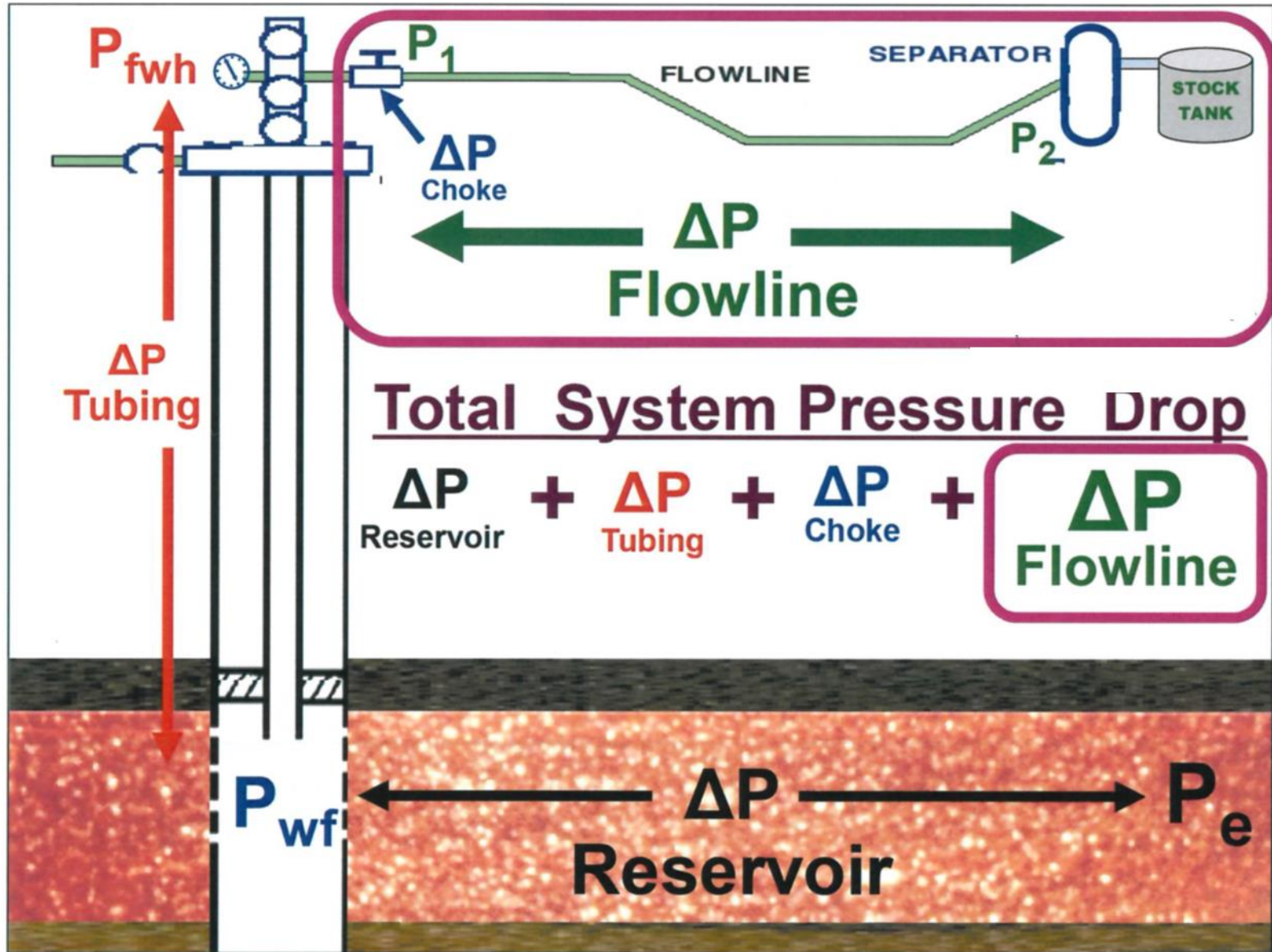


Image courtesy of FMC Technologies

Pigging operation: Flow Assurance Perspective

Seoul Nation University,
Dept. Naval Architecture and Ocean Engineering
Yutaek Seo

