



3D GRID ORIENTED HYDRAULIC FRACTURE SIMULATOR

# RELEASE NOTES

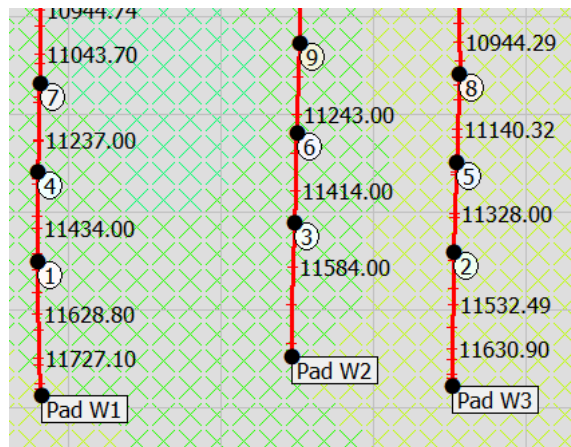
## GOHFER 3D 9.1.0.x

Original Release Date July 6, 2018



### Highlighted GOHFER 3D v9.1 Features:

- **Design Template/Design Creation** - can be used to generate multiple designs very quickly instead of having to make designs one at a time. This is useful to quickly create and populate multiple pumping schedules, perforation configurations, fracture spacing and clusters per stage for multiple stages across multiple wellbores.
- **Automatic Stage Shadowing** - this new feature is used to graphically set the order in which the fracture stages will be pumped across multiple wellbores and automatically set the stage shadow order accordingly.



- **Performance Enhancements** -
  - In Grid Setup added parallel processing for computing the calculated grids.
  - Added parallel processing to improved 3D display. The display is simplified while rotating and moving with the mouse for improved response.
  - Previous versions had about 1/3 of the computations in the engine using parallel processing. This version has about 2/3 of the computations running in parallel.
  - Engine Priority - In the Run Engine Options, the priority level of the simulation can be set. Recommendations are shown below based on number of cores.

| Setting                | Priority                           | Recommendation                    |
|------------------------|------------------------------------|-----------------------------------|
| <b>Background</b>      | low priority with ½ the cores      | Recommended setting for dual core |
| <b>Foreground</b>      | normal priority with all the cores | Best for most users               |
| <b>Max Performance</b> | high priority with all the cores   | Quad core or above recommended    |

## Well Construction

- Site Location now defaults to the Reference Well location. This addresses issues with wells not being landed in the right TVD section of the grid. If there is no reference well location, then use the center of all the treatment wells as the site location.
- Added import function for a Surface Map that either loads from a GSLIB or csv file.
- Added option to Clear or Remove Surface Map
- New Zoom/Drag controls added to Map View
- Increased geologic model size limit
- GSLIB Viewer
  - Wellhead locations now displayed on map view in viewer
  - Save or extract a surface map layer or structure map to be used in the GOHFER 3D project
  - Select or reduce the size of the geomodel area to be imported into a GOHFER 3D project
  - Select the desired properties from the geomodel to be imported into a GOHFER 3D project
  - Displays total number of layers
- Fixed an issue with copying/pasting easting, northing, and elevation from a spreadsheet into the Well Construction well locations table.
- Added CLAT (completed lateral length) to each treatment well wellbore string information. It should be set to the length of the lateral that can be frac'd without the stages running up the build section.
- Ability to read/import our own exported GSLIB file

## Log Processing

- GR\_STEER has been replaced by GR\_TOTAL. GR\_TOTAL is an input into GR as an omitted curve. The GR log assistant has been moved to GR\_TOTAL for setting GR Min/Max.
- GR\_ND is a new input for GR computed from PHIN – PHID and can be used as a surrogate spectral gamma ray. The GR log assistant is used to scale GR\_ND.
- For vertical well simulations, added the ability to assign the same well as the Reference Well and Treatment Well. In this scenario, the unassigned well can be removed from the project column and the grid will be constructed from the remaining well.
- Change  $R_w$  default for  $S_w$  to 0.02.

## Grid Setup

- Added ability to import a depletion model to either the pore pressure or pore pressure offset grid (very similar to the main geologic model)
- Ability to export selected input grid properties as a geologic model in GSLIB format
- Fixed an issue where if there is no structure, any user drawing did not get into the engine correctly

## Engine Output Viewer

- Proppant Cutoff Length can now be seen on both the Proppant Concentration and Effective Conductivity output grid. Proppant cutoff length can only be altered on the Effective Conductivity grid.
- Fixed an issue with the 3D display of single vertical fractures.
- Removed triplets.csv file and replaced with triplets.gslib file
- Ability to export selected output grid properties in GSLIB format for all desired simulations (via Treatment Configurations screen)

### **Batch Queue**

- Jobs in the Batch queue are indented when shadowed by a design.
- A right click on a Geologic Section adds all the designs in the section to the batch queue.
- A right click on a Stage that is not shadowed has a new item to add all designs in the shadow group to the batch queue.
- After batch queue has run, right-click on batch message allows all jobs to be completed by opening them all and generating the output summaries

### **Pressure Diagnostics**

- The x-axis on the Test Events plot is now defaulted to logarithmic scale
- The permeability estimate from G at Closure is initially calculated using a default closure-pore pressure of 1500 psi. Once closure pressure and PZS is set from the analysis, perform the after-closure analysis (ACA) to determine the correct value for the ACA pore pressure. This updates the pore pressure in the Reservoir Properties section. To get the final G-perm it is no longer necessary to go back to the G-function and move the closure line to re-calculate the results.
- Fixed an issue where changing the pore pressure in the est. reservoir properties did not update the diagnostics Pp (while diagnostics was open). Had to previously close and reopen diagnostics to refresh.
- Can now select (from dropdown menu) the associated treatment well for an individual diagnostic analysis
- Added setting of CFOP value in G Function, Log Log and Sqrt plots

