

*Excaped Completion Process Reduces Gas Emissions
and Speeds Well Completions*



*14th Annual Natural Gas STAR Workshop
Houston, Texas
October 2007*

Marathon 

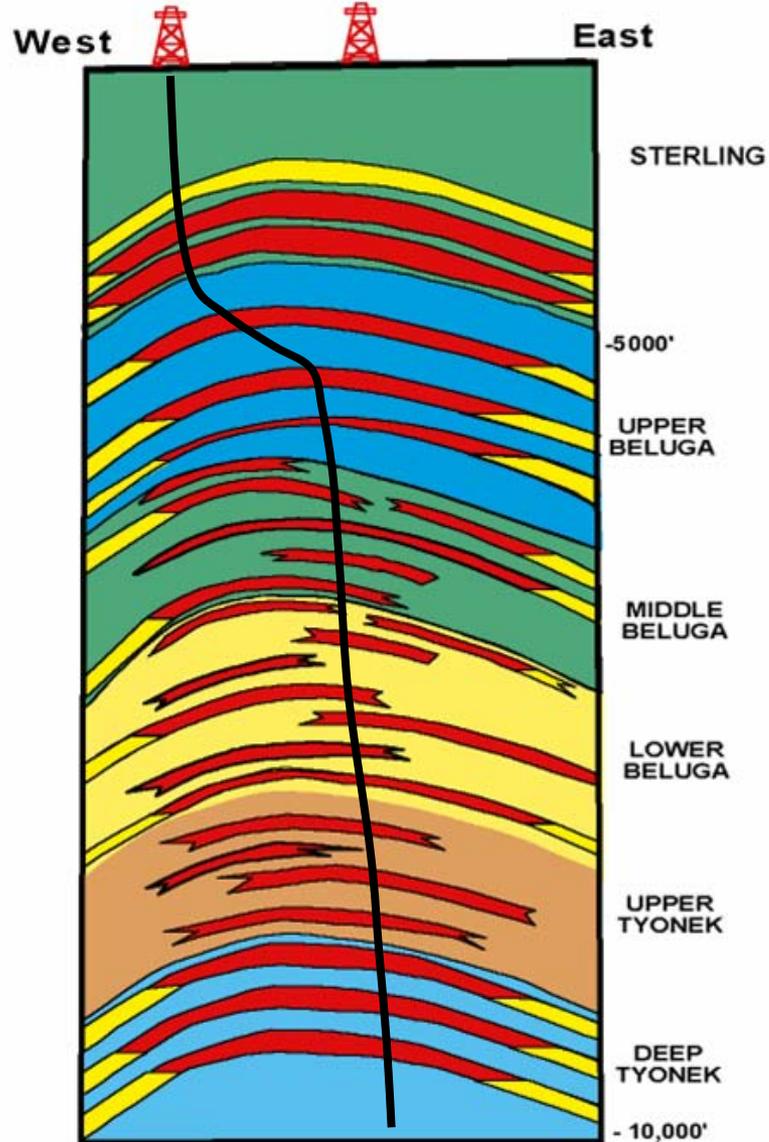


Original Driver for the Technology Development: Cook Inlet, Alaska Beluga Gas Sands

- ◆ 10 to 20 sand bodies typically encountered
- ◆ 1700' gross interval
- ◆ Each sand 5' to 30' thick
- ◆ Permeability 0.01 to 3 md
- ◆ Unfrac'd well rate 500 to 1,000 mcf/d. Some individual sands too tight to produce without stimulation.

KENAI GAS FIELD DIAGRAMMATIC CROSS SECTION

14-6 Pad 41-7 Pad



How am
I going
to frac
this???

