CLAIMS

1. A cluster tool ~~assembly~~, comprising~~:~~.

a vacuum transfer module including a first robot;

a plurality of process module~~s having a first side connected~~ coupled to the vacuum transfer module;

an atmospheric transfer module including a second robot, the atmospheric transfer module coupled to the vacuum transfer module via a load lock;

~~an isolation valve having a first side coupled to a second side of the process module; and~~

a replacement station coupled to ~~a second side of the isolation valve~~ the atmospheric transfer module, the replacement station ~~including an exchange handler and a part buffer, the~~ having a part buffer ~~includes~~ with a plurality of compartments for ~~holding new or used~~ storing a plurality of consumable parts used in one or more of the plurality of process modules; and

an isolation valve coupled between the replacement station and the atmospheric transfer module, the second robot is configured with access to the replacement station via the isolation valve to retrieve consumable parts for installation in one or more of the plurality of process modules and store consumable parts removed from one or more of the plurality of process modules,

wherein the first robot of the vacuum transfer module is configured to handle the consumable parts for installation or removal from the one or more of the plurality of process modules and the second robot of the atmospheric transfer module is configured to handle the consumable parts retrieved from the replacement station or stored when removed from the one or more of the plurality of process modules,

wherein end effectors of the first robot and the second robot configured to move a wafer are also configured to move the consumable part to achieve alignment of the consumable part delivered to the one or more of the plurality of process modules, and wherein the consumable part is geometrically different from the wafer and the replacement station storing the plurality of consumable parts is different from a wafer loader storing the wafer used in the plurality of process modules.

~~the process module having a lift mechanism to enable placement of a consumable part installed in the process module to a raised position, the raised position providing access to the exchange handler to enable removal of the~~

consumable part from the process module and storage to a compartment of the part buffer,

the exchange handler of the replacement station enabled to install a replacement for the consumable part from the part buffer back to the process module;

wherein the lift mechanism is configured to receive the consumable part provided for replacement by the exchange handler and lower the consumable part to an installed position;

wherein the replacement by the exchange handler and the process module is conducted while the process module and the replacement station are maintained in a vacuum state.

2. The cluster tool assembly of claim 1, wherein the isolation valve, the replacement station and the at least one of the plurality of process modules are interfaced with a controller, the controller including transfer logic and a vacuum state control for coordinating access between the replacement station and the process module while the process module remains in the vacuum state includes lift pins for removing and installing one of said consumable parts.

3. The cluster tool assembly of claim 21, wherein the controller includes a transfer logic and a vacuum state control for coordinating access between the replacement station and the process module while the process module remains in the vacuum state is coupled to a side of the atmospheric transfer module.

4. The cluster tool assembly of claim 21, wherein the replacement station includes a vacuum control coupled to a pump, the vacuum control interfaces with the controller to coordinate action of the pump to maintain the replacement station in the vacuum state during replacement of the load lock provides an exchange location for ones of the consumable parts handled between the first robot and the second robot.

5. The cluster tool assembly of claim 1, wherein the process module maintained in the vacuum state enables a reduced reconditioning of the process module before the process module returns to active operation following the replacement of the consumable part is a replacement part of at least one of the plurality of process modules, and removal of the consumable part is performed without shutting down the process module having the consumable part replaced.

6. The cluster tool ~~assembly~~ of claim 1,

wherein the consumable part is an edge ring that ~~is configured to~~ surround~~s~~ a ~~substrate~~ wafer received in the one or more of the plurality of ~~when disposed over an electrostatic chuck of the~~ process module~~s~~;

~~wherein the lift mechanism includes a plurality of lift pins and actuators that enable placement of the edge ring installed in the process module to the raised position;~~

~~an actuator drive connected to the actuators; and~~

~~a controller interfaced with the actuator drive and the replacement station to enable coordination of replacement of the edge ring~~.

7. The cluster tool ~~assembly~~ of claim ~~6~~1, ~~wherein the actuators are connected to a power source, the power source used to supply power to the consumable part through the lift pins, wherein the power supplied is used to provide heat to~~ further includes a controller coupled to the atmospheric transfer module, the vacuum transfer module and the replacement station, the controller is configured to coordinate movement of the first robot and the second robot during replacement of the consumable part.

8. The cluster tool ~~assembly~~ of claim ~~7~~1, wherein the ~~actuators and the lift pins are made of a conductive material, the lift pins are connected to a switch so as to allow the lift pins to supply different power to the consumable part~~ replacement station is an attachable unit.