### **Miscellaneous**

- Updated Sentinel Run-Time Environment (v7.80)
- Updated help documentation
- Updated system requirements posted to <https://barree.net/gohfer/system-requirements.html>



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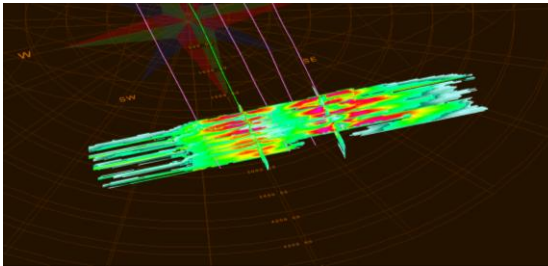
### INTRODUCING GOHFER 3D 9.0!

Original Release Date May 30, 2017

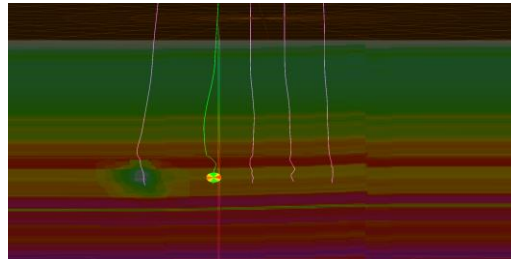


#### New GOHFER 3D 9.0 Features

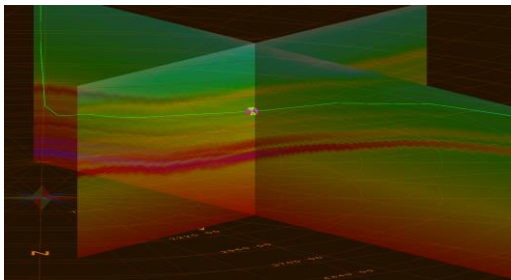
- Ability to add multiple wells, including vertical and horizontal, in the same project
- Fracture stress shadow interference between each fracture and stage on each well
- Can simulate: Multi-layer completions / Zipper-fracs/ Offset Depletion Effects
- Full 3D geo-mechanical earth model input (from Petrel GSLIB file)
- Optional input of 2D surface map with reference well logs
- Geo-steering of laterals and engineered completions
- Full processing of log or “core” from 3D earth model



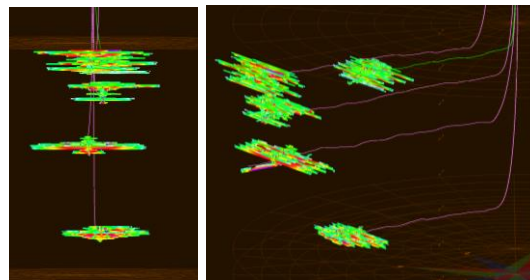
*Zipper-Frac Interference*



*Offset Well Depletion Effect on Total Stress*



*Example Total Stress Imported from 3D Model*



*Multi-Layer Completions*

#### Well Construction

- Can define coordinate system and site/ well locations
- Ability to convert latitude and longitude to state plane
- Ability to lookup state plane zone by county
- Ability to display location on map
- Ability to view surface map (and layers) of all wells
- Removed option to Add Reference Survey and LAS option in Well Construction
- Removed option to Convert Treatment LAS to Reference LAS option in Well Construction

- New Project Type options:
  - Single Vertical Treatment Well / No Transverse Fractures
  - Multiple Treatment Wells / Enable Transverse Fractures
- Wellbore string inputs now accessible from each individual well under Well Construction or from the well tab under Geologic Section
- Disabled MD/TVD mode in survey. MD/INC/AZI required.
- Added GSLIB viewer
- Added link to State Plane and UTM conversion tools
- Fixed an issue with right click paste in Well Construction/Well Locations table

### Log Processing

- Reference LAS input data options:
  - Reference well logs only (no geologic model available)
  - Reference well logs and core sample(s) taken from an imported geologic model
  - Core sample(s) taken from an imported geologic model (no reference well logs)
- Moved PORE\_P\_LAS and STRESS\_TOTAL\_LAS to bottom of PORE\_P\_SRC and STRESS\_TOTAL\_SRC so they will no longer be automatically used if they are mapped. To use these curves, the user must manually move these to the top of the list.
- Moved LAS Assignments to the top in LAS Processing/GOHFER Curves column
- Added a change to prevent user from shifting or scaling PORE\_P\_SRC or PORE\_P\_EST
- Added the following new LAS curves:
  - AVH / PHIS / YMELAS / DTCYME / NETPAYEST / SWEST / BIOTS\_VPHIE

### Grid Setup

- Simulation mode options:
  - Transverse Only
  - Transverse + Longitudinal
  - Longitudinal + Transverse
- Default node size now set to 5 ft
- Further separated and reorganized grids into separate folders (Grid properties and Intermediate Calculations)
- Tabs for each wellbore
- Ability to see multiple wells in transverse grid tabs
- Added Map view option to grid setup
- Ability to add faults in map view
- Ability to view geologic model scatter plot in map view
- Added the ability to change the map layer in Treatment Configurations/Wellbore tab
- Addressed issues with renaming designs affecting stage shadowing
- Ability to export grid data to geologic model in GSLIB format
- Added a Fit to Ruler option in the Engine output for Node Width
- Removed V/H Factor from the PZS and PHOLD grid. Now handled by the AVH grid.
- Renamed Baseline Conductivity output grid to Effective Conductivity
- Each simulation now generates a triplets file in gslib format (\*.triplets.gslib) in addition to the triplets.csv file
- Added the option to select which curves to export to the triplets file
- Added wellbore stability calculations and ability to export the data

