

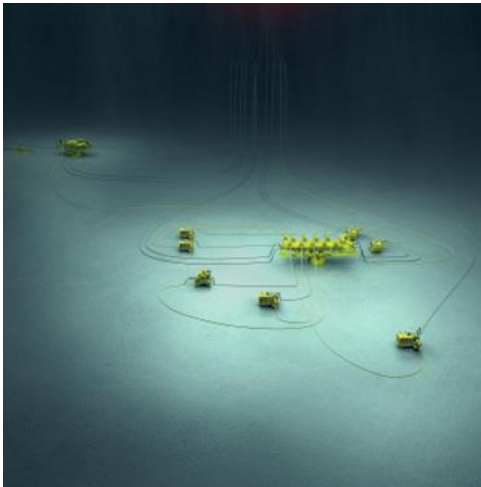
# VALUE PROPOSITION SUBSEA ALL-ELECTRIC

Increasing Shareholder Value with Subsea Electric Actuation Systems

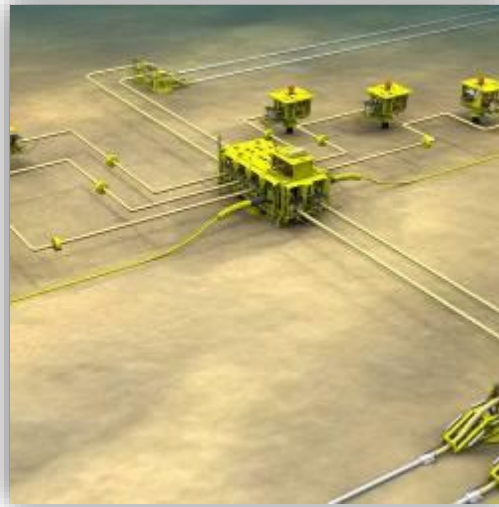
Mark Perry  
Global Business Development  
WITTENSTEIN motion control GmbH



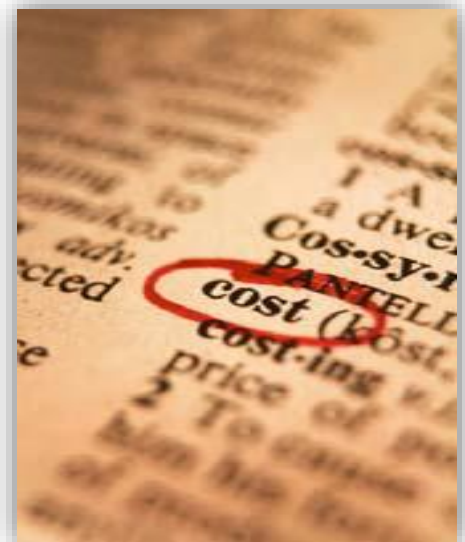
# Subsea Technology DRIVERS



Environmental risk  
Deeper waters  
Longer step-outs  
Reducing Carbon Footprint  
Reduced HSE issues



