



San Francisco  
International  
Airport

GBAS

# San Francisco International Airport GBAS Overlay and Innovative GLS

SFO Roundtable Technical Working Group

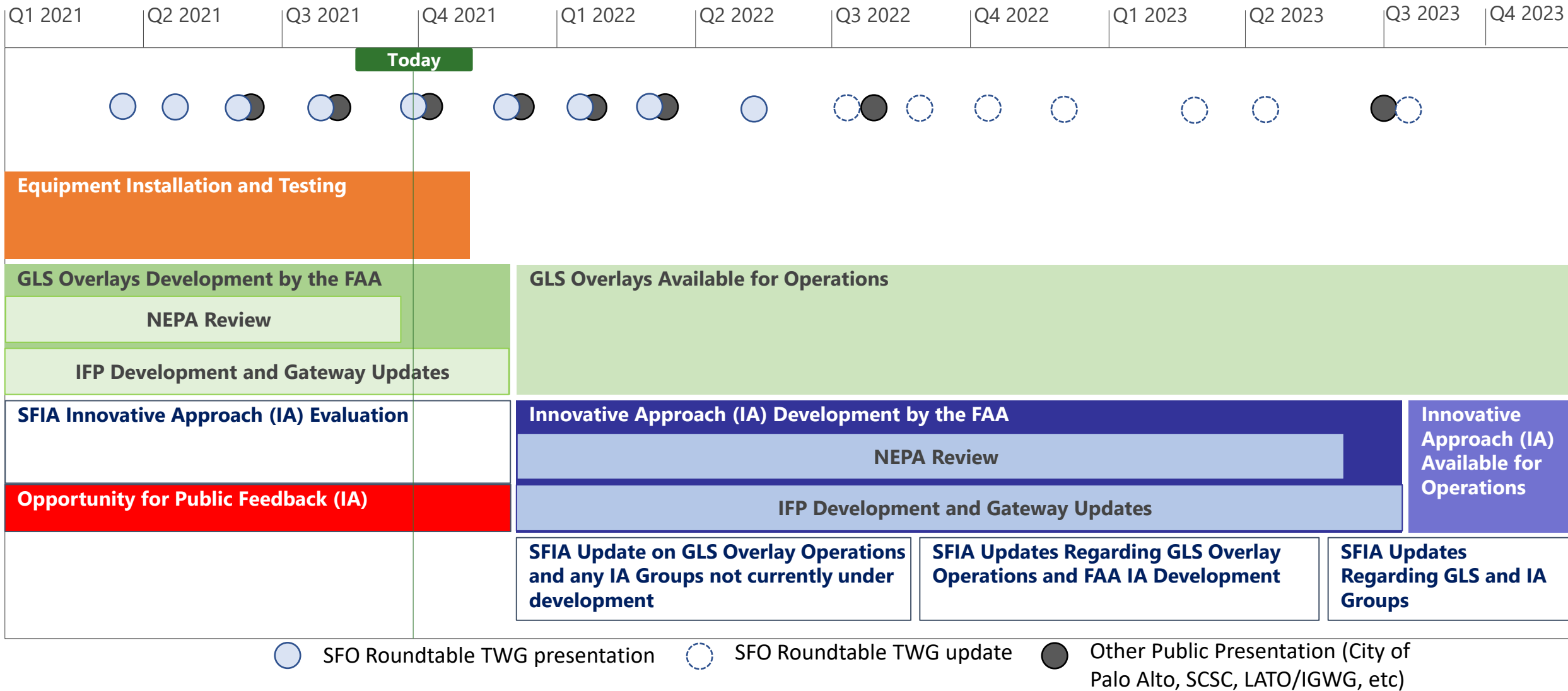
September 22, 2021







# SFO GBAS Estimated Schedule and Planned Outreach



# Important SFO GBAS Milestones (Updated 17SEP21)

**SEP21** – Anticipated date for FAA Instrument Procedure Gateway Update to introduce GLS Overlay Procedures

**OCT21** – Opportunity for UAL Flight Evaluation

**18-21OCT21** – FAA Flight Inspection/Validation of GBAS and Overlay GLS Approaches

**02DEC21** – Earliest start date for GLS Overlay Approach Procedures

**DEC21** – Target date for SFO to request FAA Development of Group 1 Innovative GLS Procedures

## SFO SAN FRANCISCO/SAN FRANCISCO INTL

Notify me of changes to SFO

Charts (58) IFP Production Plan (16) **IFP Coordination (9)** IFP Documents (NDBR) (53)

