

Final Report

APPROACH DEVELOPMENT FEASIBILITY STUDY

Charles M. Schulz - Sonoma County Airport (KSTS)

Prepared by Cignus Consulting LLC

Rev 1.1

May 2025

Table of Contents

1. Introduction 4
2. Project Background 4
3. Project Approach 4
3.1. Review of Existing Procedures 5
3.2. Manage Obstruction Data 8
3.3. Develop New Vertically Guided Approaches 9
3.4. Develop Departure Procedures 12
3.5. Assess Runway 32 ILS Capabilities 13
3.6. Support Stakeholder & Community Outreach Program 16
4. Consolidated Community Feedback 18
5. Conclusions and Recommendations 20

Glossary of Acronyms

Acronym	Definition
AC	Advisory Circular
AICs	Aeronautical Information Circulars
ALS	Approach Lighting System
ALSF	High Intensity Approach Lighting System with Sequenced Flashing Lights
AMSL	Above Mean Sea Level
ARTCC	Air Route Traffic Control Center
A-SMGCS	Advanced Surface Movement Guidance & Control System
ASOS	Automated Service Observing System
ATC	Air Traffic Control
CASP	California Aviation System Plan
CAT I	Category I Precision Approach
CAT II/III	Category II and III Precision Approach
DA	Decision Altitude
DA/H	Decision Altitude Height
DER	Departure end of runway (DER)
DH	Decision Height
DME	Distance Measuring Equipment
DP	Departure Procedure
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FAS	Final approach segment
FPC	Facility Performance Category
GPS	Global Positioning System
HIRL	High Intensity Runway Lights
IAF	Initial Approach Fix
IF	Intermediate Fix
IF/IAF	Intermediate/Initial Approach Fix
IFP	Instrument Flight Procedures
IFR	Instrument Flight Rules
LOC	Localizer
LP-LNAV	Localizer performance (LP) - Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
LVO	Low Visibility Operations
LVOP	Low Visibility Operations Plan
MALSR	Medium Intensity Approach Lighting System with Sequenced Flashing Lights
MEA	Minimum Enroute Altitude
MOCA	Minimum Obstacle Clearance Altitude
MVA	Minimum Vector Altitude
NCT	Northern California Terminal
NM	Nautical Mile
NoPT	No Procedure Turn
NRA	Non-Rulemaking
OAPM	Optimization of Airspace and Procedures in the Metroplex
ODP	Obstacle Departure Procedure
PAPI	Precision Approach Path Indicators
Rev	Revision
RNAV	Area Navigation
RNP	Required Navigation Performance
ROI	Return on Investment
RVR	Runway Visual Range
RWY	Runway
SA	Special Authorization
SARP	Standards & Recommended Practices
SIGMETs	Significant Changes in Weather and Relevant Significant Weather Reports
SM	Statute Mile
SMGCS	Surface Movement Guidance

ILS	Instrument Landing System	SUPU	& Control System Static Uninterruptible Power Unit
IPU	Interruptible Power Unit	TARGETS	Terminal Area Route Generation Evaluation and Traffic Simulation System
KOAK	Metropolitan Oakland International Airport	TDZ	US Standard Touchdown Zone
KSFO	San Francisco International Airport	TERPS	US Terminal Instrument Procedures
KSJC	Norman Mineta – San Jose International Airport	TODA	Takeoff Distance Available
KSMF	Sacramento International Airport	TRACON	Terminal Radar Approach Control
KSTS	Charles M Schulz – Sonoma County Airport	T-ROUTES	Low altitude RNAV routes
LLC	Limited Liability Company	VFR	Visual Flight Rules
LNAV	Lateral Navigation	VGLS	Visual Guidance Lighting System
LNAV/VNAV	Lateral navigation/vertical navigation (LNAV/VNAV)	VOR	VHF Omnidirectional Radio Range
		ZOA	Oakland Air Route Traffic Control Center

1. Introduction

The Approach Development Feasibility Study for Charles M. Schulz - Sonoma County Airport (KSTS) was initiated to address growing concerns about aircraft noise impacts on surrounding communities. This study has been a collaborative effort involving Cignus Consulting LLC., airport management, and community stakeholders with some initial engagement with the Federal Aviation Administration (FAA).

