

NASGRO v9.21 Release Notes

Updates to Material Property Databases and Material IDs:

A review was performed of the file containing the material IDs (*identify.dat*) and the NASMAT da/dN and toughness databases. Updates were made to make them consistent with each other to ensure that all data in the databases can be found using the “Build NASA ID” feature in NASMAT.

- **Updates to *identify.dat***

Forty-three codes were found that are used in the data that were not available in *identify.dat*. Therefore, *identify.dat* was updated to add these codes. Most of the updates were for alloys or heat treats, but there was also one environment and one temperature added.

Action required	ID	Details
Add alloy	B1KA	A148
Add alloy	C3RD	4147 140-160 UTS
Add alloy	C4BF	4330 200-220 UTS
Add alloy	C4BH	4330 220-240 UTS
Add alloy	C4BI	4330 240-260 UTS
Add alloy	C4BJ	4330 260-280 UTS
Add alloy	C4CT	4335V 200-220 UTS
Add alloy	C6CA	52100 (1562F)
Add alloy	D6AA	MIL-S-16113 Type 1
Add alloy	D6BA	MIL-S-22698 Class A
Add alloy	D6CA	MIL-S-23284 Class 1
Add alloy	D6CB	MIL-S-23284 Class 2
Add alloy	E1PB	C-250 (Ann 1675F/Age 900F)
Add alloy	E3DA	MAN-TEN
Add alloy	F4UC	HT 850F/4hr
Add alloy	G8CA	INVAR 36
Add alloy	I3MA	Ni 12-5-3(180) Maraging
Add alloy	J1GA	M2 Aus/T(2175F/OQ/1040Fx3)
Add alloy	J1GB	M2 Aus (2225F)
Add alloy	J1GG	M7 Aus (2200F)
Add alloy	K3AA	SM50A
Add alloy	K5AB	EN30A (220-240 UTS)
Add alloy	K5BZ	BS 111959 Rail Steel
Add alloy	L6AB	Jethane M152
Add alloy	M6DE	6082-T651

Action required	ID	Details
Add alloy	M7UA	7129-T5
Add alloy	O2AA	A201-T7
Add alloy	P5HB	160 UTS
Add alloy	P5HC	180 UTS
Add alloy	P5KB	Ti-4-8-6-4-3
Add alloy	P5SC	Beta-21S (1564F/967F/AC)
Add alloy	R3CB	MP98T
Add alloy	S1BM	C10200 Annealed
Add alloy	S1BT	C10200 Fine Grain OS015
Add alloy	S1BV	C10200 Coarse Grain OS050
Add alloy	S1JB	C11000 1/4 Hard
Add alloy	S1JE	C11000 Full Hard
Add alloy	S1JZ	C11000 Annealed
Add alloy	S1KZ	C15000 Annealed 30% WW
Add alloy	S2IT	C26000 Fine Grain OS015
Add alloy	S8FF	C86500 Mn-Bronze
Add environment	xxxxxxCF	NAPHTHA
Add temp	xxxxxxxx23	1550F air

Seventeen other IDs were modified in *identify.dat* to match codes for data existing in the databases.

File	ID	Data	identify.dat
Kc	B7EB26AB01	EB	EX
Kc	I5FA50AA18	FA	FZ
Kc	I5FA50AB01	FA	FZ
dadN	P3FB10AB01	FB	FX
dadN	P3FB10WB01	FB	FX
dadN	P4EA12AB01	EA	EX
dadN	P4EA12WB01	EA	EX
Kc	P4QB11AA07	QB	QX
Kc	P4QB11AB01	QB	QX
dadN	P5MA10AA16	MA	MX
dadN	P5MA10AF16	MA	MX
dadN	Q2YB12AA18	YB	YX
dadN	Q4AA51AA19	AA	AX
dadN	Q4KZ50AA19	KZ	KX
dadN	Q4KZ50AF19	KZ	KX
dadN	Q6IB50AB01	IB	IX
dadN	S1AB11AB01	AB	AX

- **Updates to the crack growth rate database**

Twenty-one IDs, shown in the table below, were corrected in the da/dN database (*nasadata.dat* and *nasahead.dat*).

