

**North Sea**



**Measurement Workshop**

**1998**

**PAPER 26**

**FOCUS DISCUSSION GROUP C**

**MULTIPHASE 2 - FIELD EXPERIENCE / INSTRUMENTATION**

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# **NORTH SEA FLOW MEASUREMENT WORKSHOP 1998**

**DISCUSSION GROUP ON MULTIPHASE  
TECHNOLOGY**

**Title**

**Operational Experience of the MFI MultiPhase Meter**

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## **Operational Experiences – 1998**

### **BRIEF INFORMATION ON RECENT INSTALLATIONS - MFI MULTIPHASE METER**

Enclosed are some plots of recent field experiences of MFI Meters in different applications. Some brief explanations are provided in the following.

The first plot is made by Statoil, showing results from a 1 year test (Feb 97 – Feb 98) at the Gullfaks platform in the North Sea. The purpose of this test was to verify the operational stability of the MFI meter and to test its repeatability. The meter readings were adjusted to the test separator readings at the start-up in Feb 97, and the meter and its calibration was never touched after that point. As can be seen from the plot, the repeatability is extremely good, with no drift at all observed after one year of operation. The Meter did not suffer from any problems, and the readings from the different well tests are generally within 5%. On an accumulated basis, the oil, water and gas rates are found by Statoil to be within 1% during the whole one year period.

The second plots show start-up (2,5 hr period) of a well in Africa. As can be seen from the charts, a heavy emulsion during the first hour changed into steady flow with GVF at 70% and watercut around 10%. Later on (not showed in the charts) the watercut decreased to the expected level around 1-2 %. The second chart shows a comparative test of the measurements from the MFI Meter towards a test separator for a period of two weeks. As seen from the graph, the measurements from the MFI Meter were within  $\pm 1.2$  % of the flow rates from the test separator during whole this period.