With forecasted increase in commercial service at KSTS and evolving airspace management techniques, this study provides a unique opportunity to leverage modern Performance-Based Navigation (PBN) technologies to develop optimized approaches and departures that can minimize environmental impacts while enhancing operational efficiency.

This final report documents the comprehensive study process, findings, and recommendations that have resulted from the extensive technical analysis and community engagement conducted throughout the project.

2. Project Background

KSTS serves as a vital transportation link for Sonoma County, providing scheduled commercial service and general aviation access. Recently, the FAA implemented both a revised departure procedure as well as a handful of arrival procedures, that have increased community concerns about noise, particularly in areas of Windsor, Santa Rosa, Sebastopol, and other surrounding communities.

The airport is equipped with two runways: the primary Runway 14/32 (approximately 6,000 feet in length) and the secondary Runway 02/20 (approximately 5,300 feet). Runway 14/32 is served by several instrument approach procedures including an ILS approach to Runway 32 and RNAV (GPS) approaches to both runway ends. Runway 02 is served by an RNAV (GPS) approach, while Runway 20 currently has no published instrument approach procedure.

Although the recent implementation of Standard Terminal Arrival (STAR) procedures (REBAS and VNYRD) as well as Departure Procedure (DP) RREHD have improved connectivity with the broader air traffic network, opportunities remain to further optimize the approach and departure procedures to reduce community impacts while maintaining operational efficiency.

This final report documents the comprehensive study process, findings, and recommendations that have resulted from the extensive technical analysis and community engagement conducted throughout the project.

3. Project Approach

The Approach Development Feasibility Study followed a structured methodology aligned with industry standards for airspace and procedure concept development. The process was guided by principles from the International Civil Aviation Organization (ICAO) Document 9992, *Manual on*

the Use of Performance-based Navigation (PBN) in Airspace Design, and FAA Order 8260 adapted to incorporate FAA procedure development requirements.

The overarching principles guiding this study and any new designs were:

- Operational safety
- Designs that aimed to not increase complexity for air traffic management or air crew
- Community/Stakeholder inputs evaluated without prejudice
- Capacity of the airport or the airspace to be unaffected
- Flight paths designed to follow procedural separation in affect
- Designs, to the extent possible, aimed to maximize greenhouse gas reductions and reduce noise with a goal to not move noise from one community to another

Throughout the project, Cignus employed a collaborative approach, engaging with airport staff, FAA representatives, and community stakeholders. Communication tools included regular project updates, stakeholder meetings, and public outreach events to ensure transparent sharing of information and collection of community feedback.

The technical analysis utilized specialized aviation software including Terminal Area Route Generation Evaluation and Traffic Simulation (TARGETS) for procedure design and evaluation. Additionally, Cignus analyzed radar track data to understand current traffic patterns and identify opportunities for optimization.

3.1. Review of Existing Procedures

The initial task involved a comprehensive review of all existing instrument approach and departure procedures at KSTS. This analysis was conducted to establish a baseline understanding of current operations and identify opportunities for improvement. The review encompassed:

- Detailed examination of published instrument approach procedures, including the ILS OR LOC RWY 32, RNAV (GPS) RWY 32, RNAV (GPS) RWY 14, and RNAV (GPS) RWY 02
- Analysis of the published CHARLIE EIGHT DEPARTURE
    - RREHD was not implemented during the execution of Task 1
- Evaluation of Standard Terminal Arrival (STAR) procedures recently implemented (REBAS and VNYRD)
- Assessment of climb and descent gradients, existing obstruction issues, and safety considerations
- Segment-by-segment analysis of individual approach and departure legs

- Analysis of radar track data to understand actual flight paths versus published procedures
- Identification of noise-sensitive areas and population centers

During task 1 KSTS' operational context within the Northern California airspace structure was also reviewed to understand the broader operational environment.