Action required	ID	Details
Correct ID	B5AB22W909	W9 should be WL
Correct ID	C7GK11AB01	K should be J
Correct ID	C7GM11AB01	M should be L
Correct ID	C7GN11AB01	N should be M
Delete	E1BN25AB01	Duplicate with incorrect code
Correct ID	E1DB25AB01	O should be 0
Correct ID	E2FFA1A01	A01 should be AB01
Delete	F3DA10AA18F	No data
Correct ID	F3DA11A109	A109 should be AA19
Correct ID	I1RF10LA02C	O should be 0
Correct ID	J1G211AB01	G2 should be GA
Delete	M21C11AB01I	Duplicate with incorrect code
Remove right portions of text	M7HA11AB01S	Malformed
Delete	M7TEST00001	Test entry
Correct ID	O1CC72AB01	CC should be CA
Correct ID	P4IB12AA07	IB should be IA
Correct ID	P4IB12AA09	IB should be IA
Correct ID	P4IBD1AA09	IB should be IA
Correct ID	P4IBD1AB01	IB should be IA
Delete	P5FS11AB01	No data
Delete	Q4V816AB01	Duplicate with incorrect code

- **Updates to the toughness database**

Thirty-six IDs were corrected in the toughness database (*nasakcdta.dat*). The majority of these are duplicate IDs, where datasets were entered with IDs that were given the same ID as an already existing dataset.

Action required	ID	Details
Correct ID	E1BF11AB01B01	Change to C01
Correct ID	E1BF11AB01B02	Change to C02
Delete	E1GB201AB01	Duplicate with incorrect code
Correct ID	E2FFA1AB01A	E2FF should be E2FD
Correct ID	E2FFA1AB01B	E2FF should be E2FD
Correct ID	E2FFA1AB01C	E2FF should be E2FD
Correct ID	E2FFA1AB01D	E2FF should be E2FD

Action required	ID	Details
Correct ID	E2FFA1AB01E	E2FF should be E2FD
Correct ID	E2FFA1AB01F	E2FF should be E2FD
Correct ID	F4MF12AB01A01	Change to A03
Correct ID	G4AH11AB01A01	Change to A07
Correct ID	G4AH11AB01A02	Change to A08
Correct ID	G4AH11AB01A03	Change to A09
Correct ID	G4AH11AB01A04	Change to A10
Correct ID	G4AH11AB01A05	Change to A11
Correct ID	G4AH11AB01A06	Change to A12
Correct ID	GREE11AB01	GR should be G2
Correct ID	M2GC11AB01E01	Change to M01
Correct ID	M2IC12AB01D02	Change to D03
Correct ID	M7GJ15AB01A01	Change to F01
Correct ID	M7HA11AB01C10	Change to C11
Correct ID	M7HB11AB01F06	Change to F10
Correct ID	M7HG22AB01A01	Change to H01
Correct ID	M7HG25AB01A01	Change to A03
Correct ID	M7HH12AB01C02	Change to C09
Correct ID	M7HH12AB01C03	Change to C10
Delete the malformed	M7HJ32AB01E01	Malformed and duplicated
Delete one	M7HJ32AB01G01	Duplicated
Correct ID	M7HM11AB01B07	Change to B12
Correct ID	M7HN31AB01A01	Change to C01
Correct ID	M7HN31AB01B01	Change to D01
Correct ID	P3EA20AB01A01	Change to B06
Correct ID	P3EA22AB01C01	Change to H01
Correct ID	P3EAJ1AB01A01	Change to A02
Correct ID	P3EB21AB01A01	Change to B01
Correct ID	SOBA19AB01A02	Change to B01

