Penn State Response
SHRP II S-01

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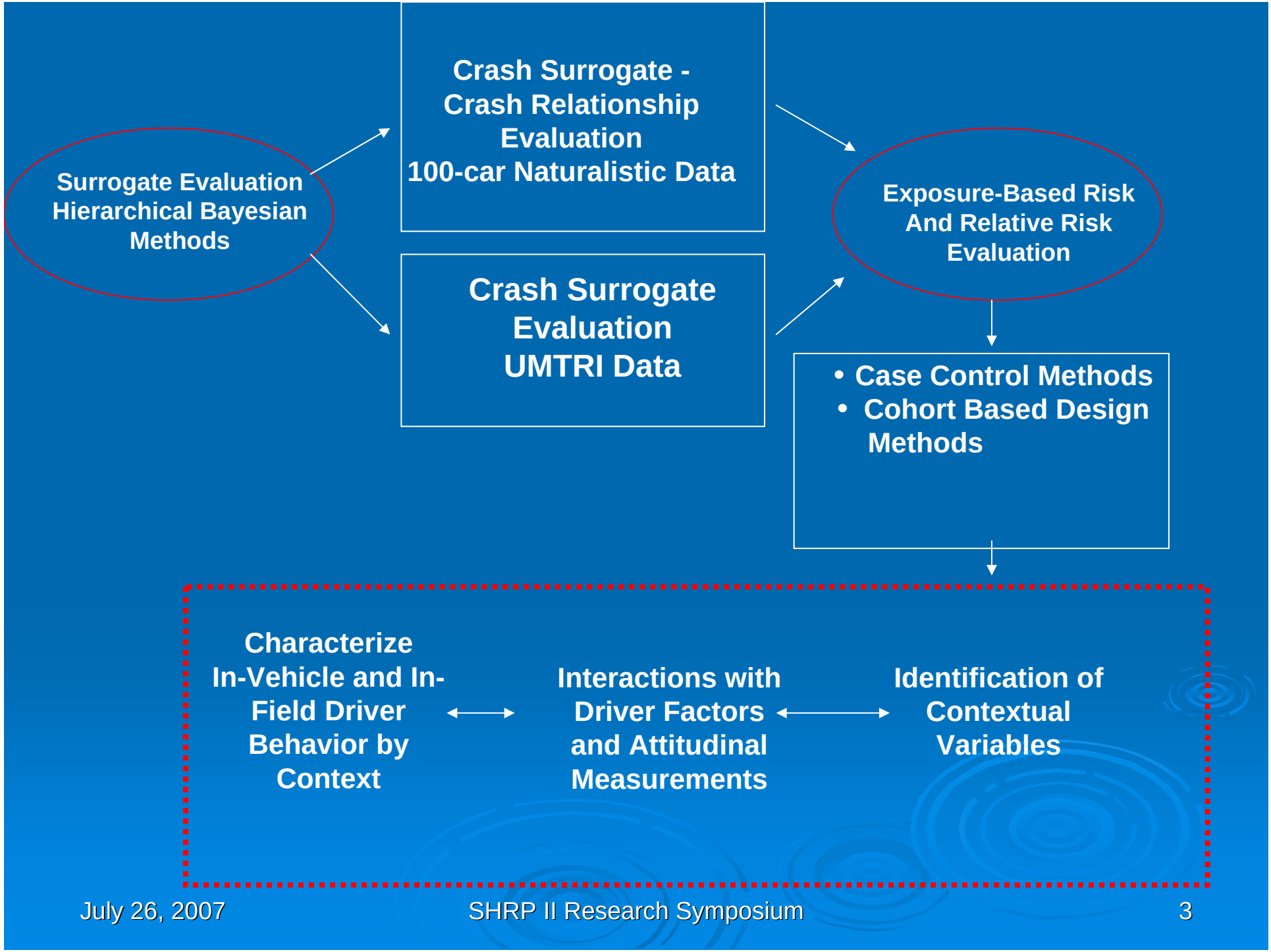
Overview

