



TOTAL

COMMITTED TO BETTER ENERGY

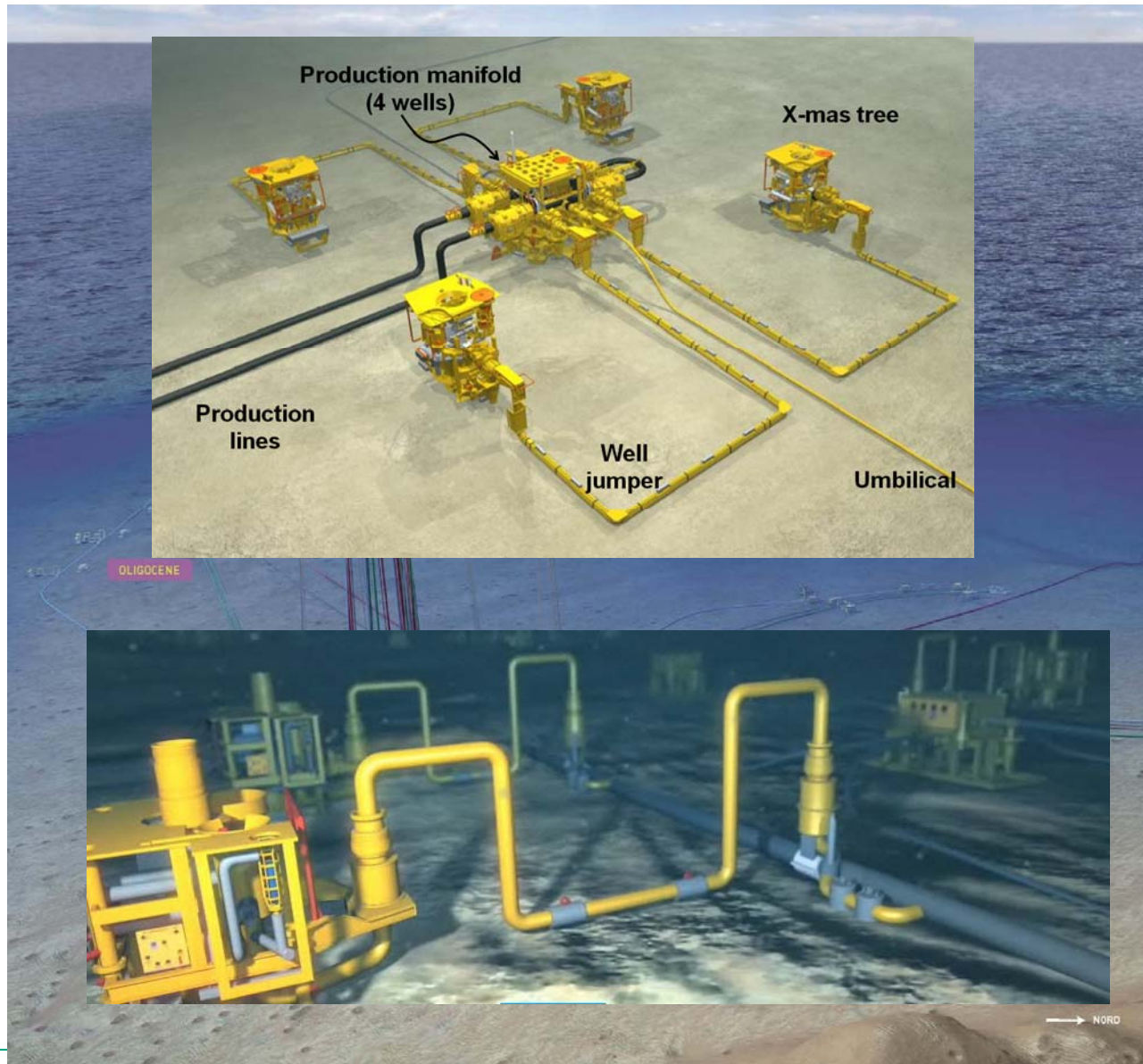


© Marc Roussel / Total

POSITIONNEMENT SOUS MARIN SUR UN CHAMP DE PRODUCTION GRAND FOND

F. AUGER – Paris 27/03/2014

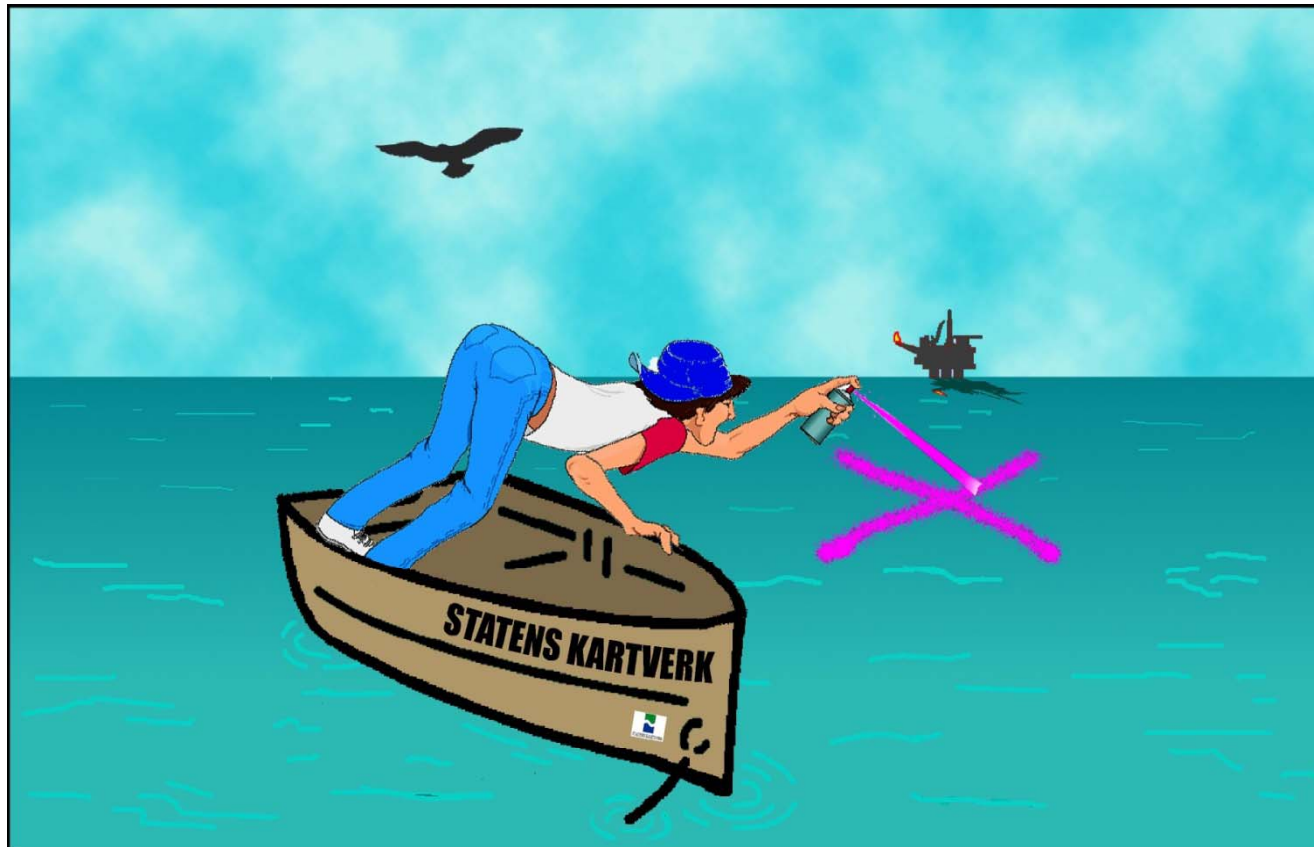
DÉVELOPPEMENT GRAND FONDS - PAZFLOR



TOLÉRANCES & PRÉCISION

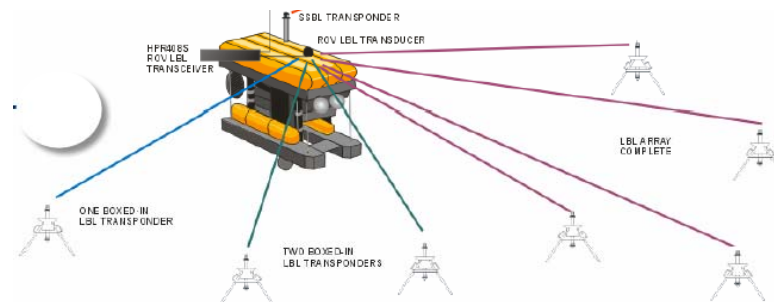
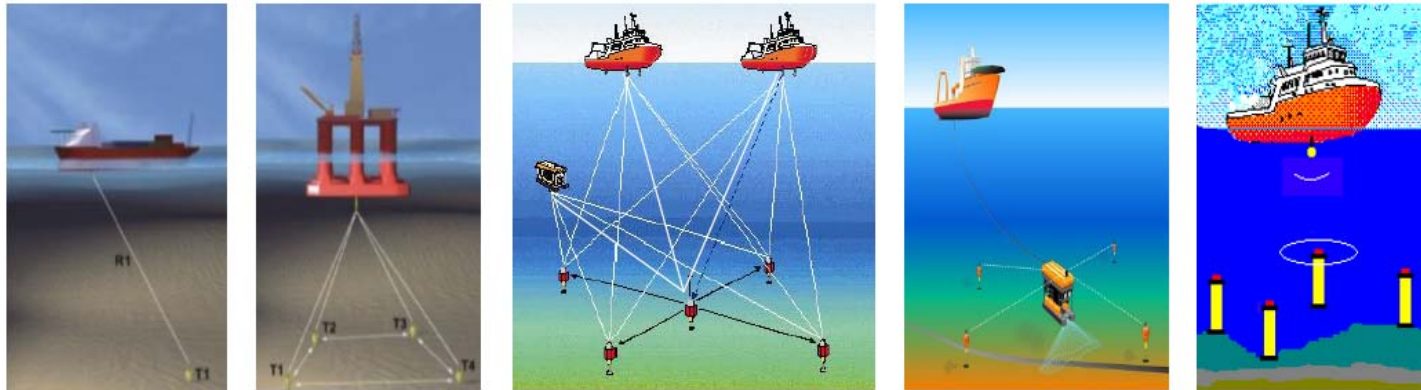
- XTREE / MANIFOLD / INJECTION TEE
 - Tolérance : +/- 2.5 m
- ANCRES FPSO / BOUEE
 - Tolérance : +/- 5 m
- INITIATION et DEPOSE DES PIPES
