Artificial Lift R&D Council

WINS Wireless Instrumentation Systems

wiGL Wireless Gas Lift Valve

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ALRDC Gas Lift Workshop

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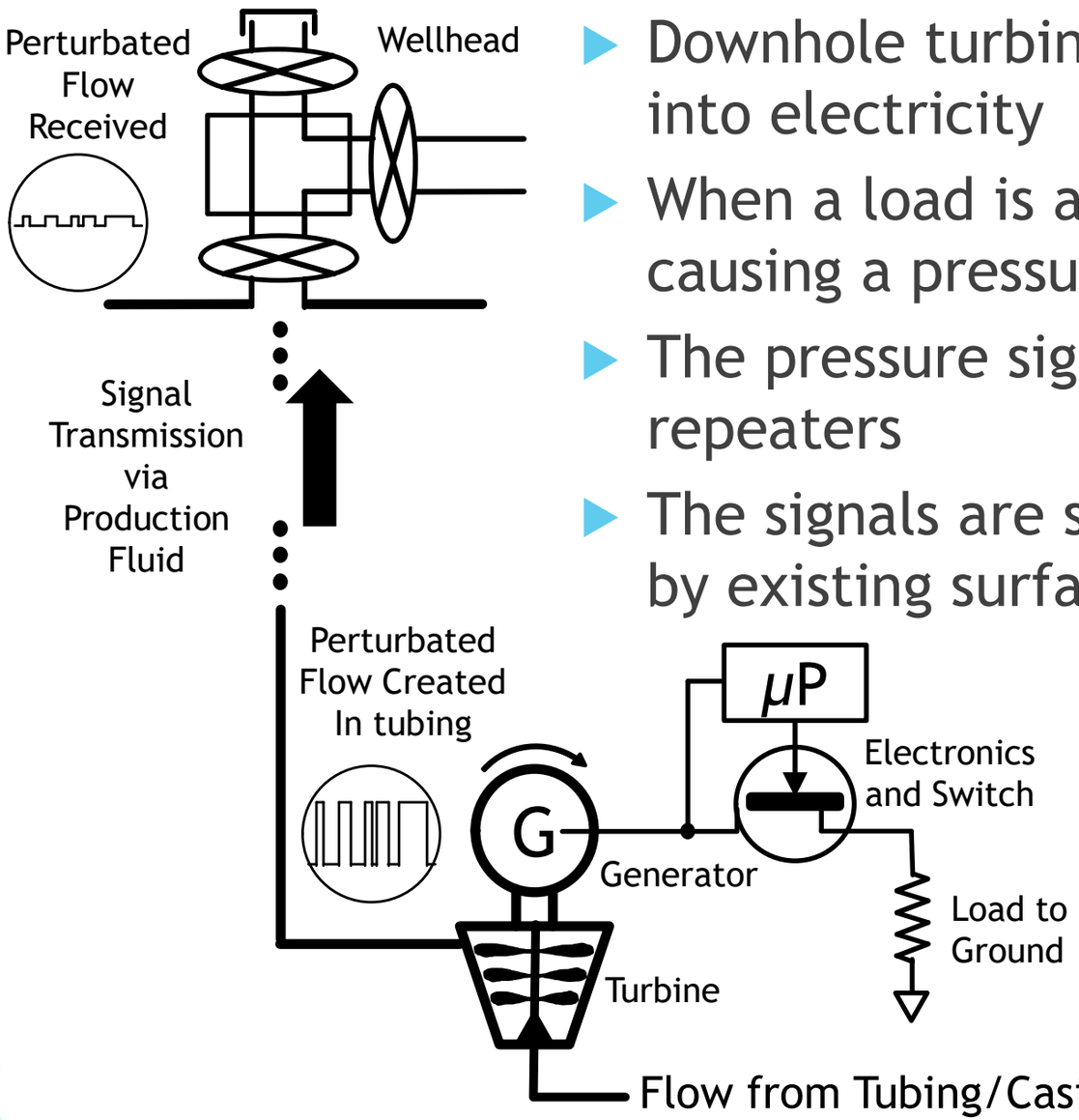
The Problem