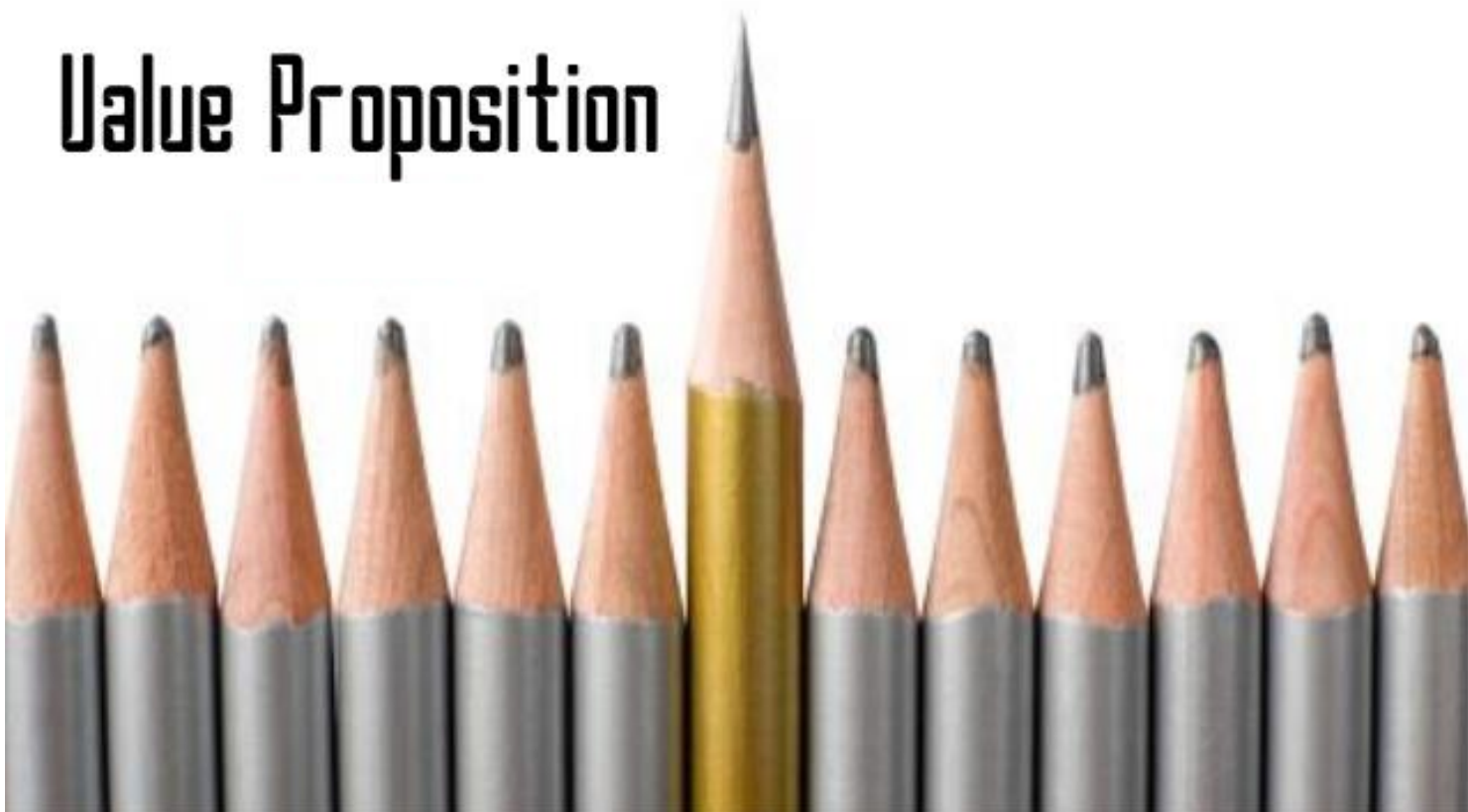
Increased Oil Recovery  
Standardization  
Operational Flexibility



CAPEX & OPEX  
REDUCTION

# Subsea Electric Actuation Technology

## Value Proposition



# SUBSEA ELECTRIC ACTUATION

Today's ENABLER to  
Value Improvement  
At low Oil price



The average oil price since 1900 is about  
\$35/bbl (inflation adjusted)