 - Tolérance : +/- 3 m CrossLine & +/- 5m InLine
- PRECISION RECHERCHEE : sub métrique (à 2σ)
*Règle du pouce : précision positionnement = 30% * tolérance*

WHAT WE WOULD LIKE TO DO IS THIS ...

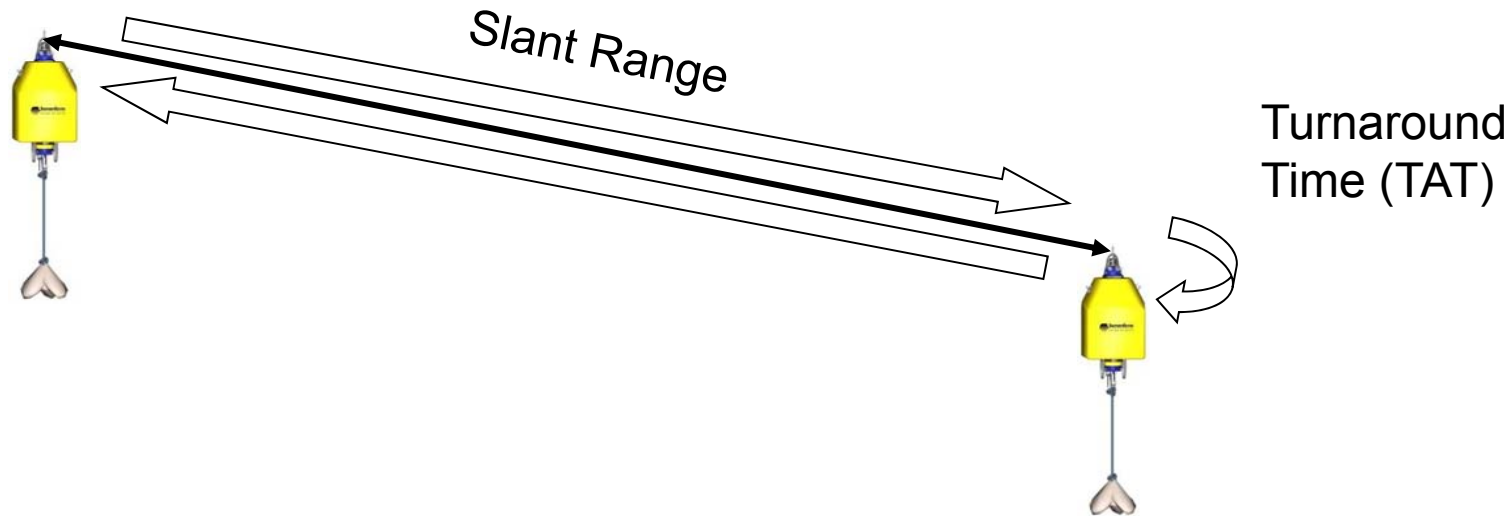


ACOUSTIC POSITIONING PRINCIPLES OVERVIEW

- SSBL/USBL Super Short Base Line / Ultra Short Base Line
 - LBL Long Base Line
 - MULBL Multi User Long Base Line
 - LBL ROV Long Base Line ROV
 - LBL TP Long Base Line Transponder
-
- Combinations of above principles