Gathering system



Long pipeline may induce phase change



Flowlines, Manifolds and Piping

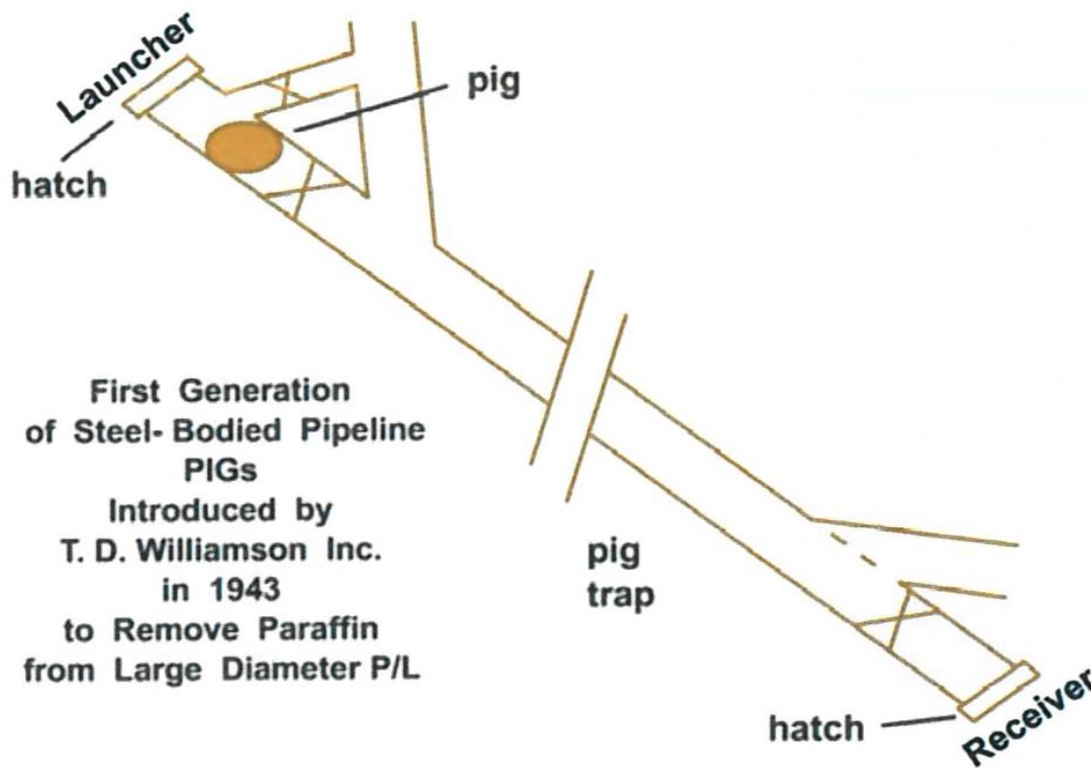
- Equipment used to transmit produced fluids from wellhead through treating equipment
 - Piping
 - Connections
 - Valves
 - Fittings
- Flowlines: Usually 2" to 16"
 - API steel line pipe
 - : Standard 5 L < 1000 psi
 - : Standard 5 LX > 1000 psi
- Pipe:
 - Closed conduit
 - Circular cross-section
 - Constant internal diameter (ID)





Pipeline Pigging System

- PIG: Pipeline Internal Gauge



Petroleum Industry PIG

- Pipeline Internal Gauge
 - Check internal condition for pipeline
 - Cleaning: Solids (wax, asphaltene etc)
 - Check or remove obstruction
 - Check for deformation / corrosion / erosion
- Intelligent PIG
 - Measure: Remaining wall thickness
 - Establish: Location and type of defects