## Value Improvements



## Benefits Outlined



SUSTAINABILITY

CAPEX Reduction



OPEX  
Improvements

# ELECTRIC ACTUATION allows



## ENVIRONMENTAL SAFETY ZERO DISCHARGE

Carbon footprint reduced

HSE improved

Hi Safety & Redundancy  
available to the valve stem

ULTRA – DEEP & Long Step  
Outs enabled



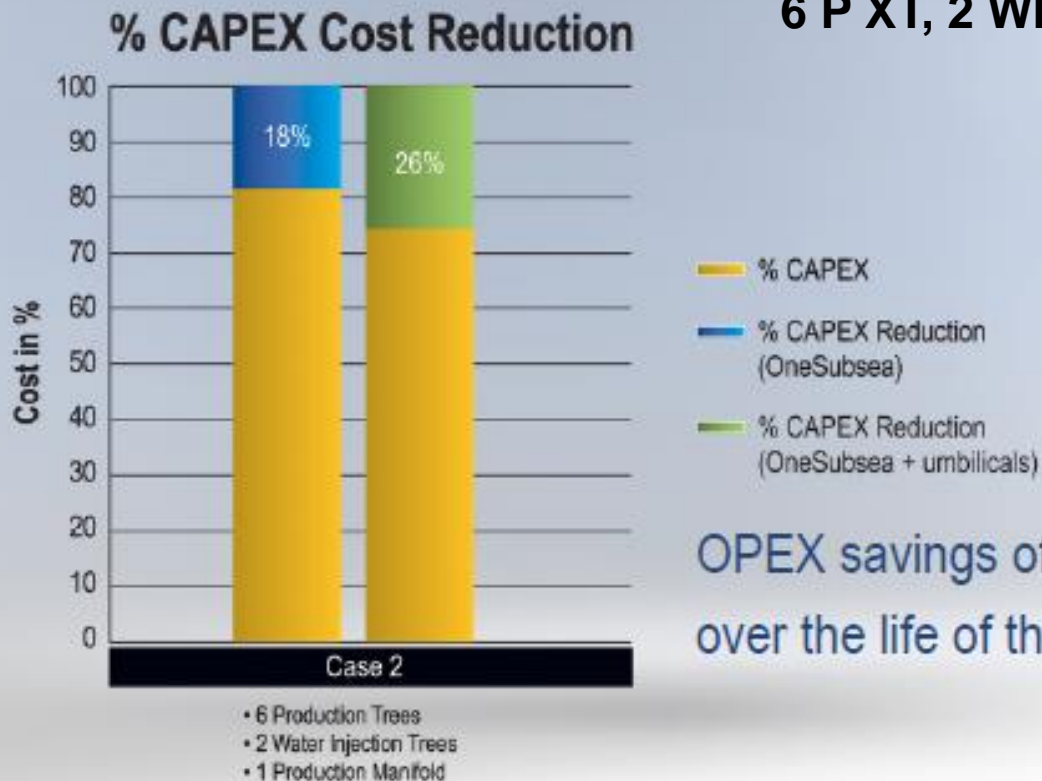
For 150 wells spread over 300 miles with  
19mm HP & LP lines  
Hydraulic fluid volume “**saved**” would be over

**HALF a MILLION LITRES**

source UT2 2007

# ELECTRIC ACTUATION Delivers Reduction in CAPEX

## Electric Actuation Technology



**6 P XT, 2 WI XT, 1 P Manifold**

**OPEX savings of 16MM  
over the life of the field**

Source OSS

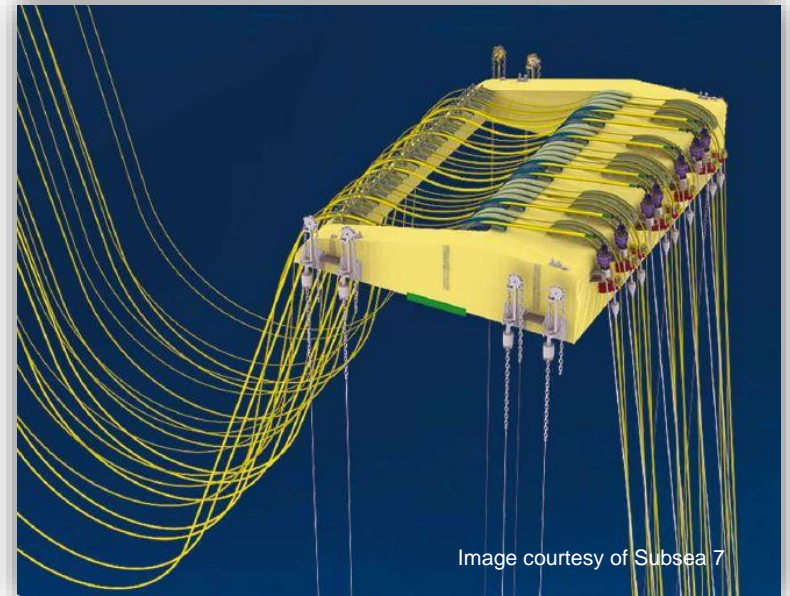
# ELECTRIC ACTUATION Delivers Reduction in CAPEX

