Statement of Work (SoW) Template for PCB Technology Projects in the EEE sovereignty program. This template provides guidelines for proposals that focus on HDI work packages while encompassing additional areas such as surface finishes, solder mask, thermal management, and high-speed aspects. You can tailor each section to your specific technology development topic and project needs. This template provides a detailed structure that covers basic elements (clear work package definitions, inputs, tasks, deliverables, and review meetings) as well as specific points critical for PCB technology proposals. It also integrates requirements for external stakeholder reviews and detailed risk management approaches to build confidence in both the process and the final outcomes.

Annex 1 provides a schematic overview of **roadmap implementation**, for background information.

Statement of Work (SoW) template

Project Title: EEE Sovereignty PCB Technology Initiative **Focus Technology:** HDI (with complementary aspects: ENIG, solder mask, nickel-free finishes, thermal management, high-speed design, etc.) **Date:** [Insert Date] **Prepared by:** [Prime Contractor Name / Project Team]

1. Project Overview

1.1 Introduction: Provide a concise description of the overall project, its strategic importance for EEE sovereignty, and the role of PCB technology improvements. Emphasize the need for robust HDI capabilities along with other advanced PCB features.

1.2 Drivers & Needs:

- **Industry Consultation:** Summarize key findings from industry consultations that have driven the need for this initiative.
- **Market Needs:** Outline OEM and end-customer requirements.
- **Strategic Motivation:** Explain why investing in HDI and complementary PCB technologies (e.g., innovative surface finishes and thermal management) is critical.

This section sets the context for the proposal and is linked closely to work package 1 below.

2. Scope of Work

2.1 General Scope: Detail the complete boundaries of the work:

- **Design:** Including schematic creation, layout design, and component integration for both HDI and other advanced PCB features. Include power integrity and signal integrity analysis. Include thermal management analysis. Use model-based design for reliability.
- **Development/industrialisation:** Commissioning of PCB manufacturing processes.
- **Prototyping:** Production of sample boards for accelerated coupon testing (e.g., HATS2, D-coupon, IST) to validate manufacturing and operational performance.
- **Testing & Validation:** Both “quick and dirty” testing on representative samples to derisk early on in the activity, as well as the final qualification tests.

- **Documentation & Reporting:** Generation of detailed reports with controlled document reference numbers and consistent titling.

2.2 Specific Technologies Covered: Mention and explain the relevance of several innovative materials and processes:

- **Materials:** Arlon 86HP, Arlon 85HP/84HP, Hitachi MCL-E-700G, Megtron 7N/8, Tachyon 100G, etc. Copper styles/roughness/thickness, (spread) glass weave, possible 1 ply dielectrics, low CTE inserts, thermal drains (coin or heat sink layer).
- **Surface finish:** ENIG/ENEPIG/ENIPIG, solder mask (inkjet or screen print), potential nickel-free finishing
- **PCB routing features:** microvia configurations, back-drilling, non-functional pad removal, fine pitch track/gap, possible use of mSAP, possible use of copper-filled buried vias.

The scope should be flexibly framed to address the evolving technology line activities defined in the annex of the EEE sovereignty compendium.

3. Work Package (WP) Structure

Each Work Package (WP) in the proposal should include the following fields with clear titles and descriptions:

WP Template

- **WP Title:** A precise title indicating the focus (e.g., "WP1 – Review of Drivers and Industry Needs").
- **Responsible Party:** Name and contact details for the team/individual in charge.
- **Input Documents:** Prerequisites to begin the WP. These might be outputs from previous work packages or external requirements. Each document must have a consistent reference number and title.
- **Task Descriptions:** A bullet list or numbered list detailing each specific activity within the WP. For example:
    - Conduct initial industry consultations.
    - Compile market requirements and technical drivers.

    - Document existing capabilities and challenges in HDI and associated PCB technologies.
- **Deliverables/Outputs:** Clearly defined documents, data, hardware samples, prototypes, or test reports. Each deliverable should include:
    - A reference number.
    - A title.
    - A format (document, data, hardware sample, etc.)
- **Review Meeting:** Schedule a review meeting at the end of the WP. This meeting involves designated external stakeholders (notably OEM customers from the PCB/SMT working group) who will review deliverables such as:
    - Analysis of needs, capabilities and challenges
    - Test plan
    - Test vehicle design
    - Test results

The Prime Contractor must distribute the deliverables, arrange the external review, and integrate their comments.

Repeat this WP structure for each core component of the project as described in Section 5 below.