- Side Pocket Mandrels (SPM) and Gas Lift Valves (GLV) enable easy intervention to maintain and repair Gas Lift systems.
- Electric gas lift has been successfully implemented, but is tubing-conveyed, requires a workover to maintain or repair.
- The industry needs an electric GLV that can fit in a standard SPM
- wiGL Wireless Gas Lift Valve proposes using an innovative wireless telemetry and a turbine-generator
- Main Challenge: Fitting all the systems needed in the required space

The Solution

- A Turbine-Generator combines many features:
  - Downhole Power Generator replaces or minimizes battery pack
  - Variable load on generator creates the wireless telemetry, lots of signal available
  - Turbine is also a mass flow meter
- wiGL **MUST** fit the standard GLV envelope so that existing SPM infrastructure is convertible to wiGL
- Batteries, Electronics, Actuators, and Valves are not space efficient.
- Miniaturize / Eliminate all systems possible

Perturbated Flow Communication*

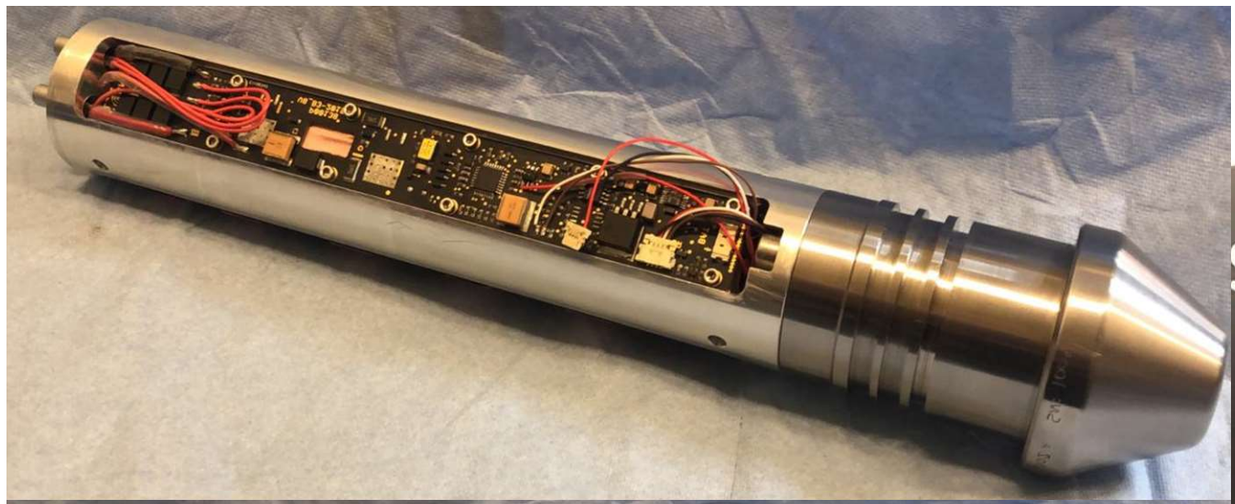


- Downhole turbine coupled to a generator converts flow into electricity
- When a load is added to the generator, it slows down causing a pressure change in the flow (signal)
- The pressure signals can be read at the surface, without repeaters
- The signals are so small that they will not be detected by existing surface equipment, i.e. no operator impact