The review revealed several key findings that informed subsequent tasks:

Runway 14 Approach Analysis:

- The existing RNAV (GPS) RWY 14 approach features a final approach course offset 15° from the runway centerline, requiring pilots to make a visual transition to align with the runway
- The approach path was designed to avoid direct overflight of the City of Healdsburg and Windsor as much as possible but points aircraft toward rising terrain in the intermediate segment
- The approach lacks vertical guidance (Limited to LNAV minimums) that increases aircraft power changes and noise generation
- The approach has a lengthy final approach segment (9.9 NM) that increases exposure to aircraft noise for communities under the approach path

Runway 32 Approach Analysis:

- Both the ILS and RNAV approaches to Runway 32 have similar ground tracks
- The ILS approach provides Category I capability with a decision altitude of 377 feet AMSL
- The RNAV (GPS) approach provides LPV capability with a decision altitude of 377 feet AMSL, and LNAV/VNAV capability with minimums higher than optimum due to obstacles
- There are opportunities to improve LNAV/VNAV minimums and add connectivity to enroute waypoints

Runway 02 Approach Analysis:

- The RNAV (GPS) RWY 02 approach provides only non-precision (LP and LNAV) capabilities
- The approach is not aligned with the Precision Approach Path Indicators (PAPI)
- There are opportunities to add vertical guidance and improve connectivity with the enroute structure

Runway 20 Analysis:

- Runway 20 currently has no established instrument approach procedure
- Analysis indicates potential for development of an RNAV approach with RNP capability

Departure Procedure Analysis:

- The CHARLIE EIGHT DEPARTURE provides obstacle clearance with specified minimum climb gradients for each runway
- Climb gradients range from 265' to 375' per NM, that should not limit most aircraft departing KSTS
- The procedure relies on radar vectors within specified heading ranges depending on the departure runway
- Analysis of radar tracks showed that a significant percentage of departures did not follow optimal noise abatement tracks

Radar Track Analysis:

- Analysis of actual flight tracks revealed significant dispersion, particularly for visual approaches
- For Runway 14, approximately 16% of arrivals followed the published RNAV procedure, while about 20% used straight-in visual approaches over Healdsburg and Windsor
- For Runway 32, a higher percentage (89-94%) of arrivals used the established approach procedures
- VFR traffic patterns were observed overpopulated areas, including Windsor, East Windsor, and Shiloh

The comprehensive review identified several opportunities for improvement that were further explored in subsequent tasks:

- Development of vertically guided approaches for all runways using modern PBN capabilities
- Optimization of approach paths to reduce noise impacts on populated areas
- Enhanced connectivity with the enroute structure
- Development of more precise departure procedures to reduce track dispersion
- Exploration of offset approach paths where appropriate to avoid direct overflight of populated areas

3.2. Manage Obstruction Data

Management of obstruction data was a critical component of the study, as obstacles (both natural and man-made) significantly influence the design of instrument procedures and impact operational minimums. The task involved:

- Identification and verification of controlling obstacles for each runway environment
- Comprehensive search of available obstruction databases, including the Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) database, Digital Obstacle File (DOF), and Non-Rulemaking Airport (NRA) obstruction data
- Evaluation of obstacles in relation to required instrument approach and departure surfaces
- Development of mitigation strategies for identified obstacles that might affect proposed procedure designs

The technical approach utilized TARGETS software to incorporate current obstacle survey data, performing a detailed evaluation of obstacles and terrain for the establishment of approach altitudes and minimums. The assessment included a review of 2015-2022 OE/AAA data to ensure that all known obstacles were accounted for in the procedure design process.

For each existing and proposed procedure, obstacle clearance surfaces were analyzed to identify controlling obstacles – those that would potentially limit the operational minimums or require higher climb gradients on departure.

Results

The obstruction analysis identified several significant obstacles that influenced existing procedures and would need to be considered in developing new procedure concepts:

- For Runway 14, controlling obstacles included terrain at 1,479 feet AMSL with a 200-foot buffer in the segment between EHETY and UCEVE, and a tree height at 348 feet AMSL in the segment between UCEVE and ACUTI
- For Runway 32, controlling obstacles included a tree at 282 feet AMSL affecting LNAV/VNAV minimums and a 301-foot AMSL tree height affecting both LPV and LNAV minimums
- For Runway 02, a 274-foot AMSL tree height was identified as the controlling obstacle for LP minimums, while a 364-foot AMSL tree height controlled LNAV minimums
- For a potential Runway 20 approach, a 169-foot AMSL transmission line and a 196-foot AMSL tree height were identified as potential controlling obstacles

The analysis also produced a catalog of 347 obstacles in the vicinity of KSTS, including those on and off airport property, that provides a valuable reference for future procedure development and obstacle management.

