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Coupled Qubits for Next Generation Quantum Annealing: Novel Interactions GABRIEL SAMACH, STEVEN WEBER, DAVID HOVER, DANNA ROSENBERG, JONILYN YODER, DAVID KIM, MIT Lincoln Laboratory, WILLIAM D. OLIVER, MIT Lincoln Laboratory; Research Laboratory for Electronics, Massachusetts Institute of Technology, ANDREW J. KERMAN, MIT Lincoln Laboratory — While the first generation of quantum annealers based on Josephson junction technology have been successfully engineered to represent arrays of spins in the quantum transverse-field Ising model, no circuit architecture to date has succeeded in emulating the more complicated non-stoquastic Hamiltonians of interest for next generation quantum annealing. Here, we present our recent results for tunable ZZ- and XX-coupling between high coherence superconducting flux qubits. We discuss the larger architectures these coupled two-qubit building blocks will enable, as well as comment on the limitations of such architectures. This research was funded by the Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA) and by the Assistant Secretary of Defense for Research & Engineering under Air Force Contract No. FA8721-05-C-0002. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of ODNI, IARPA, or the US Government.

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