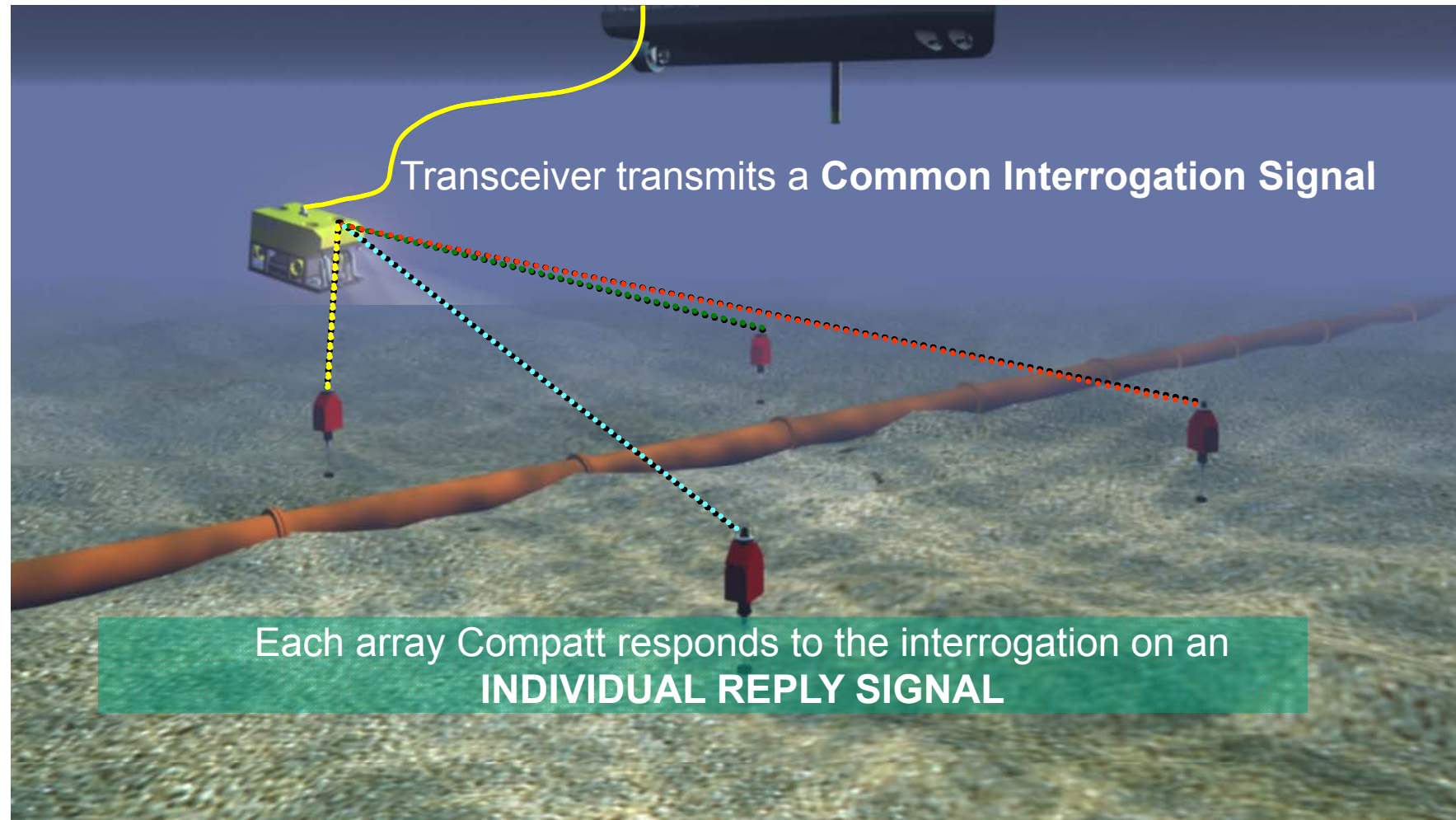
RANGE FROM ACOUSTIC OBSERVATIONS



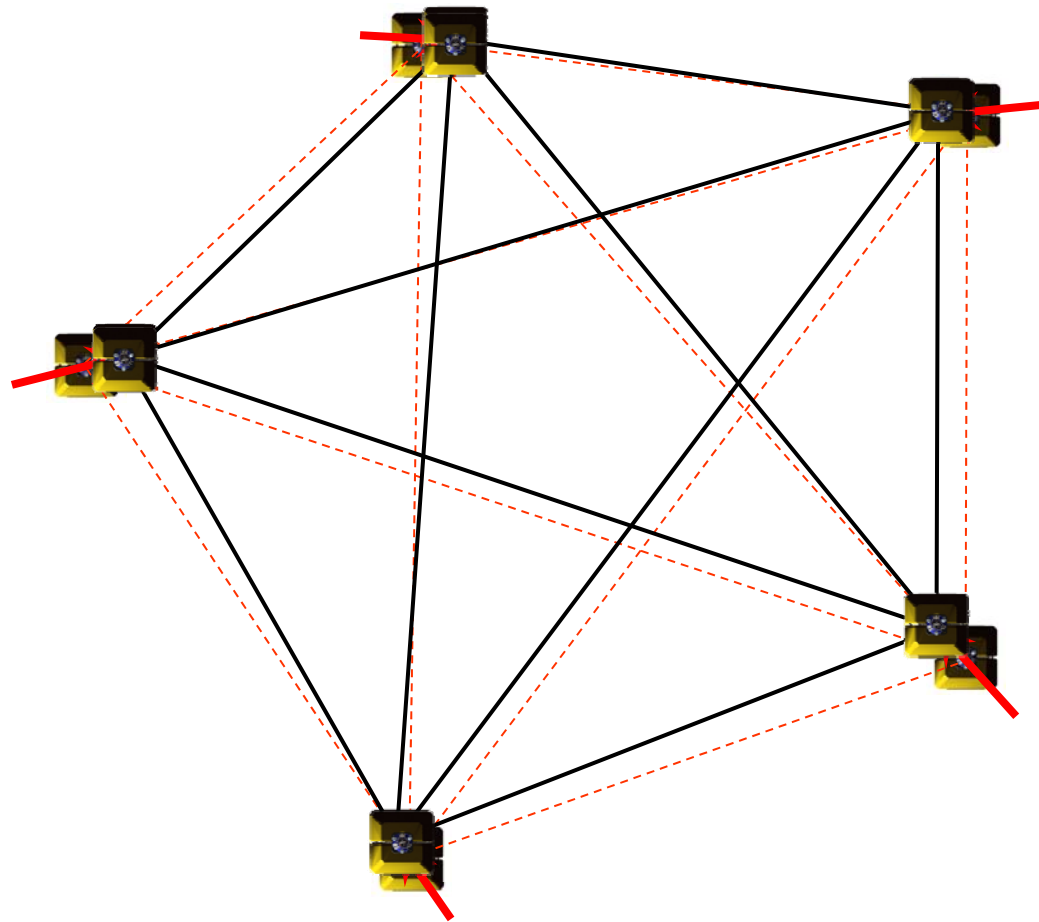
Compatts use highly accurate quartz crystal oscillators to measure 'time of flight' of an acoustic signal

$$\text{Slant Range} = \frac{(\text{two-way travel time} - \text{TAT}) * \text{Speed of Sound}}{2}$$

POSITIONING OF A MOBILE UNIT WITHIN THE CALIBRATED ARRAY

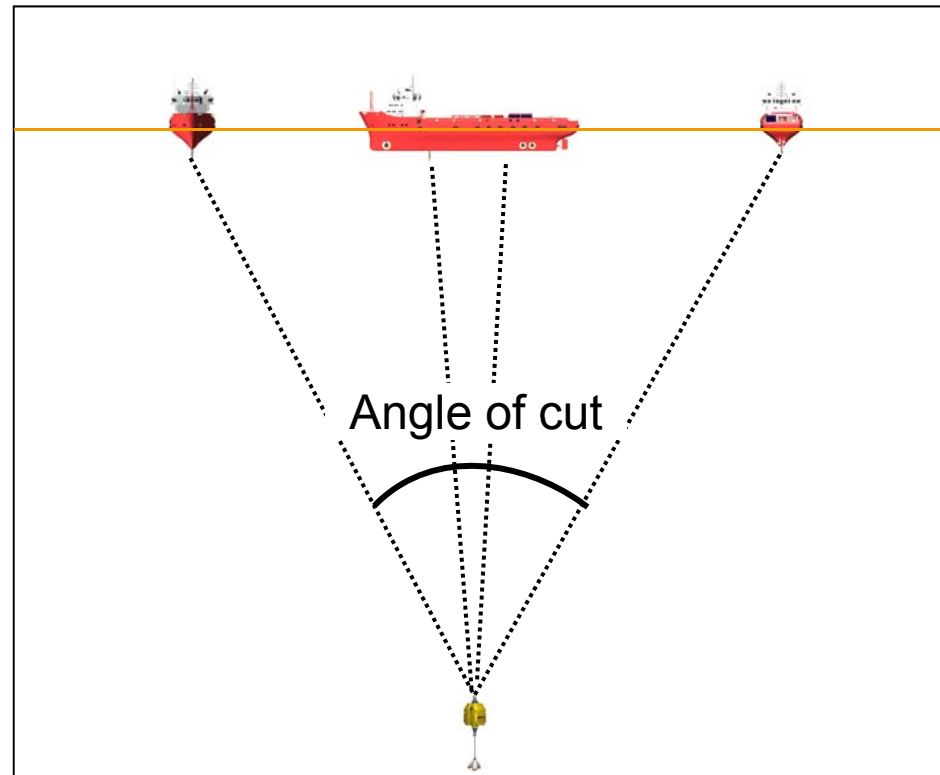
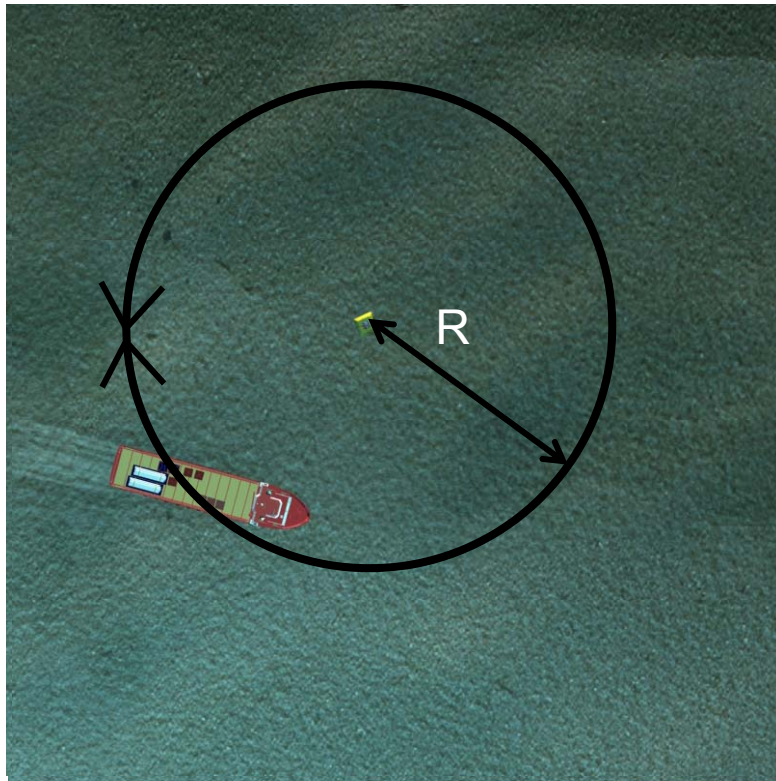


