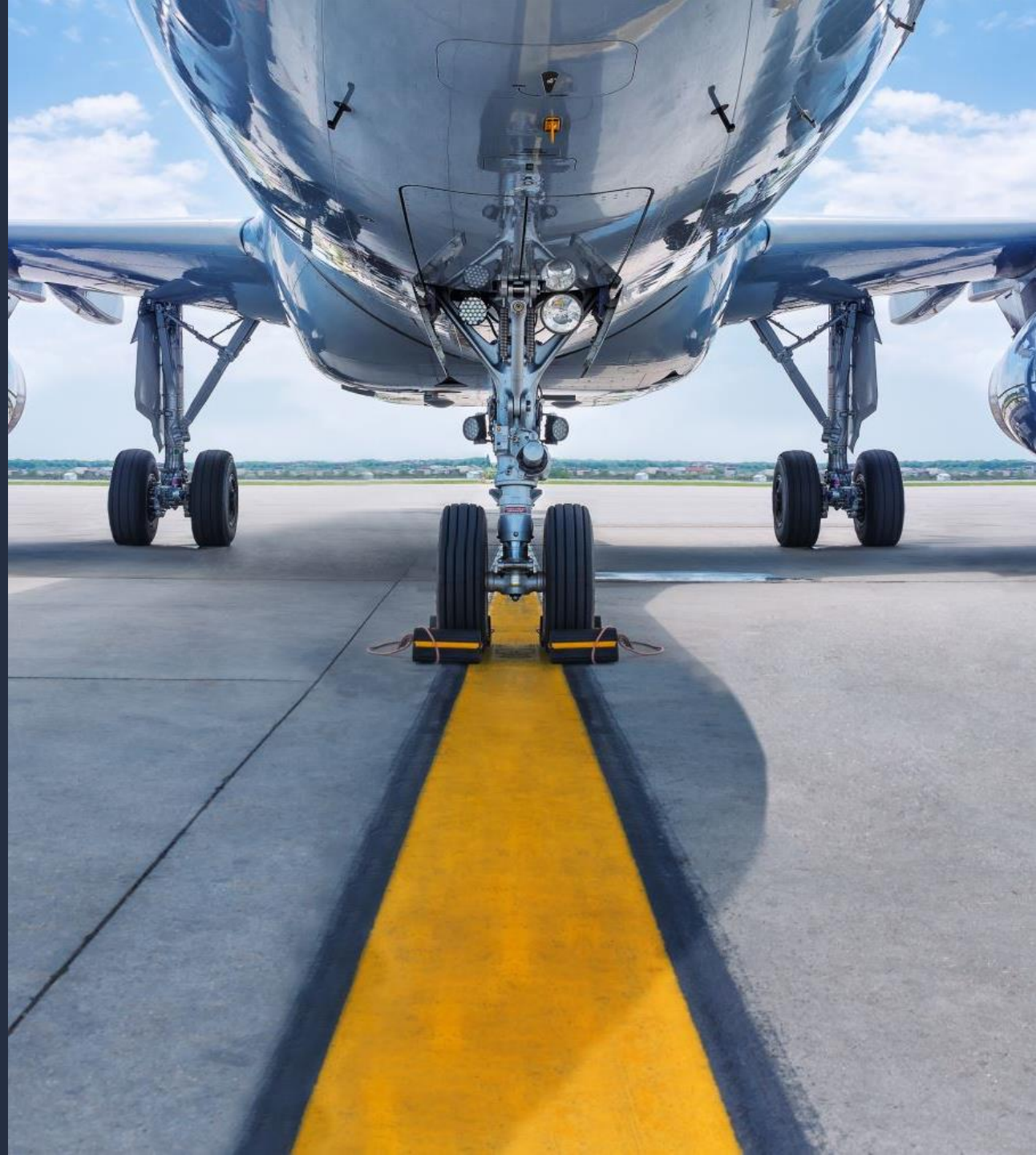


ConTrails

Bahareh Jabarzadnouri,
Aly Westwood,
Kim Alizadeh



High Level View – ConTrails Application



Flight tracking



File saving



Maintenance tracking



Security

Solution Overview

Menu & Menu Items

MainWindow

File

Tools

Due for I

Registrati

C-FGUY

C-FAAA

C-FZZZ

C-GXYA

C-GGGG

C-FFFF

Manage Airports

Manage Routes

Add Aircraft

Manage Users

All Aircraft

All Flights

All Services

te	Last Service Date	Tail #
Z		79
Z		80

AddUserDialog

Username	Legal Name
awestwoo	Aly Westwood
Bahar	Bahareh Jbn
kim123	Kim Alizadeh

AddRouteDialog

Dep. Code	Dep. City	Dest. Code	Dest. City	Duration (Hours)
C-YUL	Montreal	C-YYZ	Toronto	1
C-YYZ	Toronto	C-YUL	Montreal	1
C-YUL	Montreal	US-JFK	New York City	2
US-JFK	New York City	C-YUL	Montreal	2
C-YUL	Montreal	US-LAX	Los Angeles	5