Several key findings emerged from the obstruction analysis:

- Most controlling obstacles were trees, suggesting potential for obstacle mitigation through selective tree removal or trimming
- Some obstacles were man-made structures such as transmission lines, that would need to be accounted for in procedure design
- The presence of rising terrain, particularly north and west of the airport, significantly influences approach and departure path options

Based on the obstruction analysis, the following recommendations were developed:

- Consider selective obstacle removal where feasible to improve approach minimums, particularly for approaches to Runways 02 and 32
- For approaches where obstacle removal is not practical, design approach paths to ensure adequate clearance while minimizing impacts on populated areas
- Incorporate obstacle information into the public outreach process to help explain some of the constraints on procedure design

This comprehensive obstruction analysis directly informed the development of new vertically guided approaches discussed in the next section. By identifying controlling obstacles for each runway environment and understanding their impact on approach minimums, procedure design specialists were able to design approach paths that maintain required obstacle clearance while optimizing flight paths to reduce community noise impacts. The obstacle data was particularly crucial for determining the feasibility of adding vertical guidance capabilities to existing approaches and for designing offset approach paths that avoid both obstacles and to the extent feasible, noise-sensitive areas.

3.3. Develop New Vertically Guided Approaches

This task focused on developing new vertically guided instrument approach conceptual designs for Runways 14/32 and 02/20, building directly on the obstruction analysis completed in Task 2. With a detailed understanding of the controlling obstacles and their impacts on approach minimums, optimized approach paths were developed that maintain required obstacle clearance while addressing community noise concerns. The primary objectives were to:

- Create approaches supporting constant-descent profiles
- Minimize noise impacts and emissions during arrivals
- Identify critical obstacles and document their impact on approach minimums

- Improve connectivity with recently established Standard Terminal Arrival (STAR) procedures

The approach development process incorporated multiple factors:

- Terrain and obstacle data from Task 2
- FAA Terminal Instrument Procedures (TERPS) criteria
- Required Navigation Performance (RNP) levels and Navigation Specifications
- Critical design aircraft performance capabilities
- Noise impacts on surrounding communities
- Input from stakeholders and community outreach

Special emphasis was placed on maximizing the use of Continuous Descent Approach (CDAs) i.e. optimum profile descents to reduce noise and emission levels and provide fuel savings for operators. The designs aimed to follow existing radar ground tracks where possible to minimize changes to noise exposure patterns.

For each runway, various approach concepts were evaluated based on different navigation specifications (RNAV 1, RNP 1, RNP 0.3 or less) and approach types (LPV, LNAV/VNAV, RNP AR).

The team used TARGETS software as the core tool for procedure development, with additional tools such as Google Earth for visualization with next steps aimed at including high level noise assessment tools.

Results

The development process resulted in several conceptual approach designs for each runway, with the following key features and benefits:

Runway 14 Approach Concepts:

The team developed a revised RNAV (GPS) approach with the following characteristics:

- Offset final approach segment (3° from runway centerline) to avoid direct overflight of Healdsburg and Windsor as much as possible
- Reduced final approach segment length from 9.9 NM to 5.8 NM
- Addition of vertical guidance capabilities (LPV, LNAV/VNAV)
- RNP capabilities (0.30 and 0.15) to allow for more precise navigation
- Optimization of the intermediate segment to avoid populated areas
- Enhanced connectivity with the REBAS and VNYRD STARs

The proposed approach would enable arriving aircraft to be in a continuous state of descent with low or idle power settings, with a slightly steeper descent angle to mitigate overflight of residential communities.

Runway 32 Approach Concepts:

For Runway 32, the team developed enhanced approach concepts including:

- RNP approach capabilities (0.30, 0.15, and 0.10) to allow for more precise navigation
- Improved LNAV/VNAV visibility minimums
- Addition of a 600 ft AMSL stepdown waypoint to mitigate a 200' adverse assumption obstacle
- Modified feeder transitions to improve connectivity with enroute structure that enable CDA flight paths for reduced noise and emissions
- More consistent flight paths to better manage noise levels

These enhancements would reduce unnecessary flights over residential areas, create more consistent flight paths to better manage noise levels, and potentially reduce the noise footprint and greenhouse gas emissions.