- Broad approach using both data sets
- Focus on run-off-road crashes
- Components of proposal
  - Surrogate evaluation – hierarchical bayesian models
  - Additional modeling
    - Relative risk – case control modeling
    - Exposure-based – cohort analysis
  - Importance of context
    - Roadway and environmental characteristics
    - Though findings will be sample-specific, context stratification will provide guidance for additional data collection and model updating


Surrogate Evaluation
Hierarchical Bayesian
Methods
Crash Surrogate -
Crash Relationship
Evaluation
100-car Naturalistic Data
Crash Surrogate
Evaluation
UMTRI Data
Exposure-Based Risk
And Relative Risk
Evaluation
• Case Control Methods
• Cohort Based Design
Methods
Characterize
In-Vehicle and In-
Field Driver
Behavior by
Context
Interactions with
Driver Factors
and Attitudinal
Measurements
Identification of
Contextual
Variables

Research Question 1

What is the nature of the relationship between crashes, near-crashes, incidents and pre-event maneuvers, precipitating factors, driver factors, contributing factors and environmental factors?

- Enhance analyses already conducted by UMTRI and VTTI
- Use range of modeling approaches in exploratory setting

Research Question 1

- Case-Control Analyses Using VTTI Data
- Cases are crashes, near crashes and *incidents*
  - Would like to more thoroughly explore relationships with incidents
  - Unique opportunity with data set's potential to provide detailed insights about events not normally recorded
- Controls are the epochs already collected by VTTI.
- Unable to address exposure, but useful for surrogate analysis with existing data

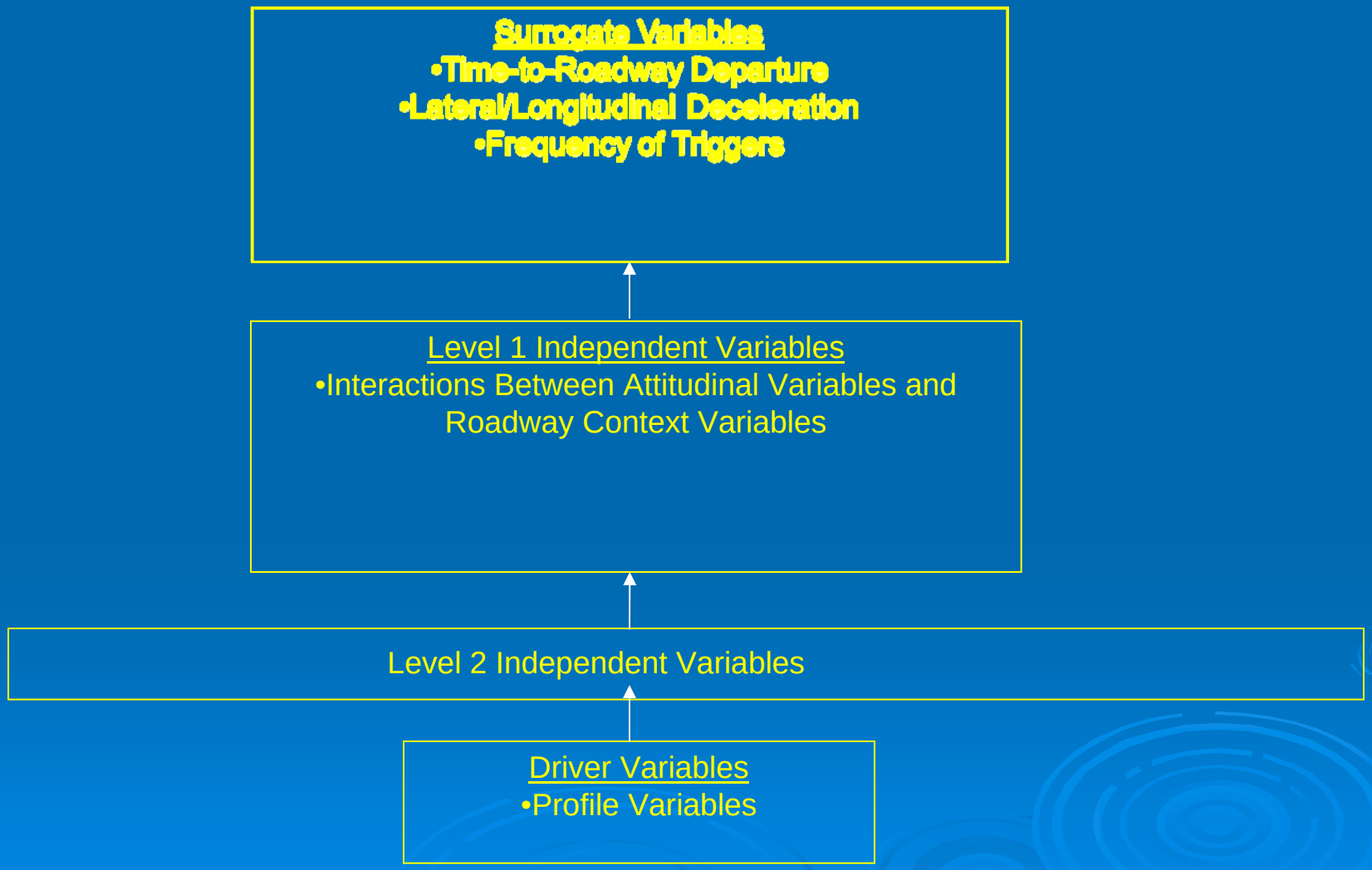
Research Question 1
Cohort Analyses Using UMTRI Data