CALIBRATION – ESTABLISHING A REFERENCE FRAMEWORK



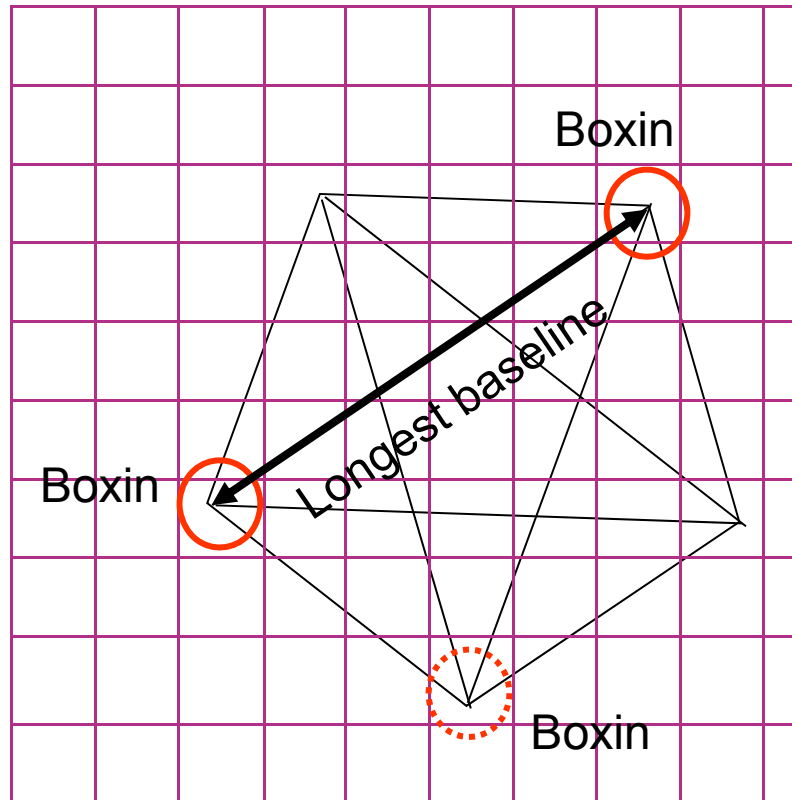
Least squares adjustment to derive best estimate of beacon positions and depths

TRANSFER OF SURFACE POSITIONING TO THE SEABED – CLASSIC BOXIN



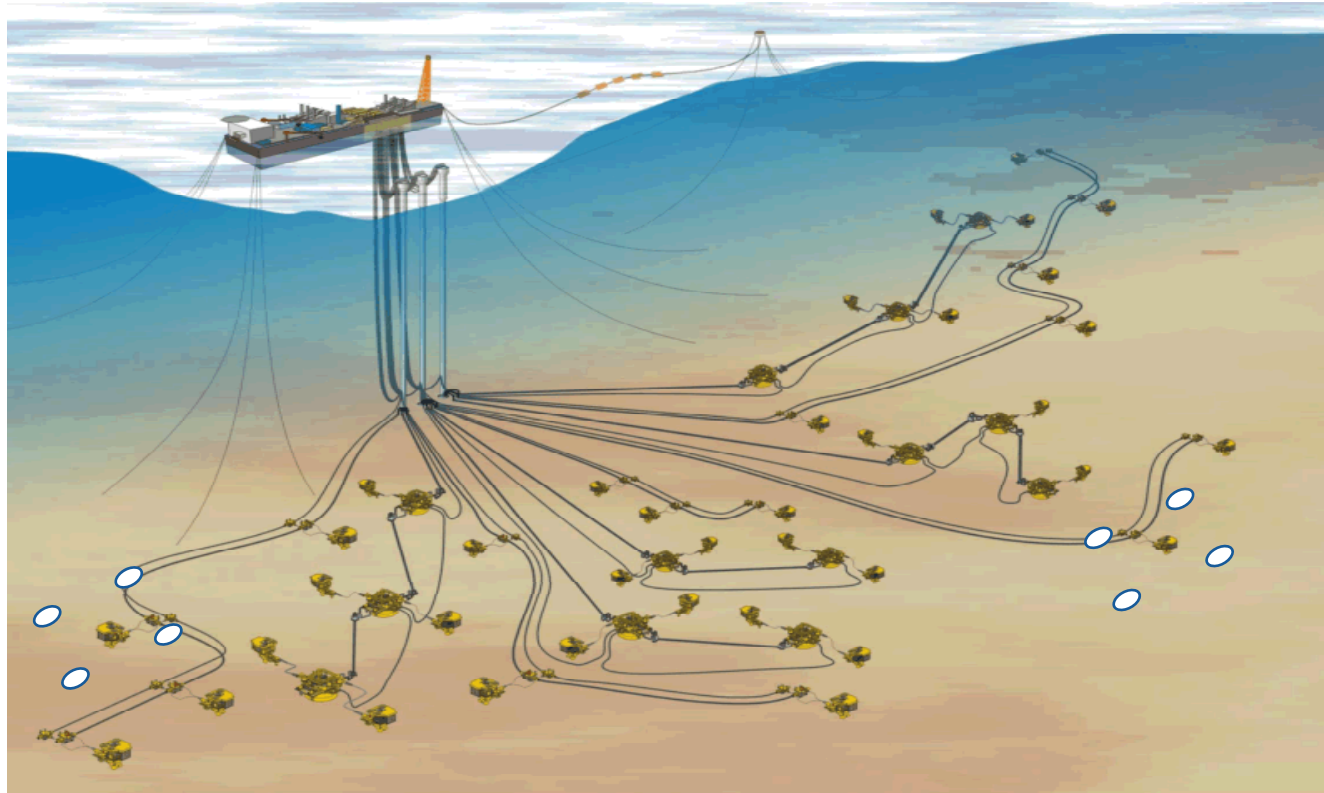
Data collection procedures minimises the effect of observational error (fixed offset from beacon and constantly changing heading)

ABSOLUTE CALIBRATION ADJUSTMENT GUIDELINES



- Distribute position observations evenly throughout the network to control error propagation
- NEVER hold more than one co-ordinate fixed in an adjustment
- Complete a relative adjustment **before** including position observations to assess the quality of the depth and baseline observations
- Enter the standard error of position observations at the same confidence level as depth and baseline observations

