Structural design engineer for lighter than air vehicle which was successfully demonstrated as a remote area communications platform

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Jun 2000 to Apr 2005	United States Air Force Academy	USAF Academy, CO
<b>Dep. Lab Director/Cost Ctr Mgr, Dept of Engineering Mechanics Assistant Professor</b>		
<ul style="list-style-type: none"> <li>▪ Taught statics and mechanics of materials, systems acquisition course covering entire DoD acquisition process, engineering systems design and aerospace composite materials courses</li> <li>▪ Rated top 5% of instructors at USAFA by students</li> <li>▪ Technical advisor for multiple cadet projects including structural weight reduction research for rocket design, and cadet competition teams (Formula-1, human-powered vehicle, heavy-lift)</li> <li>▪ Academic advisor and mentor to 25 cadets in three majors</li> <li>▪ Deputy Lab Director and Cost Center Manager: Planned and executed department budget of \$700K for supplies and new equipment—supervised five purchasing agents and monitored department and division travel, operations, maintenance and gift funds</li> </ul>		
Jan 1998 to Jun 2000	German Flight Test Center, WTD-61	Manching, Germany
<b>Flight Test Engineer - USAF Exchange Engineering Officer</b>		
<ul style="list-style-type: none"> <li>▪ Selected as USAF representative to Germany for highly competitive Engineer and Scientist Exchange Program. Expertly briefed Secretary of the Air Force Acquisition Staff quarterly on new developments of joint US, German, Dutch and European Union research projects</li> <li>▪ Structural analyst supporting flight and ground tests of aircraft and weapon systems.</li> <li>▪ Projects included impact and static analyses for test equipment installation</li> <li>▪ Design of adapter for the MiG-29 to US aircraft test stands for engine run-up tests and composite spar design for a high altitude, long-endurance aircraft</li> <li>▪ Gained insight into foreign research, development and testing methods</li> </ul>		
Jan 1995 to Jan 1998	Air Force Research Laboratory	Wright Patterson AFB, OH
<b>Aerostructures Research Engineer, Air Vehicles Directorate</b>		
<ul style="list-style-type: none"> <li>▪ Lead engineer for adaptive wing-warping technology research responsible for technology development plan and research analysis</li> <li>▪ Principal finite element analyst for two wind tunnel tests investigating variable stiffness wing structures</li> <li>▪ Managed \$500K flight test demonstration program for active vibration suppression system on B-1B</li> </ul>		
Aug 1993 to Jan 1995	NASA Goddard Space Flight Center	Greenbelt, MD
<b>Aerostructures Research Engineer, Air Vehicles Directorate</b>		
<ul style="list-style-type: none"> <li>▪ Program for Research and Education in Space Technology National Scholarship (PREST) sponsored by NASA</li> <li>▪ Analyzed satellite systems and payloads including Advanced Camera Enclosure for the Hubble Space Telescope</li> <li>▪ Recommended design changes to satellites based on finite element analysis (NASTRAN and Patran FEA programs)</li> <li>▪ Evaluated range of motion, dynamic response, and structural strength of systems and mechanisms</li> <li>▪ Received the NASA Group Award for outstanding work on the X-Ray Spectrometer Satellite</li> </ul>		
<b>Education</b>		
Aug 1993 - Jan 1995	George Washington University	Washington, D.C.
<b>MS – Mechanical Engineering</b>		
Aug 1989 - Jan 1993	US Air Force Academy	Colorado Springs, CO
<b>BS – Mechanical Engineering</b>		
<b>Professional Affiliations</b>		
Member, American Society of Mechanical Engineers (ASME)		

## Cindy L. Klahn

### Specialized Training

Siemens FEMAP Finite Element Analysis, April 2017  
Fatigue and Damage Tolerance Analysis Course, Sep 2013  
Failure Analysis and Prevention for the Air Logistics Center Engineer, 2009  
Squadron Officer School by Correspondence, 1999  
Acquisition Professional Development Program Certified Level I: Systems, Planning, Research, Development and Engineering  
Acquisition Professional Development Program Certified Level I: Test and Evaluation USAF Acquisition

### Awards

EAA Chapter 72 "Spirit of Experimental Aviation Association for Outstanding Contribution," 2002  
Air Force Commendation Medal, 2000  
Air Force Achievement Medal, 1997, 1999  
Flight Dynamics Directorate Company Grade Officer of the Quarter (4th Quarter), 1997  
Finalist Wright Laboratory Commander's Group Award: Variable Stiffness Wing Effort, 1996  
Group Award from NASA: X-Ray Spectrometer Satellite, 1994  
Program for Research and Education in Space Technology National Scholarship (PREST), 1993

### Publications

#### USAF Technical Reports

SAFE Engineering Inc.. "Analysis of KC-135 Teardown Program Failure Analysis Findings," SAFE-RPT16-005, February, 2016.  
Shah S., C.L. Klahn, and I. Pryce. "KC-135 Upper Wing Skin Study," USAFA-TR-2013-04, 2013.  
Klahn, C. L. et. al. "B-1B Teardown Planning Effort: Final Report," USAFA-TR-2013-03, 2013.  
Klahn, C. L. et. al. "C-130 Empennage Structural Teardown Analysis," USAFA-TR-2012-06, 2012.  
Shah S., C. L. Klahn, and M. Seebeck, "KC-135 Wing Joint Fitting Material Characterization," USAFA-TR-2012-01, 2012.  
Klahn C. L. and G. A. Shoales, "C/KC-135 Teardown Analysis Program Protocols, Protocol 3: Teardown Section Extraction," USAFA-TR-2009-01, 2010.

#### Conference Proceedings

Hustedde, C. L., S. F. McGrath, and M.A. Hopkins. "Further Investigations of the Aeroelastic Tailoring for Smart Structures Concept," 38th AIAA SDM Conference, April, 1997.  
Hollkamp, J. J., C. L. Hustedde, and R. W. Gordon. "Effects of Damping on a Blade-Disk Assembly," 38th AIAA SDM Conference, April, 1997.  
Giese, C. L. et. al. "An Investigation of the Aeroelastic Tailoring for Smart Structures Concept," 37th AIAA SDM Conference, Paper 96-1575. April, 1996.