IFP Production Plan - Current IFPs under Development or Amendments with Tentative Publication Date and Status.

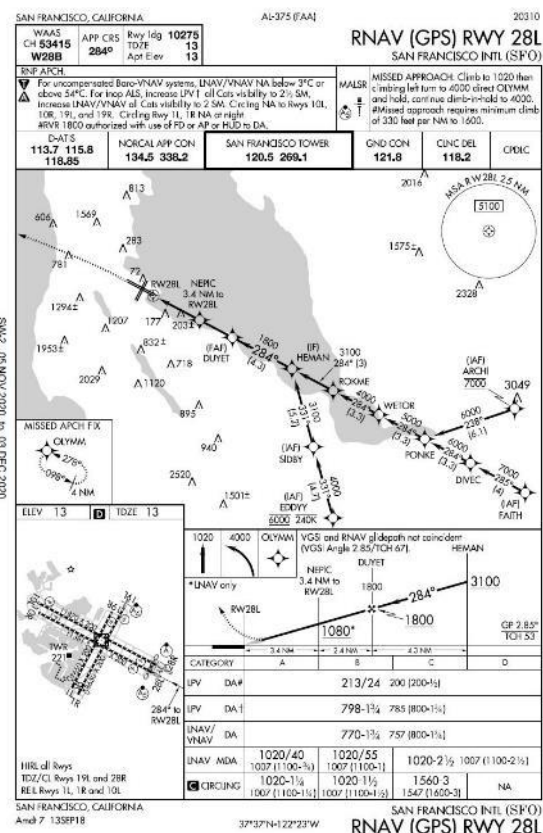
Filter Options

Showing results 1 - 16 of 16

Procedure	Airport Name	Airport ID	City/State	Scheduled Pub Date	Status	Actual Pub Date	
GLS RWY 19R, Orig	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
GLS RWY 28L, Orig	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
GLS RWY 19L, Orig	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
GLS RWY 28R, Orig	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
ILS or LOC RWY 19L, AMDT 23	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
RNAV (GPS) RWY 19L, AMDT 4	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
RNAV (GPS) RWY 19R, AMDT 4	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA

<https://www.faa.gov/air-traffic/flight-info/aeronav/procedures/application/?event=procedure.results&tab=productionPlan&nasrlid=SFO#searchResultsTop>

