Air Traffic Control (ATC) System – CRC Cards

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Date: October 20, 2025
Course: CSCI 363 — Object-Oriented Design

CRC Card

Class: TransponderReceiver

Responsibilities (2–6 bullets):

- Receive transponder packets from arriving aircraft
- Verify packet integrity and timestamps
- Forward valid packets to the IngestionService

Collaborators (if any):

- IngestionService

Assumptions (if any):

- Hardware reliably provides data frames with checksums.

CRC Card

Class: PacketParser

Responsibilities (2–6 bullets):

- Decode packet fields into structured aircraft data
- Convert measurement units to standard forms
- Reject or log malformed packets

Collaborators (if any):

- IngestionService
- Aircraft

Assumptions (if any):

- Packet schema and field ranges are documented.

CRC Card

Class: Aircraft

Responsibilities (2–6 bullets):

- Store individual aircraft information (ID, position, velocity, altitude)
- Update properties when new data is received
- Provide helper methods for calculations like speed or age

Collaborators (if any):

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Assumptions (if any):

- Each aircraft has a unique transponder ID.

CRC Card

Class: AircraftRepository

Responsibilities (2–6 bullets):

- Insert or update Aircraft objects
- Remove aircraft inactive beyond threshold time
- Provide search and query access by ID or area

Collaborators (if any):

- Aircraft

Assumptions (if any):

- Repository stored in memory for this design.

CRC Card

Class: IngestionService

Responsibilities (2–6 bullets):

- Coordinate the receive–parse–store workflow
- Queue or batch packets for efficient processing
- Handle and log errors without stopping the pipeline

Collaborators (if any):

- TransponderReceiver

- PacketParser
- AircraftRepository

Assumptions (if any):

- Assumes steady packet rate and sufficient buffer capacity.

CRC Card

Class: ConflictDetector

Responsibilities (2–6 bullets):

- Analyze aircraft positions for loss-of-separation risks
- Apply distance and altitude safety thresholds
- Trigger alerts when potential conflicts occur

Collaborators (if any):

- AircraftRepository
- AlertService

Assumptions (if any):

- Pairwise comparison acceptable for small dataset size.

CRC Card

Class: AlertService

Responsibilities (2–6 bullets):

- Generate and manage alerts issued by ConflictDetector
- Track alert states (active, resolved)
- Provide alert data to the RadarDisplay

Collaborators (if any):

- ConflictDetector
- RadarDisplay

Assumptions (if any):

- Alerts tracked in simple in-memory list with timestamps.

CRC Card

Class: DisplayModelBuilder

Responsibilities (2–6 bullets):

- Assemble display data for the radar interface
- Map aircraft coordinates to screen positions
- Integrate alert highlights into the model

Collaborators (if any):

- AircraftRepository
- AlertService
- RadarDisplay

Assumptions (if any):

- 2D projection model sufficient for this simulation.

CRC Card

Class: RadarDisplay

Responsibilities (2–6 bullets):

- Render the visual radar display for controllers
- Highlight alert aircraft and show key statistics
- Refresh screen automatically every 10 seconds

Collaborators (if any):

- DisplayModelBuilder
- AlertService

Assumptions (if any):

- Mock display output acceptable; real graphics not required.

CRC Card

Class: ControllerQueryService

Responsibilities (2–6 bullets):

- Handle controller requests for aircraft information
- Provide detailed data and alert status for queried aircraft
- Support filters such as altitude range or aircraft type

Collaborators (if any):

- AircraftRepository
- AlertService

Assumptions (if any):

- Queries are non-blocking and read-only operations.

CRC Card

Class: UpdateScheduler

Responsibilities (2–6 bullets):

- Schedule regular system tasks (e.g., display refresh)
- Trigger periodic conflict scans
- Maintain consistent update intervals across services

Collaborators (if any):

- RadarDisplay
- DisplayModelBuilder
- ConflictDetector

Assumptions (if any):

- Simple timer-based scheduler adequate for simulation timing.

Global Assumptions

- Transponder packets are received continuously from aircraft.
- System updates the radar display every 10 seconds.
- All data is stored in memory for this simplified design.
- Conflict detection uses simple distance and altitude thresholds.
- Design models one airport environment only.

AI / Internet Sources Note

I used ChatGPT to help me generate ideas, structure my CRC cards, and ensure that my design met the assignment requirements. ChatGPT provided organized examples for class responsibilities, collaborators, and assumptions. I used the tool as a learning resource to guide my completion of this assignment. No external websites or online sources were used.

Prompt used: "Design an ATC system for a single airport using CRC cards that cover transponder ingestion, parsing, storage, display updates, conflict detection, and controller

queries. Avoid god classes."

Excerpt of AI assistance: "Proposed classes: TransponderReceiver, PacketParser, Aircraft, AircraftRepository, IngestionService, ConflictDetector, AlertService, DisplayModelBuilder, RadarDisplay, ControllerQueryService, UpdateScheduler."

Thank you ChatGPT for helping me generate clear ideas and ensuring full coverage of the project requirements.

Completed assignment to be submitted to: bwoolfolk@whiteboardfederal.com