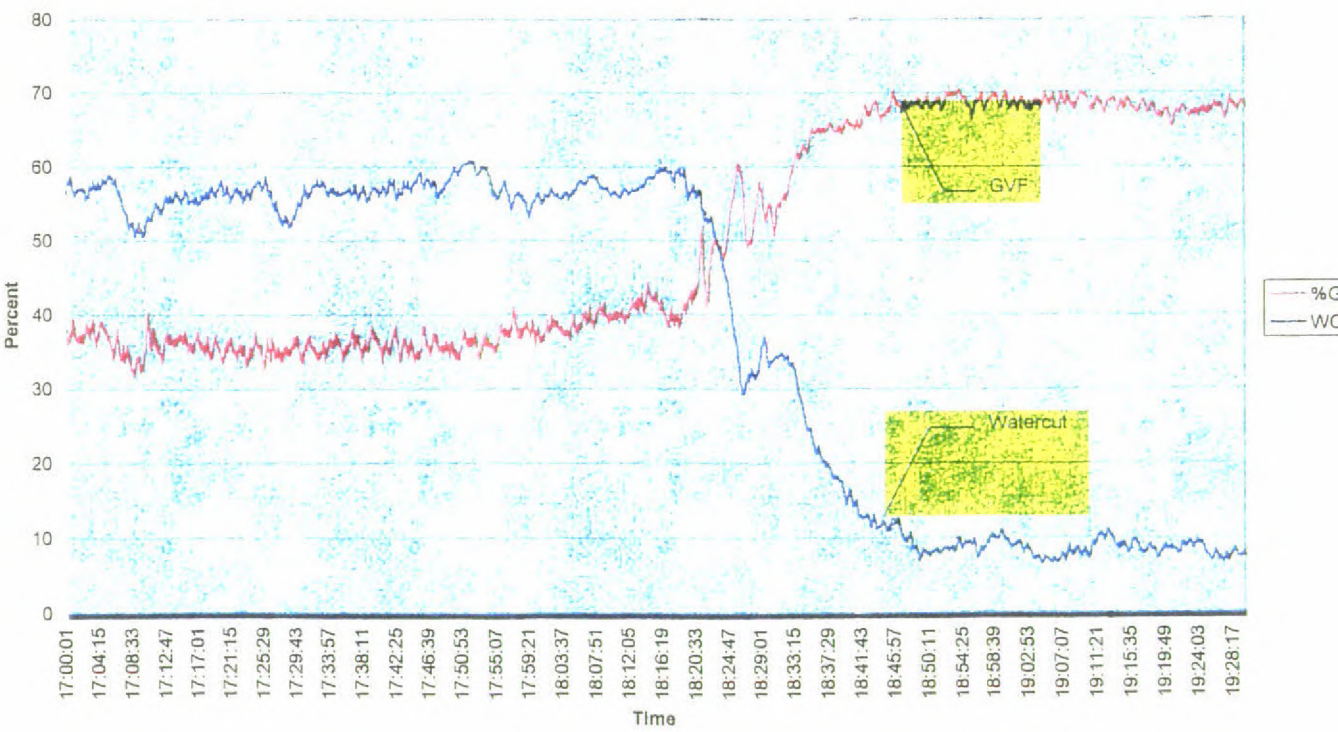
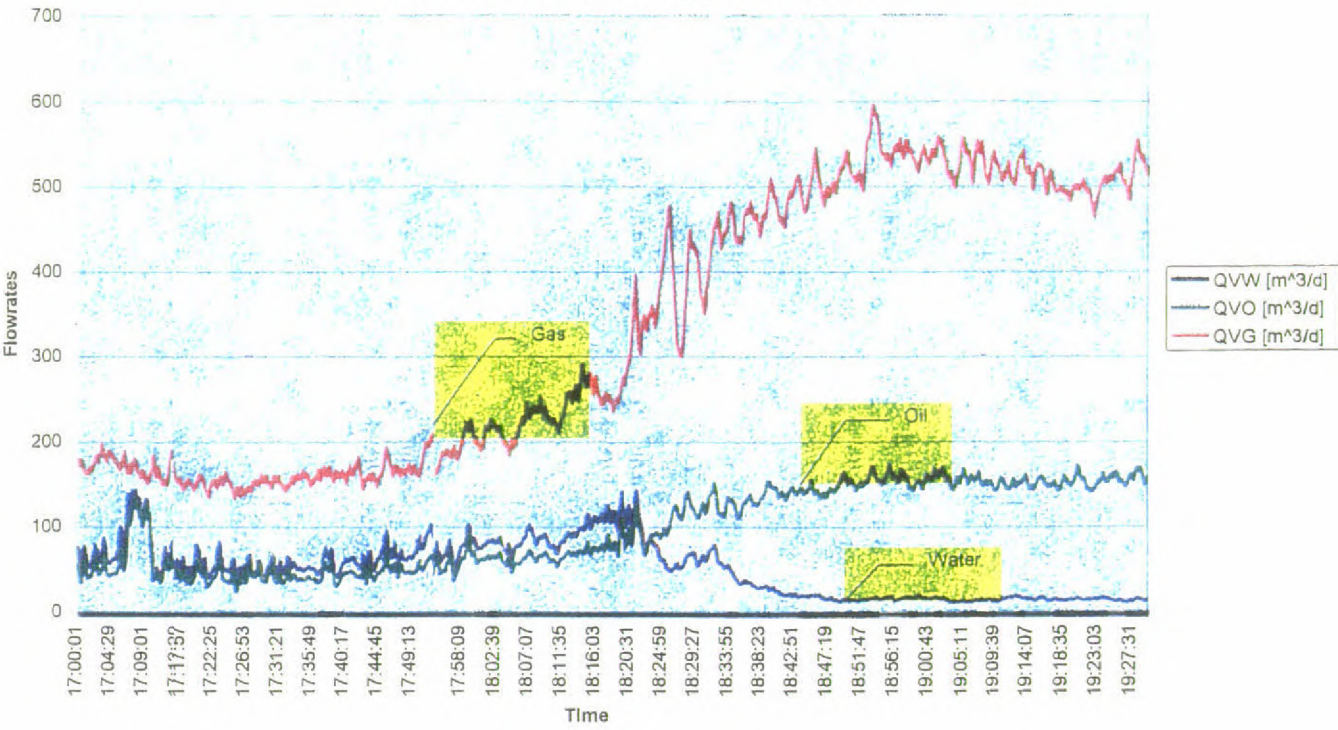
A third example is taken from the Middle East, where different wells have been tested. This MFI meter is installed in a very hostile environment (ambient temperature during the day of 55 to 60 degC), and heavy slugging. The slug intervals and lengths can easily be found looking at the plots. Another interesting finding is that the temperature has a big impact on the flow conditions in the pipe, as can be seen in the 14 h test plot. As you can see, the slugging becomes more severe as the ambient temperature decreases and the corresponding viscosity increases. Another result of the same is that some of the gas goes into the liquid phase. These things have been known by the operators, but unnecessary to say they were impressed by the MFI Meter performance which shows it real-time.

