CLAIMS

1. A child restraint (1000a, 1000b) for a vehicle, the child restraint comprising:

a base (1100, 1200) having a rear portion (1102a) configured to abut a portion of a vehicle seatback (104) of a vehicle seat (100) in the vehicle when the child restraint is installed into the vehicle; and

a seat shell (1300), rotatably coupled to the base such that the base remains stationary while the seat shell rotates with respect to the base, to support a child, the seat shell having a front side (1301a) and a rear side (1301b) and being rotatable relative to the base between:

a rear-facing position where the front side of the seat shell is closer to the rear portion of the base than the rear side of the seat shell; and

a forward-facing position where the rear side of the seat shell is closer to the rear portion of the base than the front side of the seat shell,

the seat shell including one or more first forward belt path features (1312, 1362) that define, in part, a first forward-facing belt path (1010c), the one or more first forward belt path features configured to receive a belt to couple the child restraint to the vehicle seat and restrain the child in the seat shell when the child restraint is installed into the vehicle, the seat shell is at the forward-facing position, and the belt is a vehicle seat belt;

one or more second forward belt path features (1310) that define, in part, a second forward-facing belt path (1010c 1010b) different from the first forward-facing belt path, the one or more second forward belt path features configured to receive the belt to couple the child restraint to the vehicle seat when the child restraint is installed into the vehicle and the seat shell is at the forward-facing position and disposed on a first side (1301c, 1301d) of the seat shell proximate to a seatback section (1303) of the seat shell such that the belt is placed against the seatback section when the belt is routed through the one or more second forward belt path features and the belt is tensioned.

2. The child restraint of claim 0, wherein:

the seat shell comprises a headrest (1360), disposed on a seatback section of the seat shell, to support a head of the child; and

the one or more first forward belt path features comprises:

a notch (1312), disposed on a first side of the seat shell proximate to a seat pan (1302) of the seat shell, to define a first portion of the first forward-facing belt path for a lap portion (116a) of the belt when the child restraint is installed into the vehicle and the belt is the vehicle seat belt; and

an opening (1362), disposed on the headrest, to define a second portion of the first forward-facing belt path for a shoulder portion (116b) of the belt when the child restraint is installed into the vehicle and the belt is the vehicle seat belt.

3. The child restraint of claim 0, wherein:

the belt comprises a belt tongue (112); and

the notch is shaped to rotate the belt tongue when the belt tongue is pulled through the notch.

4. The child restraint of claim 0, wherein:

the notch comprises a protruding section (1313) that extends outwards from the first side of the seat shell, the protruding section comprising:

a first edge (1314) disposed towards the front side of the seat shell; and

a second edge (1316) disposed towards the rear side of the seat shell, aligned substantially parallel with the first edge, and vertically offset from the first edge.

5. The child restraint of claim 1, wherein the one or more second forward belt path features comprises an opening (1310)

6. The child restraint of claim 1, further comprising:

the belt,

wherein the belt restricts rotational adjustment of the seat shell with respect to the base when the child restraint is installed into the vehicle via the first or second forward-facing belt paths.

7. The child restraint of claim 1, wherein the seat shell comprises a belt locking arm (1352) to securely couple the belt to the seat shell when the second forward-facing belt path is used to install the child restraint into the vehicle, the belt locking arm displacing a portion of the belt so as to ensure the belt is under tension when secured to the child restraint.

8. The child restraint of any of claims 0 to 7, wherein the base includes one or more rear belt path features (1204, 1230) that define, in part, a rear-facing belt path (1010a), the one or more rear belt path features configured to receive the belt (110) to couple the child restraint to the vehicle seat when the child restraint is installed into the vehicle and the seat shell is at the rear-facing position.

9. The child restraint of claim 8, wherein the rear-facing belt path positions the belt proximate to the rear portion and a bottom portion (1102b) of the base when the child restraint is installed into the vehicle.

10. The child restraint of claim 8, wherein the rear-facing belt path positions the belt proximate to a center of gravity of the child restraint and the child when the child restraint is installed into the vehicle.

11. The child restraint of claim 8, further comprising:

the belt,

wherein the belt is one of a vehicle seat belt (110b) or a Lower Anchors and Tethers for CHildren (LATCH) belt (110a).