Types of PIG

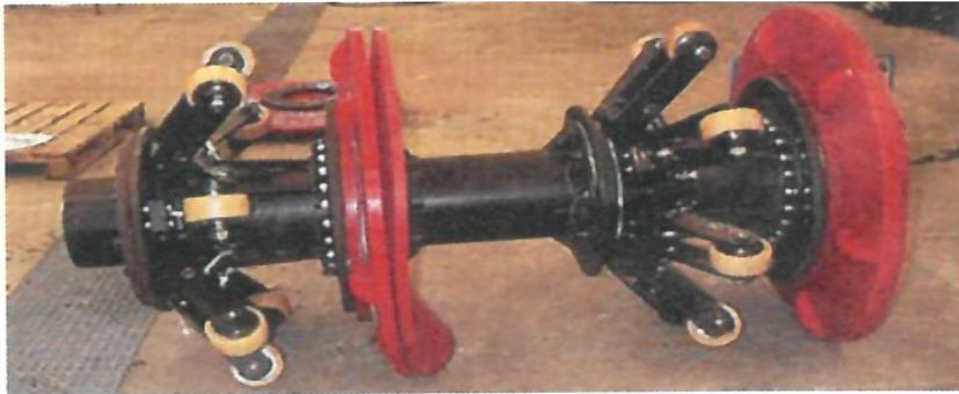
- Foam Pigs for cleaning



- Bi-Di pigs: Gauging and Cleaning



Dual Diameter PIG

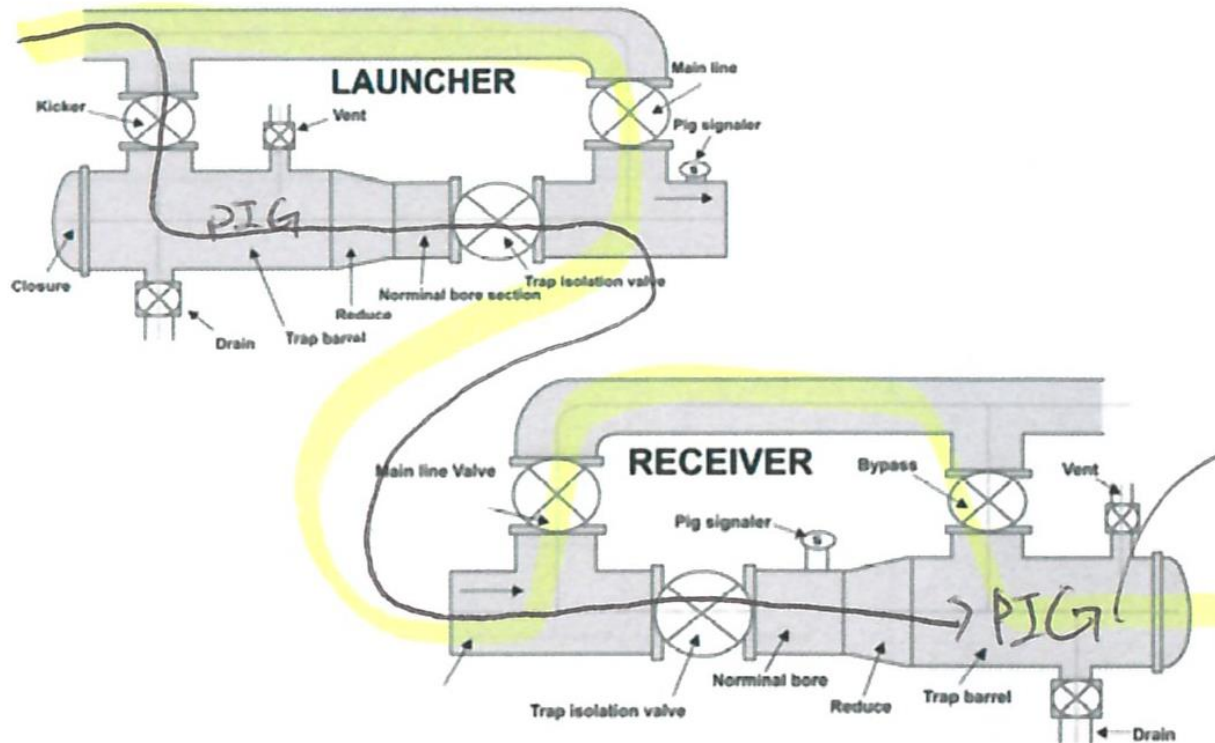