The final example is from Gullfaks A where 8 MFI MultiPhase Meters have been installed. Six of the MFI Meters are used for allocation of subsea tie-in fields and two MFI Meters are used to increase the welltest capacity of the test separator. The following two charts show a comparative test of 9 wells towards the Gullfaks A test separator. The wells have a GVF range of 25-75% and a watercut range of 10-90%. As seen from the graphs, both the oil and gas flowrates are well within  $\pm 5$ %.





Satellite Platform - Africa  
FlowRates during Start-Up, 2,5 hr period

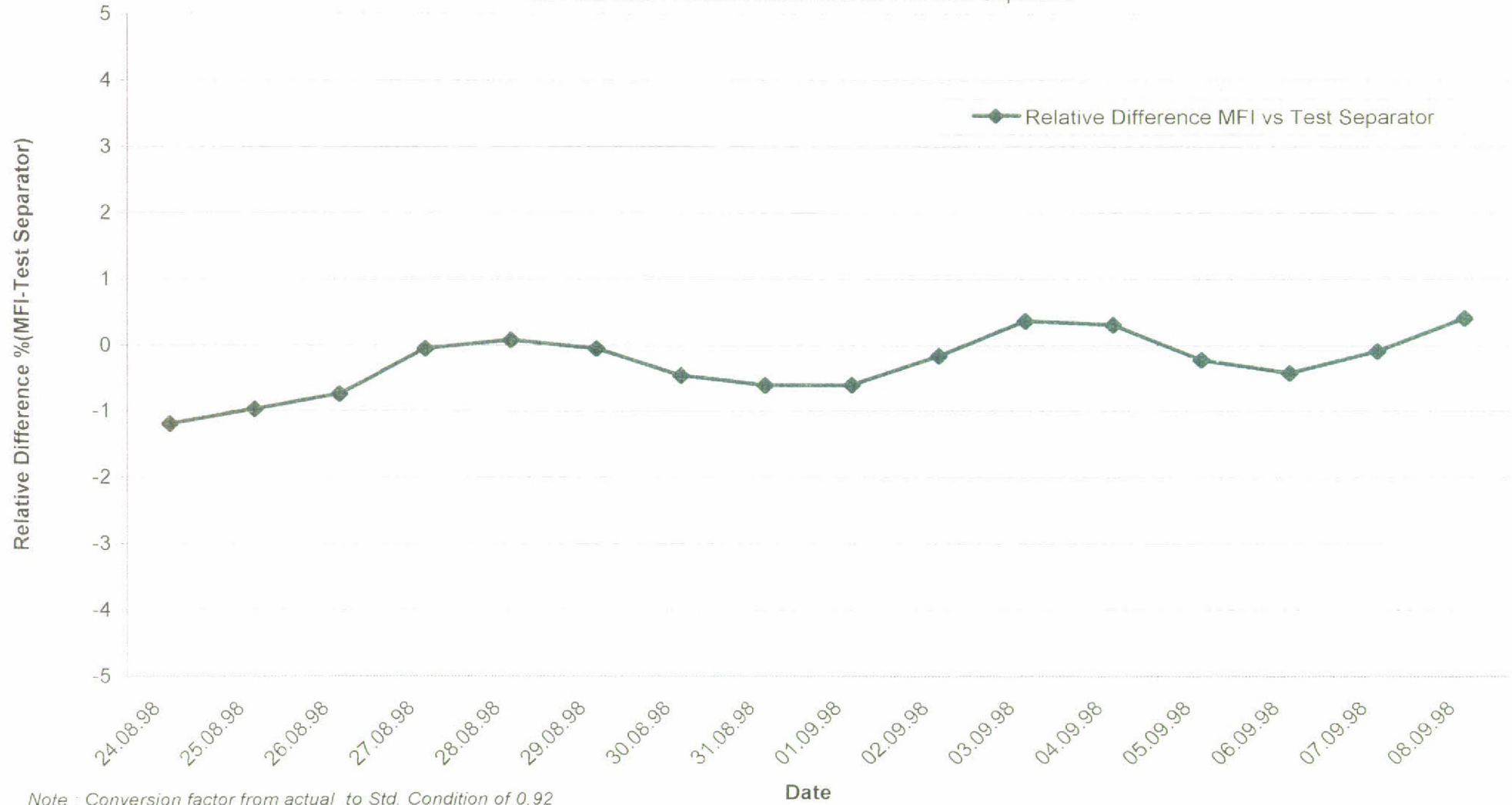


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## Satelite Platform - Africa