9. The cluster tool ~~assembly~~ of claim ~~6~~1, wherein the ~~actuator drive is connected to an air compressor to allow the actuators to operate the lift pins pneumatically~~ replacement station is disposed on a front side or on a second side that is different from a side where the load lock is disposed.

10. The cluster tool ~~assembly~~ of claim 1, wherein the ~~replacement station is a moveable unit that is coupled to the second side of the isolation valve when the consumable part is to be replaced and de-coupled when replacement of the consumable part is completed~~ second robot is configured with access to the wafer exchange module via the isolation valve to retrieve a wafer for processing in the

plurality of process modules and to store the wafer after completion of the processing, and

wherein the first robot of the vacuum transfer module is configured to handle delivery or removal of the wafer from the plurality of process modules.

~~11. The cluster tool assembly of claim 1, wherein an opening defined in the second side of the process module and an opening on a side of the replacement station that are coupled to the isolation valve are sized to allow the consumable part to be moved into and out of the process module.~~

~~12. The cluster tool assembly of claim 11, wherein the consumable part is a segmented consumable part having two or more segments that are sized to fit through the openings in the replacement station and the process module.~~

~~13. The cluster tool assembly of claim 1, wherein the exchange handler includes an end effector that is designed to retrieve, pick, lift, support, hold, move, or rotate the consumable part in any plane.~~

~~14. The cluster tool assembly of claim 1, wherein the exchange handler is designed to retrieve different consumable parts from the process module, the exchange handler having a different end effector for retrieving different types of consumable parts.~~

~~15~~11. A cluster tool ~~assembly~~, comprising~~,~~:

a vacuum transfer module ~~having~~ including a first ~~side and a second side, the vacuum transfer module including a~~ robot;

a plurality of process modules coupled to the vacuum transfer module;

~~a first isolation valve with a first side and a second side, the first side of the first isolation valve coupled to the first side of the vacuum transfer module;~~

a replacement station coupled to the ~~second side of the first isolation valve~~ vacuum transfer module, the replacement station having a part buffer~~, the part buffer includes~~ with a plurality of compartments for ~~holding new or used~~ storing a plurality of consumable parts used in one or more of the plurality of process modules;

an ~~second~~ isolation valve ~~with a first side and a second side, the second side of the second isolation valve~~ coupled ~~to the second side of~~ between the replacement station and the vacuum transfer module, the first robot is configured with access to the replacement station via the isolation valve to retrieve a consumable part for installation in one or more of the plurality of process modules and store consumable parts removed from the one or more of the plurality of process modules; ~~and~~

~~a process module coupled to the first side of the second isolation valve;~~

~~the process module having a lift mechanism to enable movement of a consumable part installed in the process module to a raised position, the raised position providing access to the robot of the vacuum transfer module to enable removal of the consumable part from the process module and store in the part buffer of the replacement station,~~

~~the robot of the vacuum transfer module enabled to install a replacement for the consumable part from the part buffer into the process module,~~

wherein an end effector provided in the first ~~the lift mechanism is configured to receive the consumable part provided for replacement by the~~ robot of ~~and lower the consumable part to an installed position,~~

~~wherein the replacement by the robot and the lift mechanism of the process module is conducted while the replacement station,~~ the vacuum transfer module ~~and the~~ configured to move a wafer is also configured to move the consumable part for installation in the one or more of the plurality of process modules, ~~are maintained in a vacuum state~~ to achieve alignment of the consumable part delivered to the one or more of the plurality of process modules, and

wherein the consumable part is geometrically different from the wafer and the replacement station storing the plurality of consumable parts is different from a wafer loader storing the wafer used in the plurality of process modules.

~~16~~12. The cluster tool ~~assembly~~ of claim ~~15~~11, wherein ~~the first isolation valve, the second isolation valve, the vacuum transfer module, the~~ at least one of the plurality of process modules ~~and the replacement station are interfaced with a controller, the controller including transfer logic and a vacuum state control for coordinating access between the replacement station, vacuum transfer module and the process module while the process module, the replacement station and the vacuum transfer module~~

~~remains in the vacuum state~~ includes lift pins for removing and installing one of said consumable parts.

~~17~~13. The cluster tool ~~assembly~~ of claim ~~15~~11, wherein the ~~vacuum transfer module, the~~ consumable part is a replacement part of at least one of the plurality of process module~~s,~~ and ~~the replacement station are interfaced with a controller, the controller includes a transfer logic and a vacuum state control for coordinating access between the replacement station and the vacuum transfer module and between the vacuum transfer module and the process module, while the vacuum transfer module, the replacement station and the process module remain in the vacuum state~~ removal of the consumable part is performed without shutting down the process module having the consumable part that is being replaced.