Conventional Industry Solution

a few years ago



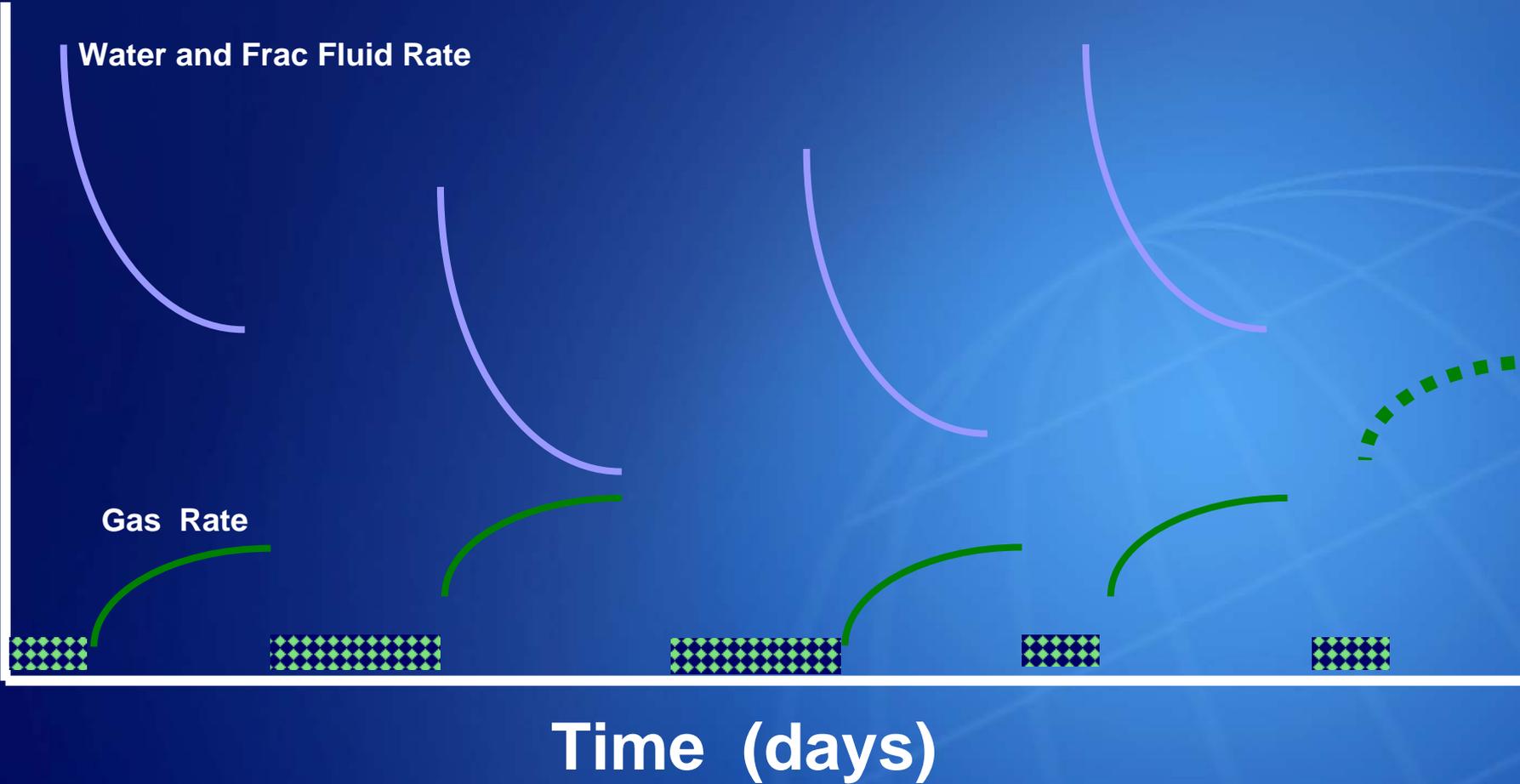
◆ Common stimulation technique

- “cherry pick” individual zones
- Perforate and attempt to stimulate multiple intervals
- Flow back (venting gas)
- Isolate lower intervals
- (repeat process multiple times)
- Remove all isolation devices and flow well.

◆ Not very effective

- Inevitably bypass much pay
- Compromise stimulation design
- Time consuming and costly
- Infrastructure issues in certain locations