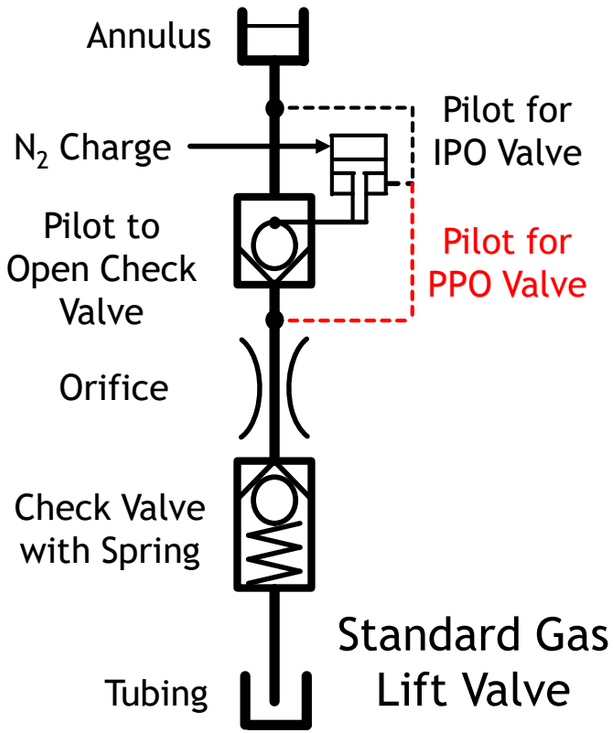
* - Patent Pending

Compact Size

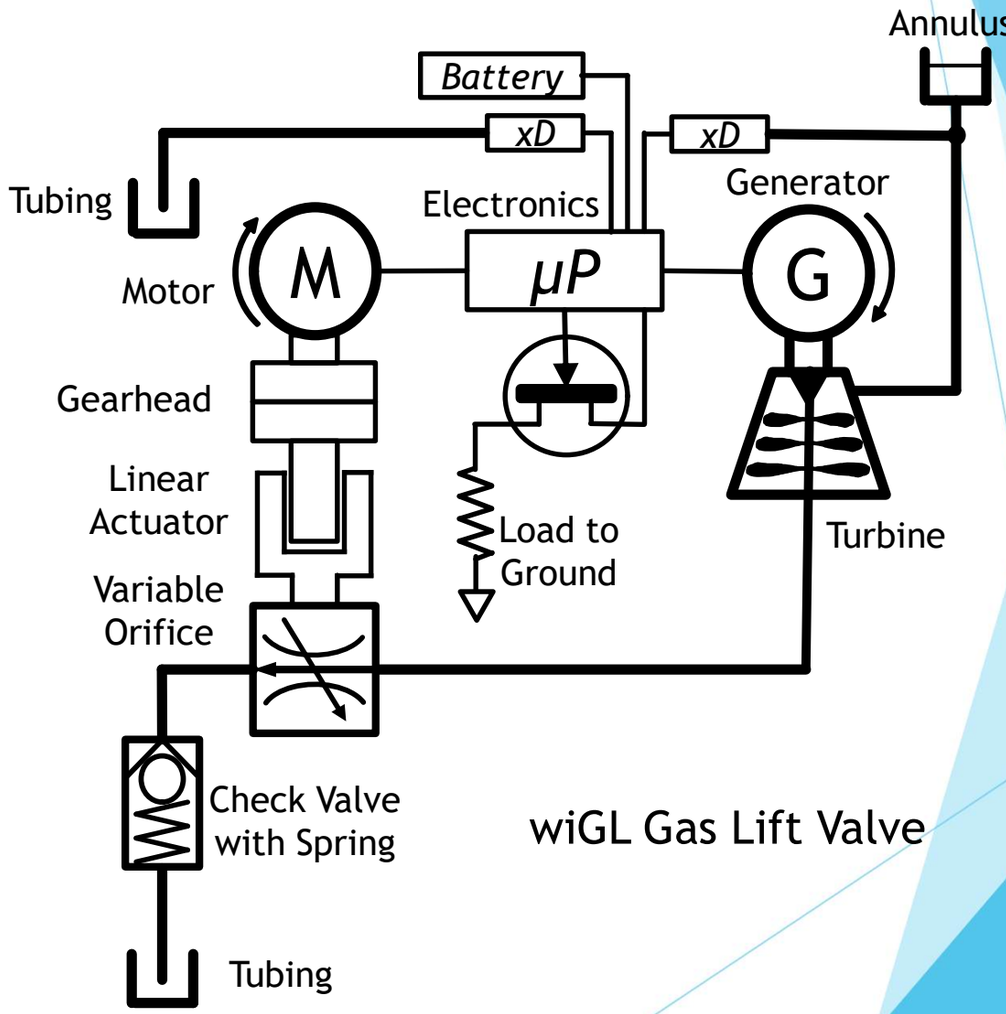
- Turbine-Generator is very compact
- Power, telemetry, and flow rate measurement



