# JarPro™ – Drillstring Jarring Analysis to Optimize Jar Placement in BHA's

#### **Product Description**

JarPro<sup>™</sup> is a general-purpose 2D jarring analysis program used for performing many phases of jarring analysis ranging from jar placement optimization to detailed time histories of jarring impact. The program uses a systematic stress wave tracking approach to simulate transmission of forces and motion in the drillstring during the jarring process. This approach enables JarPro to solve complex drillstring configurations efficiently using relatively simple inputs, thus facilitating its use by drilling engineers, rig personnel, and jar manufacturers.

#### **Benefits**

- Reduce potential of damaging or losing the BHA during jarring by proper jar Selection and placement
- Optimize jar placement in complex bottom hole assemblies

#### Features

- Simplified data input requiring only basic jarring parameter selections and drillstring data in a user-defined format
- All internal nodes and elements are automatically generated
- Output includes characteristics of jarring and stuck point movements

#### **Training and Technical Support**

 Comprehensive one-day training seminar

#### **Quality Assurance**

- Program predictions validated by users & drilling research organizations through extensive testing
- Extensive verification by transient dynamic finite element analysis & closedform solutions



In complex BHAs ,the optimum jar location depends upon number of factors, which can be analyzed by JarPro

#### **Key Capabilities:**

- Versatile 2-dimensional drillstring modeling capabilities and ease of input
- Parametric analysis for jar placement, tripping force, stuck force, and stuck location
- Detailed time history of forces, velocities, and displacements at user-selected locations
- Both jarring-up and jarring-down simulations
- Enhanced jar placement optimization options
- Special sections for accelerators and shock subs with nonlinear springs
- Modeling the effects of mud buoyancy, side wall friction, and pump-open at jar
- Material changes in a drillstring
- Single point or differential sticking simulation
- Plotting the analysis results and drillstring model

### JarPro – proven to reduce the cost associated with freeing stuck

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# JarPro 7 - Jarring Analysis Software

			The drill string drill collar, and inputs	is divided into se jar. Each section	ctions such as drill pipe, requires only simple data
Serier Type JA Jar Weight (b) 5250 Jar Weight (b) 5260 Jar Length (b) 34 Sale Face) 10 Angle (deg) 0 Upstroke Trepring Face (b) 100000 Downstroke Trepring Face (b) 20000 Downstroke Trepring Face (b) 20000 Jar Shoke (n) 7 Pump Open Area (n) n) 11 04 Add Sec	ar	ring Andynis Data Andynis Option Data Special In Data dota Ar on R4 (b) 0 incoefficient 0 4 n Coefficient 0 4 incoefficient 0 4 incoefficie	put Data	The "General Ja screen defines parameters und	arring Analysis Data" drill string environment der jarring
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Output is represented by graphs and a detailed text printout for users to obtain the optimum jar placement, and to evaluate jarring impacts to the drill string.

	JARRING CHARACTERISTICS	
0	JAR PLACEMENT : 90. FT. OF HANNER SECTION ABOVE JAR TRIPPING FORCE : 100. RIP.	Exam
rce Time History Plot	Jar Placement versus Stuck Point Plot	Displacement
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0.00 0.00 0.00	BIT 189. 225. 2.57 .22 2.01 0. DKalsi Engineering JARFRO Example 2 PAGE Disp. (in) 0.2	
	DETAILED TIME HISTORY OF JARRING  FORCES, VELOCITIES, & DISPLACEMENTS IN DRILL STRING SECTIONS	
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	rce Time History Plot	SAR FLACEMENT : 90. FT. OF HANGER SECTION ABOVE JAR rec Time History Plot Tree (sec)



# JarPro – Pactical Approach to **Jarring Analysis**

### Jar Placement for Simple BHAs

In case of BHAs with uniform Drill Collars optimum jar placement depends only on the stuck force and collar lengths. Because the actual magnitude of the stuck force and location of the stuck point are not known, a family of curves can be drawn for the range of the possible values for these parameters.



drill collars.



### **Jar Placement for Complex BHAs**

In case of BHAs with HWDP (Heavy Weight Drill Pipe) each curve has more then one local maximum in the available impulse. The available impulse is influenced by the movement of the larger cross-section Drill Collar below the jar and by stress-wave reflections. These plots shows that the magnitude and the location of the maximum available impulse change significantly with changes in over pull force, stuck force, and length above and below the jar.

## JarPro – a practical tool to predict optimum jar placement



## JarPro – Extensively Validated Against FEA, Instrumented Tests and Field Results

Extensive comparisons were made between the results from the JarPro and the FEM approach to ensure that wave tracking and superposition effects were properly considered from various configurations of BHAs. The results show very good agreement between two methods. In the stress-wave tracking method, the hammer accelerations, impact times, durations, and forces can be calculated precisely.





These figures compare JarPro predictions against transient dynamic FEA results two typical BHAs. The impact forces and impulses in the primary impact duration of the two methods match closely.

## JarPro – a validated tool to predict optimum jar placement