Runway 02 Approach Concepts:

The concept for Runway 02 included:

- Addition of LPV, LNAV/VNAV capabilities for vertical guidance
- RNP capabilities (0.30, 0.15, and 0.10)
- Alignment with the existing PAPI
- Additional feeder transitions from established airways
- Optimization to reduce overflight of Sebastopol

Runway 20 Approach Concepts:

A new RNAV (RNP) approach for Runway 20 was developed with:

- RNP 0.30 and 0.15 capabilities
- Use of Radius-to-Fix (RF) legs to avoid populated areas and minimize flight path lengths
- Optimization to reduce noise footprint over residential areas
- Connectivity with the enroute structure

All approach concepts were designed to incorporate modern PBN capabilities, allowing for more precise navigation and tailored flight paths that can better avoid noise-sensitive areas. The continuous descent profiles integrated into each approach concept improve the opportunity to reduce noise and emissions compared to the existing procedures. The approach concepts were developed in consultation with the FAA.

The proposed approach concepts were presented to stakeholders and community representatives during outreach events, with visual depictions illustrating the differences between existing and proposed procedures. Feedback from these presentations was incorporated into the final concepts.

3.4. Develop Departure Procedures

This task focused on developing conceptual departure procedures for all runways at KSTS with the goal of minimizing noise impacts while ensuring obstacle clearance. The approach included:

- Analysis of current departure tracks to understand existing patterns and dispersion
- Identification of noise-sensitive areas to avoid where possible
- Integration of Continuous Climb Operations (CCOs) to reduce noise and fuel consumption
- Evaluation of required climb gradients for obstacle clearance
- Development of more predictable departure paths to manage community expectations

The team utilized TARGETS software to analyze Departure Procedures (DPs) based on navigation specifications and performance criteria described in FAA Advisory Circular 90-100 "U.S. Terminal and En Route Area Navigation (RNAV) Operations." Procedures were analyzed and initial high-level alternatives considered primarily using RNAV 1 and RNP 1 specifications.

Similar to the approach development process, the departure procedure design incorporated obstacle data, terrain considerations, and noise-sensitive areas. Special attention was given to designing procedure(s) that would provide obstacle clearance protection while minimizing changes to existing noise contours.

Results

The analysis of departure operations revealed several opportunities for improvement:

- Radar track analysis showed significant dispersion of departure tracks, particularly for aircraft departing Runway 14, with about 44% using a straight southbound departure while 12% flew over populated areas of Monroe, Santa Rosa, and Roseland
- Departures from Runway 32 generally followed a climbing left turn that avoided overflight of Healdsburg, though approximately 12% did not use the climbing left turn and overflew the city at an average altitude of 1,340 feet above ground level

- Departures from Runways 02 and 20 were predominantly VFR flights in the traffic pattern with minimal impact on populated areas

Based on this analysis, the team reviewed certain conceptual departure procedures to be developed in Phase II for each runway:

RREHD Departure Procedure:

A modified departure procedure (RREHD) will be considered and designed with the following features:

- Establishment of a defined turn point over the ground instead of the current variable turn at 500 feet while climbing
- Definition of a specific path to the turn point
- More predictable noise exposure patterns
- Reduced variation in flight tracks

The proposed RREHD departure would offer several benefits:

- Improved noise management through more consistent flight paths
- Minimal variation in where aircraft turn, creating more predictable noise exposure
- Reduced overflight of residential areas

For Runway 02 departures, concepts included assessment of a right climbing turn to avoid built-up areas of Windsor, although this would need to be balanced against potentially higher climb gradients due to rising terrain to the southeast.

For Runways 14 and 20, the departure concepts maintained the flexibility to climb within a wide heading range while being designed to direct aircraft clear of built-up areas.

For Runway 32, the departure concept focused on optimizing the climbing turn to minimize overflight of populated areas of Windsor.

All departure concepts incorporated Continuous Climb Operations (CCOs) where possible, similar to Continuous Descent Approaches for arrivals. CCOs would allow operators to maintain optimal climb profiles, reducing fuel consumption and lowering the noise footprint through consistent climb power settings.

The feasibility of implementing these concepts would be further evaluated in coordination with FAA and would be part of Phase II implementation if approved.

