CLAIMS

1. A spacecraft servicing system, comprising:

a host spacecraft carrying spacecraft servicing devices; and

a spacecraft servicing device of the spacecraft servicing devices comprising:

a body configured to be deployed and separated from the host spacecraft at a location adjacent a target spacecraft;

at least one spacecraft servicing component configured to perform at least one servicing operation on the target spacecraft while being coupled to the target spacecraft, wherein the at least one spacecraft servicing component comprises a thruster assembly configured to alter at least one of an orbit, a velocity, or a momentum of the target spacecraft when coupled to the target spacecraft, the thruster assembly comprising at least one thruster; and

a communication device configured to receive data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft from a location remote from the spacecraft servicing device and, based on the received data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft received by the communication device, the spacecraft servicing device is configured to control the thruster assembly to alter the at least one of an orbit, a velocity, or a momentum of the target spacecraft while the spacecraft servicing device is coupled to the target spacecraft, wherein the spacecraft servicing device lacks any internal systems for determining telemetry data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft and is configured to rely on an exterior source at the location remote from the spacecraft servicing device to provide the telemetry data.

2. The spacecraft servicing system of claim 1, wherein the spacecraft servicing device is configured to be positioned at a location adjacent the target spacecraft using only mechanisms of the host spacecraft.

3. The spacecraft servicing system of claim 2, wherein a control system of the spacecraft servicing device is configured only to utilize the thruster assembly to maintenance the target spacecraft and not to move the spacecraft servicing device to the location adjacent the target spacecraft due to the lack of the telemetry data.

4. The spacecraft servicing system of claim 1, wherein the thruster assembly comprises at least one of at least one electric propulsion thruster or at least one chemical propulsion thruster.

5. The spacecraft servicing system of claim 1, further comprising a coupling mechanism configured to couple the spacecraft servicing device to the target spacecraft.

6. The spacecraft servicing system of claim 5, wherein the coupling mechanism is configured to enable rotation of the body relative to the target spacecraft.

7. The spacecraft servicing system of claim 6, wherein the coupling mechanism is configured to alter a vector of at least one thrust force applied by the spacecraft servicing device to the target spacecraft with the thruster assembly mounted on a boom arm when the spacecraft servicing device is coupled to the target spacecraft by rotating the thruster assembly on the boom arm relative to the target spacecraft.

8. The spacecraft servicing system of claim 1, where the at least one thruster is positioned on a boom arm extending away from the body, and wherein the at least one thruster is configured to move about at least one degree of freedom on the boom arm relative to the body.

9. The spacecraft servicing system of claim 8, wherein the at least one degree of freedom comprises at least three degrees of freedom including rotation about three axes.

10. The spacecraft servicing system of claim 9, further comprising a rotatable coupling mechanism configured to couple the spacecraft servicing device to the target spacecraft at an interface between the spacecraft servicing device and the target spacecraft, wherein one degree of freedom of the at least three degrees of freedom is provided by the rotatable coupling mechanism that is configured to rotate the spacecraft servicing device relative to the target spacecraft about the interface between the spacecraft servicing device and the target spacecraft when the spacecraft

servicing device is coupled to the target spacecraft.

11. The spacecraft servicing system of claim 10, wherein the at least one spacecraft servicing component comprises at least one propulsion device positioned on a distal portion of a boom arm extending away from the body, wherein movement of the boom arm is configured to alter an orientation of the at least one propulsion device positioned on the boom arm about a first degree of freedom, and wherein rotation of the body relative to the target spacecraft at the interface between the spacecraft servicing device and the target spacecraft is configured to alter the orientation of the at least one propulsion device positioned on the boom arm about a second degree of freedom.

12. The spacecraft servicing system of claim 1, wherein the spacecraft servicing device is configured to receive the data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft directly or indirectly from the target spacecraft via a radio frequency link.

13. The spacecraft servicing system of claim 1, wherein the spacecraft servicing device is configured to alter the at least one of an orbit, a velocity, or a momentum of the target spacecraft using only the thruster assembly.

14. A spacecraft servicing device, comprising:

a body configured to be deployed from a host spacecraft;

a thruster assembly coupled to the body, the thruster assembly configured to alter at least one of an orbit, a velocity, or a momentum of a target spacecraft after being coupled to the target spacecraft; and

a communication device configured to receive data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft from a location remote from the spacecraft servicing device, wherein the spacecraft servicing device is configured to be positioned at a location adjacent the target spacecraft using only mechanisms of the host spacecraft, wherein the spacecraft servicing device lacks any systems for determining telemetry data relating the spacecraft servicing device, and wherein a control system of the spacecraft servicing device is configured only to utilize the thruster assembly to maintenance the target spacecraft and not to move the

spacecraft servicing device to the location adjacent the target spacecraft due to the lack of the telemetry data.

15. The spacecraft servicing device of claim 14, wherein the spacecraft servicing device is configured to receive the data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft from the target spacecraft.

16. The spacecraft servicing device of claim 14, wherein the spacecraft servicing device is configured to alter the at least one of an orbit, a velocity, or a momentum of the target spacecraft based on the data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft received by the communication device.