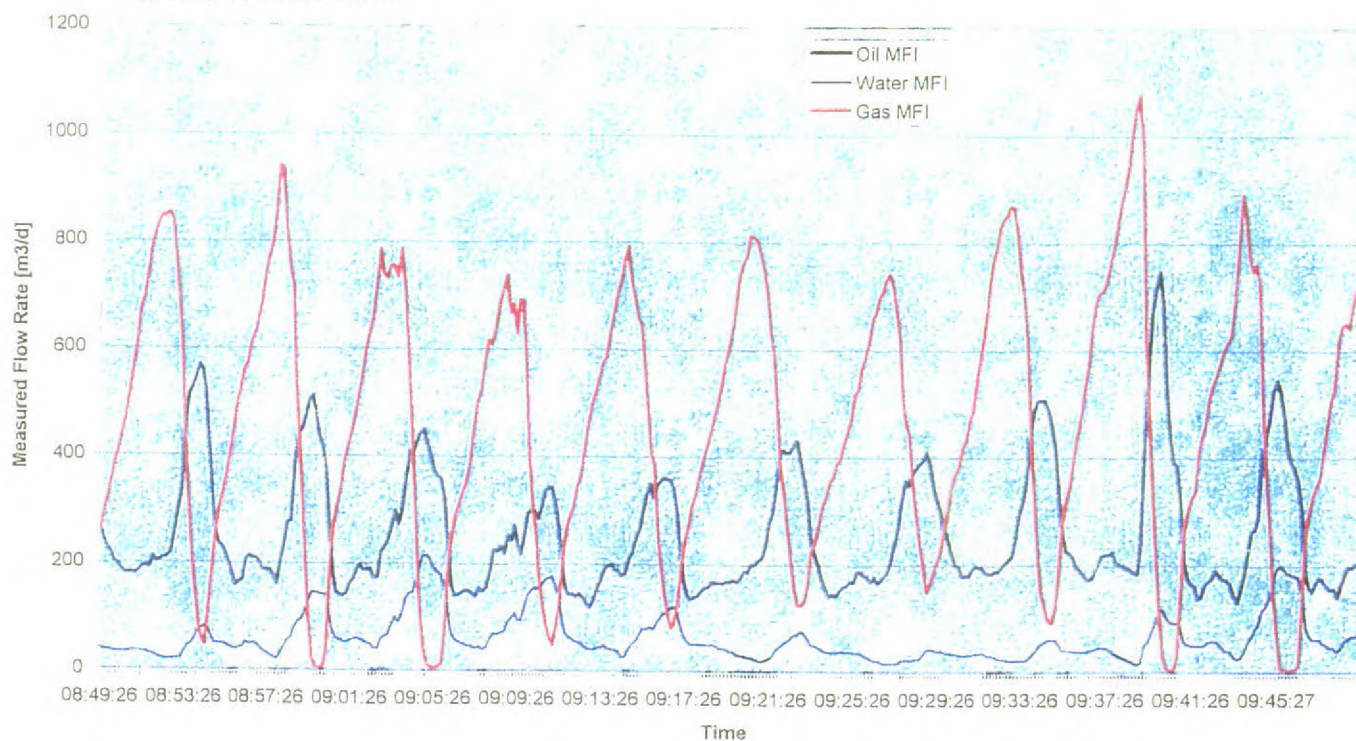
MFI MultiPhase Meter

Oil Flow Rate : Relative Difference MFI vs Test Separator

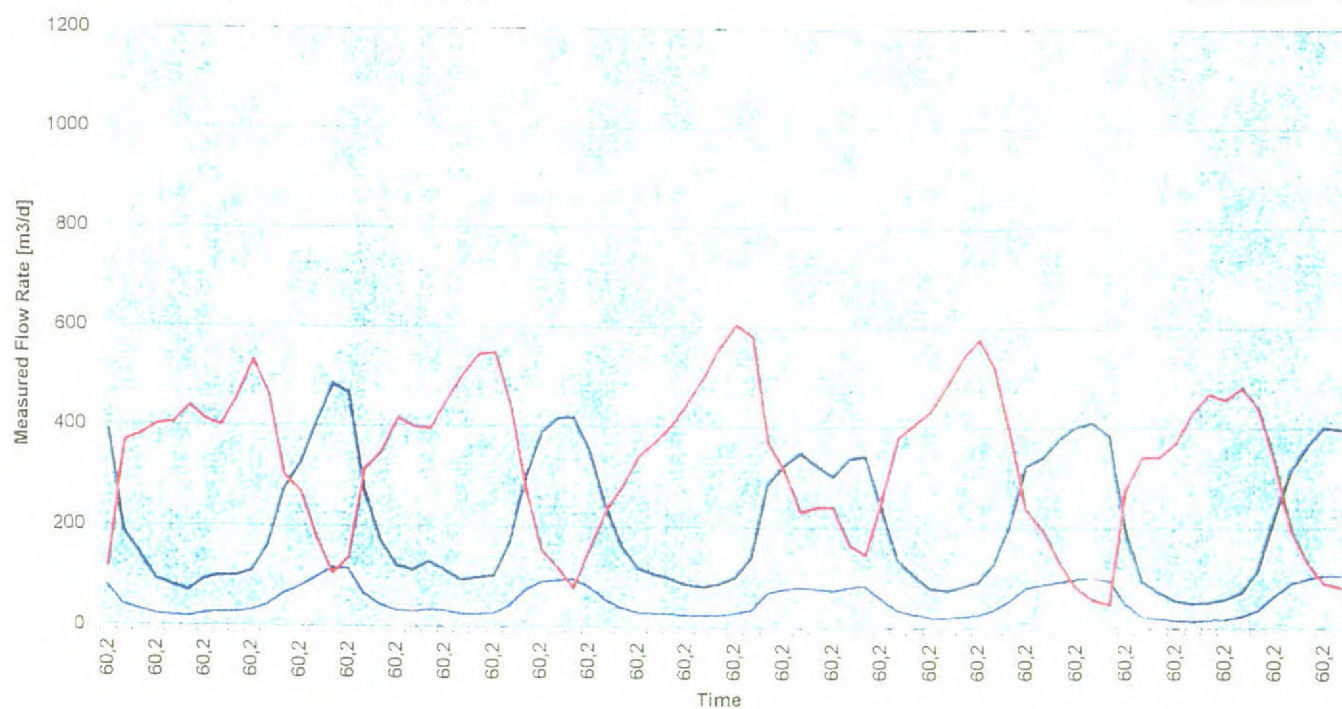




# Middle East Field , 1 hour