Supplemental Figure Legend.

Figure 1S. *Upper.* CD28 co-stimulation protects against antigen-induced cell death. Annexin V and 7-AAD staining of T cells (untransduced, BBIR-z and BBIR-28z) following 72 h (grey bars) and 96 h (black bars) co-culture with A1847 at an E:T ratio 1:1, painted with either Bio-IgG1 or Bio-EpCAM antibodies. Apoptosis was quantified as a percentages of apoptotic cells- Annexin V^+ and $7AAD^+$ (means ± SEM; *n* = 3). *Lower.* Annexin V/7-AAD assay plots showing T cells after 96 h co-culture with A1847 cell line labeled with biotinylated IgG1 (Bio-IgG1) (*top panels*) and biotinylated EpCAM specific (Bio-EpCAM) antybodies, at an *E*:*T* ratio of 1:1. One representative FACS analysis is shown (n=3).

Figure 2S. BBIR-z T cells loaded with biotinylated molecules and then washed do not produce IFNγ in response to specific antigen stimulation. Following 45min incubation at 37°C with 1ug/ml of mesothelin specific biotinylated antybodies; P4 Biobody or K1 and control Bio-IgG1 antibody, BBIR-z T cells were washed with PBS and tested against plate-immobilized human mesothelin (10^5 cells/10ng mesothelin/well). After overnight incubation, culture supernatants were analyzed for human IFNγ cytokine by ELISA. Concentration of IFNγ is expressed in pg/ml (means ± SEM; *n* = 3).

Figure 3S. Flow Cytometry analysis of an antigen surface expression on mouse AE17 cell lines transduced to express human FRα or mesothelin and human ovarian cancer cell line, A1847. FRα-specific mAb Mov18, EpCAM-specific and mesothelin-specific K1 antibody and P4 Biobody were used to measure antigen expression on tumor cell lines (open empty *histogram*), compared to a matched isotype Ab control (filled gray histogram). Numbers within plots refer to specific mean fluorescent intensity (MFI).