12. The child restraint of claim 11, wherein:

the belt is a LATCH belt; and

the base comprises a storage compartment (1140) to store the LATCH belt when the LATCH belt is not in use.

13. The child restraint of claim 0, wherein the base further comprises:

a lower base (1100) having the rear portion; and

a mid base (1200) disposed between the lower base and the seat shell, the mid base being coupled to the lower base via a recline mechanism (1120) that adjusts a recline position of the seat shell with respect to the lower base, the mid base being coupled to the seat shell via a rotation mechanism (1332) that adjusts a rotational position of the seat shell with respect to the mid base.

14. The child restraint of claim 3, wherein the recline mechanism is located below the rotation mechanism.

15. The child restraint of claim 4, wherein:

the mid base includes one or more rear belt path features (1204, 1230) that define, in part, a rear-facing belt path (1010a), the one or more rear belt path features configured to receive the belt (110) to couple the child restraint to the vehicle seat when the child restraint is installed into the vehicle and the seat shell is at the rear-facing position; and

the recline mechanism is located below the rear-facing belt path.

16. The child restraint of claim 13, wherein the recline mechanism defines a plurality of indexed recline positions, the recline position of the seat shell corresponding to one of the plurality of indexed recline positions.

17. The child restraint of claim 16, wherein the plurality of indexed recline positions comprises at least four indexed recline positions.

18. The child restraint of claim 6, wherein the recline mechanism comprises:

a pair of rails (1130), disposed on the lower base, defining the plurality of indexed recline positions;

a pair of lock pins (1127a, 1127b), disposed within the mid base, where each lock pin engages one of the pair of rails at one of the plurality of indexed recline positions;

a first flexible member (1125a) coupled to one of the pair of lock pins and disposed within the mid base along a first path (1126a);

a second flexible member (1125b) coupled to a remaining one of the pair of lock pins and disposed within the mid base along a second path (1126b), the second path overlapping the first path; and

an actuation handle (1122), coupled to the first flexible member and second flexible member, to disengage the pair of lock pins from the pair of rails when the actuation handle is actuated.

19. The child restraint of claim 3, wherein the recline mechanism comprises:

a first rail (1130) disposed on the lower base; and

a second rail disposed on the lower base in parallel alignment with the first rail, the first and second rails defining the plurality of indexed recline positions and separated by a distance less than about 5.5 inches.

20. The child restraint of claim 3, wherein:

the rotation mechanism defines a rotation plane (1006) along which the seat shell is rotatable with respect to the mid base; and

the lower base and the mid base are shaped such that the rotation plane is tilted by an offset angle relative to a horizontal reference plane when the lower base is placed onto the horizontal reference plane.

21. The child restraint of claim 20, wherein:

the offset angle is approximately 13 degrees; and

a recline angle of the seat shell, defined between a seatback section of the seat shell and the horizontal reference plane, ranges between approximately 34 degrees and approximately 49 degrees when the seat shell is at the rear-facing position and between approximately 59 degrees and approximately 74 degrees when the seat shell is at the forward-facing position.

22. The child restraint of claim 13, wherein:

the rotation mechanism comprises:

one or more brackets (1240) rigidly coupled to the mid base; and

a turn ring (1330) rigidly coupled to the seat shell, the turn ring being coupled to the one or more brackets such that the turn ring is only movable with respect to the one or more brackets along a single rotational degree of freedom.

23. The child restraint of claim 22, wherein the turn ring has at least one of a C-shaped cross section or an I-shaped cross section.

24. The child restraint of claim 22, wherein the turn ring is formed of at least one of steel or magnesium.

25. The child restraint of claim 22, wherein:

the turn ring defines a center opening (1334); and

at least a portion of the seat shell is disposed through the center opening so as position the seat shell closer to the lower base.

26. The child restraint of claim 3, wherein:

the rotation mechanism comprises:

a turn ring rigidly coupled to the seat shell; and

the seat shell includes a seatback section comprising:

a seatback (1304); and

a seatback insert (1350) coupled to the seatback and the turn ring such that the turn ring, the seatback, and the seatback insert together form a triangular structure that increases the structural rigidity of the seat shell.