### Engine Output Viewer

- **ALL** simulations are now asymmetrical. Symmetrical fractures are no longer simulated.
- Fixed an issue metric projects that displayed the perf MD at the bottom of the screen in oilfield units instead of metric units
- Fixed an issue with the pipe friction calculation for BHP in the engine
- Fixed an issue with the Ruler for proppant cutoff length not working on vertical well projects

### Pressure Diagnostics

- Removed option to override auto-calculated hydrostatic head in the Well Configuration inputs
- Updated equation for permeability estimate from G Function

**Production**

- Fixed an issue with the New Fracture Data Available message not updating properly
- Addressed an issue where production would not open after running simulations in batch mode

**Production Analysis (GPA)**

- Redesigned and reorganized input and output results screen
- Rename Num Transverse Fracs to Number of Stages
- Added context sensitive help

**Fluid Database**

- Updated Fluid Database
- Fixed an issue with the pipe friction plot calculations

**Proppant Database**

- Updated StimLab database of proppants
- Proppant grading is now provided to inform users of differentiation in terms of quality/timeliness of conductivity data

**Miscellaneous**

- Ability to convert previous projects to v9.0
- Ability to view all wellbores, fractures and map view layers on the Geologic Section/Wellbore tab
- Updated Sentinel Run-Time Environment (v7.60)
- Fixes and enhancements to the Undo Feature
- Fixed an issue with remembering a user adjusted Modulus Stiffness Factor
- Updated HTML based help file



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# RELEASE NOTES

## GOHFER 8.4.0

Original Release Date June 3, 2016

### Log Processing

- Added included/excluded range check box to all Log Assistant Limit Depths options

### Grid Setup

- Added new geosteering feature to correlate reference well GR and treatment well GR to locate the well more accurately and adjust geologic structure automatically
- Added Structure/Geosteering Keyboard Actions menu item to the Grid Setup/View menu
- Enhanced grid copy, paste and move drawn grid cell features
- Fixed an issue with the stress grid potentially not being initialized correctly in the engine when using transverse structure

### Perf Editor

- New Add perfs feature to automatically generate multiple perf clusters based on cluster spacing

### Run Options

- Redesigned Run Options screen
- Added option to *Use Closure Width for Stress Shadowing* - uses the closed fracture profile to generate the stage stress shadow. Use this option if there will be a significant time between fracture treatments (several days for example).
- Added new stability options
  - Time steps - increase stability or faster execution speed
  - Minimum Fracture Width - cells below this minimum width will not be included in material balance
  - Minimum Fluid/Proppant - controls which nodes are included in the material balance

### Engine Output Viewer

- Added optional Thermal or heat flow model for the wellbore and fracture which accounts for cooling effects on breakdown. Both vector and a grid temperature profile output is available in the engine output viewer.
- Added the ability to generate a .CMG file for vertical wells in addition to horizontal wells
- Fixed an issue with saving the Baseline Conductivity output grid to an .AVI file
- Fixed an issue with the display of the summary output of total fluid loss

### Batch Run

- Restart file - created whenever a job is terminated prematurely. Have option to run simulation from restart file instead of from beginning of the job
- Can now generate a 1 batch queue with designs from multiple projects
- Jobs may now be added directly from the Batch Queue Screen
- Batch Queue may now be reordered by dragging the jobs up or down the queue
- Added right click actions for the simulations in the queue
- Can now add simulations to the batch queue while it is running
- Added notifications for a queued job being out of date

### **Production**

- Added warning when running production if there is no frac in net pay.
- Default Well Spacing for horizontal simulations is now 2 \* Proppant Cutoff Length
- Fixed issue with mapping of secondary fracture rate curves

### **Production Analysis (GPA)**

- Restricted the minimum abandonment rate to a non-zero value to avoid an error
- Fixed error on the Rate decline or decline curve when selecting "B" before anything else

### **Pressure Diagnostics**

- Added Blowdown analysis - used to estimate the wellbore compression at the beginning of pumping which provides a good value for the decompression at shut down. This can be used to estimate the amount of tortuosity required to match blowdown and determine a more accurate ISIP.
- Renamed PDL plots to Fissure Leakoff
- Now either calculates/reports a PDL Coefficient (if positive slope) or Transverse Storage Coefficient (if negative slope) in the Fissure Leakoff Analysis
- Fixed an issue with the tortuosity units in the Blowdown analysis in metric projects
- Fixed an issue with the Fissure Leakoff analysis plot not being added to report
- Fixed an issue in the Blowdown Analysis when plotting result curve for metric projects
- Fixed an issue in the PDL Analysis with the display of the Transverse Storage Coefficient in the Results

### **Miscellaneous**

- Fixed an issue in metric projects with drawn values on the transverse grids were not being converted properly
- Fixed error that occurred if you clicked Save with no screen open
- Improved proppant transport to reduce overflushing and settling effects during shut-in
- Fixed issue with stage shadowing for wells with depth unit in meters
- Fixed issue with microseismic data rounding errors
- Added Windows 10 compatibility GUID to GOHFER.exe manifest
- Changed GOHFER to use a 32-bit format when reading the Open GL display