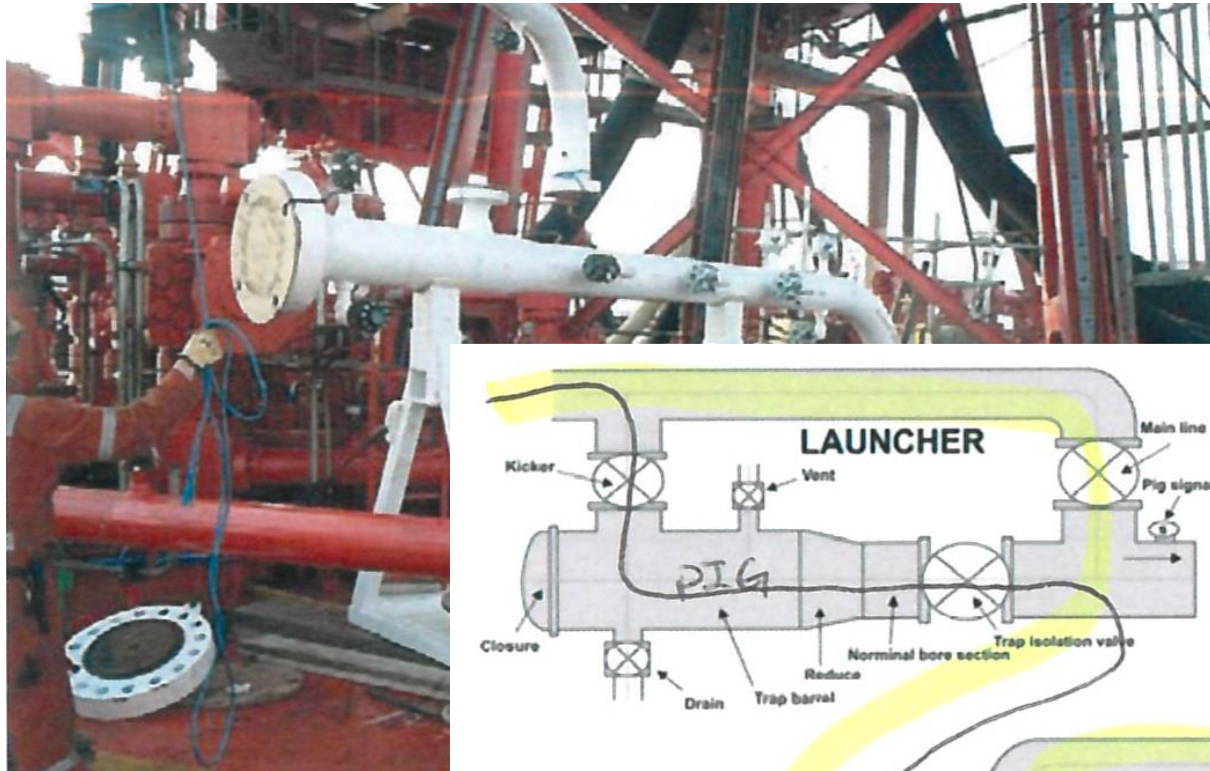


28" to 42"



**← PIG with Folded Discs
in 28" Pipe**

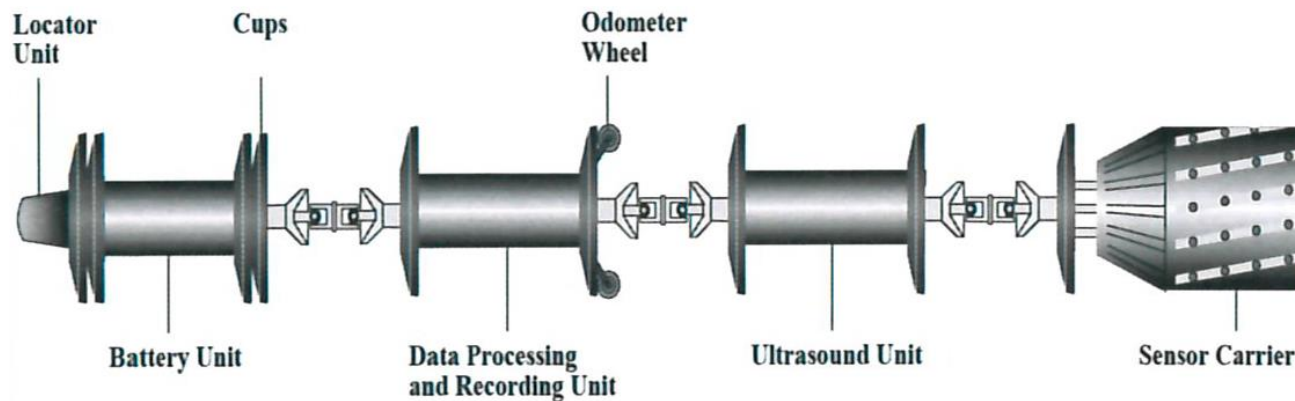
Offshore platform PIG launcher / receiver