well test MFI MultiPhase Meter

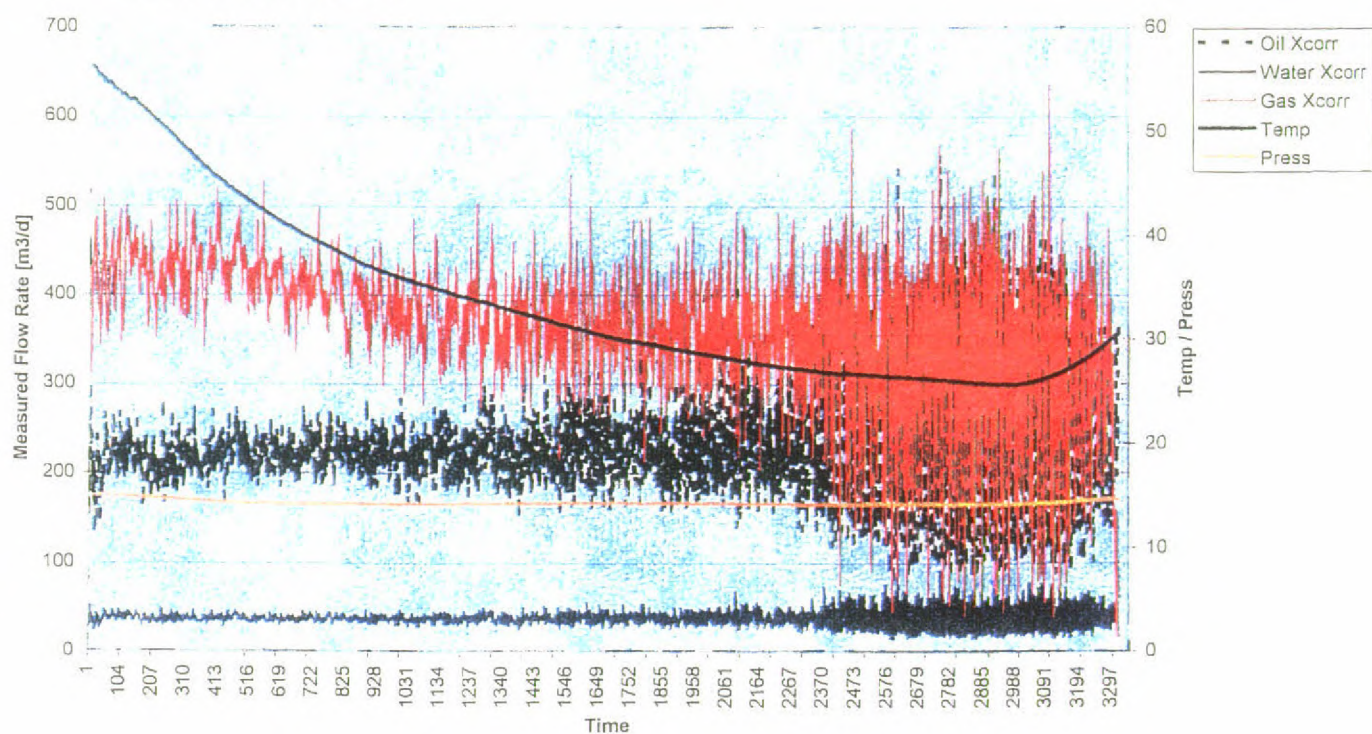


## Middle East Field , 1 hour well test MFI MultiPhase Meter

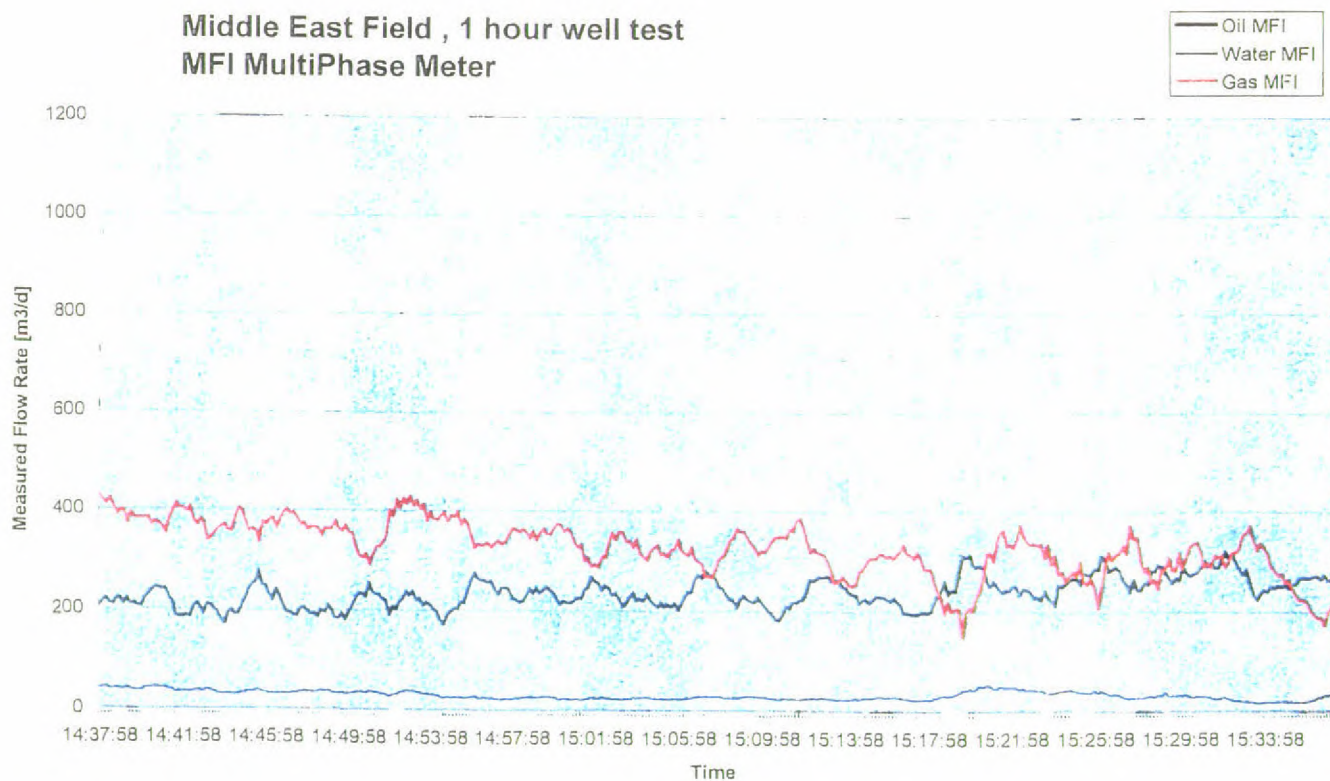