AddAirportDialog

Code	Name	City	Country
C-YUL	Trudeau Airport	Montreal	Canada
US-LAX	Los Angeles Airport	Los Angeles	USA
UK-LHR	Heathrow Airport	London	UK
		New York City	USA
		Paris	France
		Toronto	Canada
		Vancouver	Canada

Registration

Model

Add

Code:

Name:

City:

Country:

Add

Delete

Update

Departure:

Destination:

New York City

Montreal

Duration (Hours):

2

Add

Delete

Update

Username:

Legal Name:

Passcode:

Confirm Passcode:

Bahar

Bahareh Jbn

Add

Delete

Update

Solution Overview

**View All
Service &
Printing Report
as PDF**

MainWindow

File

Tools

Due for Maintenance

Unscheduled Aircraft

All Aircraft

All Flights

All Services

Registration	Base	Date of Service	Username	Legal Name	Report
C-GAAA	Trudeau Airport	2022-02-16 00:00:00Z	kim123	Kim Alizadeh	Lorem ipsum...
C-GAAA					

SERVICE REPORT

Aircraft Registration

C-FBJR

Base Of Maintenance

Trudeau Airport-Montreal

Date of Maintenance

2/16/2022 12:00:00 AM

Reported By

Bahar

Report

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Curabitur auctor sagittis arcu at sodales. Sed eleifend quam vel sem pretium tristique. Mauris lacinia urna vel lectus pellentesque volutpat. Donec eu urna maximus, semper elit vel, dapibus ipsum. Cras rutrum lacinia libero, nec molestie ligula. Aliquam rutrum, dui vitae vulputate viverra, felis leo viverra ex, quis molestie purus diam sit amet velit. Integer vel hendrerit quam. Vivamus faucibus erat nibh, nec hendrerit lacus tincidunt et. Mauris quis quam nec turpis imperdiet placerat. Quisque fringilla condimentum est, feugiat consequat urna facilisis nec. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Aircraft:

C-GAAA

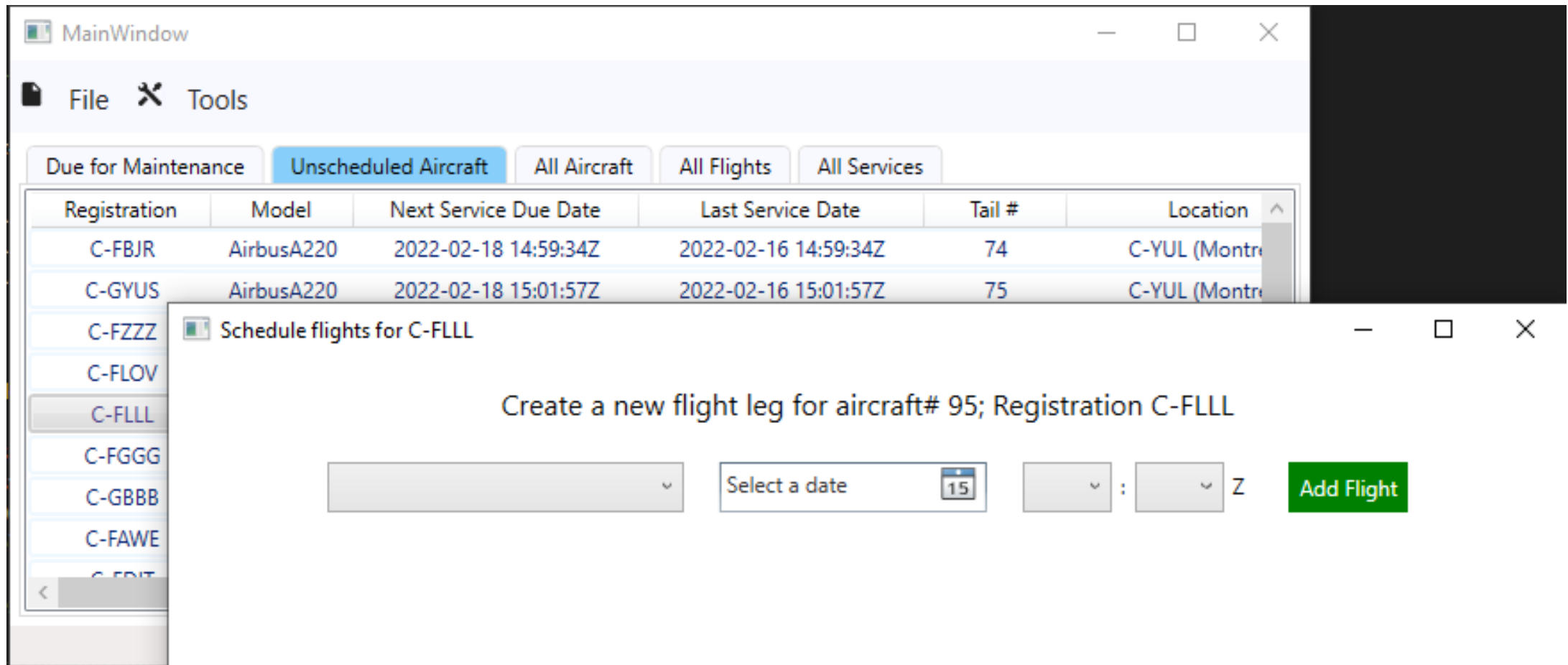
C-GAAA

C-GGUY

C-GYUS

All

Solution Overview – Tabs



Solution Overview

Flights

Due for Maintenance									
Unscheduled Aircraft									
All Aircraft									
All Flights									
All Services									
Flight No	Aircraft	Dep. Date Time	Dep. City	Dep. Code	Arr. Date Time	Arr. City	Arr. Code	Status	
CT123	C-FYYY	2022-02-17 10:30:00Z	Montreal	C-YUL	2022-02-17 12:30:00Z	New York City	US-JFK	Upcoming	
CT0C02A	C-FALL	2022-02-16 21:30:00Z	Montreal	C-YUL	2022-02-16 22:30:00Z	Toronto	C-YYZ	Arrived	
CT1002B	C-FKSK	2022-02-17 13:00:00Z	Montreal	C-YUL	2022-02-17 18:00:00Z	Los Angeles	US-LAX	Upcoming	
CT1102C	C-FKSK	2022-02-18 07:00:00Z	Los Angeles	US-LAX	2022-02-18 12:00:00Z	Montreal	C-YUL	Upcoming	
CT0C02D	C-GGUY	2022-02-17 10:00:00Z	Montreal	C-YUL	2022-02-17 11:00:00Z	Toronto	C-YYZ	Upcoming	
CT0E02E	C-FAWE	2022-02-17 12:00:00Z	Montreal	C-YUL	2022-02-17 14:00:00Z	New York City	US-JFK	Upcoming	
CT0E02F	C-FBJR	2022-02-17 00:15:00Z	Montreal	C-YUL	2022-02-17 02:15:00Z	New York City	US-JFK	In Progress	
CT123	C-FTFT	2022-02-17 23:30:00Z	Montreal	C-YUL	2022-02-18 01:30:00Z	New York City	US-JFK	Upcoming	
CT0E031	C-FSDF	2022-02-17 07:00:00Z	Montreal	C-YUL	2022-02-17 09:00:00Z	New York City	US-JFK	Upcoming	
CT0C032	C-GYUS	2022-02-17 05:30:00Z	Montreal	C-YUL	2022-02-17 06:30:00Z	Toronto	C-YYZ	Upcoming	
CT0E033	C-FBUY	2022-02-17 08:00:00Z	Montreal	C-YUL	2022-02-17 10:00:00Z	New York City	US-JFK	Upcoming	
CT0C034	C-FLLL	2022-02-17 10:45:00Z	Montreal	C-YUL	2022-02-17 11:45:00Z	Toronto	C-YYZ	Upcoming	
CT0D035	C-FLLL	2022-02-17 18:45:00Z	Toronto	C-YYZ	2022-02-17 19:45:00Z	Montreal	C-YUL	Upcoming	

Filter Aircraft:

All

Filter Status:

All

Create a new flight leg for aircraft# 97; Registration C-GBBB

Departing C-YUL at 2022-02-18 13:15:00Z; Arriving in US-JFK at 2022-02-18 15:15:00Z

Departing US-JFK at 2022-02-18 19:15:00Z; Arriving in C-YUL at 2022-02-18 21:15:00Z

C-YUL to C-YYZ

2022-02-18

22

:

15

Z

Add Flight

Confirm Leg

Due for Maintenance									
Unscheduled Aircraft									
All Aircraft									
All Flights									
All Services									
ht No	Aircraft	Dep. Date Time	Dep. City	Dep. Code	Arr. Date Time	Arr. City	Arr. Code	Status	
JE02F	C-FBJR	2022-02-17 00:15:00Z	Montreal	C-YUL	2022-02-17 02:15:00Z	New York City	US-JFK	In Progress	

Filter Aircraft:

All

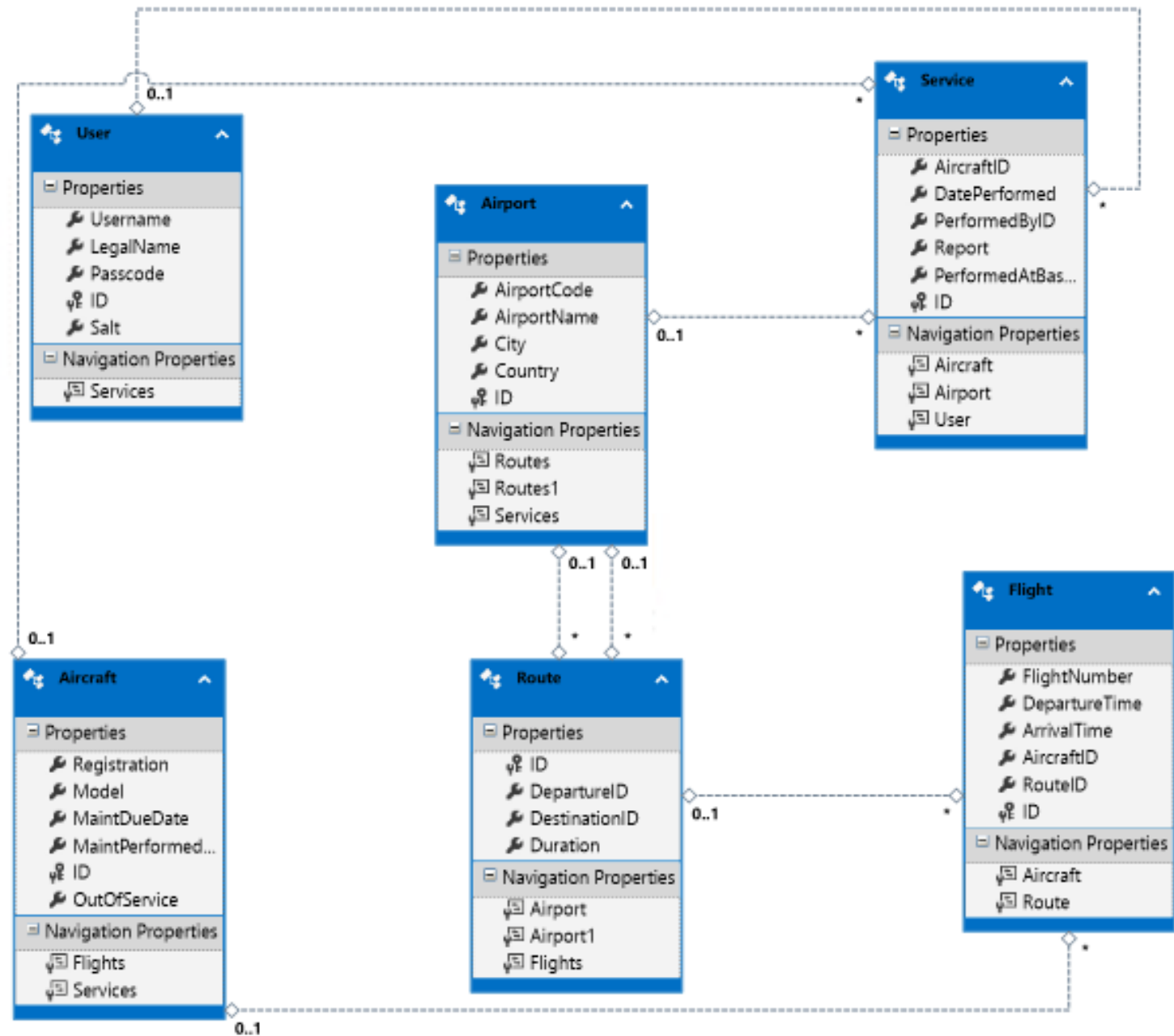
Filter Status:

In Progress

CT0C034	C-FLLL	2022-02-17 10:45:00Z	Montreal	C-YUL	2022-02-17 11:45:00Z	Toronto	C-YYZ	Upcoming
CT0D035	C-FLLL	2022-02-17 18:45:00Z	Toronto	C-YYZ	2022-02-17 19:45:00Z	Montreal	C-YUL	Upcoming

Delete

Database



Challenges & Solutions

SQL Server/Azure

- Learning curve
- Different datatypes (e.g. used int instead of enum)
- Azure account ran out of credits
- Changing IPs
- Update database structure

Upgrade now to keep building in Azure

Your free credit has expired, so we've disabled your subscription and services. It's an easy fix—just upgrade to a pay-as-you-go subscription to keep using all your configured services and data in place. You get:

Rule name	Start IP	End IP	
<input type="text"/>	<input type="text"/>	<input type="text"/>	...
All IPs	0.0.0.0	255.255.255.255	...

Challenges & Solutions

Listview Sorting

Registration	Model	Next Service Due Date	Last Service Date	Tail # ▲	Location
C-FBUY	Embraer175	2022-02-18 14:46:03Z	2022-02-16 14:46:03Z	72	C-YUL (Montreal)
C-GGUY	Boeing737	2022-02-18 17:42:48Z	2022-02-16 17:42:48Z	73	C-YUL (Montreal)
C-FBJR	AirbusA220	2022-02-18 14:59:34Z	2022-02-16 14:59:34Z	74	C-YUL (Montreal)
C-GYUS	AirbusA220	2022-02-18 15:01:57Z	2022-02-16 15:01:57Z	75	C-YUL (Montreal)

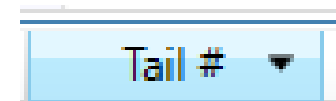
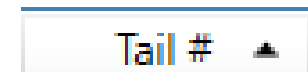
```
<GridViewColumn DisplayMemberBinding="{Binding MaintPerformedDate, StringFormat='u'}" Width="160">
    <GridViewColumn.Header>
        <GridViewColumnHeader Tag="MaintPerformedDate" Click="lvAircraftColumnHeader_Click">Last Service Date</GridViewColumnHeader>
    </GridViewColumn.Header>
</GridViewColumn>
<GridViewColumn DisplayMemberBinding="{Binding ID}" Width="80">
    <GridViewColumn.Header>
        <GridViewColumnHeader Tag="ID" Click="lvAircraftColumnHeader_Click">Tail #</GridViewColumnHeader>
    </GridViewColumn.Header>
</GridViewColumn>
```

Challenges & Solutions

ListView Sorting


```
6 references  
private void lvAircraftColumnHeader_Click(object sender, RoutedEventArgs e)  
{  
    GridViewColumnHeader column = (sender as GridViewColumnHeader);  
    string sortBy = column.Tag.ToString();  
}
```

```
3 references  
public class SortAdorner : Adorner  
{  
    private static Geometry ascGeometry =  
        Geometry.Parse("M 0 4 L 3.5 0 L 7 4 Z");  
  
    private static Geometry descGeometry =  
        Geometry.Parse("M 0 0 L 3.5 4 L 7 0 Z");  
}
```



Challenges & Solutions

Installer



Microsoft Visual Studio Installer Projects

Microsoft | 2,039,567 installs | ★★★★★ (263) | Free

This official Microsoft extension provides support for Visual Studio Installer Projects in Visual Studio.

[Download](#)

C#

Windows

All project types

Other results based on your search

Setup Project
Create a Windows Installer project to which files can be added

Properties

ConTrailsApp Deployment Project Properties

AddRemoveProgramsIcon

(Icon)

Author

Aly, Kim, Bahar

BackwardCompatibleIDGener

False

Description

Aircraft maintenance application

DetectNewerInstalledVersion

True

InstallAllUsers

True

Keywords

Localization

English (United States)

Manufacturer

Aly, Kim, Bahar

ManufacturerUrl

PostBuildEvent

PreBuildEvent

ProductCode

{8910F7A7-3A77-4F56-962A-690}

Batch Build

Check the project configurations to build:

Project	Configuration	Platform	Solution Config	Build
ConTrails	Debug	Any CPU	Debug Any CPU	<input type="checkbox"/>
ConTrails	Release	Any CPU	Release Any CPU	<input checked="" type="checkbox"/>
ConTrailsApp	Debug		Debug Any CPU	<input type="checkbox"/>
ConTrailsApp	Release		Release Any CPU	<input checked="" type="checkbox"/>

Build

Rebuild

Clean

Select All

Deselect All

Name

ConTrailsApp.msi

setup.exe

Setup1

Select Installation Folder

The installer will install Setup1 to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder:

C:\Program Files (x86)\kim.alizadeh@gmail.com\Setup1\

Browse...