3.5. Assess Runway 32 ILS Capabilities

This task involved a comprehensive assessment of the existing Runway 32 Category I Instrument Landing System (ILS) capabilities and an evaluation of the potential to upgrade this approach to Category II standards. The assessment covered:

- Analysis of ILS signal quality, continuity, and integrity requirements
- Evaluation of lighting infrastructure needs
- Review of aerodrome design requirements
- Assessment of approach design implications
- Examination of operational requirements for CAT II operations
- Identification of infrastructure improvements needed to support an upgrade

The technical approach included a detailed review of international and national standards for CAT II operations, including ICAO Annexes and Documents, FAA Advisory Circulars, Orders, and other regulatory guidance. The team analyzed the current ILS equipment specifications against the more stringent requirements for CAT II operations.

Results

The assessment identified several key differences between CAT I and CAT II operations that would need to be addressed for an upgrade:

ILS Signal Quality and Classification:

- CAT II operations require a Facility Performance Category (FPC) II ILS with Level 3 integrity and continuity of service
- Higher field strength requirements on the ILS glide path (minimum 100 microvolts per meter at 10 NM, increasing to 200 microvolts per meter at 50 feet above threshold)
- More stringent course structure requirements and modulation tolerance
- Enhanced monitoring actions and more stringent signal removal times for out-of-tolerance detection

Lighting Infrastructure:

- Current MALSR approach lighting would need to be upgraded to High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2)
- Installation of Runway Centerline Lights would be required (currently not installed)
- Installation of Touchdown Zone Lighting would be required (currently not installed)
- Enhanced taxiway lighting, runway guard lights, stop bars, and clearance bars would be needed for operations below 1,200 ft RVR
- Power supply systems would need upgrades to meet the 1-second switchover time for critical lighting components

Aerodrome Design:

- More stringent requirements for ILS critical and sensitive areas, requiring larger protected zones
- Runway and taxiway separation requirements more demanding for CAT II operations
- Obstacle limitation surfaces must be established for CAT II operations, including conical surface, inner horizontal surface, approach surface, inner approach surface, transitional surfaces, inner transitional surfaces, and balked landing surface
- A precision approach terrain chart would need to be published for CAT II operations

Operational Requirements:

- Development and implementation of a Low Visibility Operations Plan (LVOP)
- Enhanced surface movement guidance and control procedures
- Additional RVR assessment and reporting capabilities
- Specific ATC procedures for low visibility operations
- Training requirements for ATC, flight crews, and ground personnel

The assessment concluded with a comprehensive list of recommended actions that would be required to upgrade to CAT II operations:

1. Completion of an aerodrome safety assessment focused on Low Visibility Operations
2. Comparison of forecast aircraft and ground vehicle characteristics against maneuvering areas
3. Examination of aircraft fleet certified approach and departure capabilities
4. Review of obstacle surfaces for potential CAT II operations penetrations
5. Redesign of the Runway 32 ILS approach to CAT II standards
6. Review of facility engineering design specifications for compliance with CAT II operations
7. Detailed examination of ILS Flight Inspection reports
8. Creation of a Low Visibility Operations Plan and Surface Movement Guidance and Control System Plan
9. Identification of non-compliant physical attributes of runway, taxiway, apron, and holding bays

10. Development of a CAT II implementation plan including timeline for runway closure to install required lighting and markings
11. Completion of a benefit/cost analysis for the upgrade

While the assessment identified all the necessary steps for a CAT II upgrade, it also recognized that a detailed business case analysis would be required to determine the return on investment. This would involve analyzing historical weather observations, projected increased airport accessibility, operational benefits, and certified aircraft and aircrew capabilities in the current fleet mix.

The findings suggest that while technically feasible, upgrading to CAT II operations would involve significant infrastructure investments and operational changes that would need to be carefully evaluated against the potential benefits.

3.6. Support Stakeholder & Community Outreach Program

A critical component of the Approach Development Feasibility Study was engaging with stakeholders and communities to identify concerns and share details on the process of the on-going study. The outreach process involved developing and implementing a comprehensive program to facilitate transparent communication and gathering feedback on proposed concepts. This approach included:

- Development of a multi-phased process for collaborative engagement with stakeholders and communities
- Creation of presentation materials to explain technical concepts in accessible terms
- Organization and participation in both stakeholder and neighborhood meetings
- Collection and documentation of feedback from various groups

The outreach program was designed to achieve several key objectives:

1. Present and create a common understanding of technical and operational plans
2. Build consensus on the requirements for change and implementation (the 'Why')
3. Establish and present needs, objectives, scope, and timelines for designs and implementation (the 'What')
4. Work with stakeholders to identify concerns and discuss potential (If feasible) solutions
5. Develop a common understanding on the concepts and proposed procedures (the 'How')