27. The child restraint of claim 26, wherein the seat shell does not include a metal tube or a L tube.

28. The child restraint of claim 13, wherein:

the lower base and the mid base include one or more rear belt path features (1204, 1230) that define a rear-facing belt path (1010a), the one or more rear belt path features configured to receive the belt (110) to couple the child restraint to the vehicle seat when

the child restraint is installed into the vehicle and the seat shell is at the rear-facing position; and

the one or more rear belt path features comprises a belt locking arm (1230) to securely couple the belt to the mid base when the rear-facing belt path is used to install the child restraint into the vehicle, the belt locking arm displacing a portion of the belt so as to ensure the belt is under tension when secured to the child restraint.

29. The child restraint of claim 28, wherein:

the seat shell comprises a belt access panel (1320) disposed on a front portion of a seat pan of the seat shell, the belt access panel providing access to the belt locking arm when the seat shell is at the rear-facing position.

30. The child restraint of claim 28, wherein the seat shell blocks access to the belt locking arm when the seat shell is at the forward-facing position.

31. The child restraint of claim 28, wherein:

the rotation mechanism comprises at least one rotation stop (1222); and

the mid base further comprises:

a rotation lockout (1220) having a plunger end (1224) and a lockout end (1226), the lockout end engaging the at least one rotation stop to limit rotational adjustment of the seat shell when the plunger end is actuated, the rotation lockout being spring-biased such that the lockout end is disengaged from the at least one rotation stop when the plunger end is not actuated.

32. The child restraint of claim 31, wherein the plunger end of the rotation lockout is actuated by the belt locking arm pressing the belt against the plunger end when the rear-facing belt path is used to install the child restraint into the vehicle.

33. The child restraint of claim 31, wherein:

the rotational position of 0 degrees corresponds to the seat shell being at the rear-facing position; and

the rotational position of the seat shell with respect to the mid base is limited to between approximately -120 degrees and approximately +120 degrees when the lockout end of the rotation lockout is engaged with the at least one rotation stop.

34. The child restraint of claim 31, wherein the at least one rotation stop prevents the seat shell from being rotated to the forward-facing position when the rotation lockout is actuated.

35. The child restraint of claim 0, wherein:

the base comprises a top side (1202a) having a plurality of openings (1250); and

the seat shell comprises a lock pin mechanism (1370) to lock the seat shell to the base, the lock pin mechanism comprising:

a lock pin (1372a) configured to be inserted into an opening in the plurality of openings;

a first actuation handle (1374a), coupled to the lock pin, to remove the lock pin from the opening when the first actuation handle is actuated thereby enabling rotational adjustment of the seat shell; and

a spring (1382, 1384), coupled to the lock pin, to at least one of insert or maintain the lock pin in the opening when the first actuation handle is not actuated.

36. The child restraint of claim 35, wherein the plurality of openings of the base are arranged to receive the lock pin only when the seat shell is at either the forward-facing position or the rear-facing position.

37. The child restraint of claim 35, wherein the lock pin mechanism further comprises:

a secondary lock (1378), coupled to the lock pin, to prevent release of the lock pin unless the secondary lock is actuated.

38. The child restraint of claim 35, wherein:

the lock pin, the first actuation handle, and the spring are disposed on a first side of the seat shell; and

the lock pin mechanism further comprises:

a second actuation handle (1374b) disposed on a second side of the seat shell opposite the first side and coupled to the lock pin via at least one of a torsion wire or a cable (1376) such that actuation of at least one of the first or second actuation handles removes the lock pin from the opening.

39. The child restraint of claim 0, wherein:

the seat shell comprises a harness to secure the child to the seat shell, the harness having an aloc strap (1400) partially disposed underneath a seat pan of the seat shell; and

the base comprises a shield (1260), disposed proximate to the seat shell, to provide a surface for the aloc strap to slide along when the seat shell is rotated with respect to the base and the aloc strap physically contacts the surface.