# SFO GLS Overlay Approach Comparison: 28L/28R



## RNAV (GPS) RWY 28L

- GPA: 2.85°
- FAF: DUYET 1,800ft
- IAF: EDDYY 6,000ft @ 240KIAS

## GLS RWY 28L

- GPA: 2.85°
- FAF: DUYET 1,800ft
- IAF: EDDYY 6,000ft @ 240KIAS

## RNAV (GPS) Z RWY 28R

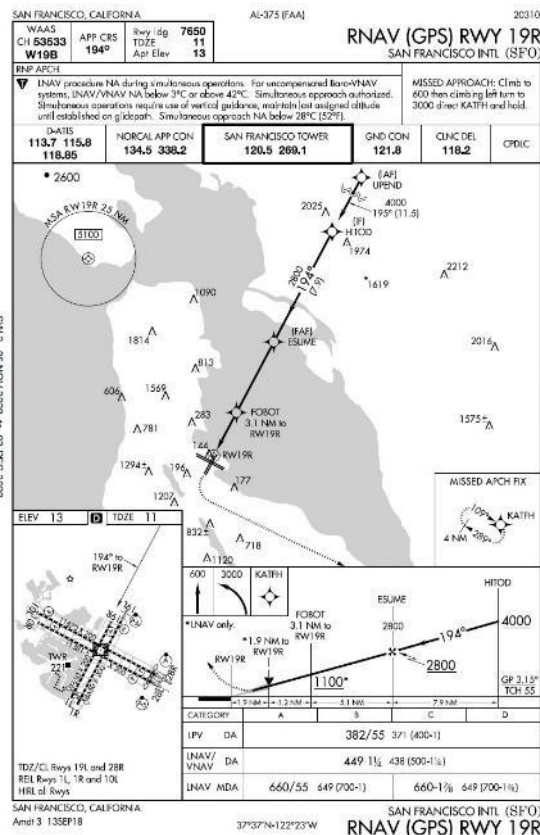
- GPA: 3.00°
- FAF: AXMUL 1,800ft
- IAF: EDDYY 6,000ft @ 240KIAS