Gas Lift Valve Schematics



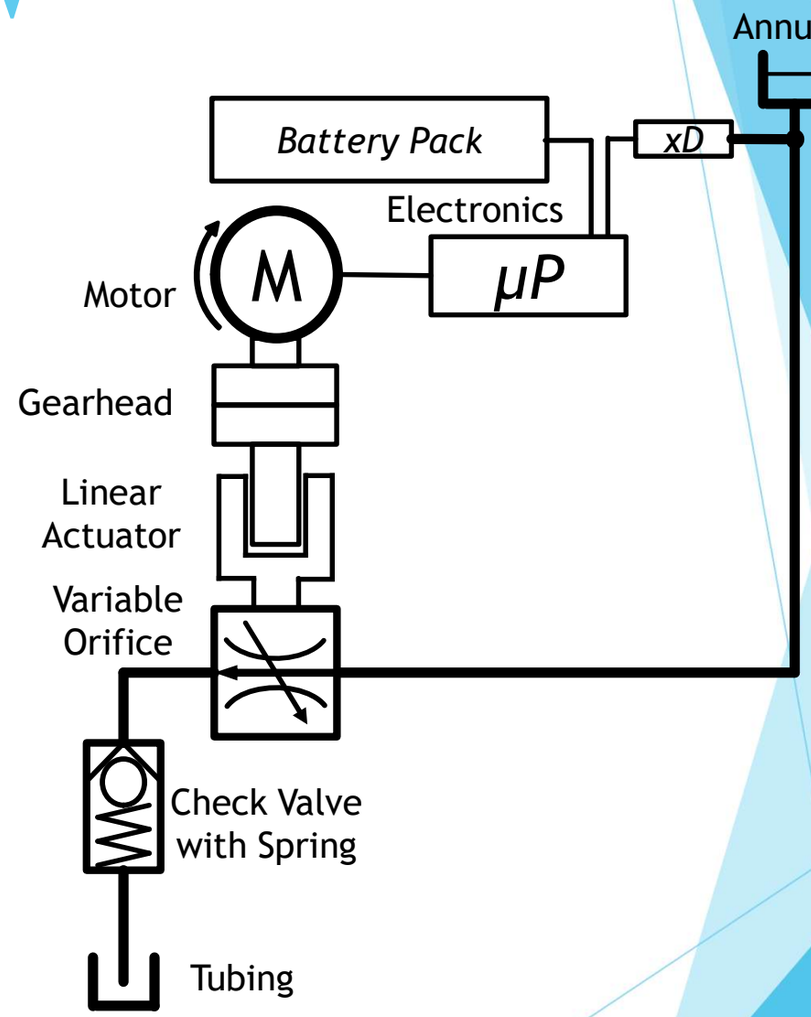
Standard Gas Lift Valve



wiGL Gas Lift Valve

Current Design: 1.5”-1W

- 1.5” OD One-Way Comms
- 10,000 psi, 125°C, 2-4 years
- Battery powered
- Adjusts orifice on command
- Conceptual design completed (see below)



wiGL One-Way Gas Lift Valve

Four Development Options

Artificial Lift R&D Council

wiGL Configuration	1.0” OD wiGL	1.5” OD wiGL
One-Way Communications (Surface to Downhole Only)	<u>Option 2</u> • Design appears feasible • To be used in existing wells • To be used in restricted envelopes where 1” pocket is the only choice	<u>Option 1</u> • Conceptual Design Completed • Fewest features
Two-Way Communications (Turbine Generator Req’d)	<u>Option 3</u> • Very difficult envelope to fit • Not feasible at present	<u>Option 4</u> • Design appears feasible • Preferred package with many features. • New wells should be designed for this config.

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Objectives

- Option 4 is the Game-Changer. Need to first determine feasibility of Option 4
- Initiate Joint Industry Project to develop Option 2 and Option 4
- Field trial Option 2 quickly while developing Option 4 in parallel
- Investigate next generation kickover tools for horizontal and extended reach installations