Conventional Well Completion



Cross-Section of Gun Assembly



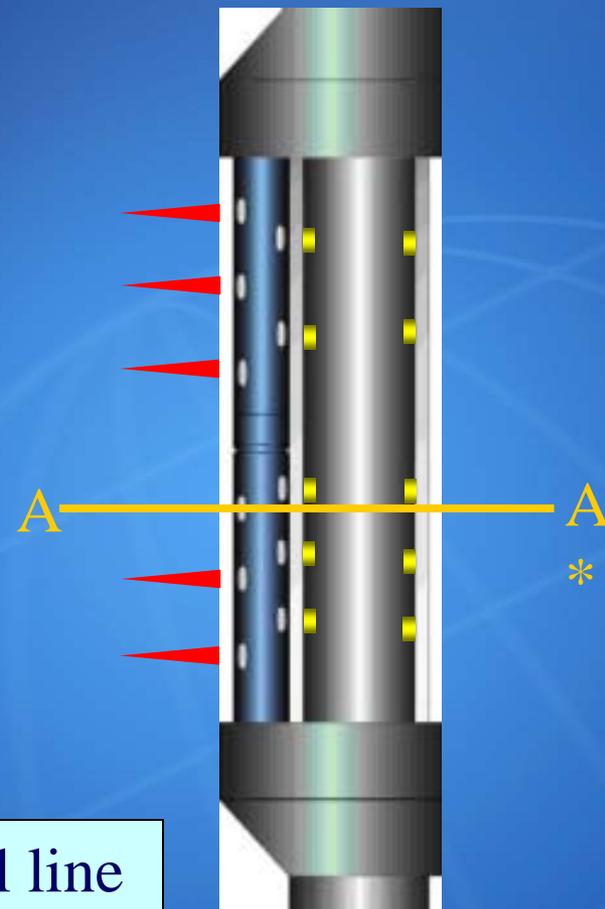
2³/₈" guns

3¹/₂" casing

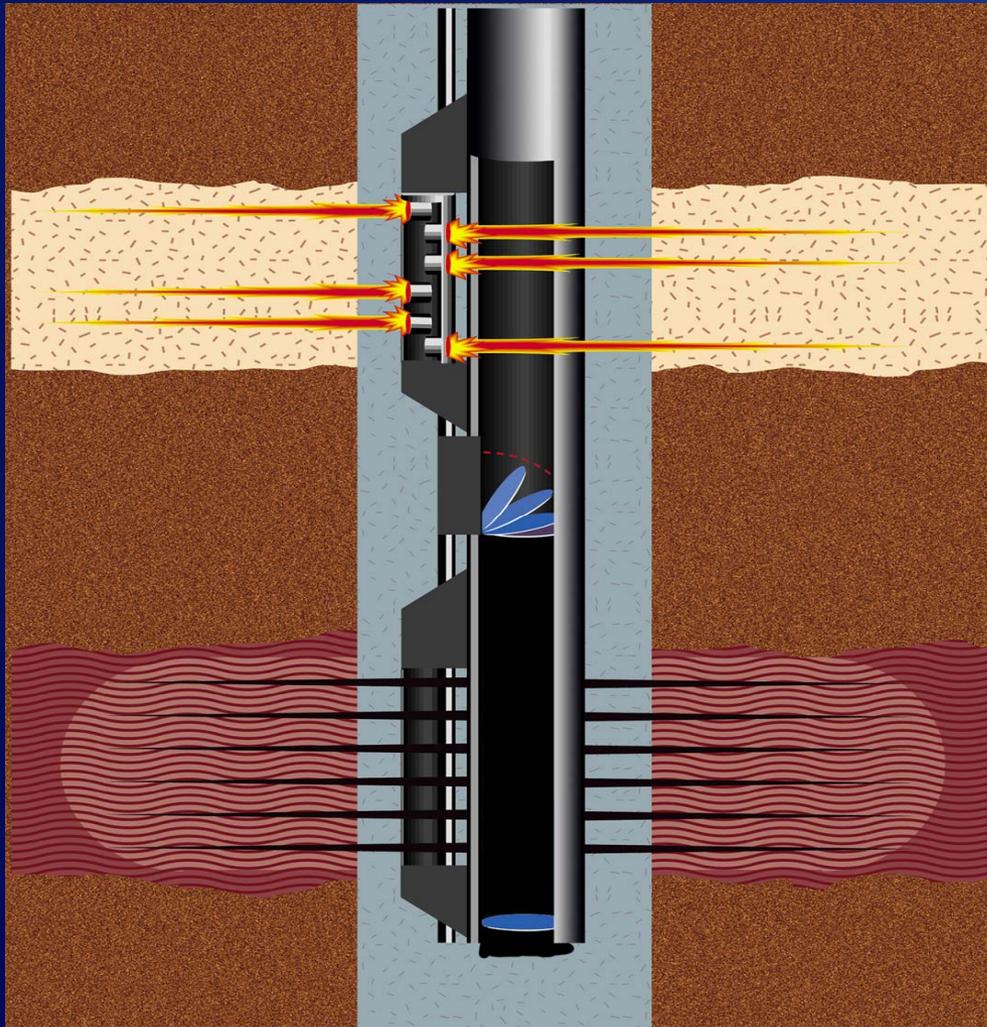
**Other Charge
Shot Densities Available**

borehole

control line



Isolation Valve Below External Perforating Gun



- ◆ Firing the gun actuates a lower isolation valve.
- ◆ Valve actuates when a protective sleeve shifts.
 - Compatible with cementing and fracturing operations
- ◆ Frangible; flapper valve removal is usually easy
 - with past knowledge.
 - Marathon, typically 15 in one hour

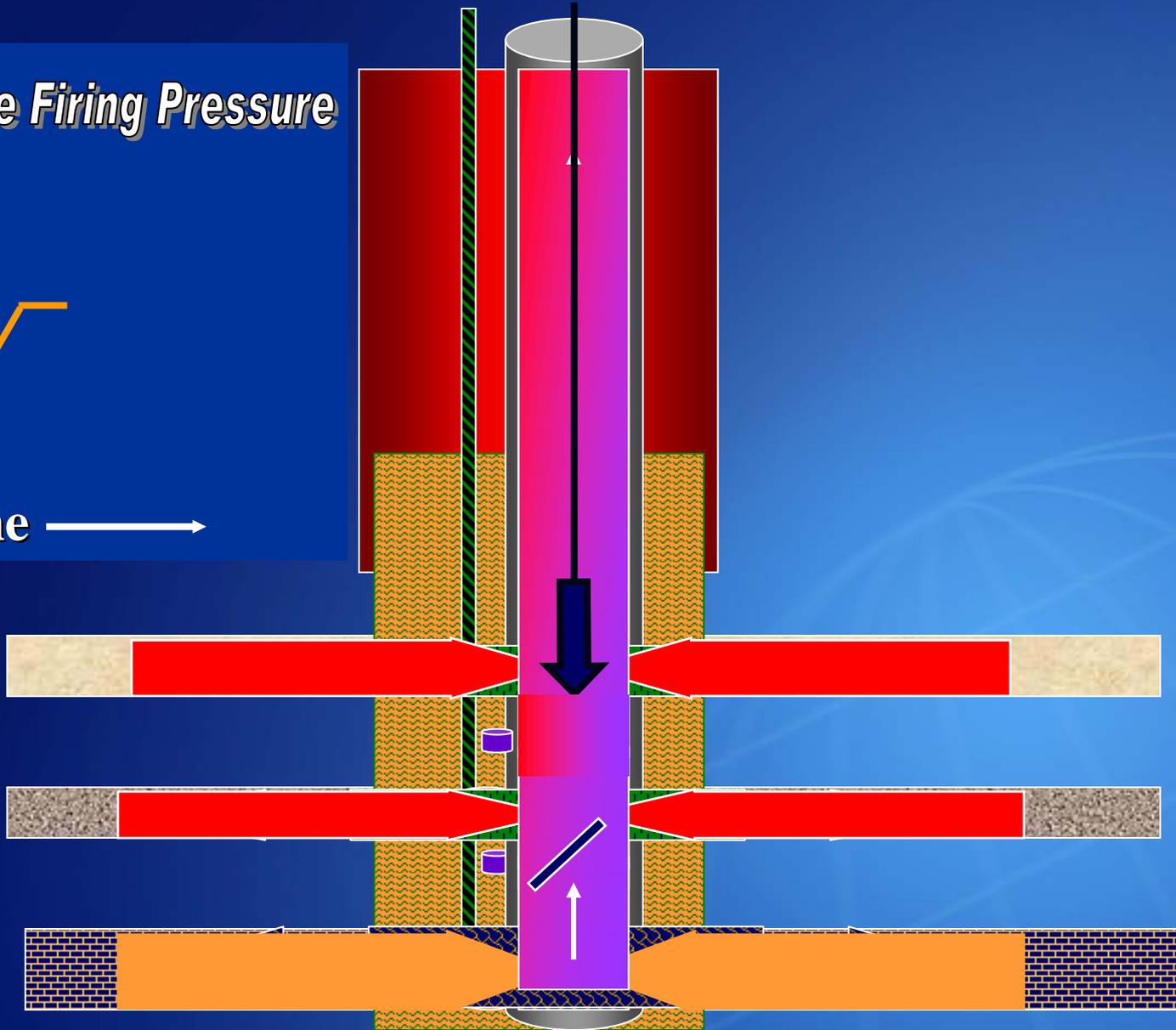
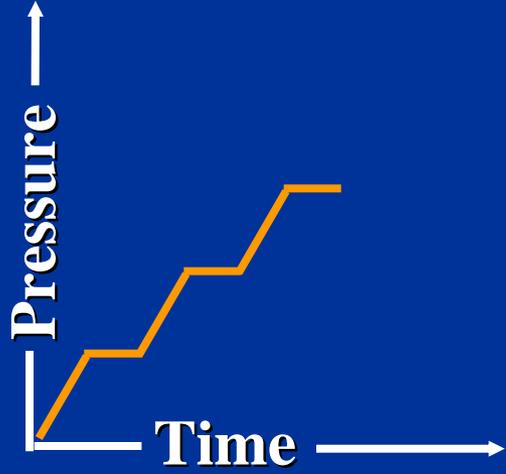