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# RELEASE NOTES

## GOHFER 8.3.1

Original Release Date December 8, 2015

### Upgrade to Sentinel LDK

- Upgraded licensing technology from Sentinel HASP to Sentinel LDK.
- Ability to easily adjust the expiration date, key memory data or add/subtract network seats without the need for a new C2V file.
- Licenses are now re-hostable which means a standalone or network license SL (soft license) can now be transferred from one machine to another by the end user. It will no longer be necessary to cancel and reactivate a license when moving to a new machine.
- The Sentinel Run-time Environment Installer to v7.41 and Sentinel License Update Utility provided in 8.3.1 will be required to be installed in order to perform all license activations from this point forward.
- The following GOHFER modules may now be licensed/purchased individually:
  - GOHFER Petrophysical Analysis
  - GOHFER Fracture Simulation & Production\*
  - GOHFER Pressure Diagnostics
  - GOHFER Production Analysis (GPA) – rate transient analysis
  - GOHFER Real Time

\*(requires the purchase of GOHFER Petrophysical Analysis)

### Survey

- Added a Reset button to the Treatment and Reference Surveys to clear the survey and reset to default values.
- Fixed issue with pasting into Survey not refreshing the calculated columns correctly

### Grid Setup

- Fixed issue with using the drawing tools in the Transverse grids
- Fixed issue with the Formation Tops when adjusting geologic structure in the grid setup

### Perfs

- Included Add button to perf menu to easily add multiple Perf Clusters by starting depth, cluster spacing and number of clusters

### Engine Output Viewer

- Updated/improved the Proppant Cutoff Length calculation
- Made new Output Grids (added in 8.3.0) available on the 3D grid view
- Fixed issue with the display of proppant ramp in Engine Output for metric projects

### Production

- Frac Height (in Production/Stimulation Properties) is now determined from by the tallest frac instead of "best" frac.

### Production Analysis (GPA)

- Added a new bottom hole pressure calculation
- Change BHP to default to 0 if it cannot be calculated
- Fixed an issue with the Input File Preprocessor in GPA causing an incorrect time shift
- Added conversion of Months to Days for Production Analysis input files

### Miscellaneous

- Added a legend on the Production Composite and Engine Composite
- Improved the File/Project Cleanup Screen



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## RELEASE NOTES

### GOHFER 8.3.0

Original Release Date August 31, 2015

#### INTRODUCING GOHFER PRODUCTION ANALYSIS (GPA)!



- Uses actual production data to analyze post-frac performance and assess stimulation effectiveness.
- Includes rate transient type-curve analysis, decline curve analysis, production forecasting to ultimate recovery and flow regime identification.
- Determines fracture spacing and effective well spacing for horizontal wells along with the fraction of the lateral producing.

**NOTE:** GPA will be available for purchase as an add-on to GOHFER 8.3. Purchase of the entire GOHFER product suite *is not required* to acquire GPA. Existing GOHFER users will receive limited term evaluation copies of GPA with their 8.3 license update.

#### Log Processing

- Fixed error that occurred when right-clicking to remove an input curve

#### Well Construction

- First line of 3D survey fully is now editable to allow for surveys not starting at MD/TVD=0
- Added folders for improved presentation of information (Well Information / Location / Project Settings / Ball Seats)
- Added State Plane Coordinate System as alternative for UTM Coordinates
- Added Ball Seat table used to define ball seat depths (MD) and diameter. Values used in ball seat pressure drop calculations

#### Geologic Section

- Rock Compressibility in the Est. Reservoir Properties now has the option to be Auto Calculated or overridden and entered manually
- Fixed issue with Zone in the Est. Reservoir Properties not being remembered
- Fixed issue with OBG in the Est. Reservoir Properties that did not automatically update the calculated Total Stress grid

#### Grid Setup

- Moved Formation Tops to Grid Setup
- Ability to edit Formation Tops line thickness
- Added ability to apply geologic structure transverse to wellbore in horizontal simulations
- Added ability to draw structure starting at different locations in the grid
- Added Ruler that displays length/height/average value of user selected area/grid
- Added option to display Gamma Ray curve and/or lithology along left side of grids
- Added ability to display Horizontal Treatment LAS along bottom of grid with ability to edit visible curves
- Added ability to Undock/Dock individual grids
- Fix refresh issue in grid when changing # columns.
- Add ability to display/hide curves on Input Data tab/image
- Added user selection of curves to display on Input Data tab/image

## **Pumping Schedule**

- Added the ability to generate a proppant ramp pump schedule
- Added an automatic actual pump schedule generator with time and sensitivity filters to quickly generate stages from actual job data files
- Fixed issue with the Ball Drop Copy >> function

## **Engine Output Viewer**

- 3D output grid view now in orthographic projection in 3D instead of perspective by default
- Added new Vector Data curves:
  - Ball Seat Pressure Drop
  - Cumulative Injected Slurry Volume
  - Cumulative Pumped Proppant Mass
  - Total Fracture Proppant Mass
  - Fluid Loss (to) Storage
  - Proppant Loss (to) Storage
- Added new Output Grids:
  - Transverse Stress (simulations w/ multiple transverse fracture only)
  - Shadow Pressure (simulations w/ Stage Shadowing only)
  - Total Velocity
  - Cumulative Injected Slurry Volume
  - Fluid Loss to Storage
  - Proppant Loss to Storage
- Baseline Conductivity output grid now displayable in 3D view
- Added Ruler:
  - Displays length/height/average value of user selected area/grid
  - Can be used to show and set Proppant/Acid Cutoff Half-Length / average proppant concentration / averaged etched width / Gross Frac Length
- Improved algorithm for calculating proppant/acid cutoff half length
- Added Show/Don't Show Perfs option on grids.
- Additional information provided in selected output grid properties menu including average, min, max value for the current time step and selected fracture.
- Added logarithmic axis option in the axis properties for the engine output vector plots