**Offers average 8% reduction in umbilical \$**

Example of 6 P XT, 2 WI XT, 1 P Manifold

50 Km umbilical = \$2.17 MM savings

- ✓ **Topside HPU footprint gone**
- ✓ **Leaks eliminated**
- ✓ **HSE improved**
- ✓ **Carbon Footprint reduced**



Umbilical costs with Hydraulic based on \$542k/Km Source Statoil  
Reduction calc source OSS

# ELECTRIC ACTUATION Improves Project Schedules



## NO HYDRUALIC PIPING

Over 100m of small bore tubing removed from XT  
with over 300 m reduced on a template

## Providing an estimated 30% time improvement

(No: Flushing, Pressure testing, Weld testing, Weld documentation, Inspection)

**Weight and Space reduced**



Image courtesy of FMC

Source OSS

# ELECTRIC ACTUATION Reduces Downtime

**HYDRAULIC** failures identified on  
Production Umbilicals in Offshore Angola :

**Unplanned** leak repair SPS to Umbilical 2011  
**150 MUSD**

**Scheduled** critical Umbilicals update 2016  
**85 MUSD**



Source 2016

# ELECTRIC ACTUATION Used in Enhanced Oil Recovery

Statoil Asgard subsea Gas compression & process facility is all electric.

All control is via electric actuated modulating valves

- Improved controllability
- Improved resolution
- Improved speed of operation

**Will produce an extra 278 MMBOE  
Over the lifetime to 2050 (13,9B\$)**

Source Statoil 2011

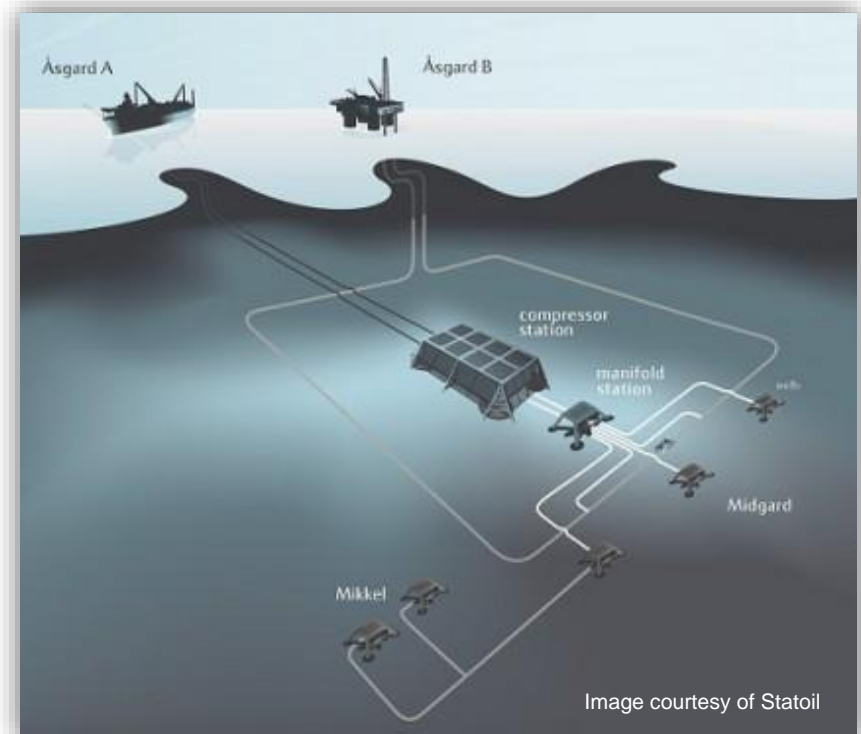
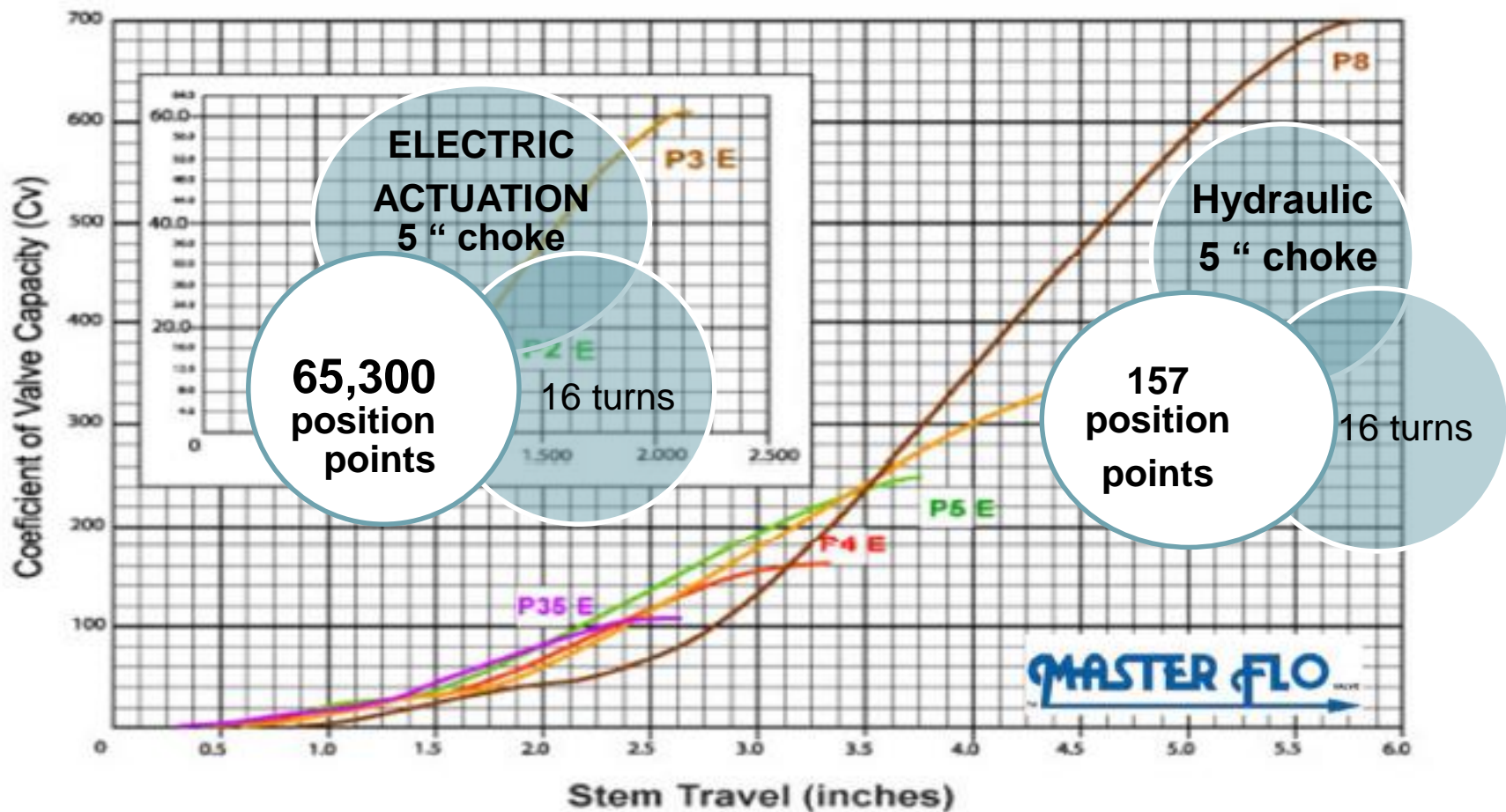