## GLS RWY 28R

- GPA: 3.00°
- FAF: AXMUL 1,800ft
- IAF: EDDYY 6,000ft @ 240KIAS

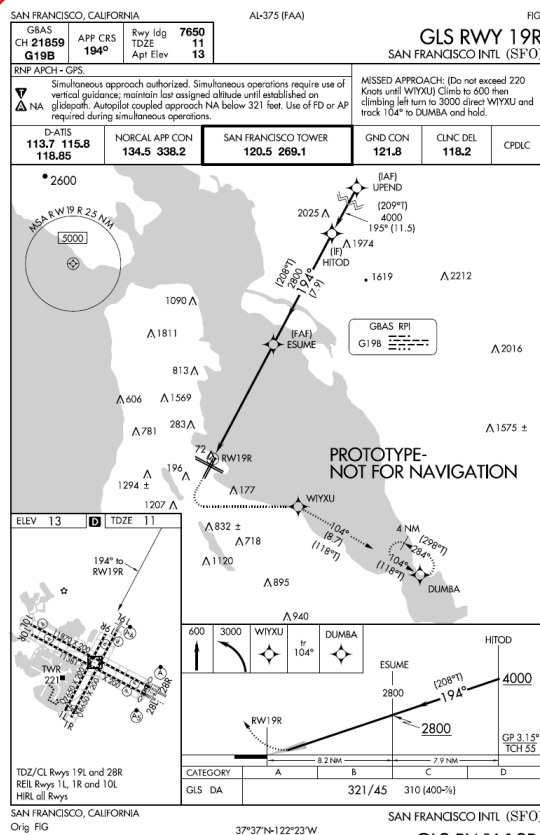


# SFO GLS Overlay Approach Comparison: 19R/19L



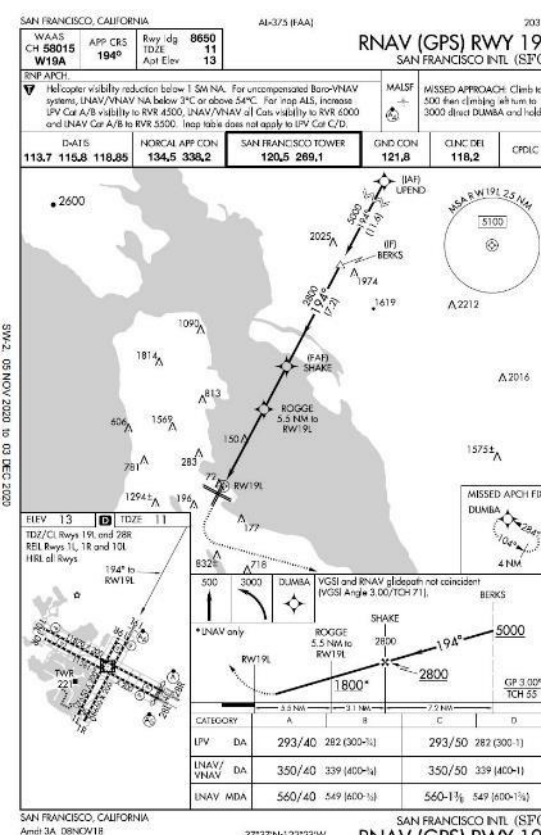
## GLS RWY 19R

- GPA: 3.15°
- FAF: ESUME 2,800ft
- IAF: UPEND 5,000ft



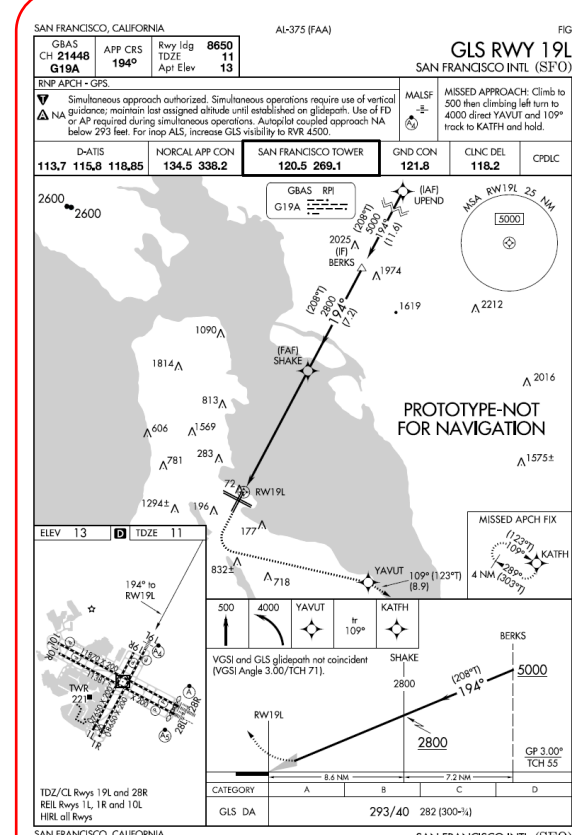
## GLS RWY 19R

- GPA: 3.15°
- FAF: ESUME 2,800ft
- IAF: UPEND 5,000ft



## RNAV (GPS) RWY 19L

- GPA: 3.00°
- FAF: SHAKE 2,800ft
- IAF: UPEND 5,000ft



## GLS RWY 19L

- GPA: 3.00°
- FAF: SHAKE 2,800ft
- IAF: UPEND 5,000ft

## Flight Evaluation of SFO GLS Approaches



**United Airlines has offered to support the community evaluation of both the overlay and innovative GLS approach concepts by performing evaluation flights for the purposes of noise data collection<sup>\*</sup>, <sup>\*\*</sup>**

The flights will occur between September and October of 2021

Summary report of results made available via <https://noise.flysfo.com>

The Flight Procedures Subcommittee, aided by the SFO GBAS Project Team, will use the information from the test flights to

1. Verify that overlay GLS approaches will not introduce “new” noise when compared to current approaches
2. Evaluate initial AEDT v3D / BADA 4 SEL noise predictions (presented in the CFPPs) vs noise monitor results
3. Make adjustments to the AEDT v3D / BADA 4 noise predictions where applicable

*\*UAL flight test information may not precisely reflect the current AEDT/BADA modeling assumptions*

*\*\*SFO GBAS Project team may not be able to modify the BADA 4 models to take advantage of detected noise results due to differences in aircraft weight, pilot technique, ambient conditions and data samples per procedure*

# Planned Noise Monitoring Locations for UAL Flight Evaluation (Update Prior to TWG)

## Locations

- A** Location on Tevis Pl, Palo Alto (near SIDBY)
- B** Jesuit Retreat Center of Los Altos (Prior to EDDYY)
- C** Private Residence near Arastradero Rd & Donald Dr
- D** TBD
- E** TBD
- F** Belle Haven Child Development Center in Menlo Park