## **Production**

- Fixed an issue with the reported rate units in the Production1Metric.csv file
- Improvements to importing/displaying actual production history
- Actual production pressure history can now be used for Well Control Flag
- Added the ability to simulate multiple production scenarios for each design
- Added fracture data status message to indicate when new fracture data (proppant cutoff half-length/proppant concentration) is available via Ruler adjustments

## **Diagnostics**

- Can now add multiple Diagnostics analyses for each Geologic Section
- Renamed the PDL event line to FO (Fissure Opening) on the G Function Plot
- Renamed PDL Coefficient Analysis to Fissure Leakoff
- Negative slope of the Fissure Leakoff Analysis will not produce an associated Transverse Storage Coefficient
- Added a close button to each analysis window
- Rock Compressibility in the reservoir inputs now has the option to be Auto Calculated or overridden and entered manually
- Revised the calculation for the reservoir temperature in the reservoir inputs

## **Fluid Database**

- Added editable pipe friction plot for each fluid

## **Perfs**

- Added ability to import ball seat locations for perfs if entered in Well Construction

**Real Time**

- Fixed an issue with acquiring real time space delimited network files
- Added ability to save RT plots to reports
- Fixed Save/Copy picture feature on RT plots
- Added support for additional time formats

**Reports**

- Fixed an issue with adding the Baseline Conductivity output grid image to report
- Gas compressibility, Gas Viscosity and Total Viscosity now added to the reservoir fluids section of the production report
- Improved reporting of Transverse Fracture properties
- Updated Design summary display to show the same table of fractures as the report

**Input File Preprocessor**

- Can now paste data directly into Input File Preprocessor. This will avoid the need to save data from a spreadsheet to temporary csv file.
- Added a new Conversion - Fixed Step on the time column. Can be used if GOHFER cannot read the time/date. Options are steps of 1/60 or steps of 1.

**Treatment Composite**

- Added Engine Composite to compare vector data from multiple designs/geologic sections in a project
- Can now import actual production history into the Production Composite for history matching

**Acid Fracturing**

- Fixed issue with FCD and conductivity calculations in horizontal and transverse fracs

**Miscellaneous**

- Added support for Windows 8.1 variable screen resolutions
- Added a repair for projects that have been renamed by user
- Save As function can now be used save to zip file for archive or backup
- Improved overall simulation stability
- Added support for multiple processors. Simulations may run as much as 30% faster
- Fixed a bug that allowed PC to go into sleep mode during a long batch run
- Addressed floating point overflow" errors
- Added Delete All option to all tables (accessed via right-click)
- Added yellow icon markers to the project column to indicate that one or more of the input screens has changed since the Design was last saved. Design may need to be executed again to generate new output to reflect the changes to the input data.
- Added green icon markers to the project column to indicate that the engine output viewer (results) have not been viewed (only applies to simulations run in batch mode).



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# RELEASE NOTES

## GOHFER 8.2.6

Original Release Date February 25, 2015

### Log Processing

- Fixed issue with editing and remembering the LAS Assistant Limit Depths
- Fixed TVD conversion issue for mixed unit projects (Meters/Oilfield)
- Disallowed entry of 0 for Null value for the LAS
- Add YMEPHIA to the list of Best Fit curves on the YME Log Assistant
- Fixed scaling issue with metric logs

### Well Construction

- Added right click menu in project column with option to open In Windows Explorer – Allows browsing to the directory containing the GOHFER files.
- Fixed issue if azimuth was all 0's that resulted in Unable to Read Perfs error
- Fixed an issue where the wrong average azimuth was being calculated when there was an azimuth change of > 180 without going past zero

### Pumping Schedule

- Fixed issue with saving the pump schedule
- Fixed issue with start time being later than time 0.0

### Grid Setup

- Fixed issue with using transverse or longitudinal aspect ratio in the grids when modeling a single transverse fracture
- Fixed refresh issue when performing an Undo on the grids
- The "depth", as tracked by the cursor, is now labelled correctly. It was being labeled as time until a grid was chosen

### Engine Output Viewer

- Fixed issue with stress shadowing on vertical wells
- Replaced Effective Conductivity output grid with Baseline Conductivity to facilitate exporting fracture conductivity from GOHFER to a reservoir simulator (see help file for more detailed explanation)
- Fixed issue in projects with long metric horizontal wells where structure was not displaying the longitudinal frac properly in the longitudinal output grid
- Fixed issue with Engine Output not calculating the intersection of the wellbore with the top of the grid correctly

### Production

- Fixed production NPV Issue where the treatment cost was multiplied by both the number of fracs and by the number of stages
- Fixed issue with horizontal production when modeling only a single transverse fracture
- Updated internal calculations for Embedment and Spalling
- Fixed some inconsistencies in transverse fracture production

### Diagnostics

- Re-enabled option to double-click in order to open an Analysis window
- Fixed issue with drawing on curves that are not in the project units

### **Fluid Database**

- Updated fluids.csv file with updated friction factors for slickwater
- Added adjustable effects of crosslink delay factor to graph
- Fixed issue with  $U_o$  (zero shear viscosity) auto-fit in fluid database that resulted in a negative  $g_L$  (transition shear rate)
- Removed redundant question when prompted to save fluid that was being deleted, which could cause the fluid to not be deleted