# Middle East Field, 14 h Test over night MFI MultiPhase Meter



## Middle East Field, 1 hour well test MFI MultiPhase Meter



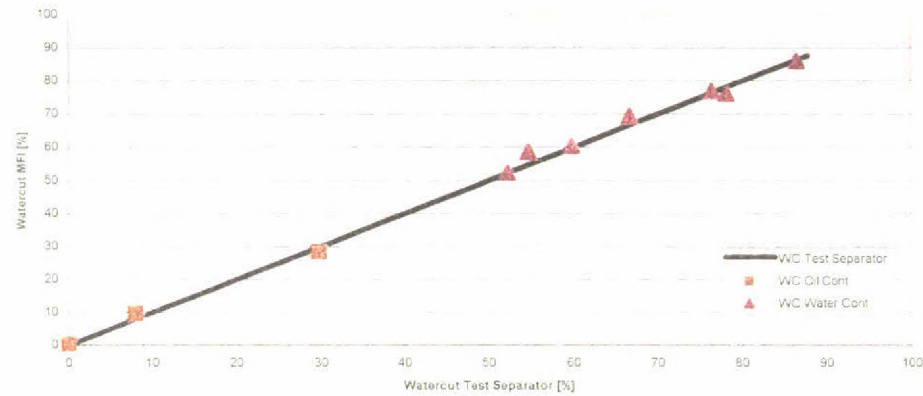


# Gulfaks A Satellites

## Increased Well