

What is claimed:

1. A blowout preventer stack comprising: a ram preventer; an annular preventer and, a shear laser module.
- 5 2. The blowout prevent stack of claim 1, wherein the blowout preventer is a subsea blowout preventer and wherein the annular preventer, ram preventer, and the shear laser module have a common cavity, the common cavity having a cavity axis.
- 0 3. The blowout preventer stack of claim 2, wherein the shear laser module comprises a laser cutter having a beam path that extends from the laser cutter into the common cavity.
- 5 4. The blowout preventer of claim 3, wherein the shear laser module comprises a laser cutter shield located adjacent to the common cavity, wherein the laser cutter shield protects the laser cutter from conditions present in the common cavity, while not appreciably interfering with the movement of tubulars through the common cavity.
- 10 5. The blowout preventer of claim 1, wherein the ram preventer is a shear ram and wherein the blowout preventer stack comprises: a second annular preventer, a second shear ram, a first pipe ram, a second pipe ram, and a third pipe ram.
- 15 6. A shear laser module for use in a blowout preventer stack, the module comprising:
 - a. a body having a first connector and a second connector, the first and second connectors adapted for connection to components in a blowout preventer stack;
 - b. the body having a cavity for passing tubulars therethrough; and,
 - c. a laser cutter in the body and having a beam path;
 - d. wherein the beam path travels from the laser cutter into the cavity and to any tubular that may be in the cavity.

7. The shear laser module of claim 6, comprising a laser cutter shield.
8. The shear laser module of claim 6, comprising a second laser cutter.
9. The shear laser module of claim 6, wherein the laser cutter is configured within the body to orbit around the cavity.
- 5 10. The shear laser module of claim 6, comprising a laser cutter shield located adjacent to the cavity, wherein the laser cutter shield protects the laser cutter from drilling fluids, while not appreciably interfering with the movement of tubulars through the cavity.
11. The shear laser module of claim 6, comprising: a support cable optically associated with the laser cutter and a feed-through assembly mechanically associated with the support cable.
12. The shear laser module of claim 11, wherein the module is rated at greater than 10,000 psi operating pressure.
13. The shear laser module of claim 6, comprising a second laser cutter, wherein the laser cutter beam path constitutes a first beam path, wherein the second laser cutter has a second beam path that extends from the second laser cutter into the cavity.
14. The shear laser module of claim 13, wherein the first and second beam paths intersect within the cavity.
15. The shear laser module of claim 13, wherein the first and second beam paths are directed toward the cavity axis
16. The shear laser module of claim 13, wherein the cavity has a cavity axis and the first and second beam paths intersect the cavity axis.
17. The shear laser module of claim 13, wherein the first and second beam paths do not intersect within the cavity.
18. The shear laser module of claim 13, wherein the first and second beam paths are substantially parallel.

19. The shear laser module of claim 6, wherein the cavity has a cavity axis and the beam path forms a normal angle with the axis.

20. The shear laser module of claim 6, wherein the cavity has a cavity axis and the beam path forms an obtuse angle with the axis.

5 21. The shear laser module of claim 6, wherein the cavity has a cavity axis and the beam path forms an acute angle with the axis.

22. The shear laser module of claim 10, wherein the laser cutter is configured to orbit at least partially around the cavity during activation.

0 23. A method of retrofitting a pre-existing blowout preventer ("BOP") stack with a shear laser module to make a laser assisted BOP stack, the method comprising:

- a. evaluating a pre-existing BOP stack;
- b. determining that the pre-existing BOP stack does not meet the requirements for an intended potential use; and
- 5 c. retrofitting the pre-existing BOP stack by adding a shear laser module to the pre-existing BOP stack; whereby the retrofitted BOP stack meets the requirements for the intended use.

24. A method of making a laser assisted blowout preventer ("BOP") stack, the method comprising:

- 10 a. obtaining an annular preventer;
- b. obtaining a ram preventer;
- c. obtaining a shear laser module;
- d. assembling a BOP stack comprising the annular preventer, the ram preventer and the shear laser module.