### **Real Time**

- Added support for the following time format with MMDDYYYY HH:MM:SS (space in between) in comma delimited file formats
- Mouse over shows values on Real-Time plot

### **Miscellaneous**

- Fixed an inadvertent limit on the number of allowable transverse fracs
- Fixed a bug where adjusting the Transverse Storage Coefficient had no effect on results. Issue impacted vertical well simulations only.
- Fixed issue with copying and deleting designs
- Implemented stage stress shadowing options for the batch run process
- BHP Datum now displays <Grid Top> instead of negative value for default
- Sorting of transverse fractures is now the same in both the Engine Output Viewer and Production
- Grid lines are now optional on Time base plots and settable per axis
- Lithology track on Perfs, Grid Setup and Engine Output are now drawn fresh rather than being pulled from the image written by the LAS processing
- Fixed issue with Plot the Column feature in the Input File Preprocessor
- Fixed issue with some csv files that were not importing correctly because of time steps less than 1 second.
- Fixed a bug that was preventing purging of the Debug log
- Fixed "Not a Valid Date and Time Error" issue observed in international locations
- Implemented new Delphi compiler that eliminated most third-party controls for windows and tree structures
- Updated icons on the toolbar and menus



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# RELEASE NOTES

## GOHFER 8.2.4

Original Release Date September 2, 2014

### Log Processing

- Rearranged hierarchy for PR and YME Log Assistants to reflect PRDTC/PRACT/PRPHIA and YMEDTC/YMEACT/YMEPHIA
- User defined Auto Fit depths (top/bottom) in Log Assistants is now saved and added as a global variable
- Fixed bug associated with opening a 2<sup>nd</sup> LAS file after processing the initial LAS file

### Well Construction

- Default Stress Anisotropy is set to the CFOP (Critical Fissure Opening Pressure) grid
- Added ability to define the wellhead location elevation, northing and easting
- Added utility to convert latitude and longitude to UTM coordinates
- Added ability to import directional survey using the input file pre-processor to select and map data

### Treatment Configurations

- Added ability to mark formation tops and manipulate formation top label and line on grid
- Added ability to import microseismic data and plot with grid output in 3D view
- Added BHP Datum to dictate the TVD depth used to determine the GOHFER calculated BHP curve displayed in the engine output viewer time plot
- Addressed issues with saving and renaming geologic sections and designs
- Acceptable transverse exponent value range now 2 or less (previously limited to between 1 and 2)
- For horizontal transverse fracture simulations, added ability to simultaneously model the longitudinal fracture component along the wellbore
- Both transverse and longitudinal frac components can be modeled in vertical wells with low stress differential.

### Pumping Schedule

- Fixed issue with CSXP (sand exponent) friction calculation. Default value is now 0. When opening existing projects, the user will be asked to open and save the pumping schedule to refresh the CSXP.
- Fixed bug in foam pumping schedules that changed inadvertently changed the proppant concentration and foam quality

### Diagnostics

- Changed *dp at Closure* label to *Process Zone Stress* on all associated diagnostic plots and results
- Results screen – Irrelevant or results not found denoted in red
- Results screen – Added Pore Pressure Found (True/False) result
- Added table to step down analysis results displaying a breakdown of the pipe, perf and near wellbore friction.
- Fixed issue with smart line not appearing on G Function plot the first time it was opened

### **Grid Setup**

- Added ability to determine fracture orientation (breakdown pressure / breakdown angle) to any location in the grid with secondary detailed display
- Added separate aspect ratio for the transverse grid. Different aspect ratio may now be used for the grid along the wellbore and the transverse grid
- No longer lose user drawing or structure in grids when a change is made to the grid node size and aspect ratio or the grid top/bottom. These are still lost if a change is made to the perf type (symmetrical/asymmetrical).
- Added grid properties options to the grid right-click menu for both the grid setup and the output grid

### **Engine Output Viewer**

- Improved Effective Conductivity output grid calculation to avoid extremely low values.
- Added AVI movie capability. Output grid data in 2D or 3D view may now be saved as a movie file.
- Transverse fracture grid output now displays in asymmetric view
- Added longitudinal output grid for the longitudinal fracture component along the wellbore in transverse fracture simulations (when selected)
- Added user defined UTM coordinates to the XYZ Triplets file
- Added ability to generate time-stamped output XYZ Triplets file at any time during the simulation
- Added pipe friction curve to the engine output viewer vector data

### **Production**

- GOHFER horizontal production now calculates production from each frac generated from each cluster and displays production results (plots) for each fracture simulated.
- Added stage lateral length and well spacing inputs. GOHFER now automatically calculates the total lateral length, frac spacing, the per fracture drainage area and aspect ratio and the stage and total drainage area.
- Added Treatment Composite module that will cumulate production from separately executed stages and generate a total well production rate. Capable of also comparing production from multiple designs
- Added user option to include/exclude unstimulated well production results

### **Proppant Database**

- Updated StimLab Proppant Consortium proppant database

### **Fluid Database**

- Updated system fluids database file

### **Real Time**

- Added an un-dockable user defined numerical display window of incoming data
- Added ability to place cursor over any point on a curve to view the specific value

### **Miscellaneous**

- Context sensitive help (press F1 to access)
- Updated HASP driver (6.64)
- Added silent installation option (/s)
- Fixed issue with accessing Sentinel License Update Utility with 2<sup>nd</sup> installation option
- Fixed numerical front instability that resulted in a sensitivity to the aspect ratio
- Fixed issues with cutting and pasting into editors throughout GOHFER