Module Placement



- West Texas Rig

Control Line Firing Pressure

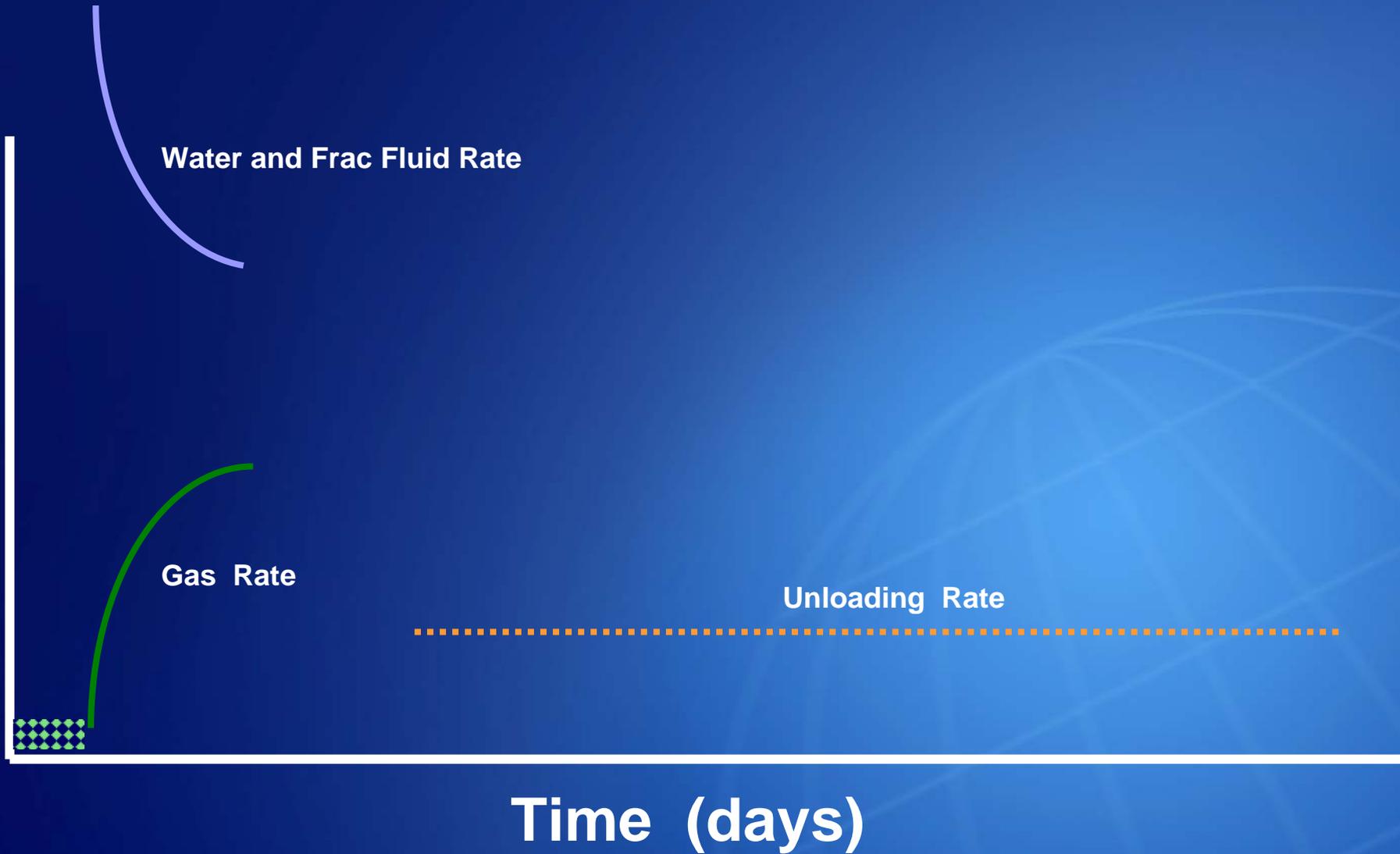


Technical Achievements Marathon Alaska



- ◆ **Single Day Completion – 24 hour period**
 - 16 stages fracture stimulated
 - with well cleanout and isolation valve removal
 - gas to sales within 30 hours