Requirements

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Operator:	A	B	C	D
Location:		Brunei	Global	
Depth (TVD):	10,800 ft	1500-8000 ft	5-11,000 ft	8500-9520
SIWHP:	8400 psi	70-300 psi	0-2500 psi	400-2000 psi
Annulus Pressure:	3800 psi	725-870 psi	500-3500 psi	1800 psi
Tubing Pressure at Operating Valve:	10,646 psi	290-850 psi	500-1500 psi	1500-1850 psi
Annulus Pressure at Operating Valve:	5578 psi	700-950 psi	500-3500 psi	1600-2000 psi
Circulating Valve Orifice Area:	0.186 in^2	0.186 in^2	0.196 in^2	0.186 in^2
Circulating Direction:	Both	Ann to Tbg	Both	Ann to Tbg
Gas Lift Orifice Diameters Used (in):	0.016, 0.156, 0.188, 0.250, 0.438”	0.016” to .438”	.156-.500” in .032” inc	.156-.500” in .032” inc
Gas Lift Direction:	Ann to Tbg Only	Ann to Tbg Only	Both	Ann to Tbg Only
Unloading Flow Rate:		“Slowly”	1 bpm spec 3 bpm accident	

Requirements

Operator:	A	B	C	D
Gas Lift Valve Size (Initial):	1”	1”	1-1/2”	1-1/2”
GLV Comms (Initial):	One-way	One-way	One-way	One-way
Gas Lift Size (final):	1-1/2”	1-1/2”	1-1/2”	1-1/2”
Gas Lift Comms (Final):	Two-way	Two-way	Two-way	Two-way
Max Temp (°C):	80-132°C	50-100°C	125°C	125°C
Check Valve Needed:	Yes	Yes	Yes	Yes
Check Valve Type:	Barrier Rated (need spec)	Barrier Rated	Barrier Rated	Barrier Rated
Valve Pressure Rating:	5000 psi	5000 psi	5000 psi	5000 psi
Dummy Pressure Rating:	6500 psi (screen out)	5000 psi	5000 psi	
Lifetime (Desired):	3 years	3 years	5 years	5 years
Lifetime (Minimum)	3 years	3 years	3 years	3 years
SPM Metallurgy:	L-80 and P-110 at HT	L-80 Some 13Cr L-80	P-110 and 13Cr L-80	L-80 and 13Cr L-80
Max SPM Deviation (deg):	80+	60 max	80-90	65 (was 70-80)

Requirements

Artificial Lift R&D Council

Operator:	A	B	C	D
SPM Size 2.875” x 1.0		**X**		
SPM Size 3.5” x 1.0	**X** (inj also)	**X**		
SPM Size 4.5” x 1.0	**X** (inj also)			
SPM Size 3.5” x 1.5	**X**	**X**		**X**
SPM Size 4.5” x 1.5	**X** (low demand)		**X**	X
SPM Size 5.5” x 1.5			**X**	
SPM Size 7” x 1.5			**X**	
SPM Size 7” x 1.5 x 1.5” (dbl)			**X**	

Requirements

Operator:	A	B	C	D
Experience with Standard Kickover Tool	Can't lift 1.5" GLV at 80^0+ Deviation, 15 misruns of 1" GLV on 1 job. Intend to run calipers to determine SPM orientation	No problems.	Probs with 7" dbl pocket in vertical hole, dropped GLVs after release	
Experience with Ratchet Kickover Tool	Worked in lab, problems in field	None	Worked in lab, no field exp, think it is fine for their needs	
KOT Extra Features	Want GR/CCL with pip tag in GLV for position	None needed		None needed at 65°. Still looking at higher deviations
General Comments:	EM-KOT and -KOR separate from wiGL	Could gradually change from 1" to 1.5" GLVs		

Project Schedule

Projects		Year 1				Year 2					
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
1	1.0x1W wiGL									wiGL Joint Industry Project	B
2	1.5x2W wiGL										
3	1.0 EM-KOT									EM-KOT/R Joint Industry Project	C
4	1.5 EM-KOR										
		Feasibility Study									
		A									

Legend			
	Design		Test
	Detail		Field Trial
	Manufacture		

Summary

- WINS has four operators interested in wiGL:
  - Shell Brunei Petroleum (land and platform)
  - ExxonMobile (multiple locations)
  - ConocoPhillips (Alaska ERD and North Sea)
  - ADNOC (UAE land and offshore ERD)
- Project A Feasibility Study is needed to de-risk the wiGL Option 4 “Game-Changer”
- WINS can receive seed funding for Project A from Norwegian government if sufficient Letters of Interest are obtained from key operators
- Projects B&C could utilize a Joint Industry Project

Acknowledgements, Thank You & Questions

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