3D GRID ORIENTED HYDRAULIC FRACTURE SIMULATOR

# RELEASE NOTES

## GOHFER 8.2.3

Original Release Date December 9, 2013

### Log Processing

- Added ability to depth shift an entire input LAS
- Now accepts LAS file with a start/stop/step of FEET or METERS.
- Added option to run auto log assistants upon exiting the initial log processing window.
- Changed the default Kmult in the LAS inputs PERMEST from 100 to 20.
- Added new curve titled Slowing described as DTSLOW-DTFAST. This DTC slowing correlates well to TOC% in shales, or any hydrocarbon pay zone. It is a good pay indicator and a useful curve to know where the measured DTC/DTS are suspect.
- Added ability to add a reference survey and LAS if one was not selected in the original project options.
- Added ability to convert a treatment LAS to reference LAS if reference LAS was inadvertently processed as a treatment LAS.
- Fixed issue where the Depth range was incorrect on the display of the LAS Outputs in TVD.
- Input curves (data brought into the model from an external LAS or CSV file) are now plotted with dotted lines by default.

### Well Construction

- Added Stress Anisotropy to the Wellbore Configuration. If non-zero it overrides CFOP in the Breakdown Pressure Calculations
- Added Azimuth of Max Stress for of angle transverse fractures
- Added query with option to "Enable Transverse Fractures" when exiting the well construction section.

### Survey

- Added interactive 3D rotatable well survey view with MD, inclination and azimuth input option

### Treatment Configurations

- Added Wellbore Pressure Breakdown and Orientation calculations
- Changed Treatment Stage name to Geologic Section
- Added a new Input Data tab on the Grid Setup.
- Change the units on the Transverse Storage Coefficient to inverse pressure

### Perfs

- Removed TVD/Offset option
- Fixed issue with double headers appearing on plot

### Pumping Schedule

- Fixed ball drop timing issue and issue with multiple balls in the wellbore simultaneously
- Added a force save on the pumping schedule when doing an acid frac schedule. Fixed occasional issue with acid output not appearing after running an acid frac simulation.

### Diagnostics

- Defaulted the log-log plot the minimum time axis to 1 minute.
- Added the ability to save the diagnostics summary output page to reports as an image.

### **Engine Output Viewer**

- Added an Effective (Damaged) Conductivity output grid
- Engine Output Viewer now remembers plot settings changed while the engine is running
- Added interactive 3D rotatable grid output viewer
- Added option to draw a single wing of a symmetrical fracture in the 3D output view to provide better visibility of multiple transverse fractures if spaced close together.

### **Production**

- Added new filtercake deposition model related to permeability of the formation. Filtercake erosion and removal calculations are dependent on the Reynolds Number established during transient flow during production, and the specified residual filtercake percent.
- Added time dependent conductivity
- Adjusted reservoir fluid inputs to only reflect those associated with user defined oil or gas reservoir.
- Plot scales are now saved on the production plots.
- Tubing diameter in metric projects changed to mm.

### **Proppant Database**

- Updated StimLab Proppant Consortium proppant database.
- Added compare proppants feature that allows multiple proppants to be plotted on the Proppant Conductivity plot of measured conductivity vs. stress. Compares proppants based on the user defined calculation parameters.

### **Fluid Database**

- Fixed sensitivity when adjusting exponent lines

### **Input File Preprocessor**

- Fixed an issue with selecting the last column of any input file.
- Added ability to handle the following time stamp – MM/DD/YY hh:mm:ss

### **Reports**

- Fixed various issues with data being reported in oilfield units for metric projects

### **Real Time**

- Fixed an access violation if you open the real-time plot before connecting to a data source.

### **Miscellaneous**

- New installation setup package
- Added 64 bit installation option. Now have 32 bit and 64 bit options.
- Modified the engine to use a variable automatic courant number that makes it run faster and with more stability.
- New graphics package with enhanced control over curve, axis and label properties
- Made fix to issue with proppant disappearing from the grid
- Fixed issue with tortuosity if a negative rate was used in the pump schedule
- Fixes for occasional floating-point errors



3D GRID ORIENTED HYDRAULIC FRACTURE SIMULATOR

# RELEASE NOTES

## GOHFER 8.1.5

Original Release Date May 3, 2013

### Log Processing

- Added the following curves as mappable generated curves to allow source curves to be mapped and remembered in the names and history:
  - BIOTS\_V
  - SW
  - CFOP
  - YMES
  - NETPAY
- Changed the defaults for DTMA and DTFL for metric projects to 590 and 197 respectively to better match Oilfield defaults.
- Added new Tools menu item titled - **Reset All LAS Processing**
  - Intended for updating older projects (can be used on recent ones as well)
  - This feature resets:
    - All GOHFER Curves
    - All Output Curves
    - All Parameter Info to defaults.
  - After resetting, the LAS is saved and the screen is closed.
  - The LAS processing must then be reopened. At that time all the input files will be remapped as if the user was opening them for the first time.
  - Userdraw files are kept and mapped automatically.
  - All previous user processing except for Userdraw is lost.
- Revised the PORE\_P and STRESS\_TOTAL curves
  - New Curves
    - PORE\_P\_SRC
    - STRESS\_TOTAL\_SRC
      - SRC stands for source - selects the source for the pore pressure or total stress from either the input curve or the associated internally calculated (EST) curves
  - PORE\_OFFS and STRESS\_OFFS take the SRC and the EST curve and output the difference
  - PORE\_P and STRESS\_TOTAL sum the OFFS and EST curves and output the sum. These curves are written to the output LAS.
  - User may offset/draw on the PORE\_OFFS or STRESS\_OFFS curves.
  - User may draw on the PORE\_P, STRESS\_TOTAL curves, but the draw is translated to the associated OFFS curves.
- Removed X Shift, Scale, Power from the PORE\_P and STRESS\_TOTAL curves.
- In Track 2 when *Scale All Curves the Same* is selected the min and max scales of all the curves are used instead of the scale for the first curve.
- Changed the default calculation in DTC ACT to copy.
- Added **Auto Log Assistant**.
  - This runs and auto fits all the DTC, PR and YME log assistants.
- Rearranged the log assistant screens. Only shows the parameters for the selected fit rather than disabling the others.
- Made change to Spline interpolation to limit to the same range possible with linear interpolation. This fixes some averaging issues that were causing negative perm.
- Fixed repair issue where repair failed if no LAS.