Image courtesy of Statoil

# ELECTRIC ACTUATION Improves Controllability



# ELECTRIC ACTUATION Improves Production and Reduces Sand Break Thru.

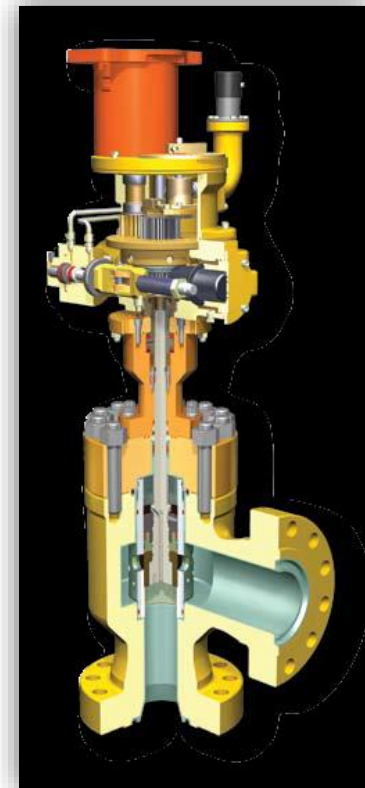
## BROWNFIELD UPGRADES

Statoil Statfjord field in 2001

**16 wells were retrofitted with electric actuators delivering a staggering**

**Increase of 1900b/d in production or**

**\$35 MM per year @ \$50perBOE**

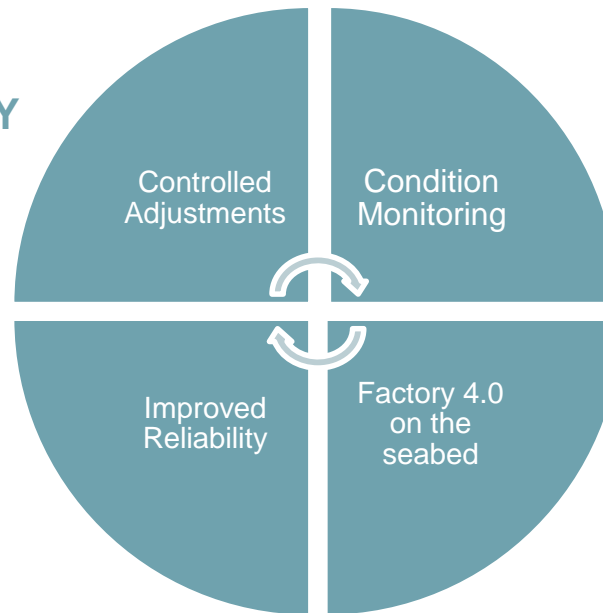


(Source UT2 Jan 2007)

# ELECTRIC ACTUATION Provides Information and Enables Condition Monitoring on the Seabed

## •OPERATIONAL EFFICIENCY IMPROVEMENTS thru

- Flight Recorder
- Finger Printing of valve
- Partial Stroke Tests
- Maintenance Diagnostics
- Speed,Torque,Position