15 25. A method of drilling subsea wells by using a laser assisted blowout preventer and riser, the method comprising:

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- a. lowering a laser assisted blowout preventer from an offshore drilling rig to a seafloor using a riser, wherein the riser has an inner cavity, and wherein the laser assisted blowout preventer comprises a shear laser module having an inner cavity;
- b. securing the blowout preventer to a borehole in the seafloor, whereby the borehole, the shear laser module cavity and the riser cavity are in fluid and mechanical communication; and,
- 0 c. wherein, the shear laser module has the capability to perform laser cutting of a tubular present in the laser assisted blowout preventer cavity.

26. A subsea tree comprising: a mechanical valve and a laser cutter.

27. The subsea tree of claim 26, comprising:

- 5 a. an outer wall, configured to be placed adjacent to a blowout preventer cavity wall;
- b. an inner wall, defining a subsea tree inner cavity; and,
- c. the inner and outer walls defining an annular area therebetween;
- d. wherein the laser cutter is contained substantially within the annulus defined by the inner and outer walls.

28. A method of performing work on a subsea well by using high power laser assisted technology, the method comprising:

- 10 a. lowering a blowout preventer having an interior cavity, from an offshore drilling rig to a seafloor;
- b. securing the blowout preventer to a borehole in the seafloor, whereby the borehole and the interior cavity are in fluid and mechanical communication;
- 15 c. positioning within the interior cavity a subsea test tree having an inner cavity and comprising a laser cutter; and,

- d. lowering tubulars or line structures from the offshore drilling rig down through the inner cavity of the subsea test tree;
- e. wherein, the subsea test tree has the capability to perform laser cutting of any tubular or line structure present in the inner cavity of the subsea test tree cavity.

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What is claimed:

1. A blowout preventer stack comprising: a ram preventer comprising a pressure containment cavity; an annular preventer comprising a pressure containment cavity, and a shear laser module capable of delivering a cutting laser beam having a power of at least about 1 kW and comprising a pressure containment cavity; and, the ram preventer pressure containment cavity, the annular preventer pressure containment cavity and the shear laser module pressure containment cavity in pressure and fluid communication.
2. The blowout prevent stack of claim 1, wherein the blowout preventer is a subsea blowout preventer and wherein the annular preventer, ram preventer, and the shear laser module have a common cavity, the common cavity having a cavity axis.
3. The blowout preventer stack of claim 2, wherein the shear laser module comprises a laser cutter having a beam path that extends from the laser cutter into the common cavity.
4. The blowout preventer stack of claim 3, wherein the beam path intersects the axis of the common cavity.
5. The blowout preventer of claim 3, wherein the shear laser module comprises a laser cutter shield located adjacent to the common cavity, wherein the laser cutter shield protects the laser cutter from conditions present in the common cavity, while not appreciably interfering with the movement of tubulars through the common cavity.
6. The blowout preventer of claim 1, wherein the ram preventer is a shear ram and wherein the blowout preventer stack comprises: a second annular preventer, a second shear ram, a first pipe ram, a second pipe ram, and a third pipe ram.
7. The blowout preventer of claim 1, wherein the shear laser module comprises a plurality of laser cutters.
8. The blowout preventer of claim 2, wherein the shear laser module comprises a first laser cutter and a second laser cutter, wherein the first laser cutter has a first beam path that extends from the first laser cutter into the common cavity, wherein the second laser cutter has a second beam path that extends from the second laser cutter into the common cavity.
9. The blowout preventer of claim 8, wherein the first and second beam paths intersect

within the common cavity.

10. The blowout preventer of claim 8, wherein the first and second beam paths are directed toward the cavity axis.

11. The blowout preventer of claim 8, wherein the first and second beam paths intersect the cavity axis.

12. The blowout preventer of claim 8, wherein the first and second beam paths do not intersect within the common cavity.

13. The blowout preventer of claim 8, wherein the first and second beam paths are substantially parallel.

14. The blowout preventer of claim 3, wherein the beam path forms a normal angle with the axis.

15. The blowout preventer of claim 3, wherein the beam path forms an obtuse angle with the axis.

16. The blowout preventer of claim 3, wherein the beam path forms an acute angle with the axis.

17. The blowout preventer of claim 2, wherein the ram preventer is a shear ram and wherein the blowout preventer comprises: a second annular preventer, a second shear ram, a first pipe ram, a second pipe ram, and a third pipe ram.