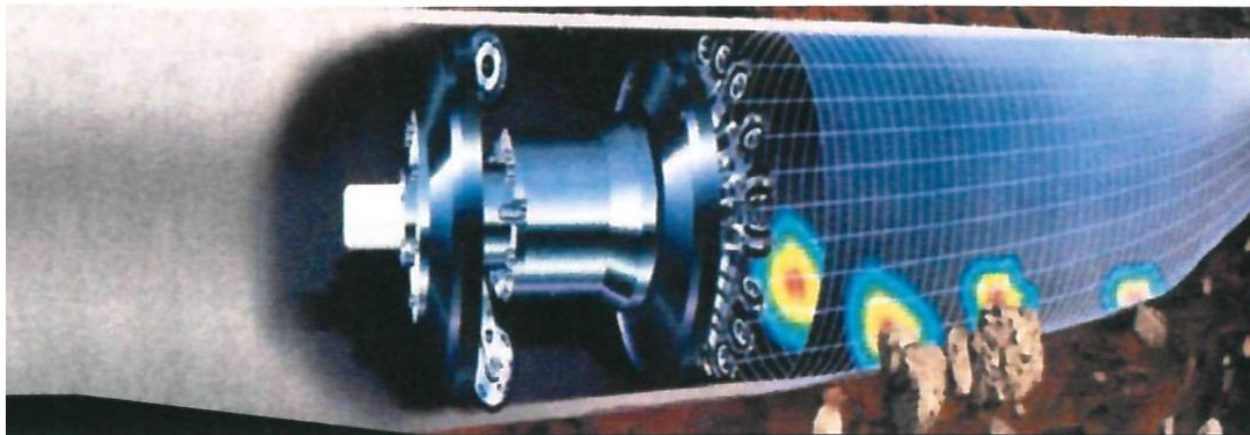
The Intelligent PIG

- Ultrasonic inspection of pipeline
- Measures actual wall thickness
 - Internal / external metal loss
 - Shape of metal loss area
 - Midwall defects



