2. Phase 2 Introduction

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2.1. Phase 2 Program Goal

The program goal of Phase 2 was the validation of Phase 1 results and the build of demonstration hardware.

Phase 1 was the concept phase and consisted of concept design and analysis. The design was basic wire frame and surface data, without holes for drainage or locators for assembly. The Phase 1 analysis, based on the design concept, was meshed in its basic form to reflect the surfaces of the structure.

2.2. Phase 2 Design and Analysis

The design in Phase 2 was a refinement of the Phase 1 design. It includes surface data, allowing for production of tools including principal location points (PLP) and holes for tooling, drainage and weld access. Additionally, refinement of the design for manufacture and assembly (DFMA) was developed as the final design progressed, with emphasis on mass production (more than 100,000 units per year).

The intention in Phase 2 was to continue the development of a “generic” structure that takes into consideration manufacturing and assembly methods. With the detailed design of the structural components, and assemblies, and with materials selected, build specifications and the final assembly sequence were established.

Computer Aided Engineering (CAE) continued in Phase 2 in conjunction with the refinement of the design. The analysis provided confirmation of the design as well as structural and crash performance. The CAE analysis in Phase 2 included:

- Finite Element Model Modification
- Structural Analysis consisting of:
  - Mass
  - Static Torsion
  - Static Bending
  - Modal Analysis

Continuing development of crash simulation concentrates on:

- AMS, 50% frontal offset crash at 55 km/h
- NCAP, 100% frontal crash at 35 mph (FMVSS 208)
- Side impact crash at 50 km/h (96/27 EG, with deformable barrier)
- Rear moving barrier crash at 35 mph (FMVSS 301)
- Roof crush (FMVSS 216)

All models were continuously updated to compare Phase 2 and Phase 1 results in order to maintain the same performance standards.

2.3. Demonstration Hardware (DH)

The term “demonstration hardware” is used to emphasize that the body structure is not a prototype but a legitimate representation of a production unit. All demonstration hardware components had to be fully tooled (soft tools for stamping and hard tools for hydroforming). All demonstration hardware was built in a single build sequence. The completed structure had to be “clear-coat” painted for unrestricted view of the build and construction methods.

2.4. Scope of Work

Porsche Engineering Services, Inc. in Troy, Michigan executed the program. The DH build, testing and the CAE analysis was performed at the Porsche R & D Center in Weissach, Germany. To achieve the targets for performance, timing and cost, the program responsibilities of PES included the following tasks:

- Program Management and Planning
- Build Management for the Construction of the Demonstration Hardware
- Build of Demonstration Hardware
- Part Supplier/Manufacturer Evaluation and Selection
- Component Structure Design and Engineering
- CAE Analysis
- Physical Testing of Test Unit
- Economic Analysis Study
- Final Program Report

2.5. Materials

The ULSAB Consortium member companies provided all material-specific data required to design, develop and construct the ULSAB body structure in Phase 2. All materials used to manufacture parts for the DH build were provided to Porsche by ULSAB Consortium member companies including the tailor welded blanks and raw material (tubes) for the manufacturing of the hydroform side roof rail. In addition, the individual ULSAB Consortium member companies supported the program with data related to material selection and tailor welded blank development, as well as forming simulation and circle grid analysis on selected parts in order to create a feasible part design.

2.6. Testing of Test Unit

Physical testing was undertaken on the test unit to provide data and allow correlation of the CAE results with regard to:

- Mass
- Static Torsion
- Static Bending
- Modal Analysis

Physical crash testing was not part of Phase 2. This could be executed in a possible Phase 3, with the necessary components, such as suspension, powertrain, and interior available.

2.7. Phase 2 Program Timing

Prior to the start of Phase 2 the program timing was established and the various tasks assigned.

Based on this timeline the ULSAB Consortium established specific information release dates to keep

ULSAB Phase 2 Program Timeline

Task Name	1996				1997				1998	
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Package Refinement											
Styling (CAS)											
Class A Surfacing											
Design & Engineering											
Economic Analysis											
CAE Analysis											
Design Changes											
CAE Analysis (Iteration 1)											
Design Changes											
CAE Analysis (Iteration 2)											
Design Changes											
CAE Analysis (Iteration 3)											
Release Long Lead Items											
Tooling											
Test Unit Build											
Testing											
Design Changes											
CAE Validation											
Tooling Adjustments											
DH Build											