Collision Avoidance Sub-committee Update

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Agenda Topics

- Pete Clark: Review of Collision Avoidance Reporting
- Pete Clark: Bounding box offset well selection
- Updates
- SPE ACR & Rev 5 model interaction

Pete Clark: Review of Collision Avoidance Reporting

- Information rich reporting for safety critical operations
- Differences in reported attributes
- Differences in nomenclature

Actions

- Review lexicon
  - Investigate standard codes/mnemonics to remove ambiguity and facilitate non-English outputs
- Imagine what the best report will have
  - Distinctions between Planned and actual
  - Different data for different stakeholders?

Common Table Elements

Column	Headers (1)	Headers (2)	Headers (3)
Reference Well Measured Depth	Ref MD	Reference Measured Depth	Reference MD
Reference Well True Vertical Depth	Ref TVD	Reference Vertical Depth	Reference TVD
Offset Well Measured Depth	Offset MD	Offset Measured Depth	Offset MD
Offset Well True Vertical Depth	Offset TVD	Offset Vertical Depth	Offset TVD
Centerline to Centerline Wellbore Proximity	C-C Clear Dist	Distance Between Centers	Ct-Ct Distance
Minimum Acceptable Separtion Distance required to satisfy Collision Avoidance Rule	Rule MASD	Minimum Separation	Minimum Allowable Separation
Separation Factor	Sep Ratio	Separation Factor	OSF
Rule Status (Pass / Fail)	Rule Status		
Collision Avoidance Action Criteria		Warning	Status

- Eight common elements
- “Reference” & “Offset” are de facto standards
- Reporting includes reference to collision avoidance rule
- Four shared primary outputs are given different labels

Pete Clark: Bounding box offset well selection

- Define ‘bounding box’ around wells encompassing lateral extent + PU
  - Stored in database
  - Min box size = 100ft; Max related to MD & Confidence
- Where a well’s bounding box overlaps the reference it becomes an offset

Updates

- Harry Wilson: CA/Error Model Sidetrack Working Group Update
- Bill Allen: Teaser of today's main presentation

SPE Rule & Rev 5 Model interaction

- Andy McGregor: Worked example comparing Rule's Surface Margin (Sm) term with affect of Rev 5 error model's misalignment terms
- Jerry Codling: Presented on impact of Sm and Project Ahead uncertainty (σPA)
  - Both factors have greatest impact near surface (as designed)
  - Introduces a challenge for implementation
- Adoption of rule is a substantial process/management change

ISCWSA CA Rule

- $SF = \frac{D - R_r - R_o - S_m}{k\sqrt{\sigma_s^2 + \sigma_{PA}^2}}$

D	The distance between a given point on the reference well and closest point in 3D space on the offset well.	
R_r	The open hole radius of the reference well.	
R_o	The open hole radius of the offset well.	
S_m	Surface margin increases the effect radius of the offset well and is used to accommodate small, unidentified errors. It also defines the minimum allowable slot separation during facility design and ensures the separation rule will prohibit the activity before nominal contact when the uncertainties are zero.	0.3m
k	A dimensionless scaling factor which represents the number of standard deviations at which SF is evaluated. This is related to the confidence level in the SF result.	3.5
σ_s	The relative uncertainty between the reference and offset wells, at one standard deviation, along the direction of D determined from individual uncertainties of the two wells σ_r and σ_o	
σ_{PA}	Is the one standard deviation uncertainty in the project ahead from the current survey station to the bit and next survey station. This takes into account the ability of the driller to steer the well to the required point.	0.5m