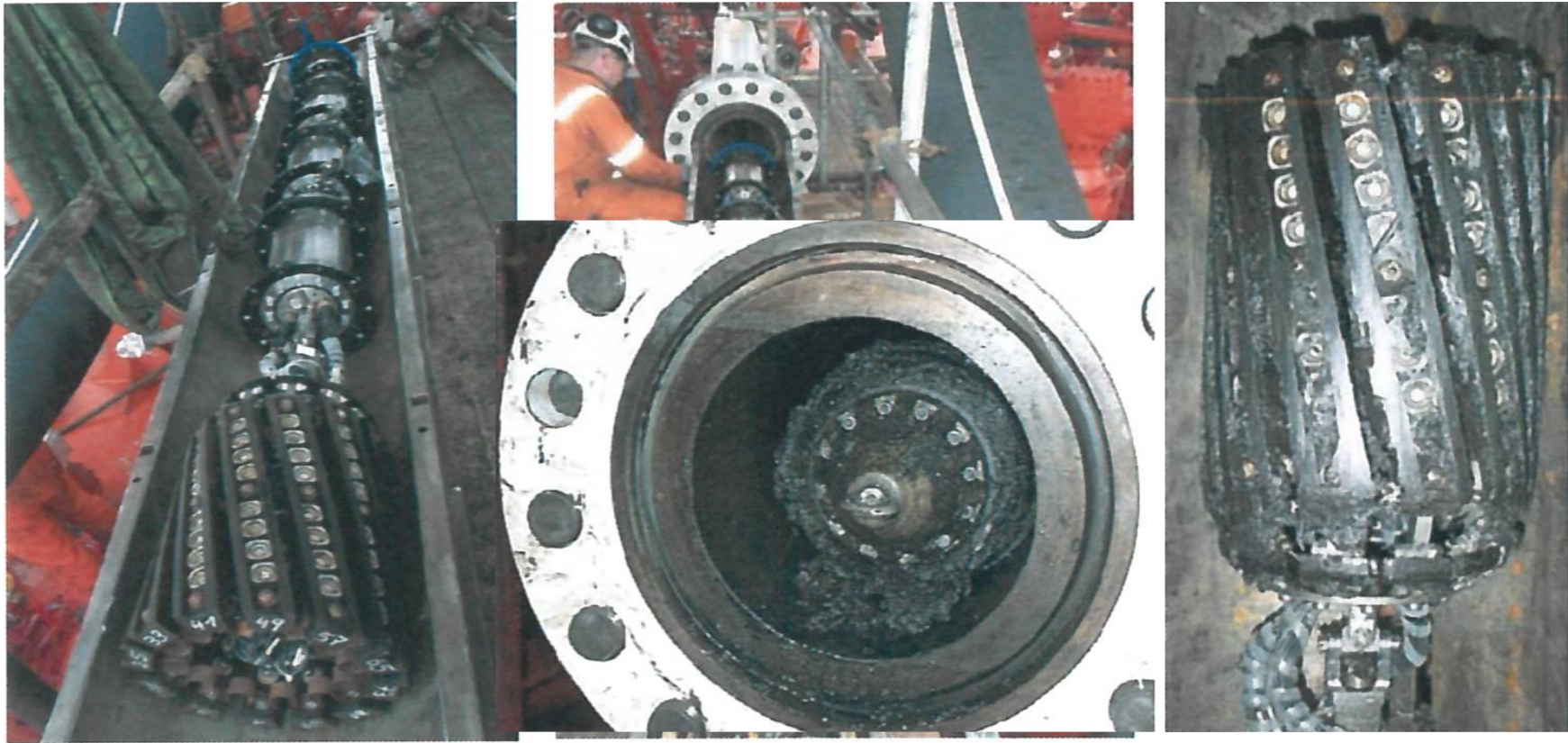
Multichannel caliper pipeline pig

- Defect position (5% accuracy), Diameter measurement (0.2% accuracy)
- Monitor erosion by measuring pipeline wall thickness

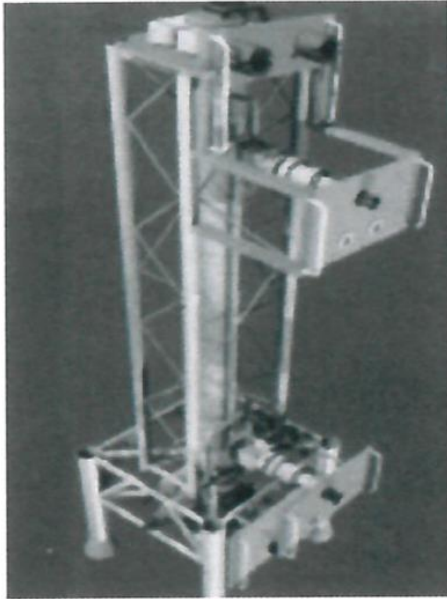


Intelligent PIG: Launch & Return

- Metal loss measurement
- Bend radius 1.5 Pipe I.D.