Disk Cost...

Install Setup1 for yourself, or for anyone who uses this computer:

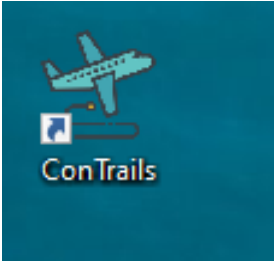
☒ Everyone

☐ Just me

< Back

Next >

Cancel

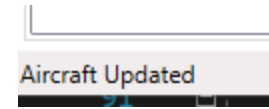


Challenges & Solutions

Status bar

```
9 references
public void ShowStatusMessage(string message)
{
    tbStatus.Text = message;
    var timer = new System.Timers.Timer();
    timer.Interval = 20000; //20 seconds
    timer.Elapsed += delegate (object sender, System.Timers.ElapsedEventArgs e)
    {
        //stop the timer
        timer.Stop();
        //remove the StatusMessage text using a dispatcher, because timer operates in another thread
        this.Dispatcher.BeginInvoke(new Action(() =>
        {
            tbStatus.Text = "";
        }));
    };
    timer.Start();
}
```

```
ubContext.SaveChanges(),
mainWindow.ShowStatusMessage("Aircraft Updated");
```



Challenges & Solutions

Hashing Users Password:

Step 1: Generate Salt:

```
public static string CreateSalt(int size)
{
    //Generate a cryptographic random number.
    RNGCryptoServiceProvider rng = new RNGCryptoServiceProvider();
    byte[] buff = new byte[size];
    rng.GetBytes(buff);
    return Convert.ToBase64String(buff);
}
```

Step 2: Generate Hash:

```
public static string GenerateHash(string input, string salt)
{
    byte[] bytes = Encoding.UTF8.GetBytes(input + salt);
    SHA256Managed sha256ManagedString = new SHA256Managed();
    byte[] hash = sha256ManagedString.ComputeHash(bytes);
    return Convert.ToBase64String(hash);
}
```

Challenges & Solutions

Hashing Users Password:

Step 3: Generate Hash:

```
public static bool AreEqual(string plainTextInput, string hashedInput, string salt)
{
    string newHashedPin = GenerateHash(plainTextInput, salt);
    return newHashedPin.Equals(hashedInput);
}
```

Challenges & Solutions

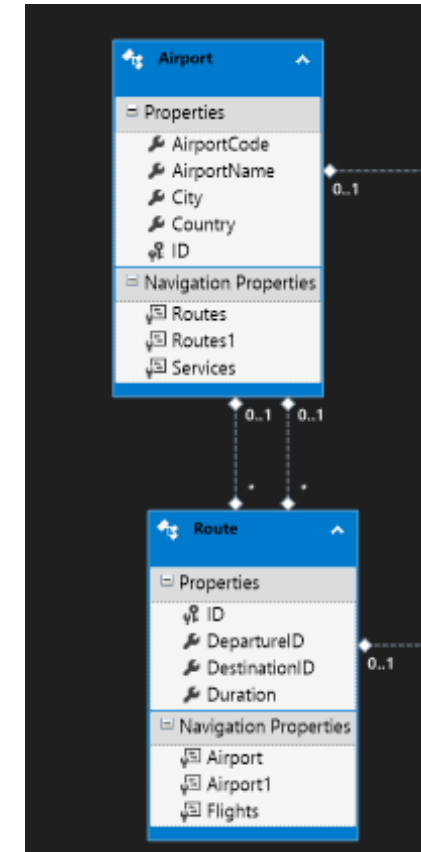
Flight consistency

Solution: make a routes table

Create a new flight leg for aircraft# 73; Registration C-GGUY

C-YUL to C-YYZ 2022-02-17 10 : 0 Z Add Flight

Flight No	Aircraft	Dep. Date Time	Dep. City	Dep. Code	Arr. Date Time	Arr. City	Arr. Code	Status
CT0C02D	C-GGUY	2022-02-17 10:00:00Z	Montreal	C-YUL	2022-02-17 11:00:00Z	Toronto	C-YYZ	Upcoming