18. The blowout preventer of claim 8, wherein the ram preventer is a shear ram and wherein the blowout preventer comprises: a second annular preventer, a second shear ram, a first pipe ram, a second pipe ram, and a third pipe ram.

19. The blowout preventer of claim 8, wherein the first and second laser cutters are configured to rotate around the common cavity upon activation.

20. The blowout preventer of claim 3, wherein the laser cutter is positioned outside of the common cavity.

21. The blowout preventer of claim 8, wherein the first and the second laser cutters are positioned outside of the common cavity.
22. The blowout preventer of claim 17, wherein the first and the second laser cutters are adjacent to the common cavity.
23. The blowout preventer of claim 3, wherein the laser cutter is adjacent to the common cavity.
24. The blowout preventer of claim 8, wherein the first and the second laser cutters are adjacent to the common cavity.
25. The blowout preventer of claim 17, wherein the first and the second laser cutters are positioned outside of the common cavity.
26. The blowout preventer of claim 3 or 6, wherein the shear laser module comprises a laser cutter shield located adjacent to the common cavity, wherein the laser cutter shield protects the laser cutter from damage, while not appreciably interfering with the movement of tubulars through the common cavity.
27. The blowout preventer of claim 14, wherein the ram preventer is a shear ram and wherein the blowout preventer comprises: a second annular preventer, a second shear ram, a first pipe ram, a second pipe ram, and a third pipe ram.
28. A shear laser module for delivery of a cutting laser beam for use in a blowout preventer stack, the module comprising:
- a. a body having a first blowout preventer stack connector and a second blowout preventer stack connector;
 - b. the body having a pressure containment cavity for passing tubulars therethrough and conveying and controlling a flow of a drilling fluid therethrough; and,
 - c. a laser cutter in the body and having a beam path and capable of delivering a high power cutting laser beam having a power of at least about 1 kW and;
 - d. wherein the beam path travels from the laser cutter into the cavity and to any tubular that may be in the cavity.
29. The shear laser module of claim 28, comprising a laser cutter shield.

30. The shear laser module of claim 28, comprising a second laser cutter.
31. The shear laser module of claim 28, wherein the laser cutter is configured within the body to orbit around the cavity.
32. The shear laser module of claim 28 comprising a laser cutter shield located adjacent to the cavity, wherein the laser cutter shield protects the laser cutter from drilling fluids, while not appreciably interfering with the movement of tubulars through the cavity.
33. The shear laser module of claim 28, comprising: a support cable comprising a high power laser optical fiber optically associated with the laser cutter and a feed-through assembly mechanically associated with the support cable.
34. The shear laser module of claim 33, wherein the module is rated at greater than 5,000 psi operating pressure.
35. The shear laser module of claim 33, wherein the module is rated at greater than 10,000 psi operating pressure.
36. The shear laser module of claim 33, wherein the module is rated at greater than 15,000 psi operating pressure.
37. The shear laser module of claim 28 comprising a second laser cutter, wherein the laser cutter beam path constitutes a first beam path, wherein the second laser cutter has a second beam path that extends from the second laser cutter into the cavity.
38. The shear laser module of claim 37, wherein the first and second beam paths intersect within the cavity.
39. The shear laser module of claim 37, wherein the first and second beam paths are directed toward the cavity axis.
40. The shear laser module of claim 37, wherein the cavity has a cavity axis and the first and second beam paths intersect the cavity axis.
41. The shear laser module of claim 37, wherein the first and second beam paths do not intersect within the cavity.

42. The shear laser module of claim 37, wherein the first and second beam paths are substantially parallel.

43. The shear laser module of claim 28, wherein the cavity has a cavity axis and the beam path forms a normal angle with the axis.

44. The shear laser module of claim 28, wherein the cavity has a cavity axis and the beam path forms an obtuse angle with the axis.