4. Prime Contractor Requirements

4.1 Technical Experience: The prime contractor or consortium should demonstrate:

- Extensive experience in advanced PCB technology, particularly with HDI development, innovative surface finishes, thermal management solutions, and high-speed signal integrity, etc.
- Experience with complementary technologies such as thermomechanical modelling for electronics.
- Knowledge and application of accelerated coupon test methods (e.g., HATS2, D-coupon, IST) to ensure high reliability. This should include statistical analysis and acceleration modelling.

4.2 Project Management Expertise:

- Demonstrated ability to manage complex, cross-functional projects.
- Proven history of coordinating with external stakeholders (e.g., OEM customers in PCB/SMT WG).
- Effective distribution, tracking, and integration of deliverable reviews.

5. Detailed Work Plan

Structure your proposal into the following logical sections, each representing a self-standing work package or a sequence of interlinked WPs:

5.1 Review of Drivers and Needs (WP1)

- **Objective:** Gather and synthesize industry insights to define technical drivers.
- **Tasks:**
  - Hold strategic consultations with industry experts through web meetings and questionnaires.
  - Develop a comprehensive requirements document.
  - Verify prerequisites for subsequent work packages.
- **Deliverables:**
  - Documented stakeholder requirements (Doc Ref #001)
  - Summary report of consultations.
- **Review:** Formal review with external stakeholders from the PCB/SMT WG.

5.2 Model-Based Design for Reliability (WP2)

- **Objective:** Develop a predictive design model to ensure long-term reliability and assess design variations.
- **Tasks:**
  - Build model-based design frameworks.
  - Simulate PCB behaviour under expected operational stresses.
- **Deliverables:**
  - Simulation output reports (Doc Ref #002)
  - Updated design guidelines.
- **Review:** Include external feedback session with OEM input.

5.3 Test Plan and Test Sample Description (WP3)

- **Objective:** Define a robust test plan and provide detailed descriptions of test vehicles.
- **Tasks:**
  - Draft test plans covering, e.g. the accelerated coupon tests (HATS2, D-coupon, IST), and ECM testing (electrochemical migration, i.e. CAF and THB), etc.
  - Define test sample specifications.
- **Deliverables:**
  - Formal test plans (Doc Ref #003)
  - Technical description of test samples.
- **Review:** Present to the PCB/SMT WG for comment and approval.

5.4 Sample Manufacture & Release Test/Inspection (WP4)

- **Objective:** Fabricate samples and perform initial release tests.
- **Tasks:**
  - Oversee prototype production using selected innovative materials.
  - Conduct “quick and dirty” early testing on representative samples to check feasibility, and derisk the subsequent qualification test program. This should be done as early as possible, perhaps in parallel to WP1.
- **Deliverables:**
  - Sample boards with corresponding manufacturing records (Hardware Ref #HW01)
  - Preliminary test reports (Doc Ref #004)
- **Review:** Organize a review meeting with external stakeholders to discuss early findings.

5.5 Evaluation/Qualification Test Including Reporting (WP5)

- **Objective:** Perform qualification tests to validate final designs.
- **Tasks:**
  - Execute comprehensive testing procedures.
  - Analyse test data against reliability and performance requirements.
- **Deliverables:**
  - Final qualification test report (Doc Ref #005)
  - Data analysis summaries.

- **Review:** Conduct a final review session with the PCB/SMT WG to validate outcome.

5.6 Conclusions and Next Steps (WP6)

- **Objective:** Summarize project outcomes and recommend future activities.
- **Tasks:**
  - Integrate the results from prior WPs.
  - Prepare conclusions and recommendations.
- **Deliverables:**
  - Project conclusion document (Doc Ref #006)
  - Recommendations for scale-up or further development.
- **Review:** Final presentation and review with all key stakeholders.

6. Risk Assessment and Mitigation

6.1 Manufacturing Risks:

- **Risk Evaluation:** Conduct an upfront analysis of potential manufacturing challenges including material compatibility, process variability, and reliability risks.
- **Mitigations:**
  - Example: Perform early “quick and dirty” testing on a representative sample to build confidence for final qualification.
  - Develop contingency plans for delays in prototyping or unforeseen design issues.
  - Regular risk review meetings to update stakeholders on mitigation progress.

6.2 Integration & External Reviews:

- Ensure that each work package includes predefined checkpoints and review meetings.
- Document feedback from external stakeholders and update the risk management plan accordingly.

7. Deliverable Management and Document Control

7.1 Documenting Deliverables:

- Each deliverable should carry a consistent reference number and title.

- Format types include documents (reports, test plans), software, and hardware samples.
- Maintain a version-controlled repository accessible to all project stakeholders.