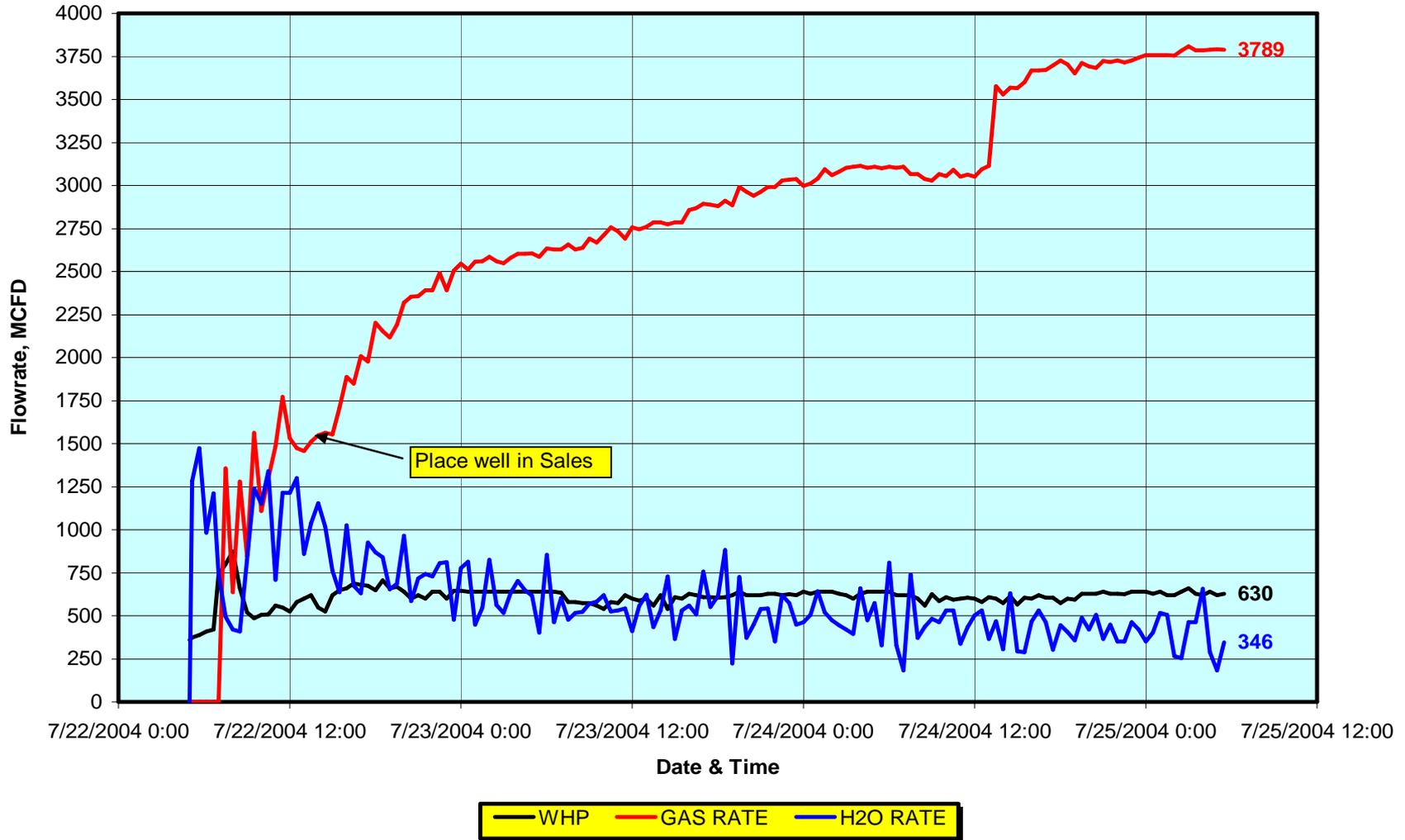
Excave Well Completion



Marathon Alaska Escape Well Post –Completion Production Data



KBU 23-7 Test Data
As of 0530 7/25/04



How Much Gas Was Not Vented? Marathon Alaska Excape Wells



Excape Completion Process Well Name	Location	Depth	Modules Completed (Zones Competed)	IP	Excape: Estimated Venting Before Sales	Total Vent time
KBU 42-7	Alaska	7,500 feet	15 modules	3,150 MCFD	700 MCF	