40. The child restraint of claim 0, wherein the seat shell comprises:

a harness to secure the child to the seat shell, the harness having an aloc strap partially disposed underneath a seat pan of the seat shell; and

a belt routing feature (1324), coupled to the seat pan, to retain the aloc strap against the seat pan when the seat shell is rotated with respect to the base.

41. The child restraint of claim 0, wherein the seat shell comprises:

a headrest, disposed on a seatback section of the seat shell, to support a head of the child, the headrest being adjustable with respect to a seat pan of the seat shell such that a distance between a bottom portion of the headrest and the seat pan ranges between about 8.8 inches and about 18.7 inches.

42. The child restraint of claim 0, wherein the child restraint occupies a volume less than or equal to approximately 7 cubic feet.

43. The child restraint of claim 0, wherein the child restraint does not include an adjustable foot.

44. A child restraint (1000a, 1000b) for a vehicle, the child restraint comprising:

a base (1100, 1200) having a rear portion (1102a) configured to abut a portion of a vehicle seatback (104) of a vehicle seat (100) in the vehicle when the child restraint is installed into the vehicle; and

a seat shell (1300), rotatably coupled to the base such that the base remains stationary while the seat shell rotates with respect to the base, to support a child, the seat shell having a front side (1301a) and a rear side (1301b) and being rotatable relative to the base between:

a rear-facing position where the front side of the seat shell is closer to the rear portion of the base than the rear side of the seat shell; and

a forward-facing position where the rear side of the seat shell is closer to the rear portion of the base than the front side of the seat shell,

the seat shell including one or more first forward belt path features (1312, 1362) that define, in part, a first forward-facing belt path (1010c), the one or more first forward belt path features configured to receive a belt to couple the child restraint to the vehicle seat and restrain the child in the seat shell when the child restraint is installed into the vehicle, the seat shell is at the forward-facing position, and the belt is a vehicle seat belt; wherein

the base further comprises:

a lower base (1100) having the rear portion; and

a mid base (1200) disposed between the lower base and the seat shell, the mid base being coupled to the lower base via a recline mechanism (1120) that adjusts a recline position of the seat shell with respect to the lower base, the mid base being coupled to the seat shell via a rotation mechanism (1332) that adjusts a rotational position of the seat shell with respect to the mid base; and wherein

the lower base and the mid base include one or more rear belt path features (1204, 1230) that define a rear-facing belt path (1010a), the one or more rear belt path features configured to receive the belt (110) to couple the child restraint to the vehicle seat when

the child restraint is installed into the vehicle and the seat shell is at the rear-facing position; and

the one or more rear belt path features comprises a belt locking arm (1230) to securely couple the belt to the mid base when the rear-facing belt path is used to install the child restraint into the vehicle, the belt locking arm displacing a portion of the belt so as to ensure the belt is under tension when secured to the child restraint.

45. The child restraint of claim 44, wherein:

the seat shell comprises a belt access panel (1320) disposed on a front portion of a seat pan of the seat shell, the belt access panel providing access to the belt locking arm when the seat shell is at the rear-facing position.

46. The child restraint of claim 44, wherein the seat shell blocks access to the belt locking arm when the seat shell is at the forward-facing position.

47. The child restraint of claim 44, wherein:

the rotation mechanism comprises at least one rotation stop (1222); and

the mid base further comprises:

a rotation lockout (1220) having a plunger end (1224) and a lockout end (1226), the lockout end engaging the at least one rotation stop to limit rotational adjustment of the seat shell when the plunger end is actuated, the rotation lockout being spring-biased such that the lockout end is disengaged from the at least one rotation stop when the plunger end is not actuated.

48. The child restraint of claim 47, wherein the plunger end of the rotation lockout is actuated by the belt locking arm pressing the belt against the plunger end when the rear-facing belt path is used to install the child restraint into the vehicle.

49. The child restraint of claim 47, wherein:

the rotational position of 0 degrees corresponds to the seat shell being at the rear-facing position; and

the rotational position of the seat shell with respect to the mid base is limited to between approximately -120 degrees and approximately +120 degrees when the lockout end of the rotation lockout is engaged with the at least one rotation stop.

50. The child restraint of claim 47, wherein the at least one rotation stop prevents the seat shell from being rotated to the forward-facing position when the rotation lockout is actuated.