Test Capacity utilising MFI MultiPhase Meters

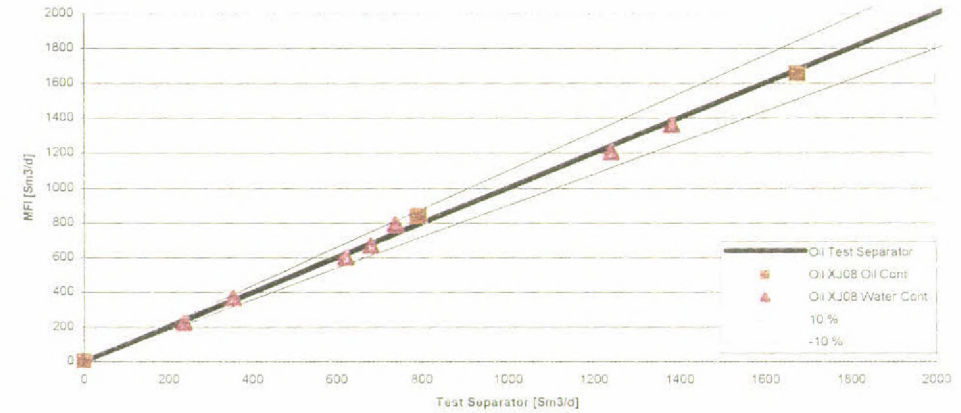
### Watercut

Note: Caliseb PVT on both Test Separator & MultiPhase Meter  
GVF = 25-75% Watercut = 10-90%