- Could compare to crashes if crash data were available; driver alert is the dependent variable
- Responds to need to track driver over time in different driving contexts
  - Driving captured in series of homogeneous trip segments which are used to characterize “exposure”
  - Defined by variables such as time of day, road type, location (urban/rural), traffic density, environmental conditions (e.g. temperature, rain), alert settings
  - Exposure is sum of distance or time in each of these homogeneous segments

Research Question 1
Cohort Analyses Using UMTRI Data

- Aggregating time periods allows measurement of events of interest (e.g. number of alerts) in given trip segment, for driver with specific attributes
- Count regression can be used to identify association between alert warnings (dependent variable) and a set of driver and trip segment variables
- Will adjust for repeated measures on drivers

Plausible Hierarchical Modeling Structure



Hierarchical Bayesian Models
Cohort Analyses

- Can explicitly include driver attitudinal variables in addition to measures such as age and experience
- Numerous modeling options:
  - Total model includes all “exposure” and incidents
  - Separate models for each homogeneous segment type
  - Separate models by alert type

Research Question 2

What hierarchical structure (statistically speaking) if any, exists in the manner in which these relationships need to be explored?

- Nature of interaction and inter-relationship between driver factors (such as attitudes) and context
- Focus on run-off-road events

Research Question 3

What kind of elucidative evidence emerges from the analysis of roadway departure crashes in terms of questions 1 and 2? Can the illustrative hierarchy of relationships be generalized to other non-intersection crash types such as leading vehicle crashes, for example?

- Explore through modeling main effects and interactions

Research Question 4

In terms of elucidative evidence, what types of behavioral correlates emerge? For example, are attitudinal measurements indicative of revealed behavior in terms of headway maintenance and speed reductions?

- Prior team experience positive in linking attitudinal and objective variables in behavioral modeling
- Unique opportunity with these data sets

Research Question 5

- If elucidative evidence does in fact emerge in terms of attitudinal correlates and how their interactions vary by context, is it plausible to parse out the marginal effects of various context variables on *crash risk* by suitable research design?
  - Constrained by available data
  - Many statistical tools to be explored here

Approach Self-Perceived Strengths

- Unique opportunity in uncharted analysis territory calls for flexibility and range of methodological options
- Exploring range of levels of detail to help advise next phases of variables for experimental design (e.g. urban/rural)
- Modeling will address within-driver variability and repeated measures