NASGRO v9.21 Changes and Fixes by NASGRO Module

August 12, 2021

Category	Applicable NASGRO Module										Description
	NASGRO Main Config Control	NASFLA	NASSIF	NASCCS	NASGLS	NASFAD	NASMAT	NASBEM	NASFORM	Users Manual	
Fix		X		X	X	X					Crack case CC08: For the configuration of the crack on the long ligament, the upper limit for "c" has been corrected, to be normalized with respect to "B-D/2", instead of "W-B-D/2."
Fix			X								Negative combined load leading to indefinite loop in CC08 NASFLA computation. The revision allows the computation to keep going if the pin load is zero with the assumption that its initiation angle is zero.
Fix			X	X							No error was being issued for geometric dimensions exceeding the CC08 solution limits. The check condition in the routine has been revised for consistency.
Fix			X		X						Fixed a bug in setting the maximum allowed crack size for CC16, which can impact NASCCS calculation and NASFLA inverse calculation of initial flaw size.
Fix			X								Plotting "Beta Factor f" from the 'Computations' tab would not generate a plot.
Fix			X								Materials added in 9.10f were unable to be viewed via the 'view basic fit' plots on the 'Material' tab.
Fix			X								Under a bivariate case with no residual stress, users would see an erroneous error stating the 'residual stress file name is not specified,' blocking computation even though no residual stress was selected.
Fix			X								Crack case SC29: The xmax and ymax values for validating the alt-2D stress input file were not being validated correctly, effectively setting the maximum x value to zero.
Fix			X								Crack case SC19: Shakedown was erroneously shown as an option when tabular data is selected.
Fix				X							Output in OUT1 files for CC23 crack model revised to have consistent line spacing at short ligament and at long ligament. The revision has been implemented.
Fix				X	X						When using metric unit system M1 and loading a US units input file, the units conversion was erroneously skipped, leading to incorrect values.
Fix			X								Switching stress scale factors (SSFs) at t1 and t2 time points leading to different FCG life result from bivariate shakedown. The numerical scheme to support bivariate shakedown with negative load increments was not in place.
Fix					X						Input echo shown incorrectly in old OUT1 file and missing in new OUT1 file when NASCCS with pin load assumption was used.
Fix			X	X							NASFLA was terminating computation with error due to non-existing SIF compounding tables. The requirement had been revised due to the conflict scenario between enabled SIF compounding option and non-existing compounding tables. The program now assumes the SIF compounding with the tip and the stress quantity is disabled if compounding tables contain no data.
Fix			X	X							NASFLA with SIF compounding terminating computation after just one step. Part of the root cause was found from a bug where the crack length used to check against the upper and lower bounds in the compounding table was inconsistent. The immediate termination was from incorrect programmatic re-direction when encountering an error.
Fix			X	X	X						Problem with geometry factors for CC15. Incorrect load flag to invoke the determination of loads as well as a few un-initialized variables were identified.
Fix			X								CC11 output issue relating to c-tip in OUT2 file after transitioning into TC28. The number of columns in OUT2 file has been expanded to include the extra output with c-tip in connection with this scenario.
Fix			X								NASFLA was producing an error when "Perform bolt joint analysis" feature was turned on and multiple load blocks were used in crack cases SC08 and SC14.
Change										X	Added crack transition info of CC19 to TC27 in Table 2.2.2 of the main manual and in AppD.
Fix			X								NASFLA with centered SC27 crack terminated with error message shown in SCREEN.OUT file. The culprit was an incorrect check for the two-symmetric cracks feature.
Fix			X								Corrected an error in the code that validates data in the parameter analysis (multirun) grid, which erroneously stated that there were missing entries.
Fix						X					NASGLS with SC04 was not working; appearing from inconsistency in batch file format. The inconsistency appeared from the change in NASFLA batch file format to include more versatile features that were not reflected in NASGLS batch file format, while the DLLs did contain the revisions. This inconsistency has been corrected on the DLLs end to prevent further revision on the GUI side.
Fix			X								Undetermined behavior was seen when using the parameter analysis (multirun) grid for more than 25 runs due to an internal storage array that was too small.
Fix			X	X	X						Incorrect CC23 surface tip result for corner crack at large ligament when a/c > 1 due to un-initialized parameter. This was a bug identified during development for API functions. The adjustment was found not being applied when a/c > 1 for CC at large ligament due to un-initialization.
Fix				X							All zeros for computed correction factors with CC23 at large ligament through the usage of API function calls.
Fix			X								Fixed an error in TC03-to-TC02 transition for K calculation of the post-transition model.
Fix			X	X	X						Anomalous F2 variation for TC35 crack depth on the thick section with initiation crack site on the thin section. The interpolation approach has been revised to remove such irregularities, and a similar approach was also applied for crack initiation site at the thick section.