For neighborhood meetings specifically, the team considered different formats to determine the most effective approach for engagement:

- In-person "Open House" meetings with "Specialist Stations" in larger venues
- Town-hall style meetings with panel presentations and Q&A sessions
- Online formats successfully used by the FAA for similar purposes

The team developed comprehensive presentation materials that included:

- Graphical depictions of existing and proposed procedures
- Explanations of aviation terminology and concepts
- Visualization of radar tracks
- Illustrations of potential noise impacts
- Videos showing two-dimensional as well as three-dimensional visualizations of flight paths
- Before-and-after comparisons of existing and proposed procedures

Results

The outreach program was successfully implemented through several key activities:

Stakeholder Meetings: Two stakeholder meetings were held on October 3rd, 2024, with representatives from the airlines, local government, and general aviation pilots

Community Outreach Meetings: Two community outreach meetings were conducted on November 1st and 2nd 2023 and two follow-on meetings were held on October 2nd and 3rd 2024.

- As noted above, four neighborhood-specific meetings were conducted in different locations:
    - One meeting in Windsor
    - One meeting in Santa Rosa
    - Two meetings in Sebastopol

All meetings utilized a hybrid format with both in-person and virtual attendance options. A court reporter was present at each meeting to document public comments accurately. A dedicated website (STS Good Neighbor) was utilized to share information and collect comments.

During these events, the team presented:

- Overview of the study objectives and process (Both Meetings)
- Explanation of airspace access rules and flight phases (Both Meetings)

- Analysis of current procedures and operational patterns (2023 Meetings)
- Conceptual designs for new and modified procedures (2024 Meetings)
- Comparison of existing and proposed flight paths (2024 Meetings)
- Benefits of modernized navigation techniques, including Continuous Descent Operations (Both Meetings)
- Distinction between the Approach Feasibility Study and other noise mitigation approaches (Both Meetings)

Community participation across all sessions was substantial, with approximately 150 total attendees at the neighborhood meetings alone. Key themes from the feedback included:

- Concerns about increased flight activity over previously unaffected neighborhoods
- Questions about the implementation timeline for proposed improvements
- Requests for better noise monitoring and updated noise contour maps
- Specific concerns about helicopter training operations in the vicinity of the airport
- Questions about regulatory authority and the airport's ability to control flight paths
- Concerns about night operations and early morning departures

The input received during all outreach activities was documented and considered in the refinement of the revised procedure(s) concepts. The feedback was particularly valuable in understanding which areas were most sensitive to noise impacts and in identifying priorities for procedure optimization. This information directly influenced will further inform any updates to the proposed procedures presented above.

The engagement with both stakeholder groups and neighborhood communities helped build understanding of aviation constraints while allowing community priorities to influence the procedure development process. This two-way communication was essential for developing concepts that could balance operational needs with community concerns.

4. Consolidated Community Feedback

Throughout the study, a significant volume of community feedback was received through various channels, including stakeholder meetings, neighborhood sessions, written submissions, and online comments. This feedback was consolidated and analyzed to identify common themes and concerns.

The primary themes emerging from community feedback include:

Noise Concerns:

- Many residents reported increased aircraft noise, particularly in areas not previously affected
- Specific concerns about early morning, late evening, and night operations
- Helicopter training operations were frequently cited as a significant noise concern due to repetitive flight patterns
- Concerns about the impacts of noise on quality of life, sleep, outdoor activities, and property values

Flight Path Concerns:

- Questions about why flight paths appear to have changed in recent years
- Specific concerns about flights over Sebastopol, Graton, Windsor, and western Santa Rosa
- Requests for flights to follow major transportation corridors (like Highway 101) rather than residential areas
- RREHD Departure flight path concerns

Transparency and Process Concerns:

- Questions about notification methods for community meetings and feedback opportunities
- Requests for more accessible meeting formats and times
- Concerns about the effectiveness of the noise complaint process
- Questions about whether airport expansion decisions were subject to community input
- Requests for updated noise contour maps to reflect current operations

Administrative and Regulatory Questions:

- Confusion about the roles and responsibilities of different entities (FAA, Airport, County)
- Questions about what regulatory authority exists to control flight paths
- Inquiries about the feasibility of time-of-day restrictions for operations
- Questions about why a Part 150 noise study is not being conducted
- Concerns about enforcement of existing noise abatement procedures

The team provided responses to these concerns throughout the study process, explaining technical, operational, and regulatory constraints while also identifying opportunities for improvement. Key points emphasized in responses included:

- While the FAA has ultimate authority over airspace and procedures, the airport can propose optimized procedures for FAA consideration
- Safety remains the paramount consideration in all procedure designs
- Modern navigation technology enables more precise flight paths that can better avoid noise-sensitive areas and/or reduce noise exposure
- Continuous Descent Operations can reduce noise and Green House Gas (GHG) emissions compared to conventional step-down approaches
- Some constraints, such as terrain and obstacle clearance requirements, cannot be modified without compromising safety

The feedback received has been valuable in shaping the procedure concepts and will continue to inform the implementation process in Phase II. The ongoing dialogue with community stakeholders has helped build understanding of aviation constraints while ensuring that community priorities are considered in the procedure development process.

5. Conclusions and Recommendations

Based on the comprehensive analysis conducted throughout this study, Cignus has developed the following conclusions and recommendations:

Key Conclusions

1. **Technical Feasibility:** The development of optimized instrument procedures for KSTS is technically feasible using modern Performance-Based Navigation (PBN) capabilities. The existing obstacle environment and airspace structure can accommodate new procedures that potentially reduce community noise impacts while maintaining or enhancing operational efficiency.
2. **Community Impacts:** Aircraft noise remains a significant concern for communities surrounding KSTS, particularly in Windsor, Sebastopol, and portions of Santa Rosa amongst others. The current procedures, while designed to meet safety requirements, may not optimize noise exposure patterns everywhere given the possible growth in operations and changes in fleet mix.
3. **Operational Opportunities:** Implementation of Continuous Descent Approaches (CDAs) and Continuous Climb Operations (CCOs) could potentially reduce noise and emissions while providing fuel savings for operators. More predictable flight paths could also help manage community expectations regarding noise exposure.

4. **ILS Upgrade Assessment:** While upgrading the Runway 32 ILS to Category II capabilities is technically feasible, it would require significant infrastructure investments and operational changes. A detailed business case analysis would be needed to determine the return on investment for this upgrade.
5. **Community Engagement:** The community outreach process revealed strong interest in airport operations and flight procedures that minimize noise exposure. Continued transparent communication and engagement will be essential for successful implementation of any proposed changes.

Recommendations

1. **Procedure Implementation:** Proceed with Phase II implementation of the proposed instrument procedures, including the new and modified approaches for all four runway ends and the enhanced departure procedure. These procedures should be developed in accordance with FAA design criteria and submitted for FAA review and approval.
2. **Phased Implementation Approach:** Adopt a phased implementation approach, prioritizing procedures with the greatest potential for community noise reduction while maintaining operational efficiency.
3. **Continued Community Engagement:** Maintain transparent communication with and ongoing input from community stakeholders throughout the implementation process. Regular updates on project progress, expected benefits, and implementation timeline should be provided through multiple channels.
4. **Enhanced Noise Monitoring:** Consider implementing a virtual noise monitoring and reporting system to provide more detailed data on noise impacts in various communities. This data could help establish a noise exposure baseline for comparison to evaluate the effectiveness of implemented procedure changes.
5. **Helicopter Operations:** Explore opportunities for more structured helicopter training routes and practice areas that minimize impacts on residential areas. While such guidelines would be voluntary, they could potentially reduce community noise concerns if adopted by operators.
6. **ILS Upgrade Consideration:** Defer the decision on upgrading the Runway 32 ILS to Category II capabilities pending a detailed cost-benefit analysis. Focus initial efforts on the PBN procedure improvements that can be implemented with minimal infrastructure changes.
7. **Fly Quiet Program:** Develop a comprehensive Fly Quiet Program that provides guidelines and incentives for noise-reducing operational techniques. Such a program could include preferred routes, operating procedures, and pilot education materials.

The implementation of these recommendations would represent a significant step toward balancing the operational needs of the airport with the concerns of surrounding communities. While not all noise issues can be completely resolved due to the inherent nature of aircraft operations and safety requirements, the proposed approaches offer meaningful improvements that could enhance the relationship between the airport and its neighbors.