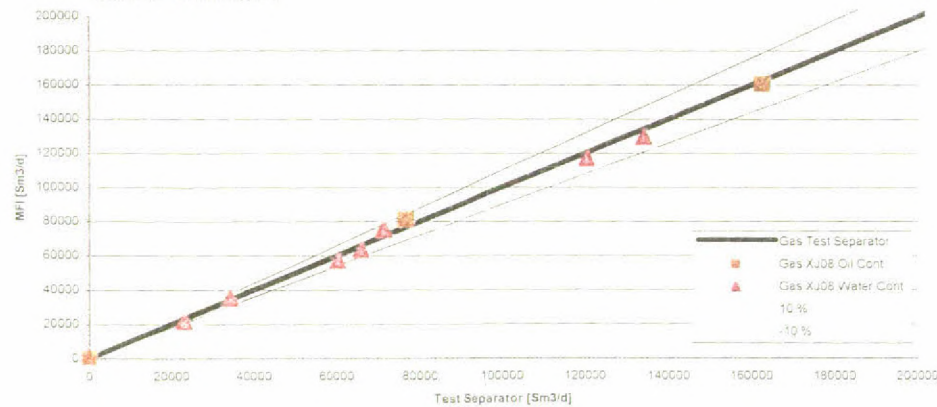
### Oil Flowrate

Note: Caliseb PVT on both Test Separator & MultiPhase Meter  
GVF = 25-75% Watercut = 10-90%



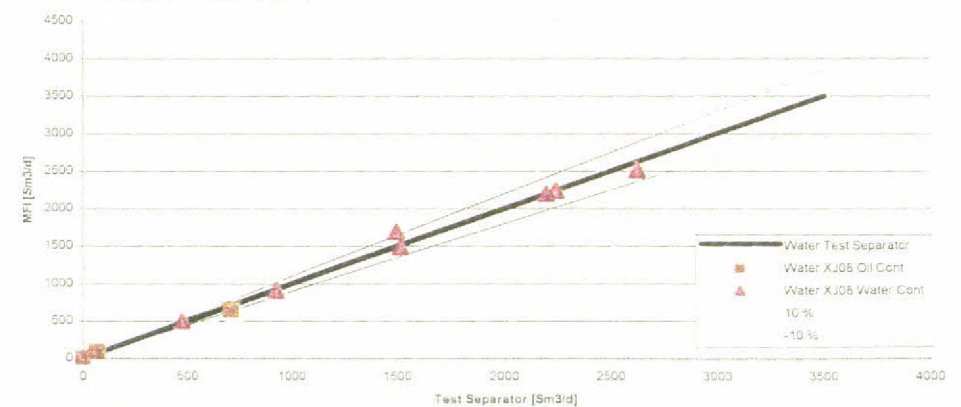
### Gas Flowrate

Note: Caliseb PVT on both Test Separator & MultiPhase Meter  
GVF = 25-75% Watercut = 10-90%



### Water Flowrate

Note: Caliseb PVT on both Test Separator & MultiPhase Meter  
GVF = 25-75% Watercut = 10-90%



# Operational Experience 1998

## MFI MultiPhase Meter

- MFI MultiPhase Meters in faultless operation for 2 years.

Examples :	<i>Location</i>	<i>Start Up</i>
	Allocation Gullfaks B ( SubSea system)	Nov. 96
	SubSea Meter Gullfaks B	Dec. 96
	Shell Gannet x 2	May 97
	Agip Trecate	Sept. 97

- Proven drift-free operation for more than one year at Gullfaks B
- Field experience covering all flow regimes.
- Accuracy reported by users to be better than  $\pm 5-7\%$



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## References

[1] Paper presented at the North Sea Flow Measurement Workshop, a workshop arranged by NFOGM & TUV-NEL

Note that this reference was not part of the original paper, but has been added subsequently to make the paper searchable in Google Scholar.