CLAIMS

1. A bent-pipe satellite having flexible intra-satellite communications between a plurality of fixed spot beams, the satellite comprising:

a fixed spot beam antenna subsystem having a plurality of uplink antenna ports and a plurality of downlink antenna ports; and

a pathway selection subsystem comprising:

a combiner-divider network;

one or more sets of interconnected switches controllable to activate a plurality of non-processed monocast signal pathway between any uplink antenna port and any downlink antenna port, based on switching an input subsystem associated with the uplink antenna port into connection with an output subsystem associated with the downlink antenna port, and further controllable to activate non-processed simulcast signal pathways between the uplink antenna port and any two or more downlink antenna ports, based on switching the input subsystem associated with the uplink antenna port into connection with a respective input of the combiner-divider network and switching the output subsystems associated with the two or more downlink antenna ports into connection with respective outputs of the combiner-divider network; and

a pathway scheduling controller that provides control signals to control the one or more sets of interconnected switches, to activate monocast or simulcast pathways between respective ones of the uplink and downlink antenna ports, according to a pathway selection schedule; and

wherein the one or more sets of interconnected switches comprise a set of input switches and a set of output switches, and wherein:

each input switch has a switch input corresponding to a respective one of the uplink antenna ports and has N+1 switch outputs comprising N monocast outputs coupled to respective monocast inputs of the output switches and one simulcast output coupled to the combiner-divider network;

each output switch has a switch output corresponding to a respective one of the downlink antenna ports and has N+1 switch inputs comprising N monocast inputs and one simulcast input coupled to the combiner-divider network; and

the divider-combiner network comprises N inputs corresponding to respective ones of the input switches and N outputs corresponding to respective ones of the output switches.

2. The bent-pipe satellite of claim 1, wherein the one or more sets of interconnected switches comprise a plurality of Uplink Pathway Selectors (UPSs) and a corresponding plurality of Downlink Pathway Selectors (DPSs), and wherein:

each UPS comprises a UPS input coupled with a respective one of the uplink antenna ports via the associated input subsystem, and a plurality of UPS outputs;

each DPS comprises a DPS output coupled with a respective one of the downlink antenna ports, and a plurality of UPS inputs; and

each of at least some of the DPS inputs is coupled with one of the UPS outputs.

3. The bent-pipe satellite of claim 2, wherein, to activate a monocast signal pathway between a particular

one of the uplink antenna ports and a particular of the downlink antenna ports, the pathway scheduling controller is configured to activate the UPS output of the respective UPS that is coupled to one of the DPS inputs of the respective DPS.

4. The bent-pipe satellite of claim 2 or 3, wherein, to activate a simulcast signal pathway between a particular one of the uplink antenna ports and two or more particular ones of the downlink antenna ports, the pathway scheduling controller is configured to activate the UPS output of the respective UPS that is coupled to one of the inputs of the combiner-divider network, and activate the DPS inputs of the respective DPSs that are coupled to outputs of the combiner-divider network.

5. The bent-pipe satellite of any one of claims 1– 4, wherein the uplink antenna ports are gateway uplink antenna ports, and the downlink antenna ports are user downlink antenna ports, such that any activated monocast or simulcast signal pathways are forward-channel signal pathways.

6. The bent-pipe satellite of any one of claims 1-4, wherein the uplink antenna ports user uplink antenna ports, and the downlink antenna ports are gateway downlink antenna ports, such that any activated monocast or simulcast signal pathways are return-channel signal pathways, and wherein, to activate a simulcast return-channel signal pathway, the one or more sets of interconnected switches are further controllable to activate non-processed simulcast signal pathways between any two or more user uplink antenna ports and any gateway downlink antenna port, based on switching the input subsystems associated with the two or more user uplink antenna ports into connection with a respective input of the combiner-divider network and switching the output subsystem associated with the gateway downlink antenna port into connection with a respective output of the combiner-divider network.

7. The bent-pipe satellite of any one of claims 1 – 4, wherein the uplink antenna ports comprise one or more gateway uplink antenna ports used for forward-channel traffic and one or more user uplink antenna ports used for return-channel traffic, the downlink antenna ports comprise one or more gateway downlink antenna ports used for return-channel traffic and one or more user downlink antenna ports used for forward-channel traffic, and wherein the one or more sets of interconnected switches is configured to provide selectively activated monocast and simulcast signal pathways for forward-channel traffic and selectively activated monocast and simulcast signal pathways for return-channel traffic.

8. The bent-pipe satellite of claim 7, wherein, for return-channel traffic, the one or more sets of interconnected switches are controllable to activate simulcast signal pathways between any two or more user uplink antenna ports and any gateway downlink antenna ports based on switching the input subsystems associated with the two or more user uplink antenna ports into connection with respective inputs of the combiner-divider network, and switching the output subsystem associated with the gateway downlink antenna port into connection with a corresponding output of the combiner-divider network.

~~9. The bent-pipe satellite of claim 1, wherein the one or more sets of interconnected switches comprise a set of input switches and a set of output switches, and wherein:~~

~~each input switch has a switch input corresponding to a respective one of the uplink antenna-~~

~~ports and has N+1 switch outputs comprising N monocast outputs coupled to respective monocast inputs of the output switches and one simulcast output coupled to the combiner-divider network;~~

~~each output switch has a switch output corresponding to a respective one of the downlink antenna ports and has N+1 switch inputs comprising N monocast inputs and one simulcast input coupled to the combiner-divider network; and~~

~~the divider-combiner network comprises N inputs corresponding to respective ones of the input switches and N outputs corresponding to respective ones of the output switches.~~

~~10~~ 9. The bent-pipe satellite of any one of claims 1-~~9~~ 8, wherein the bent-pipe satellite further comprises channel filters comprised in the input or output subsystems.

~~11~~ 10. The bent-pipe satellite of any one of claims 1-~~10~~ 9, wherein the bent-pipe satellite further comprises frequency converters comprised in the input or output subsystems, for converting between uplink-signal frequencies and downlink-signal frequencies.

~~12~~ 11. The bent-pipe satellite of any one of claims 1-~~11~~ 10, wherein each input subsystem includes a low-noise amplifier in a signal path of the input subsystem.

~~13~~ 12. The bent-pipe satellite of any one of claims 1-~~12~~ 11, wherein each output subsystem comprises a respective portion of a multiport amplifier having respective outputs coupled to the downlink antenna ports.

~~14~~ 13. The bent-pipe satellite of claim ~~13~~ 12, wherein the multiport amplifier comprises a plurality of power amplifiers coupled between a first butler matrix and a second butler matrix.

~~15.~~14. The bent-pipe satellite of claim 1, further comprising:

a memory, having stored thereon, the pathway selection schedule and a set of instructions,

which, when executed by the pathway scheduling controller, cause the pathway scheduling controller to provide the control signals to the one or more sets of interconnected switches, according to the pathway selection schedule; and

wherein the pathway selection schedule is updatable according to control information received from a ground terminal while the satellite is in orbit.