- Changed equations for PZS\_PHIE and CFOP\_PHIE such that the "scale" factor is always between 0 and .9. On loading old projects the new Contrast value is calculated to match the previous scaling factor.
- PRGRScale multiplied by 1000 for display to avoid scientific notation
- New defaults for PRGRScale and PRGROffset
- New defaults for YMEGRScale and YMEGROffset
  - New equations for some of the correlations require that the Log Assistants be run for older projects.
- New equations for lithology allowing partial coal
  - New defaults for GDAnhd and GDDolo

### Perfs

- Fixed some range check errors in the Perfs.
- Fixed bug where Perfs would go into infinite loop if invalid perf depth entered.

### Pumping Schedule

- Added traps for preventing renaming of Stage or Design while engine is running. Does not prevent renaming of batch runs.
- Fixed a bug that caused problems when more than 255 stages were created.
- In the pumping schedule setting the rate to 0 now sets the volume to 0.
- CSXP (Sand Exponent) is now a functioning input on the Pumping Schedule Run Parameters
- Changed data entry of foam pumping schedule to keep bottom hole volume constant
  - Added default value for bottom hole volume
- A couple fixes on the new data entry methods for the Pumping Schedule
- Now allow Pumping Schedule w/o creating Grid. Allows for viewing schedule for during real time.
- Pumping Schedule Time Plot may now be undocked.
- Save column settings to project file now for pumping schedule.
- Changed Pumping Schedule Design to allow for entering bottomhole or surface values.
  - The data entry mode changes automatically as the user enters a field. I.e. enter slurry it calculates based on slurry rate. Enter quality it calculates on surface or BH quality.

### Production

- Added the saving of visibility of Production curves
  - Fixed bug where colors of unstimulated and stimulated were being loaded the same
- Allow user to enter Perm and Porosity on Production
- Changed source of SW to be from values entered on Treatment instead of from Engine Results
- Renamed EUR to OOIP and divided by 1000 on Production Outputs
- Fixed a problem where new proppant/fluids were not being loaded into Production.
- Added final FCD and KfWf to production output.
- Corrected order of Est Flowing Frac Length and Inf Conductivity in table. Widened column.
- Changed the default reservoir phase to GAS for production.
- Added columns to the Engine Output Viewer Report for lateral fracs

| Transverse Fracture | Proppant Cutoff Length | Est Flowing Frac Length | Est Inf Conductivity Length | Fracture Height | Average Proppant Conc |
|---------------------|------------------------|-------------------------|-----------------------------|-----------------|-----------------------|
| 1                   | 360.000                | 9.985                   | 18.575                      | 50.000          | 0.121                 |
| 2                   | 120.000                | 8.479                   | 14.596                      | 75.000          | 0.113                 |
| 3                   | 280.000                | 8.658                   | 16.784                      | 75.000          | 0.0999                |
| 4                   | 280.000                | 8.975                   | 17.046                      | 70.000          | 0.106                 |
| 5                   | 320.000                | 9.911                   | 18.182                      | 50.000          | 0.122                 |

### **Engine Output Viewer**

- Fixed issue where wrong time units could be used on the Engine Output Viewer. Pumping schedule input curves were always assumed to be in minutes.

### **Reports**

- Fixed Avg Prop concentration display on Design Summary and report.

### **Real Time**

- Added support for space delimited Real-Time input
- Added support for time in hh:mm:ss
- Added option to save raw data.
- Raw Data now displayed at bottom of real time screen
- Pumping Schedule Time Plot may now be undocked.

### **Fluid Database**

- Fixed a data entry scaling issue for Fluid Editor when entering leakoff/viscosity data in metric units.
- Added ability to convert K' column to either oilfield or metric units in the Fluid Editor Viscosity Data tab.

### **Miscellaneous**

- Added Width Exponent on the Design
- Moved Reservoir parameters from grid to treatment and design
- Added Batch Processing
  - When starting Engine there is a check box for batch job.
  - The queued jobs show on the Treatment Configurations Page
  - The queue is started from the Treatment Configurations Page
  - The batch job is run as a Windows Batch File external to GOHFER.
  - The status of each run is displayed.
  - After the job is complete a double click on it in Treatment Configurations will bring it up.
  - Cannot add jobs while a batch job is running.
- Added Foam Viscosity to CALCMU
- Added error trap for bad path name in saving design.
- Added specific error trap for being unable to write to file because it is locked by another program (usually MS Excel)
- Fixed units issues with Meters/Oil Field projects on Design Summary
  - The Engine Output Viewer must be opened and re-saved for the correct units on old projects.