Increased **UPTIME**

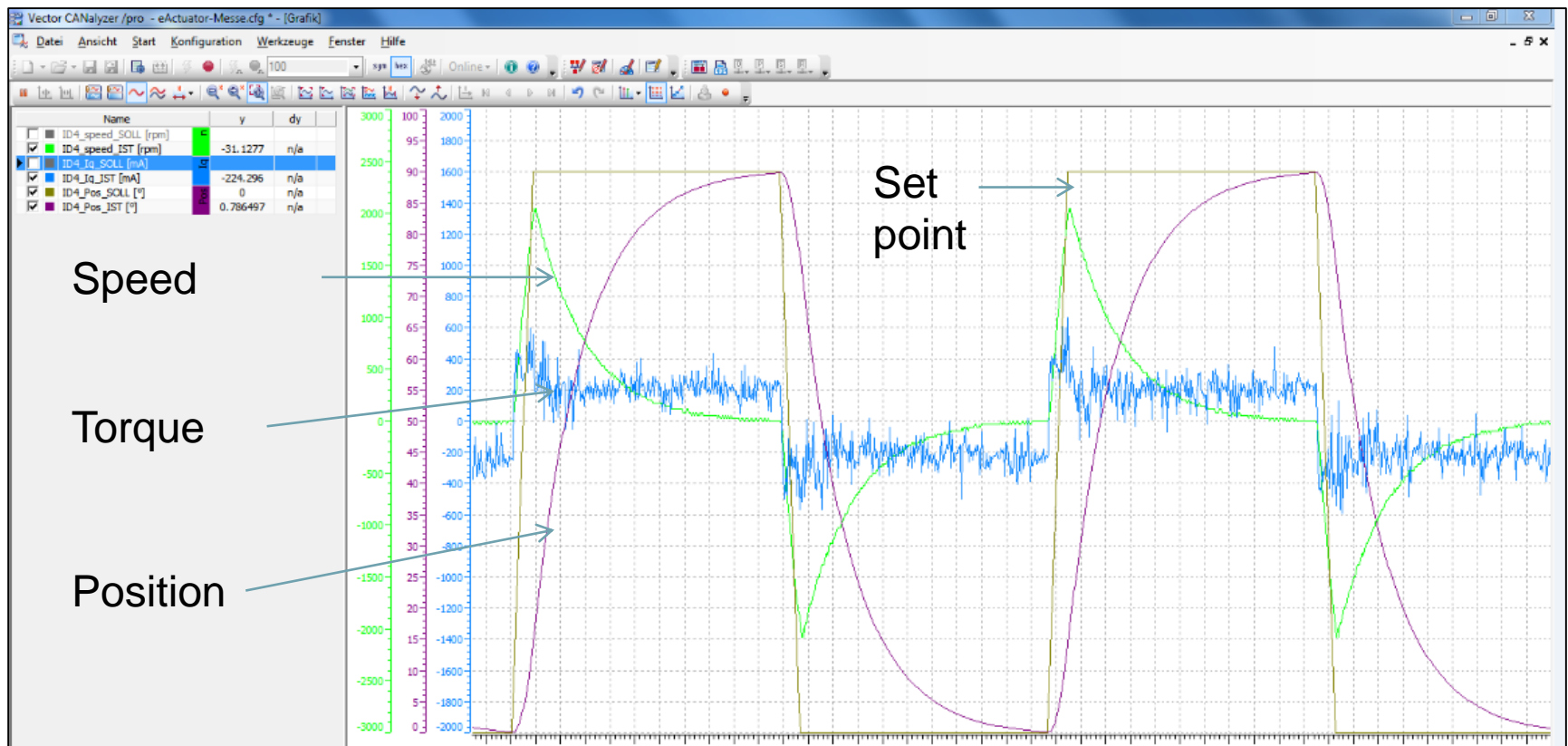
Enhanced **SAFETY**

Built to **SURVIVE**

Environmental  
**PROTECTION**

Commission **FASTER**

# Integral Valve and Actuator FINGERPRINT



# SSEAC® ELECTRIC ACTUATION from WITTENSTEIN

HIGH AVAILABILITY - COMPACT - ACCURATE



**3000 m operation**



**MTBF 400,000 hours**

**Retrofit or Integral mounted**

- ✓ Vibration, Shock, EMC, Temperature & Pressure resistant ISO 13628-6
- ✓ Fail to Safety
- ✓ Powered from Surface or SCM (1000v AC to 24v DC)

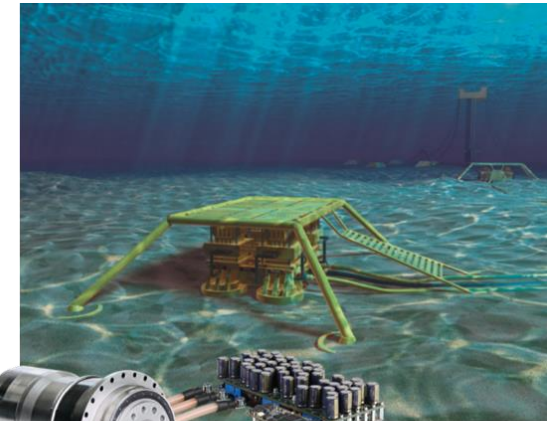
Benefits

# SUMMARY



## Deployments with Global clients since 2001 > 250 subsea units some examples:

Project	Units	Year	Application
Statfjord	16	2001	Valve actuation
Elwis	5	2002	Valve actuation
Orman Lange	5	2004	Valve actuation
Norne	60	2006	Valve actuation
Gjoa	6	2007	Valve actuation
Pluto	5	2007	Valve actuation
Tyrians	SIL 3 concept	2008	Valve actuation
Albacora	20	2007	Valve actuation
Asgard	85	2011-13	Valve actuation
Asgard	4	2011-13	Switch
Siemens	3	2012	HPU (Pump Drive)



