CLAIMS:

~~What is claimed is:~~

1. A tethered sensor system for use in a pipeline carrying a fluid comprising~~;~~:

(a) a sensing unit~~;a drogue~~

(b) a tether line secured to the sensing unit, wherein the line contains at least one optical fibre and no metallic wiring; and ~~a sensing unit~~

(c) ~~a tether line which contains at least one optical fibre and no metallic wiring~~a drogue secured to the tether line and providing a pulling force on the tether line by reacting against the flow of the fluid ~~-~~in the pipeline.

~~(d) means for extending and retracting the tether line.~~

2. The tethered system of claim 1 further comprising (d) a means for extending and retracting the tether line.

~~2~~3. A tethered sensor system as claimed in claim 1 in which the sensing unit includes

(a) a lighting source directed to illuminate a portion of the pipeline

(b) a camera to take fixed or moving images of the portion of the pipeline illuminated by the lighting source

(c) circuitry so that such images can be transmitted by a said optical fibre through the tether to a viewing or recording station external to the pipeline.

~~3~~4. A tethered sensor system as claimed in claim 1 in which the sensing unit includes an inertial measurement unit to determine changes in the location of the sensing unit , and means for sending the output of such inertial measurement unit in real time by means of a said optical fibre to a control system external to the pipeline.

45. A tethered sensor system as claimed in claim 1 in which the sensing unit includes an acoustic generator generating low frequency sounds in the range 20 -2000 Hz, and means to control the generator from a station external to the pipeline through a said optical fibre in the tether .

~~5~~6. A tethered sensor system as claimed in claim 1 in which the sensing unit includes an acoustic receiver, and means to receive output from said acoustic receiver at a station external to the pipeline through a said optical fibre in the tether .

~~6~~7. A tethered sensor system as claimed in claim 1 in which the sensing unit includes at least one magnetometer, and means to receive output from said magnetometer at a station external to the pipeline through a said optical fibre in the tether.

~~7~~8. A tethered sensor system as claimed in any of claims 1-~~6~~-7 in which the sensing unit includes at least one battery to provide electric power to components of such sensing system.

~~8~~9. A tethered sensor system as claimed in any of claims 1-~~7~~-8 in which the tether transmits light through said at least one optical fibre to the sensing unit, and further comprising power gleaning apparatus to convert light received from the tether into electrical power in the sensing unit.

~~9~~10. A tethered system as claimed in any of claims 1-~~8~~-9 ~~in which~~wherein the tether line ~~is composed~~ comprises ~~of at least one fibre optic cable,~~ a strengthening material surrounding the at least one fibre optic cable, and a surrounding jacket ~~of a polymer~~ impervious to the fluid of the pipeline with which it is designed to be used.

~~10~~11. A tethered system as claimed in any of claims 1-~~8~~-9 in which the tether comprises a fibre optic interferometer with at least one Bragg grating.

~~11~~12. A tethered system as claimed in any of claims 1-~~8~~-9 in which the tether comprises an OTDR fibre interferometer.

~~12~~13. A tethered system as claimed in any of claims 1-~~11~~12, in which the tether is of approximately neutral density for the fluid carried by the pipeline with which is expected to be used.

~~13~~14. A tethered system as claimed in any of claims 1-~~11~~12, in which the tether has a density of from about 950 Kg/m^3 to about 1020 Kg/m^3.

~~14~~15. A tethered system as claimed in any of claims 1-~~11~~12, in which the tether has a density of from about 740 to 950 Kg/m^3.

~~15~~16. A tethered system as claimed in any of claims 1-~~11~~12, in which the sensing unit has a density of from about 950 Kg/m^3 to about 1020 Kg/m^3.

~~16~~17. A tethered system as claimed in any of claims 1-~~11~~12, in which the sensing unit has a density of from about 740 to 950 Kg/m^3.

~~17~~18. A tethered system as claimed in any of claims 1-~~16~~17, in which the tether line contains a plurality of optical fibres.

~~18~~19. A tethered system as claimed in claim ~~17~~18, in which at least some of the optical fibres are within a fibre optical cable.

20. A tethered system as claimed in claim 10, wherein the tether line has a breaking strength as low as 400 pound-force.