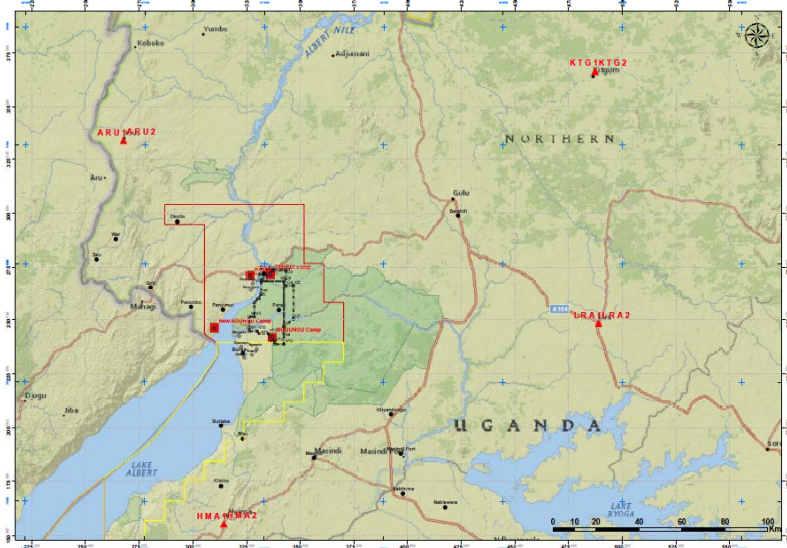
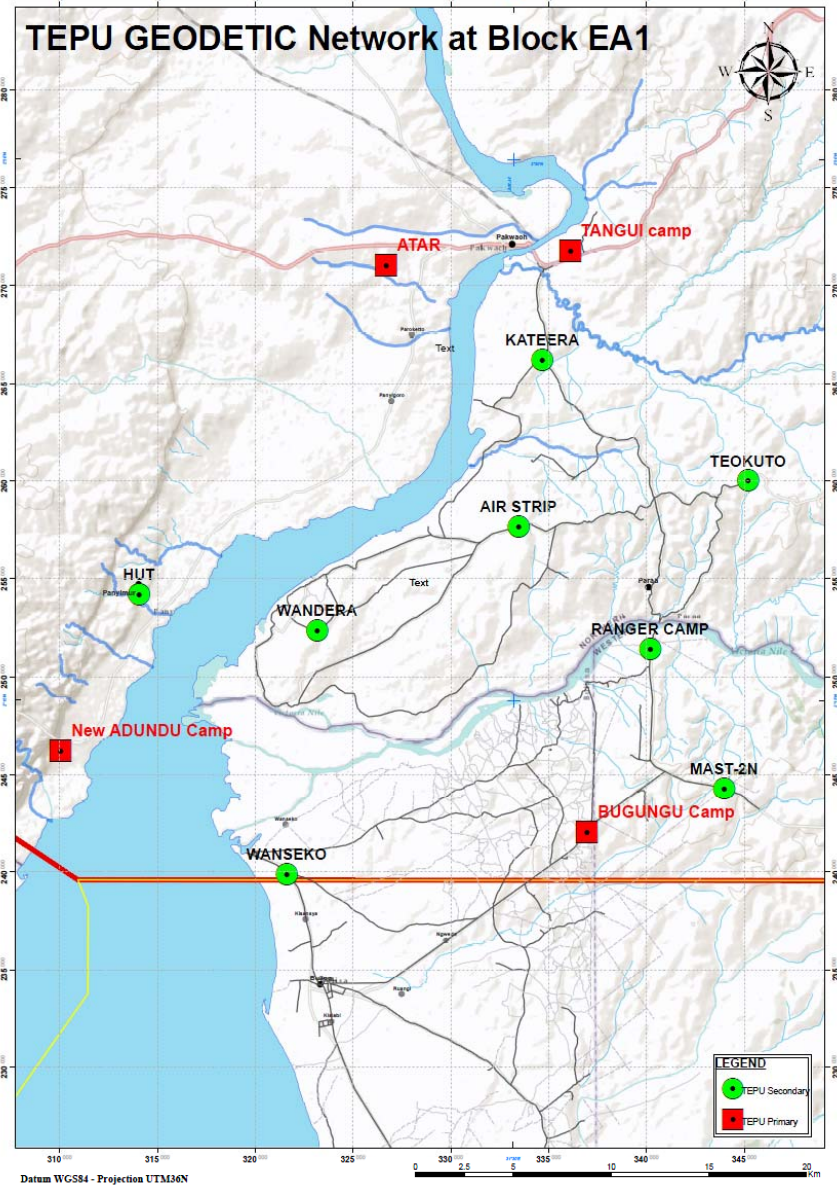
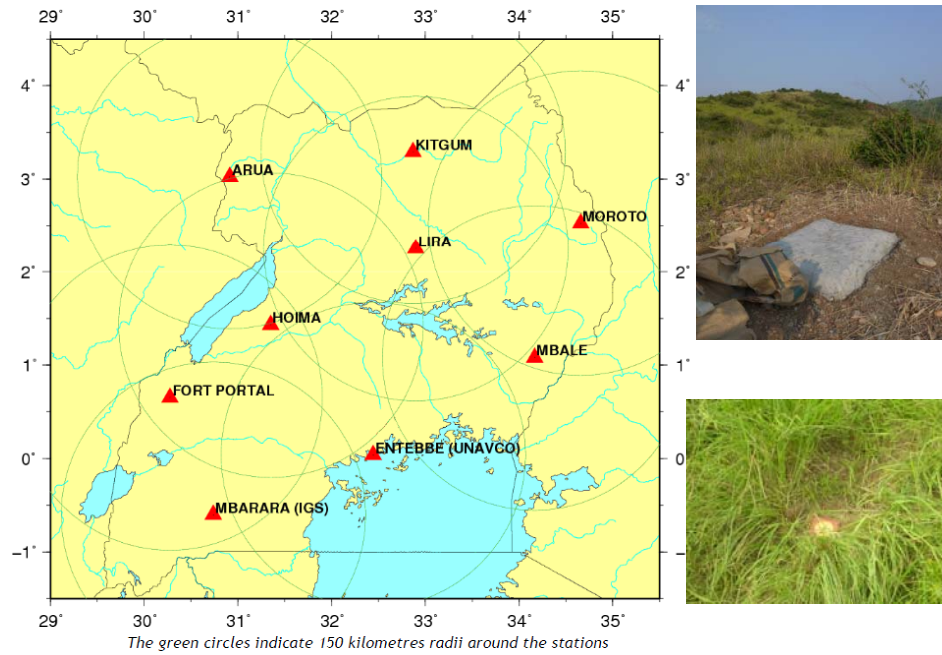
DEVELOPPEMENT DEEP OFFSHORE