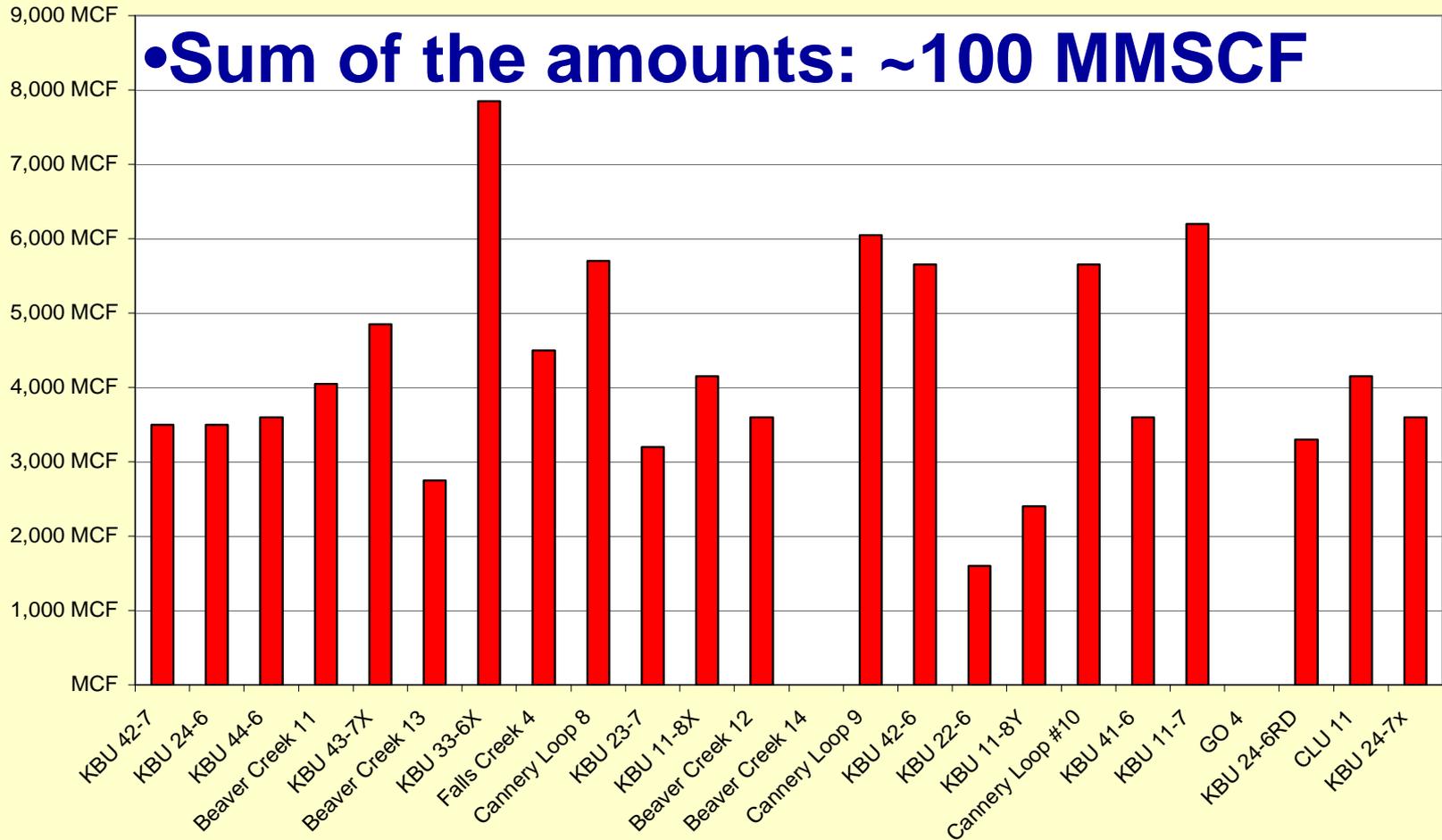
Conventional: Number of Frac Stages	Conventional: Estimated Venting per day, per Stage	Conventional: Estimated Number of Venting Days Per Stage	Conventional: Total Vented Volume	Reduction in Venting Volume
4	350 MCFD	3. days	4,200 MCF	3,500 MCF