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	NASGRO Main	Config Control	NASFLA	NASSIF	NASCCS	NASGLS	NASFAD	NASMAT	NASBEM	NASFORM		Users Manual
Fix				X								Plot solutions option for SIFs with TC33 was not working, while working for plotting correction factors (CFs). A conditional check for TC33 in the plot SIF routines was incorrectly programmed.
Fix				X								Crack case CC18: On the 'OutputOptions' tab, the 'plot solutions' output format did not generate a working plot.
Fix				X								Crack cases EC04, EC05, SC19, SC29, SC31, TC34: The "Plot solutions" feature has been disabled for these solutions since the feature is not supported for solutions having more than two DOFs.
Fix			X	X	X							Crack cases SC13/SC14: The bolt major and minor diameter dropdown box on the 'Geometry' tab would duplicate entries when switching unit types.
Fix				X								Crack cases SC17, SC18, SC26, SC27, SC28, SC30, SC32: The NASSIF GUI has been adjusted to not allow "plot solutions" for these univariant surface crack solutions when the crack is offset, since this feature is not supported. Previously, the GUI allowed a run, which would then have no results.
Fix			X	X	X							CC11 results were shown remaining constant for $c/W > 0.9$. Two issues were reported with this report. One was the constant CC11 issue as $c/W > 0.9$. The other was that the column showing the Sn values was all zeros. The first was derived from improper interpolation and the second was from the usage of an incorrect flag to invoke the Sn computation because of a revision for new features.
Fix				X								The crack case CC19 upper limit value for "a/t" has been corrected from 0.90 to 0.95.
Fix			X	X	X						X	Implemented net section stress (Sn and G3) calculation for the two-crack option of crack cases TC27 and CC19.
Fix				X								Puzzling upturn in CC08 SIF values as W increases or D/B decreases for a small crack depth. The interpolation for stress gradient with small D/B ratios was revised to resolve this issue.
Fix			X									Material tab controls did not display properly when loading an elastic-plastic input file.
Fix			X									Material M7HA11AB1 did not plot 'view basic fit' properly.
Fix							X					Corrected the textual description of the Secondary Stress checkbox, removing the term "cyclic," which was used in error.
Fix			X									Material M2EF11AB1 did not plot 'view basic fit' properly.
Fix			X	X	X	X		X				If user had not previously saved the menu options before, NASFLA/SIF/CCS/GLS/FAD would not automatically save the most recently used directory.
Fix			X									When changing the 'post-transition geometry option' setting in TC28, the material tab layout was not properly being redisplayed, causing overlap of the failure criteria controls.
Fix			X				X					Computed (Lr, Kr) falling outside FAL was designated as SAFE. This inconsistency was uncovered when plotting (Lr,Kr) data points against FAL using the developed NASFAD-failure stress feature. The pitfall was from the approximation for f(Lr) with very small strain where appreciable discontinuities could occur.
Fix			X									Crack case SC34/SC35: When selecting and unselecting residual stress, the OPS checkbox would erroneously stop displaying when 'residual stress' was unselected.
Fix			X	X	X	X						Reselecting the same crack case a second time in the Show Crack Case Library dialog, then changing the tab view, erroneously caused the Geometry tab's geometry grid values to be cleared.
Fix				X								Crack case SC18: The values for cmin and cmax, used for run-time error checking, were not being properly calculated from geometry values.
Fix			X	X	X							Fixed a bug in net section stress calculation for crack case SC05, which resulted in the program crashing for a tiny crack due to floating-point errors.
Fix			X	X	X	X						Crack case SC04: The descriptions for the stresses Si(X): "other stresses" and S0(X): "stress due to internal pressure" were erroneously interchanged in the diagram.
Fix			X									Loading input files with multi-temperature materials could cause corruption of internal memory states, leading to unwanted program behavior such as corrupted data values, incorrect controls being shown, and crashes.
Fix			X									User defined material fits were unable to be saved to the user material file due to a crash that attempted to re-initialize table variables that had not yet been created.
Fix			X									NASFLA-S (scale factor multiplier) crashing DLLs when residual stress was included. The error was found from an altered flag value used to designate the usage of residual stress. The altered flag then mistakenly triggered the shakedown algorithm and crashed the code.
Fix			X									NASFLA results with SC34 crack model using two different SSFs for the same polynomial residual stress were found identical. The implementation relating to this feature was found not being completed with cracks at cylindrical components; i.e., SC34 and SC35.
Fix			X									NASFLA scale factor multiplier crashing when shakedown was enabled and also triggered. A file access error was found as the culprit during iterations.
Fix			X									Loading an input file with HCF controls and then switching analysis type to "Calculate Stress scale multiplier, given target life" could erroneously display some of the HCF controls on the 'Load Blocks' tab.