~~18~~14. The cluster tool ~~assembly~~ of claim ~~16~~11, ~~wherein the replacement station~~ further includes a ~~vacuum~~ controll~~er~~ coupled to ~~a pump, the vacuum control interfaces with the controller to coordinate action of the pump to maintain~~ the replacement station ~~in the vacuum state~~ and the one or more of the plurality of process modules, the controller configured to coordinate movement of the first robot during replacement of the consumable part.

~~19~~15. The cluster tool ~~assembly~~ of claim ~~15~~14, ~~wherein the replacement station,~~ further includes an atmospheric transfer module including a second robot, a first side of the atmospheric transfer module coupled to the vacuum transfer module via a load lock, ~~and the process module maintained in the vacuum state enables a reduced reconditioning of~~ a second side of the atmospheric transfer module coupled to a wafer exchange module via a load port, the second robot of the atmospheric transfer module configured with access to the wafer exchange module to retrieve wafers for processing in the plurality of process module~~s~~ and store the wafers processed by ~~before~~ the plurality of process module~~s returns to active operation following the replacement of the consumable part~~.

~~20~~16. The cluster tool ~~assembly~~ of claim 15, wherein the load lock provides an exchange location for the wafers handled between the atmospheric transfer module and the vacuum transfer module~~the lift mechanism~~

~~includes a plurality of lift pins and actuators that enable placement of the consumable part installed in the process module to the raised position;~~

~~an actuator drive connected to the actuators; and~~

~~a controller interfaced with the actuator drive, the replacement station and the vacuum transfer module to enable coordination of replacement of the consumable part~~.

~~21~~17. The cluster tool ~~assembly~~ of claim 15, wherein the ~~robot includes an end effector that is designed to retrieve, pick, lift, support, hold, move, or rotate the consumable part in any plane~~ controller is further coupled to the atmospheric transfer module, the controller is configured to coordinate movement of the first robot and the second robot during movement of wafers for processing.

~~22~~18. The cluster tool ~~assembly~~ of claim ~~21~~11, wherein the ~~robot includes a second end effector designed to move a semiconductor wafer into and out of the process module~~ consumable part is an edge ring that surrounds a wafer in the one or more of the plurality of process modules. ~~23. The cluster tool assembly of claim 15, wherein openings are defined in the first side and the second side of the vacuum transfer module for coupling the replacement station and the process module so as to maintain uniformity and symmetry in the cluster tool assembly.~~

~~24. A cluster tool assembly, comprising:~~

~~an atmospheric transfer module having a first side and a second side, the atmospheric transfer module having a robot;~~

~~a vacuum transfer module having a first side and a second side, the vacuum transfer module including a second robot;~~

~~a loadlock chamber coupled to the first side of the atmospheric transfer module and a first side of the vacuum transfer module, the loadlock chamber providing an interface between the atmospheric transfer module and the vacuum transfer module;~~

~~a process module coupled to the second side of the vacuum transfer module; and~~

~~a replacement station coupled to the second side of the atmospheric transfer module, the replacement station having a part buffer, the part buffer includes a plurality of compartments for holding new or used consumable parts;~~

the process module having a lift mechanism to enable movement of a consumable part installed in the process module to a raised position, the raised position providing access to the second robot of the vacuum transfer module to enable removal of the consumable part from the process module and transfer to the loadlock chamber, the robot of the atmospheric transfer module enabled to move the consumable part from the loadlock chamber to the part buffer of the replacement station,

the robot of the atmospheric transfer module and the second robot of the vacuum transfer module enabled to move a replacement for the consumable part from the part buffer into the process module,

wherein the lift mechanism is configured to receive the consumable part provided for replacement by the second robot and lower the consumable part to an installed position,

wherein the replacement by the second robot and the lift mechanism of the process module is conducted while the vacuum transfer module and the process module are maintained in a vacuum state.

25. The cluster tool assembly of claim 24, wherein the atmospheric transfer module, the vacuum transfer module, the process module, and the replacement station are interfaced with a controller, the controller including transfer logic and a vacuum state control for coordinating access between the replacement station, the atmospheric transfer module, the vacuum transfer module, and the process module while the process module and the vacuum transfer module remains in the vacuum state.

26. The cluster tool assembly of claim 24, wherein the atmospheric transfer module and the replacement station are maintained at atmospheric condition.