Confirmed Locations     Need to Select Two Locations From These Three





## SFO GBAS Website Q&A Section

- All questions received from the public
  - Verbally during SFO TWG Roundtable, Full SFO Roundtable and/or During Palo Alto Workshop
  - Electronically in advance, during or immediately following SFO TWG RT, SFO RT and/or Palo Alto Workshop
  - Via email: [SFO.GBAS@flysfo.com](mailto:SFO.GBAS@flysfo.com)
- Questions are compiled by category and include additional information about the date when the question was first posed and from which
- Where a response is yet to be provided, the estimated time until an answer will be posted is provided



### Compiled GBAS Requests and Questions

- Legend**
- ✓ Answered
  - 🕒 Estimate 1 Week Until Answered
  - 🕒 Estimate 2 Weeks Until Answered
  - 🕒 Estimate 3 Weeks Until Answered
  - 🕒 Estimate 1-2 Months Until Answered

Category	Date	Question or Request	Status	Answer or Action Plan
GBAS Schedule & Timeline	Palo Alto Workshop - 10/02/2018	1 Can we get a more detailed GBAS roadmap with milestones and deadlines? In addition, how do we keep up with updates (changes in tasks or calendar, response times)?	✓	The GBAS roadmap has been presented at the SFO Roundtable, the SFO Roundtable Technical Working Group Meetings, and on the SFO GBAS webpage. These three outlets are where the public can obtain information regarding timeline and deadline changes, should they occur.
GBAS Schedule & Timeline	Palo Alto Workshop - 10/02/2018	2 How will SFO provide current schedule, roadmap, and decision information to the community?	✓	The GBAS roadmap has been presented at the SFO Roundtable, the SFO Roundtable Technical Working Group Meetings, and on the SFO GBAS webpage. These three outlets are where the public can obtain information regarding timeline and deadline changes, should they occur.
GBAS Schedule & Timeline	Palo Alto Workshop - 10/02/2018	3 What is the rush to implement GBAS knowing that the FAA currently will not change the flight paths? Why is SFO rushing to implement GBAS before the serious problems of traffic concentration and congestion at Menlo vicinity are resolved (including low and loud night flights)?	✓	GBAS are one of only a few types of navigational technology that can effectively support new, Innovative Approach procedure operations to SFO's closely spaced parallel runways. Because the technology is still relatively new in the United States, and new to the Bay Area/NCT, the sooner GBAS technology is implemented, and stakeholders enabled to gain experience on the system, the sooner more innovative approach options can be implemented that have the potential to decrease noise.
GBAS Schedule & Timeline	Palo Alto Workshop - 10/02/2018	4 How do the recent Class B changes affect GBAS planning?	✓	The Class B Airspace changes have been in effect for some time now. All overlay approaches and Innovative Approach GBAS procedure concepts currently being evaluated are inside of the new Class B Airspace.
GBAS Schedule & Timeline	Regular Roundtable Meeting 12/02/2020	5 How is the Roundtable addressing the SFO environmental review process [of GBAS and SERFR 5]? I want to understand the environmental review process and to have all the rules straight and to understand which CATEXs are being used and what it means.	✓	Because the FAA retains sole authority over airspace procedures, the FAA alone determines what level of environmental review to conduct. The FAA will also conduct its own review of any innovative GBAS procedures submitted by SFO.
GBAS Schedule & Timeline	Roundtable TWG Meeting 1/21/2021	6 Is the CATEX for testing GBAS or is it for using GBAS?	🕒	
GBAS Schedule & Timeline	Roundtable TWG Meeting 1/21/2021	7 Who will provide environmental information to us, is it SFO or the FAA?	✓	Because the FAA retains sole authority over airspace procedures, the FAA alone determines what level of environmental review to conduct. The FAA will also conduct its own review of any innovative GBAS procedures submitted by SFO.
GBAS Schedule & Timeline	Regular Roundtable Meeting 2/03/2021	8 Will SFO delay its original schedule, which was to submit the GBAS approaches in February or March?	✓	The new target date for Airport submission of Group 1 Procedures supported by the public is the end of December 2021. If some procedures warrant additional review and discussion, they can be submitted at a later date.
GBAS Innovative Approach Procedures	Roundtable TWG Meeting 11/19/2020	9 You use 3% GPA glide path angle for example, is this relative to a constant horizon or is this from the runway? This makes a difference for distances further out like Palo Alto.	✓	The GBAS glide path angle is relative to the horizon from the touch down point on the runway. The GPA only affects a horizontal distance of approximately 5.5 nautical miles (6.3 statute miles) from the touch down point of Runways 28L and 28R.