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Fix			X	X	X							Crack cases SC34 and SC35: the text descriptions for these solutions have been updated, changing "univariant WF" to "WF solution."
Fix		X	X									The "Cth value option" was not able to be locked or hidden, or set to a specific value in the Configuration Control GUI, which affected how that radiobox was controlled in NASFLA.
Fix				X								Crack case SC34/SC35: The S3 stress controls on the 'OutputOptions' would erroneously show in some cases when 'correction factors' was selected.
Fix				X								Crack Case EC05: The a/c lower limit was not updated to reflect the new 0.01 value.
Fix				X								Temperature interpolation for FCG properties showing too low toughness values with varying "q" value in NASGRO equation from 0.05 to 0.15. A bug was found when determining DK values for two bounding temperatures to support further interpolation for DK with an intermediate temperature.
Fix			X									NASFLA analysis showing no progress and stuck with increasing memory usage. The root cause was from the non-converging iteration in OPS routine due to a bug resulting in increasing memory allocation. It's fixed in both DLLs and the routine to support GUI stress plotting.
Fix				X								NASSIF plotting CC11 SIF solutions crashed with the selection of "a/c" for x-axis and "c" for curve values. For all the six combinations to plot SIFs, there were two combinations that failed: (1) x: a/c and curve: c, and (2) x: a/c and curve: a.
Fix						X						NASFAD for EC05 crashing in Debug mode; but not in Release mode. This fix will not affect the release. The revision is for v9.2 and v10 branches.
Fix			X									Removed the prior restriction of disallowing Express mode for various crack case models when the Shakedown option was used. Now, Express mode will be offered for Shakedown and non-Shakedown analyses for all crack case models.
Fix			X									Ensure Express mode (EM) is disabled when cyclic shakedown is invoked automatically with univariant crack models. Since cyclic shakedown can not be identified upfront, the revision would ensure DLLs to internally overwrite the EM option if cyclic shakedown is encountered and the EM option is enabled.
Fix			X									Indirect NASFLA analysis invoking cyclic shakedown to compute initial flaw size was crashing the DLLs. The error was from prematurely closing the backup file for residual stress gradients per step pair during cyclic shakedown, resulting in inconsistency during data readback.
Fix						X						NASGLS computation with TC12 subjected to remote loads completed without result. The pitfall was from inconsistent data lines in GLSBAT file.
Fix						X						NASGLS analysis with TC13 subjected to remote loads crashed the DLLs (not GUI).
Change			X									EPFM analysis crashed when the number of steps (blocks) increased above 60. The upper limit was increased from 60 to 600 and the maximum allowable number of stacked blocks increased from 80 to 1000.
Fix			X									For EPFM (elastic-plastic) calculation mode, increased the size of the "Distinct block case repetition table on the Build Schedule tab from 400 to 1000 rows. [Note: for LEFM (linear-elastic) calculation mode, the table remains unchanged, at 400 rows.]
Fix			X									For the Material tab's Compare IDs dialog, corrected a source code error causing incorrect values being used in the calculation of DK threshold for the second and third ID that is plotted.
Fix				X								Different F3 result with TC10 crack case between v8.21 and v9.0/v9.1/v9.2/v10.0. This was erroneous from the very beginning when NASGRO software structure was revised; i.e., v9.0.
Fix			X				X					Crack case SC34, SC36: When S3 is available and the FAD option on the Geometry tab is selected, the S3 stress checkbox is erroneously placed at the top of the of the GUI tab.
Fix			X	X	X		X					Crack case TC15: Corrected the limits equation from "0 <= c/W <= 0.9" to "0 < c/W <= 0.9".
Fix				X								Revised DLLs to allow SIF computation for c/W=0.9 with TC15 crack model. A tolerance was implemented with the exact c/W=0.9 ratio in this enhancement.
Fix				X								Providing TC16 SIF solution when extrapolation is utilized as described in the NOTE section of OUT1 files. The enhancement has revised the approach to support the output.
Fix						X						Corrected the text descriptions in the menu "Options, Units" to be "in/hr" for US, and "mm/hour" for M1 (from the incorrect "in/cycle", "mm/cycle").
Fix						X						Material file updated to show correct ALON material data
Change						X						On the material tab, the radiobox "K1c value to use" has been expanded to include a fourth option: "mean value - 3 sigma".
Fix			X									CC10 with flat stress gradient and not invoking OPS failed the computation right after transitioning to TC13. This scenario was also reproducible with the "old" CC10 in v9.2. The program was pointing to a disabled feature in the TC13 SIF module.
Fix			X									Fixed a NASFLA problem with CC16 (one crack) in Express mode -- the crack failed immediately after CC16 transitioned to TC23.
Fix			X									Elastic modulus information was not properly loading in the stress-strain grid when multi-temperature material were selected.

