FUTURE RESEARCH

§12.1 Introduction
The work described in this dissertation has obvious extensions in many directions. These are important experimental design ideas that nicely branch from this work. These ideas address both theoretical and pragmatic issues. The general areas for future research are detailed in the sections that follow.

§12.1.1 Other GLM Models
Other error distributions and link functions should be considered. It is quite possible that the generalization of the D-optimal factorial and fractional factorial designs can be accomplished with binomial, exponential, and gamma responses and links other than the canonical link. This would essentially extend the work to all important generalized linear model situations that accommodate dose-response problems in biomedical areas and process improvement problems in industrial areas.
§12.1.2 Robustness Issues

Several important robustness issues should be addressed. More work should be done which deals with robustness to link misspecification. In addition, there remains more to be learned about practical application of these designs under “parameter misspecification”. For example, if practitioners can identify certain EC combinations in the design variables then exact construction of the optimal design is complete. However, some strictly pragmatic questions remain, questions that deal with the efficiency of the designs when the researcher applies the factorial structure with runs placed at the extremes of the operability region. This extension would not require the level of creativity demonstrated here but would allow the naïve user to better understand how it should be implemented.

§12.1.3 Classical Response Surface Analysis

It is quite likely that this work can be extended into the complete classic response surface analysis. In this dissertation, the use of main effect and two factor interaction terms in the linear predictor do not allow response surface optimization. In that regard, designs that mimic the central composite or Box-Behnken designs should be developed. There is no assurance that these designs will be optimal. Indeed, in the standard linear model/RSM situation, D-optimal central composite designs are rare. However, the development of these designs might proceed along the lines of augmentation of the factorials or fractional factorials presented here, the augmentation being that which efficiently estimates quadratic terms.

§12.1.4 Block Designs

A noted extension of the current work is the accommodation of block effects. For the models discussed in this dissertation, this should not be particularly difficult. Indeed, it is quite possible that the most efficient blocking designs are very much like the standard blocking designs for linear models. However, designs that block orthogonally should be developed for second order designs.
§12.1.5 Non-Standard Correlation Structures

A very important application of response surface analysis and design is that which necessitates a non-standard correlation structure. One can characterize this as the standard split plot type experiment or the case of generalized estimating equations as applied in biological and biomedical scenarios. For each case, restrictions in randomization require the assumption of non-zero correlations among observations in a “cluster”. The development of efficient designs for response distributions that are members of the exponential family may be very useful.