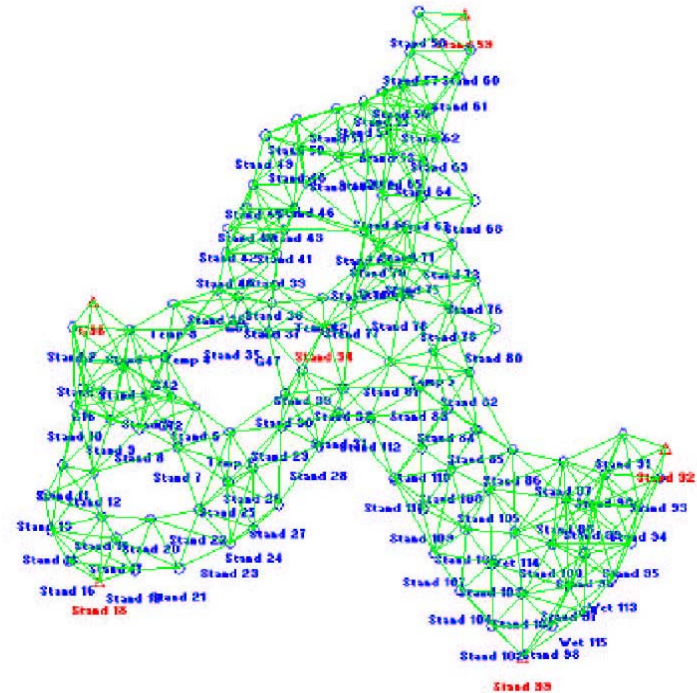
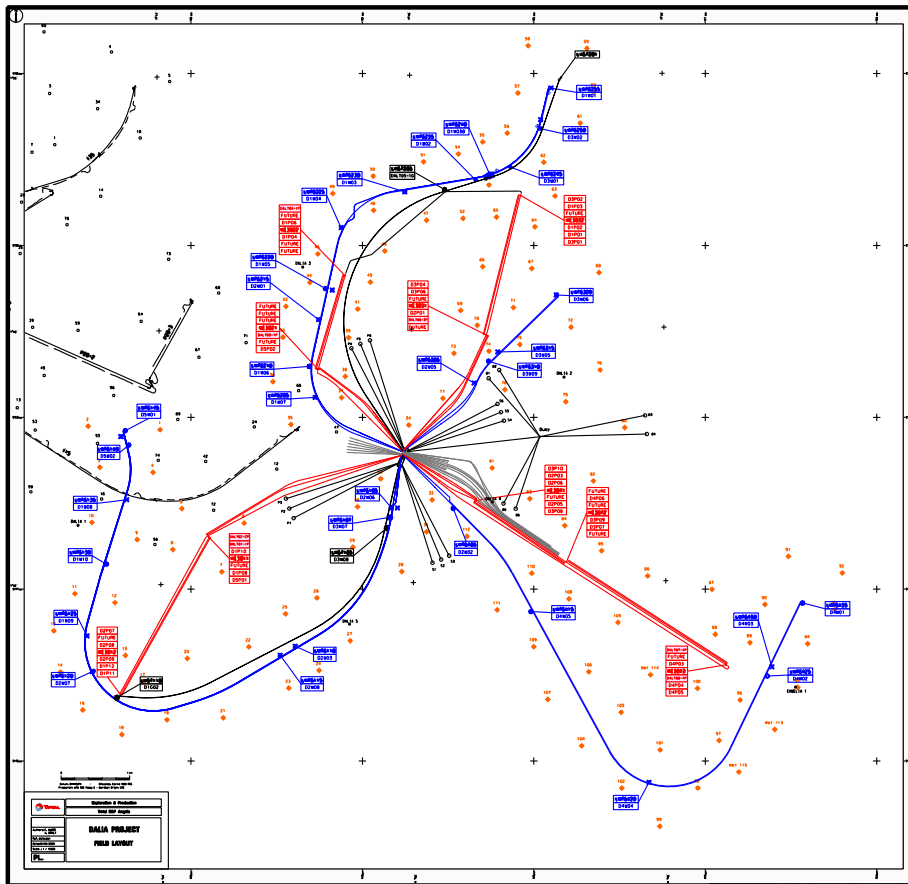
- ↪ Positioning of subsea equipment with acoustic technique LBL (Long Base Line) for all parties : drilling, SPS, FPSO, SURF
- ↪ Need to use a common, homogeneous and unique coordinates referential
- ↪ To save calibration time for installation vessels and drilling rigs
- ↪ To minimize number of dead weight left on sea bed

→ **Installation of a permanent frame array**

GEODETIC NETWORK UGANDA

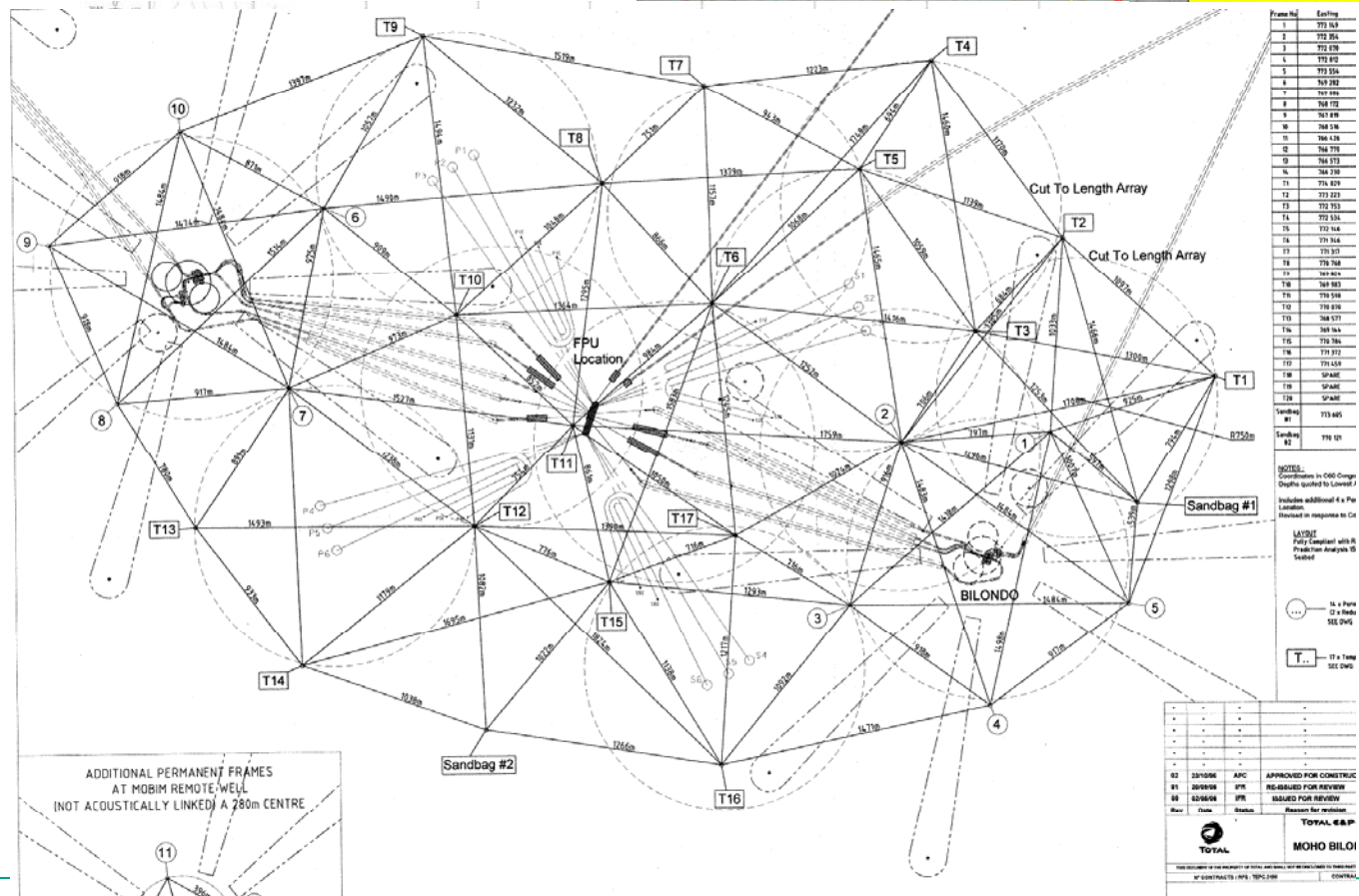
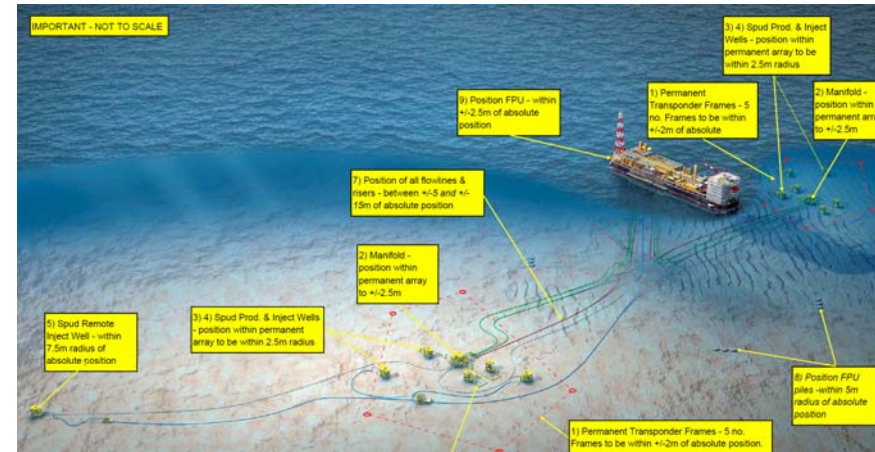