<https://noise.flysfo.com/2021/05/17/presentations-and-answers-to-public-questions-regarding-gbas/>

# Group 1 Innovative Approach Completed and Planning for Group 2


## SFO GBAS Project Team has uploaded new CFPPs for Innovative GLS Procedure Concepts

- The SFO GBAS Project team is uploading Community Flight Procedure Packages (CFPPs) to evaluate the difference between Innovative GLS Approach concepts and the nearest existing approaches
  - 14 CFPPs (1 for each Innovative GLS Approach and Starting Point)
  - Includes 2 New CFPPs for Tipp Toe
  - 4 Aircraft Types
- The CFPPs will continue to be updated based on flight evaluation results, potential changes to the procedures or additional supporting information

## SFO GBAS Project Team is beginning evaluation of Group 2 Procedures for discussion at the next TWG

For Community Evaluation Only - Not Intended for Navigation

<b>GLS-TT RWY 28L (EDDYY)</b>	<b>Revision 1</b>
	Changes: New



Google Earth

<p>GLS Instrument approach to runway 28L originating southeast of the airport, starting at EDDYY.</p> <p>This approach is an identical overlay of the existing Tipp Toe Charted Visual Flight Procedure (CVFP) approach, in use today, under VFR conditions. The GLS version of the approach converts optional CVFP published altitudes into required minimum IFR altitudes.</p>	<p><b>Project Goals</b></p> <ul style="list-style-type: none"> <li>✓ Noise reduction</li> <li>✓ ILS Redundancy</li> <li>✓ Efficiency</li> <li>✓ Reduce Delays</li> </ul>
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<https://noise.flysfo.com/>

<https://noise.flysfo.com/2021/05/14/gbas-innovative-approach-procedures/>



# New CFPPs: GLS-TT Rwy 28L and 28R

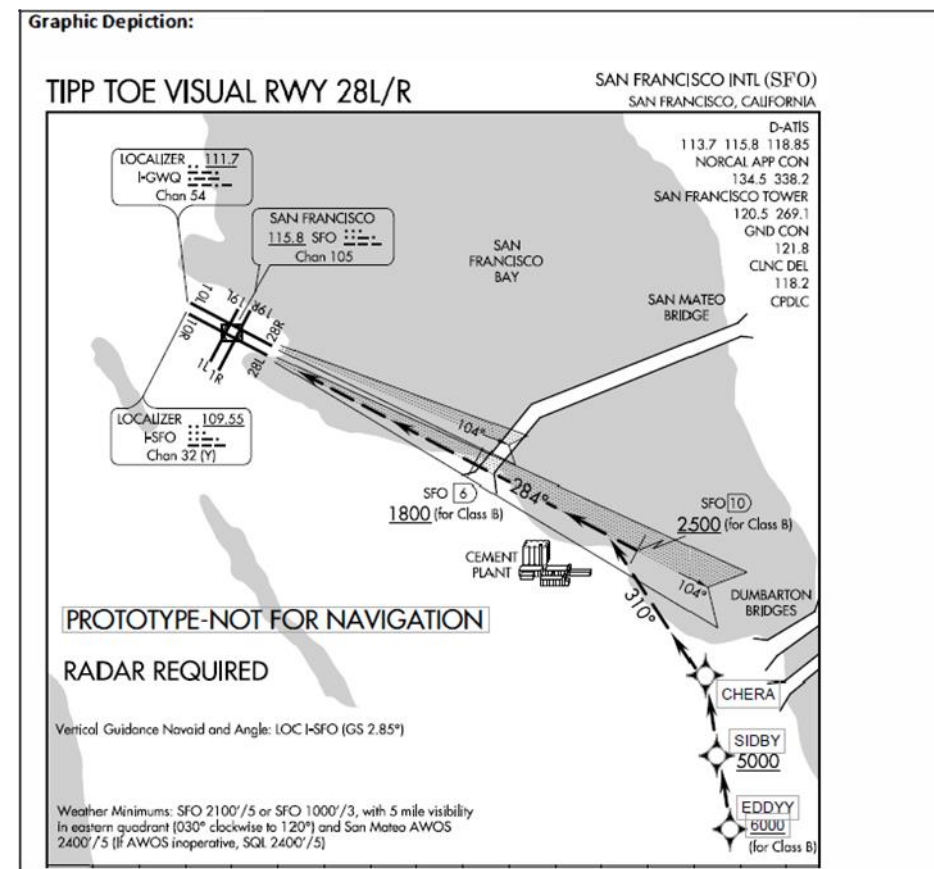
## Conversion of Tipp Toe Visual Rwy 28L/R