Estimated Gas Not Vented



Reduction in Venting Volume

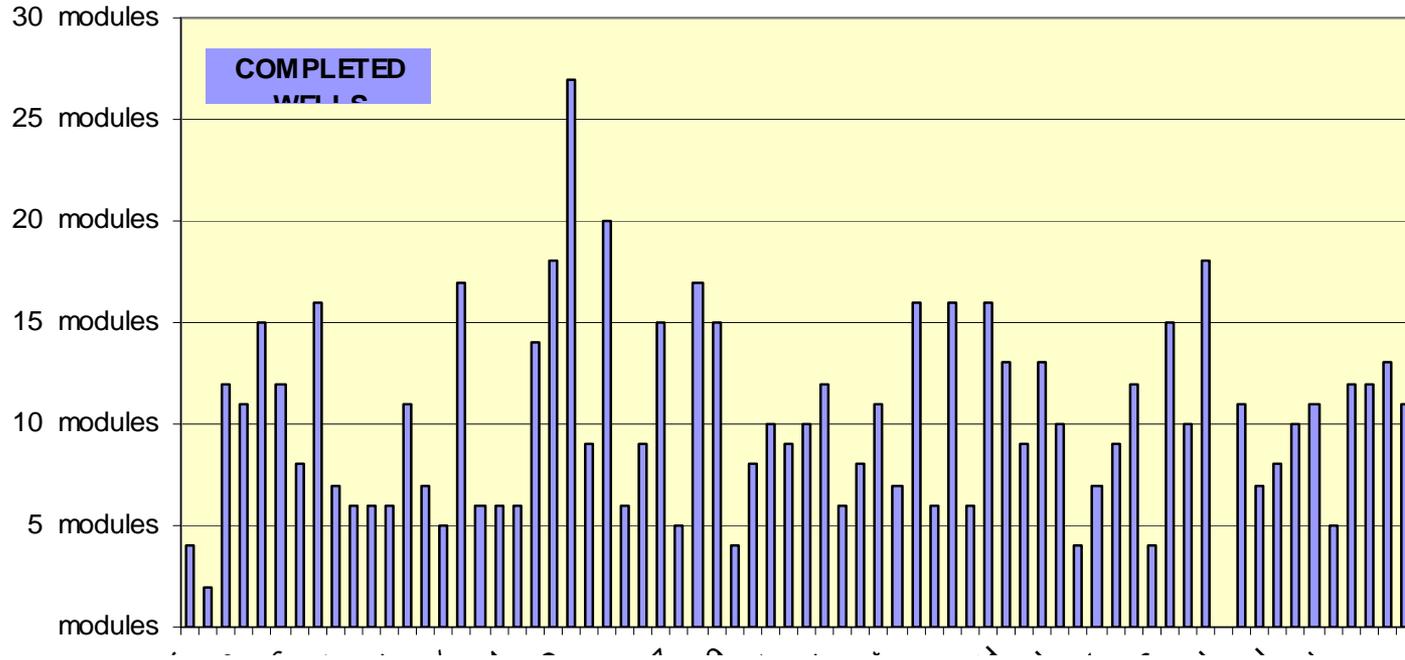
• Sum of the amounts: ~100 MMSCF



Modules Run Per Well



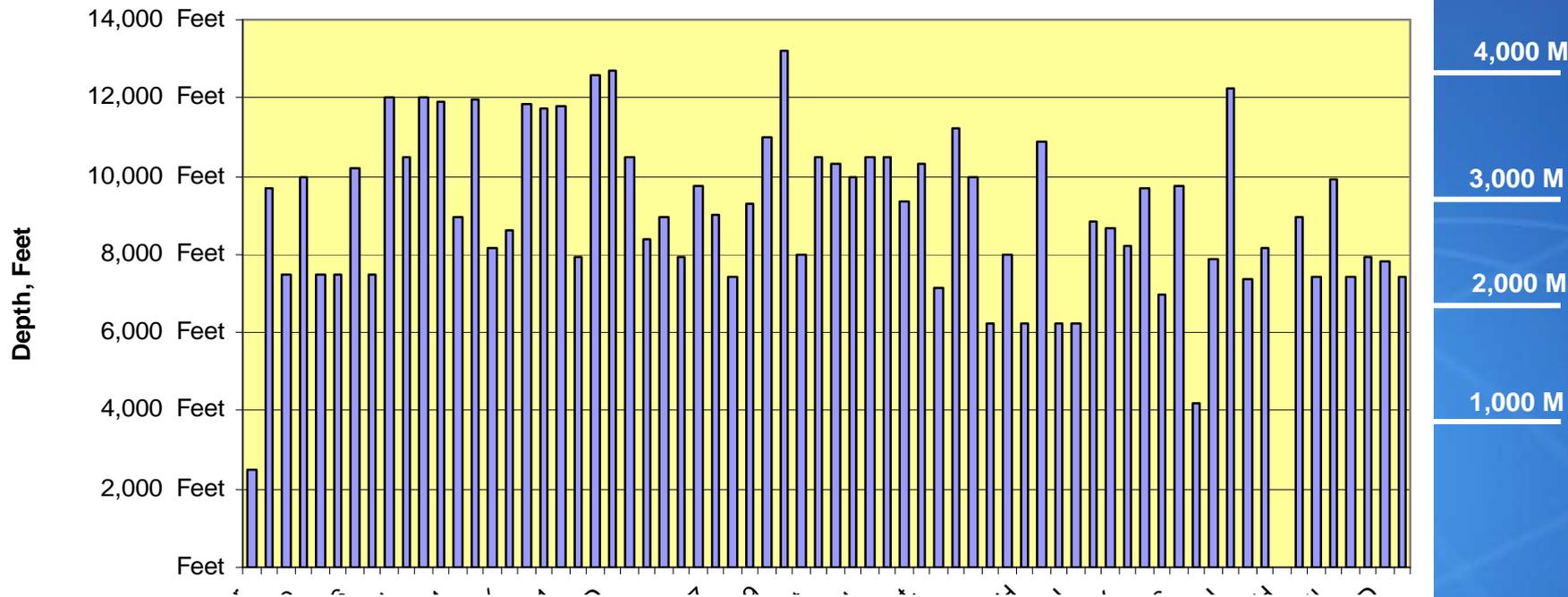
Number of Modules Run Per Well



Well Depths



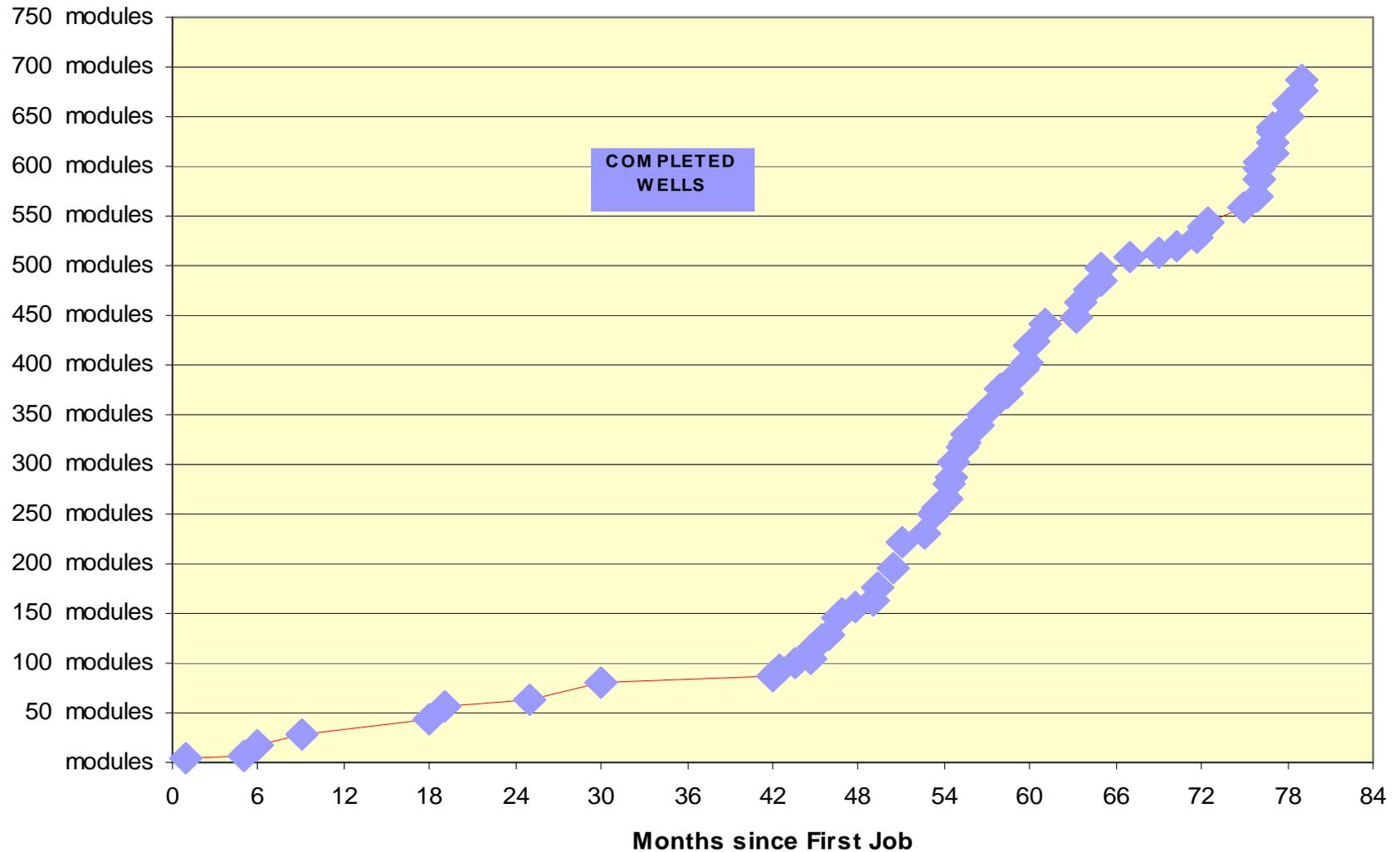
Escape Well Depths



Technology Acceptance: Modules vs. Time



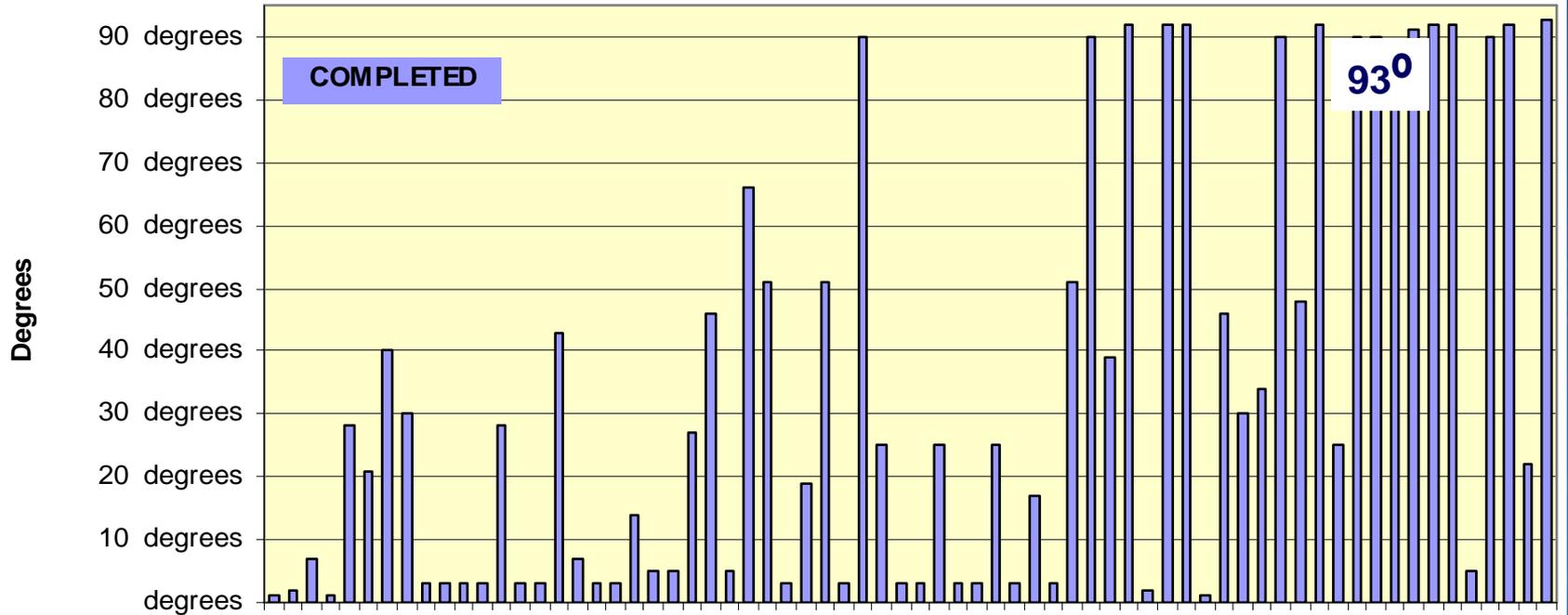
Cumulative Modules vs. Time



Escape Well Deviations



Escape Well Deviation





Excaped:

Technical Operating Efficiencies

	Industry	Marathon Only	Horizontal
Review Date:	3/13/2006	3/13/2006	3/13/2006
Number of Modules Installed	677	373	146
Number of Modules Attempted to be Fired w/control line	631	340	113
Number of Modules Successfully Fired w/control line	589	339	102
Percent successfully fired	93.3%	99.7%	90.3%
Number of Fracture Stimulations	602	315	106
Number of Premature Screenouts on Frac Jobs	22	15	0
Percent of Frac Jobs which Screened out Prematurely	3.7%	4.8%	0.0%



Conclusion

*This Excape Technology is reliable, and has safety and environmental benefits
(~50% reduction in man hours, less exposure)*

It has led to development of competing multi-zone stimulation techniques, which is beneficial to industry as a whole.

The amount of gas which can avoid being vented is very significant.