NASGRO is a suite of programs used to analyze fracture and fatigue crack growth in structures and mechanical components. The software is developed jointly by Southwest Research Institute® (SwRI®) and NASA under a Space Act Agreement, with additional support from the NASGRO Consortium and the FAA.

NASGRO consists of integrated modules with user-friendly graphical interfaces that:
- Calculate fatigue crack growth (FCG) life, critical crack size, and stress intensity factors (K)
- Store, retrieve, and curve-fit FCG and fracture toughness data
- Calculate Ks and stresses using 2-D boundary element method

NASGRO is the most widely used fracture mechanics and fatigue crack growth software in the world today.

Recent Enhancements
Recent enhancements available in the current version 9.0 include:
- New GUI options for selection of stress intensity factor models
- New K solution for through crack growing toward a hole
- New K solution for two collinear through cracks of unequal length
- New K solution for through crack at edge of plate with one symmetric step change in thickness
- New bivariant weight function K solution for offset semi-elliptical surface crack at offset hole
- New K solutions for obliquely loaded tapered lugs with through or corner crack on long ligament side of hole
- Addition of compounding capability to 3- and 4-dof K solutions
- New failure assessment diagram (FAD) capabilities for bivariant weight function models CC09, SC31, EC04
- New capability to create and import load block filesets for complex spectra
- New implementation of ESA strip yield model
- New option to set absolute or relative file paths
- New material data sets in NASMAT

Future Development
Major new features planned for version 9.1 include:
- New K solution for displacement-controlled surface crack
- New K solution for displacement-controlled off-center through crack
- Addition of bending restraint options to K solution for through crack in L-section
- New K solutions for through cracks in C-section
- 2-D data table (DT and KT) models for one or two through cracks (two tips)
- Bivariant monotonic shakedown capabilities
- Polynomial input option for residual stress

Plans for future versions include:
- New NASGRO module for FAD assessment
- New weight function K solution for surface crack in round bar or hollow shaft
- New K solution for curved off-center through crack
- Superposition methods for time-dependent crack growth
- Simple method for using Paris equation
- Approximate (compounding) approach for multi-site damage
- Additional K solutions for other unique geometries

NASGRO equation curve fit to da/dN data

Advanced science. Applied technology.
Crack Growth Module
- Over 85 different $K$ solutions
  - Uniform tension/bend/pressure/pin load
  - Uniaxial/biaxial/uniaxial weight
  - User-defined tables
  - Generalized compounding
- Multiple crack growth equations
  - NASGRO, Walker
  - Tabular $da/dN$ vs. $\Delta K$
  - Temperature effects
- Multiple load interaction models
- Multiple load history input formats
- Load spectrum visualization, editing, cycle counting
- Multiple analysis options
  - Calculate $K$, life, $da/dN$
  - Critical initial, final, or threshold crack size
- Account for residual stresses
- Cyclic shakedown for local plasticity
- Elastic-plastic crack growth analysis
- Failure assessment diagrams
- Interactive and batch modes

Material Property Module
- Search, retrieve, plot, and curve fit data
- Import user data
- English or SI units
- Nearly 500 metallic materials
- 3,000 sets of FCG data
- 6,000 fracture toughness points

The NASGRO software runs on all Windows platforms. User support and training courses are available. A perpetual license for a single copy of version 9.0 is $4,200. Organizations with multiple users should consider a site license or participation in the NASGRO Consortium. Special prices may apply for non-US companies, especially in mainland China and India. Please contact SwRI for a specific quote.

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