Community feedback from SFO Roundtable TWG indicated a desire to explore additional innovative GLS approach options to runway 28L

- Achieve noise reduction through higher GPA and altitudes over residential areas
- Increase likelihood of aircraft and ATC usage under VFR conditions
- Provide opportunities in the future to enable some level of path dispersion

SFO GBAS Flight Procedures Subcommittee evaluated the existing, and soon to be updated, CVFP and identified a conversion to GLS for 28L and 28R

Procedure is part of Group 1 Innovative approach options for consideration by residents of the Bay Area in 2021



# Questions



<https://noise.flysfo.com>



# Backup Material

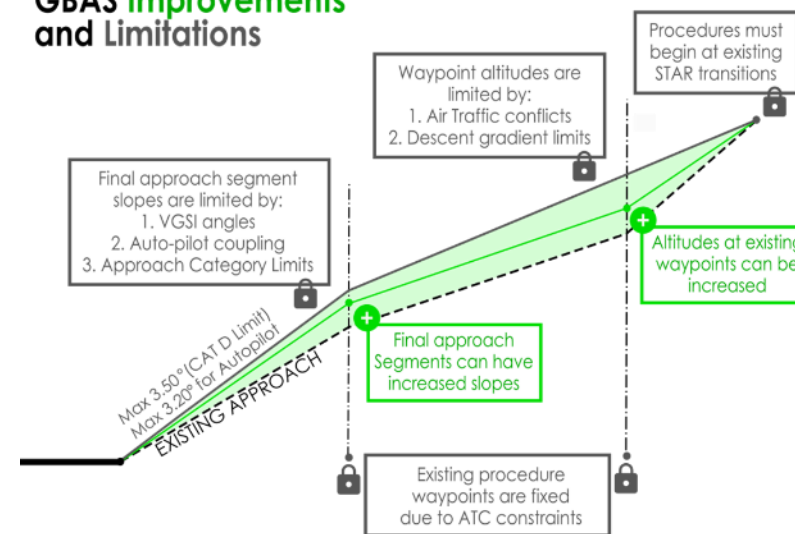


# GBAS Innovative Approach Evaluation Status

## SFO GBAS Project Team Has 8 Innovative GLS Concepts For Evaluation

- Developed through a flight procedures subcommittee to identify criteria, ATC and flyability challenges
- 23 initial concepts were reduced to 8
- Resulted in two “groups” of concept approaches to pursue
- Group 1 focusses on what can be published and flown within the next 5 years
  - 28R – 5 Concepts
  - 28L – 2 Concepts
  - 10R – 1 Concept
  - 10L – 1 Concept
- Group 2 procedures may have more substantial noise benefits, but will require further coordination for FAA to implement

### GBAS Improvements and Limitations



### GBAS Limitations