45. The shear laser module of claim 28, wherein the cavity has a cavity axis and the beam path forms an acute angle with the axis.

46. The shear laser module of claim 32 wherein the laser cutter is configured to orbit at least partially around the cavity during activation.

47. The shear laser module of claim 28, 32, or 34 wherein the laser cutter is positioned outside of the cavity.

48. The shear laser module of claim 37, wherein the first and the second laser cutters are positioned outside of the cavity.

49. The shear laser module of claim 37, wherein the first and the second laser cutters are adjacent to the cavity.

50. The shear laser module of claim 28 or 34 wherein the laser cutter is adjacent to the cavity.

51. A method of retrofitting a pre-existing blowout preventer ("BOP") stack with a shear laser module to make a laser assisted BOP stack, the method comprising:

- a. evaluating a pre-existing BOP stack, comprising determining an operational specification for the pre-existing BOP stack;
- b. comparing the operational specification for the pre-existing BOP stack to a requirement for an intended use of the pre-existing BOP stack, and determining that the pre-existing BOP stack operational specification does not meet the requirement for the intended use; and
- c. retrofitting the pre-existing BOP stack by adding a shear laser module capable of delivering a cutting laser beam having a power of at least about 1 kW and comprising a

pressure containment cavity to the pre-existing BOP stack; whereby the retrofitted BOP stack meets the requirement for the intended use.

52. A method of making a laser assisted blowout preventer ("BOP") stack, the method comprising:

- a. obtaining an annular preventer comprising a pressure containment cavity;
- b. obtaining a ram preventer comprising a pressure containment cavity;
- c. obtaining a shear laser module capable of delivering a cutting laser beam having a power of at least about 1 kW and comprising a pressure containment cavity;
- d. assembling a BOP stack comprising the annular preventer, the ram preventer and the shear laser module; whereby the containment cavities are in pressure and fluid communication.

53. A blowout preventer stack comprising: a body defining a pressure containment cavity for passing tubulars through; a means for mechanically sealing the cavity; a means for providing a high power cutting laser beam having a power of at least about 1 kW along a laser beam path within the cavity; and a means for sealing the laser beam providing means; whereby the laser beam can be delivered in the mechanically sealed cavity.

54. The blowout preventer stack of claim 53, wherein the blowout preventer stack is a subsea blowout preventer stack and wherein the means for mechanically sealing the cavity is a ram preventer.

55. The blowout preventer stack of claim 54, comprising an annular preventer.

56. The blowout preventer stack of claim 53, wherein the means for providing a laser beam along a laser beam path comprises a laser cutter.

57. The blowout preventer stack of claim 53, wherein the means for providing a laser beam along a laser beam path comprises a plurality of laser cutters.

58. The blowout preventer stack of claim 53, wherein the means for providing a laser beam along a laser beam path comprises a plurality of orbital laser cutters.

59. The blowout preventer stack of claim 53, wherein the means for providing a laser beam along a laser beam path comprises a plurality of laser cutters each having a beam path and wherein at least two beam paths intersect within the cavity.

60. A subsea blowout preventer stack comprising: a means for connecting to a well; a means for connecting to a riser; a body defining a pressure containment cavity; the cavity in fluid communication with the means for connecting to the well and the means for connecting to the riser; a means for sealing the cavity; and, a means for providing a high power cutting laser beam having a power of at least about 1 kW within the cavity.

61. The subsea blowout preventer stack of claim 60, wherein the means for providing a laser beam comprises a laser cutter.

62. The subsea blowout preventer stack of claim 60, wherein the means for providing a laser beam comprises a plurality of laser cutters, each providing a laser beam path, wherein at least two laser beam paths intersect within the cavity.

63. A subsea blowout preventer stack comprising: a means for defining a pressure containment cavity for passing tubulars therethrough and conveying and controlling a flow of a drilling fluid therethrough; a means for sealing the cavity; and, a means for providing first and second high power cutting laser beam paths for laser beams having a power of at least about 1 kW within the cavity.

64. The subsea blowout prevent stack of claim 63, wherein the first and second laser beam paths intersect within the cavity.