17. The spacecraft servicing device of claim 14, wherein the spacecraft servicing device is configured to periodically alter the at least one of an orbit, a velocity, or a momentum of the target spacecraft based on data relating to the at least one of an orbit, a velocity, or a momentum of the target spacecraft periodically received by the communication device.

18. The spacecraft servicing device of claim 14, wherein the spacecraft servicing device is configured to perform at least one of station-keeping, orbital raising, momentum adjustment, attitude control, relocation, de-orbit, refueling, component replacement, component addition, or repair to the target spacecraft.

19. The spacecraft servicing device of claim 14, further comprising a single solar array extending from one side of the body, the single solar array configured to move about a first axis of movement in order to position the single solar array relative to a light source and configured to move about a second axis of movement to counteract at least one rotational motion of the body.

20. The spacecraft servicing device of claim 14, wherein a total mass of the spacecraft servicing device is less than 500 kg.

21. The spacecraft servicing device of claim 20, wherein the total mass of the

spacecraft servicing device is less than 300 kg.

22. The spacecraft servicing device of claim 14, wherein the communication device comprises a flexible frequency transceiver configured to selectively alter a frequency of communication of the flexible frequency transceiver, the flexible frequency transceiver configured to be in communication with a ground station associated with the target spacecraft and to alter the frequency of communication of the flexible frequency transceiver to match a frequency of communication of the ground station.

23. A spacecraft servicing pod, comprising:

a body configured to be deployed from a host spacecraft housing a plurality of spacecraft servicing pods at a location adjacent a target spacecraft;

a coupling mechanism attached to the body and configured to couple the pod to the target spacecraft at the location adjacent the target spacecraft, the coupling mechanism comprising at least one movable coupling configured to rotate the body relative to the target spacecraft at a joint between the spacecraft servicing pod and the target spacecraft when the spacecraft servicing pod is coupled to the target spacecraft; and

at least one spacecraft servicing component configured to perform at least one servicing operation on the target spacecraft while being coupled to the target spacecraft, the at least one spacecraft servicing component comprising at least one propulsion device positioned on a distal portion of a boom arm extending away from the body, the at least one propulsion device configured to alter at least one of an orbit, a velocity, or a momentum of the target spacecraft when the spacecraft servicing pod is coupled to the target spacecraft, wherein movement of the boom arm is configured to alter an orientation of the at least one propulsion device positioned on the boom arm about a first degree of freedom, and wherein rotation of the body relative to the target spacecraft at the joint between the spacecraft servicing pod and the target spacecraft is configured to alter the orientation of the at least one propulsion device positioned on the boom arm about a second degree of freedom.

24. The spacecraft servicing pod of claim 23, wherein the at least one movable coupling is configured to rotate the body and the at least one propulsion device relative to the target spacecraft.

25. The spacecraft servicing pod of claim 23, wherein the at least one spacecraft servicing component comprises at least two propulsion devices configured to alter at least one of an orbit, a velocity, or a momentum of the target spacecraft, each of the at least two propulsion devices comprising at least one thruster coupled to the pod with at least one boom.

26. A method of servicing a spacecraft, the method comprising:

transferring a pod of a spacecraft servicing host device to the spacecraft with the spacecraft servicing host device;

coupling the pod to the spacecraft while the pod is in contact with the spacecraft servicing host device;

after being coupled to the spacecraft, altering at least one of an orbit, a velocity, or a momentum of the spacecraft with a thruster assembly of the pod;

receiving data relating to the at least one of an orbit, a velocity, or a momentum of the spacecraft from a location remote from the pod with a communications device, wherein the pod lacks any systems for determining telemetry data relating to the at least one of an orbit, a velocity, or a momentum of the spacecraft; and

based on the received data relating to the at least one of an orbit, a velocity, or a momentum of the spacecraft, further altering the at least one of an orbit, a velocity, or a momentum of the spacecraft with the thruster assembly of the pod.

27. The method of claim 26, wherein altering at least one of an orbit, a velocity, or a momentum of the spacecraft comprises modifying a momentum of the spacecraft.

28. The method of claim 26, wherein receiving data relating to the at least one of an orbit, a velocity, or a momentum of the spacecraft comprises receiving the data directly or indirectly from the spacecraft.

29. The method of claim 26, further comprising:

receiving updated data relating to the at least one of an orbit, a velocity, or a momentum of the spacecraft at selected intervals; and

utilizing the updated data to further alter the at least one of an orbit, a velocity, or a momentum of the spacecraft with the thruster assembly of the spacecraft servicing device.

30. The method of claim 26, wherein altering at least one of an orbit, a velocity, or a momentum of the spacecraft comprises modifying the at least one of an orbit, a velocity, or a momentum of the spacecraft according to a predetermined schedule.

31. The method of claim 26, further comprising:

delivering the pod to the spacecraft using only propulsion of the spacecraft servicing host device; and

only utilizing the thruster assembly of the spacecraft servicing device to maintenance the spacecraft.