DEVELOPPEMENT DEEP OFFSHORE



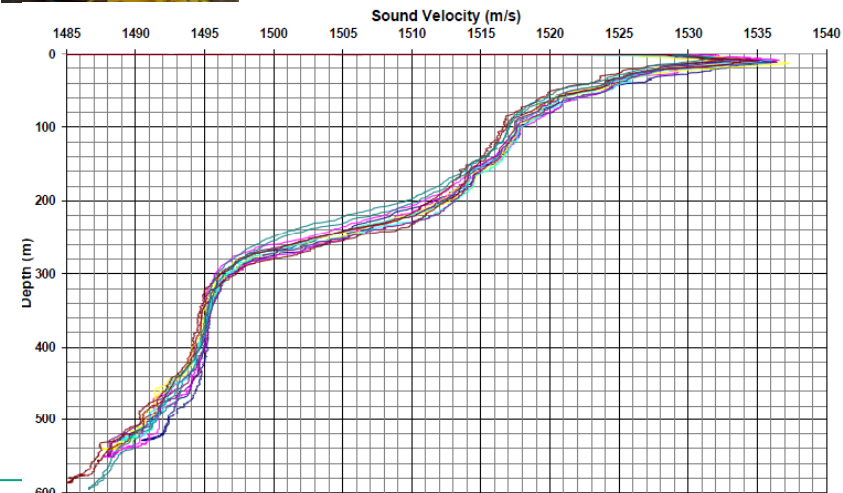
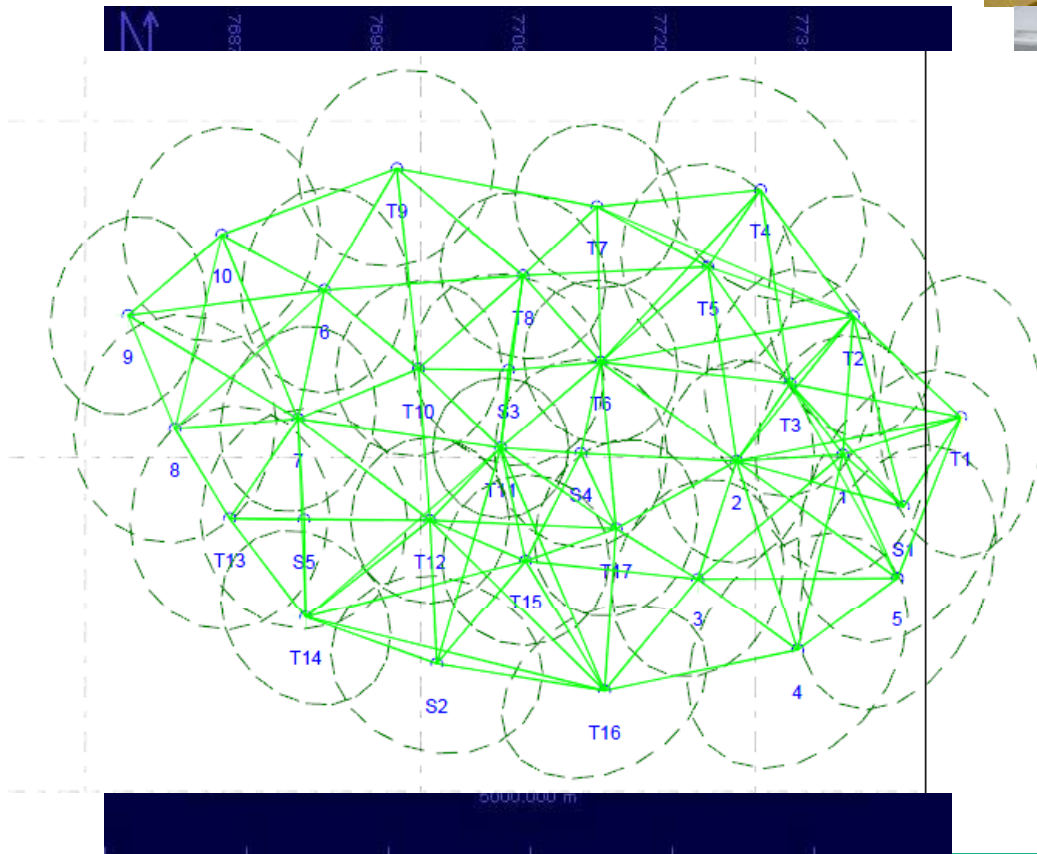
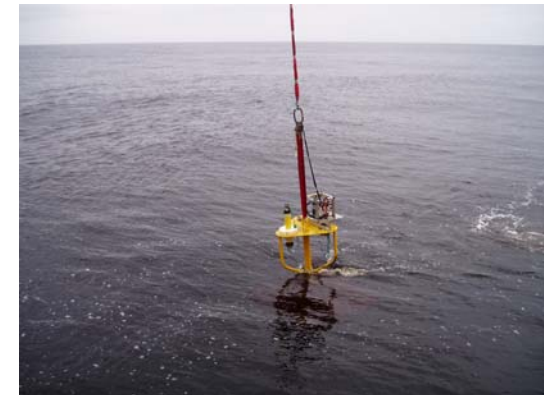
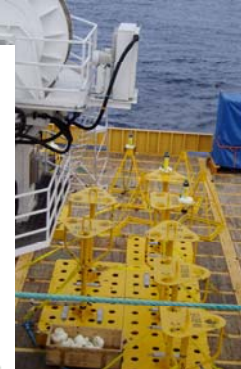
MOHO BILONDO

- Water depth : 540 to 740m
- Project launched in August 2005
- First oil in April 2008
- Only 2 production centers (subsea manifolds)