Challenges & Solutions



Must land before MaintDueDate



Must be in the future




No overlap



No teleporting - flight path consideration

Due for Maintenance					
Unscheduled Aircraft					
All Aircraft					
All Flights					
All Services					
Flight No	Aircraft	Dep. Date Time	Dep. City	Dep. Code	Arr. Date Time
CT0C039	C-FDIT	2022-02-17 09:30:00Z	Montreal	C-YUL	2022-02-17 10:30:00Z
CT0D03A	C-FDIT	2022-02-18 12:30:00Z	Toronto	C-YYZ	2022-02-18 13:30:00Z
CT0E03B	C-FDIT	2022-02-18 15:30:00Z	Toronto	C-YYZ	2022-02-18 17:30:00Z
CT0F03C	C-FDIT	2022-02-18 19:30:00Z	Toronto	C-YYZ	2022-02-18 21:30:00Z

Remove 4 Flights

 This will also remove every flight following the selected flight for this aircraft. Are you sure you want to remove this flight?


Schedule flights for C-FDIT

Create a new flight leg for aircraft# 100; Registration C-FDIT

Departing C-YUL at 2022-02-17 09:30:00Z; Arriving in C-YYZ at 2022-02-17 10:30:00Z
Departing C-YYZ at 2022-02-18 12:30:00Z; Arriving in C-YUL at 2022-02-18 13:30:00Z
Departing C-YUL at 2022-02-18 15:30:00Z; Arriving in US-JFK at 2022-02-18 17:30:00Z
Departing US-JFK at 2022-02-18 19:30:00Z; Arriving in C-YUL at 2022-02-18 21:30:00Z

C-YUL to US-JFK2022-02-182330ZAdd Flight

Error

 The flight cannot be scheduled after the maintenance due date.
Maintenance is due 2022-02-19 00:00:00Z.
The flight you selected is 2022-02-18 23:30:00Z to 2022-02-19 01:30:00Z

OK

Sche

```
public static List<Aircraft> FindUnscheduledAc()
{
    return (from a in dbContext.Aircraft
        where a.MaintDueDate >= DateTime.UtcNow
        && a.OutOfService == false
        && !(from f in dbContext.Flights where f.ArrivalTime > DateTime.UtcNow select f.AircraftID).Contains(a.ID)
        select a).ToList().Where(a => a.MaintDueDate > DateTime.UtcNow.AddHours(shortestFlightOut(a) + 1)).ToList();
}

/// <summary>
/// Finds the length of the shortest possible flight out of the airport where the provided aircraft is located
/// </summary>
/// <param name="ac"></param>
/// <returns></returns>
2 references
private static int shortestFlightOut(Aircraft ac)
{
    return (int)Route.FindRoutesOut(LocateAc(ac)).Min(r => r.Duration);
}
```

Schedule flights for C-FDIT

Create a new flight leg for aircraft# 100; Registration C-FDIT

Departing C-YUL at 2022-02-17 10:30:00Z; Arriving in C-YYZ at 2022-02-17 11:30:00Z

Departing C-YYZ at 2022-02-18 14:30:00Z; Arriving in C-YUL at 2022-02-18 15:30:00Z

Departing C-YUL at 2022-02-18 17:30:00Z; Arriving in US-JFK at 2022-02-18 19:30:00Z

Departing US-JFK at 2022-02-18 21:30:00Z; Arriving in C-YUL at 2022-02-18 23:30:00Z

2022-02-18 21 : 30 Z Add Flight

Remove 2 Flights



This will also remove every flight following the selected flight.
Are you sure you want to remove this flight?