**FMC Technologies**

**AkerSolutions™**

**woodside**

**Statoil**

**SIEMENS BR PETROBRAS**

**GE Oil & Gas**

**OneSubsea**  
A Cameron & Schlumberger Company

# The Sea Bed

## Operator Benefits:

RETROFIT & GREENFIELD

REDUCED MAINTENANCE  
CONDITION MONITORING

OPERATIONAL EFFICIENCY  
MODULATING CONTROL

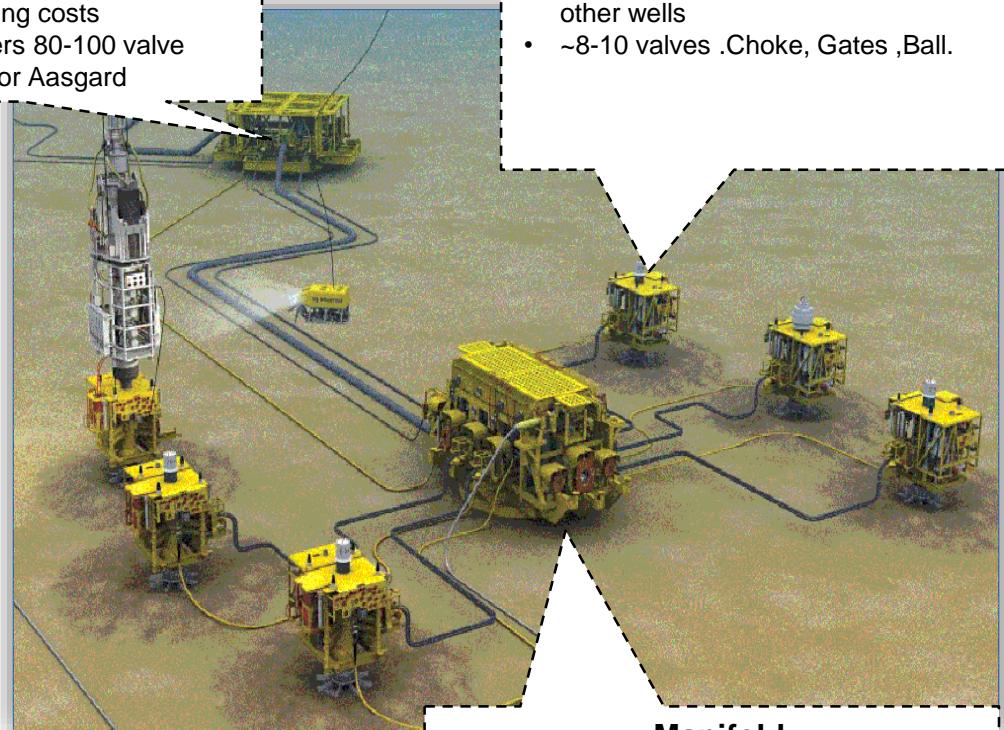
SAFETY & RELIABILITY  
SIL available  
Long MTBF

### Processor / Compressor

- Subsea Processing of oil/compression of gas enhances field economics by maximizing recovery, increasing production and reducing costs
- WITTENSTEIN delivers 80-100 valve system components for Aasgard

### Xmas Tree

- Assembly of valves, spools, and fittings used for an oil, gas, water injection, water disposal, gas injection, condensate and other wells
- ~8-10 valves .Choke, Gates ,Ball.



### Manifold

- Structure consisting of pipes and valves and designed to transfer oil / gas from wellheads into a pipeline
- ~2-5% manifolds on the NCS are electrical
- ~18-20 valves per manifold



## Increased Functionality: Operational Efficiency: Environmental Safety:

OPEX :

CAPEX :

RELIABILITY:

ENABLING:

OPERATIONAL EFFICIENCY:

SUSTAINABILITY:

No hydraulic fluids and maintenance of it.

Reduces overall project costs circa 20%

Facilitates condition monitoring

Longer step-outs and deeper water

Closer control of EOR and Production

Environmentally safe - zero discharge

# QUESTIONS?



Sustainability!