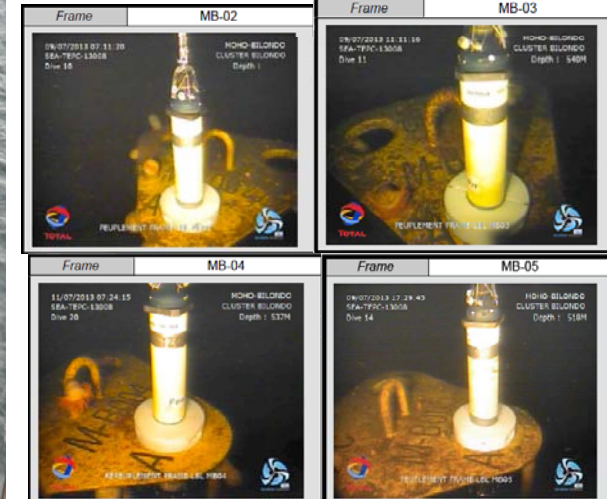
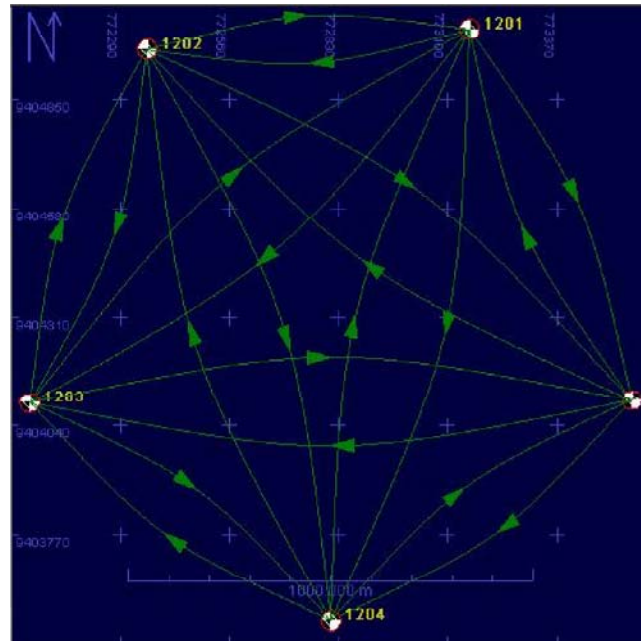
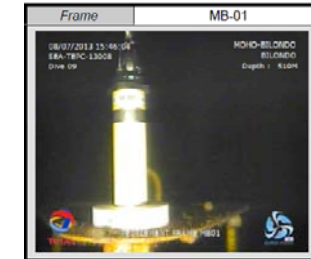
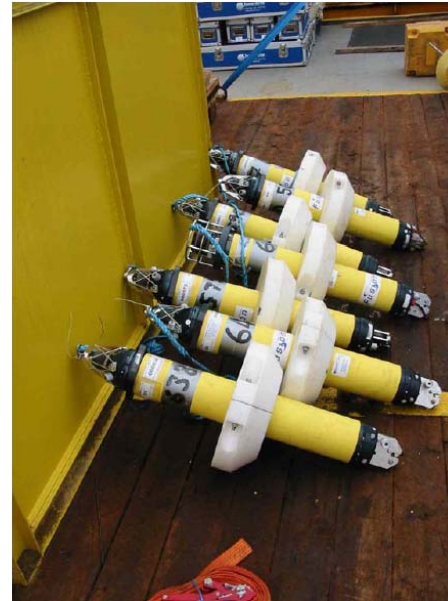
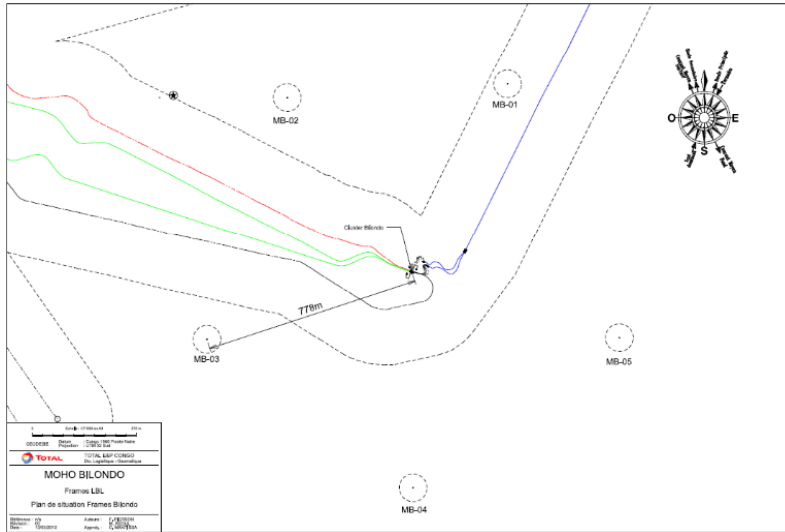


MOHO BILONDO FRAME ARRAY

- Installation & Calibration : Dec 2006
- 14 Permanent Frames
- 17 Temporary Frames



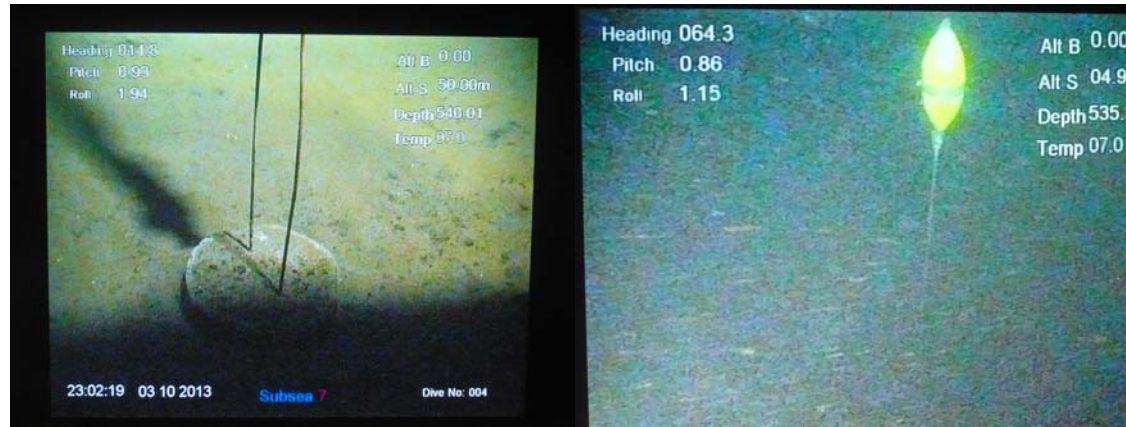
MOHO BILONDO DRILLING BIL2-06



MOHO BILONDO DRILLING BIL2-06



ROVNAV



Marker Buoy



Installation with the ROV

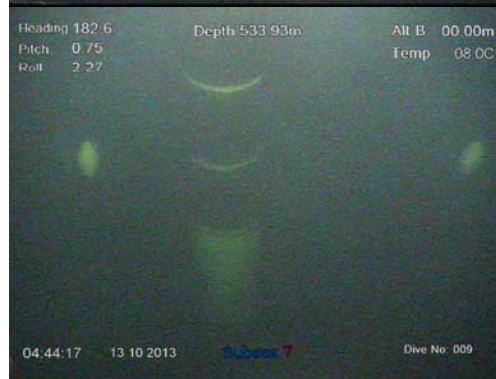


2 marker buoys in place

MOHO BILONDO DRILLING BIL2-06



Drilling Rig GSF135



MOHO BILONDO DRILLING BIL2-06



Total E&P Congo

Topography

COUNTRY : CONGO
WELL : BIL2-06

Licence : Moho Bilondo
Rig : GSF 135

Moho Bilondo BIL2-06 / P 213 Development Well

DATUM : (C60) : Congo 1960 Pointe Noire
PROJECTION : (S32) : UTM S32 (CM 9° East)
SPHEROID : (C80) : Clarke 1880 (IGN)
MERIDIAN ORIGIN : (GRE) : Greenwich

<u>GEOGRAPHICAL Co-ordinates</u>	<u>UTM Co-ordinates</u>
Latitude : 05° 23' 04.672" S	Easting : 772 814.3 m
Longitude : 11° 27' 42.169" E	Northing : 9 404 323.3 m

Revision : 01
Final positioning : 13/10/2013
Positioning system : Wideband LBL
Accuracy : +/- 0.2m

Contractor : FUGRO FSBV
Supervisor : Emilie BLANCART

PGB Heading (True) : 200.9° True
PGB Heading (Grid) : 201.1° Grid

PGB Elevation : 3.4 m (sea bed)
Note: PGB elevation refers to the top of the 36° conductor

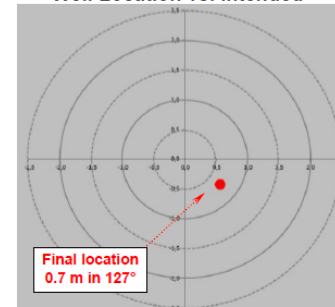
PGB bulls-eye reading : 0.25°
(Starboard aft)
@ bearing 335°

Water Depth : 541.5 m (MSL)
Note: Water depth from C&C2004 site survey (EP/DEV/TEC/GEO)

RT elevation above MSL : 26 m

LAT = MSL - 0.96 m

Well Location vs. intended



Thank
You

Frederic AUGER