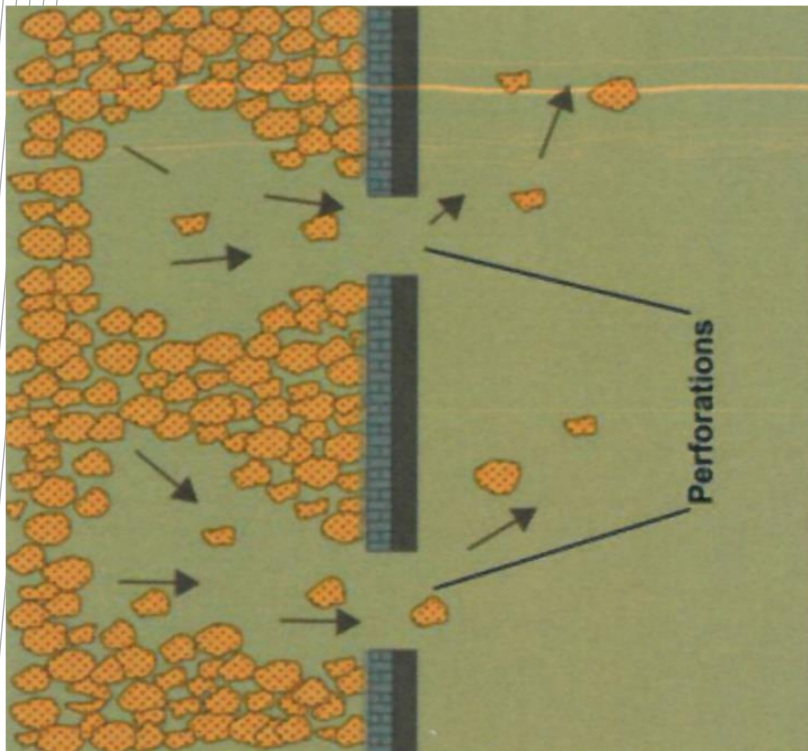
Seabed PIG Launcher



- Hold up to 12 PIGs
- Eliminates dual lines
- Reloaded by ROV
- Depths to 10,000 ft
- Due to low temperature in seabed, many flow assurance issues may happen in cold pipeline including hydrate, wax, and slug.
- PIG become important in subsea systems operation

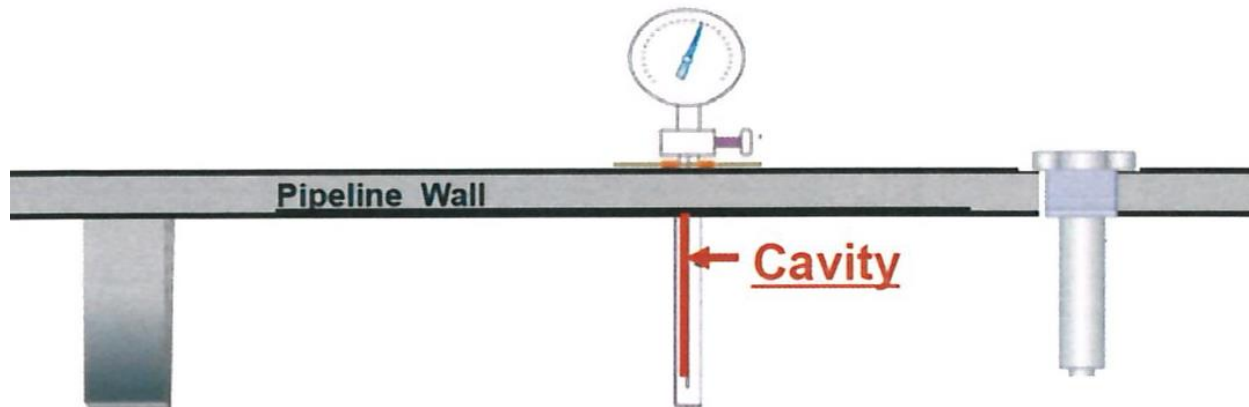
Erosional velocity with solids in flowstream

- Minimum flowrate to prevent erosion: not known
- Sand production induces erosion of surface equipment



- Use sand probes
- Measure / Inspect wall thickness
- Use 3+ feet of straight pipe after turns / choke
- Use long radius ells or Target tees
- Monitor solids with sand detectors
- Control solid production (Sand control)
- Remove solids from flow (Desander)

Using Sand Probes or Coupons





Thank you