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Fix		X									When defining Kc values at tips with multi-temperature data, changes to the tip location or tip class were not being saved properly when immediately switching tabs. Further, the "through tip" location was not being correctly written to the batchfile.
Fix			X								Crack Case SC34: The entered or derived c-values were not properly checked against geometry limits.
Fix			X								"Plot stress" showing two identical gradients for both internal and external SC04 crack from pressurization. The gradient for the internal crack needs to account for pressure on the crack surfaces.
Fix				X							Different in-plane bending gradients found with two different bases for TC13 subjected to remote loads. The bug with this issue was fixed and this release contains the update.
Fix		X									SC18 with automatic shakedown and limit stress check failing to complete computation using API calls. The regular interfacing deployed with NASGRO GUI works fine with this scenario. This bug could only be triggered when using API calls.
Fix		X									Computation for SC35 fatigue crack growth continuing but not generating any OUT2 result; i.e., suspending. The pitfall was found in a routine used to define "roundness" of the crack tip perimeter, which made the iteration get stuck.
Fix					X						Crack Case SC30: S0 stress quantity not properly displaying when initially selecting tabular data.
Fix		X									SC29 indirect NASFLA analysis for initial flaw size crashing the DLLs. The iterations in implicit analysis might prematurely unload the stress arrays, causing the program to crash if crack transition was invoked.
Fix					X						The material selection combobox would not always display properly when changing units.
Change		X									Cleaning up the unnecessary information in iteration table shown in OUT files for TC13 implicit analysis to compute initial flaw size.
Fix		X	X	X							For crack case SC18, corrected both the upper and lower bounds in the initial geometry requirement of "0.1 <= D/B <= 1.9" to "0.02 <= D/B <= 1.8."
Fix								X			Fixed an error in the code for finding the maximum and minimum stresses and calculating stress .
Fix		X									SC34 and SC35 not working with GW and CW load interaction models. The routine to compute yield zone size was updated to include the two models.
Fix		X									For crack case SC09, a description change to the crack size field in the geometry grid on the Geometry tab caused the calculated "NASA std NDE" initial flaw size for "Max machining flaw" NDE type to not be written to the grid.
Fix			X								Slight inconsistencies found between hand-calculated global total force and local bending against the internally computed ones. The deficiency was further amplified by the user-specified nearly discontinuous stress gradient. The shortcoming was from the incorrect selection for numerical integration. A linear integration routine should be deployed if the OPS option was not required.
Fix			X								Crack Case TC28: The residual stress table would not initially display when selecting residual stress.
Fix		X	X								Crack case TC11: When selecting "Symmetric crack with symmetric stressing" on the Geometry tab with SIF Compounding enabled, the Geom Tables tab erroneously displayed the checkbox to allow for S2 compounding. This added an incorrect line to the batchfile, blocking successful computation.
Fix						X					Crack Case SC30: Symmetric cases were not being processed properly, sending the non-symmetric flag to the batchfile regardless of whether the case was symmetric or not.
Fix		X									Incorrect post-transition crack length from SC30 to TC12. The starting crack depth after transition was assigned incorrectly.
Fix		X									Implicit NASFLA computation of flaw size and scale factor from CC11 to TC28 crack transition not working. Two issues were identified: an incorrect assignment on the number of DOFs for TC28 and a flag value not being reset to its default when iterative steps were invoked.