OK

Cancel

Confirm Leg

What We Learned – IValueConverter

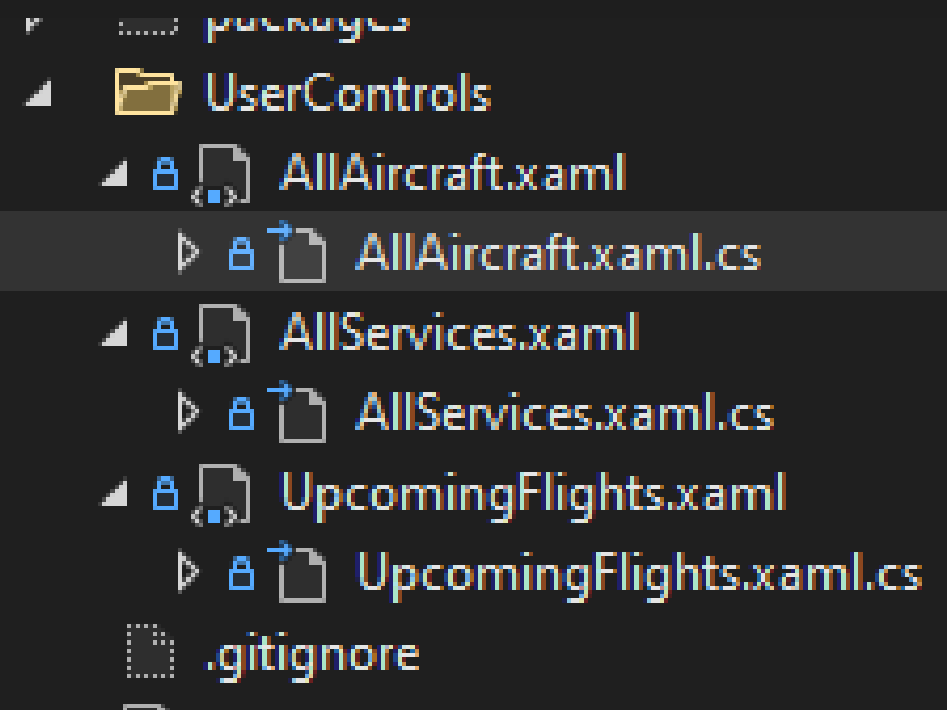
```
public class IntModelConverter : IValueConverter
{
    0 references
    public object Convert(object value, Type targetType, object parameter, CultureInfo culture)
    {
        return (Aircraft.ModelEnum)value;
    }

    0 references
    public object ConvertBack(object value, Type targetType, object parameter, CultureInfo culture)
    {
        return (int)value;
    }
}
```

```
<UserControl.Resources>
    <local:IntModelConverter x:Key="IntModelConverter" />
    <local:AircraftLocationStringConverter x:Key="AircraftLocationStringConverter" />
</UserControl.Resources>
<Grid>
    <GridViewColumn DisplayMemberBinding="{Binding Model, Converter={StaticResource IntModelConverter}}" Width="80">
        ...
    </GridViewColumn>
    <GridViewColumn DisplayMemberBinding="{Binding Converter={StaticResource AircraftLocationStringConverter}}" Width="160">
        ...
    </GridViewColumn>
    <GridViewColumn Headers>
        ...
    </GridViewColumn>
</Grid>
```

What We Learned – User Controls

```
</TabControl.Resources>
<TabItem Header="Due for Maintenance">
    <local:AllAircraft x:Name="ucDueForMaint" />
</TabItem>
<TabItem Header="Unscheduled Aircraft">
    <local:AllAircraft x:Name="ucUnscheduled" />
</TabItem>
<TabItem Header="All Aircraft">
    <local:AllAircraft x:Name="ucAllAircraft" />
</TabItem>
<TabItem Header="All Flights">
    <local:UpcomingFlights x:Name="ucFlights" />
</TabItem>
<TabItem Header="All Services" >
    <local:AllServices x:Name="ucAllServices"/>
</TabItem>
```



What We Learned

Save Reports as PDF file:

```
PrintDialog printDialog = new PrintDialog();  
if (printDialog.ShowDialog() == true)  
{  
    printDialog.PrintVisual(print, "ReportService");  
}  
this.DialogResult = true;
```

Styling PDF File by using:



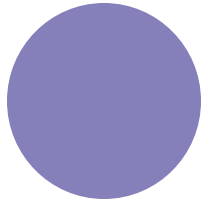
MaterialDesignThemes by James Willock

ResourceDictionary instances containing Material Design templates and styles for WPF controls in .NET.

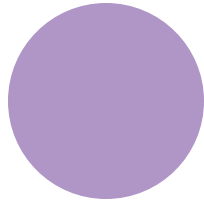
4.3.0



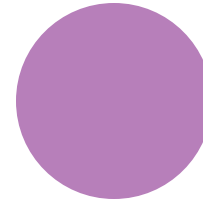
Future Work



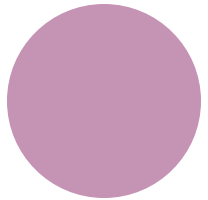
Login



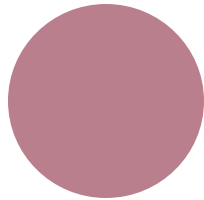
Different types of checks/issue tracking



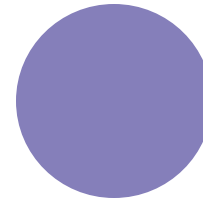
Having specific bases for maintenance



Incorporating flight hours



Attaching images of snags (broken stuff) to the service reports



API for flight times instead of routes

Summary

Accomplished many
of the goals in
our proposal

Created a functional
Airplane
Maintenance
windows application