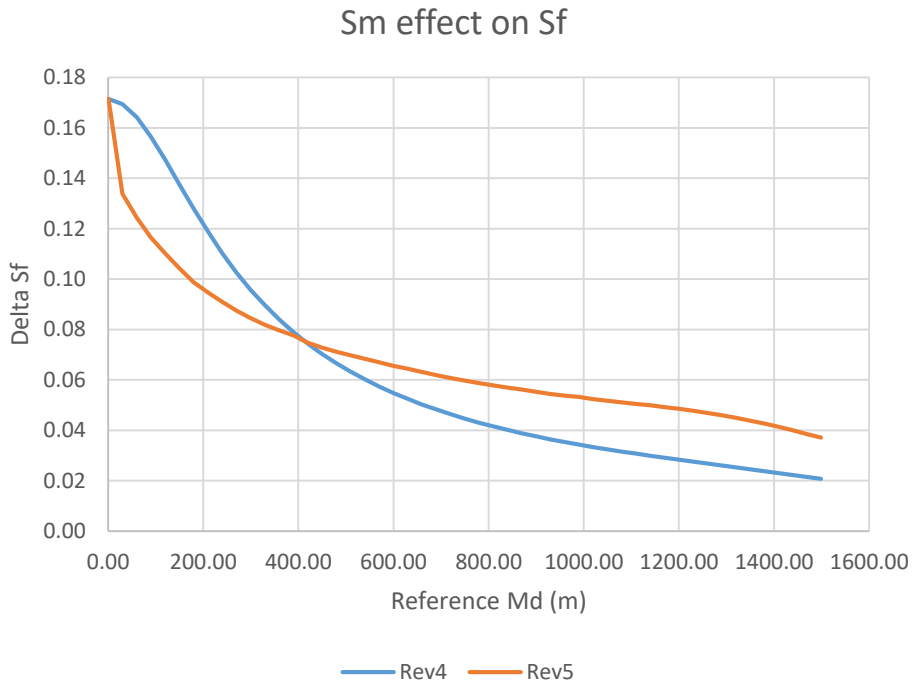
Possible Avenues for modification

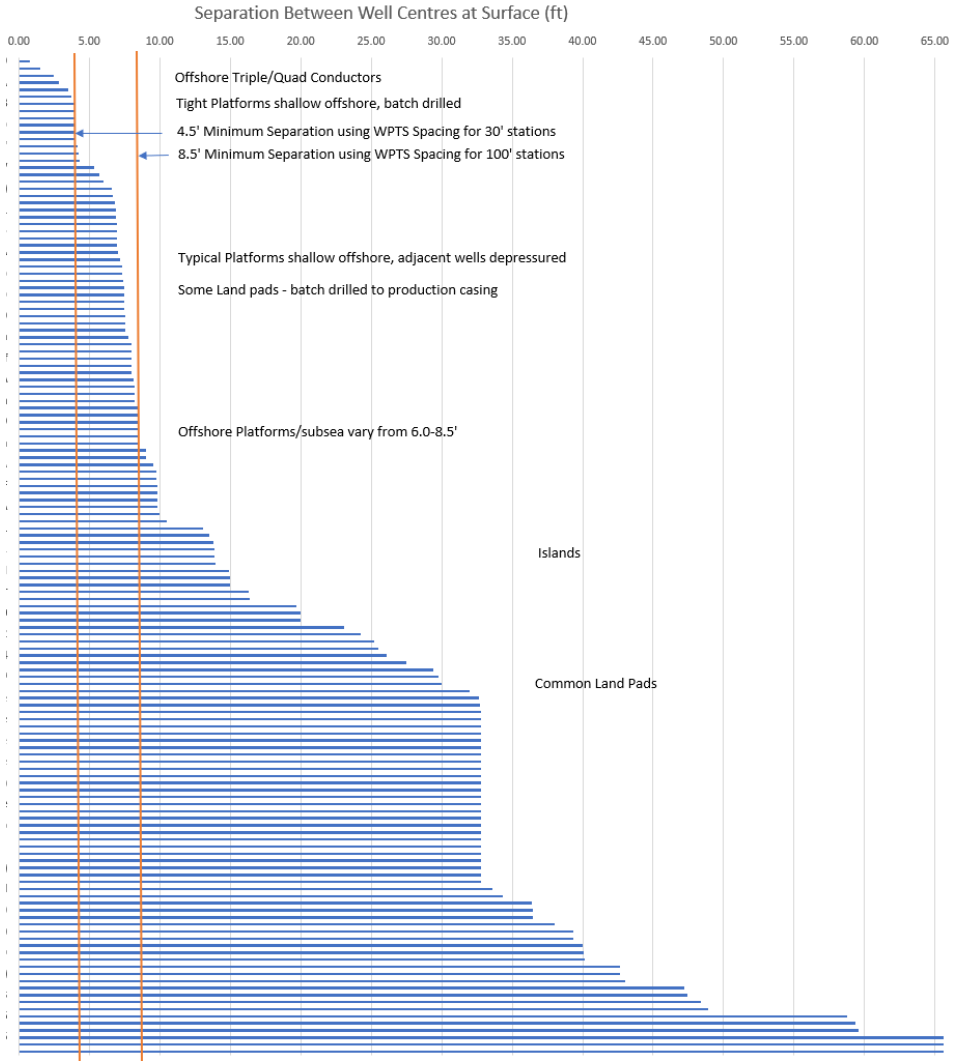
- Reduce σPA when survey frequency increased
  - 0.15m/0.5ft, max course length 10m/30ft
- Reduce Sm when relative slot uncertainty is firmly established
  - Sm=0 when surface uncertainty estimate comprehensive and conservative

Effect of Sm

Sm reduces Sf by an amount

$$\Delta SF = \frac{S_m}{k\sqrt{\sigma_S^2 + \sigma_{PA}^2}}$$




Separation Between Well Centres at Surface (ft)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
55.00
60.00
65.00
Offshore Triple/Quad Conductors
Tight Platforms shallow offshore, batch drilled
4.5' Minimum Separation using WPTS Spacing for 30' stations
8.5' Minimum Separation using WPTS Spacing for 100' stations
Typical Platforms shallow offshore, adjacent wells depressured
Some Land pads - batch drilled to production casing
Offshore Platforms/subsea vary from 6.0-8.5'
Islands
Common Land Pads