7.2 Distribution and External Feedback:

- The prime contractor must manage the distribution of deliverables.
- Schedule and document external stakeholder (OEMs, PCB/SMT WG) review meetings for each WP.
- Include a feedback loop to integrate external comments into the subsequent project work.

8. Project Schedule and Milestones

Provide a timeline or Gantt chart illustrating start and end dates for each work package, including review meetings and decision points. Highlight critical milestones such as:

- Completion of industry consultation review.
- Prototype manufacture and preliminary testing.
- Full-scale qualification testing results.
- Final review and project summary approval.

9. Conclusions

Emphasize that the integration of thorough work packages, risk mitigation strategies, and external stakeholder participation ensures a robust and credible advancement in PCB technology tailored toward EEE sovereignty.

Annex 1

The following table provides a schematic overview of roadmap implementation, focussing on HDI technology, and some aspects of high speed, embedding and flexible technologies. This working file has been reviewed with stakeholders of the PCB/SMT WG of the Components Technology Board CTB. The column RM reference refers to roadmap activities as listed in the Printed Circuit Boards and Electronic Assembly Technologies harmonisation dossier 2022: https://technology.esa.int/page/harmonisation/4#topics-list

This overview is not complete for all countries, nor for all technology subjects, and may be modified to suit the needs of the bidding consortium.

				RM ref	title	description and comments	Belgium	France	Italy	UK	Germany	Austria
HDI				A01+02	HDI basic qual + HDI complex (6 Gbps) evaluation		completed basic qual granted; complex (M6) failed but superseded by M7	completed but basic qual failed; complex qual (M6) failed but not of interest to be repeated	Budget confirmed Cistelaier (derisk; GSTP-E1) P1	Budget confirmed Invotec P1	HDI polyimide to be done with ILFA if interested P1 HDI with polyimide or M6 not a priority for TESAT	
				A08	HDI complex (6 Gbps) qual			Delta qual for basic HDI polyimide with Systro and Elvia				
				B02	Fine pitch surface finish	ENIG, also Pb-free	to be done P1	to be done P2	to be done	to be done with A02	TESAT self-funded qualification of ENEPIG	
				A13	HDI with stable material	Stable material allows more complex design	to be done P2 The impact on SMT and equipment qualification need to be better understood and possibly covered within the budget.				to be done TESAT (replacing metal core) P3	
	high speed			A05	HDI high speed (28 Gbps)	This includes partnering with raw laminate supplier, which is of strategic importance for EU independence. Panasonic Meg7 (Austria) and Isola Tachyon100G (Germany) are candidates.	ongoing Meg7 and T100G	to be done with Systro, Elvia P3	to be done with Somacis P2 Generic qual w Somacis to be clarified	to be done, probably with Tachyon 100G P3	TESAT self-funded the qual of Meg7 HDI Delta qual for complex microvia configuration P2	
				A12	back drilling for high speed		done with A01 and A05	to be done with A05	to be done with A05	to be done with A05	to be done with A05	
				H03	high speed surface finish	Ni-free						
		embedding		A09	embedding film resistors	Ohmega-ply, Ticer			to be done with A05	to be done with A05		
				A10	embedding passive parts	resistors, capacitors, inductors						completed in TDE 2015
				A11	embedding active parts	embedded chip accesses with uvias, incl thermal management			Somacis is capable			AT&S is capable
				A14	(Ultra)HDI for chip-on-board	additive manufacturing for ultra fine pitch routing to chip					TESAT wire bonding of chip in cavity/pockets of HSHDI module P1	AT&S is capable
				A15	anylayer (ultra)HDI	all layers uvias						
			FLEX	M01, M03	long rigid-flex, full flex and sculptured flex			Sculptured flex qualified with Elvia Chateaubourg, exploring with Flexconnect		Flex PCB harness with Merlin Flex (1.2m and sculptured) and Trackwise (no length limit).		
			background		generic ESA qualification for standard techno		ACB qualified, incl HDI	Systro qualified; Elvia Chateaubourg ongoing for standard techno	Cistelaier qualified. Exploring Somacis as next candidate.	Invotec qualified.	TESAT qualified. Exploring ILFA as next candidate.	Exploring AT&S
				A07	EU IPC UVIA WG		ACB involved and driving. IMEC leading.	Systro, Elvia involved	Cistelaier, Somacis involved	Invotec, Graphic and Labtech involved	TESAT, ILFA involved	AT&S involved for high speed, not for polyimide

green font indicates current status with running or completed activities
red font indicates unsuccesful outcome, to be re-initiated
blue font indicates work plan with near future activities
blank cells indicate longer term proposals and neutral text